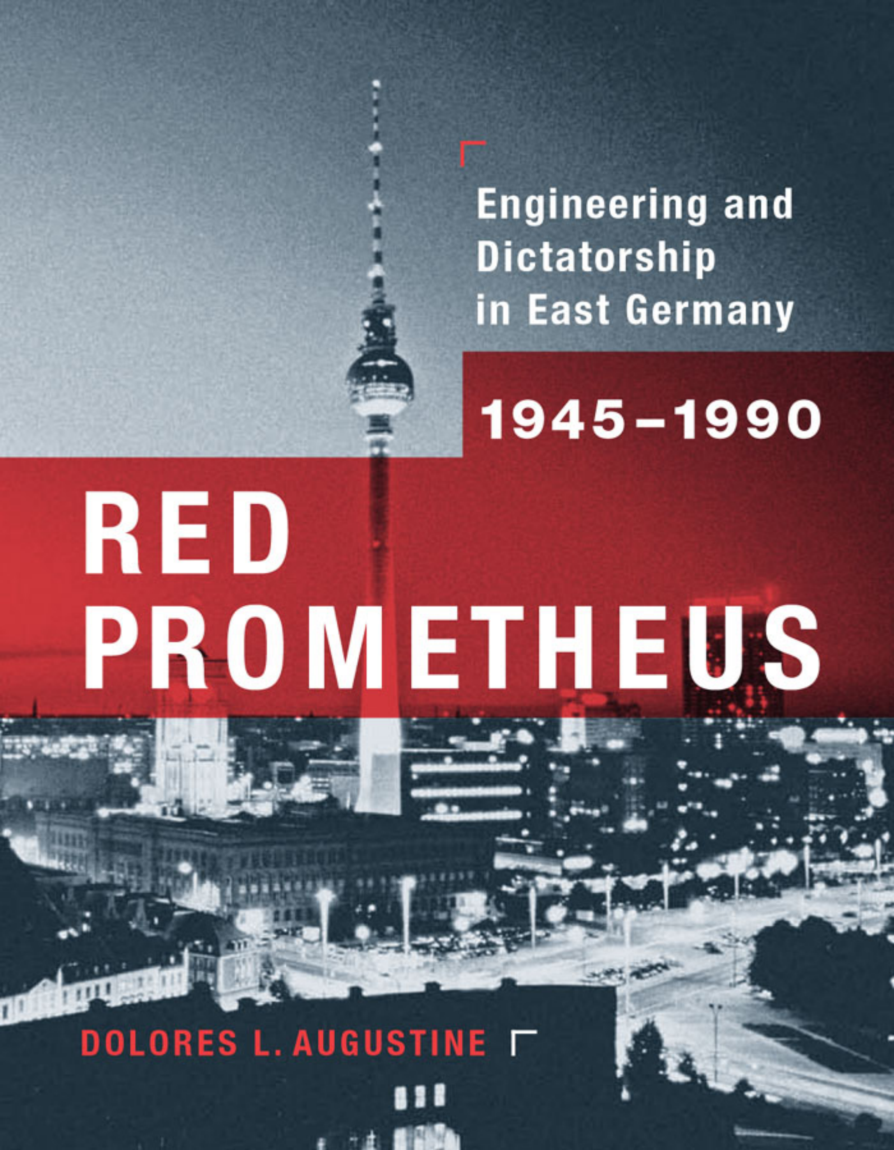

Engineering and Dictatorship in East Germany
1945–1990
RED PROMETHEUS
DOLORES L. AUGUSTINE

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This book is dedicated to my husband, Claude LeBrun, and to my children, André and Caroline LeBrun

Contents

List of Illustrations

Introduction

What is the relationship between dictatorship and science? How effectively can scientific and engineering communities resist the totalitarian impulse of a dictatorial ruling party? Was the Communist system able to produce good science and technology? What does this tell us about the degree to which an autonomous society continued to exist under Communist rule? These questions stand at the center of this study, which focuses on one of the most technically advanced East bloc countries, East Germany. There, the German tradition of science-based technology was wedded to a socialist system that accorded technological progress a central place in modernization strategies. German engineering and Communism held in common a profound belief in the transformative power of technology, but differed on how to unleash it. Their alliance was complex and fraught with contradictions.

German engineering, which played a central role in the creation of the Nazi killing machine, enjoyed twin rebirths after the Second World War in East and West Germany. Scientists and engineers tried to revive a culture of technological excellence and a tradition of science-based industry. They brought with them attitudes and expectations that stemmed from the military-dominated Nazi research establishment and from patriarchal traditions of engineering going back to the nineteenth century and before. German intellectual tradition viewed technology as a manifestation of culture. The great men of science and technology—whether university-educated specialists or engineers trained on the job—were thought capable of forging unique cultural products that solved major technological puzzles. Scientists and engineers in East Germany counted on the Communist state to give due recognition to their unique creative powers and mastery of complex technologies through experience and education.

Communism did not only accept technological modernity, but viewed technology as an essential part of socialist progress. Radically rejecting the Nazi utopias of racial purity and absolute violence, after the war East German Communism embraced equality and technological modernity—the wonders of science harnessed to the needs of the people. Marx believed technology to be essential to the triumph of socialism.[1] Lenin made industrialization, rather than equality or the pursuit of world revolution, the centerpiece of efforts to win and keep the support of the masses, thus establishing priorities that would guide the Soviet bloc until the fall of Communism.[2] Technology provided the basis of modern industrial production and became an important part of East German socialist identity. This expressed itself in propaganda, high culture, and popular culture. In East Germany, technology was central to the way Communists saw their system and citizens saw their state. Technology was a crucial weapon in the Cold War struggle between East and West, and was seen as essential to the creation of a better socialist future. To a much greater extent than any other Communist state, East Germany legitimized and undergirded its existence with technology.[3]

In the post-Stalin era, the universality of science, whether in East or West Germany, was affirmed, and the earlier doctrine of the superiority of "socialist science" was jettisoned.[4] Technology was conceived as a derivation of science. Unsullied by the system under which it was developed, technology could travel without difficulty from the capitalist world to the socialist world, believed supporters of the Communist system. It was the use to which technology was put that differed drastically between capitalism and socialism. While capitalists used technologies to promote exploitation and war, socialists deployed technology to the benefit of their people and all mankind. According to this view, the work of engineers and scientists was not intrinsically good or bad. This "technical intelligentsia" could serve the bourgeoisie, and do its evil bidding, or it could become the partner of the working class, and help build a better, socialist society. It was hoped that the "old intelligentsia," educated and socialized in the pre-socialist era (i.e., the Imperial, Weimar, and Nazi eras), could be won over to the socialist project. The trustworthiness of these holdovers from the capitalist period was questioned by some, however. Above question, at least in theory, were the loyalties of the "new technical intelligentsia"—engineers, scientists, and technicians recruited, educated, and socialized under socialism. The creation and expansion of the ranks of "socialist engineers" became a major goal of the SED (the Socialist Unity Party, as the Communist Party of East Germany was known).

During the 1960s, socialist ideology came to be infused more and more with a belief in technology. The GDR (German Democratic Republic) aspired to overtake the West through "technical-scientific revolution." With this ambition came a profound shift in the relationship between technical professionals on the one hand and state and party bureaucrats on the other. When the SED leadership started allowing itself to believe it could win the competitive race with the West, it came to believe it could become the central driving force behind technological innovation. A process of centralization, bureaucratization, and ideologization of decision-making took place. The SED and the secret police also attempted to co-opt and penetrate the "technical intelligentsia," replacing any alternate ideology or loyalty to professionalism with loyalty to the socialist system. Now infused with a belief in technology, Communist ideology was seen as capable of becoming not only the guiding force behind "scientific-technological progress," but the ultimate source of technical innovation. This major shift in power relations and ideological claims made by the SED had a major impact on the innovative process.

In recent years, scholars have sought to overcome the "black-and-white picture . . . [of] the oppressive state versus the victimized scientific community" under dictatorial rule.[5] Research on the Nazi era has come to emphasize the complicity of engineers and scientists with the Nazi régime.[6] In his work on Stalinist science, Nikolai Krementsov explores the maneuverings of scientists intent on promoting their own interests, careers, disciplines, and research institutes under Communism. They worked within the context of a system in which the state not only held a monopoly over the funding of science, but also had at its disposal a considerable repertoire of methods of coercion. Who won or lost in the competition for state sponsorship was not, however, determined by ideology, but rather by the resources and abilities of groups of scientists, organized in often competing networks. To win out over its competitors, a discipline, subdiscipline, or institute needed spokesmen able to formulate a particular scientific approach in ideological terms, connections in the upper echelons of the party hierarchy, and the prospect of military applications of its scientific work. According to Krementsov, the party pursued its own political and ideological aims, and "service to the party's goals was the main criterion in defining the objects and subjects, and even the pace, of scientific studies . . ." Nonetheless, the outcomes were often unexpected, reflecting the needs and desires of segments of the scientific community as much as those of the party hierarchy, which itself was profoundly fragmented.[7]

Asif Siddiqi has shown that the Soviet space program was the brainchild of engineer Sergei Korolev and other missile experts, who induced the political leadership to embark on a project that they did not see as of central importance.[8] The development of nuclear missiles was the main concern of political leaders, who were focused on the conflict with the United States. Resources and personnel were shifted from the missile program into the space program on the initiative of missile scientists and engineers. The Soviet leadership had extraordinary confidence in them because of their role in the build-up of Soviet defenses, and was therefore willing to accord them a good deal of autonomy. The propaganda value of the space program was an unforeseen by-product. Siddiqi sees this case as evidence of the dynamic quality of the relationship between scientists and political elite in the USSR. Policy was not always dictated from above, he argues.

Slava Gerovitch has studied the way Soviet scientists used the ideas and language of cybernetics to reform society and to create a new sort of relationship between themselves and the rulers of the Soviet Union. Under Stalin, "newspeak" dominated, a form of speech that placed ideology and philosophy above science. Western ways of talking about the use of computers and cybernetics were thoroughly rejected as intrinsically capitalist. Based on ideas developed by American mathematician Norbert Wiener, the central concept of cybernetics was that much of reality could be reduced to logical relationships within systems that could be controlled with the help of computers. With the Khrushchev-era liberalization and the acceptance of computers as essential to growth and progress, it became possible to completely overturn the ideologically motivated rejection of cybernetics, to make it into a kind of master science in the Soviet Union, and to replace "newspeak" with an entirely new form of speech, "cyberspeak." Scientists were now able to successfully impose their language and the supremacy of scientific rationality on philosophers. Some even hoped that cybernetics would remake the power structures and economic system. In the end, however, cybernetics became a new orthodoxy, a tool of the Communist elite. Gerovitch shows that scientists in the Soviet Union had considerable resources at their disposal in their negotiations with the state, though he is more pessimistic than some historians about their ultimate ability to retain control over those resources.[9]

This emphasis on the agency of scientists in the Soviet Union has parallels in the broader literature on the nature of dictatorship. Historians such as Robert Gellately have found much evidence of the complicity of the population in Nazi terror.[10] Historian Sheila Fitzpatrick has argued that even in the darkest days of Stalinism, the masses played an active role in social and political life in the Soviet Union. Social and cultural historians have made a similar argument with regard to East Germany. They assert that although the East German leadership aspired to totalitarian rule, it did not fully achieve it, failing in important ways to control and direct society. The resulting tensions within Communist societies often went right to the top, leading to competition between opposing factions within the elite.[11]

Others have sharply rejected such a view. For them, the GDR was a totalitarian dictatorship terrorized to the end by the secret police. An important group of historians who subscribe to this interpretation rely heavily on the files of the Ministry for State Security (or MfS), which ran the East German secret police, known as the Stasi. They believe that these files reveal the true mechanisms at work in East German society. A totalitarian state-within-a-state, the Stasi maintained labyrinthine networks of informers who not only kept the MfS informed of possible deviation from absolute loyalty to the Communist system, but also took action to root out the (supposedly) disloyal. Security procedures increasingly took precedence over all other criteria (such as professional competence), with the result that only highly conformist individuals were given positions of responsibility and power.[12]

There are alternatives to the "totalitarianism" interpretation. Sigrid Meuschel has given us a sociologist's definition of the SED dictatorship, which she calls a "party state" (perhaps best rendered in English as a "one-party-state"). According to her analysis, the SED effectively destroyed the autonomy of different sectors of society, insinuating the "logic" of Communism into all aspects of life. This destroyed the functional differentiation of society, which Talcott Parsons and others have asserted is a central characteristic of modern societies.[13] Alternate interpretations of the East German system include Jürgen Kocka's concept of the "modern dictatorship" and Konrad Jarausch's "welfare dictatorship," which emphasize the linkage between coercion and consensus-building in Communist rule in the GDR.[14]

This study addresses this debate, making use of the kinds of sources used by the two major schools—secret police reports as well as all sorts of sources that provide the perspective of the common citizen.

This book explores the creation of technology in East German industry as a process of constantly renegotiated power relations. But this is not the story of struggles between two homogeneous camps. Both the bureaucracy of party and state and the technical professionals were torn by rivalry and competition. The dynamics of their interactions were also profoundly influenced by two actors that cannot be left out of the equation. The first is the Soviet Union. Unfortunately, the thinking behind Soviet policymaking is often obscured by the lack of access to Soviet archives (though pioneering research has begun). Nonetheless, a Soviet agenda can often be inferred from a multitude of decisions and interactions with East German industry. The Soviet leadership was torn between two goals. On the one hand, the Soviet leadership sought to gain whatever advantage it could from the advances of East German industrial research. On the other hand, the Soviets viewed the East Germans as potential rivals whose advances, particularly in the atomic and high tech sectors, posed a potential threat to the Soviet Union.

The fourth actor in the process of creating technology is society. To create an alternative to Western-style professionalism, society had to be mobilized. The model of autonomous, self-regulating professions was to be replaced by a new loyalty to the SED. Serious attempts were made to sever the historical links between the professions and the bourgeoisie, as well as to forge new ones between the professions and the proletariat—above all by recruiting university students from the working class. Women were also to gain new professional opportunities. It was thought that this "new intelligentsia" would promote "social progress."[15] The participation of society was not only essential to the creation of the "socialist engineer," but also to the mobilization of the creative talents of the proletariat in the factory. Art, literature, public representations, and educational efforts attempted to reach the masses with the message that they should help build socialism by promoting technological progress.

How successful was socialist science and technology? During the Cold War, it was often argued that in the Soviet Union, ideology had impeded the search for scientific truth. The classic case of this is Trofim Lysenko, a poorly educated agronomist and a "clever and cruel political maneuverer" whose teachings began to supplant genetics in the 1930s and ruled supreme until 1965.[16] The purges of the 1930s killed off or silenced the best scientists and engineers. Initiative and critical thinking were suppressed. It has also been argued that theoretical work in the sciences suffered from an overemphasis of practical applications. In numerous works, Loren Graham has argued that the oppressive role of the state slowly, over the decades, eroded the scientific and technical prowess of the Soviet Union. The central problem lay in the creation of a top-down, overly centralized system, particularly in its Stalinist incarnation. As in the days of the tsars, engineers and scientists put pleasing the rulers first, and as a result oscillated between frenetic activity and passivity. However, Graham has also argued that political interference was not great enough to prevent valuable scientific work from being done. Soviet scientists often performed well because they were given tremendous social prestige and financial resources for research. Marxist ideology not only did not stand in the way of scientific progress, but in some cases sparked new insights and profitable new paths. Graham's overall evaluation of Soviet science is nuanced: "The Russian experience points to a strong distinction between those conditions that are necessary for the survival, even prospering, of science, and those that are necessary for its most creative achievements."[17] Graham also points out the human costs, particularly of Soviet engineering. Universities and engineering colleges churned out engineers with very narrow technical specializations and lacking a sense of the "broader social concerns" that earlier generations of Russian engineers had possessed. Huge technical projects were carried out without giving thought to the human costs, environmental impact, or social utility, resulting in unnecessary human suffering and social problems, and thus contributing to the ultimate downfall of the Soviet Union.[18]

A younger generation of scholars has been more categorical than Graham in its rejection of the idea that democracy fosters better science. In a book defiantly entitled *Stalin's Great Science*, Alexei Kojevnikov argues that many of the factors that Western scholars have cited as causes of the failures of Soviet science and technology could just as easily be used to explain the triumphs of Soviet science. Indeed, centralized control very much facilitated the emergence of Big Science, notably in the case of the Soviet atomic program. Despite tremendous hardships and the political persecution around them, many scientists worked with great dedication, and were rewarded with great success. They were motivated by careerism, but also by profound patriotism, fueled by their bitter experiences in the Second World War and fear of the United States. Their attitudes toward socialism varied. Many of the scientists educated in the early Soviet period were rebels whose socialist beliefs led them to embrace revolutionary scientific concepts and to reject the conservatism of the academic establishment. The era of "High Stalinism," which was also the era of the purges, brought sober careerists to the fore. Although they publicly toed the party line, their primary concern was the preservation of the scientific community and its institutions, as well as the promotion of their own careers, institutes, schools, and disciplines. Kojevnikov considers the triumph of Lysenkoism to be a very exceptional case. He also argues that ideological opposition to quantum physics and Einstein's theory of relativity hardly had a serious chance of success, due to nuclear physicists' "skills—and some luck—in playing the rhetorical, ideological, and political games of that culture." According to Kojevnikov, atomic scientists possessed enough freedom to pursue the ideas they found promising, and the state provided them with tremendous resources to do so. Moreover, competition within the scientific community promoted scientific excellence. Gradually abandoning attempts to develop a uniquely "socialist science," the Soviet Union nonetheless developed its own brand of modern science. Kojevnikov attributes what he sees as great successes to the "extraordinary cultural value and importance" accorded to science in the Soviet Union.[19]

Though the detonation of the first H-bomb in 1955 and the launching of Sputnik in 1957 unleashed a wave of intense anxiety about the technological and scientific capabilities of the Soviet Union, on the whole, the West underestimated the scientific capabilities and technological might of the Soviet Union. In the West, it was argued that conformism and the inefficiencies of the planned economy stood in the way of good scientific and technical research. With the end of the Cold War and the opening of Soviet archives, the debate over Soviet science and technology has become more complex and less colored by ideology. The history of science and technology in Eastern Europe must be explored in a similar spirit.

East Germany makes for an interesting and unique case study on technology under Communism. Unlike the Soviet Union, which was a relative backwater at the time of the Russian Revolution, Germany was one of the top scientific and technological powers in the world at the end of the war. Its research and teaching infrastructure largely intact, East Germany inherited an academic tradition of excellence in science and a strong base for high-tech research in industry. Along with this went certain cultural attitudes, notably a consensus that science and technology should be left to the experts. Anxious to make use of German capabilities, the Soviet Union signaled a willingness to largely leave institutions and personnel alone after the war. In time, de-Nazification, state control of industry, the introduction of the planned economy, and secret police surveillance had a considerable impact on the universities and industry. Nonetheless, there were clear lines of continuity at the universities and in industry in the conception and organization of scientific and technical research and teaching. A major reason for this is the deep respect the Communist leadership felt toward the German university tradition and German science.

German professionalism was also uninterrupted. Although bureaucracy clearly triumphed over scientific and technical professionalism in the Soviet Union, this was much less the case in East Germany. In part, this is due to the more pervasive impact of professionalization in German society. In Germany, the professional ideal was intimately bound up with aspirations to join the bourgeoisie, as well as with the reconfiguration of masculine identity in the nineteenth century. A period of deprofessionalization in the Weimar Republic was followed by what was widely perceived as re-professionalization of engineering and industrial science in the Nazi era. Professional autonomy in these fields was sharply curtailed during the Communist era. Nonetheless, a professional ethos persisted, thanks to traditions of university training, the persistence of the scientific ideal, the vitality of professional organizations, and continuities in research culture, particularly in large enterprises with a long history.

A third major difference between East Germany and the Soviet Union is the problematic transition from Nazism to Communism. With some exceptions, one could say that the Germans chose National Socialism, whereas Communism was imposed on East Germany from the outside. Some felt nostalgia for what they had perceived in the Nazi era as increased autonomy, greater opportunities for professional advancement, and the sheer joy of technical work, untroubled by political or ethical considerations (particularly in the militarized sector of the economy). However, the Nazi era also set the stage for the Communist period. Engineers and scientists working in the high-tech sector became accustomed to working in high-security facilities, cut off from society, unconcerned with consumers, enjoying job security and generous support for industrial research, responsible only to the state, but completely dependent upon that state. These were the conditions many encountered in East German industrial research after the war.

Ideologically, acceptance of the new political system was eased by a fourth German peculiarity, namely the cultural model of the apolitical scientist or engineer.

This ideology was based partly on the defense mechanisms developed by technical professionals working for the Nazis to justify themselves after the war. It was, however, also rooted in professional ideology, as propagated by the *Verein Deutscher Ingenieure* (Association of German Engineers) since the nineteenth century. This organization's outlook combined a supposedly apolitical loyalty to Kaiser and nation with an ostensibly ideology-free dedication to technology.

Fifth, the existence of West Germany had a significant impact on the situation and mindset of the higher technical professions in East Germany. Particularly in the era before the building of the Berlin Wall in 1961, West Germany provided a frame of reference that affected the way professionals saw their personal career trajectories, issues involving professional autonomy, and the economic and technical accomplishments of East German industry. The greater earnings, status, and mobility of their Western counterparts, the public role played by West German engineering organization, and the successes of West German industry engendered discontent in the GDR. Some of these disillusioned professionals fled across the border into West Germany. The SED and secret police tried to combat this brain drain, as well as real or imagined acts of sabotage and espionage.

The identification of these five East German characteristics is useful in understanding the process of negotiation involved in the creation of new technologies and, in particular, why this process occurred so differently in the GDR than in the USSR. Methods of analysis are drawn from disparate fields: social history, cultural history, the history of professions, the history of elites, the STS ("Science, Technology and Society") school of the history of technology, analysis of the power structures of party and state (including the secret police), and biographical approaches. I have chosen to focus on high-tech industry rather than consumption and production of consumer goods, although very important debates have developed concerning that sector. The economic choices made in the GDR, choices that had a profound impact on the availability of consumer goods and that contributed to the downfall of the GDR, cannot be understood without a full appreciation of the cultural values that ascribed a central role in industrial development to high-tech industries. I set out to study the East German obsession with high-tech industries as a cultural, political, social, ideological, and gendered phenomenon, a subject that, despite the extensive literature on these industries, has not really been explored in any great depth. (This literature has concerned itself mainly with a chronicling of technological progress within the histories of individual enterprises.) In addition, high-tech industries lend themselves well to the science-under-dictatorship theme because science and industrial scientists play a prominent role in these industries, because they had leverage and influence as highly favored industries, and because they were swept up in power conflicts to a greater extent than other industries.

This book is not about the ways in which innovation was blocked by the economic inefficiencies of the planned economy or false incentives created by the socialist system—a fine literature already exists on this subject.[20] Instead, I attempt here to look at the way engineers and industrial scientists—who were motivated by a complex mixture of professionalism, individualistic careerism, socialist ideology, a belief in science, company traditions, and personal goals and ties—interacted with the dictatorial system. This will tell us something about the innovative process in the GDR, but also about many other things: the ways in which the SED mobilized society, the interaction of cultural forces coming from above but also from below, and the ways in which individuals conformed or did not conform to socialist norms in everyday situations.

My strategy is to delve deeply into individual examples, using biography as a vehicle. This methodology has been tried too little in research on East German technology. The analysis of biographies, autobiographies, and interviews illuminates vital aspects of the relationship between culture and technology, providing insights that institutional histories cannot. They make it possible to examine motivations, ideology, and career strategies. A re-creation in detail of the interactions of individual and system in the factory, university, and research facility becomes possible. What biographical and autobiographical approaches to these microcosms show is that the actors were seldom driven by simple opportunism or by blindly ideological thinking. Rather, their lives were, like all lives, messy and driven by complex and contradictory forces. To understand the nature of life under dictatorship and its impact on science and technology, we must understand these complexities. This approach brings up problems with regard to sources, problems that are, however, surmountable.

Vast archives have opened up since the fall of Communism. Official reports—the reports of party and government agencies, industrial reports, and other papers from enterprises, socialist "combines," and other organizations—give a fairly good picture of the engineering profession and the development of technologies. However, they do not make it possible to re-create in detail the process of negotiation among technical professionals, state, Soviet authorities, and society. Almost entirely missing is the realm of public debate that existed in the West. Biographical and autobiographical materials offer an alternative, yet they are extremely sparse for the GDR (unlike for the Soviet Union[21]).

To my knowledge, the best memoir of a person active in East German industrial research is the unpublished, handwritten memoir of Werner Hartmann (born on January 30, 1912, in Berlin-Friedenau, died on March 8, 1988, in Dresden), an industrial physicist. As the head of the Office for Molecular Electronics (*Arbeitsstelle* *für Molekularelektronik*) in Dresden, he oversaw the birth of microelectronics in the GDR. The existing eight volumes of his memoirs cover important phases in German history of technology from the Nazi era to the Honecker régime.[22] As far as I know, nothing more than brief accounts of his life have been published.[23] Hartmann's account, as well as the archival record, show him to have been a very talented industrial scientist and organizer of research who carried out highly innovative research programs. His struggles with the Communist bureaucracy provide a great deal of insight into the complex relationship between the innovator and the state.

Hartmann's career will be compared with that of some of his contemporaries. I chose individuals who (like Hartmann) played a prominent role in high-tech industrial research, where innovation was of central importance and innovative behavior was highly likely to be encouraged and rewarded. They worked in the electronics industry and related industries—semiconductors, computers, and computer software—as well as in the East German Carl Zeiss corporation (specializing in precision instruments and, later, microelectronics). I have also gathered considerable but very dispersed material on the work and lives of rank-and-file engineers and industrial scientists.

In conducting research for this project, I visited (in some cases several times) the Archives of the Parties and Mass Organizations of the GDR/Federal German Archives (SAPMO/BArch) in Berlin, the secret police (Stasi) archives (the former Gauck-Bureau, now the Birthler-Bureau), National Archives II (in College Park, Maryland), the archives of the Carl Zeiss corporation in Jena, the Provincial Archives of Berlin, the Provincial Archives of Brandenburg (in Potsdam), the Provincial Archives of Saxony (in Dresden), the Archives of the Technical University of Dresden, and the Archives of the Mining Academy of Freiberg, and the Berlin office of the German census bureau (*Statistisches Bundesamt*), as well as a considerable number of small archives, some of them now defunct, such as the Technical Collections of Dresden, the archive of the Chamber of Technology (*Kammer der Technik*), GESIS (a collector of quantitative material), and the "Project Group on University Research."

I have also made extensive use of oral history. An NSF grant financed two sets of interviews, conducted by my two research assistants in Berlin, one with software engineers, one with female engineers. My interview questions focused on professional and personal identity and links between the two. The interviewees' responses were not restricted. They were allowed to roam across the landscape of their professional lives, reconstructing the paths they had followed or abandoned, as well as tracing the highs and lows, the continuities and discontinuities. They were encouraged to reflect upon the meaning of their lives up until that point and the importance of their profession in those life trajectories. In addition, I have interviewed numerous public figures, engineers, relatives of industrial researchers, and scholars.

In addition to what was visible on the surface, there was a subterranean level of interaction between professionals and the state in East Germany, represented by the secret police. This is not a subject to which I originally intended to accord much attention. The lurid sensationalism of the revelations of Stasi involvement of various public figures in the 1990s appeared to be little more than a distraction from other, more important issues, such as the difficulties in integrating East Germany into West. Many felt that such accusations were a handy cudgel in the hands of Westerners intent on asserting their superiority over Easterners. Even for those (such as myself) who felt the revelations to be justified in theory, the spectacle of mass denunciations seemed unwise, given the sensitivity of Easterners to their vulnerable and unequal position in the new Germany.[24] Nonetheless, I have come to understand during the years of research that went into this book that one simply cannot begin to understand the relationship between state and professional without studying the involvement of the Stasi. It is also here that the layers of the personalities of these prominent East Germans—victims, perpetrators, and bystanders of secret police repression—reveal themselves, along with conflicted feelings and divided loyalties.

I have not attempted to trace the relationship of a large number of individuals to the secret police. Such an endeavor would be impossible in any case, given the difficulties in procuring Stasi files from the office that oversees those records.[25] Rather, I have confined myself to a couple of case studies for which I also had access to a large body of other kinds of sources. I can only hope that I have handled the Stasi files with the necessary discretion and critical sensibility.

This book's organization is both thematic and (roughly) chronological. Chapter 1 explains why many German scientists and engineers deported to the Soviet Union after the Second World War decided to go to Communist East Germany after the war instead of to the capitalist West. These decisions are placed in the context of these scientists' experiences in the USSR and (earlier) in Nazi Germany, as well as in the context of engineering ideology and professional history. Chapter 2 traces the attempts of engineers and industrial scientists to hold on to certain aspects of professional autonomy. Three sources of professional identity will be discussed: the "bourgeois" tradition of engineering and industrial science inherited from Nazi Germany, institutions of higher technical education, and the Chamber of Technology, an engineering organization. Chapter 3 is about major challenges to professional identity that engineers and industrial scientists faced in everyday life in the factory. Workers, local party officials, women, and a "new technical intelligentsia" forced these (mainly male and apolitical) professionals to rethink their position in the factory, and called forth resistance to an extent that has been often been overlooked. Five high-tech researchers are the subject of chapter 4, which explores the causes of failure of pioneering research projects in the 1950s and 1960s. Chapter 5 focuses on the clash between the cultures of innovation cultivated by three major research directors and the culture of control pushed by the SED and the secret police. Popular culture and propaganda are the theme of chapter 6, which explores the role of technological fantasies in the mobilization of the masses, the recruitment of engineers and scientists, and the legitimation of the system. Chapter 7 is devoted to an analysis of my oral history project. This chapter focuses on the individual career strategies in the Honecker era, looking at the reasons why people went into technical fields; how this fit in with private and family life; what role gender played in the higher technical professions; the factors behind upward professional mobility; and attitudes toward the power structures of the East German system. Chapter 8 deals with the increasing importance of microelectronics, militarization, and SED and Stasi control of high-tech research in the 1980s, focusing on strategies used by enterprises, combines, and individual engineers and industrial scientists in dealing with changing power relations.

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Notes

1. See Alvin W. Gouldner, *The Two Marxisms* (New York: Seabury Press, 1980), esp. 42–43, 73, 269–275, 385–386.

2. On Lenin, see Jonathan Coopersmith, *The Electrification of Russia, 1880–1926* (Ithaca, NY: Cornell University Press, 1992). Stalin's massive assault on technocratic thinking led to little change in these priorities. On Stalin, see Kendall Bailes, *Technology and Society under Lenin and Stalin: Origins of the Soviet Technical Intelligentsia, 1917–1941* (Princeton, NJ: Princeton University Press, 1978), 64–120; Loren R. Graham, *The Ghost of the Executed Engineer: Technology and the Fall of the Soviet Union* (Cambridge, MA, and London: Harvard University Press, 1993); Susanne Schattenberg, *Stalins Ingenieure: Lebenswelten zwichen Technik und Terror in den 1930er Jahren* (Munich: R. Oldenbourg Verlag, 2002), 70–107. For a longer view, see Paul Josephson, *Red Atom: Russia's Nuclear Power Program from Stalin to Today* (New York: W. H. Freeman and Company, 2000), esp. 7–19.

3. See Sigrid Meuschel, *Legitimation und Parteiherrschaft in der DDR* (Frankfurt: Suhrkamp Verlag, 1992); Jürgen Kocka, "Wissenschaft und Politik in der DDR," in *Wissenschaft und Wiedervereinigung*, ed. Jürgen Kocka and Renate Mayntz (Berlin: Akademie-Verlag, 1998), 435–459.

4. See Slava Gerovitch, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics* (Cambridge, MA: MIT Press, 2002), 155.

5. Nikolai Krementsov, *Stalinist Science* (Princeton, NJ: Princeton University Press, 1997), xi.

6. See Monika Renneberg and Mark Walker, eds., *Science, Technology and National Socialism* (Cambridge and New York: Cambridge University Press, 1994); Margit Szöllösi-Janze, ed., *Science in the Third Reich* (Oxford: Berg Publishers, 2001); Eric Katz, *Death by Design: Science, Technology and Engineering in Nazi Germany* (New York: Pearson Longman, 2006); Mark Walker, *Nazi Science* (New York and London: Plenum Press, 1995); Dirk Böndel, *Ich diente nur der Technik: Sieben Karrieren zwischen 1940 und 1950* (Berlin: Nicolai, 1995).

7. See Krementsov, *Stalinist Science*, quotation on p. 81.

8. See Asif Siddiqi, *Challenge to Apollo: The Soviet Union and the Space Race, 1945–1974* (Washington, DC: National Aeronautics and Space Administration, 2000). Reprinted in two

volumes: *Sputnik and the Soviet Space Challenge* (Gainesville: University Press of Florida, 2003); *The Soviet Space Race with Apollo* (Gainesville: University Press of Florida, 2003).

9. See Gerovitch, *From Newspeak to Cyberspeak*.

10. See Robert Gellately, *Backing Hitler: Consent and Coercion in Nazi Germany* (Oxford and New York: Oxford University Press, 2001); Robert Gellately, *The Gestapo and German Society: Enforcing Racial Policy 1933–1945* (Oxford: Clarendon Press; New York: Oxford University Press, 1990).

11. See Sheila Fitzpatrick, *Everyday Stalinism* (New York: Oxford University Press, 1999); also Wendy Goldman, "Stalinist Terror and Democracy: The 1937 Union Campaign," *American Historical Review* 110, no. 5 (December 2005): 1427–1453. Important studies touching on these themes for East Germany include Richard Bessel and Ralph Jessen, eds., *Die Grenzen der Diktatur* (Göttingen: Vandenhoeck & Ruprecht, 1996); Ralph Jessen, "Die Gesellschaft im Staatssozialismus: Probleme einer Sozialgeschichte der DDR," *Geschichte und Gesellschaft* 21 (1995): 96–110; Jürgen Kocka and Renate Mayntz, eds., *Wissenschaft und Wiedervereinigung: Disziplinen im Umbruch* (Berlin: Akademie-Verlag, 1998); Detlef Pollack, "Die konstitutive Widersprüchlichkeit der DDR," *Geschichte und Gesellschaft* 24 (1998): 110–131; Monika Kaiser, *Machtwechsel von Ulbricht zu Honecker* (Berlin: Akademie-Verlag, 1997). An older literature points to competition between factions of the Communist elite: Gouldner, *The Two Marxisms*; and (on East Germany) Peter Christian Ludz, *Parteieliten im Wandel* (Cologne and Opladen, Germany: Westdeutscher Verlag, 1968).

12. On the totalitarianism approach and use of related concepts in research on the GDR, see Corey Ross, *The East German Dictatorship: Problems and Perspectives in the Interpretation of the GDR* (London: Arnold, 2002). For an important study that emphasizes the role of the secret police in industry, see Reinhard Buthmann, *Kadersicherung im Kombinat VEB Carl Zeiss Jena* (Berlin: Ch. Links Verlag, 1997).

13. See Meuschel, *Legitimation und Parteiherrschaft in der DDR*.

14. See discussion and literature cited in Ross, *The East German Dictatorship*, 28–43.

15. See Hartmut Zimmermann, "Intelligenz," in *DDR Handbuch*, vol. 1 (Köln: Verlag Wissenschaft und Politik, 1985), 658; Erika Hoerning, "Der gesellschaftliche Ort der Intelligenz in der DDR," in *An der Spitze: Von Eliten und herrschenden Klassen*, ed. Beate Krais (Konstanz, Germany: UVK Verlagsgesellschaft mbH, 2001), 113–155.

16. Loren Graham, *Science in Russia and the Soviet Union* (Cambridge and New York: Cambridge University Press, 1993), 126.

17. Loren Graham, *What Have We Learned About Science and Technology from the Russian Experience?* (Stanford, CA: Stanford University Press, 1998), 132; Loren Graham, "The Fits and Starts of Russian and Soviet Technology," in *Technology, Culture and Development: The Experience of the Soviet Model*, ed. James P. Scanlan (Armonk, NY, and London: M. E. Sharpe, 1992), 3–24; Graham, *Science in Russia and the Soviet Union*.

18. Graham, *Science in Russia and the Soviet Union*, 165; Graham, *The Ghost of the Executed Engineer*.

19. See Alexei Kojevnikov, *Stalin's Great Science: The Times and Adventures of Soviet Physicists* (London: Imperial College Press, 2004), quotations on pp. 244, 304. Siddiqi advances similar arguments for the space program. See Siddiqi, *Challenge to Apollo*.

20. See Heike Knortz, *Innovationsmanagement in der DDR 1973/79–1989: Der Sozialistische Manager Zwischen ökonomischen Herausforderungen und Systemblockaden* (Berlin: Duncker & Humblot, 2004) and literature cited therein.

21. Susanne Schattenberg was able to make use of a great wealth of memoirs and other autobiographical and biographical sources in her study, *Stalins Ingenieure*.

22. His memoirs are in the collection "Nachlaß Prof. W. Hartmann," held by the archives of the museum "Technische Sammlungen Dresden." I thank Renée-Gertrud Hartmann for granting me permission to use these memoirs.

23. See Hans Becker, "Prof. Werner Hartmann: Würdigung eines diskriminierten Wissenschaftlers," *radio fernsehen elektronik* 39 (1990): 648–650; Hans Becker, "Ein Pionier der Mikroelektronik," *Sächsische Zeitung*, January 30, 1997; Günter Dörfel, "Werner Hartmann: Industriephysiker, Hochschullehrer, Manager, Opfer," in *Physik im Nachkriegsdeutschland*, ed. Dieter Hoffmann (Frankfurt am Main: Verlag Harri Deutsch, 2003), 221–230; Reinhard Buthmann, "Die strukturelle Verankerung des MfS in Wissenschaft, Technik und Technology," *Dresdener Beiträge zur Geschichte der Technikwissenschaften* 25 (1998): 39–70, esp. 59–60, 68.

24. See my article, "The Impact of Two Reunification-Era Debates on the East German Sense of Identity," *German Studies Review* 27 (Fall 2004): 563–578.

25. The office's official title is "Der Bundesbeauftragte für die Unterlagen des Staatssicherheisdienstes der ehemaligen Deutschen Demokratischen Republik."

26. Thomas Baylis, *The Technical Intelligentsia and the East German Elite* (Berkeley, CA: University of California Press, 1974).

Abbreviations and Acronyms

AME, AMD Arbeitsstelle für Molekularelektronik, Arbeitsstelle für Molekularelektronik Dresden (Facility for Molecular Electronics, Dresden)

BAF Bergakademie Freiberg (Mining Academy of Freiberg)

BArch Bundesarchiv (Federal Archive of Germany, Berlin)

BLHA Brandenburgisches Landeshauptarchiv (Provincial Archive of Brandenburg)

BStU Bundebeauftrage für die Unterlagen des Staatsicherheitsdienstes der ehemaligen DDR (Federal Administration for the Records of the State Security Service of the Former GDR)

CoCom Coordinating Committee for Multilateral Export Controls (Western organization established to maintain embargos on Western exports to East bloc countries)

COMECON Council for Mutual Economic Assistance (Eastern European economic organization)

CZ Carl Zeiss Archiv (Carl Zeiss Archive, Jena)

DAF Deutsche Arbeitsfront (German Labor Front, a Nazi organization)

DM deutsche mark (former official currency of West Germany)

EOS Erweiterte Oberschule (East German high school)

ESER Einheitliches System der Elektronischen Rechentechnik (unified system of electronic computing technology)

FDGB Freier Deutscher Gewerkschaftsbund (Federation of Free German Trade Union, an East German trade union federation)

FDJ Freie Deutsche Jugend (Free German Youth, East German youth organization)

HF Werk für Fernmeldewesen (Telecommunications Works), located in the Oberschöneweide section of Berlin, later known as WF

HWF Halbleiterwerk Frankfurt/Oder (Semi-Conductor Works of Frankfurt an der Oder)

IM Inoffizieller Mitarbeiter (secret police informant)

LAB Landesarchiv Berlin (Provincial Archive of Berlin)

MfS Ministerium für Staatssicherheit (Ministry for State Security)

MVD Ministerstvo Vnutrennikh Del (Ministry of Internal Affairs, USSR)

NARA National Archives and Records Administration, College Park, MD

NKVD Narodnyi Komissariat Vnutrennikh Del (secret police, Soviet Union)

NSBDT NS-Bund Deutscher Technik (National Socialist League of German Technology)

NSDB NS Dozentenbund (National Socialist Teachers' League)

POS Polytechnische Oberschule (polytechnical school, the basic school type in the GDR, encompassing grades one through ten)

SächsHStA Sächsisches Hauptstaatsarchiv, Dresden (Central Archive of Saxony, Dresden)

SAG Sovietische Aktiengesellschaft (enterprise directly run and controlled by Soviet authorities in SBZ)

SAPMO/Barch Stiftung Archiv der Parteien und Massenorganisationen der DDR im Bundesarchiv (Foundation of the Archive of the Parties and Mass Organization of the GDR in the Federal German Archives)

SBZ Sovietische Besatzungszone (Soviet zone of occupation of Germany)

SMAD Sowjetische Militäradministration in Deutschland (Soviet military administration in Germany)

SB Statistisches Bundesamt (Federal Office for Statistics)

SED Sozialistische Einheitspartei Deutschlands (Socialist Unity Party of Germany)

TSD Technische Sammlungen Dresden (Technical Collections of Dresden)

TH, TU Technische Hochschule, Technische Universität (technical university)

TUD Technische Universität Dresden (Archives of the Technical University of Dresden)

VDCh Verein Deutscher Chemiker (Association of German Chemists)

VDI Verein Deutscher Ingenieure (Association of German Engineers)

VDDI Verband Deutscher Diplom-Ingenieure (Association of German University Engineers)

VEB Volkseigener Betrieb (people's enterprise)

VVB Vereinigung Volkseigener Betriebe (association of people's enterprises)

WF Werk für Fernsehelektronik (Television Electronics Works), located in the Oberschöneweide section of Berlin

WTB Wissenschaftlich-technisches Büro (scientific-technical bureau)

WTZ Wissenschaftlich-technische Zentren (scientific-technical center)

ZKDS Zentraler Kaderdatenspeicher (Central Cadre Data Repository)

1

The “Great Eastward Trek”: German Specialists in the Soviet Union

German scientists and engineers entered into a new relationship with the Soviet Union quite suddenly at the end of the Second World War. From the beginning of the Red Army invasion of Germany to the end of Soviet occupation in 1949, Soviet authorities captured, coerced, and recruited German scientists and engineers to go to the USSR to work on the atomic bomb and other essential technical projects. Virtually all, even those who had gone voluntarily, felt like prisoners at least part of the time. They experienced extreme rupture in their personal and professional lives, and were confronted with tremendous difficulties and hardships. Amazingly, despite these traumatic experiences, a large percentage of them, upon their release, decided not to flee to the capitalist West, but to make their lives in Communist East Germany. Their exact numbers will never be known, but they made themselves felt in every corner of the GDR. Indeed, many of these deported Germans rose into positions of prominence in East Germany. During their time in the Soviet Union, they entered into a complex relationship with the Communist system, one that would have a profound impact not only on their professional lives, but also on the engineering profession and industrial research in the GDR. The roots of their decisions to go to work for the Communists and their understanding of their position within the system can only be understood against the background of their experiences in the Soviet Union, so it is to this chapter in their lives that we turn.

“A Piece of Familiar Home in a Continually Changing Landscape”

On October 22, 1946, Werner Albring, an aerodynamics expert working at the Soviet-run rocketry research center in the Thuringian village of Bleicherode, was shaken awake by his wife and sister-in-law just before 6:00 a.m. Groggy after a night of hard drinking at a banquet orchestrated by the Soviet authorities, he was startled by the words of a friend, a Soviet officer who had come to prepare him for a very unexpected turn of events: “You must travel to Moscow today. . . . At 6 o'clock, a lieutenant will come to your apartment, accompanied by four soldiers. He will order you to pack up all of your furniture and belongings for the trip." Albring's escorts arrived punctually. An interpreter translated their written orders: *Zentralwerke*—the research center where Albring worked—was to be moved for five years to the Soviet Union, and some of its employees were required under the Potsdam Agreement to go along to continue their work under Soviet supervision as a kind of reparation.[1]

All over the Soviet zone of occupation, similar scenes were playing out. This was the beginning of *Osoaviakhim*, the Russian code name by which this deportation action has come to be known.[2] A big military research and production complex that the Soviets had built up in their zone of occupation in Germany from Nazi-era corporations and research institutes—clandestinely, and in violation of four-power agreements—was now moved to the Soviet Union. Laboratories, factories, and documents were disassembled or gathered up and loaded onto trains. The thousands of scientists and engineers who were rounded up were welcome to bring along employees, family members, even lovers, along with personal effects, household items, heavy furniture, pets, livestock, and house plants. Adults, children, animals, and goods were carefully loaded on to ninety-two Soviet trains. Many specialists protested vociferously, but, convinced of the hopelessness of their situation, resigned themselves to their fate. Few were given a contract, and so began a long period of living in a legal limbo.[3]

This was the beginning of a temporary migration to the great "socialist motherland," a collective experience shared by about 300 scientists, 1,300 engineers, and 1,300 skilled workers, along with some 5,000 family members.[4] They were called "specialists," a term that in Russian referred not only to engineers and scientists, but also to skilled workers. Later, when they returned to East Germany, a mystique surrounded them, admired as they were for having helped rebuild the Soviet Union. According to historian Burghard Ciesla, over 80 percent initially returned to the German Democratic Republic when they were permitted to do so, though many later fled to the West.[5] The roster of those who attained key positions in the East German technical and scientific elite or even (in a few cases) in the party leadership is impressive. They include: Peter Adolf Thiessen (head of the Research Council [*Forschungsrat*] in 1957–1965 and member of the State Council [*Staatsrat*] in 1960–1963), Max Volmer (head of the Academy of Sciences [*Deutsche Akademie der Wissenschaften*] in 1955–1958), Manfred von Ardenne (top researcher in many areas, head of a private institute, and member of the Research Council [*Forschungsrat*]), Erich Apel (member of the Central Committee of the SED and head of the State Planning Commission), Matthias Falter (an important figure in early semiconductor research), Werner Hartmann (head of the first major institute for microelectronics research), Paul Görlich (head of research at Carl Zeiss Jena), Herbert Kortum (who built the first computer in the GDR), Nikolaus Joachim Lehmann (another computer pioneer), and many of the founders of the East German aviation industry (which attained considerable prominence in the 1950s). The "specialists" played an important role in East German industrial research, and had a major impact on technological culture in East Germany.

This roster of "alumni" reflects the degree to which scientists and engineers found their relationships with the powerful congenial, or at least workable. Coercion obviously played a major role in the interaction between experts and Soviet authorities. But in many cases, there was also a strong element of consent. Some went to the Soviet Union voluntarily. Osoaviakhim swept up those who were already working—directly or indirectly—for the Soviets. A process of negotiation began immediately upon their deportation. Most German scientists and engineers accommodated the expectations of the Soviets, but also felt themselves lucky to have the opportunity to continue their research.

Werner Albring's account of deportation to the Soviet Union is one of the most positive. Very much colored by loyalty to the Communist system, he depicts his trip to the Soviet Union as the beginning of a very constructive phase of his life. Inspired by Sputnik, Albring began writing his memoirs in 1957, although he did not complete them until 1988 and did not publish them until 1991, when they were published free of GDR censorship. This account is shaped by a desire to find meaning in a life dedicated to East Germany. For Albring, the normalization of an extraordinary situation came surprisingly early in his "great eastward trek," as he calls it in his memoirs. Albring's wife's twenty-year-old sister, Liddy, who had been living with the Albrings, decided to go along out of a sense of adventure. The sisters, having made their preparations for the unexpected move "with bravado," seemed very much at ease with the sudden turn of events. The journey to Moscow took nearly three weeks on the completely overwhelmed and still badly damaged Eastern European rail system. Reminders of the war and the privations of the post-war period were subtle: a field of sun-browned wheat left unharvested since 1944, unseen Polish bandits who were kept out at night by tying the handles of the train cars from the inside. Although the trip was tiring, the food was good, the compartments pleasantly heated, and the company congenial. Two cows in the freight compartment provided the small children with milk. Liddy was soon being courted by two admirers. Albring's three-year-old daughter played happily, day after day, feeling secure in the midst of her family. Soon the train became "a piece of familiar home in a continually changing landscape." Blown-up tanks and damaged planes lay strewn around fields in Belorussia, but grass had already covered the grenade craters.[6]

Albring's eastward journey had actually begun before his deportation, shortly after the war, as it had for many others in armaments production. A former employee of the wartime Institute for Aerodynamics and Aviation, he found himself unemployed and living in the British zone of occupation. His first crossing over into the Soviet zone in 1946, on his way to a job interview, felt to him "as adventurous as an expedition of the legendary Baron Münchhausen" (an eighteenth-century figure made famous by a Nazi-era film). Like other engineers, he feared the Soviets, partly because of Nazi propaganda, but also partly because he knew of the Stalin-era show trials and persecution of engineers. However, Albring felt compelled by circumstances to overcome these fears. Thirty-two years of age, with a young wife and three-year-old daughter, Albring faced unemployment or life abroad, away from his family. The Albring family (which included Werner Albring's sister-in-law) lived in two small rooms, with inadequate facilities. During the winter (a winter of bitter hunger in Britain as well), food rations in the British zone were reduced to a thousand calories per person per day. Many German children died that winter due to privations of various sorts. The Albrings augmented their rations with mushrooms and berries from the woods, often preserved in jam jars, and spent a good deal of time gathering fire wood. On the other hand, the Soviets offered the family 4,500 calories worth of daily rations per person and offered Albring the chance to work on the V-2 rocket, Hitler's much-vaunted *Wunderwaffe*, which was used during the last days of the Second World War to terrorize the civilian population of Britain. This was an enticing prospect for Albring, as it represented a professional advancement.[7]

The Soviets offered him a job at Zentralwerke, a rocket research center that had been evacuated by the Nazis from Peenemünde (where Wernher von Braun conducted rocketry research for the Nazis) to Bleicherode, a small village in Thuringia, and was renamed and converted into a SAG (*Sovietische Aktiengesellschaft*, an enterprise directly run and controlled by Soviet authorities) in 1946. Helmut Gröttrup, the head of Zentralwerke, inspired confidence in Albring, as evidently did the Soviet officers present at the first meeting, whose calm demeanor and excellent German made a positive impression on Albring. Albring claims that he believed the Russians when they asserted the rocket research would be used for peaceful purposes, such as mail transport and space exploration.[8]

Working and living conditions in Bleicherode fully lived up to the researchers' expectations. Sergei Pavlovich Korolev, who was to become the father of the Soviet space program, was assigned to Bleicherode with the rank of major. Albring describes him as "a talented engineer, a figure of authority, decisive, possessing a precise knowledge of engineering coupled with common sense." Germans and Russians socialized with each other, visiting each other's homes along with their families. The specialists' optimism burst forth in daydreams of a futuristic, technocratic nature. One evening, Hoch is reported to have said: "We are now in our most productive years . . . And it is important to work on a meaningful task . . . I sometimes think that sometime in the far distant future our earth could become uninhabitable. And we are the ones who are doing the pioneering work on the future means of transportation, the rocket." The dawning realization that the rockets developed at Bleicherode would, indeed, be used for military purposes did not deter him or his colleagues from continuing their research with great enthusiasm. He rationalized his decision to stay with the arguments that other professional possibilities were no longer available, and that he could not let down his colleagues by leaving.[9]

"Du, Dokument. Ich, Revolver": Werner Hartmann's Trip to the Soviet Union

Werner Hartmann, a thirty-three-year-old physicist who had participated in pioneering industrial research on television, electronics, and solid-state physics during the Nazi period, had been commandeered to go to the Soviet Union to work on the atomic bomb project over a year before Albring. His unpublished memoirs, secretly written by hand between the 1960s and early 1980s, give insight into the chaotic and dangerous situation that scientists and engineers faced at the end of the Second World War and the decisions that led to their migration to the Soviet Union.

Although living in Zehlendorf, an affluent suburban area of Berlin, Hartmann was caught up in the struggle to survive after the Red Army occupied Berlin. His fear of Soviet soldiers is palpable in his descriptions of their "habit" of shooting aimlessly all day and all night. Once, when they entered and took him down to the basement of his house with a rifle (MP) to his back, he thought they were going to shoot him; it turned out they were only looking for objects of value. He took in a secretary of the television company, Fernseh GmbH, where he worked, as well as her husband. The two men told her to always keep her back to Soviet soldiers so that they would not see her physical beauty. Hartmann recalls the long lines outside of doctors' offices of women who had been raped by soldiers. Hartmann's bicycle—even though he had papers allowing him to keep it—was confiscated with the words, "Du Dokument, ich Revolver!" Hartmann's depiction of Soviet soldiers very much follows the pattern of many post-war accounts, colored by racialized perceptions. He recalls that one day, two Soviet soldiers with "Asiatic" features showed up at the home of a former Nazi. They played in a very kind way with the man's dachshund, then walked into the house and smashed all the furniture in the parlor with their rifle butts, came out again, and again petted and fed the little dog. "Not until much later did I learn that this behavior demonstrated the two sides of the Slavic-Asiatic soul: brutality and tenderness."[10]

In downtown Berlin terrible devastation and chaos were everywhere. "The most terrible sight was the stream of people—often women with several small children or very old people with a cane—carrying those few possessions that they had been able to save in backpacks, bags, suitcases, cardboard boxes, baby carriages or small carts. All of them had lost their homes and all their belongings in the inner city, along with family members, and were now marching out of Berlin, toward an uncertain future, most without a destination." Like these people, Hartmann did not know what to do after his old company and other places where he might have been able to work were shut down by the Soviets. It was rumored that all factories were to be disassembled and taken to the Soviet Union as reparations or plunder. "What should I do now?" he asked himself.[11] Like many Germans in that period, Hartmann suffered from hunger. When he came upon a crowd looting a grocery store, he helped himself. Decades later, he still remembered with pleasure a meal of fried potatoes and bacon that he ate in this period at the home of Gustav Hertz.

Through Hertz, Hartmann received what he saw as a chance to escape this miserable situation. Hertz, winner of the 1925 Nobel Prize in physics and Hartmann's mentor at the Technical University (TU) of Berlin-Charlottenburg, had been considered a "quarter-Jew" during the Nazi period. A *Mischling* (a person of mixed racial ancestry) under the Nuremberg Laws, but too famous to be rounded up, Hertz was forced out of the TU, but was invited by the Siemens Corporation to conduct industrial research as the scientific head of Siemens Laboratories. Sickened by the crimes of the Nazis, Hertz accepted an invitation to go to the Soviet Union after the war to set up a physics institute and to run it for two years. Hertz put Hartmann's name on a list of assistants he would like to take along. Hartmann signed on the day after he learned of this, motivated primarily by a desire to continue his research.[12]

Hartmann flew with the Hertzes on a two-motor Douglas plane to Moscow. From the air one could see "fires, the whole extent of the destruction." During a refueling stop in Germany he put a handful of soil in his pocket, which he threw away in the late 1940s, after he lost hope of ever returning home. Images of a confrontation with wrathful Russians passed through his mind on the truck-ride from the Moscow airport: "Five weeks after the surrender of Hitler's Germany, which had attacked the USSR and inflicted gigantic losses on her . . . My only wish was that the truck not break down. If it did, I would probably have to get out, and someone could recognize me as a German; how would the population react?"[13]

The Soviet Seizure of Scientists and Engineers

It is quite surprising how so many German engineers and scientists quickly accustomed themselves to their new lives in a land they hardly knew, given that they had very different agendas from that of their Soviet captors. The Soviet seizure of German scientists and engineers must be seen both in the context of the Soviet push for reparations and in the context of the early Cold-War scramble to grab specialists who might otherwise end up developing military hardware for the other side. At Yalta, Roosevelt and Churchill agreed that forced labor was to be included as a form of reparations, which were to total $20 billion, half of which was to go to the Soviet Union. At the same time, the Soviets vied with American and British forces to capture or recruit as many scientists and leading technical experts as possible. The German nuclear program was a principal target. The secret Anglo-American Alsos mission (whose name derived from the Greek work for "groves," a bilingual pun of sorts on the name of the head of the Manhattan Project, General Leslie Groves) was charged with capturing leading German scientists, especially atomic physicists. Another Anglo-American program, code-named Operation Paperclip, recruited German scientists such as Wernher von Braun to work for the United States and Britain. Occupying parts of Thuringia and Saxony that were later to be turned over to the Soviets, American forces seized laboratories and papers from military research facilities and were able to induce technical personnel to go west (not always using the gentlest of methods). The Soviets tried to recruit scientists and engineers living in the American and British zones, as well as to win over the cooperation of technical and scientific experts in the Soviet zone of occupation, offering the unemployed among them jobs and offering the former Nazis leniency. Generous food rations and good housing sweetened the deal, as did the prospect of living with their families and receiving open-ended contracts (as opposed to the temporary contracts offered by the Americans and British). The Soviet contracts even stipulated that the Germans could resign if their place of work was moved.[14]

The first group of German scientists sent to the Soviet Union (May to September 1945) consisted of about a hundred scientists who were to work on the atom bomb. The importance attached to this project by the Soviets is reflected in the fact that the NKVD (the Soviet secret police, headed by Lavrenty Beria) was put in charge of it. A number of nuclear physicists surrendered to the Soviets, among them Gustav Hertz and former students of his such as Heinz Barwich, as well as Professor Max Volmer and Baron Manfred von Ardenne, who had built a cyclotron at his institute in Berlin-Lichterfeld. Their hopes for Soviet leniency proved well founded. Peter Adolf Thiessen, the director of the Institute for Physical Chemistry and an "ardent Nazi" who had joined the party in the 1920s, only underwent pro forma de-Nazification. Anti-Nazi feelings, bitterness over their experiences in the Nazi period, and leftist leanings (particularly in Barwich's case) motivated Hertz, Barwich, and Volmer to agree to go voluntarily to the Soviet Union. They were also anxious to continue their work, together with their colleagues, using their own laboratory equipment and notes, which had been confiscated by the Soviets. Two institutes were established in September 1945 at the Soviet Black Sea resort, Sukhumi (now capital of the breakaway republic of Abkhazia): one in Agudseri, headed by Gustav Hertz, and one in Sinop, where Ardenne, Thiessen, and Max Steenbeck worked. Nikolaus Riehl, who had worked on uranium purification and heavy water for Auer Company in Rheinsberg (Brandenburg), was taken to Elektrostal, near Moscow, along with the Auer Company laboratories and staff. At his institute there, Riehl continued work on the production of purified uranium.[15]

A year later, Osoaviakhim relied much more exclusively on compulsion than had the seizure of specialists for the atomic program. Without contracts or valid passports and bereft of the protection of international agreements or international law, these Germans were forced to stay in the Soviet Union as long as the Soviet leadership so desired. The immediate goal of the October 22, 1946, action was to move huge aviation, rocketry, and other weapons research and production facilities in Saxony and Thuringia to the Soviet Union. These Nazi-era facilities had been rebuilt by the Soviets, who were well aware of the perils of conducting military research in Germany, given the open frontiers among the United States, British, French, and Soviet zones of occupation in Germany and the four-power prohibition of such research. The heart of the Nazi aviation industry was also located in the Soviet zone of occupation. The Soviets were quite interested in jet research, which had been more advanced in Nazi Germany than in the Soviet Union. The Soviets scoured the ranks of BMW, AEG, and Junkers employees for engineers and scientists who could work on aviation programs.[16]

The Soviets also put recruits from POW and civilian prison camps (many of the latter former Nazis) to work in atomic research and in the development of aircraft parts. German specialists were recruited to set up and run dismantled German factories, as well as to supply qualified technical specialists that the Soviet Union lacked.[17]

For most of these Germans, this was the first direct encounter with the Soviet Union: Most of the top scientists and engineers had worked on high-priority research projects during the war and had not seen the battlefield (least of all on the Eastern Front). Fewer still had been to the Soviet Union during the period of the Hitler-Stalin Pact, or had gone to live there in the Weimar or Nazi periods.[18] How did these specialists experience the Soviet Union, its culture, its research system, its political system? How did they negotiate this system? What impact did this have on the way they approached the situation in the GDR upon their return from the Soviet Union?

A One-Way Street: German Specialists and the Transfer of Technology to the Soviet Union

One-way technological transfer was what the Soviets sought: the transfer of know-how from Germany to the Soviet Union. Indeed, the Germans made significant contributions to Soviet technological development. However, recent studies such as that by Christoph Mick show that popular assumptions about the extent of those contributions are greatly exaggerated. Albring emphasizes that Sputnik was not German-built. It is now generally agreed that the espionage activities of Klaus Fuchs and others at Los Alamos made a far greater contribution to the Soviet atomic program than did the German nuclear physicists in the Soviet Union.[19]

But the Germans learned little from Soviet research, according to Mick. They were not allowed to interact with their Soviet counterparts, nor were they given access to Soviet research results. This is particularly odd since Soviet research teams were conducting parallel research. However, the parallel research gave the Soviet leadership a method for checking German results for signs of deception, sabotage, lack of motivation, or incompetence, while spurring Soviet scientists and engineers to a maximal effort. Members of the Soviet research groups were allowed to visit the German groups and to question them about their research, at times gaining insights that helped them solve key research problems. By contrast, the Germans almost never received help from Soviet engineers or scientists. According to Albring, Korolev and others ended personal friendships begun in East Germany after their transfer to the Soviet Union: "The beloved acquaintances from Bleicherode had turned into monosyllabic people." The German rocketry team provided interesting ideas to Soviet researchers, but ultimately lost out to Korolev's team.[20] Too few bridges were built between Soviet and German technical experts. This prevented the forging of Soviet-German links that could have provided a firm foundation for long-term German-Soviet technological collaboration.

Confronted with tremendous hurdles, many German researchers felt overwhelmed. The atomic scientists reacted to a report about the accomplishments of the Manhattan Project in the United States with anxiety: "Compared with the huge army of scientific personnel, the capacity of laboratories which had been operating for five years, we looked to ourselves like castaways who, in order to save themselves, had to build an ocean liner." However, they displayed ingenuity and energy in confronting the problems posed by isolation, poor working conditions, the lack of materials and skilled workers, the indifference of factory management, and the inefficiencies of the planning system. They improvised and built their own equipment and parts. They simplified design. Forced to work with pen and paper—sheets cut off of a big roll of brown paper—and isolated from other research institutes or libraries, the rocket research team nonetheless did very good work.[21]

Hardship, coupled with the opportunity to devote themselves to interesting and challenging technical projects, actually seems to have unleashed tremendous energy in the Germans. Many of them felt a great deal of pride in their hard-won accomplishments. Herbert Kortum, suffering greatly from the privations of life in the Soviet Union, wrote to a colleague at Carl Zeiss that he and others were working hard on the projects assigned to them because they wanted to prove the value of their company and of German culture to the Soviets: "If we again and again pull ourselves together and try to accomplish something, despite all the difficulties, we do so out of a feeling that we stand here as representatives of our old, world-renowned company and of our German people, and that everything that we do or leave undone will be seen from this perspective."[22] Barwich and Hartmann savor moments of triumph over Soviet rivals in their memoirs. Barwich was subjected to a scathing and brutal attack by a rival when, at a talk at an isotope separation plant in Siberia, he presented new techniques that he had developed. But afterward, the rival became quite friendly. Barwich remarks, "The cold war between the two sides was familiar to all the participants; it was nothing but a mock battle." At the end of the day, Barwich was offered a new job at the plant.[23] Successes such as this contributed to a sense of professional satisfaction as well as to a feeling of normalcy in the working lives of these Germans. They proved to be adaptable in other regards as well.

Isolation and the Re-Creation of the *Heimat*

The physical isolation of the Germans is quite striking. Many were sent to remote locations. Whatever hopes the Germans may have had of being associated with the premium research institutes of the Soviet Union were in most cases dashed at the outset. The rocketry specialists were bitterly disappointed to learn, soon after their arrival, that most were to be sent to a remote island, Gorodomliya. Most of the Germans in the Soviet Union had little or no access to Soviet research institutes or research libraries. German specialists were also unhappy to find themselves confined to relatively small compounds or perimeters around their places of work and residence, generally well patrolled and ringed with barbed wire. They were seldom allowed to visit Moscow or other cities, and then only in the company of a member of the NKVD, or, from 1946 onward, the MGB, or Ministry for State Security.[24]

Censorship was another irritant. Hartmann once received a letter from his father, of which the censor had blackened out all but two lines: "Dear Werner" and "Love, Father." However, Hartmann's father sent a second copy of each letter a few weeks after the first, and the censor usually censored different parts of the letter the second time around. The censorship of letters virtually ceased in 1952. Germans in the atomic bomb project received copies of West German publications such as *Stern* and *Der Spiegel* and listened to Western radio broadcasts. Nonetheless, many at Agudseri felt profoundly frustrated by restrictions on mobility, professional isolation, and restrictions on contacts between Germans and Soviets. Hertz told Beria about the discontent of the Germans. The infamous head of the secret police did not punish Hertz for complaining, but neither did he loosen security restrictions.[25]

However, isolation also had its advantages. Isolation was, for some, a welcome escape from the chaos of post-war Germany. Coming from a Germany lying in ruins, suffering from hunger and hopelessness, most of the German specialists found themselves in relatively unscarred, remote areas, where they were provided with good housing, food, and pay as well as a kind of security, albeit behind barbed wire. Knowing that Soviet vengeance had rained down on women who had fallen victim to mass rapes, on the hapless conscripted labor put to work in the dreadful uranium mines, as well as on those sent off to NKVD/MVD "special camps,"[26] the German "specialists" felt relatively well off. And although the experience of captivity and relative isolation seems to have caused some of the Germans great suffering, for others, such as Werner Hartmann, isolation brought the opportunity to totally immerse themselves in their work. Hartmann writes, "I never during my professional life—neither earlier in Germany nor later in the GDR—was able to work with such concentration . . . in a congenial atmosphere that was never disturbed." Reduced to "subservient work animals," many of the Germans got used to being taken care of by the Soviets, and in fact thrived professionally. They coped well with their situation and, rather than succumbing to feelings of claustrophobia, got along remarkably well, displaying a high degree of solidarity. Some had become accustomed to working in high-security facilities during the Nazi period, where they had developed a kind of "military comradeship" with fellow engineers.[27]

Two factors seem to have been central to the well-being of the Germans: their ability to work effectively and their ability to re-create a *Heimat* (hometown or homeland) away from home. Family and familiar gender relations were an important part of this portable *Heimat*. Traditional gender roles were the norm among the Germans, who expressed considerable disapproval over the employment of Soviet women in heavy work, such as construction work. The occasional female scientist or engineer among the Germans was marginalized. Hartmann writes, for example, that one female physicist from Germany was "a dried out, pimply old maid." Virtually all experts were allowed to bring along their families. The Germans were initially not allowed to divorce or marry in the Soviet Union, but this did not prevent them from setting up house in marriage-like relationships. But Soviet authorities did not allow friendships or romantic relationships between Germans and Soviets until at least 1951 or 1952. If there appeared to be a romantic interest between a German man and a Soviet woman, the woman was moved to another job. However, there seem to have been enough German women along to provide a pool of possible partners, at least in Agudseri and Suchumi.[28]

While the men appeared content with their domestic set-up, the wives felt differently. In her memoirs, Irmgard Gröttrup depicted the lives of the women who went along to the Soviet Union as arduous and full of self-sacrifice. Getting and preparing food was exhausting work, involving on at least one occasion a two-hour march in minus-forty degree weather to an open-air market. Caring for her children was also difficult, particularly given her son's poor health and the lack of good medical care. As a "poor female creature without intellect," hardly ever seeing her workaholic husband, she suffered from depression and constantly longed to return to Germany.[29]

Heinz Barwich, unlike most of the men, gladly escaped an unhappy marriage in the Soviet Union, leaving his wife in Suchumi (on the Black Sea) and moving to a job in Kieferstadt, an industrial town in Siberia. He discovered that the few available women there were off limits to him because they were Soviet citizens. Although this made a relationship with a woman he had met at a ballroom dance class impossible, he seems not to have minded very much because he was happy in the egalitarian, work-centered environment of Kieferstadt. This deprivation was also made more bearable by the belief that it was a fact of life for many: The living conditions were such that none of the single men (who shared living quarters) seemed to have a sex life. Barwich was happy that Germans were treated the same as Soviets there, and could freely move around in the town and its environs. There was a tremendous sense of camaraderie among his plant's employees: "We often got together with the Russians in the evening for casual social gatherings. We drank tea and vodka, ate cookies and candies, chatted, sang and danced to records." Thus for him, the company of men (temporarily) replaced conventional family life.[30]

One of the ways that the Germans sought to re-create the *Heimat* in the Soviet Union was through a romantic escape into nature—a predilection of middle-class Germans. Hartmann portrays Agudseri as a semi-tropical paradise. The main house, a former sanatorium that had once been the fifty-room summer home of a wealthy businessman, looked out over the Black Sea. The gardens were filled with palm and mandarin trees, camellias, bamboo, magnolias, eucalyptus trees, box trees, and agaves. However, taste and temperament varied, as did the circumstances under which individuals were forced to live and work. Barwich preferred life in Siberia to that in Suchumi: "Here, I found not just the work, but also life more romantic. Perhaps I was enchanted by the Siberian winters, with their great masses of snow and temperatures down to minus forty degrees Centigrade. In that clear air, one could breathe better and more deeply than in the humid climate of the Black Sea coast." At Gorodomliya, the Germans related to the natural beauty of the island in ways typical of the German bourgeoisie. They set up a tennis court and parallel bars for gymnastics, went skiing and swimming, sunbathed in the nude (discreetly), and camped out. However, many of the Germans probably lived under far more difficult circumstances. According to Riehl, in Elektrostal entire German families lived in single, bug-infested rooms. German engineers and scientists working for the Soviets while interned in POW or other camps were particularly badly off. Industrial physicist Kurt Berner found these camps an improvement over the prison camps in Soviet-occupied Germany, where he (a former Nazi Party member) had spent over two years. However, hunger and deprivation were part and parcel of the hard lives of rocketry researchers in Berner's camp in the Soviet Union. For German such as these, the *Heimat* remained at the far horizon.[31]

Dealing with Communism, Encountering Russia

German memoir writers tend to depict the Soviet system and Russian culture as two distinctive entities, and their accounts of the two reveal interesting things about the strategies they developed in trying to deal with the power the Soviets had over them and in coming to an understanding of their place in that system. These memoirists had few illusions concerning the nature of the Stalinist system, although they saw some positive aspects to Soviet-style socialism. Hartmann and other Germans knew of the persecution in the Soviet Union of those who disagreed with the biologist Lysenko. They were also shocked and dismayed to learn that quantum mechanics (as developed by Niels Bohr, Werner Heisenberg, and others) was officially rejected. Riehl (figure 1.1), who grew up in St. Petersburg as the son of a German father and a Russian mother, rejected the Soviet system on a profound level: "I was free from illusions from the start. As a firsthand witness to the October Revolution in 1917 and of the first years of Soviet communism, I knew the devastation Communism inflicted on the living standard." During his time in the Soviet Union, Riehl worked with two Soviet scientists who had been sent to a gulag during the Second World War. Of Alexander Solzhenitsyn's *Gulag Archipelago* Riehl writes, "I can confirm the accuracy of his descriptions and evaluations both from my own experiences and from those of many individuals mentioned in the book whom I have known."[32]

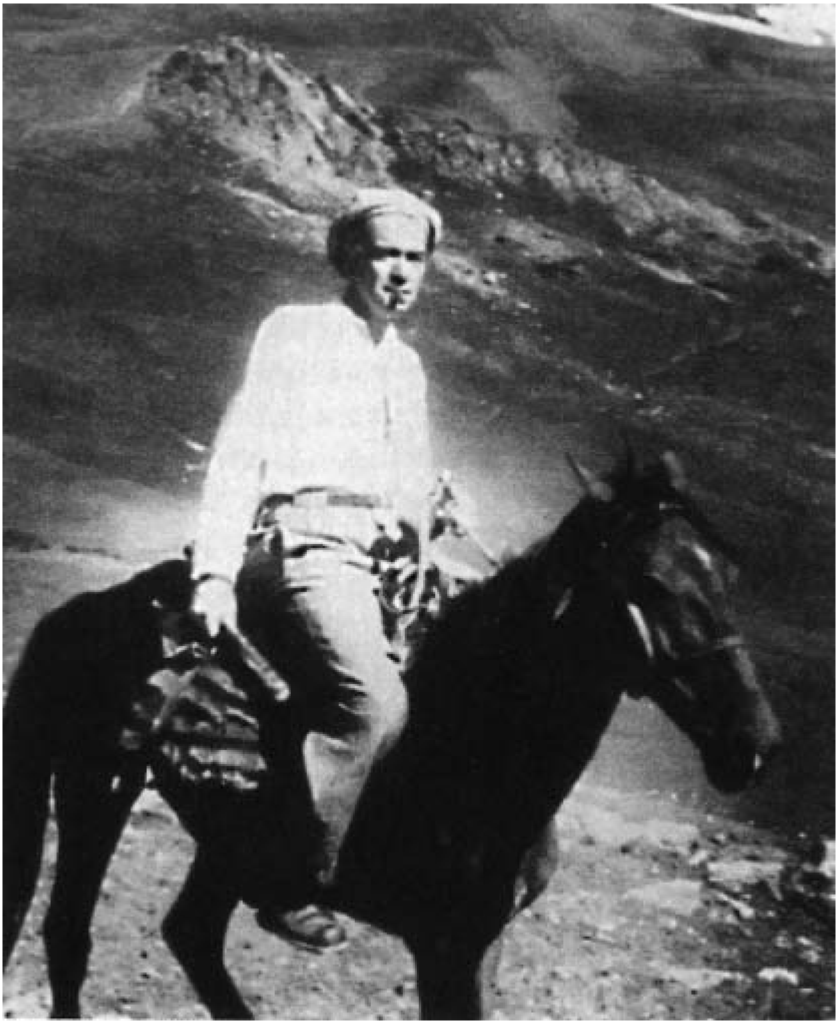

Figure 1.1
Nikolaus Riehl during his stay in the Soviet Union. Photo credit: Chemical Heritage Foundation

By contrast, Barwich, a non-Communist socialist from childhood, went to the Soviet Union with vaguely positive feelings and a desire to get to know "the grandiose historical experiment of building socialism according to a theoretical plan." Barwich comments positively on some aspects of the system, such as free medical care, but is more critical of the economic system, which he saw as wasteful and inefficient, although he was very impressed by the effectiveness of the Soviet atomic program and the highly motivated people who worked on it. Nonetheless, he became bitterly disillusioned with the Soviet system because of what he saw as its basic dishonesty. (Soviet rivals succeeded in discrediting his work through unjustified accusations of "moral failings.") He was also perturbed by what he saw as a pattern of lies on the part of the authorities in their dealings with the Germans. He indicates that the other Germans at Agudseri had come to see things in a similar way: "Of the seventeen German scientists at the institute in Agudseri, not one later became a member of the German Communist Party. And those from the other institutes who today loudly proclaim themselves to be Communists—most of these are former Nazi party members or collaborators—do not really believe Soviet promises." Barwich felt more profoundly disappointed than other Germans because he had positive feelings toward the Russians, and had not come to the USSR expecting the worst, as they had.[33]

Despite these overwhelmingly negative perceptions regarding the nature of the Soviet system, many German experts became convinced that they could function within this system. One reason is that they were convinced that the Soviet authorities treated technology and politics as two separate categories, not allowing politics to impinge on technical rationality: "When the Soviet government sets itself a technological goal, it sets politics aside. One knows that one cannot 'build power plants with ideology.'"[34] As far as ideology is concerned, most Germans were left alone, although a few groups were subjected to political indoctrination. Germans also found grounds for optimism in the apparent lack of enmity against them among Soviets, a phenomenon that bewildered them. This astonishment can be seen in a passage in Hartmann's memoirs:

> It would not have been surprising if the Soviets had treated us with hatred and disdain after this war was forced on them. In all the ten years [that we spent in the Soviet Union], none of us ever experienced an unfriendly encounter. We were astonished about that, and I still am today. The soul of these Slavic and Asiatic peoples is for us very difficult or impossible to understand. In the opposite case, that is, if Soviet specialists had come to a Germany attacked and devastated by the Soviet Union, we Germans would out of understandable hatred not have behaved in such a conciliatory manner.[35]

Hartmann evidently believed in the cultural incommensurability of Germans and Russians, and yet he devoted considerable time and energy to learning the Russian language. He was fascinated by the Soviets' exoticism, which he illustrates with depictions of Russians singing, dancing, and playing the accordion at every opportunity. Barwich asserts that the Russians themselves cultivated an image of exoticism: "This is how the Russians defused the German group's fear of the old 'Bolshevik peril,' [an idea] which they themselves had strenuously propagated. This doubtlessly evidences their skill in playing primitive/natural to win over the other side; and their success is so resounding because at that moment they themselves are quite convinced of the genuineness of their sentiments."[36] Indeed, the implied dichotomy of the Communist system and Russian culture helped Germans to overcome fears of Communism.

Another factor that helped the German experts to become accustomed to working in the Soviet Union was their privileged position. A few were given major prizes, notably the Stalin Prize. In many cases, their pay was very generous, allowing them to save a considerable amount of money or to help loved ones in Germany. They were also provided with "chocolate, tobacco, and other glorious things." They (rightly) felt protected from the most repressive aspects of the system. They were generally treated with great respect, while their Soviet counterparts worked in a "tension-loaded atmosphere" and were subject to crude tongue-lashings laced with obscenities and even jail sentences for professional failings. The Germans were insulated from these practices.[37] They did imitate some aspects of their Soviet counterparts' behavior, for example by indulging in heavy drinking, a habit that according to Barwich made life under Stalin's regime more bearable. At Agudseri, nightly vodka-drinking competitions were accompanied by the imbibing of large quantities of champagne and cognac.[38]

Most importantly, the Germans came to believe that the Soviet authorities would treat them with respect if they demanded respect. When the deputy minister of the interior of the USSR, General Swerjew, failed to respond as Hartmann hoped to his complaints about pay and restrictions, Hartmann reacted with great anger, pounding his fist on the general's fine, polished desk, sending pens rolling. The general walked over to him and grabbed his arm to prevent him from leaving. They drank together, and in the end Hartmann got what he wanted. After that, whenever the general saw Hartmann, he slapped him on the shoulder and asked, "Well, how is it going, my friend?" Hartmann drew the following conclusions from this relationship: "The Soviets give greater recognition to contradiction than to constant servility and fearful compliance—naturally without openly saying so." The Germans working on the atomic bomb project were very frank in their criticism of Soviet policies and life in the Soviet Union as well as in their complaints to the MVD. They even spoke to Beria with great candor, and came to respect and trust this man who had terrorized a nation.[39] In fact, their negotiating style was not unlike that of top

Soviet scientists, although they may not have known this.[40] Hartmann and others believed that their special status and working relationship with the Communist authorities could be carried over into a new life in Communist East Germany.

Meanings of Migration: The Migration of Exiled Engineers and Scientists to the GDR

Those German specialists who decided to go back to East Germany had to overcome bitter feelings over their long fight for release. For years on end, they were kept in ignorance of their fate, as their numerous letters and verbal requests for release went unanswered. Unable to negotiate, they mutinied. By 1951, many of those who had not yet been allowed to leave the Soviet Union had become quite desperate, leading to a rash of suicides and threats of suicide. Protest took other forms as well. Steenbeck threatened to withhold further cooperation if the Soviet authorities did not allow his fifteen-year-old daughter to return to Germany. Beria first allowed Steenbeck's family, then Steenbeck himself, to leave. Riehl struggled to not become ensnared in a "trap" baited with privileges and luxuries, such as a mansion in Moscow, which he and his family refused to move into. He wrote Zavenyagin that he was not prepared to work for the Soviet Union after July 1, 1952. He, along with others in atomic and military research, were allowed to leave after a quarantine period of two to three years, during which they were moved to unclassified work. Thousands of Germans were able to leave the Soviet Union prior to Stalin's death in 1953, but most of the atomic scientists were not allowed to leave until March or April of 1955. Hartmann believed they would not have been allowed to go at all if Stalin had still been alive. At a party the night before their departure, "the mood was exuberant," and they drank champagne to celebrate their crossing over the River Oder by train on April 2. Only a handful of Germans were forced to stay until 1957 or 1958. A few unlucky ones died before they were released.[41]

The prospect of life in the newly founded GDR appeared bleak to some. GDR representatives who visited Suchumi and Sinop made a strange impression on the Germans there. Rather than meeting with the specialists to discuss issues such as their professional futures, the officials went on an outing with the general in charge of the institutes. Upset over being snubbed, some decided to go to West Germany. Afterward, the Germans discovered that no ministries would admit to having sent the emissaries from the GDR—they were presumably from the secret police.[42]

However, many of the Germans were not deterred by the indistinct shadow of future problems with Communist authorities in the USSR and the GDR, particularly in the hopeful era after Stalin's death, when Beria was put on trial and the general in charge of the Black Sea institutes was sent off to be a clubhouse director in a small town. Ciesla estimates that about three-quarters of the German specialists in the Soviet Union went to the GDR. Some even put a positive spin on the 1953 uprising: "Even the life-threatening revolt of the GDR population against the Ulbricht régime took a positive turn: There was no blood-bath because the Russians did not shoot. The government of the GDR admitted many shortcomings. They not only promised improvements, but actually came through with a series of not minor concessions." Barwich, like others, assumed that German reunification was around the corner. In addition, he assumed that German-style Communism had to be different from Russian-style Communism, an attitude that was reinforced by many Germans' cultural attitudes toward the Russians: "We had gotten to know Stalinism fairly well and were ready to downplay many things as 'typically Russian' and to forget them, and we gave ourselves over to the hope that the methods of the German Communists had little in common with those of the Russian Communists." By contrast, Riehl, who called Russia his "native land," placed his experiences in the Soviet Union in an ideological rather than a cultural context and, drawing his conclusions, decided to migrate to West Germany.[43]

Only a small minority of the "specialists" became Communists. Two later members of the East German research establishment, Steenbeck and Thiessen (the latter a former Nazi), wrote in memoirs published in the GDR that they had been converted to socialism during their stays in the Soviet Union. A period of personal crisis in Leningrad led Steenbeck to introspection—or at least so he wrote in his memoir—out of which emerged a sense that it was better to do good for others than to concentrate on his own personal advancement in the West and a belief that there was a deeper meaning in helping the GDR to overcome its problems than to go to the more advanced West Germany. Bothered by the competitive, profit-oriented spirit in West German industry, Steenbeck felt that there were greater prospects for the evolution of a better system in the GDR than in the Federal Republic. However, one should not overlook more prosaic, career-oriented motives. A former Nazi, Thiessen had been treated leniently in the East, but did not know what to expect in the West. Steenbeck was very hurt that the Siemens Corporation showed little interest in him and that Hermann von Siemens did not acknowledge a letter in which Steenbeck wrote about the death of Hermann's brother, whom Steenbeck had gotten to know in a Soviet prison camp. By contrast, the GDR made a major effort to recruit him, flying him to Moscow for a meeting with an East German minister who spoke with him for hours. Steenbeck went to the GDR, where he became a university professor, the director of a research institute and a member of the Academy of Sciences, and where he remained until he died in 1981.[44]

Barwich, Hartmann, and most of the others were drawn to East Germany primarily by two factors: professional prospects and strong nationalist sentiments.

Heinz Barwich was offered a full professorship at the University of Halle, and was later named director of an atomic research center and professor at the Technical University of Dresden. He was given a lovely house in an idyllic residential neighborhood of Dresden, where one mansion stood next to another. The East Germany he returned to seemed very prosperous and affluent, indeed a "*Schlaraffenland*" (land of milk and honey) in comparison with the Soviet Union. The atmosphere seemed "liberal" (again, in comparison with the Soviet Union): In East Germany, the Communist Party ruled in coalition with four "democratic" parties; scientists and engineers were not required to join a party; they could attend conferences in the West and bring back Western literature; and there was no East German army. Skeptical about Western-style parliamentary democracy, Barwich was willing to give the East German system a chance. He looked to the future with considerable optimism: "East Germany had not only welcomed me with open arms, had offered me living and working conditions that I found attractive; I also had the impression that the course of liberalization and rapprochement with the Federal Republic would be successful." However, unhappy about the building of the Berlin Wall and the increasing political pressure on scientists in the GDR, Barwich fled to the West in 1964. As a result, his children were imprisoned in East Germany. Only able to secure freedom for his daughter, he died in 1966, not knowing that his son, too, would eventually be released.[45]

Nationalism also played a role in the decision to go to East Germany. Specifically, the specialists who went there saw the German-ness of East Germany as the country's overriding characteristic. When family ties and regional loyalty entered the mix, the GDR could appear to be a reasonable choice. As one of the "specialists behind barbed wire" (the title of his memoirs), Kurt Berner (figure 1.2) was very bitter over his years in Soviet internment camps (1945–1951) and as a involuntary rocketry researcher in the USSR (in 1951–1958), during which time he was separated from his family. (His wife died during his absence, and he did not see his children again until they joined him in 1958.) Initially he planned to migrate to West Germany after his release. But fearing that if he gave the Federal Republic as his destination, his departure would be delayed even more than it already had been, he declared that he planned to move to the GDR after his release. However, his very emotional arrival in East Germany opened up the possibility of actually staying there. All that mattered to him in those first moments was that he was in Germany—the political system was irrelevant: "The train rolled into the station at Frankfurt an der Oder. I saw German signs, and people were speaking German. I was back in Germany. My blood rushed to my heart, and tears burst out of my eyes. It was an incredible moment, all my wishes of ten years were fulfilled. I opened the window and stuck my head out, I had to see German people. My children came out of the

Figure 1.2
Kurt Berner and Bruno Golecki during their stay in the Soviet Union. Photo credit: Unknown. Originally published by Brandenburgisches Verlagshaus

compartment; they didn't understand why I was crying." He took a first-rate job at the Central Institute for Atomic Research in Dresden. He claimed that his decision to stay in the East was motivated by the fear that the Americans would force him to write detailed reports on his time in the Soviet Union and to go to work in the defense industry. He quickly decided to forget his second wife, a Russian whose papers had not arrived in time to leave the Soviet Union with him. Settled in East Germany, life again became blissfully "normal."[46]

Paul Görlich's widow (Irmgard Görlich) provides a simple explanation for the Görlichs' decision to return to Jena (where her husband resumed work at Carl Zeiss, now a socialist corporation): "We wanted to go home. There was nothing to discuss." Here, "home" (*Heimat*) meant one's home town, the place one had dreamed of during the long years in the Soviet Union. That this hometown was now under Communist control did not outweigh their urge to return to their roots.[47]

A letter that Herbert Kortum wrote from the Soviet Union makes clear that both memories of Germany and memories of his company drew him back to Jena. He longed to return to Carl Zeiss: "With great interest we have read, how with great effort and with encouraging successes, it has been possible to keep our company alive, despite everything. It is unnecessary to say how strongly we feel that we once had a protector—our company—and that for us it is bitter that we cannot participate in the difficult task of rebuilding. If I can make just one request, it is to hear . . . about our company and our town and perhaps—if thought has been given to this—whether, when we return to Germany, we will be received again by our company, and what our relationship to the company is—this is a question which understandably excites everyone." Kortum also hoped that "Germany will succeed, through hard work, in making up for the past and again winning a place in the sun (*Platz an der Sonne*)."[48] Dedication to a quest for renewed German greatness, love of one's hometown, and company loyalty—these were the basic values that Kortum and other German engineers and scientists held dear, and that blinded them to difficulties that a life in the GDR might hold in store.

The third major factor in the decision to go to the GDR was the conviction that in the Soviet system—as in Nazi Germany—politics and the scientific-technological realm were separate spheres. The bargain was simple: Scientists and engineers would leave politics to the politicians and, in return, would be shielded, would be allowed full freedom to develop the desired technologies or conduct basic research without outside interference, and would enjoy a special status distinct from that of the normal citizen. Though informed by their experiences in the Soviet Union, this expectation was also molded by the history of the engineering profession and industrial science in Germany. Thus, to understand the mentality of the first generation of scientific and technical experts in East Germany, we need to look at their professional lives before 1945, and to place their careers, ideologies, and professional ambitions within a larger historical context.

The "Apolitical" Expert: A Short History of an "Anti-Ideological" Ideology in Germany

The German concept of the "apolitical" expert grew out of the quest for professionalization. Germany was a country with a strong tradition of professionalization. According to historians Jürgen Kocka and Konrad Jarausch, nineteenth- and early twentieth-century German professionals had a good deal in common with their counterparts in the United States and elsewhere: schooling or academic training that imparts a body of specialized theoretical knowledge; procedures for admission to the profession, generally involving examinations; a state-enforced monopoly in the area of expertise; a professional ethos that claims the common good as its goal; freedom from supervision by persons or institutions outside the profession; self-regulation (usually involving a code of professional conduct); claims to high status and income; and the formation of professional associations.[49] The professions were traditionally associated with the public, male sphere of activity, and with male rationality and self-realization.[50] In Germany, the state played a more prominent role in professionalization than in the Anglo-Saxon world. State certification and regulation of professions was more invasive and central to group identity, and in some cases, professionals became state employees, at least during a particular phase of their professional lives. Another peculiarity of German professionalism was class consciousness, which centered on the linked ideals of a bourgeois lifestyle and educational attainments that involved a humanistic education, available only at elite schools.[51]

Professionalism was weaker among engineers than in the "classic" professions, such as law or medicine, due in large part to the fact that most engineers were employees, and thus torn between loyalties to their profession and to their employer.[52] In Germany (as in the United States), the rise of higher technical education in the nineteenth century—particularly the founding of the technical universities (*Technische Hochschulen*)—greatly encouraged professionalization, which went hand in hand with a scientific model of engineering. However, many engineers continued to be recruited from the ranks and trained on the job. Despite the ascendancy of "school culture" (associated with a science-based educational ideal), "shop culture" (which saw engineering as rooted in practical skills learned on the shop floor) nonetheless continued to flourish for decades. Before the First World War, the German term *Ingenieur* carried the connotation of professional responsibilities, technical knowledge, and a certain measure of social respectability, but did not necessarily have anything to do with educational attainments. The term *Techniker* (technician) did exist to denote those performing engineering work who did not possess an engineering degree of some kind, but the term was applied very inconsistently. The growth of nonacademic engineering education (higher technical schools, for example, *Fachschulen* and *Ingenieurschulen*) led to increasing diversity in the profession as a whole. Up until 1945, there was considerable "balkanization" of the profession in terms of education, level of work, and kind of employer, both in Germany and in the United States.[53]

Roadblocks to professionalization were, however, particularly daunting in Germany (and in Great Britain, though for different reasons). In Germany, engineering was not fully accepted as a higher profession by more established segments of the educated middle classes before the Second World War. German engineers were much more on the defensive than in other countries, forced to come to terms with assertions that technology was part of soulless, modern "civilization" (*Zivilisation*), spread by the English, the French, and the Americans, as opposed to superior, spiritually deep "culture" (*Kultur*), to be found primarily among Germans.[54] Engineers faced more prosaic problems as well. They had little access to careers in the civil service, which was dominated by lawyers. Moreover, a virtual "proletarization" of engineers took place in the years leading up to the First World War, as an oversupply of engineering graduates from universities and higher technical schools led to the employment of many in low-paying jobs that did not involve real engineering work, a trend compounded by bureaucratization and resulting segmentation and standardization of work in private industry.[55]

These developments did not lead to political activism. An ideology, claimed not to be an ideology, emerged among German engineers.[56] In Imperial Germany, most of the engineering profession developed an "apolitical" but strongly statist stance that had a tremendous impact on the profession well into the twentieth century. Faced with the difficulties of organizing so diverse a mass profession as engineering, the Association of German Engineers (*Verein Deutscher Ingenieure*, or VDI, founded in 1856) embarked in the 1870s on a policy of studied neutrality on political issues as well as professional issues. The VDI promoted scientific objectivity and political abstinence as core values for engineers. This tied in with the idea that the engineer was predestined to play the role of arbiter, particularly in conflicts between labor and management, due to the engineer's position between the two, as well as due to his supposed scientific objectivity. The VDI managed to project the image of an organization without a political or social agenda, promoting technology and industry for the common good of the nation, while in actuality pursuing policies friendly to business. The VDI's loyalty to the state was perceived as apolitical, just as the state was conceived as standing "above politics." Technology was seen as value-neutral in Germany, and engineering ideology was generally not tied to a sense of social or political responsibility.[57] This contrasts markedly with the social and political involvement of progressive engineers in early twentieth-century America, and the similar progressivism among Russian engineers.[58]

In the nineteenth and early twentieth centuries, science became far more securely professionalized than engineering. Being part of the German tradition of education and culture, scientists were also more fully integrated into the bourgeoisie than engineers, and tended to be recruited from the upper-middle class (*Bürgertum*). Historian Gabriele Metzler has shown that German physicists saw themselves as theoretically part of an international scientific community, but that in fact they put the promotion of national interests and prestige above scientific internationalism. Science became closely tied to the state and dependent upon state funding of research and the universities. During the First World War, but particularly under the Nazis, science served the state, overcoming older prejudices against practical, often military, applications of science. Nonetheless, many scientists continued to cling to the fiction that their work was "apolitical."[59]

Coming out of a supposedly "apolitical" tradition that in fact involved support of the authoritarian system, engineers of the Imperial and Weimar periods were receptive to the ideas of "reactionary modernism." As defined by Jeffrey Herf, this was an ideological and philosophical position that rejected one side of modernity—democracy and rationality—while embracing another: technology. At their most extreme, these thinkers argued that technology did not belong to the realm of rationality, science, capitalism, and materialism—said by anti-modernist thinkers to alienate human beings from what was best in them—but (using the ideas of Nietzsche and Schopenhauer) to the realm of the spirit, creativity, the will, the power instinct. Irrationality even invaded the bastions of a science-based conception of professionalism—the universities. Technology was draped with the banner of national greatness.[60]

Another prominent aspect of engineering ideology was technocratic thinking. Pervasive in engineering circles before the First World War, it manifested itself in the idea that engineers were particularly suited to a public role because their scientific training gave them an "objective" understanding of public affairs.[61] This idea had its origins outside of Germany. The utopian socialist Henri de Saint-Simon was a technocrat, as was engineer Frederick W. Taylor, whose system of "scientific management," or Taylorism, gave engineers a central role in the running of the factory. As agents of scientific change, engineers were to bring to bear the laws of science and nature in the factory and beyond, thus contributing to the lasting solution of basic problems of human society. Another important advocate of technocracy, Thorstein Veblen, had visions of the formation of a "soviet of engineers" that would take over the running of the economy. Only briefly in the 1920s, in the United States and Germany, did self-proclaimed "technocrats," such as the American Howard Scott, lay claim to political power.[62] Despite their failure, technocratic thinking lived on, not as a coherent ideology, but as a subterranean source of images, attitudes, and ideological predispositions.

Various elements of engineering ideology before 1933 turned a majority of engineers against the Weimar Republic and, in the long run, made them vulnerable to National Socialism: an acceptance (at least on some level) of anti-rational arguments; a rejection of politics (and thus of democracy); loyalty to a state seen as being "above politics"; dedication to a "neutral" technological mission; and simple anger over social and economic problems. According to historian Karl-Heinz Ludwig, there were somewhat fewer Nazi sympathizers, party members, and officials among engineers than among other segments of the middle class both before and after 1933. If not avowed Nazis, a crucial segment of the engineering profession was, however, very willing to loyally serve the Nazi regime. From 1937 onwards, members of the VDI and many other engineering organizations automatically became members of the National Socialist League of German Technology (*NS-Bund Deutscher Technik,* or NSBDT), while purely professional organizations such as the Association of German University Engineers (*Verband Deutscher Diplom-Ingenieure*, or VDDI) were abolished. There were no protests; there was no mass exodus of those who found themselves NSBDT members, now comprising a third of all German engineers.[63]

At the same time that this *Gleichschaltung* (establishment of Nazi control) of engineering organizations took place, engineers gained a measure of economic security and social status that had been denied them before 1933. The title of engineer (*Ingenieur*) was granted state protection, although experience and achievement could qualify a practicing engineer without a higher education for this title. Unemployment declined as the state lent support to the engineering service (*Ingenieurdienst*), which provided engineers with temporary, virtually unpaid jobs, and this sometimes led to permanent, paid employment. Enrollments in college and university engineering programs dropped, partly due to the mandatory labor service and the draft. Moreover, rearmament brought about a tremendous expansion of jobs for engineers in industry. In fact, by the late 1930s, there was a shortage of engineers. Nazi policies and projects—not only rearmament, but also import substitution, public works projects, the *Autobahn*, and settlement schemes—held the promise of growing professional opportunities for engineers and applied scientists, both in terms of numbers of jobs and power. Becoming heavily involved in the production of military hardware, corporations such as Volkswagen gained tremendous opportunities to develop their products technologically. Scientists in areas such as aeronautical research were given resources that they had only dreamed of before the Nazi era. Engineers were also very gratified by Hitler's enthusiasm for technology and the Nazi depiction of technology as an aspect of the creative force of the Aryan race, a thesis that fit in well with the old technology-as-culture engineering ideology. According to Konrad Jarausch, this illusion of a "reprofessionalization" consolidated the cooperation of engineers with the Nazi regime, although engineers clung to the illusion that the nature of this cooperation was apolitical.[64]

Some engineers had the illusion that the Nazis were fulfilling a long-time wish: the subordination of the economy to the dictates of technology, rather than the dictates of profitability. An engineer and president of the VDI, as well as Hitler's Autobahn czar, Fritz Todt was put in charge of military production and the Four Year Plan in 1940. He became quite disillusioned, however. "Fortified by an engineer's calculation," he tried to convince Hitler that Germany could not win the war, according to historian Karl-Heinz Ludwig. Todt's successor, Albert Speer, did not represent the interests of engineers as Todt had, but was primarily concerned with increasing the production of military hardware.[65] Engineers remained largely ignorant of what was going on, accepting Speer with respect.

After the Second World War, Speer popularized the idea of the apolitical expert. Using a strategy developed with his lawyer, Speer argued at the Nuremburg War Crimes Trials that the Nazi system was the first dictatorship to make full use of technology, using technical experts as tools, and unleashing the destructive, unstoppable power of technology in pursuit of the aims of the dictatorship. Asserting that politics and technology were separate, autonomous spheres, Speer claimed that as a technical specialist, he had had little insight into political events, and that his work had been "purely" technical. Gitta Sereny, his biographer, has revealed that Speer knew much more about the use of slave labor than he let on. Nonetheless, this line of defense was taken up by many engineers who had collaborated with the Nazis. As Orland and others have made clear, the conception of the apolitical engineer is the product of a specific system of values. In particular, it is part of the legacy of engineering politics of the Imperial and Weimar periods, rooted in an ideological tradition of loyalty to a state conceived as "above politics."[66]

According to historian Andreas Heinemann-Grüder, a "retreat into purely technical work" was widespread among engineers and scientists in military research. They claimed that their huge workload kept them from knowing about the Holocaust or thinking about the use of slave labor, which took place in front of them in many cases. Their value system was dominated by a "cult of technical feasibility." The quest for professional advancement and job security also played a role in their unwillingness to question the purpose of their work. Although few of these engineers were avowed Nazis, they were well aware of the important role assigned to them as part of the war effort: "National Socialism integrated engineers into its political and military goals and policies by elevating them explicitly to the rank of ideological soldiers."[67]

The Nazis were also very receptive to the needs and demands of engineers and applied scientists. Helmuth Trischler has, for example, demonstrated this with regard to aeronautical research. Until 1939, aeronautical experts retained considerable autonomy, while enjoying a large increase in funding that led to a proliferation of small projects. During the early years of the war, research was centralized, forcing scientists and engineers to concentrate on projects thought by the central authorities to be of immediate help to the war effort. Researchers were frustrated. Encountering growing problems in the air war, the Nazi leadership again remolded the system in a way much more to the scientists' liking, giving them considerable leeway in their research. Big science coexisted with smaller projects, which, it was hoped, might yield new Wunderwaffen.[68]

Recent research on the history of the Kaiser Wilhelm Institute under National Socialism contradicts earlier assumptions that the Nazis were hostile to science, and casts serious doubt on the thesis that Nazi science was characterized by "polycratic chaos."[69] The theory of polycracy posits that Nazi Germany was rocked by fierce rivalries between the Nazis, the military, and industry, resulting in crippling chaos.[70] Instead, Florian Schmaltz found in a study on research on chemical weapons, "Despite the partially divergent interests of the economy, the military, and science, the research and development of chemical weapons in the Nazi regime was characterized by an astonishingly high degree of cooperation among the different actors, as the smooth teamwork in the area of nerve gas research shows." Here lies, in his estimation, the explanation for the murderous efficiency of Nazi military research. Scientists were with few exceptions happy to work for the Nazis, who provided massive funding and professional opportunities. Sufficient elements of self-organization were preserved among scientists working on this and other projects to maintain the illusion of having preserved the "purity" of science and not having given in to the ideologization of science.[71]

Among the numerous actors competing for resources within the complex Nazi system, engineers and scientists enjoyed major successes in their negotiations with the state. Professional organizations were disbanded or greatly weakened, but engineers felt fully compensated by the return to full employment and dramatically improved prospects for their careers, institutes, or firms, and lines of research. They participated fully in the building and expansion of the Nazi war machine, welcoming what appeared to be the chance to exercise greater political influence. Plunging into extreme forms of denial concerning the political or ethical impact of their work, they became deeply enmeshed in the use of technology for mass destruction. Indeed, they saw their work as serving the German nation.

In memoirs, engineers and scientists who were sent to work in the Soviet Union developed different strategies in dealing with their collaboration with the Nazis.

The Search for Self-Justification: Specialists' Autobiographical Accounts of Work in Nazi Germany and the Soviet Union

An interesting photograph appears in the autobiography of engineer Kurt Berner (figure 1.3). The caption reads in part: "The specialists often thought of loved ones at home." The picture is of a rather formal gathering (an anniversary party) at which well-dressed people sit at a long table. The swastika banners in the background and the Nazi uniform of one of the participants are not commented upon either in the caption or in the text. Presumably, Berner took this photo with him to the Soviet Union, and never gave the Nazi symbols in the picture much thought. Berner, who spent years in Soviet camps because of his membership in the Nazi Party, admits to no wrongdoings in his memoir. Indeed, he depicts himself as a victim of the Soviets.

Figure 1.3
Photo taken by Kurt Berner to the Soviet Union and reproduced in his memoir. Original caption: "The specialists often thought of loved ones at home." Photo credit: Unknown. Originally published by Brandenburgisches Verlagshaus

The Nazi past loomed over the past of all the specialists, but self-critical reflections on this subject are rare in their memoirs.[72]

Werner Hartmann, Heinz Barwich, Werner Albring, and Nikolaus Riehl, along with most of the other German specialists who went to the Soviet Union in 1945–1950, had worked for the Nazis. They developed elaborate strategies of self-justification to explain to themselves and others their work on military technologies for the Nazis, and later the Soviets. Peter Adolf Thiessen, who can be called a war criminal for his role in the development of nerve gases such as sarin, did not mention his Nazi past in his memoirs.[73] At Siemens, Max Steenbeck worked on projects for the military, notably mine removal. Riehl, a student of Lise Meitner, directed the manufacture of nuclear reactor-grade uranium for Werner Heisenberg's research team, which was trying to develop an atomic bomb during the Second World War. It is not Riehl himself, but the commentator and translator of his memoirs who writes, "Riehl had nothing but disdain for the leaders of the National Socialist Party." Ardenne, the scion of a wealthy aristocratic family, had his own private laboratory for atomic research from 1928 to 1945. He later portrayed himself as an outsider who in the Nazi period had been involved in a struggle against the corporate world and the official science establishment.[74] In his memoirs, he argues that his work on military technologies was driven by his humanitarian desire to defend the German people.[75]

Heinz Barwich was the son of a socialist and pacifist who, as a deserter in the First World War, had spent five years in prison. Barwich, himself a socialist, greatly admired his father, whom he saw as "a symbol of resistance of the individual against the power of injustice." However, after the Nazi takeover, Heinz Barwich (then a student) told a suspicious student leader that "I had recognized the enormity of the Jewish and Communist peril." A former student of Gustav Hertz, Barwich took a job at Siemens when Hertz was hired there, having been expelled from the university as a *Mischling*. Barwich loyally served Siemens and the Nazi state, working on projects "important to the war [effort]," such as signaling devices, detonators, and a device to detect underwater mines. He expresses concern about this contribution to the war effort in his memoirs, but attempts to excuse his activities by the failure of his projects due to technical difficulties. Barwich convinced himself that he had been a kind of dissident, both under the Nazis and in his time in the Soviet Union, because he had "hostile or skeptical" attitudes toward the "authoritarian" regimes he had served, "partly voluntarily, partly under compulsion." He claims to have "violated" laws and regulations of these regimes so as to "be able to live more or less in spiritual freedom," although no concrete example of such a transgression is given in his memoirs. He argues that by upholding science, he worked against the goals of the party leadership:

And yet this did not cause me bitterness and disillusionment; on the contrary: a life without contradictions, without a fight against social ills, solely dedicated to research, would hardly have satisfied me. Certainly, the joy in scientific discovery often compensated for the disappointments in daily life. But science had also trained me to strive for objectivity, including in the attitudes towards the world around me, so that I almost automatically became an opponent of the methods of the politicians. I sometimes tried to encroach upon their domain and call forth rationality and humanity.

Again, there is little or nothing in his memoirs that would bear out this portrayal of the impact of his work.[76]

Werner Hartmann does not resort to this sort of attempted justification of his actions. Rather, in an unvarnished account, he depicts himself as an average German, one of millions who supported Hitler because he had restored German greatness, recounting "that I listened to Hitler with great enthusiasm and was very happy about Germany's slowly growing new authority in the world, much like millions of other Germans: One was proud again to be a German." Clearly, Hartmann believes that he and others were mistaken, primarily because of the harm done to the nation: "We had no idea what Hitler was doing to Germany: bringing ruin upon Germany for a long, long time!" In this unpublished memoir, he does not directly apologize for his actions or reflect upon the mistakes of millions of Germans. This is very much in keeping with the very dry, dispassionate tone of the account, which largely focuses on his professional life. He does, however, speak of the "sadness and shame" that he and his German companions felt when they saw the areas of the Soviet Union that had been laid waste by the Nazis. By contrast, he was professionally very happy during the Nazi period, when he was at Siemens. (He, like Barwich, took a job at Siemens to be able to work for his former mentor, Hertz.) He contrasts the "honesty" and "trust" that he sees as typical of industrial research in that era with the inflexibility and overly bureaucratic system of the GDR: "By today's standards, particularly in comparison with the overly bureaucratized and inflexible mode of operation in the GDR—whether in industry, universities, or other entities—such a flexible organization which is based on flexibility, honesty and trust, indeed must be based on those things, is a dream that appears unreachable and unrealistic. But it was reality." Hartmann does not claim to have been apolitical. He joined the SA in 1935, leaving in 1936 only because he needed more time to work on his dissertation and prepare for his doctoral defense, as well as the National Socialist League of German Technology, the National Socialist Welfare for the People, the German Labor Front and the Nazi Air Raid Defense. Once, when an out-of-town friend visited him in Berlin, Hartmann took her to the Wilhelmsplatz, where the Reich chancellery was located. When Hitler appeared briefly on the balcony, the cheers of the crowd were too uncoordinated for Hartmann, who took off his hat, using it in place of a baton to lead choruses of "Sieg Heil." "The huge crowd shouted to my orders." It is a moment in which the Prussian worship of authority with all of its fateful historical ramifications comes into sharp focus, a moment that would have been worthy of Heinrich Mann's novel, *Der Untertan* (The Man of Straw). In 1937, Hartmann took a new job at Fernseh-AG (which became Fernseh-GmbH in 1939). There, he participated in the early development of television, as well as in the militarization of research and production under Aviation Ministry control during the Second World War. Hartmann was very happy to work in a high-tech area with a team of dedicated professionals.[77] Ultimately, though, Hartmann justified his work not in purely technical terms, but as a form of service to the nation. Like Hartmann, many engineers and scientists in industry (along with many other Germans) thought of themselves as apolitical but loyal to a state that was above politics, and for which Hitler was the representative. Many later served the East German state in much the same spirit.

Conclusion

Although most German specialists in the Soviet Union did not have formal contracts, their relationship with the Soviet authorities was governed by an informal understanding not unlike that of Soviet specialists. According to historian of science Alexei Kojevnikov, the "pact" between scientists and the state changed during the years of Stalin's rule. From 1929 onward, a division of labor took place between Communist functionaries and scientists. The understanding was that scientists would be allowed considerable freedom in their scientific work, but were not allowed to intervene in any way in the political realm. On the other hand, spasmodic acts of violence were committed against the scientific community by Soviet authorities in the pre-war period. The treatment of scientists improved during the Second World War and the Cold War atomic bomb program. However, although they were given privileges, they were still not given power.[78] This chapter has shown that the Germans in the Soviet Union enjoyed roughly the same degree of autonomy and suffered under the same restrictions as their Soviet counterparts. They were told what projects to work on, were forced to live and work in particular places, could not leave the country, were forced to compete with rival research teams, and encountered the distrust of the Communist leadership, much like their Soviet colleagues. However, they were given considerable resources for their work, could design their research projects themselves, and were free to express their criticism of any and all aspects of their situation to the political leadership. The Germans accepted the division of labor between science and the state that they encountered in the Soviet Union. The only aspect of their situation that they rejected was that the Soviet leadership long delayed their return to Germany. Once their demands in this regard were satisfied, returning German engineers and scientists were willing to consider living under the rule of German Communists.

The experiences in the Soviet Union converted few to socialism, but did convince many that they could live in East Germany. Due to their Nazi past, they were predisposed to get along tolerably well in the Soviet Union. They were accustomed to being the privileged but politically impotent helpers of a dictatorship, and to putting ethical concerns regarding military research out of mind. Although critical of some aspects of the Soviet system, particularly overly tight security measures, those who decided to go to the GDR believed that they could function well within that system. Their experiences showed them that whatever hardships they might encounter due to the poverty of the East bloc could be overcome, and that they could compete with the best the Soviet Union had to offer. Moreover, they believed that they would continue to be shielded from the worst aspects of the socialist system: terror and hardship. The lack of animosity against them was an unexpected reprieve for them. If Joseph Stalin had treated them with great respect, would not Stalin's more liberal successors, along with their East German colleagues? The GDR promised top positions and a continuation of the relatively privileged existence the specialists had enjoyed in the Soviet Union. Having been largely spared political reeducation in the Soviet Union, most hoped not to become involved in politics, but to continue to function as "apolitical" technical and scientific experts. Moreover, what counted the most was that they would be returning to their *Heimat*, a homeland that they had kept alive during their stay in the Soviet Union. The image of Russian exoticism led some German specialists to believe that East German socialism had to be very different—more rational, more German. East Germany seemed liberal in comparison with the USSR. The lack of democracy there did not disturb those who had become disillusioned with democracy during the Weimar Republic. And German reunification seemed like a real possibility in the early 1950s. So it was with this optimism that Hartmann, Barwich, and many others returned to East Germany. If they were not believing socialists, they were at least open to an alternative to the defeated and discredited Nazi system.

Notes

1. Werner Albring, *Gorodomlia: Deutsche Raketenforscher in Rußland* (Hamburg and Zurich: Luchterhand-Literaturverlag, 1991). Albring's statement that this event took place on October 21 appears to be wrong. On Soviet orchestration of the banquet see Christoph Mick, *Forschen für Stalin: Deutsche Fachleute in der sowjetischen Rüstungsindustrie 1945–1958* (Munich and Vienna: R. Oldenbourg Verlag, 2000), 83.

2. It is unclear whether this code name was really used at the time. See Burghard Ciesla, "Der Spezialistentransfer in die UdSSR und seine Auswirkungen in der SBZ und DDR," *Aus Politik und Zeitgeschichte. Beilage zur Wochenzeitung, Das Parlament*, B49–50/93 (December 3, 1993): 24.

3. See Mick, *Forschen für Stalin* 43–45, 83–85, 94.

4. See Mick, *Forschen für Stalin* 15, 94–95; Ciesla, "Der Spezialistentransfer in die UdSSR," 25, 29. There is a somewhat higher estimate in Ulrich Albrecht, Andreas Heinemann-Grüder, and Arend Wellmann, *Die Spezialisten: Deutsche Naturwissenschaftler und Techniker in der Sowjetunion nach 1945* (Berlin: Dietz Verlag, 1992), 181.

5. See Ciesla, "Der Spezialistentransfer in die UdSSR," 29.

6. See Albring, *Gorodomlia*. For a far more negative depiction of the trip east, see Kurt Magnus, *Raketensklaven* (Stuttgart: Deutsche Verlags-Anstalt, 1993), 37–56.

7. See Albring, *Gorodomlia*, 31–37. On the persecution of engineers in the Stalin era, see Graham, *Science in Russia and the Soviet Union*, 93–94; Bailes, *Technology and Society under Lenin and Stalin*, 64–120.

8. See Albring, *Gorodomlia*, 37–40.

9. See Albring, *Gorodomlia*, 46–47; quotations on pp. 46, 44.

10. TSD, Nachlaß Hartmann, vol. F, 4; see 1–4.

11. TSD, Nachlaß Hartmann, vol. F, 2, 5, 7.

12. TSD, Nachlaß Hartmann, vol. F, 7–8.

13. TSD, Nachlaß Hartmann, vol. F, 11–13.

14. See Norman Naimark, *The Russians in Germany: A History of the Soviet Zone of Occupation, 1945–1949* (Cambridge, MA, and London: Belknap Press of Harvard University Press, 1995), 166–193, 205–208; John Gimbel, *Science, Technology, Reparations: Exploitation and Plunder in Postwar Germany* (Stanford, CA: Stanford University Press, 1990); Charles Frank, *Operation Epsilon: The Farm Hall Transcripts* (Berkeley, CA: University of California Press, 1993).

15. See Naimark, *The Russians in Germany*, 207–214; Albrecht, Heinemann-Grüder, and Wellmann, *Die Spezialisten*, 48–72; Mick, *Forschen für Stalin*, 148–150; Nikolaus Riehl, *Stalin's Captive: Nikolaus Riehl and the Soviet Race for the Bomb*, trans. and ed. Frederick Seitz (Washington, DC: American Chemical Society and the Chemical Heritage Foundation, 1996); Heinz Barwich and Elfi Barwich, *Das rote Atom* (Frankfurt am Main and Hamburg: Fischer Bücherei, 1970), 7–16.

16. See Mick, *Forschen für Stalin*, 43–45, 51–65, 66–85; Magnus, *Raketensklaven*, 19–37; Albring, *Gorodomlia*, 14–16, 37–41; Albrecht, *Die Spezialisten*, 90–93, 123, 134, 154, 161–162; Ciesla, "Der Spezialistentransfer in die UdSSR," 25.

17. See Albrecht, *Die Spezialisten*, 11; Mick, *Forschen für Stalin*, 93–95, 210–219.

18. See Albrecht, *Die Spezialisten*, 20–22.

19. See Mick, *Forschen für Stalin*, esp. 148–154; Albring, *Gorodomlia*, esp. 9, 11.

20. Albring, *Gorodomlia*, quotation on p. 47. See also Mick, *Forschen für Stalin*, 141–191; James Harford, *Korolev* (New York: John Wiley & Sons, 1997).

21. Barwich and Barwich, *Das rote Atom*, quotation on p. 56. See also Albring, *Gorodomlia*, 94, 117–118; Mick, *Forschen für Stalin*, 179–188.

22. Carl Zeiss Archive (Jena) BACZ 8244, letter from Kortum to Schomerus, dated January 16, 1948.

23. See Barwich and Barwich, *Das rote Atom*, 92–101, quotation on p. 93; TSD, Nachlaß Hartmann, vol. F, 57–60.

24. See Mick, *Forschen für Stalin*, 188–191; Riehl, *Stalin's Captive*, 83–87, quotation on p. 87.

25. TSD, Nachlaß Hartmann, vol. F, 39–41, 86, quotation on p. 86; Barwich and Barwich, *Das rote Atom*, 90.

26. See Naimark, *The Russians in Germany*, 69–140, 235–248, 376–378.

27. TSD, Nachlaß Hartmann, vol. F, 45–46, 109. On research in high-security installations during the Nazi period and "military comradeship," see Andreas Heinemann-Grüder, "*Keinerlei Untergang*: *German Armaments Engineers during the Second World War and in the Service of the Victorious Powers*," in *Science, Technology and National Socialism,* ed. Monika Renneberg and Mark Walker (Cambridge and New York: Cambridge University Press, 1994), 38.

28. See Barwich and Barwich, *Das rote Atom*, 41; TSD, Nachlaß Hartmann, vol. F, 21; Magnus, *Raketensklaven*, 245–250.

29. Irmgard Gröttrup, *Die Besessenen und die Mächtigen* (Stuttgart: Steingrüben Verlag, 1958), 45. See also Magnus, *Raketensklaven*, 173–176.

30. See Barwich and Barwich, *Das rote Atom*, 96–97.

31. On the re-creation of the *Heimat*, see TSD, Nachlaß Hartmann, vol. F, 26–27, 29; Barwich and Barwich, *Das rote Atom*, 93; Albring, *Gorodomlia*, 149–157; Riehl, *Stalin's Captive*, 87, 177; Gröttrup, *Die Besessenen*, 129–132; Mick, *Forschen für Stalin*, 210–219. For accounts by specialists in POW camps or prison camps, see Kurt Berner, *Spezialisten hinter Stacheldraht* (Berlin: Brandenburgisches Verlagshaus, 1990); Bernhard Weber, *Erlebnisse in und um Stalins geheimen Atombereich* (Aachen: Verlag Mainz, 1993). Both Berner and Weber were released and sent to work at Black Sea institutes.

32. See TSD, Nachlaß Hartmann, vol. F, 111–112, quotation on p. 112; Riehl, *Stalin's Captive*, 72, 74, 103, 169.

33. Barwich and Barwich, *Das rote Atom*, 16, 116; see also 22, 56, 121–122, 126, 133.

34. Barwich and Barwich, *Das rote Atom*, 86.

35. TSD, Nachlaß Hartmann, vol. F, 16–17; see also 31–32. On indoctrination, see p. 46; also Albring, *Gorodomlia*, 16–17; Max Steenbeck, *Impulse und Wirkungen: Schritte auf meinem Lebensweg* (Berlin: Verlag der Nation, 1977), 212; Mick, *Forschen für Stalin*, 240–256.

36. Barwich and Barwich, *Das rote Atom*, 37; see also 21, 41.

37. See Riehl, *Stalin's Captive*, 105–109, quotations on pp. 79, 105.

38. See Barwich and Barwich, *Das rote Atom*, 96; TSD, Nachlaß Hartmann, vol. F, 14, 28, 38–39.

39. See Barwich and Barwich, *Das rote Atom*, 37, 41–42. See also TSD, Nachlaß Hartmann, vol. F, 55–56, 61–63, 74, quotation on p. 56; Dmitri Alexejewitsch Sobolew, *Deutsche Spuren in der Sowjetischen Luftfahrtgeschichte: Die Teilnahme Deutscher Firmen und Fachleute an der Luftfahrtentwicklung in der UdSSR* (Hamburg: Mittler, 2000), 243. On the German specialists' relationship with Beria, see Agnes Tandler, "Geplante Zukunft: Wissenschaftler und Wissenschaftspolitik in der DDR 1955–1971" (Diss. Europäisches Hochschulinstitut, Florence, Italy, 1997), 58–59.

40. See Kojevnikov, *Stalin's Great Science*, 111–124, 292–293. However, Soviet scientists were put on a shorter leash after the end of the Second World War.

41. See Barwich and Barwich, *Das rote Atom*, 103, 116; TSD, Nachlaß Hartmann, vol. F, 83, 95, 103–105; Steenbeck, *Impulse und Wirkungen*, 271–278, 308; Riehl, *Stalin's Captive*, 115, 138–139; Dmitri Alexejewitsch Sobolew, *Deutsche Spuren in der Sowjetischen Luftfahrtgeschichte*, 242–243; Magnus, *Raketensklaven*, 251–256, 296–303, 310–342; Mick, *Forschen für Stalin*, 286–298; Albrecht, Heinemann-Grüder, and Wellmann, *Die Spezialisten*, 61, 72, 81–82, 108, 119–120.

42. TSD, Nachlaß Hartmann, vol. F, 101–102.

43. See Barwich and Barwich, *Das rote Atom*, 126–130, 134, quotations on pp. 126, 130; Riehl, *Stalin's Captive*, 145–149. Discussion of the numbers of those who went to the GDR in Ciesla, "Der Spezialistentransfer," 29.

44. See Steenbeck, *Impulse und Wirkungen*, 317–319, 324–338; Peter Adolf Thiessen, *Erfahrungen, Erkenntnisse, Folgerungen* (East Berlin: Akademie-Verlag, 1979), 18–31, 249–256.

45. See Barwich and Barwich, *Das rote Atom*, 134–136, quotation on p. 135; also see Paul Maddrell, "The Scientist Who Came In from the Cold: Heinz Barwich's Flight from the GDR," *Intelligence and National Security* 20, no. 4 (December 2005): 608–630.

46. Berner, *Spezialisten hinter Stacheldraht*, 270, 311–313, 322–332, quotation on p. 318.

47. Paul Görlich was actually a Saxon, from Dresden, but had moved to the Thuringian town of Jena in 1932 to begin work at Zeiss. His wife, however, was from Jena. Interview with Irmgard Görlich, November 12, 2004.

48. Carl Zeiss Archive (Jena) BACZ 8244, letter from Kortum to Schomerus, dated January 16, 1948.

49. See Konrad Jarausch, *The Unfree Professions* (New York and Oxford: Oxford University Press, 1990), 4–8; Jürgen Kocka and Werner Conze, introduction to *Bildungsbürgertum im 19. Jahrhundert*, vol. I (Stuttgart: Clett-Kotta, 1985), 16ff.

50. See Ute Frevert, "Einleitung" and "Bürgerliche Meisterdenker und das Geschlechterverhältnis," in *Bürgerinnen und Bürger: Geschlechterverhältnisse im 19. Jahrhundert*, ed. Ute Frevert (Göttingen, Germany: Vandenhoeck & Ruprecht, 1988), 11–48.

51. See Hannes Siegrist, "Bürgerliche Berufe: Die Professionen und das Bürgertum," in *Bürgerliche Berufe*, ed. Hannes Siegrist (Göttingen, Germany: Vandehoeck & Ruprecht, 1988), 11–48; Jarausch, *The Unfree Professions*, esp. 7, 22–23.

52. See Edwin Layton, *The Revolt of the Engineers: Social Responsibility and the American Engineering Profession* (Cleveland, OH, and London: The Press of Case Western Reserve University, 1971).

53. See Kees Gispen, *New Profession, Old Order: Engineers and German Society, 1815–1914* (Cambridge: Cambridge University Press, 1989), esp. 1–11. See also Kees Gispen, "The Long Quest for Professional Identity: German Engineers in Historical Perspective, 1850–1990," in *Engineering Labour: Technical Workers in Comparative Perspective*, Peter Meiksins and Chris Smith, with Boel Berner et al. (London and New York: Verso, 1996), 132–149. On educational institutions, see Peter Lundgreen, "Die Ausbildung von Ingenieuren an Fachschulen und Hochschulen in Deutschland, 1770–1990," in *Ingenieure in Deutschland, 1770–1990*, ed. Peter Lundgreen and André Grelon (Frankfurt am Main and New York: Campus Verlag, 1994), 13–78.

54. See Burkhard Dietz, Michael Fessner, and Helmut Maier, "Der 'Kulturwert der Technik' als Argument der Technischen Intelligenz für sozialen Aufstieg und Anerkennung," in *Technische Intelligenz und 'Kulturfaktor Technik.' Kulturvorstellungen von Technikern und Ingenieuren zwischen Kaiserreich und frühen Bundesrepublik Deutschland*, ed. Burkhard Dietz, Michael Fessner, and Helmut Maier (Münster, Germany, and New York: Waxmann, 1996), 1–34.

55. Jarausch, *The Unfree Professions*, 48; see also 27–111. On deprofessionalization of engineers in this period, see Gispen, *New Profession*, 200–231.

56. In this study, the term "ideology" is used in a neutral, not a pejorative sense. I understand ideology to mean any program for the improvement of the world, society, or individuals—systematic in its intentions and connected both to a discourse that molds meanings linguistically, as well as to a field or potential field of action. See Terry Eagleton, *Ideology: An Introduction* (London and New York: Verso, 1991).

57. See Gispen, *New Profession*; Karl-Heinz Manegold, "Der VDI in der Phase der Hochindustrialisierung 1880 bis 1900," in *Technik, Ingenieure und Gesellschaft: Geschichte des Vereins Deutscher Ingenieure 1856–1981*, ed. Karl-Heinz Ludwig and Wolfgang König (Düsseldorf: VDI-Verlag, 1981), 133–166, esp. 139–140; Kees Gispen, "Interessenkonflikte und Organisationsbildung bei den deutschen Ingenieuren, 1890–1933," in *Ingenieure in Deutschland*, 1770–1990, ed. Lundgreen and Grelon, 323; Wolfgang König, "Die Ingenieure und der VDI als Großverein in der wilhelminischen Gesellschaft 1900 bis 1918," in *Technik, Ingenieure und Gesellschaft*, ed. Karl-Heinz Ludwig and Wolfgand König, 235–288, esp. 255–257, 269; Helmut Klages and Gerd Hortleder, "Gesellschaftsbild und soziales Selbstverständnis des Ingenieurs im 19. und 20. Jahrhundert," in *Ingenieure in Deutschland*, 1770–1990, ed. Lundgreen and Grelon, 269–293, esp. 269–280; Wolfgang König, "Der Verein Deutscher Ingenieure und seine Berufspolitik, 1856–1930," in *Ingenieure in Deutschland*, 1770–1990, ed. Lundgreen and Grelon, 304–315; Gerd Hortleder, *Das Gesellschaftsbild des Ingenieurs* (Frankfurt am Main: Suhrkamp Verlag, 1970), 45–76.

58. See Layton, *The Revolt of the Engineers*; Graham, *The Ghost the Executed Engineer*.

59. See Gabriele Metzler, *Internationale Wissenschaft und nationale Kultur: Deutsche Physiker in der internationalen Community 1900–1960* (Göttingen, Germany: Vandenhoeck & Ruprecht, 2000).

60. See Jeffrey Herf, *Reactionary Modernism: Technology, Culture and Politics in Weimar and the Third Reich* (Cambridge: Cambridge University Press, 1984).

61. In the German context, technocratic thinking is often taken to mean not only the advocacy of an out-and-out replacement of democratic (or monarchical) institutions by the rule

of technical experts, but also simply the push for a privileged political or economic role for engineers.

62. See Stefan Willeke, *Die Technokratiebewegung in Nordamerika und Deutschland zwischen den Weltkriegen* (Frankfurt am Main: Lang, 1995); Hortleder, *Das Gesellschaftsbild*, 93–102; Layton, *The Revolt of the Engineers*; Thomas Baylis, *The Technical Intelligentsia and the East German Elite* (Berkeley: University of California Press, 1974), 3–14.

63. See Karl-Heinz Ludwig, *Technik und Ingenieure im Dritten Reich* (Düsseldorf: Droste, 1974), esp. 72–198; Karl-Heinz Ludwig, "Ingenieure im Dritten Reich, 1933–45," in *Ingenieure in Deutschland*, 1770–1990, ed. Lundgreen and Grelon, 338–352; Jarausch, *The Unfree Professions*, 122–124.

64. See Jaruasch, *The Unfree Professions*, 133–137, 157–158, 161, 187–188; Ludwig, *Technik und Ingenieure*, 161–168; Hans Mommsen and Manfred Grieger, *Das Volkswagenwerk und seine Arbeiter im Dritten Reich* (Düsseldorf: Econ-Verlag, 1996); Helmuth Trischler, "Aeronautical Research under National Socialism: Big Science or Small Science?" in *Science in the Third Reich*, ed. Margit Szöllösi-Janze (Oxford and New York: Berg Publishers, 2001), 79–110.

65. See Ludwig, *Technik und Ingenieure*, 189–198, quotations on pp. 190, 197; Ludwig, "Ingenieure *in Dritten Reich*," 349–352, quotation on p. 351.

66. See Barbara Orland, "Der Zwiespalt zwischen Politik und Technik: Ein kulturelles Phänomen in der Vergangenheitsbewältigung Albert Speers und seiner Rezipienten," in *Technische Intelligenz*, ed. Burkhard Dietz, Michael Fessner, and Helmut Maier, 269–295; Gitta Sereny, *Albert Speer: His Battle with Truth* (New York: Knopf, 1995).

67. Heinemann-Grüder, "*Keinerlei*," 32, 41, 42, article on pp. 30–50.

68. See Trischler, "Aeronautical Research."

69. Overview and preprints at http://www.mpiwg-berlin.mpg.de/KWG/publications.htm#Ergebnisse.

70. See Peter Hüttenberger, "Nationalsozialistische Polykratie," *Geschichte und Gesellschaft* 2 (1976): 417–442.

71. See Florian Schmaltz, *Kampfstoff-Forschung im Nationalsozialismus: zur Kooperation von Kaiser-Wilhelm-Instituten, Militär und Industrie* (Göttingen, Germany: Wallstein, 2005), quotation on p. 609. See also Susanne Heim, *Kalorien, Kutschuk, Karrieren: Pflanzenzüchtung und landwirtschaftliche Forschung in Kaiser-Wilhelm-Instituten 1933–1945* (Göttingen, Germany: Wallstein, 2003). See also Margit Szöllösi-Janze, "National Socialism and the Sciences," in *Science in the Third Reich*, ed. Margit Szöllösi-Janze (Oxford and New York: Berg Publishers, 2001), 1–35.

72. See Berner, *Spezialisten hinter Stacheldraht*, first page (bottom) of photo section between pp. 160 and 161.

73. See Schmaltz, *Kampfstoff-Forschung*, 59–62, 96–134, 164–169, 609–610; Thiessen, *Erfahrungen.*

74. See Steenbeck, *Impulse und Wirkungen*; Riehl, *Stalin's Captive*, 2. On Ardenne, see Heidrun Bomke, *Vergangenheit im Spiegel autobiographischen Schreibens* (Weinheim, Germany: Deutscher Studien Verlag, 1993), 43. Bomke cites an article with Ardenne in *Neues*

Deutschland, November 11, 1972. There is some mention of disagreements and minor frictions with the establishment in his memoirs. See Manfred von Ardenne, *Ein glückliches Leben für Technik und Forschung* (Zurich and Munich: Kindler Verlag, 1972), 131–133, 145, 150–152, 160, 177–179.

75. See Ardenne, *En glückliches Leben*, 151, 160, 177. Concerning the régime's rejection of his 1940 suggestion to pursue radar research, he writes, "Today, our honest wish to help defend the lives of German people must seem suspect, an illusion, associated as it was with those aggressive policies [of the Nazis]. . . . However, the cold-hearted ignorance with which the brown members of the master race disregarded the interests of the people angered me tremendously" (151). He claims that his goals in pursuing atomic research were of a non-military nature, although he clearly knew of the possibility of building an atomic bomb (153–156).

76. See Barwich and Barwich, *Das rote Atom*, 7–16, quotations on pp. 7, 8, 14.

77. TSD, Nachlaß Hartmann, vol. D, 1, 14, 18, 23, 24; vol. E, 8; vol. F, 24. On membership in NSBDT, see NARA, RG 242, BDC Microfilm Roll A3345-DS-D049. On membership in SA, see NARA, SA Personnel Files, Record Group 242, Microfilm Publication A3341, SA-Kartei 002A. On Fernseh-GmbH, see K.T., "50 Jahre 'Fese.' Bosch hatte den richtigen Riecher," *Funkschau*, no. 16 (1979): 913–915.

78. See Kojevnikov, *Stalin's Great Science*, 283–295.

2

Reinventing Professionalism in Soviet-Occupied Germany and the Early GDR

Comrades, you have fought well. Now the revolution begins in earnest. Become technicians, become engineers, learn to think in economic terms![1]

Attributed to Lenin by a member of the SED, 1949

The GDR called upon its citizens to participate as engineers in the building of a socialist modernity—a project that joined technology and socialism. Becoming an agent of technical and social progress, the "socialist engineer" was expected to break historical ties with the bourgeoisie, repudiate individualism, and become the partner of the working class.[2] Political loyalty and obedience were an essential part of this new identity. Attempts were made to sever the historical links between the professions and the bourgeoisie, as well as to forge new ones between the professions and the proletariat, above all by recruiting university students from the working class. Working in harmony with the SED, this "new intelligentsia" would promote "social progress."[3]

That was the theory. In practice, this new ideal clashed with the needs of a devastated economy in desperate need of rebuilding. The GDR urgently needed the services of the older generation of engineers and industrial scientists—holdovers from the pre-socialist era. The possibility of fleeing across the open border to West Germany gave this "old intelligentsia" a very favorable negotiating position vis-à-vis the Communist state. A great believer in the central importance of technology in the socialist project of modernization, Walter Ulbricht, the leader of the GDR from 1949 to 1971, was very open to giving these experts a privileged position in the system. Indeed, the state catered to them in important ways, while at the same time pursuing the conflicting goal of socialist transformation. Socialist professionalism, as it evolved in the Ulbricht era, combined elements of pre-socialist professionalism—specialization, monopoly over exercise of a particular profession, state accreditation, maintenance or even expansion of educational entry requirements (as in the case of engineering[4]), professional organizations and publications, a sense of dedication to a higher mission, and a conception of expertise rooted in a particular system of knowledge (applied science, in the case of the "technical intelligentsia"[5])—with new elements, such as state control over professional organizations and educational institutions; state censorship and control of professional publications, professional discourse, and the content of professional training; and the cadre system. "Cadres" owed their leadership positions to the party and were therefore subject to political control from above. Under the "nomenclature" system, the party hand-picked people for top positions in the bureaucracy, the economy, and the party. Professional organizations ceased to be organs of self-regulation and self-policing.[6]

The SED's attempts to bring about a sharp break with the past and sweeping socialist transformation in industrial research, professional organizations, and the universities met with subtle but pervasive resistance. Out of an era of intense conflict and negotiation during Soviet occupation (1945–1949) emerged a compromise between political leadership and engineers and industrial scientists. This compromise lasted until the building of the Berlin Wall, which ended the possibility of escape to the West for most people, and thus profoundly altered power relations. The nature of this compromise will be explored in this chapter. In the early years of the GDR, technical professionals had three frames of references: the long history of science-based industrial research in Germany, the Nazi period (falsely seen as an era of ideal state-industry cooperation), and West Germany (seen both as a threat and as a more liberal alternative). More strongly than in the Soviet Union, the industrial research elite rejected the rule of bureaucrats. The professional model, although radically altered, remained an alternative to bureaucratic subjugation.[7] This chapter looks at three centers of semi-autonomy within the engineering community: the "old intelligentsia," the Chamber of Technology, and the universities.

Winning Over the "Old Technical Intelligentsia," One Dacha at a Time

From the beginning, Soviet administrators in East Germany (the SBZ, or Soviet zone of occupation) gave members of the Nazi-era "technical intelligentsia" every possible incentive to stay and work in the East—a policy reminiscent of Lenin's decision to keep on "bourgeois specialists" after the Russian Revolution. Fearful of Soviet vengeance and hoping to find professional success in the capitalist West, both top German scientists and engineers and many rank-and-file technical professionals fled westward; their exact number is not known. Nonetheless, credible unpublished data of the Communist-dominated labor organization, the Federation of Free German Trade Unions (*Freier Deutscher Gewerkschaftsbund*, or FDGB) indicate that the number of engineers, technicians, and people in related technical professions in the

Soviet zone of occupation rose modestly from 82,110 (about 1.7 percent of the total work force[8]) in 1946 to 89,182 in 1948.[9]

It may seem surprising that so many stayed, given the bleak situation in the Soviet zone. There was widespread hunger, as well as dismay over looting, raping, and confiscation of German goods and factories. The dismantling of industry by the Soviets caused widespread dislocations. Many factory employees were embittered by the chaotic, arbitrary, and destructive nature of these seizures (however justified they were in light of Nazi aggression). However, in both the short and the long run, these policies had less of an economic impact than has often been assumed. Christoph Buchheim and Rainer Karlsch have shown that the economic performance of the SBZ equaled or surpassed that of the Western zones of occupation up until the Western currency reform of 1948.[10] Growth meant jobs. By late 1946 or early 1947, only about 0.9 percent of all engineers and technicians in the SBZ were unemployed. Even among female engineers, the unemployment rate fell from roughly 8 percent in early 1946 to below 1 percent in late 1948. Admittedly, these rosy data do not reveal that some engineers and technicians were working in jobs other than those for which they had been trained.[11]

U.S. intelligence reports confirm that the SBZ offered attractive opportunities to German engineers and industrial scientists. The most important specialist on surveying instruments at Carl Zeiss left a job at the Zeiss company in Western Germany to go to the SBZ because he was unhappy with his job and thought he could do better in the East.[12] One German scientist expressed the opinion that although "most of the German scientists sympathized with the West rather than with Russia," the lure of employment in the Soviet zone was great: "many people [in West Germany] died of hunger and cold and the majority of German engineers were without employment. During this period, the Russians offered positions, accommodations, food, and above all, interesting work for engineers, regardless of their party affiliations."[13]

In the face of East-West competition for engineering and scientific personnel, Soviet authorities showed little inclination to root out former Nazis in these professions. In the Soviet-owned sector of the economy, which was responsible for almost a third of all production in 1946, former Nazi engineers, scientists, and factory administrators were kept on in large numbers. Under pressure to keep up production, Soviet directors of Soviet-owned corporations (*Sovietische Aktiengesellschaften*, or SAGs) ignored SED and FDGB protests and even direct orders of the Soviet military government (*Sowjetische Militäradministration in Deutschland*, or SMAD) to fire employees who had been active Nazi party members. De-Nazification officially ended in the SBZ in March 1948.[14]

On the other hand, initial attempts to induce engineers and scientists returning from the Soviet Union in 1949–1958 to come to or remain in the SBZ or GDR were hamfisted and inadequate. At first, the returning deportees were sent to a camp in Wolfen, where several families had to share halls in spare wooden barracks. Job search counseling was perfunctory, and many found that they had to travel around the GDR looking for work. However, once the Central Office for Research and Technology (*Zentralamt für Forschung und Technik*) was put in charge of the returning Germans, things improved.[15] Nonetheless, Werner Hartmann, who returned in 1955, was outraged at not being allowed to immediately go to Berlin, where his aged father was waiting at the train station. Upon arrival in his hotel, Hartmann found a Stasi agent waiting for him, standing "casually leaning up against a column" in the lobby. He attributed the decision of many to go to the West to bitter feelings engendered by this sort of treatment.[16]

However, job offers, top pay, and good benefits contributed to the decision of many engineers and scientists to remain in East Germany, a decision that was also rooted in nationalist orientation and the ideology of the apolitical technical expert (outlined in chapter 1). Municipal mayors were made personally responsible for finding a place for the scientists to live. Returnees received special rations, and increasingly found work in their specializations. For example, the Telecommunications Works (*Werk für Fernmeldewesen*, commonly referred to—as was customary in the GDR—by its acronym, "HF," which was derived from "Hochfrequenztechnik," meaning high frequency technology or radio technology), located in the Oberschöneweide section of Berlin, had by 1951 rehired fifty-nine of its employees who had been in the Soviet Union. (Only five or six employees went to the West.)[17] Engineers, industrial scientists, and industrial managers were given special contracts that assured them pay well above standard pay categories. For example, at HF, special contracts were signed with 106 employees in August and September of 1951, sixteen of whom had been in the Soviet Union. At HF, special contracts tended to raise pay by some 15–20 percent, generally giving engineers a monthly gross income in the 700–900 mark range, while department heads (*Abteilungsleiter*) generally earned 950–1500 marks per month.[18] By contrast, stenotypists at HF tended to earn some 300–375 marks, and skilled workers (*Meister*) were usually in the 450–550 mark range.[19] As a result of the special contracts, pay tended to be distinctly better in industry than at the universities, making it difficult to recruit engineering specialists to university positions.[20] In turn, the Soviet-owned SAG enterprises were able to skim university graduates off the top of the job market by offering even more lucrative contracts.[21]

Top scientists, particularly nuclear physicists, were in a category of their own. They were treated, in the words of one contemporary, like "nobility without titles."[22] Many eventually received the National Prize (*Nationalpreis*), introduced in 1949, which carried monetary awards of 25,000 to 100,000 marks. Given the circumstances of the Cold War, the SED was anxious not to lose atomic scientists to the West, where they could give a boost to the other side's nuclear power or nuclear weapons programs. They also had prestige value. If scientists such as Nobel Prize-winner Gustav Hertz remained in the GDR, they would bolster the portrayal of the GDR as the heir to the German tradition of excellence in science. In addition, their rich web of contacts in the West gave the Soviet Union a good source of information on scientific and technical developments there.[23] For example, an East German chemist reported to U.S. Army intelligence that he had been closely questioned by a Soviet official about a trip he had made to West Germany in 1951. The Soviets were interested in finding out through him about I. G. Farben research during the last days of the war, as well as about contemporary research on gasoline synthesis.[24]

Werner Hartmann belonged to this privileged elite. In 1956, he founded and became the head of Vakutronik, an industrial institute for the development and production of electronic measuring devices for nuclear industry (such as Geiger counters). In the late 1950s he earned the regal sum of 8,000 marks per month, and was promised a pension of 80 percent of his regular salary. Employees of the municipal government of Dresden helped him find an elegant apartment in which two well-known symphony conductors had lived. In 1956, he moved into a large house with his wife and two daughters, building a two-car garage for 10,000 marks. After divorcing his wife in January 1957, he left the house to her. Remarrying in 1958, he was able to buy a new house, for which the upkeep was paid for by the municipal government of Dresden. At a time when private automobile ownership was not very widespread, Hartmann had a company car (first a Pobeda, later a Wolga, then a Tatra—all East bloc luxury cars) and a chauffeur. It is rich with irony, though none too surprising, that Hartmann found out during an interrogation in 1976 that his chauffeur had been working for the Stasi all along. Between 1945 and 1963, Hartmann was able to give his father and stepmother (who lived in West Berlin) about 200,000 marks—a huge sum—in support.[25] He was paid this money in Western deutsche marks by the East German authorities.[26]

Enjoying a prosperous lifestyle not unlike that of his West German counterparts, Hartmann was part of an exclusive, though subordinate, in-group. Large incomes enabled these top scientists and engineers to purchase status symbols, as well as affording them comfort, peace of mind, and a considerable amount of personal freedom. Money did not have much importance in East Germany. It did not buy economic power or access to educational institutions or cultural realms. What Pierre Bourdieu has called "symbolic capital" was of greater significance, but did not carry much independent weight: subordinated elites such as top technical personnel owed their status, their relative wealth, and the honors bestowed upon them (such as the

National Prize) to the SED.[27] Symbolic capital produced not only admiration but envy.

Members of the "old" technical-scientific elite, that is, top engineers and scientists who had entered their professions before 1945, were considered by the SED to be "bourgeois." This attitude is not consistent with the Leninist thesis that the technical intelligentsia was an intermediary stratum that could serve either the bourgeoisie or the proletariat. Hartmann had a personal take on this association of the technical-scientific elite with the bourgeoisie: "Though my grandfathers were a bricklayer and a greengrocer, later a switchman, my grandmother a maid, my father a house painter and day worker, my mother a seamstress, and my uncle a country postman I was considered a member of the bourgeoisie. [For this reason and because I was] not a member of the state party, I naturally belonged to that intermediary stratum which, though very useful, was looked upon with great distrust."[28] Hartmann believed that this prejudice was based not on social origins, but rather that what made himself and others "bourgeois" in the eyes of the SED was primarily their political abstinence, their unwillingness to act, think and speak in complete accordance with the SED. In Hartmann's mind, the basis of this lack of harmony with the SED was a dedication to technical-economic rationality.

However, more than ideology or belief systems were at work here. Members of the "old intelligentsia" were rarely of working-class origins; during the capitalist period they had enjoyed educational opportunities not open to every German.[29] Even those not of upper-middle class origins had joined that class and adopted its class-specific habits—habits that after 1945 reminded everyone of where they came from. According to his own account, Hartmann stood out with his middle-class manners, for example, his habit of standing up whenever anyone came into the room. His concept of gentlemanliness was, however, somewhat unusual in the he stood up even for a cleaning lady. Hartmann also bought expensive, fashionable clothes, and had an appreciation for Glenn Miller's big band sound (only heard, alas, in snippets at the Leipzig Trade Fair).[30] Although the SED elite also cultivated a lifestyle that was doubtlessly modeled on the pre-Communist *Bürgertum*—living in large, pre-war homes in older, upper-middle-class suburbs, for example[31]—they seem to have avoided obviously bourgeois gestures, at least in public.

The attributes that earned engineers and scientists the hated label of "bourgeois" in SED circles seem to have won them social status in their own circles. Glamorous soirées, exclusive clubs where items in the Western press were openly discussed, and business meetings held in the beautiful gardens of the Lingner-Schloss, a modernized castle overlooking the River Elbe, appeared to serve the same function as in similar settings in West Germany: to promote both group cohesion and individual ambitions. Hartmann describes this milieu:

On the initiative of M. v. A. [Manfred von Ardenne], the "Dresden Club" was set up in the so-called Lingner-Schloss, overlooking the Elbe on the Neustadt side, Bautzner Street. I was one of the founding members; the club opened in the spring of 1957. If I remember correctly, Minister Selbmann held the opening address. . . . Western newspapers and magazines were available in the club library; there were very interesting discussions. We often ate there, went there after the opera, celebrated New Year's Eve there: Interesting people got together there. How and where else could one meet people in Dresden? . . . When I wanted to think something over in quiet, I often sat out on the terrace in the sunshine, looking out over the Elbe Valley, during work hours.[32]

But do these outward signs indicate a true coalescing of forces independent of the SED? Even at its most assertive, the reconfigured old establishment was less and less able to present a coherent standpoint, let alone influence the formulation of state policies. Nonetheless, its core values had a profound and lasting impact on various institutions, notably in the areas of higher education and professional organization.

The Chamber of Technology: Representative of a Profession or Tool of the Regime?

After the Second World War, the Communist leadership was determined that the independent voice of professional organizations not be allowed to reemerge. The Association of German Engineers (*Verein Deutscher Ingenieure*, or VDI) was outlawed along with all other Nazi-affiliated organizations by the Allied Control Council (although the VDI's revival was permitted in the western sectors). The Chamber of Technology (*Kammer der Technik*, or KDT) was established as an organization of all technical professionals under the auspices of the Communist-dominated FDGB on July 2, 1946.[33]

The KDT was expected to promote both the emergence of the socialist engineer and the "active participation of broad segments of the population in the tasks of technology." One of its major aims was to overcome class barriers and help the working class play a greater role in technical innovation. A new journal, *Die Technik* (Technology), as well as lectures aimed at "talented workers and technicians" were to promulgate technical knowledge.[34] The KDT was thus not, strictly speaking, the representative of a profession. The new organization welcomed not only technical professionals with college or university degrees, such as engineers, architects, mathematicians, physicists, and chemists, but also technicians, factory workers, and other manual workers engaged in creative technical work. However, scientists and engineers dominated the organization, making up 55 percent of the membership in 1951, while only a sixth of the members were workers. The KDT was also a professional organization in the sense that it petitioned the Soviet authorities, and later the East German government, for improvements in pay, working and living conditions, and cultural opportunities for the "technical intelligentsia."[35]

The KDT was also expected to play an important role in the development of cutting-edge technologies. It was to promote and evaluate industrial research, as well as to assist in searching for solutions to major technical problems. Its journals became technical publications for specialists. The Chamber of Technology had a consultative role in the drawing up of curricula for technical schools and colleges, worker safety, rationalization, and patent law.[36] The tension among the KDT's roles in promoting the alliance between the new technical intelligentsia and the working class, in representing the professional interests of the "technical intelligentsia," and in promoting highly specialized technical research lasted until 1989.

The SED expected political conformity from the KDT, as well as support for key SED policies. The central business office (*Geschäftsleitung*) seems to have been the chief conduit through which the FDGB and SED tried to impose their political line on the KDT. For example, at a 1948 conference of the central business office with business offices of the provincial Chamber of Technology branches, delegates declared that engineers had to take the lead in imposing the unpopular "Order 234" in the factories, working in close cooperation with the FDGB and provincial governments.[37] The purpose of this order was to overcome poor morale and performance in the factories by introducing piecework pay and incentives for higher productivity.[38]

Nonetheless, there was marked resistance in the early years to giving political work a prominent place in the KDT. Initially, Hans-Heinrich Franck, a cofounder of the KDT, wanted pre-1945 technical work to be continued under KDT leadership. He hoped that blocs of members of pre-socialist organizations such as the Association of German Chemists (*Verein Deutscher Chemiker*, or VDCh) would join the KDT, bringing their concepts of what a technical organization should do with them. A friend of his, a professor in Dresden, hoped that coordination between technical organizations in the four zones of occupation (and thus pressure from the West) could help overcome the "stagnation" of the Chamber of Technology and poor supervision on the part of the FDGB.[39]

Enno Heidebroek (born in 1876), president of the KDT from 1946 to 1949, was a member of the older, bourgeois engineering elite. Never a member of the Nazi party, he had nonetheless been a member of two Nazi organizations, the National Socialist League of German Technology (*NS-Bund Deutscher Technik*, or NSBDT) and the National Socialist Lecturers' League (*NS Dozentenbund*, or NSDB), and a member of the executive committee of the much older VDI. A member of the liberal German Democratic Party (*Deutsche Demokratische Partei*, or DDP) from 1919 to 1931, he joined the liberal LDPD (one of the Eastern German bloc parties) in 1946.[40]

Heidebroek feared the Chamber of Technology would become a mere "bureaucratic institution" if it did not start concentrating on technical, scientific work. He was publicly accused of being interested in only narrowly technical issues and of neglecting political and social concerns. He defended himself in a letter to Franck: "Since my speeches and publication are well known to a large number of people, I don't think that anyone [truly] believes that I am so obtuse as not to understand the social responsibilities of technology." The FDGB never responded to his proposals for the reorganization of the Chamber of Technology. Deeply frustrated and concerned about the direction the "central authorities" were taking, he stepped down as KDT president.[41]

His resignation came at a time of tumult in the Chamber of Technology. The SED-dominated central office (*Geschäftsleitung*) fought mightily to gain greater control over the overly independent-minded technical divisions, initiating a wave of firings, as well as hirings of more ideologically conformist staff. The vice president of the KDT, Max Günther (an FDGB appointee) angrily suggested that one staff member who had been fired without notice look for a job in the West. The fired man complained to Franck (who had succeeded Heidebroek as president) that the central office was preventing the technical divisions from concentrating on technical work, which he asserted was the central mission of the KDT. This disgruntled former staff member even took his complaints to Willi Stoph, then head of the economic division of the SED secretariat.[42]

Franck, KDT president from 1949 to 1959, was not a pushover. Having joined the Social Democratic Party in 1917, he was dismissed from his professorship at the Technical University of Berlin in the Nazi era. Reinstated after the war, he was again dismissed from this West Berlin university because he joined the SED in 1946. He then moved to Humboldt University, in the Soviet sector. Although a Communist, his loyalties lay first and foremost with the engineering and scientific community. Under his stewardship, the Chamber of Technology resolved (on February 26, 1951) to concentrate on technical work and on building its factory-level organization.[43] Factory KDT chapters were more pragmatic and less subject to pressure from the FDGB and SED than the provincial KDT branch offices. Many KDT conferences dealt with purely technical problems, ignoring political and economic issues.[44] Members were allowed to maintain their distance from political life.[45] As a result, the Chamber of Technology became popular among technical professionals, growing from 51,207 members in 1951 to about 110,000 members in 1961, making it the largest engineers' organization in Germany.[46]

Franck was an advocate of humanistic education for engineers. He argued that a utilitarian orientation in education had led to "experimentation without spirit or conscience" and to the "gas chambers and medical experiments on concentration camp inmates." His vision of renewal of higher technical education centered on the introduction of a core curriculum in the liberal arts. Engineering students should be inculcated with humanistic values. A key role was to be played by courses in economics, scientific method, and foreign cultures (cultural history, modern foreign languages, and cultural sociology).[47] Given the SED's lack of interest, such reform recommendations were doomed to failure from the start. Soon, Franck's concept of technology as culture was eclipsed by an ideology of technology as science,[48] which had far better prospects for success in the East German university system.

Some engineers and other technical personnel hoped to use the KDT to strengthen East-West ties in the area of technology. The official line, propagated from above, was that the West German *Verein Deutscher Ingenieure* (VDI) had not broken with its militaristic, fascistic past as a supporter of the Nazi régime.[49] However, some East German technicians and engineers remained members of this organization or simply attended VDI conferences. In 1959, a machine tools professor at the Technical University of Dresden tried to persuade colleagues to sign a letter criticizing an article in *Die Technik* that condemned the VDI. This professor argued that it was in the best interests of East German machine tools experts to allow them to participate in VDI work in this area. The SED was anxious to convince him and his supporters of the folly of such collaboration with the enemy.[50] The SED was also upset that East German members of the international electrotechnical commission had agreed to sit together with West Germans in a pan-German commission. The SED called on the KDT to take a political stand against the VDI.[51] The KDT tried to cling to an apolitical stance, but was very hesitant to pursue ties to West German organizations in defiance of SED wishes. Engineers were thus far less politically assertive than medical doctors who, according to a study by Anna Ernst, insisted on maintaining ties with West German organizations.[52] Along with many other organizations, the Chamber of Technology proclaimed its support for the building of the Berlin Wall. In the fall of 1961, KDT officials were sent around to factories to report on any signs of discontent and to provide support for the SED party secretaries.[53] However, at the grassroots level, there were muffled protests against the building of the wall. In the early 1960s, KDT members put up quiet resistance to cooperation with the FDGB, the "*Neuererbewegung*," and the activists' movement (discussed in chapter 3).[54]

The KDT insisted that local enterprise chapters become their factories' "technical conscience," an oddly moralistic turn of phrase.[55] In theory, this role gave engineers and industrial scientists room to develop ideas of their own. Indeed, it has been asserted that on the factory level, the Chamber of Technology provided a place where technical professionals could develop technological ideas that did not fit into industrial planning, and in defiance of their superiors.[56] It is extraordinarily difficult to document this thesis of grassroots empowerment. Further research is needed here.[57]

Unable to address professional concerns and unwilling to promote an ideologized vision of technology, the KDT defined its mission in purely technical terms, thus recreating the engineer as the apolitical caretaker of technology in modern industrial society. But whereas the "apolitical engineer" of the Imperial period clung to the state as a benevolent protector, standing above politics, East German engineers and scientists looked to the KDT to shield them from what was perceived as an overly politicized state.

Technical Universities and Colleges between Stalinization and Resistance

Did the East German universities produce cogs that fit neatly into the machinery of Communist society? Or did some elements of independent thinking survive among faculty and students? Ralph Jessen and John Connelly have come to different conclusions regarding the era before the 1968 university "reform." They agree that in the early years of the GDR, the ruling party asserted control over the universities and colleges, breaking political resistance, even in supposedly apolitical fields such as engineering and science. A Soviet model was imposed on East German of higher education that was much the same as in other Soviet satellites. It involved the creation of a "new intelligentsia" whose loyalty was supposedly guaranteed by its proletarian or peasant origins; ideological control over the professoriat; the shift of resources from the humanities and social sciences into engineering; the transformation of universities into vocational training facilities for the socialist economy; the introduction of a narrow curriculum featuring narrowly defined majors, military training, and no electives; and the shift of research facilities from universities to research institutes. John Connelly argues that the East German leadership successfully subordinated the universities to its will, thus creating a professional class that was politically and ideologically loyal. He has demonstrated that in East Germany, the universities resisted Sovietization less than in Poland and Czechoslovakia. As explanations for the East German pattern, he points to Soviet occupation, the "unparalleled delegitimation of the old elites," the ability of Communists to sell purges of anti-Communists as de-Nazification measures, the open border (which rid East Germany of anti-Communist students and professors), East-West rivalry within Germany, and the interest that the Communist leadership showed in higher education. Massive numbers of professors fled or were replaced, and most who remained joined the Communist Party (SED). The SED also put a great deal of effort into recruiting members of the working class to university studies. These students felt a profound debt of gratitude to the state, a sentiment that was to be of lasting significance.[58]

While not calling into question the basic Stalinization thesis (that is, the thesis that the SED wanted to impose a Soviet model on GDR universities), Ralph Jessen emphasizes the ways in which East German professors resisted those aspects of Communist policy that threatened to undermine professional status. Thus, professionalism was the driving motivation behind a subtle struggle to maintain the autonomy of the universities. The weight of professional Habitus (to use sociologist Pierre Bourdien's term) blocked a thoroughgoing ideologization of higher education—at least up until 1968.

This debate is highly relevant to technical fields. To what extent were engineering professors motivated and able to resist Sovietization? What impact did this have on the training of engineers and industrial scientists? Were certain aspects of professional Habitus preserved? These questions will be addressed in this section by looking primarily at two case studies: the Technical University of Dresden (*Technische Hochschule Dresden*) and the Mining Academy of Freiberg (*Bergakademie Freiberg*). The former, the largest technical university in the Soviet sector, was very badly damaged during the bombing of Dresden in 1945. Later, it reemerged as the most modern and advanced technical university in East Germany. The Mining Academy of Freiberg, left largely physically intact by the war, could claim to be the oldest technical university (founded in 1765), as well as one of the foremost institutions of higher learning devoted to mining and heavy industry in the world. It was a small, highly specialized institution. Among other things, I conducted a quantitative study based on the "professors' files" of these two universities. I used the records on professors in technical fields at the Technical University of Dresden until 1968, as well as on all professors at the Mining Academy of Freiberg from 1946 to 1989. The latter group includes only professors who were part of the regular teaching faculty. I also used the *Berlin Records Center* records on Nazi party membership (now on microfilm at the National Archives) to determine whether these engineering professors had been members of the Nazi Party.[59]

One reason the SED did not encounter overwhelming resistance when it took over the universities was the tremendous discontinuity of the faculty. Between January 1945 and January 1946, about three-quarters of all full professors left their positions at major universities in the SBZ. The Technical University (*Technische Hochschule*, or TH) Dresden lost about two-thirds of its full professors by the end of 1945, leaving a total of twenty-six. Five of the remaining faculty members were forced to go to the Soviet Union on October 22, 1946.[60] In the era of Soviet occupation, a half-hearted de-Nazification of the universities took place (while former Nazis in industry were generally kept on). Of seventeen full professors at the Mining Academy of Freiberg in 1946–1949, only three had been members of the Nazi Party. However, just over a quarter (12 out of 46) of the professors who taught at the Technical University of

Dresden in the era of Soviet occupation had been members of the Nazi Party. As the East German state attained control over the universities, de-Nazification was dropped. Most of the professors appointed in 1950–1960 in Freiberg (16 out of 29, or 55.2 percent) and in Dresden (63 out of 107, or 58.9 percent) were former Nazis.[61]

Discontinuity was a tremendous problem at the Mining Academy, although somewhat less so at the TH Dresden. Just over a third (six) of the sixteen professors at the Mining Academy of Freiberg began their academic careers before 1945. By contrast, twenty-two (47.8 percent) of forty-six professors who taught at the TH in 1946–1960 entered academia before 1945. Most of the new professors came from industry, and thus could not build on pre-1945 careers, reputations, and structures of authority within academia. They were not as well qualified as their predecessors. Five who taught before 1961 at the Mining Academy (31.3 percent) and eleven (23.9 percent) out of forty-six professors at the TH Dresden did not even have a doctoral degree. Just over two-thirds of the professors at these two universities were lacking a *Habilitation* degree (a kind of second doctoral degree). On the other hand, they did have strong ties with industry. At Freiberg, nine out of sixteen professors (or 56.3 percent) of the SBZ era had worked in industry in the Nazi period, and eight (66.7 percent) worked in industry after 1945, often for extended periods. Somewhat fewer Dresden professors (72 [47.1 percent] out of 153) had had careers in Nazi industry, while seventy (45.8 percent) had jobs in industry after 1945. The industrial realm thus became the frame of reference for many professors in technical fields, particularly at the Mining Academy of Freiberg.[62]

Despite high turnover after the war, the professoriat in Freiberg tried to hold on to certain elements of self-administration and autonomy. One advantage that the Mining Academy had was Soviet protection. The Soviet authorities were keenly aware of the importance of the research facilities there. The first thing that the military administration did after the Red Army takeover on May 8, 1945, was to place the Mining Academy, its property, and its personnel under Soviet protection. Scientific-technical bureaus (WTBs) conducted numerous research projects vital to Soviet industry. The second factor that put the Mining Academy in an advantageous position was its subordination to the Central German Authority for the Fuels Industry (*Deutsche Zentralverwaltung der Brennstoffindustrie*). This German-run office was headed by Ferdinand Friedensburg, a renowned mining expert, a non-Communist, and a proponent of democracy. In a speech on February 8, 1946, the day on which the Mining Academy officially reopened and on which his office took over, he promised to uphold academic freedom in Freiberg, although he also made it clear that he expected a break with the past: “I promise you that you shall enjoy as much academic freedom as you need to pursue scientific knowledge. We expect you to do everything possible to break with tradition, not to pick up where things left off almost a year ago, but, fully cognizant of the great responsibility invested in you, that you will create something new, better, and more valuable."[63]

The struggle to maintain university autonomy centered on three issues: the election of the university administration, de-Nazification, and the role of the works councils (*Betriebsräte*) in hiring and firing. According to historian Helmut Albrecht, the chancellor and senate tried to get around further demands for the de-Nazification of teaching faculty after an initial wave of firings. However, they capitulated when it became clear that if they did not, the university would not be allowed to reopen. The faculty elected a senate that was cleansed of its many former Nazi Party members, but had only one Communist among its ranks. The most divisive issue was that of the role of the Communist-dominated works council (*Betriebsrat*) in hiring and firing. This council, which represented university employees in manual labor and office jobs, wanted veto power, a demand that the senate resisted. However, the senate had to give up after Friedensburg's fall from power in the fall of 1946. Soon thereafter, the Mining Academy was accused in the press of being a "Nazi bastion." Albrecht sees this as part of a smear campaign, aimed at bringing the Mining Academy to its knees.[64]

At the TH Dresden, the Nazi-era chancellor, Wilhelm Jost, was forced to resign by the professoriat. Enno Heidebroek, a professor of mechanical engineering (*Maschinenbau*) and later KDT president, was elected chancellor, and took office on July 26, 1945. (According to Pjotr Nikitin, a former SMAD education official, SMAD did not interfere in the election of university chancellors in the SBZ.[65]) The speech he gave on the occasion of the reopening of the TH Dresden on September 14, 1946, was filled with words of remorse: "We Germans brought about, under the influence of a blind and criminal leadership, a terrible catastrophe, and now must suffer the consequences the most severely." He expressed his respect for the Soviet authorities and his belief in the superiority of socialism. In particular, he asserted that socialism would be better able to cope with the dangers posed by modern technologies than would Western capitalism. Nonetheless, his intellectual framework was essentially bourgeois in character. For example, he cites Goethe—an icon of middle-class German culture—at the end of his speech, rather than Marx. More important, he argues in favor of meritocratic principles in university admissions: "We want to set free real talents and abilities—which in the case of technology slumber in the working class as well as in intellectual circles . . . But what really matters is ability and dedication!" Here, he is implicitly arguing against class-based admissions quotas, although this was the policy of the day. Heidebroeck was a representative of an older German engineering tradition, one that he tried to keep alive to the extent possible. He went on to become a major figure in the engineering profession and in technology in the GDR as president of the Chamber of Technology, a member of the Academy of Sciences in Saxony, a member of the German Norms Commission (*Deutscher Normenausschuβ*), a member of the parliament of Saxony in 1949–1950, and the recipient of the coveted National Prize.[66]

Although the SED allowed such "bourgeois scholars" to retain a superficial appearance of scholarly autonomy, in fact, power relations shifted under their feet, undermining their ability to resist. In 1957, technical colleges and universities came under the authority of the State Secretariat of Higher Education, which exercised considerable authority over university curricula, course content, admissions and appointments, thus reducing the power of university senates and chancellors. SED domination over university senates was virtually guaranteed by a February 13, 1958, decree that allocated a set number of seats to members of Communist mass organizations.[67] SED party cells publicly confronted opponents among the faculty.[68] University "cadre divisions" attempted to influence the university appointment process. However, as an example from the architecture division of the TH Dresden's school for civil engineering in 1955 shows, universities still had a certain amount of autonomy in the appointments process during this era. Officials hoped to weaken the dominant position of three very influential, conservative, religiously oriented professors, Heinrich Rettig, Gerhard Hempel, and Wolfgang Rauda, by appointing Rolf Göpfert, who was thought to be a "progressive." However, the cadre division seemed confused about Göpfert, unsure as to whether or not he was the candidate of these reactionary professors.[69] Göpfert was appointed, but Rettig and Hempel remained at the TH until retirement age, when each was named professor emeritus, while Rauda fled to the West in 1958.[70] Not until after the building of the Berlin Wall did the SED achieve direct control over university appointments, establishing nationwide cadre planning, and subverting the traditional academic search process.[71]

While protecting their own, the professoriat did nothing to stop the authorities from clamping down on students, among whom anti-Communism was rampant. According to a CIA report, there were at least eleven engineering students among the fifty-six students given long prison sentences for "subversive" acts (such as the distribution of pamphlets critical of the GDR) in 1951–1958.[72] A distaste for rebellious activities and anti-state behavior is reflected in the comments of one non-Communist engineering professor at the TH Dresden, who expressed the (fallacious) opinion that the uprising of June 17, 1953, had been organized by the Western radio station "RIAS."[73]

In another case, an engineering student identified as M. Hampel, who, along with a fellow student, was threatened in 1952 with expulsion from the Mining Academy of Freiberg because they were members of the Protestant Student Congregation, initially encountered a rather different attitude. His chemistry professor allowed him to take an examination, and “there was a sense of sympathy, even without words or gestures.” In addition, a secretary allowed him and his fellow Protestant students to make illegal copies of their transcripts. However, he and a friend fled to West Berlin in April 1953 when it became clear that they were about to be expelled and possibly jailed. Days later, a meeting of the university faculty voted to suspend eleven other students because of their activities as members of the Protestant student congregation.[74] In the end, silent sympathy was worth very little.

The SED saw the replacement of the “old intelligentsia,” recruited largely from the more privileged sectors of society, with a “new intelligentsia” as key to the long-term solution of the problems of student unrest and political hostility or indifference among professionals.

The SED Asserts Control over the Student Body

SED-dominated university admissions committees gave preferential treatment to applicants of working-class or peasant backgrounds and to members of the SED, rejecting large numbers of applicants who did not fulfill these criteria. Middle-class, anti-Communist students lost their dominant position at the universities very quickly. (However, children of state functionaries were considered to be of proletarian background.) The prospective student’s political record played an important role in admissions, which were controlled by SED district offices from 1949 onwards. Factory workers were prepared for university studies in special preparatory courses and at Workers’ and Peasants’ Schools (*Arbeiter- und Bauernfakultäten*, or ABF). Three-year programs at these schools emphasized technical subjects, and many ABF graduates went on to major in engineering at the university. As a result, technical universities had the most “proletarian” student bodies. The working-class component at the TH Dresden (full-time day students only) rose from 40.6 percent in 1947 to 48.6 percent in 1949, then remained in the 49–54 percent range from 1950 until 1960.[75] Over a third of the first students at the Mining Academy of Freiberg after the war were considered to be “worker-peasant students,” but their presence declined somewhat in 1949, only to experience a tremendous rebound in the 1950s (to 53.5 percent in 1952 and 58.5 percent in 1961).[76] Tuition was eliminated in 1957, and virtually all students received scholarships to cover living expenses.[77] Theoretically, 60 percent of all students in each major were supposed to be of peasant or proletarian origins. Universities were achieving this SED-mandated goal by the late 1950s thanks to part-time, evening, and correspondence programs.[78]

The KPD/SED argued that these policies helped overcome the elitism of the past. No more would an isolated bourgeoisie dominate the professions. Students and teachers had to be recruited from and serve the proletariat and peasantry.

Heidebroek also expressed anti-elitist sentiments in his 1946 speech: "The striving for university education—overemphasized at times today—should not lead to a disparagement of practical work, which also makes use of valuable intellectual powers, nor to undemocratic class snobbism, which we reject." He hoped that a new, egalitarian spirit at the universities would foster new relations in the factory: "The true factory manager should teach and convince, not give orders and yell. We do not want to see the type of the drill sergeant or the insult-hurling boss in our future factories." However, Heidebroek, like other non-Communist engineering professors and administrators, believed that talent and dedication were the decisive factors in academic and professional success.[79] In at least one case, this led to a conflict with Communist officials. With the support of Friedensburg, the senate of the Mining Academy of Freiberg fought the intervention of political institutions in the admissions process, but SED policies were forced through.[80]

While the SED tried to open the doors of the universities to students of working-class or peasant backgrounds, it hardly challenged traditional male domination in this era. Addressing his audience as "meine Herren Studenten" ("gentlemen, students"), Heidebroek, in his 1946 speech, revealed deeply ingrained notions about the male character of engineering. The SED gave preferential treatment to women in the university admissions process. Nonetheless, at the TH Dresden, women made up 14.8 percent of all students in 1947, but their share dropped steadily to 5.9 percent in 1950, rising slightly (to 8.9 percent) in 1963.[81] Women did not begin to have a more substantial presence at the TH Dresden until the late 1960s.[82] Only 9 out of the 116 students (or 7.7 percent) attending the Mining Academy of Freiberg in 1946 were women. In the GDR as a whole, 5–7 percent of students admitted to university engineering programs in 1958–1961 were women. Women did somewhat better at the technical colleges, where they made up 11 percent of admissions to engineering programs for the 1960–1961 academic year.[83] In terms of gender imbalance, the situation in West Germany was even worse, however.

The engineering curriculum was quite rigid and highly specialized, but retained important elements of pre-Communist technical training. Engineering students were told precisely which courses to take each semester, although they had some leeway in selecting specialized courses in their major in their junior and senior years. Engineering students also spent long hours in the classroom—a Communist "innovation." At the TH Dresden, for example, electrical engineering majors had twenty-two to thirty-six hours of course work per week during their freshman and sophomore years. During their first years of studies, three-quarters of their classroom time was spent listening to lectures. To cover all the courses, graduate students were assigned to teach many courses, and so teaching quality declined. (Nonetheless, in the mid-1960s, one institute director at the Mining Academy of

Freiberg was teaching twelve to fourteen hours per week, a heavy teaching load.) By their fourth semester, students were supposed to conduct experiments or be involved in some type of interactive learning over half the time.[84] This was not, however, always the case. Film strips replaced actual experiments in Werkstoffkunde at the TH Dresden in 1953 because of the large number of students, the small number of assistants, and the lack of laboratory space.[85]

The party took care to keep students occupied during their supposedly free time. Vacations were short, and often filled with required practical training in industry or agriculture (amounting in some cases to unpaid physical labor with little or no pedagogical value). Students were placed in study groups, or seminars—groups of about twenty students who did all their course work together. This system, modeled on Soviet practices, promoted group cohesion and student retention, but also facilitated surveillance and ideological control. Compulsory weekly meetings were overseen by a seminar secretary appointed by the FDJ (the main Communist youth organization), who reported on students' academic progress and political views and had the power to get students expelled from the university if they were deficient in either.[86] Students were sometimes called on to participate in mass actions, some of which genuinely increased the feeling of participating in a good cause. This tied into feelings of community awakened by the Nazis, as in the case of one industrial scientist: "As a student, I volunteered for an emergency relief operation in response to the weather catastrophe of May 23, 1950, in Bruchstedt. I very much wanted to help, and I had become familiar with organized settings in the Hitler Youth, antiaircraft forces (*Luftwaffenhelfer)*, Labor Service and *Wehrmacht*."[87]

Up until 1949, courses that exposed students to democratic thinking and a non-Communist interpretation of German history were offered at the Mining Academy of Freiberg.[88] However, humanistic or non-Communist approaches were pushed aside by the early 1950s, replaced by ideological indoctrination. A humanistic conception of technology was lost. Nonetheless, a socialist conception of technology never emerged to any great extent at the universities.[89] Rather, the older ideology of technology as science reasserted itself.

Many in higher technical education saw a scientific outlook as a path to independent thinking. As such, it could serve as an antidote to unthinking adherence to ideology and could promote professionalism in the "new technical intelligentsia."

Thinking for Themselves?: Scientific versus Vocational Ideals in Higher Technical Education

Loren Graham has argued that overspecialization led to a tremendous narrowing in the way Soviet engineers saw technology, blinding them to the social consequences of technology.[90] In the GDR, engineering specializations became narrower than in West Germany, but engineering studies retained a science-based view of technology that was broader than in the Soviet Union.

This scientific tradition was noticeably preserved at the renowned technical universities. These looked back on a long tradition. The oldest were the Mining Academy of Freiberg and the Technical University of Dresden (founded in 1828). The University for Architecture and Civil Engineering in Weimar grew out of the Bauhaus, a famous school of architecture in the 1920s. On the other hand, in 1953, highly specialized Soviet-style "special universities" were established. These included the "Higher Schools" for electrical engineering (in Ilmenau), mechanical engineering (Karl-Marx-Stadt), chemistry (in Merseburg-Leuna), heavy machinery (in Magdeburg), civil engineering (in Leipzig), and transportation (in Dresden). These represented a defeat for the professoriat, as well as a departure from German educational tradition, according to historian Karin Zachmann. However, this anti-academic "innovation" was basically reversed in the 1960s. Most of these institutions were converted into general polytechnic universities or merged with other institutions. Core curricula with general requirements in science, engineering, and economics were introduced or expanded.[91]

The emphasis on science and theory at East German technical universities counteracted overspecialization. Solid scientific training also had the potential to empower future engineers, an expectation expressed by Heinrich Schubert, a chair holder, institute director, and vice chancellor for research at the Mining Academy of Freiberg: "Today, the goal of engineering education can no longer be to teach students a bunch of [isolated] facts. Rather, students should learn to solve the complex and varied problems which await them in their future work through a broad education in the fundamentals and learning to work independently."[92]

In 1950–1951, university electrical engineering majors at the TH Dresden were required to take fifty credits in mathematics, physics, mechanics, and chemistry to graduate.[93] The 1964–1965 academic bulletin at Freiberg stipulated that mining majors take seventy-seven credits worth of general science courses in the course of their studies.[94] Insisting on the importance of science, the professoriat persuaded the SED to give up on plans to create a special engineering degree with a weak science component.[95] In the late 1960s it was reported that student participation in research (a new requirement) "serves the development of the student's personality, with the goal of leading him to greater independence."[96] Imitating the traditional universities, the specialized universities also promoted mathematics and science as subjects that taught engineers to think independently. In addition to being intellectually enriching, exposure to science reinforced the self-image of university-educated engineers as part of a scientific tradition, and thus strengthened their sense of professionalism. Dedication to this commitment was reinforced by the survival of patriarchal ties between professors and their students—a hallmark of the German university system—up until the 1968 reform.[97]

A second tier of higher engineering education was built upon the German tradition of *Ingenieurschulen* and *Fachschulen*, schools that were halfway between universities and vocational schools, and proud to offer "a good and solid technical education."[98] Their curricula resembled that of a secondary school more than that of a university. In the GDR, engineering colleges (*Ingenieurschulen*) were institutions of higher education that offered much shorter (three-year) programs than the universities. They were considered *Fachschulen*, or schools for vocational training. Graduates of these colleges held the title of "*Ingenieur*," whereas university graduates received the degree of "*Diplom-Ingenieur*."[99] Substantially more engineers were trained at engineering colleges than at universities throughout the Ulbricht era. Engineering college graduates made up almost 80 percent of the 14,201 engineers who graduated in 1960 and nearly three-quarters of the 20,444 engineering graduates in 1970.[100] Some of the older engineering colleges were quite prestigious. The list would include those in Wismar (founded in 1908), Mittweida (founded in 1867), Dresden (founded in 1861), and Zwickau (founded in 1897). These institutions strove to preserve a sense of tradition.

Following the Soviet model, the Central Committee of the SED decided in 1951 that vocational schools should become more specialized than had previously been the case. Engineering colleges were assigned specializations: maritime technologies to Wismar; electrical engineering to Mittweida; mechanical and electrical engineering to Zwickau; shipbuilding to Warnemünde-Wustrow; electrical energy to Zittau (but only until 1969), agricultural technologies to Berlin-Wartenberg; civil engineering to Cottbus; and mechanical and electrical engineering to Berlin-Lichtenberg. The disadvantage of this division of labor was that it cut cross-disciplinary ties—for example, between mechanical engineering and electrical engineering at the Mittweida engineering school.[101] However, all the aforementioned institutions were turned into higher engineering schools (*Ingenieurhochschulen*) as part of the Third University Reform of 1968. As a result, they began offering *Diplom* degrees, and their offerings became broader and more science-based.[102] By contrast, highly specialized engineering colleges in areas such as technical glass production, foundry techniques, or textile technologies[103] offered little in terms of first-rate science instruction, interaction of disciplines, or individual choice.

The SED sought to counterbalance the scientific, academic model in higher technical education with a more praxis-oriented model. Factory experience was considered to be pedagogically valuable, indeed a way of schooling students in socialism. By the mid-1950s, practical training in industry (the *Praktikum*) was required of university and technical college students before they began their studies, as well as during vacation periods. State officials nonetheless felt that the distance between industry and academia was too great: "Full-time programs at universities and engineering colleges suffer greatly from a division of theory and practice. Some of the faculty have little first-hand experience in socialist production and as a result are hardly able to derive general theory from the demands of practice and to teach this to students. Students themselves are hardly or not at all acquainted with the practice of socialist production, and hardly get to know it during their yearly four-week practical training." This lack of "shop culture" was thought to have negative ideological consequences.[104] Links with factories intensified by the 1960s. A short-lived attempt to move engineering education into "factory academies," workplace institutions where some college and university courses were held, was aborted, however.[105]

Birthplace of Innovation or School of the Dictatorship?: The Classroom Experience in Technical Programs

The ability of engineering graduates to think independently depended, of course, not only on curriculum and institutional framework, but also on what went on in the classroom. Evaluating the quality of teaching in engineering education and the degree of regimentation in the classroom is difficult. According to a government report from 1949, teaching quality was initially poor at the Mittweida engineering school, where faculty dictated word for word what the students were supposed to learn. (Perhaps the recent recruitment of teachers from industry played a role in this.) But soon professors were reproducing handouts that served as substitutes for dictated notes or textbooks, making word-for-word dictation unnecessary. A Pedagogical Council was formed in 1953 to help improve teaching.[106] The Protestant student at the Mining Academy of Freiberg who eventually fled to West Berlin (M. Hampel) had happy experiences (aside from his run-ins with the authorities) in Freiberg, a beautiful small town with winding, cobblestone streets, sixteenth- and seventeenth-century buildings and a sunny marketplace. He found little to object to in his studies, which, though regimented, were well organized: "One became accustomed to life in Freiberg very quickly, and I felt very contented behind the walls of this old mountain town. My studies took their course. Everything was well organized: One was told what courses to take in which semester and when to take examinations, a system which certainly has its advantages and which makes for a streamlined course of studies."[107]

It is, of course, possible that Hampel did not know what he was missing. Werner Gilde, a long-time industrial institute director and well-known popularizer of technology in the GDR, wrote in his memoir (published in 1980 in the GDR) with such intense enthusiasm and nostalgia about his years as a student at the University of Göttingen (in West Germany) that one wonders if he did not see the Western university system as superior.[108] In particular, he lauds the unstructured curriculum, the opportunities to study under great scientists, and the inspired and inspiring experiments conducted by his professors. Is there not a note of longing here, and perhaps also the hopeful thought that he might be able to reach East German policymakers through his book?

However, the GDR was not bereft of excellent teachers, professors, and researchers. Werner Hartmann, head of an industrial research institute and a part-time professor, seems to have put a good deal of thought and effort into his lectures:

> Anyone who has never given a lecture can hardly imagine how much time and thought goes into the preparation of lectures. It is only possible to explain not-so-simple problems in such a way that they are comprehensible and above all learnable if one approaches everything with the knowledge and way of thinking of a student in mind. What is that, though? One cannot think back to one's own youth; back then, the knowledge base was much smaller and not as broad. So it takes a good deal of effort.[109]

According to his own description, he was a relaxed and enthusiastic teacher: "I always tried to loosen up lectures with episodes from my professional life, references to practical and original uses, or jokes and gags. Despite all the work, I enjoyed this activity."[110] He was very interested in bringing together science and engineering, and theory and industrial practice in his teaching at the School for Nuclear Technology at the TH (from 1961 on, TU) Dresden. Shuttling back and forth between Vakutronik and the university, Hartmann devised a new course, an electronics laboratory for physicists, who until the mid-1950s were not exposed to electronics—a teaching innovation he was proud of. In general, he felt that there was a great deal more freedom at the universities than in industry. He writes that he would recommend a career in academia to young people rather than a career in industry. He does, nonetheless, have critical remarks to make about the universities. In particular, he was bitter that the still fairly new equipment he used for the electronics lab courses was literally thrown on the junk pile by the university after the dissolution of the School for Nuclear Technology—the result of the jealousy of a senior member of the faculty who taught in this area. Clearly, turf warfare could undermine good teaching.[111]

According to Alfred Kirpal, who participated in a national curriculum commission, nationwide curricula did not put an iron grip on teaching. Representatives of many universities sat on these commissions. Although the curricula were theoretically established for all universities or all colleges, each institution was in fact able to make some alterations, particularly in the programs for juniors and seniors. In engineering and science programs, professors were not required to present lecture notes for approval and could teach the material as they wished,[112] although comments critical of the GDR could lead to a professor's dismissal.[113]

Reinventing the Alma Mater

The SED sought to win the loyalty of future "socialist engineers" through various means. Virtually all students in East Germany received stipends. Individual institutions did what they could to improve the lives of their students (e.g., by building dormitories). Students were expected to join the FDJ—and roughly 90 percent did—which organized many politically oriented activities. Students were also required to participate (often on a yearly basis) in mass student deployments to the fields of collective farms, where they helped bring in the harvest. Such activities not only had a practical purpose, but also sought to foster a sense of socialist solidarity.[114]

However, colleges and universities also tried to promote a more traditional sense of belonging among students. At the Mining Academy of Freiberg, traditional mining officials' uniforms (a manifestation of the guild tradition, going back to medieval times) were worn on special occasions (figure 2.1). Sports teams and sporting events also contributed to school identity. So, too, did cultural groups, such as the Central Cultural Group Mittweida, which was comprised of a chorus, a small orchestra, a dance ensemble, a German folk ensemble, a folk guitar group, and a drama club. Mittweida also had a school radio station.[115] Mittweida, along with the Mining Academy of Freiberg, published finely bound, well-written volumes for the anniversary of their institution's founding. These Festschriften place the respective institutions in the context of a socialist community, explaining how SED policies are carried out locally. And yet more traditional forms of loyalty to the alma mater are evoked here, such as in pictures and documents that reflect the historic past of these institutions. The massive two-volume commemorative publication of the Mining Academy is an intelligent work, containing a surprising amount of highly accurate information about the history of the school in the 1940s, '50s and '60s, along with detailed descriptions of programs and personnel (figure 2.2).[116]

The much slimmer volume produced by the Mittweida Engineering School severely criticizes the seventy-eight-year association of the school with the evil forces of capitalism, but praises in roundabout fashion the quality of its technical training in the capitalist era: "Education in the majors mechanical engineering, electrical engineering and mill construction at the technical school Mittweida corresponded to the level of development of the forces of production, and guaranteed yearly

Figure 2.1
Parade, Bergakademie Freiberg. Note the traditional mining officials' uniforms. Photo published in a 1965 volume commemorating the 200th anniversary of the founding of the Bergakademie Freiberg. Photo credit: TU Bergakademie Freiberg, Medienzentrum, D-09596 Freiberg

increases in the number of students from the ruling class and the various middle classes, and thus precluded financial risk for the founder."[117]

Sports are emphasized as part of an attempt to create a "spiritually, morally, and physically well-rounded human being." A picture of a large group of students doing calisthenics bears the caption, "In a healthy body, a healthy mind."[118] These are pictures of a male community, with no women present. Women are pictured elsewhere, as students. A photo shows two rather attractive young women in sleeveless attire, flanking a male student working at an oscilloscope (a premier high-tech device of the day). The male student appears to be in charge, while the women are working together with him in supporting roles. By contrast, the only foreign student in the graduating class of 1966—a student from Guinea—is shown in a more egalitarian pose, and his short essay suggests that he was treated as an equal.[119]

Figure 2.2
Unknown woman in a laboratory, probably in the early 1960s. Photo published in a 1965 volume commemorating the 200th anniversary of the founding of the Bergakademie Freiberg. Photo credit: TU Bergakademie Freiberg, Medienzentrum, D-09596 Freiberg

In 1967, Mittweida alumni (excluding West Germans) participated in a week-long centennial celebration at their alma mater.[120] Festivities began with a special convening of the municipal assembly, but formal ceremonies were few. Alumni were invited to participate in informal open houses at the departments, to listen to talks on subjects such as prospects for color TV and stereo radio transmission or on recent accomplishments of the college, and to visit an exhibition at the school. Sports were also a major component of the program, with soccer, tennis, bowling, volleyball, and/or basketball games every day. There were youth club dances on three nights during the week, and a torchlight procession of local schools and factories and fireworks on Saturday night of that week. The celebration ended with a reception, a classical concert, and yet another dance.[121] According to Karin Zachmann, the newer special universities also tried to invent traditions that placed them in the bourgeois academic tradition.[122] Thus, many aspects of traditional academic culture remained intact into the 1960s, or were reinvented.

Traditionalism undermined socialist brotherhood. There is virtually no evidence of hostility between university and engineering college graduates, nor do the former appear to have looked down on the latter. They do seem to have been united by a sense of superiority toward the working class, however. An engineer complained about the snobbism of graduates of the vocational school of Altenburg (which, she was not to ashamed to note, she had also attended): "Colleagues who attended this school think that they are superior," she noted, in particular, superior to manual workers.[123]

Resisting the SED at Engineering Colleges and Universities

Many engineering professors and students resisted political conformism until the 1968 reform. Of the forty-four professors appointed to the Mining Academy of Freiberg between 1945 and 1960, twenty-six (just under 60 percent) remained aloof of the SED.[124] In 1962, only one in eight faculty members in one department of the Higher School for Electrical Engineering in Ilmenau was a member of the SED. This had a definite impact on students and assistants there. The teaching assistants had a "purely professional outlook," and among students a generally "indifferent attitude" toward politics prevailed. Many students eschewed the insignia of the Communist youth organization, the FDJ, in favor of the insignia "I," which stood for Ilmenau. At a students' ball in 1962, a special newspaper was distributed that was critical of East German policies.[125]

Signs of resistance to SED rule or at least a questioning of particular policies crop up again and again in documents from the late 1950s and early 1960s. Five of the ten full professors at one school of the TH in 1957 were considered to be openly hostile to the SED, while only two strongly supported the Party. Out of ninety-eight assistants, nineteen were Party members. One assistant complained about the to-do over the launching of Sputnik: "One shouldn't make so much noise; the journalists are blowing too much wind about it." The cozy atmosphere at another institute made faculty feel comfortable enough to openly criticize the SED.[126] Students were swept up in a wave of unrest in 1956–1957, unleashed by Khrushchev's famous denunciation of Stalin, as well as by the Hungarian Revolution. At a meeting of SED representatives with students at the Technical University of Dresden in 1956, one young Communist chided the top leadership for having isolated itself from the common people. Pointing to the example of the Paris Commune of 1871, another youthful SED member suggested that top state officials be paid the same as skilled workers.[127] Reform Communists also made themselves felt at the Friedrich Schiller University in Jena in 1956. A more broad-based resistance emerged there, primarily among math and science students, some of whom were vociferously anti-Communist.[128]

But resistance did not stop in 1956. In 1963, the FDJ chapter for physics students at the TH Dresden wrote an astonishing document. These students claimed for themselves the right to think for themselves and to openly express their views, even if they made mistakes. "Our interpretation of our social duty as citizens does not lead us to content ourselves with the interpretation of opinions and directives coming from above, but rather to make our contributions at the lowest level and [to expect that] they will be heard." They recognized that security, the military, and law and order had been top priorities in the first socialist states because the fledgling socialist system had to be protected. However, now that socialism had established itself—so they asserted—it was time to liberalize the system. They used arguments similar to those employed by Gorbachev in defense of Glasnost, and by reformers during the Prague Spring of 1968. These physics students argued that liberalization was needed so as to assure that the "productive forces [would be able] to develop optimally." This was essential if the East was to come out on top in the struggle between the capitalist and socialist systems. East Germans should be allowed to form their own views about social and economic problems and be able to engage in public discussions of those problems. The document implies that a free press should be created. It also calls for a price system that reflects societal needs and desires—another affirmation in the belief of self-regulation. Although not questioning the system of "democratic centralism," which guaranteed SED domination, these students believed that initiative from below ("die Schöpferkraft des Volkes") had to be encouraged, that the people had to be involved in the socialist project. If this initiative was smothered, then "it will one day violently free itself." These students did not question SED rule per se, but rather the form that rule had taken.[129]

The SED brushed off the students' document, attributing the "petit bourgeois objectivism" and "intellectual arrogance" expressed there to "hostile influences" in the administration of the physics department. An investigation of the instigators was initiated.[130] What happened to them is unknown. But as a rule, resistance was brutally suppressed.[131]

The SED even saw student high jinks as threatening. In June 1966, large numbers of students at the Technical University of Dresden celebrated their graduation with irreverent processions and raucous revelry. "Anyone who studies has only himself to blame" read one placard carried around campus. At a student convocation, a speech was held "commemorating" fellow students who had been expelled due to drunkenness and a love of "night life." Students rode around in a street car on which they had written "unworthy" slogans. Others strode around the campus wearing top hats and carrying a beer barrel, or, in another case, carrying a beer barrel and a coffin. Still others rode around the campus and the surrounding neighborhood in a horse-drawn wagon, displaying a sign saying, "We thank the mothers of Dresden for having put their daughters at our disposal." The great majority of faculty and Party officials at the university thought the revelry harmless. One functionary cautioned, "We're starting to bring everything under official control. Why shouldn't the students be merry and relaxed? One shouldn't take everything so seriously." Nonetheless, the students were called before a committee of highly placed administrators to answer for their deeds.[132] What is particularly interesting here is the survival of a pre-socialist, pre-Nazi collegiate culture—sexist, apolitical, and anti-intellectual, but also anti-authoritarian—into the third decade of the GDR's existence.

Conclusion

Facing overwhelming state power, engineering schools and universities did not become bastions of resistance to SED rule. The SED (and before it, the Soviet administration in Germany) was very effective in gaining control over institutions of higher education and professional organizations. Overt opposition was relentlessly crushed; SED members were placed in positions of power; and democratic procedures were replaced with top-down administrative procedures. Professional and academic autonomy did not disappear, however.

The German tradition of science-based industrial engineering, the university system, and the vocational training system provided tremendous opportunities for the builders of socialist society, but also proved to be quite resistant to Communist ideology. Following the dictates of Marxist-Leninist-Stalinist ideology as well as reacting to unfolding East-West rivalry, Ulbricht and the Soviets decided to accord reconstruction and the quest for technological progress top priority. In some cases this meant putting off socialist restructuring. Thus, university engineering programs were left largely intact. Many engineers and scientists of the older generation, even former Nazis, were given privileged positions. Pre-socialist professionals perpetuated an apolitical conception of engineering work. They resisted the politicization of the Chamber of Technology. Many university engineering professors refused to join the SED or engage in political activities, and many of their students followed suit.

The SED did make progress in its quest to create a politically loyal "new technical intelligentsia." Material incentives were provided: free higher education, stipends for living expenses, and bright career prospects for SED members. The SED gave students and young engineers the sense of being part of something larger than themselves: the building of a socialist society. At the universities, the infrastructure of a new political culture was put in place: courses in Marxist-Leninist theory, deployments to collective farms, FDJ activities, and study groups. A new professional organization, the KDT, was created. It was able to discredit the major pre-socialist organization, was controlled by a Communist organization (the FDGB), and could claim to promote an end to the alienation between the "technical intelligentsia" and the working class.

However, another kind of professional identity was available to engineering students, engineers, and industrial scientists. A scientific view of engineering was propagated at universities and colleges as well as in the pages of *Die Technik*. In technical and scientific areas, the old patriarchal university system was left largely intact until 1968. Given the profound reverence that Germans felt toward their universities, it is not surprising that most students, graduate assistants and young academics happily found a place in hierarchically organized institutes headed by revered professors. Traditional trappings of academic life had a great deal of appeal at the universities. Not only the older engineering colleges, but even the new colleges and specialized universities emulated the universities, both in their scientific orientation and in their fostering of academic culture. These were not just vestiges of a dying tradition, but constantly reinvented and redefined traditions that remained very much alive throughout the first half of the GDR's existence. The universities imparted to engineering students a way of looking at the world that was quite different from that of the SED.

Non-socialist outlooks that survived at the universities were not necessarily progressive. They were preserved by hierarchical, patriarchal relationships. These hierarchies were gendered. Women played a marginal role at these institutions up until the mid-1960s, making up a small percentage of the student body. There was only one female professor at the Technical University of Dresden (but she became chancellor) and none at the Mining Academy of Freiberg.[133] The East German technical universities also remained quite insular. There were virtually no foreign-born, non-ethnic German professors at these institutions, and very few visiting professors from abroad.

The two cultures—socialist and academic/professional—competed for the loyalty of the younger generation. While many settled into some kind of identity as socialist engineers, others chafed at the all-too-obvious political control from above. Only a small minority openly rebelled, but, as will be shown in the next chapter, many carried a sense of divided loyalties into their workplace. Engineers and industrial scientists continually reasserted a set of values quite distinct from those of the Communist leadership—an outgrowth of the socialization that they experienced in East German universities and colleges. These findings confirm for engineers and industrial scientists what Ralph Jessen argued for the East German professoriat. On the one hand, he demonstrated that the SED transformed academia in profound ways. Nonetheless, he argued that a pre-socialist professional ethos survived into the early 1960s, thanks to the prestige of science, the survival of patriarchal structures of authority, and a widespread resistance to the crushing of academic autonomy. Engineers and industrial scientists made similar attempts to preserve a pre-socialist professional model.[134]

The SED could have broken that resistance if that had been its top priority. Instead, Ulbricht made the conscious decision to create conditions that would win over the "old intelligentsia" to the new system. The explanation for this policy lies not only in the open border. It also must be recognized that Ulbricht greatly admired the German academic and scientific heritage, and was aware that he could not harness it to the Communist system by force alone. The SED did not make a serious attempt to take over the centers of engineering education and industrial innovation until the late 1960s. The level of conflict between the party-state and the professional community, even in the early GDR, should not be underestimated, however, as the following chapter will show.

Notes

1. Stiftung Archiv der Parteien und Massenorganisationen der DDR im Bundesarchiv (below: SAPMO/BArch) DY 30 IV 2/5/1196, transcript of a district party meeting in Köpenick, November 12–13, 1949, 23. The speaker claimed that Lenin had made such a statement at the 10th Party Congress in 1921. However, no such statement is to be found in the relevant volume of Lenin's works: V. I. Lenin, *Collected Works* (Moscow: Progress Publishers, 1965), vol. 32.

2. See Joachim Römer, *Vom Beruf des Ingenieurs: Gedanken zum sozialistischen Ingenieurethos* (Berlin: Dietz, 1984).

3. See Zimmermann, "Intelligenz," 658; Erika Hoerning, "Der gesellschaftliche Ort der Intelligenz in der DDR," in *An der Spitze: Von Eliten und herrschenden Klassen*, ed. Beate Krais (Konstanz, Germany: UVK Verlagsgesellschaft mbH, 2001), 113–155.

4. The term "Ingenieur" long lacked an exact definition in the German language and up until 1945 included all technical occupations above that of foreman. However, in the GDR, the title of engineer came to be reserved for graduates of the *Technische Fachschule*, or technical college (whose engineering graduates were called "Ingenieur") and the *Technische Hochschule*, or technical university (whose engineering graduates were called "Diplom-Ingenieur"), though in exceptional cases, the title was granted on the basis of professional experience and expertise alone (mainly to experienced engineers of the pre-Communist era).

5. In the GDR, engineers and industrial scientists became part of the "technical intelligentsia." This category included not only graduates of universities and technical colleges (*Fachschulen*) working in industry (engineers, chemists, mathematicians, and economists, among others), but also personnel at research institutes, as well as university professors, technicians, and even (in some cases) factory foremen. See Zimmermann, "Intelligenz," 658; Hoerning, Ort, 113–155.

6. See Charles E. McClelland, Stephan Merl, and Hannes Siegrist, eds., *Professionen im Modernen Osteuropa* (Berlin: Duncker & Humblot, 1995); Anthony Jones, ed., *Professions and the State. Expertise and Autonomy in the Soviet Union and Eastern Europe* (Philadelphia: Temple University Press, 1991); Arnd Bauerkämper, Jürgen Danyel, and Peter Hübner, "'Funktionäre des schaffenden Volkes'? Die Führungsgruppen der DDR als Forschungsproblem," in *Gesellschaft ohne Eliten?*, ed. Arnd Bauerkämper, Jürgen Danyel, Peter Hübner, and Sabine Roß (Berlin: Metropol Verlag, 1997), 11–86; Gert-Joachim Glaeßner, *Herrschaft durch Kader* (Opladen, Germany: Westdeutscher Verlag, 1977), esp. 93–98. Cadres were professionals who were expected to carry out Communist policies.

7. On the competing principles of bureaucracy and professionalism, see Howard Vollmer and Donald Mills, eds., *Professionalization* (Englewood Cliffs, NJ: Prentice Hall, 1966), 264–294.

8. Without the self-employed.

9. My analysis, based on SAPMO/BArch FDGB-BUVO 2985: "Monats- und Quartalsberichte zur Arbeitslage in der SBZ"; SAPMO/BArch FDGB-BUVO 2987: "Statistische Übersichten zur Bevölkerungsstruktur der SBZ." These data exclude those not "fully employable" and do not include East Berlin.

10. See Rainer Karlsch, *Allein bezahlt? Die Reparationsleistungen der SBZ/DDR 1945–1953* (Berlin: Ch. Links Verlag, 1993); Christoph Buchheim, "Kriegsfolgen und Wirtschaftswachstum in der SBZ/DDR," *Geschichte und Gesellschaft* 25 (1999): 515–529; Johannes Bähr, "Institutionenordnung und Wirtschaftsentwicklung: Die Wirtschaftsgeschichte der DDR aus der Sicht des zwischendeutschen Vergleichs," *Geschichte und Gesellschaft* 25 (1999): 538–541, as well as literature cited in both articles.

11. See note 9.

12. NARA CREST, CIA Report number CIA-RDP82-00457R006200340005-5.

13. NARA, Records of the Army Staff, G-2 Intelligence, (319 270/10/33/01), ID Nr. 462169-A.

14. See Wolfgang Zank, *Wirtschaft und Arbeit in Ostdeutschland 1945–1949* (Munich: Oldenbourg, 1987), 47–56; Naimark, *The Russians in Germany*, 191–193; Karlsch, *Allein bezalt?*, 123–124.

15. SAPMO/BArch DF4 40463, 3–7, 10–11, 33, 45.

16. TSD, Nachlaß Hartmann, vol. G, 14–15.

17. Landesarchiv Berlin, Rep. 404, Nr. 117.

18. Landesarchiv Berlin, Rep. 404, Nr. 117, "Aufstellung über die deutschen Spezialisten des Werkes für Fernmeldewesen 'HF' mit denen nach dem Stand vom 1.1.1952 Einzelverträge abgeschlossen waren."

19. Landesarchiv Berlin, Rep. 404, Nr. 117, "Personalaufstellung . . . für das Jahr 1952."

20. SAPMO/BArch, DF-4 46, memorandum from ZAFT, dated June 13, 1951.

21. SAPMO/BArch, DF-4 461, memorandum from Dr. Meyer of the State Planning Commission, dated May 7, 1951.

22. Author's interview with Hans Becker, July 2000. See also Ciesla, "Spezialistentransfer," 26, 31; Mick, *Forschen für Stalin*, 96–98.

23. See Burghard Ciesla and Dieter Hoffmann, "Wie die Physik auf den Weißen Hirsch kam: Zur Gründung des Forschungsinstituts Manfred von Ardenne," in Dieter Hoffmann, ed., *Physik in Nachkriegsdeutschland* (Frankfurt am Main: Verlag Harri Deutsch, 2003), 106; Tandler, *Geplante Zukunft*, 50–54; Mike Reichert, *Kernenergiewirtschaft in der DDR* (St. Katharinen, Germany: Scripta Mercaturae Verlag, 1999), 55–91.

24. NARA, Records of the Army Staff, CIC, IRR Impersonal Files (319/270/84/20/2), File ZE 152328.

25. TSD, Nachlaß Hartmann, vol. G, 21, 23, 45, 31–32, 61, 72–73.

26. BStU, MfS 444/87, 44 ("Gedanken," dated January 9, 1975, appendix "Zu seiner bürgerlichen Denk- und Lebensweise," 2).

27. Bourdieu defines symbolic capital as any kind of symbolic demonstration of power that converts power into legitimacy. See Pierre Bourdieu, *The Logic of Practice*, trans. Richard Nice (Stanford, CA: Stanford University Press, 1990), 112.

28. TSD, Nachlaß Hartmann, vol. G, 26–27.

29. Most engineers of the pre-war era were of middle-class origins. See Jarausch, *The Unfree Professions*, 19.

30. TSD, Nachlaß Hartmann, vol. G, 44, 127.

31. See Catherine Epstein, *The Last Revolutionaries: German Communists and Their Century* (Cambridge, MA: Harvard University Press, 2003).

32. TSD, Nachlaß Hartmann, vol. G, 47.

33. SAPMO/BArch DY 61, Nr. 380, "Liquidierung des Vereins Deutscher Ingenieure," dated December 1, 1945; DY 30 IV 2/6.02 65, "Bericht über die Sitzung des Org-Komitees der K.d.T. am 26.June 1946."

34. SAPMO/BArch DY 30 IV 2/6.02 65, 12. The statutes were published in *Die Technik* 1, no. 6 (December 1946), 263–264.

35. Factory foremen constituted 1.6 percent of the members; 21.5 percent were clerks and technicians without a degree from a technical school; and 5.4 percent were those who established work norms (TAN). There were 51,207 members in 1951. SAPMO/BArch DY 61, Nr. 80, letter from KDT to Soviet Control Commission, dated April 21, 1951. Other examples of the KDT's role in representing the professional concerns of the higher technical professions: letters (in same file) from KDT, dated January 22, 1949; March 16, 1951; October 20, 1950.

36. SAPMO/BArch DY 30 IV 2/6.02 65, 12–14. A major dissertation was written on the KDT in the Communist period: Egon Stelzner, "Die Herausbildung und Entwicklung der Kammer der Technik 1945/46–1955" (Dissertation B, Bergakademie Freiberg, 1985).

37. SAPMO/BArch DY 61, Nr. 138, 28 ("Bedeutsame Konferenz der Kammer der Technik").

38. See Naimark, *The Russians in Germany*, 195.

39. SAPMO/BArch DY 61, Nr. 73, letter from Hans-Heinrich Franck to Friedrich Müller, dated October 4, 1946; letter from Friedrich Müller to Hans-Heinrich Franck, dated October 15, 1947.

40. Technische Universität Dresden, Universitätsarchiv (TUD), Bestand Rektorat, catalogue of professors ("Professorenkatalog").

41. SAPMO/BArch DY 61, Nr. 73, letter from Enno Heidebroek to Hans-Heinrich Franck, dated March 11, 1949.

42. SAPMO/BArch DY 61, Nr. 73, letter from W. Brandt to Hans-Heinrich Franck, dated August 25, 1949; letter from Fr. Landgraeber to Hans-Heinrich Franck, dated August 31, 1949; letter from Fr. Landgraeber, dated August 1, 1949.

43. SAPMO/BArch DY 61, Nr. 97, Draft Resolution of the Chamber of Technology, February 26, 1951. Comments on this resolution in SAPMO/BArch DY 61, Nr. 80, KDT memorandum, dated June 29, 1951, 3.

44. SAPMO/BArch DY 30 IV 2/2.029/14, 18.

45. SAPMO/BArch DY 30 IV 2/2.029/177, 1; SAPMO/BArch DY 30 IV 2/2.029/12, 251.

46. SAPMO/BArch DY 61, Nr. 80, letter from KDT to Soviet Control Commission, dated April 21, 1951; SAPMO/BArch DY 30 IV 2/2.029/177, 315 ("Vorlage für das Sekretariat des Zentralkomitees").

47. See Hans-Heinrich Franck, "Neugestaltung der Technischen Universität," *Die Technik* 3/2 (February 1948): 49–53.

48. On this debate see Karin Zachmann, *Mobilisierung der Frauen: Technik, Geschlecht und Kalter Krieg in der DDR* (Frankfurt and New York: Campus Verlag, 2004), 166–177.

49. SAPMO/BArch DY 61 380, "Missbrauch der Wissenschaft"; memorandum, dated January 15, 1946; "Kammer der Technik," undated manuscript.

50. SAPMO/BArch DY 30 IV 2/904/352, 76–79.

51. SAPMO/BArch DY 30 IV 2/2.029/12, 262–265.

52. See Anna-Sabine Ernst, " 'Die beste Prophylaxe ist der Sozialismus': Ärzte und medizinische Hochschullehrer in der SBZ/DDR 1945–1961" (D.Phil. diss., Free University of Berlin, 1996), 96–115. Dissertation published under the same title (Münster, Germany: Waxmann, 1997).

53. SAPMO/BArch DY 30 IV 2/2.029/177, 379–417, 420.

54. SAPMO/BArch DY 30 IV/2/6.07/52, 18–28 ("Information über die Zusammenarbeit KDT-FDGB"). Also see K. Junghanns, "Der Ingenieur und das technische Aktiv," *Die Technik* 5/4 (April 1950): 177–179, esp. 178.

55. SAPMO/BArch DY 30 IV 2/2.029/177, 430; SAPMO/BArch DY 30 IV 2/2.029/14, 8.

56. See article "Kammer der Technik (KDT)," in *So funktionierte die DDR*, vol. 1, ed. Andreas Herbst, Winfried Ranke, and Jürgen Winkler (Reinbek bei Hamburg: Rowohlt Verlag, 1994), 459.

57. Local KDT chapters naturally had little motivation to record any activities that did not conform to state policies. I have looked at the records of numerous enterprises, including Carl Zeiss Jena, Arbeitsstelle für Molekularelektronik, *VEB Werk für Fernmeldewesen/ Werk für Fernsehelektronik* and the transformer works "Karl Liebknecht" in Berlin. One example of engineers using the KDT organization to overcome resistance of the enterprise administration to technical change may be found in SAPMO/BArch DY 61, Nr. 135, 32–33.

58. See John Connelly, *Captive University: The Sovietization of East German, Czech, and Polish Higher Education, 1945–1956* (Chapel Hill and London: University of North Carolina Press, 2000).

59. NARA NSDAP Ortsgruppenkartei. Microfilm Publication A3340, Series MFOK; NSDAP Zentralkartei. Microfilm Publication A3340, Series MFKL.

60. See Manfred Heinemann, ed., *Hochschuloffiziere und Wiederaufbau des Hochschulwesens in Deutschland 1945–1949* (Berlin: Akademie-Verlag, 2000), 39; Matthias Lienert and Claudia Nowak, "Der Wiederbeginn nach dem Zeiten Weltkrieg," in *Zur Wissenschaft in Dresden nach 1945*, vol. 3, *Geschichte der Technischen Universität Dresden in Dokumenten, Bildern und Erinnerungen* (Dresden: Technische Universität Dresden, 1996), 8; Ralph Jessen, *Akademische Elite und kommunistische Diktatur* (Göttingen, Germany: Vandenhoeck & Ruprecht, 1999), 320–322; Connelly, *Captive University*, 98.

61. Three of the professors appointed between 1950 and 1960 who had not been in the NSDAP had been members of the SA, bringing the percentage of professors with some sort of Nazi affiliation up to 61.7 percent.

62. Bergakademie Freiberg Hochschularchiv (BAF), professors' files (*Professorenkartei*).

63. BAF, Rektorat, Nr. 333/2: "Eröffnungsrede von Präsident Dr. Friedensburg," February 8, 1946, quotation on p. 8. See also BAF, Rektorat, Nr. 332, no. 2: "Die Bergakademie Freiberg am Kriegsende und ihr Wiederaufbau," June 1946. The secondary literature includes Werner Arnold, "Streifzüge durch die Geschichte der Bergakademie im Zeitraum von 1920 bis 1950," *Zeitschrift für Freunde und Förderer der Technischen Universität Bergakademie Freiberg* 1, no. 1 (1991); 33–37; Helmut Albrecht, "Wiedereröffnung oder Neubeginn? Die Bergakademie Freiberg nach dem Ende des Dritten Reiches," *Zeitschrift für Freunde und Förderer der Technischen Universität Bergakademie Freiberg* 3, nos. 1–2 (1994/1996): 25–33; Werner Arnold, "Ferdinand Friedensburg (1886–1972)—Gustav Sobottka (1886–1953)," *Zeitschrift für Freunde und Förderer der Technischen Universität Bergakademie Freiberg* 4, nos. 1–2 (1997): 50–60; Eberhard Wächtler, ed. *Bergakademie Freiberg 1765–1965*, vol. 1 (Leipzig: Deutscher Verlag für die Grundstoffindustrie, 1965), 315–322.

64. See Albrecht, "Wiedereröffnung," esp. 28–29; Heinemann, *Hochschuloffiziere*, 100, 426–432.

65. See Pjotr Nikitin, *Zwischen Dogma und gesundem Menschenverstand: Wie ich die Hochschulen in der Besatzungszone 'sowjetisierte'* (Berlin: Akademie-Verlag, 1997).

66. Technische Universität Dresden, Universitätsarchiv (TUD), Bestand Rektorat, Nr. I/12, Enno Heidebroek, "Die neue Hochschule," quotations on pp. 4 and 10; Professorenkatalog.

67. NARA CREST, CIA Report number CIA-RDP78-02771R000100320002-1, quotation on p. 5.

68. SAPMO/Barch DY 30 IV 2/904/456, 40–47.

69. TUD, personnel file for Rolf Göpfert.

70. TUD, professors' files.

71. See Jessen, *Akademische Elite*, 119–129.

72. Jessen, Akademische Elite, Appendix B. See also Connelly, *Captive University*, 78, 97–98, 119–125; Waldemar Krönig and Klaus-Dieter Müller, *Anpassung Widerstand Verfolgung: Hochschule und Studenten in der SBZ und DDR 1945–1961* (Cologne: Verlag Wissenschaft und Politik, 1994), 256–321.

73. SAPMO/Barch DY 30 IV 2/904/352, "Analyse der Fachrichtungen," December 10, 1953.

74. See M. Hampel, "Student in Freiberg 1950 bis 1953," *Zeitschrift für Freunde und Förderer der Technischen Universität Bergakademie Freiberg* 6 (1999): 81–83; R. Ciesielski, "Geschichte der Katholischen Studentengemeinde in Freiberg nach 1945," *Zeitschrift für Freunde und Förderer der Technischen Universität Bergakademie Freiberg* 5 (1998): 55, article on pp. 53–56.

75. TUD, "Technische Hochschule Dresden," 26; compare with John Connelly's data for other universities in Connelly, *Captive University*, 230; on admissions policies and practices, see pp. 226–231, 241–242.

76. BAF, Data compiled by U. A. Volkmer (of the BAF archives) on the basis of the "Unterabteilung Planung und Statistik." Also SAPMO/Barch DY 30 IV 2/904/456, "Vergleich in der sozialen Schichtung, Wintersemester 1946/47 zu 1947/48 bei den Universitäten, TH Dresden und Bergakademie Freiberg." Full-time day students only.

77. NARA CREST, CIA Report number CIA-RDP78-02771R000100320002-1, 14. On scholarships for worker-students: SAPMO/Barch DY 30 IV 2/904/456, 203–206.

78. A commission overseeing admissions at four universities (one of which was the Technical University of Dresden) determined in 1957 that 65–75 percent of all students were of working-class or peasant origins. SAPMO/BArch DY 30 IV 2/9.04/477, report, dated September 4, 1957.

79. TUD, Heidebroek, "Hochschule," 8 and 10. On KPD/SED anti-elitism, see Albrecht, "Wiedereröffnung," 26.

80. BAF, Hans Hofmann, Bernd Meister, and Eberhard Wächtler, "Die Neueröffnung der Bergakademie Freiberg am 8. Februar 1946," internal publication of the Bergakademie Freiberg, 1985, 9.

81. TUD, "Die Technische Universität Dresden in Zahlen 1949–1963," 22; Heidebroek, "Hochschule," 12.

82. See Karin Zachmann, *Mobilisierung der Frauen: Technik, Geschbecht und Kalter Krieg in der DDR* (Frankfurt and New York: Campus Verlag, 2004), 184.

83. SAPMO/BArch DY 30 IV 2/9.04/479, appendix to "Maßnahmeplan für die Zulassungsarbeit 1961/1962," 9, 15.

84. The evaluation of the curriculum at the TH Dresden is based on TUD, "Personal- und Vorlesungsverzeichnis," winter semester 1948–1949, 50–51. The number of required credits is similar in other technical majors, and did not change to any significant degree in 1947–1950. (Based on "Personal- und Vorlesungsverzeichnis," winter semester 1947–1948, winter semester 1949–1950.) See also Connelly, *Captive University*, 62–64.

85. SAPMO/Barch DY 30 IV 2/904/352, "Analyse der Fachrichtungen," December 10, 1953, 3.

86. NARA CREST, CIA Report number CIA-RDP78-02771R000100320002-1, 13–15.

87. Hansjürgen Pröger, *Mikrostrukturen: Erinnerungen an ein Arbeitsleben bei Carl Zeiss Jena* (Jena, Germany: Thüringer Forum für Bildung und Wissenschaft, 2003), 206.

88. On Fischer-Baling, see Arnold, "Streifzüge," 36.

89. For a discussion of "socialist technology," see Raymond Stokes, *Constructing Socialism: Technology and Change in East Germany, 1945–1990* (Baltimore and London: Johns Hopkins University Press, 2000), 110–128.

90. See Graham, *The Ghost of the Executed Engineer*, esp. 39–41, 68–70.

91. SAPMO/BArch DY 30 IV A2/9.04/283, "Erster Entwurf einer Konzeption zur Reform der Lehre und Forschung an den technischen Hochschulen und Fakultäten der DDR," undated draft of the State Secretary for Universities and Colleges [from period 1965–1969]. See also Zachmann, *Mobilisierung*, 184–185, 200–203, 222–223, 235–236; Jessen, *Akademische Elite*, 147–157. I have also consulted the web sites of these institutions, all of which still exist, although they have in some cases been reorganized.

92. Heinrich Schubert and Walter Hälbich, "Institut für Aufbereitung," in *Bergakademie Freiberg 1765–1965*, vol. 2, ed. Eberhard Wächtler (Leipzig: Dentscher Vevlag für die Grundstoffindustrie, 1965), 209.

93. TUD, "Personal- und Vorlesungsverzeichnis," winter semester 1950–1951, 82–83.

94. *Bergakademie Freiberg 1765–1965*, vol. 2, 157. These included courses in mathematics, physics, mechanics, earth sciences, and chemistry.

95. See Zachmann, *Mobilisierung*, 209–249.

96. SAPMO/BArch DY 30 IV A2/2.024/27, 127.

97. See Zachmann, *Mobilisierung*, 216–217; discussion regarding universities on pp. 209–222.

98. Quotation from a speech by M. Schneidereit, marking the hundredth anniversary of the founding of the Engineering School of Mittweida. Quoted in Jan-Peter Domschke et al., *Vom Technikum zur Hochschule: 125 Jahre technische Bildung in Mittweida* (Mittweida: Hochschule für Technik und Wirtschaft Mittweida, 1992), 90.

99. *Ingenieurhochschulen* also conferred doctoral degrees, while technical universities also conferred postdoctoral degrees.

100. See Zachmann, *Mobilisierung*, 186.

101. See Domschke et al., *Vom Technikum zur Hochschule: 125 Jahre Mittweida*, 86.

102. This growing emphasis on mathematics and science in these institutions began before the Third University Reform: SAPMO/BArch DY 30 IV A2/9.04/265, "Analyse der bisherigen Durchführung der Studienreform in den Ingenieurwissenschaften . . . ," dated May 21, 1965, 3. SAPMO/BArch DY 30 IV A2/2.021/320, 39–45.

103. See Eric Stone, *Education in the German Democratic Republic 1949–1990* (Anchorage, AK: Frank Severy Publishers, 1993), 129–130.

104. BArch DF-4 472, "Vorschlag über Veränderungen der Studienformen an Hoch- und Fachschule," report of ZAFT/Forschungsrat from 1958 or 1959.

105. See Zachmann, *Mobilisierung*, 210–215; *100 Jahre Ingenieurschule Mittweida* (Mittweida, Germany: Ingenieurschule Mittweida, 1967), 19–23.

106. Jan-Peter Domschke, *Vom Technikum zur Hochschule: 125 Jahre technische Bildung in Mittweida*, 82, 86–87.

107. Hampel, "Student in Freiberg," 81.

108. See Werner Gilde, *Leben ohne Rückfahrkarte: Erinnerungen* (Halle-Leipzig, Germany: Miteldeutscher Verlag, 1980), 248–252, 265.

109. TSD, Nachlaß Hartmann, vol. G, 52.

110. TSD, Nachlaß Hartmann, vol. G, 53.

111. TSD, Nachlaß Hartmann, vol. G, 54–55.

112. Interview with Alfred Kirpal, November 11, 2004. An example of university participation in the drawing up of the curriculum is to be found in SAPMO/BArch DY 30 IV 2/904/352, 177–178.

113. According to the "professors' files" at the Technical University of Dresden, Theo-Ernst Schunck, an engineering professor, was dismissed in 1957 because he criticized the GDR in his lectures, whereupon he moved to Hamburg.

114. For an example, see Domschke, *Vom Technikum zur Hochschule: 125 Jahre technische Bildung in Mittweida*, 93.

115. See Domschke, *Vom Technikum zur Hochschule: 125 Jahre technische Bildung in Mittweida*, 85, 89.

116. See *Bergakademie Freiberg*. Two publications of the Technical University of Dresden also evoke a sense of proud tradition: Kurt Koloc, *125 Jahre Technische Hochschule Dresden: Festschrift* (Berlin: Deutscher Verlag der Wissenschaften, 1953); Werner Klaus, ed., *Gebäude und Namen: Technische Universität Dresden* (Dresden: Die Universität, 1978).

117. *100 Jahre, Ingenieurschule Mittweida*, 5.

118. *100 Jahre, Ingenieurschule Mittweida*, 13, 11.

119. *100 Jahre, Ingenieurschule Mittweida*. Additional photo of sporting events appears on p. 16, photo of students at the oscilloscope on p. 21, and photo of student from Guinea on p. 42.

120. See Domschke, *Vom Technikum zur Hochschule: 125 Jahre Mittweida*, 94.

121. "100 Jahre Ingenieurschule Mittweida—20 Jahre Bildungsstätte des Volkes 1867–1967. Programm der Festwoche vom 2. Mai bis 7. Mai 1967." I thank Dörfel, who participated in these events, for providing me with a copy of this program.

122. See Zachmann, *Mobilisierung*, 203. See also Jessen, *Akademische Elite*, 153–154.

123. SAPMO/BArch FDGB-BUVO A3782, transcript of a meeting on February 16, 1961, 82.

124. Bergakademie Freiberg Hochschularchiv (BAF), professors' files (*Professorenkartei*).

125. SAPMO/BArch DY 30 IV 2/6.07, Nr. 71, 218–220.

126. SAPMO/BArch DY 30 IV 2/904/352, 63–68.

127. SAPMO/BArch DY 30 IV 2/904/352, 23–24. Another example: 184–188.

128. See Werner Fritsch, "Hoffnung auf einen politischen Frühling: Oppositionelle Reformsozialisten an der Universität Jena und die Aufbruchsstimmung des Jahres 1956," in *Macht und Milieu: Jena zwischen Kriegsende und Mauerbau*, ed. Rüdiger Stutz (Rudolstadt and Jena, Germany: Hain-Verlag, 2000), 277–305. See also literature cited in that article.

129. SAPMO/BArch DY 30 IV A2/2.024/27, "Einleitung und 12 Thesen," dated January 11, 1963. Quotations on pp. 93, 96, 97 [archivists' numbering].

130. SAPMO/BArch DY 30 IV A2/2.024/27, 111.

131. For examples, see John Koehler, *Stasi: The Untold Story of the East German Secret Police* (Boulder, CO, and Oxford, UK: Westview Press, 1999), 107–148.

132. SAPMO/BArch DY 30 IV A2/2.024/27, 135–140. Another interesting case appears on pp. 112–113.

133. TUD and BAF, professors' files.

134. Jessen, *Akademische Elite und kommunistische Diktatur.*

3

Under Siege: Facing Challenges to Professionalism in the Ulbricht Era

In the rough-and-tumble world of the East German factory, engineers and industrial scientists faced challenges to their professional status from various directions in the Ulbricht era. They faced suspicion and angry demands by workers and the party grassroots that their privileges be curtailed. In East Germany, technical specialists were not demoted or persecuted on anything like the scale of Maoist China or Stalinist Russia. In fact, the central SED organs came to the defense of the old technical intelligentsia. Nevertheless, many of the engineers felt very unsettled by the transformations taking place. Male domination of the profession was thrown into question by the propaganda (if not the reality) of gender equality. A complex web of rivalries and cooperation evolved between the older and younger (post-1945) generation of technical professionals, as well as between these and industrial administrators, many of whom were without a higher or even secondary education. The technical intelligentsia also faced significant changes in the organization of industry and the economy, changes that challenged their understanding of their role in the factory and in society. Given the possibility of boarding a train to West Berlin, some escaped from these problems.

The open border gave engineers and industrial scientists a great deal of leverage in their relationship with the SED. The SED made tremendous efforts to accommodate their needs and desires in the era before the building of the Berlin Wall. Special contracts gave them higher earnings and better perquisites than they would have had under regular industrial contracts. The party leadership shielded them from the ideological overzealousness of workers and factory-level party officials. Engineers and scientists were not even required to join the party until the early 1960s. The SED made little serious effort to put propagandistic promises of gender equality into practice, leaving gender hierarchies largely intact into the 1960s. The privileges and power of the older generation of engineers vis-à-vis the younger generation also remained largely untouched. Due to restrictions on the media, industrial engineers and scientists could not step before the public with collective demands.

The SED did, however, open direct channels of communication that allowed these professionals to pitch their demands to officialdom.

The building of the Berlin Wall in 1961 brought about fundamental shifts in the relationship between state and party on the one hand and technical professionals on the other. It was no longer necessary to give these scientists and engineers special privileges. The SED could now crush their autonomy without fear of a mass exodus to the West. A complete restructuring of the universities in the so-called Third Educational Reform of 1967–1968 brought the universities under much more direct and effective SED control than had been possible up until then.

The Technical Intelligentsia and Changing Power Relations in the Factory

A major shift occurred in the relationship between workers and technical professionals in East German factories after nationalization (in the late 1940s), the result of the ideologization of a segment of the working class, as well as a more pervasive and subtle egalitarianism. In many factories, Communist- or SED-dominated unions and factory councils demanded, often successfully, that the old directors, top managers, and top engineers be fired, particularly if they were former Nazis. In the Soviet zone of occupation, factory councils tried to narrow or eliminate the wage gap between workers and technical professionals, and they tended to be successful in German-run factories. However, the Soviet administration of the SAGs (Soviet-owned corporations) tended to shield top managerial and technical personnel from de-Nazification and to give them special contracts that involved higher pay and benefits. In many SAGs, management style remained much the same as in the pre-1945 era.[1] This dichotomy between official favoritism and factory-level hostility toward the "old intelligentsia" is oddly reminiscent of the situation in post-revolutionary Russia, where Lenin tried to crack down on "specialist baiting."[2]

After the founding of the GDR, the party leadership and the party grassroots continued to work at cross purposes. Many factory-level party officials treated engineers with special contracts as representatives of the hated bourgeoisie, an attitude that many workers shared. In discussions with party envoys at the Transformer Works "Karl Liebknecht" in 1951, workers complained that while new collective contracts led to lower wages for workers, the intelligentsia was given special contracts and higher salaries and pensions. One worker expressed the suspicion that if it were not for these incentives, all these members of the old intelligentsia would flee to the West.[3] At a 1950 district party meeting in Berlin, one delegate was greeted with resounding applause when he criticized the special privileges of the intelligentsia.[4]

Resentment was not, however, only aimed at the privileged members of the old intelligentsia. At times, local party officials treated *all* engineers as "class enemies"—

an attitude not tolerated by the upper echelons, and often referred to as a form of "sectarianism" (a rather ominous term that had been applied to Trotskyism and other deviations). A Party secretary in a Dresden steel works told party members to gather material on members of the technical intelligentsia that could be used as evidence that the latter were reactionaries. "He created in the entire factory an atmosphere of fear and distrust." The secretary was relieved of his duties by the SED.[5] Such fanatics were to be found in other factories as well. One party member reported at a district party meeting in 1949, "We had in our plant a comrade [i.e., a party member] who thought himself to be the most radical person around . . . His attitude toward the intelligentsia was completely wrongheaded." An employee of another factory complained about managers who were former members of the Nazi Party. They were reassigned, but the man continued to complain, "our leadership has become fascistic." Sending him to party "schooling" did no good—he could not be silenced. While such openly aggressive behavior was not condoned, a more subtle sort of distrust was allowed to simmer among the party officials at the factory cell level, as can be seen in the assertion of a party member at the same 1949 party meeting in Köpenick, "That the Socialist Unity Party is a party of the workers and that we are in danger of letting this working-class element in the party fall under the table to a certain extent . . . A large part of the intelligentsia and white-collar workers are completely and wholly our comrades. But a large number are just painted red on the outside." Some engineers were intimidated by this atmosphere. At one factory, the technical intelligentsia remained largely passive at a meeting on its behalf. When asked why he had not participated in the discussion, one member of the audience replied, "I have a wife and children!"[6]

Anti-intelligentsia attitudes in the factory had a negative impact on the relationship between the party and engineers. Party and union records of this period are filled with exhortations to make more of an effort to win over the technical intelligentsia, to break through their "hard bourgeois crust."[7] There were successes, though modest ones. From 1946 to 1957, just under 18 percent of all engineers and technicians were party members, while just over a quarter of the work force were party members in 1946.[8] At the socialist electronics firm "Elpro," forty out of sixty newly hired young engineers left the Free German youth, a Communist youth organization (*Freie Deutsche Jugend*, or FDJ) in their first two weeks on the job in 1959.[9] At a party conference of the Berlin district in 1956, it was noted that many members of the scientific and technical intelligentsia in industry were "politically unstable" and prone to ideologically "false" points of view.[10] One of the consequences of this was that most engineers and industrial scientists could not take advantage of the new career path that opened up in the late 1940s—a political path that allowed persons with very little education but excellent political qualification to rise into positions of power. Large numbers of managers were still not in the SED, and thus not eligible.

The larger role that workers were supposed to play in the innovative process posed another challenge to the authority and professional identity of engineers and industrial scientists. Under socialism, workers were to play a leading role in the running of the factories. Production advisory meetings (*Produktionsberatungen*) were seen as central to the "democratization of the economy." Here, all employees of a particular section or shift were to come together to discuss their work. Such meetings became an important forum where workers were able to bring forth suggestions relating to work organization, production problems, or further education for employees.[11] The activist movement attempted to explicitly make workers the agents of technological progress. The model was the Stakhanov movement in the Soviet Union, named for a coal miner who in 1935 had exceeded his work quota fourteen times over. Offered large bonuses, workers all over the Soviet Union tried to duplicate his feat. In 1948, an East German coal miner named Adolf Hennecke became the German Stakhanov, mining over three times his normal quota of coal during one shift. There was widespread resistance among workers to this transparent attempt to raise the miserably low level of productivity in the SBZ (Soviet zone of occupation) by inducing employees to work more for the same money. Discontent over higher work quotas culminated in the uprising of June 1953. Nonetheless, the ranks of "activists"—workers committed to raising their productivity in return for higher pay and privileges—spread across the SBZ. At a time when true worker participation in factory-level decisionmaking was greatly declining, a small core of workers felt empowered. These measures challenged the technological monopoly of university-educated engineers and scientists by offering workers a leading role in the raising of the level of productivity.[12]

Through "socialist cooperation" (*sozialistische Gemeinschaftsarbeit*)—organized forms of teamwork—the "alliance between the working class and the intelligentsia" was to be fortified, and skilled workers were to be involved in planning, research, and other responsible activities. The work brigade—the smallest unit of people working together in the factory—was involved in campaigns to promote higher productivity, such as the competitions to win the title, "Collective of Socialist Work." Ad hoc "work and research communities" (*Arbeits- und Forschungsgemeinschaften*) were formed to solve particular tasks. These forms of collaborative work were supposed to develop the "socialist personality," characterized by a thirst for education and culture, moral behavior, a spirit of friendship—particularly toward working people—a cooperative attitude, a good work ethic, loyalty to socialist ideals, self-discipline, and optimism.[13] This attempt on the part of the SED to mobilize and ideologize the work force through technical work largely failed. Surveys conducted by East German sociologists in the 1960s cast doubt on the success of this attempt to remold consciousness.[14]

The most important attempt to involve workers in research and development was the innovators' movement (*Neuererbewegung*). Individuals could submit suggestions, but most participants were members of teams that had contracts to work on particular projects. These innovators received bonuses for their work. There have been a number of detailed studies on this movement, which indicate that most workers were totally indifferent to the movement; only a small number of workers became seriously involved as innovators; most participants were factory foremen (*Meister*) or engineers; most young people and many workers who participated were token members of teams, put in to satisfy state mandates; women played a marginal role; successful innovations financed by the movement were generally conventional projects planned from above and directed by engineers; and the factories generally considered this movement an annoyance rather than a real spur to innovation.[15]

While the state pushed the *Neuererbewegung*, it initially did little to promote innovation of a more conventional sort. There was a system of submission of suggestions through factory "Inventors' Offices" (*Erfinderbüros*), which both the "intelligentsia" and the workers could make use of, but it was highly ineffective. In 1960, the Zeiss management gave up on ever catching up with a backlog of suggestions dating back six years and more. Engineers and industrial scientists were also unhappy that the patent system in the GDR was quite cumbersome.[16]

There is a tremendous amount of evidence that workers and technical specialists generally worked well together, but there is also ample evidence of friction. Although constrained by state policies, some engineers and scientists displayed a condescending attitude toward factory workers, or at least a certain amount of unease in the newly defined relationship. Speaking at a top-level meeting of union officials and the intelligentsia, a geologist complained that his suggestion to use hot water in pipes used in drilling for oil to prevent them from freezing and bursting was ignored because the person in charge of his enterprise's inventors' office was a worker: "Our inventors' office is manned by an experienced worker, but he is just a worker and does not have the knowledge needed to judge such a case." The geologist declared that he very much valued the participation of workers in the innovation process. However, he felt that workers would contribute more if they were taken out of the unstimulating environment they lived in. (In his town, workers spent most of their time watching TV or sitting in a tavern.) He felt they should read more and be taught to think for themselves.[17] The next speaker reacted rather angrily, accusing the intelligentsia of being overly critical and wanting to travel for free in the "train that we all ride on." A later speaker called upon engineers and scientists to "have the courage to allow workers to say what is on their minds, to listen to them," and discuss differences of opinion rather than "saying from the start, you [as a worker] don't understand that."[18]

Engineers and industrial scientists were little inclined to accept the officially proclaimed "convergence of working class and intelligentsia," particularly with regard to pay, benefits, and recognition. Earnings were a public sign of a person's value to society, openly known and discussed in factories, and thus possessed considerable symbolic value. While many engineers and industrial scientists were guaranteed high pay and benefits under special contracts during the early years of the GDR, a large and growing contingent of technical professionals were in a far less privileged position. Paid according to a standard pay scale (*Tarif*), they only earned a quarter to a third more than factory foremen, according to a 1958 study.[19] In particular socialist enterprises, such as VEB Bergmann-Borsig, some engineers actually earned less than foremen.[20] Before the era of economic reform (1963 onward) engineers could not count on premiums for special individual achievements, either.[21] A top union official noted that members of the intelligentsia were sometimes barred from purchasing washing machines, television sets, and other durable goods from the Konsum, a ubiquitous chain of state-run cooperatives. Some factory party organizations did not allow engineers and other professionals to join workers' housing construction cooperatives. Cultural and public social life (in club houses, for example) was seldom tailored to the interests of the intelligentsia. (The club in Dresden, mentioned in chapter 2, was something of an exception.) A petroleum geologist complained that when a worker and a member of the intelligentsia applied for a spot in a vacation home, the worker got it. As the top geologist at VEB Erdöl (a petroleum producer), he earned only 1,200 marks per month in 1961. He did not receive stipends for his three children. He could not afford a car, a television set, or even clothing and shoes for himself. "I'm fed up," he publicly declared.[22]

Members of the new intelligentsia in particular were discriminated against in state-owned industry. First of all, it was difficult for them to get a job.[23] Many engineering positions were still held by employees without degrees, and factory administrators were reluctant to force them out, partly because of the belief, prevalent in GDR industry, that experience counted for more than academic training.[24] This grew out of the way state planning emphasized production (and in quantitative rather than in qualitative terms) rather than research and development. In addition, factory administrators were fearful of losing their jobs to academically trained experts, and thus reluctant to hire and promote personnel with engineering degrees.[25] In comparison with their colleagues who had entered the profession before 1945, young engineers were also less likely to have a special contract. At the Telecommunications Works (HF), located in Berlin-Oberschöneweide, only 7 of the 106 specialists (or 6.6 percent) who had special contracts were young enough to be members of the "new intelligentsia," whereas over 15 percent of all electrical engineers were in that age bracket.[26] Many recent engineering graduates were not given positions that befit their degrees, but were used as errand boys or errand girls, or given temporary assignments that involved jumping in wherever they were needed. Their employers often kept them in limbo for years, not letting them know when they could expect to advance to more responsible and interesting work.[27]

Some members of the old intelligentsia evidently swayed the way the wind was blowing, probably encouraged by a sense of rivalry and perhaps disdain toward products of the post-1945 system of higher education. Older engineers, for example, displayed a lack of confidence in young engineers, denying them professional autonomy. Older engineers and foremen kept knowledge of procedures and techniques to themselves, with the result that the young engineers could not work effectively when their middle-aged colleagues were absent due to illness. At the chemical concern Buna, members of the old and new intelligentsia were thrown together in work and research teams in an attempt to overcome the "prejudices" of older chemists and engineers toward their younger colleagues.[28]

This was an odd, dysfunctional aspect of the system. It would seem to be politically counterproductive to favor Nazi-era engineers over the new technical intelligentsia, who represented the future of socialism. Discontent over low pay was a common complaint of engineers who fled to the West. Low pay also discouraged skilled workers from pursuing engineering degrees. Moreover, by stunting the professional development of young engineers, human capital was wasted.[29]

In terms of sheer numbers, the domination of the old intelligentsia was broken by the early 1960s. Census data shows how the balance between the generations of engineers changed during the course of the first twenty years of the existence of the GDR. In 1950, roughly 30 percent of all engineers and technicians were fifty or older and about 60 percent were forty or older.[30] Presumably, most of these older engineers would have entered their profession in the Nazi period or earlier. By contrast, in 1964, about two-thirds of all engineers were *under* forty, and thus were almost certainly educated after 1945; a further 13.2 percent were in their forties, the great majority of whom were post-1945 graduates.[31] Just under a fifth were fifty or older, of which perhaps 60 percent were educated before 1946.[32] Thus, by 1964, the old technical intelligentsia probably did not occupy too much more than a tenth of all engineering positions,[33] although their power probably exceeded their numbers. By the end of the Ulbricht era (1971), the old guard had virtually disappeared from the scene, and the age structure of the engineering profession had again changed, with engineers fifty and over making up only 7.7 percent of all engineers.[34]

However, the problems between old and new intelligentsia should not be exaggerated. As the post-war careers of Werner Hartmann and Paul Görlich show, outstanding members of the old intelligentsia were not only respected but revered by their employees, whether of the older or younger generations. Moreover, Hartmann and Görlich show little sign of having discriminated against younger industrial scientists.[35]

Another issue for engineers in the early Ulbricht era was the influx of women into the profession. Whereas in 1950 only 3.3 percent of all engineers and technicians were women, women made up 7.5 percent of all engineers in 1964.[36] Sexism at the workplace was rampant. Female engineers—particularly if they were young and had children—were often relegated to jobs that did not correspond to their training.[37] A female engineer working at a pulp factory encountered male hostility at her workplace. The top factory mechanic would only allow her to look at documentation for equipment under his supervision, not allowing her to take it to her office. Female engineers were put on display when there were visitors, but discriminated against after the visitors left: "Vis-à-vis the outside world we are so to speak the exhibition pieces for the factory. But how is it in the factory? We have to literally beg for work in the factory, and that is not just the case in our factory, but also in almost all the factories of our industry."[38] The head of the Television Electronics Works (known as WF) in the Oberschöneweide section of Berlin was accused of politically false policies toward women. He got into trouble with the SED because in a conflict between female workers and factory-level planning bureaucrats, he took the side of the bureaucrats.[39] Werner Hartmann openly airs his prejudices against women in his unpublished memoirs, doubtlessly expressing what many male scientists and engineers felt about women in their profession:

> I can imagine that in the last 20 years, many high school graduates were "talked into" doing a university degree, even though they were not suited to it, maybe a major in which slots were open. . . . In the process, a huge chunk of the people's wealth was wasted—first, the education of all those who were forced and who were unsuited cost lots and lots of money, and the capacity was later missing. This is especially true of the many girls who were recruited for university studies. It was considered a positive characteristic of equality: they married early, had children, and often had to take time off. Today, this mistake has been recognized and . . . university studies for women have been curtailed. One could have avoided all this! But there was no public discussion of the issue, no consultation of experts who could have expressed their opinions without fear of reprisals. Now our entire people must pay dearly![40]

The second-to-last sentence implies that technical expertise is purely masculine. The deep-seated attitudes expressed here made it very difficult for women to win a place—both in GDR factories and in the popular imagination—as creators of technology.

In the 1950s and early 1960s, engineers feared the loss of professional identity. Attempting to stabilize their self-images, some older engineers and industrial scientists appear to have sought to dominate younger professionals and female colleagues. In addition, they tried to maintain their authority, as well as economic and social superiority, in their relations with workers. Engineers and industrial scientists were also uneasy about changes in the work environment, the introduction of the planned economy, and changes in the research system.

Confronting a New Economic and Research System

From the beginning, Sovietization was seen both as a curse and a blessing. There was considerable resistance to forcible removal of German factories and equipment during the period of occupation. By 1947, the Soviets were phasing out the forcible removal of factories and technical experts from Germany, and putting German research personnel to work for them in East Germany at SAGs, scientific-technical bureaus (*Wissenschaftlich-technische Büros*, or WTBs), and reparations-producing enterprises. Products were often designed and produced to Soviet specifications, resulting in a transfer of Soviet norms and standards to the SBZ. In addition, SMAD and the Soviet Academy of Sciences assigned research projects to German institutes, universities, and industrial research units.[41] They were, for example, "eagerly interested in every phase of research" at Carl Zeiss Jena, from which they ordered large numbers of specialized instruments and equipment.[42] In his book, *Allein Bezahlt?*, Rainer Karlsch argues that the distorting impact of closer economic ties with the Soviet Union—which induced East Germans to turn their backs on the world market—had more serious long-term negative consequences for the East German economy than did Soviet dismantling of German industry.[43]

Nonetheless, engineers and scientists were happy that important research facilities were preserved and expanded and that they were able to continue working in their respective fields, even on wartime projects in some cases. The Oberspreewerk in Berlin-Oberschöneweide (a SAG that had originally been part of the electronics corporation, AEG) conducted electronics research that received accolades in a 1949 U.S. Army intelligence report: "Topics such as fluoroscopic image amplification, transistors, electron microscopes, pulse modulation, etc., are probably not far behind the research programs of first-class US firms."[44] Oberspreewerk became a major producer of television tubes for the Soviets. This helped establish it as an important high-tech enterprise, which became the Telecommunications Works in 1952 and the Television Electronics Works (*Werk für Fernsehelektronik*, or WF) in 1960.[45]

Anti-Soviet feeling was on blatant display during the period of confiscation and deportation, but once this subsided, East German engineers and industrial scientists—at least those committed to staying in the SBZ—soon resigned themselves to Sovietization. The chief of research at Carl Zeiss Jena, eighty-three-year-old Hans Harting, initially displayed considerable resistance, telling his personnel not to cooperate with Robert Rompe (one of the most decisive figures in East German science and technology), arguing that Rompe "was a Russian, not a German." Once he realized that the new rulers were there to stay, Harting made a 180-degree turn, becoming very friendly to Rompe.[46] However, the Western orientation of many industrial researchers persisted. As late as 1971, report a report of the district administration of the SED complains of the "*Westdrall*" (westward-leaning slant) of the thinking of reseach personnel at VEB Wema Planen (a machine-tools manufacturer). It was charged that the "technical intelligentsia" tended to favor Western journals over Soviet journals, and to imitate Western technologies.[47]

Although industrial R&D was profoundly transformed by centralization and state takeover, centralizing tendencies were far weaker in the GDR than in the Soviet Union. The universities and the German Academy of Sciences were given a central role in basic research, while industry was supposed to apply the fruits of basic research to industry. In practice, much important industrial research was conducted in industry: at major state-owned enterprises (*Volkseigene Betriebe*, or VEBs), at associations of people's companies, which were GDR-wide industrial umbrella organizations (*Vereinigungen Volkseigener Betriebe*, or VVBs), and at central institutes and laboratories operating under the authority of the industrial ministries. This system gave engineers and scientists the much-welcomed opportunity to retain jobs with companies for which they had worked for many years and to which they felt intense loyalty. Engineers and industrial scientists were, however, quite critical of inadequacies of the industrial research system. Top-down attempts were made to strengthen ties among universities, the German Academy of Sciences (DAW until 1972, thereafter AdW), and industry. Industrial enterprises could contract out research projects to universities or academy institutes.[48] However, problems coordinating this research plagued the GDR.

Werner Hartmann believed that there were deeply ingrained prejudices against industrial engineering in the GDR. In his years as head of Vakutronik, a research-oriented industrial enterprise focused on the production of instruments for the atomic industry, he became convinced that in the GDR "an incredible overestimation of so-called 'science' and the so-called 'scientist'" existed. The press made a big deal about inventions, but ignored the work of putting them into production, which involved "four to five times" the work and expense of the development of a prototype. According to Hartmann, this transfer from the research stage to the production stage often ended in complete failure because of "the underestimation of the necessity for scientific methods in industry by the functionaries." This is one of the main messages of Hartmann's memoirs (written in the early 1980s): What East German industry needed was the kind of infusion of scientific methods and methodical management that Hartmann preached and practiced in his twenty-some-year career in the GDR. He believed that what doomed the East German economy to stagnation was the failure of the party leadership to recognize this. Industrial research was, in his estimation, underfunded, and top research people such as himself had gone unrecognized: "Thus, while the professor at the university institute is publicly praised for this one apparatus, such recognition is denied the many engineers, academics, economists, among others in industry who have constantly achieved incomparably more important and more influential results. . . . I have often tried to promote better, more balanced conditions through talks, newspaper articles and such, but unfortunately without success; indeed, I was often falsely attacked."[49]

Although there is doubtlessly an element of self-interest here, Hartmann's critique is valid. It is borne out by his later experiences as the head of the main institute conducting microelectronics research in the 1960s (to be discussed in chapter 5), as well as by reports on state-owned industry.

The difficulties in getting recently developed products onto the production line was a much-discussed topic in the GDR. There were not only problems in the transfer of research results from universities and the Academy of Sciences to industry, but also within socialist combines, and even within enterprises. This was generally due to a lack of funding or other resources, such as factory floor space, materials and inputs of all sorts, qualified personnel, and modern equipment and machinery. Many believed that R&D was too decentralized, with too much duplication of effort and too many R&D projects in many VEBs and VVBs.[50] This is indicative of a large degree of autonomy in the formulation of R&D projects.

Engineers and scientists were very frustrated about the long delays between the time when they finished up an R&D project and the time when the new product rolled off the assembly lines. "The intelligentsia sees this as an obstruction to its work, and cannot understand this wasting of state funds." This report, coming out of the office of Erich Apel in the early 1960s, reflects the disdain on the part of bureaucrats that Hartmann refers to above: "Often, state officials treat the intelligentsia with contempt, ignore their recommendations, or see cooperation with them as a necessary evil." Moreover: "State offices, factory administrations, but also many party organizations often act in an obtuse, petty, and tactless manner toward members of the intelligentsia. They are left with the impression that they are given support only as long as they are needed to take care of particular tasks." Examples were given in which the advice of technical experts was ignored. It was also noted that engineers felt insulted that they were forced to participate in mass actions such as the bringing in of the berry harvest or the home delivery of potatoes to the population. Here, Apel was trying to advance the interests of professionals in industry. His efforts on behalf of the microelectronics industry, discussed at length in chapter 4, yielded mixed results.[51]

The centralized planning system also had an unsettling impact on the work of engineers and scientists in industry. Before the institution of the New Economic System (in 1963), economic planning created incentives to meet production goals, but largely neglected R&D. Planning encouraged what East Germans called the "ton ideology"—the idea that the more the better, and the heavier the better—since plan goals were usually expressed in terms of quantity and weight. Thus, it was usually advantageous to continue to produce older models of heavy machinery rather than newer, lighter models. Quality control was poor in the 1950s, as a result of which a fair percentage of production in some industries had to be scrapped. To meet production goals, research was often shunted aside, since it drew resources away from production. Factory administrators were often reluctant to put new products into production because of the costs and risks involved. Production capacity for new product lines was often not available, the result of poor coordination of R&D and production planning. In the 1950s, enterprises were generally not rewarded for getting new designs into production within a short time period. Factory research personnel were sometimes taken away from their work and forced to work on the production line for a couple of weeks to help the factory meet a planning deadline.[52]

Resistance against the planning of research (begun under the First Five-Year Plan of 1951–1955) was fairly widespread in the early years. It was noted in 1949 that at one recently nationalized firm, some coworkers "were against planning in general, reasoning that scientists, researchers, and engineers cannot be pressed into a narrow mold."[53] In 1950, top research personnel at Carl Zeiss Jena and the Central Laboratory of Jena expressed similar reservations about the planning of both basic and applied research. They and others increasingly accepted the system of central planning, but were critical of its inefficiencies, particularly the difficulties in procuring equipment, components, materials, and other inputs needed in R&D—a result of poor coordination of production and R&D planning in different enterprises and institutes.[54] State planning of research and development promised greater rationality in project selection than under capitalism. However, in industry, topics were largely selected by R&D personnel rather than by central agencies, particularly in the era before the New Economic System. To the extent that research and development was truly centrally planned, bureaucratic involvement in R&D injected into the process a strong element of irrationality, which grew out of the planners' lack of technical expertise and lack of knowledge of conditions in specific industries, as well as the proliferation of red tape. Economic usefulness and costs of projects were barely taken into account. Market research was neglected and consumer and industrial needs were ignored.[55]

Another consequence of planning that very much angered engineers and scientists involved in both research and production was the enormous amount of paperwork they were expected to take care of. They also complained bitterly about endless meetings, which they said were poorly prepared and often did not yield concrete results. One research engineer estimated that he spent 60 percent of his work time in meetings, 25 percent taking care of administrative work, and only 15 percent conducting actual research, which he saw as his real job.[56] Part of a system of top-down administration of the economy, meetings proliferated as they came to be seen as "good form" in a political culture that sought to draw participants into increasingly politicized teamwork.

Another factor that impinged on the professional lives of technical specialists was the destruction of civil society and the market economy, impeding the flow of information on technological developments and production methods, not to mention costs, demand, and markets. There were sometimes delays in procuring much-needed technical literature, particularly Western publications, due to the shortage of foreign exchange, and this prompted the bitter complaints of research personnel.[57] At one East Berlin enterprise (Karl Liebknecht, one of the largest transformer and electrical equipment works in Europe), articles on new technological developments (including some translations of American and Soviet articles) were reproduced in an internal newsletter. However, up until 1962, technical journals themselves were only circulated among division heads. By the early 1960s, however, foreign technical journals were becoming somewhat more accessible.[58]

The state failed to make up for these deficiencies of the system through its own activities. Despite the work of the Chamber of Technology (*Kammer der Technik*), many seem to have felt it difficult to keep up with technical advances. The flow of technical knowledge was also impeded by the rather tenuous links among industry, the universities, and the Academy of Sciences, as well as between GDR institutions and those in other East bloc countries. Engineers and industrial scientists were particularly resentful over being denied permission to attend conferences in the West.[59] With the building of the Berlin Wall in 1961, travel to the West became impossible for most East Germans.

All these larger changes in the economic and research system had an impact on the professional lives of engineers and industrial scientists. They had to conform to the timetables and goals laid out by state planners, they became more dependent on other economic units for inputs, and they no longer had influence over hiring and firing practices. As industry ceased to be a self-regulating realm, decisions regarding research and development were increasingly made by state and party bureaucrats. It should be recognized, however, that research personnel also had some freedoms. Above all, they were able to participate in the setting of the research agenda on the factory level.

The ultimate expression of unhappiness over these changes was the decision to flee to the West. Among these frustrated engineers and industrial scientists were not just members of the older generation, but also many post-1945 graduates.

Fleeing Westward, Fleeing Professional Frustrations

Until the Wall was built, GDR policymakers were faced with the bleeding away of technical specialists. Starting out with 106,777 engineers and technicians out of a work force of some 7.2 million persons in 1950,[60] about a hundred engineers a month were fleeing the GDR at the height of the exodus in 1958–1959.[61] This brain drain was of major concern to the SED, and the reports of that era contain detailed analyses of the motives of technical specialists who had "abandoned the republic." One grumpy party secretary of one Berlin electronics enterprise opined that "the great majority of members of the economic and technical intelligentsia have a hostile attitude toward the policies of our republic. The causes are almost entirely personal issues."[62] But what he saw as "personal issues" could in many cases be interpreted as professional issues. (Religion and the quest for political freedom were far less likely to be motivating factors.)

Although discontent over pay was a factor in the decision of some technical experts to seek their fortune in the West, professional frustrations loomed large in their thinking. According to a 1953 report, "Securing conditions that will allow them to devote their full energies to their specialized work without any bothersome obstacles—that is more important to the creative scientist and engineer than the question of their pay."[63] The attitude of engineers in television and radio research and development was typical of the less successful sectors of the GDR economy in the 1950s: "They take it as a personal insult that their research work is in decline relative to that in the West."[64] One employee of Karl Liebknecht, the East Berlin transformer works, applied for a job in West Berlin because he was concerned that he would not be able to continue to work in his specialization in the GDR; the lack of testing facilities at Karl Liebknecht made the development of new high-voltage switches very difficult.[65]

Some engineers and industrial scientists fled to the West because they were not allowed to travel. (Restrictions on professional travel increased in 1958.) Here personal and professional goals were intertwined. As one industrial geologist pointed out, travel was an important component of professional training and accumulation of expertise for geologists: "With regard to international travel, people are right in saying that the best geologist is the one who has seen the most and experienced the most." He admitted, though, that for many East German professionals, travel was a fulfilling experience in and of itself: "Some colleagues feel the urge to go out into the world, to see the world, to see something, anything, to experience something and then to drive here, find an exhibition there, and then drive who knows where in their Volkswagen, somewhere where they feel like going.[66]

The Television Electronics Works (WF) in the Oberschöneweide section of Berlin kept good records on engineers who fled to the West. Reading through their forty-two reports, it becomes clear that professional issues often loomed large in an individual's decision to go west. Five engineers appeared to have left primarily because they felt hostility toward the Communist system. One complained about "planless planning, which wastes the national wealth." Another wrote, "Most people have come to recognize, as I have, that the overemphasis of political activity in the economic realm has gradually allowed a parasitic relationship to emerge. This state of affairs and no other is to blame for the mess that the GDR economy in general and your enterprise in particular have gotten into." In two cases, pay was the decisive issue, although discontent over pay seems to have been a secondary issue in many cases. Those who fled often harbored a sense of injustice over the lack of proper monetary recognition for their contribution to the enterprise. Eleven engineers went to West Germany because they got a better job there. In five cases, other professional issues stood in the foreground. For example, one engineer complained that there were not enough opportunities for professional development for the new intelligentsia.[67]

In eight cases, personal problems stood behind the decision to leave the GDR. Most of these cases involved problems finding a place to live. One engineer's marriage broke up because he and his wife had to live in different cities. In another case, a friend's move to the West was the decisive factor. Yet another engineer fled so he could join his parents in the West. Many of those who left were unhappy over the loss of a friend or—more often—a colleague who had moved west. In the great majority of cases, professional ambitions and outlooks, along with friendships with former colleagues, seem to have contributed in important ways to the decision to leave the country. One letter from an engineer who went to West Berlin conveys a sense of wounded pride: "I take it, from the factory administration's indifferent attitude regarding my personal affairs, that my departure from WF will not be a painful loss for the enterprise . . . No one could expect me to keep up indefinitely in the GDR the sort of professional idealism that I have displayed in the past few years."[68] This letter reveals how emotionally involved this engineer was in his professional life.

Young engineers and industrial scientists were somewhat more likely to flee the country than their older colleagues. A thick folder has been preserved that contains carefully filled out cards on members of the technical-scientific intelligentsia (including doctors and university professors) who fled in 1951–1952. Engineers, scientists, and technicians who were working in industry made up 142 of the cases, and of these thirty-five (24.6 percent) were born in 1921 or later, making them thirty-one at the oldest in 1952. Only 19.5 percent of all engineers and technicians were in this age group in the 1950 census.[69] Young people had a greater tendency to migrate to the West because they were at the beginning of their professional lives and were less settled, both professionally and personally, and thus more mobile. Nonetheless, their openness to the idea of leaving East Germany shows that the new intelligentsia was not as loyal to the GDR as the old intelligentsia. In 1960, young engineers at Carl Zeiss were reported to "not yet have the attitude towards our state that we would expect of them."[70]

The SED viewed the hemorrhaging of the ranks of the technical intelligentsia with great alarm. The loss of several technical specialists at once created a crisis situation in some industries and firms. For example, in the third quarter of 1950, eleven engineers working at the Electrical Appliance Works of Treptow (Berlin) quit and took jobs in West Berlin. The firm director fled around the same time.[71] A vital research project at the VEB Farbenwerk Wolfen was totally disrupted in 1958 when three members of the research team left the GDR.[72] Machine tools was the hardest hit state-run industry, reporting losses of about twenty-five to thirty higher educated employees per month in 1958–1960.[73] GDR policymakers felt that shortages of engineers would put the brakes on technological advances. In 1958, authorities estimated that the GDR would have a deficit of thirty thousand engineers in coming decades. The SED feared that Western corporations were plotting to undermine East German industry and make up for a tremendous shortfall in the number of qualified engineers and scientists in the West by luring away East Germans.[74]

Qualitatively of great importance, the flight of the technical intelligentsia was overshadowed by the exodus of factory workers, a point made by Ray Stokes with regard to the East German chemical industry.[75] Between January 1959 and May 1960, 7,554 employees of the mechanical engineering industry escaped from the GDR, 74.2 percent of whom were workers, and only 5.7 percent of whom were members of the technical intelligentsia. The data are not dissimilar for the electronics industry: workers and intelligentsia made up 73.4 percent and 6.9 percent respectively of the 2,035 émigrés from that industry between January 1958 and April 1959. Members of the intelligentsia made up 4.8 percent of all East Germans who illegally left the country (5085 in total) in July to October 1958, and 5.2 percent of the 9615 who left in 1959.[76] However, a considerably higher percentage of engineers and scientists than of workers became refugees in the West.[77] Thus, the average engineer was much more likely to flee than the average worker—a reflection of the mood of stress and frustration among engineers and industrial scientists.

Discontent initially worsened with the building of the Berlin Wall. The party secretary at the electronics plant associated with the Television Electronics Works WF said that the majority of the technical intelligentsia rejected the building of the Wall, but were guarded in the face of massive state power. Young engineers were particularly prone to reject the Wall. At the Television Electronics Works WF itself—where the work force had been bled dry over the preceding years—the mood was calmer, although younger professionals there tended to be more critical. Elsewhere in East Berlin, professionals who lived in the eastern sector but worked in one of the western sectors of the city were forced to return to former employers in the East. Greeted with distrust, these *Grenzgänger*, or border crossers, were generally sullen and very guarded in their behavior in the factories. At VEB Bergmann-Borsig, where workers and engineers had been advocating a crackdown on border crossers (who were perceived as living on the cheap while raking in large paychecks), the building of the Wall was seen by some as necessary. But even they wanted to know when they would be able to see friends and relatives in West Berlin again.[78]

In the long run, by closing off alternatives, the Wall forced East Germans to accept the Communist system. For engineers and industrial scientists, the Wall brought about profound frustrations, but also forced them to reconfigure their expectations, both personal and professional, in conformity with the new situation. Within a couple of years, the dark days of late 1961 began to recede from memory. A bright future seemed to beckon with the dawn of a new day of technology-driven modernization in the reform era of the 1960s. This was to be the régime's most important attempt to integrate the technical elite into the system.

The New Economic System: A New System of Research?

The New Economic System meant tremendous autonomy for industry. The party feared that it would no longer be able to impose its will on industry.[79]

Hans-Joachim Pohl, research director at Carl Zeiss Jena

The New Economic System? I hardly remember what that was. One experienced it as a slogan. There were so many state initiatives. They never really changed much of anything.[80]

Hans Becker, researcher at AME, Dresden

There has been tremendous disagreement about the meaning of the reforms of 1963–1971. Did they represent a real chance to turn around the socialist economy? Would an East German Glasnost have followed on the heels of this Perestroika?

Did Erich Honecker's takeover in 1971 nip the socialist renewal in the bud? Political scientist Peter-Christian Ludz asserted that in this era, young, flexible technocrats came to power who, by instituting pragmatic policies aimed at improving the economic efficiency of the GDR, turned their backs on political fundamentalism and overt oppression. Others, however, see the economic reforms as a sham—a collection of ineffectual, half-baked measures dressed up as major reforms.

The New Economic System (NÖS, in force from 1964 to 1967), and its successor, the Economic System of Socialism (ÖSS, 1967–1971) were primarily economic reforms aimed at decentralizing economic responsibility and decision-making. Enterprises were to become profitable, manage their own expenses and income, and contribute to the planning process from below. Incentives were created that were supposed to motivate employees, factories, and socialist corporations to higher achievement and plan fulfillment. According to André Steiner, the system's main flaw was that prices were not determined by the market. As a result, decisions continued to be based on administrative and political criteria rather than on supply and demand. The success of the reforms was also undercut by Soviet insistence that East Germany provide more goods in exchange for imports from the USSR.[81]

The impact of the economic reforms on industrial research was contradictory. Industrial research personal were quite pleased that enterprises had more leeway in allocating resources between production and research, and there were rewards for increased sales and productivity. This meant greater resources for R&D and greater flexibility in moving around funds among projects. Increasingly, however, the direction of high-tech research was determined from above. Research in fields that played a central role in "scientific-technical revolution," including chemicals, machine tools, electronics, and computing, was centralized under the Ministry for Science and Technology (established in 1967). Under the Economic System of Socialism, innovation was to be forced from above. Ulbricht hoped for a tremendous leap in productivity.[82]

According to Steiner, the main problem was that the infrastructure, energy production, and supplies of materials and components were not up to the task, and imports could not make up the difference. Although considerable progress was made in terms of growth of productivity, growth rates, and the standard of living, the GDR fell further and further behind West Germany. Ulbricht was willing to rack up debt to import Western (especially West German) machines, debts that the GDR would pay off by exporting industrial products to the West. This meant closer economic ties with West Germany, a prospect that worried the hard-line faction in the SED, resulting in Ulbricht's fall from power in 1971. Although they were not allowed to progress to their logical conclusion, the reforms were, in Steiner's view, destined to fail anyway. The SED did not allow forms of liberalization that would have produced a more dynamic economy because such reforms would have undercut its monopoly on power.[83]

Political scientist Olaf Klenke believes that true reform was inherently incompatible with SED rule. First, because there was no market mechanism, but rather decisions about factory closings or price hikes had to be made by fiat, the state would be blamed for painful but necessary adjustments. Thus, moving workers from a less productive sector to a more productive one could destabilize the political system—a risk the SED did not want to take after the 1953 uprising. Second, there was a danger that reforms would allow competing factions to emerge in government. In their attempts to win over the support of the populace, these could awaken dangerous hopes for change, leading to unrest. The Prague Spring (1968) presented a cautionary example of this.[84]

Jörg Roesler disagrees with Klenke's interpretation, arguing that the economic principles of the reform were sound, but that they were undone by mistakes and bad luck.[85] Certainly the reforms tackled major stumbling blocks to innovation in East German industry. Minor, perhaps, from an outsider's perspective but very important to technical professionals were pay increases. In the early GDR, the SED saw morality as the motivating force behind hard work. At a 1949 district meeting of the SED in Köpenick, one member said that conditions would improve if party members thought over what they had done during the day before going to bed at night. "When I was unable to do a job well, I feel guilty. We have to ask ourselves: 'Have I done enough?' "[86] This self-questioning has a pseudo-religious quality, and is offered here as a replacement for evening prayer. A tremendous cultural shift took place by the mid-1960s when material incentives took the place of individual motivation. Under the New Economic System, "material interestedness" was the force that attracted young people to technical professions and motivated workers and professionals to do their jobs well. Engineers' pay was to rise in comparison to skilled workers' pay. The huge difference in pay between the best- and worst-paid engineers was to be reduced. Technical professionals were to receive bonuses for exceptional performance, particularly if they were involved in the development of new technologies.[87] However, these reforms were largely ineffectual. In some cases, the new system of bonuses brought about de facto pay cuts.[88] As late as 1970, the 1952/1953 pay scale for engineers was still in place in some industries, while workers' wages had risen to the point that many skilled workers were earning as much as engineers. This was exacerbated by the tax system, which taxed engineers at a higher rate than workers in production.[89] The pay gap between engineers and workers was to narrow even more after Erich Honecker's takeover in 1971.

Producing more engineers and industrial scientists was another high priority for the SED and, here, by contrast, tremendous strides were made in the reform era. In

1967, Ulbricht asserted that the number of scientists and engineers had to more than triple by 1980.[90] It was thought that legions of technical specialists would be needed to solve society's problems by promoting "scientific-technical revolution." As historian Karin Zachmann has pointed out, the SED also thought that this was an important field of competition with West Germany, where the number of engineering students was rapidly expanding.[91] New and reorganized institutions of higher education for engineering helped accommodate the throngs of new students (see chapter 2). University enrollments in engineering rose 19.5 percent (from 23,716 to 28,344) between 1960 and 1965, but 62.2 percent between 1965 and 1970 (to 45,967). The number of math and science majors went from 9,090 to 9,313 between 1960 and 1965 (an increase of only 2.5 percent), but then grew by 45.6 percent (to 13,563) between 1965 and 1970.[92] The number of engineers in industry rose from thirty-one for every thousand employees in 1961 to sixty-eight per thousand in 1970.[93] The number of employed persons with engineering degrees rose from 189,604 in 1964 to 281,210 in 1971.[94] Nonetheless, demand for engineering graduates outstripped the supply until at least 1967.[95] But by the time this growth wave peaked (in 1972, shortly after Ulbricht stepped down from power), there were clear signs that far too many engineers were being produced.[96]

This growth was achieved with difficulty, given that the number of potential students shrank in these years because of the low birth rate in 1940–1945. Strains in the class-based quota system became more and more evident in the late 1950s, as it became increasingly difficult to recruit a sufficient numbers of students from working-class or peasant backgrounds to engineering programs.[97] Doubtlessly the building of the Wall improved the situation (stemming the flow not only of young engineers, but also of young workers who could go on to become engineers), and the 60 percent quota was allowed to slide just a bit in the reform era.[98] It is also possible that over time university administrators learned how to "massage" the data to bolster the numbers.

Efforts were made to encourage factory workers to become engineers. Workers under twenty-five were generally "delegated" to regular degree programs, sometimes after attending remedial programs at a Workers' and Peasants' Faculty or completing a special high school diploma. Older workers were supposed to enroll in part-time, correspondence, or night programs.[99] Although these programs attracted large numbers of factory workers, they also became a route to social and economic mobility for graduates of engineering colleges (*Fachschulen*) who wanted to attain the coveted degree of *Diplom-Ingenieur*.[100] Some were members of social groups that were discriminated against—particularly children of white-collar workers or professionals—whose applications to the university were turned down, but who were able to get into engineering colleges.[101]

To ensure the continued proletarianization of the engineering profession, the state had to take on various problems that discouraged workers from pursuing higher studies. Socialist enterprises undermined state programs by doing what they could to keep highly skilled workers in production, where they were needed to help fulfill the plan.[102] They often demanded that young workers get their military service behind them before taking up college or university studies. The state was able to force industry to change this policy.[103] Officialdom was also very concerned about low retention rates at colleges and universities, mainly among students of working-class or peasant origins. It was suggested that such students "gave up" too easily and that they did not have good study habits. However, poor teaching methods and severe grading policies were also blamed. Positive improvements in pedagogy were recommended, such as an increase in active learning methods. However, professors seem to have taken the brunt of the blame, and were called onto the carpet for overly severe grading policies.[104] (Grades had been shockingly low at some institutions, such as the School for Mechanical Engineering of the Technical University of Dresden, where the average grade declined from D-plus to D-minus between 1959 and 1962.[105]) Eventually, professors lowered their grading standards. In addition, admissions standards were lowered by 1965 in order to fill entering classes. Officials also tried to fill unpopular majors by forcing applicants to change their prospective major.[106]

Perhaps the most successful and productive strategy used by the SED to recruit engineers was the opening of educational opportunities in this field to women. Their presence at colleges rose from 12 percent in 1961 to 17 percent in 1964 and at universities from 6 percent in 1961 to 8 percent in 1964 and 9 percent in 1966.[107] Whereas in 1950 only 3.3 percent of all engineers and technicians were women, women made up 7.5 percent of all engineers in 1964 and 8.6 percent of all employed persons with engineering degrees in 1971.[108] This was in part a strategy to deal with the shortage of engineers.[109] However, ideological motivations also played a role—not just the desire to promote gender equality, but also to promote the development of a "socialist personality" among women. Thus technology had a pedagogical and ideological role: "To develop well-rounded personalities in women and girls according to the principles of a socialist society, it is necessary to bring them into the educational system to a greater extent than has been the case up until now, and in particular to increase their contact with technology."[110] Technology would help women to become good socialists. The very literal, industrially-oriented Marxist model of man as *homo faber* ("man the maker") was to be fully extended to women. This involved overcoming prejudices against women, as well as traditional female aversion to technology.

Quotas for the recruitment of women were established, and women were given training and incentives to become engineers or scientists. Women were to be introduced to technology through science and technology classes in polytechnic high schools (*Polytechnische Oberschulen*). Systematic training programs aimed at women were to enable them to become skilled workers. The best of them would go on to become factory foremen or engineers. Female students received special assistance if they became pregnant before graduation. Special courses and college programs for female factory workers were to be tailored to their family situations.[111] What the SED did not want women to do was to interrupt their education and professional lives to have children. Women were supposed to find a way to have both a family and a career.[112] Women were particularly attracted to technical college programs because these were shorter than those at universities. On the other hand, women—who continued to carry a heavy burden of household and family duties—seldom took advantage of night or correspondence programs in engineering.[113] In 1965, quotas were established to ensure increased admissions of women into university engineering programs.[114]

The flow of women into the higher technical professions was met with considerable hostility. There was a good deal of resistance to the SED push to place women in supervisory roles. It was commonly held that "women cannot assert their authority; men are better at running things," and that women did not really want engineering jobs with supervisory responsibilities. It was claimed that "women are lacking in technical understanding" and "women themselves don't think that they are capable of doing such things." SED reports were filled with examples of factories in which young female engineers were not promoted. The better qualified the woman, the greater the resistance: "The more qualified the women, the more stubborn and difficult to combat the old, traditional ideas about the role of women in production and technology, and the greater the resistance to giving them responsibilities and appropriate work."[115]

Nonetheless, the 1960s was a era of change. In some enterprises, women were indeed given opportunities for professional advancement as a major SED report from 1961 shows. In 1,400 state-owned enterprises (around 1960), there were five hundred women in upper-level positions. Sixteen of these headed factories (*Werkleiter*), and seven were technical directors. The great majority, however, held nontechnical administrative jobs. This report asserts that these women in top engineering and managerial positions were not able to grow professionally to the same extent as their male colleagues because of the burdens of family and home. Many were reportedly so overwhelmed that they became ill and were forced to step down.[116]

According to historian Gunilla-Friederike Budde, professional women were in a terrible bind during this period. On the one hand, they were discriminated against for daycare and after-school child care. (The state thought female workers had a greater need of such facilities.) On the other hand, propaganda criticized childless professional women. They were expected to work as hard as men, but their professionally ambitious husbands expected them to be supportive of their careers, which meant a heavier burden for women at home.[117] In terms of sheer numbers, a greater degree of gender equality was achieved in the engineering profession in East Germany than in West Germany or the United States in this period. However, the SED bungled this very positive piece of social engineering by expanding the engineering profession far beyond the needs of industry. Thus, women were granted entry into this male domain just as deprofessionalization was beginning,[118] a pattern also observable in the Soviet Union and elsewhere. Growing gender equality in the end proved to be a hollow triumph.

The most profound and lasting change wrought by the reform era at the universities was the completion of the process begun in 1945: the destruction of academic freedom and the takeover of the centers of power by the SED. According to Jessen, professors—especially those in the sciences and in medical schools—tried to keep the "idea of the university" alive, resisting in myriad ways the totalitarian ambitions of the SED. However, the living memory of university autonomy died an unnatural death in the 1960s. Under the "Third University Reform," the traditional structure of the universities was replaced by a centralized system, controlled by the SED. The most important component of the old system was the institute. Patriarchal in nature, these institutes were run by full professors (*Ordinarien*) who set the research agenda, held the purse-strings, and determined who would advance professionally and who would not. Young scholars and assistants applauded the abolishment of this hierarchical system, which the SED argued would promote "democratization." Equality was achieved, but virtually every vestige of autonomy was lost. The microcosm of the institute was broken apart as institutes were combined into large departments, called "sections" (*Sektionen*). These were run by directors named by the central administration and accountable to that administration rather than to the faculty. The new section directors were generally members of the SED. Many of them were reputed to be mediocrities whose careers would not have gotten off the ground had it not been for the assistance of the SED.[119]

By the late 1960s, the SED had attained extensive power over the selection and promotion of faculty. Under the older German academic system, an academic pyramid had existed. Facing stiff competition, only a few advanced to the next level. The pinnacle of the pyramid, the institute director, had tremendous influence over this "Darwinian" process, as Jessen calls it. The SED saw to it that this system was replaced by a bureaucratic system in which all who got their feet on the bottom rung of the academic ladder were guaranteed an academic job, as long as they conformed politically. This measure won much support among those in the early stages of their careers. But political "credentials" became an important criterion for determining who would be given a teaching certification, which was required of all who taught on the college or university level. Professors had always been state employees, but by the late 1960s, those in the East were taking orders from university administrators who in turn were taking orders from the state and the SED.[120] Parallel to the Third University Reform, the "Academy Reform" of 1968–1969 served to bring the Academy of Sciences under greater state control.[121]

Some have argued that these "reforms" freed the East German research establishment and system of higher education of patriarchal structures, thus opening the way for modernization. Zachmann argues that the opening of the engineering profession to women would not have been possible if the resistance of the old professorial establishment had not been broken.[122] Did the reform period bring modernization or did it destroy initiative and strengthen dictatorship? This question cannot be examined here with regard to the universities or the Academy of Sciences, but only with regard to industry, where a similar, although much more subtle pushing aside of the older establishment and its patriarchal authority was taking place. This is the theme of the next two chapters.

Conclusion

The pre-reform era was a period of tremendous ferment, dynamism, and conflict. Reading the reports of that era, one gains a vivid sense of the almost religious fervor with which the party tried to win over the support of the crucially important technical professionals. Both younger and older segments of the technical intelligentsia initially felt on some level that the socialist system could be made to work for them. The older generation operated within an ideological framework that defined its role as that of apolitical experts serving a German state. Professional opportunities and material rewards also provided important incentives for remaining in the GDR. The kind of cultural capital these engineers and scientists possessed was still highly valued in the GDR, and could be readily converted into monetary or symbolic capital. Nonetheless, there was a real stigma attached to being "bourgeois" in the GDR. These professionals had no independent power base and were not protected by institutions or the legal system. Power delegated to them could be withdrawn at any time. They were vulnerable to attack, particularly from within the party. They were perceived as an irritant. On the factory level and in the technical universities, they put up considerable resistance to assimilation into the Party-run system. In particular, they refused to become the junior partners of the workers, and worked to undermine the rise of women and (in some cases) GDR-educated engineers and industrial scientists. Many questioned aspects of the system that appeared detrimental to their efficiency. But until 1961, the Party had to refrain from attacking the engineers, and indeed had to curry their favor, lest it lose their expertise to the West. In addition, Ulbricht liked and trusted technical experts too much to turn on them.

The SED hoped to be able to rely increasingly on a loyal new technical intelligentsia. SED expectations of the younger generation were only partially fulfilled, however. In the era before the Third University Reform, many young engineers and industrial scientists absorbed the values of a largely-intact academic system, dominated by a patriarchal elite, and imbued with the values of science and professionalism. Although young engineering graduates encountered at least some problems with the older generation when they stepped into working life, many absorbed the values of the "bourgeois" engineers and industrial scientists. The relationship between older and younger engineers and industrial scientists was really quite complicated. They were thrown together by the hostility of workers and party cells in the factories, as well as by deprofessionalizing forces: downward pressure on their salaries, lack of housing, and mandatory collaboration with workers on research projects. If anything, newly minted engineers and scientists reacted with particular vehemence to the inefficiencies of the socialist system—the lack of funding, materials, and equipment for R&D, red tape, and difficulties in gaining access to much-needed information. Thus, a kind of negative integration of the new intelligentsia into the old took place from below—with consequences that dismayed the SED.

The Third University Reform sought to secure greater SED control over the universities and thus over the socialization of the new intelligentsia. Jessen and others have described this process of centralization: The quasi-autonomous fiefdoms of traditional university institutes were replaced by departments subordinated to an administration controlled by the Ministry of Higher and Vocational Education. The older generation of professors, many of them not in the SED, were supplanted by department heads selected by the administration, based largely on political loyalty. Young academics no longer competed for a few academic positions on the basis of their scholarly and academic accomplishments, but were guaranteed university posts if they were politically loyal.

Greater SED control over the higher technical professions went hand in hand with expansion. Technology taught men and women to be good socialists. The creation of a mass profession under increasing SED control was thus part of the building of a socialist society.

It was not until the 1960s that a real break from the patriarchal, semi-autonomous structures of the past came. In industry, a similarly dramatic break came, one that was to totally transform power relations and have dramatic consequences for the innovative capabilities of industrial research. I now turn to this theme.

Notes

1. See Jeffrey Kopstein, *The Politics of Economic Decline in East Germany, 1945–1989* (Chapel Hill, NC, and London: University of North Carolina Press, 1997), 27; Karlsch, *Allein bezahlt*?, 122–129; Johannes Bähr, *Industrie im geteilten Berlin (1945–1990)* (Munich: K. G. Saur, 2001), 101–102; Rainer Karlsch and Johannes Bähr, "Die Sowjetischen Aktiengesellschaften (SAG) in der SBZ/DDR," in *Mikropolitik im Unternehmen*, ed. Karl Lauschke and Thomas Welskopp (Essen, Germany: Klartext-Verlag, 1994), 234–238; Zank, *Wirtschaft*, 53–54.

2. See Bailes, *Technology and Society*, 45–63, esp. 51–52; Graham, *Science*, 83–90.

3. SAPMO/BArch DY 30 IV 2/5/1196, "Bericht über die Tätigkeit der Parteiorganisation der Parteigruppen und die Lage im Transformatorenwerk 'Karl-Liebknecht' Oberschöneweide Kreis Köpenick, vom 18.-26.9.1951."

4. SAPMO/BArch DY 30 IV 2/5/1196, "Bericht von der Kreisdelegiertenkonferenz Berlin-Lichtenberg am 24. und 25. Juni 1950." Of 368 delegates, only four technicians and engineers were present.

5. SAPMO/BArch DY 30 IV 2/5/1177, "Bericht über den Instrukteureinsatz im Edelstahlwerk Döhlen, Dresden-Freital, vom 8.-10.3.1951," 1.

6. SAPMO/BArch DY 30 IV 2/5/1196, "Protokoll 12. und 13.11.49—Kreisdelegierten-Konferenz Köpenick," 10a, 4, 26, 3.

7. SAPMO/BArch DY 30 IV 2/5/1196. Further examples in SAPMO FDGB-BuVo A6040, resolution of the executive committee of the *FDGB* from March 9, 1956, number P7/56; SAPMO FDGB-BuVo A4131, "Stellungnahme des Sekretariats des Bundesvorstands des FDGB zur Verbesserung der Arbeit der Gewerkschaften mit der Intelligenz," dated December 14, 1951; SAPMO/BArch FDGB-BuVo A 4599, "Präsidiumsvorlage," dated March 6, 1961.

8. My calculations and estimates, based on SAPMO/BArch DY 30 IV 2/5/1367: Analysen über die Mitgliederbewegung in der Gesamtpartei, "Stand der Organisation am 31.Juli 1946"; "Stand der Organisation am 30.September 1947;" SAPMO/BArch DY 30 IV 2/5/1368, "Stand der Organisation am 31.Oktober 1948;" SAPMO/BArch DY 30 IV 2/5/1369, "Organisationsstatistik für den Monat Juli 1950;" SAPMO/BArch DY 30 IV 2/5/1370, "Berichtsbogen zur Organisationsstatistik nach dem Stand vom Dezember 1952;" SAPMO/BArch DY 30 IV 2/5/1371, "Statistischer Jahresbericht über die Zusammensetzung der Parteiorganisation Gesamtpartei zum 1. January 1957."

9. SAPMO/BArch DY 30 IV 2/2.029/114, "Analyse der Republikfluchten der Intelligenz aus der Elektroindustrie," dated July 10, 1959, 7.

10. SAPMO/BArch DY 30 IV 2/5/1308, "Material für die Bezirksdelegierten-Konferenz Berlin," February 25, 1956, 13.

11. SAPMO/BArch IG Metall 11/910/3528, transcript, dated October 17, 1949.

12. See Kopstein, *The Politics of Economic Decline*, 19–35; Anneli Hartmann and Wolfram Eggeling, "'Das zweitrangige Deutschland'—Folgen des sowjetischen Technik- und Wissenschaftsmonopols für die SBZ und die frühe DDR," in *Der Technikdiskurs in der*

Hitler-Stalin Ära, ed. Wolfgang Emmerich and Carl Wege (Stuttgart and Weimar: Verlag J. B. Metzler, 1995), 195–202; Naimark, *Russians*, 195–204.

13. See Rudi Weidig, *Sozialistische Gemeinschaftsarbeit* (Berlin: Dietz Verlag, 1969), esp. 30–31, 370–423. Also SAPMO/BArch DY 30/IV A2/9.04/265, "Programm zur weiteren Verbesserung von Erziehung und Ausbildung an den Ingenieurschulen des Sektors Technik I."

14. See Günter Erbe, *Arbeiterklasse und Intelligenz in der DDR* (Opladen, Germany: Westdeutscher Verlag, 1982), 182–191.

15. See Martin Hartmann, *Die Neuererbewegung* (Cologne: Verlag Wisseschaft und Politik, 1988). The author analyzes a large number of studies on the Neuererbewegung.

16. BArch F-4 634, report, dated November 11, 1950, 2. Carl Zeiss Archive (Jena), NG 44, meeting of the factory heads on November 7, 1960. On the patent system, also see Kees Gispen, *Poems in Steel: National Socialism and the Politics of Inventing from Weimar to Bonn* (New York: Berghahn Publishers, 2002), 297.

17. SAPMO/BArch FDGB-BUVO A3782, transcript of a meeting on February 16, 1961, 44, 53.

18. SAPMO/BArch FDGB-BUVO A3782, 58, 102.

19. SAPMO/BArch FDGB-BuVo A3383, table III. This data includes basic pay, overtime, bonuses, and other extra pay.

20. SAPMO/BArch DY 30 IV 2/5/1196, "Bericht der Instrukteurgruppe des ZK der Landesleitung Berlin und der Kreisleitung Pankow im VEB Bergmann-Borsig," dated September 13, 1950, 6.

21. Example in SAPMO/BArch DY 30 IV 2/5/1177, "Bericht der Instrukteurgruppe des Parteivorstandes über die Tätigkeit im VEM Transformatoren- und Röntgenwerk Dresden in der Zeit vom 6.-8.Dez. 1949," 6.

22. SAPMO/BArch FDGB-BUVO A3782, transcript of a meeting on February 16, 1961, 16–18, 51–53, quotation on p. 16.

23. SAPMO/BArch DY 30 IV A2/9.04/422, report entitled "Information an die Abt. Wissenschaften beim ZK der SED über die Schwierigkeiten beim Einsatz von Hoch- und Fachschulabsolventen," ⟨undated⟩.

24. SAPMO/BArch DY 30 IV A2/9.04/422, report entitled "Information an die Abt. Wissenschaften beim ZK der SED über die Schwierigkeiten beim Einsatz von Hoch- und Fachschulabsolventen," no date. A survey conducted in the 1950s shows that half of lower administrators and engineers had only completed an elementary-school education. See Baylis, *The Technical Intelligentsia*, 28.

25. SAPMO/BArch DY 30 IV 2/9.04/607, "Einschätzung des Berufseinsatzes der Hochschulabsolventen 1957," esp. 3.

26. My own calculation. This is a crude estimate, based on the assumption that electrical engineers under thirty in the 1950 census had entered the profession after 1945, while older engineers had all entered the profession before; for the "HF" engineers, I used the age of thirty-two as a cutoff. *Sources:* Statistisches Bundesamt, "Volks- und Berufszählung in der DDR am 31.August 1950," 202 and 209, and unnumbered pages for Berlin. Landesarchiv

Berlin, Rep. 404, Nr. 117, "Aufstellung über die deutschen Spezialisten des Werkes für Fernmeldewesen 'HF' mit denen nach dem Stand vom 1.1.1952 Einzelverträge abgeschlossen waren."

27. SAPMO/BArch DY 30 IV 2/5/1308, "Instrukteur- und Brigadeberichte" for Berlin, report, dated August 5, 1955, 6; SAPMO/BArch DY 30 IV 2/5/1349/1, report of a brigade of the Central Committee on the Chemical Works in Buna, dated June 4, 1959, 14; SAPMO/BArch DY 30 IV 2/9.04/607, "Einschätzung des Berufseinsatzes der Hochschulabsolventen 1957," 3; SAPMO FDGB-BuVo A3782, transcript of meeting of the FDGB chair with the intelligentsia on February 16, 1961, 8–9, 34; Carl Zeiss Archive (Jena), NG 55, meeting of the factory heads on July 9, 1956. Young engineers at Zeiss were also unhappy that recently hired skilled workers earned more than they did.

28. SAPMO/BArch DY 30 IV 2/9.04/607, "Einschätzung des Berufseinsatzes der Hochschulabsolventen 1957," 3; SAPMO/BArch FDGB-BuVo A3782, transcript of meeting of the chair of the national executive committee of the *FDGB* with the intelligentsia on February 16, 1961, 8–9, 34; SAPMO/BArch DY 30 IV 2/5/1308: "Instrukteur- und Brigadeberichte" for Berlin, report, dated August 5, 1955, 6; SAPMO/BArch DY 30 IV 2/5/1349/1, report of a brigade of the Central Committee on the Chemical Works in Buna, dated June 4, 1959, 14.

29. These issues are discussed in BArch F-4 461, memorandum, dated May 7, 1951; SAPMO/BArch DY 30 IV 2/2.029/114, "Bericht über die Republikabgänge, Rückkehrer und Zuziehenden im Bereich des Maschinenbaus," dated July 30, 1960, 9; SAPMO/BArch FDGB-BuVo A3385, undated FDGB report (1970), 10–11; SAPMO/BArch FDGB-BuVo A3384, "Probleme der materiellen und ideellen Stimulierung in den produktionsvorbereitenden Bereichen," dated December 28, 1967, appendix, 4.

30. Statistisches Bundesamt, "Volks- und Berufszählung in der DDR am 31.August 1950," 200–209, and unnumbered pages for Berlin.

31. Statistisches Bundesamt, *Ergebnisse der Volks- und Berufszählung am 31.Dez. 1964* (Berlin [GDR] 1967), 233–235. Only 1,829 out of the 412,490 GDR citizens under forty who had a university or college (*Fachschule*) degree (all majors) had completed their degrees by 1945. Of the 91,436 GDR citizens aged forty to forty-nine who had completed their higher education, 13,258 (14.5 percent) finished their studies by 1945. My calculations are based on Statistisches Bundesamt, *Ergebnisse*, 275. There is no reason to think that the age distribution of engineering graduates would be any different. However, it is impossible to estimate how many engineers without a university or college degree entered their profession by 1945.

32. This is merely an educated guess, based on the fact that 59.9 percent of the GDR college- or university-educated population aged fifty or older had completed their degrees by 1945. My calculations are based on Statistisches Bundesamt, *Ergebnisse*, 275.

33. This estimate may be somewhat low because the percentage of engineers without higher education was most likely higher in the older age cohorts.

34. This figure, calculated on the basis of 1971 census data, actually refers to employed persons with engineering degrees. This tremendous generational shift was primarily caused by the educational boom and the demographic "hole" caused by the war. There may also be a distortion here because the 1964 figure is for practicing engineers, whereas the 1971 figure is for persons with engineering degrees. (There were probably more older engineers who had not completed their higher education.) *Source*: Statistisches Bundesamt, *Volks-, Berufs-,*

Wohnraum- und Gebäudezählung am 1. Jan. 1971, vol. 5: *Wirtschaftlich tätige und nichtwirtschaftlichtätige Wohnbevölkerung*, Berlin (GDR) 1972, 114–119.

35. See chapters 4 and 5.

36. Statistisches Bundesamt, "Volks- und Berufszählung in der DDR am 31August 1950," 200–209, and unnumbered pages for Berlin; *Ergebnisse der Volks- und Berufszählung am 31. Dez. 1964*, Berlin (GDR) 1967, vol. 1, 233–235.

37. SAPMO/BArch DY 30 IV 2/9.04/618: "Probleme der Qualifizierung und Förderung von Frauen," 13–14; SAPMO/BArch DY 30 IV 2/5/998, "Information über die Durchführung des Beschlusses des Politbüros vom 5.12.1961 . . . ," dated January 24, 1962.

38. SAPMO/BArch FDGB-BUVO A3782, transcript of a meeting on February 16, 1961, 82–83, quotation on p. 83.

39. SAPMO/BArch, IV 2/5/998, 11: "Information," dated January 24, 1962, 3.

40. TSD, Nachlaß Hartmann, vol. G, 56–57.

41. See Karlsch, *Allein, bezaht*?, 121–124; Bähr, *Industrie im geteilten Berlin*, 93–104; Karlsch and Bähr, *Die sowjetischen* 214–255; see also Matthias Judt, "Die sowjetische Nutzung des Produktions- und Wissenschaftspotentials der ostdeutschen elektrotechnischen und feinmechanisch-optischen Industrie 1945–1955," in *Wirtschaftliche Folgelasten des Krieges in der SBZ/DDR*, ed. Christoph Buchheim (Baden-Baden, Germany: Nomos Verlagsgesellschaft, 1995), 121–129; Wolfgang Mühlfriedel, "Einige Bemerkungen zu den Technischen Kommissionen und den Technischen Büros sowjetischer Volkskommissariate in der Ostzone," in *Wirtschaftliche Folgelasten*, ed. Buccheim, 131–140.

42. NARA CREST, CIA report of May 21, 1951, CIA-RDP83-00415R008200080004-8.

43. See Karlsch, *Allein bezaht*?.

44. NARA, Records of the Army Staff, G-2 Intelligence (319 270/10/33/01), ID Nr. 686230, 1. On the *Oberspreewerk*, see Johannes Bähr, "Das Oberspreewerk," *Zeitschrift für Unternehmensgeschichte* 39 (1994): 145–165; Dieter Hoffmann and Hubert Laitko, "Zwischen Erneuerung und Kontinuität: Rahmenbedingunge ostdeutscher Physik in der Nachkriegszeit," in *Physik im Nachkriegsdeutschland*, ed. Dieter Hoffmann (Frankfurt am Main: Wissenschaftlicher Verlag Harri Deutsch, 2003), 12–13.

45. Landesarchiv Berlin, Rep. 404 Nr. 814, "Betriebsgeschichte."

46. NARA CREST, CIA report of May 21, 1951, CIA-RDP83-00415R008200080004-8.

47. SAPMO/BArch DY 30 IV A 2/6.04/254, report of the District Administration of the SED on VEB Wema Plauen, dated November 26, 1971.

48. SAPMO/Barch DF-4, 40463, "Beschluß zur Förderung und Intensivierung der Forschungs- und Entwicklungstätigkeit vom 27.7.1950"; SAPMO/Barch DF-4, SFT 8, "Zusammengefaßte Auswertung der Jahresberichte der Forschungs- und Entwicklungsstellen 1961 unter Berücksichtigung weiterer Quellen," dated 1962. See also Raymond Bentley, *Technological Change in the German Democratic Republic* (Boulder, CO, and London: Westview Press, 1984), 27–34; Stokes, *Constructing Socialism*, 49. Some of the most important R&D units at VEBs were classified as "scientific-technical centers" (Wissenschaftlich-technische Zentren, or WTZs), though some were not. The central institutes were at first under the

authority of the State Planning Commission, then the Volkswirtschaftsrat, then the industrial ministries.

49. TSD, Nachlaß Hartmann, vol. G, 39–40.

50. BArch F-4, Nr. SFT 8: “Zusammenfegaßte Auswertung der Jahresberichte der Forschungs- und Entwicklungsstellen 1961 unter Berücksichtigung weiterer Quellen,” dated 1962. Also BArch F-4, Nr. SFT 1720, memorandum, dated February 6, 1965; BArch F-4, Nr. 21184: “Information über Ergebnisse und Probleme bei der Durchführung des Staatsplanes Wissenschaft und Technik und des Planes der Naturwissenschaftliche Forschung im Jahre 1966.”

51. SAPMO/BArch, DY 30/IV 2/2.029/177, “Zur Lage und Stimmung unter der wissenschaftlich-technischen Intelligenz,” undated (written between 1960 and 1964, probably 1961 or 1962).

52. See Bentley, *Technological Change*.

53. SAPMO/BArch DY 30 IV 2/5/1196, “Protokoll 12. u. 13.1l.49—Kreisdelegierten-Konferenz Köpenick,” 22a. On the beginning of planning of research: SAPMO/BArch DF-4, 40463, “Beschluß zur Förderung und Intensivierung der Forschungs- und Entwicklungstätigkeit vom 27.7.1950.” See also Bentley, *Technological Change*, chapter 4.

54. BArch DF-4, 40634, report, dated November 28, 1950. On growing acceptance of the planning system: SAPMO/Barch DY 30/IV 2/2.029/177, 183.

55. An example is the materials division of the Institute for Light Construction: BArch F-4, Nr. SFT 1720, memorandum on the visit of Comrades Kraaß and Richter at the Institute for Light Construction, dated February 6, 1965, 3. See also Bentley, *Technological Change*, 61–67.

56. SAPMO/BArch, DY 30/IV 2/2.029/177, “Zur Lage und Stimmung unter der wissenschaftlich-technischen Intelligenz.”

57. SAPMO/BArch DF-4, 40634, report, dated November 28, 1950.

58. Landesarchiv Berlin Rep. 411, Nr. 804, “Die Lage in den Entwicklungsbereichen . . . und Schlußfolgerungen zur Beschleunigung des wissenschaftlich-technischen Fortschritts” (1965, 1966), 1–3; Rep. 411, Nr. 800, “Jahresbericht 1958 der Forschungs- und Entwicklungsstelle;” “Jahresbericht 1962 der Forschungs- und Entwicklungsstelle.”

59. SAPMO/BArch DY 30 IV 2/2.029/114, “Bericht über die Republikabgänge aus der chemischen Industrie,” April 29, 1959, 10; BArch F-4, Nr. SFT 8: “Zusammenfegaßte Auswertung der Jahresberichte der Forschungs- und Entwicklungsstellen 1961 unter Berücksichtigung weiterer Quellen,” dated 1962.

60. My calculations (no totals were given in the original source) are based on Statistisches Bundesamt, “Volks- und Berufszählung in der DDR am 31.August 1950,” 200–209 and unnumbered pages for Berlin.

61. My estimate is based on SAPMO/BArch DY 30 IV 2/2.029/114, reports from the Department for State and Legal Questions, dated December 12, 1958; January 23, 1959; and February 2, 1959.

62. SAPMO/Barch DY 30 IV 2/2.029/177, 379: “Bericht über den Besuch im Werk für Fernmeldewesen . . . am 17.8.61.”

63. BArch, Rep. F-4, Nr. 464: “Maßnahmen zur Verbesserung der Arbeits- und Lebensbedingungen der technischen Intelligenz 1950–53,” draft, dated August 31, 1953, 2.

64. SAPMO/BArch DY 30 IV 2/5/1308: Instrukteur- und Brigadeberichte Berlin, “Material für die Bezirksdelegierten-Konferenz Berlin, February 25, 1956, 13.

65. Landesarchiv Berlin Rep. 411, Nr. 1076: Kaderunterlagen, memorandum on Joachim Jerratsch, August 8, 1955.

66. SAPMO/BArch FDGB-BUVO A3782, transcript of a meeting on February 16, 1961, 48, 49.

67. Landesarchiv Berlin Rep. 404, Nr. 176; quotations on p. 92 and back of p. 55 (letter, dated April 28, 1955, 4). In nine cases, little is known about the motivation of the fleeing engineer.

68. Landesarchiv Berlin Rep. 404, Nr. 176, 55 (letter, dated April 28, 1955, 3, 4).

69. My calculations (no totals were given in the original sources) are based on BArch F-4 40462, cards 1–328 (only cases where birth date is noted); Statistisches Bundesamt, “Volks- und Berufszählung in der DDR am 31. August 1950,” 200–209, and unnumbered pages for Berlin.

70. Carl Zeiss Archive (Jena), NG 44, meeting of the factory heads on August 8, 1960.

71. BArch F-4 461, memorandum, dated October 5, 1950.

72. SAPMO/BArch DY 30 IV 2/2.029/114, “Analyse über die Republikfluchten aus der chemischen Industrie,” undated (sent to Erich Apel on June 8, 1959), 3.

73. SAPMO/BArch DY 30 IV 2/2.029/114, reports from the State Planning Commission (Cadre Department), dated December 12, 1958; July 30, 1960; and April 9, 1960.

74. SAPMO/BArch DY 30 IV 2/2.029/114, report from the Department of Internal Affairs, no date, sent to Erich Apel’s office on June 8, 1959.

75. See Stokes, *Constructing Socialism*, 44.

76. SAPMO/BArch DY 30 IV 2/2.029/114, “Bericht,” dated November 5, 1958, appendix, 2; “Bericht,” dated April 9, 1960, 83, 93–94.

77. Exact figures are hard to find. According to the 1950 census, engineers and technicians made up about 1.5 percent of the workforce. (My calculation is based on Statistisches Bundesamt, “Volks- und Berufszählung in der DDR am 31. August 1950,” 200–209, and unnumbered pages for Berlin.) In 1964 (after a period of tremendous growth of the engineering profession), engineers made up 2 percent of the workforce, and 4.4 percent of the workforce in industry (including the construction industry). Even adding ten thousand scientists to the number of engineers brings the figure for engineers and scientists as a percentage of the workforce in industry only up to 4.7 percent. My calculation is based on Statistisches Bundesamt, *Ergebnisse der Volks- und Berufszählung am 31. Dez. 1964,* Berlin (GDR) 1967, 203, 216, 276–278, 291–294.

78. SAPMO/BArch DY 30 IV 2/2.029/177, 379–417.

79. Author’s interview with Hans-Joachim Pohl, former employee of Carl Zeiss, on November 8, 2004.

80. Author’s interview with Hans Becker, former employee of Werner Hartmann at the Facility for Molecular Electronics (AME), Dresden, July 2000.

81. See André Steiner, *Von Plan zu Plan: Eine Wirtschaftsgeschichte der DDR* (Munich: Deutsche Verlags-Anstalt, 2004), 129–142; a more detailed account appears in André Steiner, *Die DDR-Wirtschaftsreform der sechziger Jahre* (Berlin: Akademie-Verlag, 1999).

82. See Steiner, *Von Plan*, 142–146.

83. See Steiner, *Von Plan*, 143–164.

84. See Olaf Klenke, *Ist die DDR an der Globalisierung gescheitert?* (Frankfurt am Main: Peter Lang, 2001), 106–107.

85. See Jörg Roesler, *Zwischen Plan und Markt: Die Wirtschaftsreform in der DDR zwischen 1963 und 1970* (Berlin: Rudolf Haufe Verlag, 1990).

86. SAPMO/BArch DY 30 IV 2/5/1196, transcript of district SED conference, held November 12–13, 1949, in Köpenick, 4b.

87. SAPMO FDGB-BuVo A3383.

88. Examples in SAPMO/BArch DY 30 IV A 2/6.07/163, resolution, dated December 16, 1964, and memorandum, dated April 5, 1965.

89. SAPMO FDGB-BuVo A3385, undated FDGB report (1970), 10–11. For explanations of the failure of this reform, see Steiner, *DDR-Wirtschaftsreform*, 306–315.

90. SAPMO FDGB-BuVo A3383, "Analyse über einige Probleme der volkswirtschaftlichen und arbeitsökonomischen Entwicklung im I. Halbjahr 1967."

91. See Zachmann, *Mobilisierung*, esp. 243–249.

92. See *Statistisches Jahrbuch der Deutschen Demokratischen Republik 1981* (Berlin: Staatsverlag der DDR, 1981), 304. By contrast, between 1965 and 1970, the number of university students in all other majors grew only 13.1 percent. Growth in engineering programs at *Fachschulen* was more modest.

93. See *Statistisches Jahrbuch der Deutschen Demokratischen Republik 1961* (Berlin: Staatsverlag der DDR, 1961); *Statistisches Jahrbuch der Deutschen Demokratischen Republik 1970* (Berlin: Staatsverlag der DDR, 1970).

94. These include graduates of both universities and *Fachschulen*. My calculations are based on Statistisches Bundesamt, *Ergebnisse der Volks- und Berufszählung am 31. Dez. 1964*, vol. 1, Berlin (GDR) 1967, 276–278, 291–294; *Volks-, Berufs-, Wohnraum- und Gebäudezählung am 1. Jan. 1971*, vol. 5: *Wirtschaftlich tätige und nichtwirtschaftlichtätige Wohnbevölkerung*, Berlin (GDR) 1972, 114–119.

95. SAPMO/BArch DY 30 IV A2/9.04/422, reports, dated May 18, 1962; February 1, 1964; November 12, 1965; December 14, 1965; September 9, 1966; "Begründung zu den Orientierungsziffern . . . 1965"; "Fachberichterstattung 1967."

96. See Zachmann, *Mobilisierung*, 184.

97. SAPMO 2/9.04/477, report entitled "Information über den Stand der diesjähringen Immatrikulation . . . ," dated April 28, 1958, 1; IV 2/9.04/478, "Vorlage f. das Sekretariat des ZKs der SED über Maßnahmen zur Auswahl und Zulassung Direkt-, Fern-, und Abendstudium . . . ," dated January 7, 1959, 2; SAPMO/BArch DY 30/IV 2/6.07/63, 34–36.

98. By this I mean the policy that 60 percent of all university students were to be of working-class or peasant origins. SAPMO/BArch DY 30 IV 2/9.04/479, "Erste Einschätzung der Zulassungsarbeiten . . . zum Studienjahr 62/63."

99. For data on correspondence and night programs at the Technical University of Dresden, see Zachmann, *Mobilisierung*, 187. About 7 percent of engineering graduates in 1960 had gone through a correspondence or night program. The percentage reached a high point of 21.2 percent in 1970, but dropped to 9.4 percent in 1978. On special high school diplomas, see Zachmann, *Mobilisierung*, 245.

100. SAPMO/BArch DY 30/IV 2/904/352, 195–199.

101. SAPMO/BArch DY 30 IV 2/9.04/477, "Information über den Stand der diesjährigen Immatrikuation an den Universitäten . . . ," dated April 28, 1958.

102. SAPMO/BArch DY 30 IV 2/2.029/157: "Diskussionsbeitrag des Gen. Dahlem auf der Wirtschaftskonferenz am 10./11.10.61," 3; SAPMO/BArch DY 30 IV A2/9.04/379, "Information an das Büro für Industrie und Bauwesen," dated February 27, 1963.

103. SAPMO/BArch DY 30 IV 2/9.04/477, "Information über den Stand der diesjährigen Immatrikuation an den Universitäten . . . ," dated April 28, 1958; SAPMO/BArch DY 30 IV 2/9.04/478, "Bericht über den Stand der Zulassungen zum Studium 1959/60"; SAPMO/BArch DY 30 IV 2/9.04/479, appendix to "Maßnahmeplan für die Zulassungsarbeit 61/62," 19.

104. SAPMO/BArch DY 30 IV 2/9.04/478, memorandum, dated March 25, 1959.

105. SAPMO/BArch DY 30/IV 2/904/352. Grades in several other subjects also declined in this period.

106. SAPMO/BArch DY 30 IV A2/9.04/379, memorandum, dated June 29, 1965.

107. SAPMO/BArch DY 30 IV A2/9.04/238, "Bericht des SS für Hoch- und Fachschulwesen über Maßnahmen zur Förderung der Frauen . . . ," undated, probably 1966.

108. Statistisches Bundesamt, "Volks- und Berufszählung in der DDR am 31.August 1950," 200–209 and unnumbered pages for Berlin; *Ergebnisse der Volks- und Berufszählung am 31. Dez. 1964*, vol. 1, Berlin (GDR) 1967, 233–235; Statistisches Bundesamt, *Volks-, Berufs-, Wohnraum- und Gebäudezählung am 1. Jan. 1971*, vol. 5: *Wirtschaftlich tätige und nichtwirtschaftlichtätige Wohnbevölkerung*, Berlin (GDR) 1972, 114–119.

109. This is the central theme of Zachmann, *Mobilisierung*. See also Karin Zachmann, "Frauen für die technische Revolution: Studentinnen und Absolventinnen Technischer Hochschulen in der SBZ/DDR," in *Frauen arbeiten: Weibliche Erwerbstätigkeit in Ost- und Westdeutschland nach 1945*, ed. Gunilla-Friederike Budde (Göttingen, Germany: Vandenhoeck & Ruprecht, 1997), 121–156.

110. SAPMO/BArch DY 30 IV 2/9.04/618, 39.

111. SAPMO/BArch DY 30 IV 2/9.04/618, 39–40. For the specifics, see Zachmann, *Mobilisierung*, 257–262.

112. See Heike Trappe, *Emanzipation oder Zwang? Frauen in der DDR zwischen Beruf, Familie und Sozialpolitik* (Berlin: Akademie-Verlag, 1995).

113. SAPMO/BArch DY 30 IV 2/9.04/618, "Zu Fragen der Beteiligung der Frauen am Hoch- und Fachschulstudium ohne Unterbrechung der Berufsarbeit."

114. See Zachmann, *Mobilisierung*, 254–262.

115. SAPMO/BArch DY 30 IV 2/9.04/618: "Probleme der Qualifizierung und Förderung von Frauen," 13–14, quotations on pp. 13 and 13–14.

116. SAPMO/BArch DY 30 IV 2/9.04/618: "Probleme der Qualifizierung und Förderung von Frauen," 13–14, quotations on pp. 13 and 13–14.

117. See Gunilla-Friederike Budde, *Frauen der Intelligenz: Akademikerinnen in der DDR 1945 bis 1975* (Göttingen, Germany: Vandenhoeck & Ruprecht, 2003), esp. 318–321, 327–329, 335–349.

118. See Zachmann, *Mobilisierung*, 276. For more on this subject, see chapter 7 (this volume).

119. See Jessen, *Akademische Elite*, 175–206.

120. See Jessen, *Akademische Elite*, 184–192.

121. See Jochen Gläser and Werner Meske, *Anwendungsorientierung von Grundlagen-forschung?* (Frankfurt and New York: Campus Verlag, 1996), 102–107; Hubert Laitko, "The Reform Package of the 1960s: The Policy Finale of the Ulbricht Era," in *Science under Socialism*, ed. Kristie Macrakis and Dieter Hoffmann (Cambridge, MA, and London: Harvard University Press, 1999), 44–63.

122. However, she also sees improvements in women's high school education and the cultural climate as other important factors. See Zachmann, *Mobilisierung*, 268–276.

4

In Pursuit of an Electronic Future: High-Tech Pioneers and Communist Bureaucracy in the Ulbricht Era

In West Germany they sing the song "Deutschland, Deutschland über alles," but we put it into practice.

Comment of Dr. Schiller, technical director of the East Berlin Communications Works (HF) as quoted by Gerhart Ziller of HF in 1956[1]

They were among the best and brightest of East Germany—highly innovative individuals who hoped to put the GDR at the forefront of high-tech research. Once star researchers, they had grown into the role of patriarchs by the late 1950s, had become managers of large research projects. Matthias Falter, Werner Hartmann, Paul Görlich, Herbert Kortum, and Heinz Barwich oversaw the early development of (respectively) semiconductors, microelectronics, lasers, computers, and atomic power in the GDR. Without these experts and others like them, East Germany would not have embarked upon a wave of projects whose successes and failures had a major impact on the course of East German history. Their skills, visions, and values helped mold the high-tech sector of the East German economy, which took on ever greater importance.

Falter (1908–1985), Hartmann (1912–1988), Görlich (1905–1986), Kortum (1907–1979), and Barwich (1911–1966) belonged to roughly the same generation. They were physicists who went to work in industrial research before the war. All five conducted military research for the Nazis, as well as for Stalinist Russia. Adherents of the ideology of the "apolitical scientist," they saw themselves as serving the higher good by pursuing scientific truth and technological progress. They were both internationalists and nationalists, in their minds serving the Eastern manifestation of their homeland, Germany.[2] According to one of his top employees, Hartmann saw the Communist system in East Germany as "the more progressive of the two systems," though he saw himself as essentially apolitical. "What he was primarily interested in was scientific and technological progress."[3] The other four probably held similar views.

The Ulbricht era seemed to hold great promise for these and other industrial scientists and engineers. Almost all of those of that generation still alive paint Ulbricht as a leader who did a great deal to promote technological progress and who respected technical expertise. Hansjürgen Pröger, a researcher at Carl Zeiss Jena, wrote in his memoirs, "We enjoyed virtual academic freedom in our industrial research . . . This was clearly a consequence of the political system that we worked under. For "scientific method" was not just in the tradition of Abbe [the founder of Zeiss], but was also highly regarded by the state, particularly in the Ulbricht era, since it was good advertising for the system and it brought world renown."[4]

Hartmann also reacted in a very positive way to Ulbricht: ". . . in public appearances before large, anonymous crowds of people, W. U. [Walter Ulbricht] was not very impressive, particularly since he was not a good speaker. In conversations with smaller groups, however, he was knowledgeable, perceptive, and receptive to the arguments of the person he was speaking with . . ."[5] However, Hartmann would

Figure 4.1
Werner Hartmann, center, speaking with Minister for Electrical Engineering and Electronics Otfried Steger, left, and Walter Ulbright, right foreground. Photo credit: Renée Hartmann

have vehemently rejected Pröger's thesis that researchers in industry enjoyed anything approaching academic freedom in the Ulbricht era. Indeed, his experiences, which will be recounted in detail in this chapter and the next, tell a different story.

What is clear is that technical experts were excited about the possibilities that large-scale projects of this era presented. Some believed that socialism was better equipped to respond to the needs of "big science."[6] In the words of atomic physicist Max Steenbeck, "In capitalism there isn't any money for big things."[7] This was indeed an age of "big things." A grand vision of the advancement of socialism through dramatic technological breakthroughs came to dominate strategic thinking in the SED leadership in the late 1950s. This passionate embrace of modernity (or at least its technological manifestation) goes back, according to Sigrid Meuschel, to a 1952 decision of the SED to shift ideological emphasis from antifascism to the building of a socialist system, a project that quickly took on technocratic elements. Meuschel very much emphasizes that the Communist leadership, though formally rejecting the term "technocracy," saw a certain kind of technocratic approach as compatible with Marxist-Leninism: "The argument that politics should not be based on interests, but on knowledge, that expertise is the only legitimate basis of political decisions, that conflicts are the result of a lack of information or knowledge—such an argument is structurally similar to the customary legitimation of the Marxist-Leninist party's claim to power."[8] Marxist-Leninism and technocratic ideology found common ground in their view of politics as the "administration of things." This "technocratic impulse"—to use Peter Hübner's term[9]—gained particular momentum in 1955 with the post-Stalinist discovery of the importance of "scientific-technological revolution" as a dynamic force central to the building of socialism in the Soviet Union.[10] The high-water mark of technocratic trends can be found in the reform era of the 1960s. In the Sputnik era, the stars no longer seemed out of reach. In 1960, the SED leadership went so far as to discuss the possibility of surpassing the United States in terms of productivity and standard of living.

There certainly were some notable successes, but many of the major projects of the Ulbricht era failed. Some were terminated, others quietly collapsed in stages. The cases discussed in this chapter point to five causes. First and foremost are the gross inefficiencies of the planned economy. Second, the Coordinating Committee for Multilateral Export Controls or CoCom organized Western embargos on goods with military applications to East bloc countries from 1947 to 1994. The United States tried to expand the range of goods covered by the embargos, but its Western partners were interested in limiting CoCom's scope to weapons and other military items. A greater degree of cooperation was, however, achieved in the 1980s, notably with regard to computers and microelectronics.[11] This created considerable problems for East German high-tech industry, which had limited options with regard to computers and microelectronic components: develop and produce them on their own, attempt expensive black-market purchases through essentially illegal channels in the West, or rely on Soviet or Eastern European sources. Third, the Soviet Union was an unreliable partner. As a medium-sized economic player with limited resources, the GDR needed Soviet technical assistance and petroleum, and would have greatly benefited if there had been as great an international division of labor within the East bloc as there was among Western nations. The Soviets were reluctant to pursue international technological cooperation, particularly with the East Germans, because of security concerns, a latent distrust of Germans, and fear of economic rivalry. The Soviet Union provided East Germany with inexpensive petroleum for many years, but greatly cut back on deliveries in the 1970s as economic difficulties prompted the USSR to increase petroleum exports to countries that could pay in hard currencies. The high degree of autarky within the East bloc resulted from economic inefficiencies and resulting scarcities, which motivated economic policymakers to keep as much production for the domestic market or for hard-currency markets. Fourth, precisely the grandiose thinking that won over the support of the technical intelligentsia contributed to the technological and economic failures. The Ulbricht régime attempted economic expansion and technological innovation on a scale that overwhelmed the capabilities of the small GDR, precipitating one economic crisis in 1960–1961 and another in 1969–1970. Ulbricht hoped that the GDR would weather the storm and would eventually reap tremendous rewards from its high-tech policies. Instead, he was forced from power and his successor, Erich Honecker, faced growing debts caused partly by overly ambitious technology policies. A fifth factor that undermined the projects to be discussed in this chapter is inconsistent state support, the causes of which need to be examined.

To what extent did the technical elites influence this decisionmaking process? How much initiative did the elites have on the factory level or in research institutes? To what extent were technological priorities set on this local level? What problems did they encounter with the Communist bureaucracy in their day-to-day work?

In high-tech fields such as electronics research, the central importance of technical expertise gave scientists and engineers more influence and leeway than in other areas. In addition, many of the top researchers such as Kortum, Falter, Hartmann, and Görlich had tremendous prestige as a result of their sojourns (voluntary or not) in the Soviet Union. However, the relationship between the "specialists" and the regime was very complex and ever-changing.

Economic "Wunderwaffen": Returning Specialists and the Promotion of Civil Aviation and Atomic Power

Historians have found it difficult to establish to what extent technical experts returning to East Germany from the Soviet Union in the 1950s influenced the overall shaping of industrial research. Certainly, the SED never wavered in its conviction that it alone had the vision to direct the technical modernization needed to promote the advancement of the socialist economy. The technical elite nonetheless seems to have influenced the decision to develop nuclear power in the GDR, though other factors played a role as well. Throughout the industrialized world there was tremendous enthusiasm for atomic energy in this era, and no less so in the USSR. Nuclear power was particularly attractive to the fossil fuel-poor GDR, which had mainly brown coal, but little lignite, and no natural gas or petroleum.

Anxious to not lose atomic scientists to the West, the East German leadership seems to have created research capacity partly to be able to offer them the kinds of positions they coveted. Historian Mike Reichert believes that the East German atomic program owed much to the initiative of the technical experts: "It was clearly the scientists who, to achieve their goals, succeeded in getting the support of politicians and economic administrators."[12] East German scientists, particularly specialists returning from the Soviet Union, staffed and headed a crazy quilt of newly created institutions.[13] Former specialist Heinz Barwich became the head of the most important atomic research center, the Central Institute for Atomic Physics (*Zentralinstitut für Kernphysik*, or ZfK) at Rossendorf, near Dresden, in late 1956. This institute became involved in reactor building. Gustav Hertz headed a state office in charge of administration and overall coordination of atomic research. Specialists also received academic positions, particularly in the School of Nuclear Physics of the Technical University of Dresden, which existed from 1955 to 1962. Following the suggestion of scientists, the Scientific Council for the Peaceful Use of Atomic Energy was created, giving the East German scientific community an advisory function to the state.[14] Manfred von Ardenne received considerable state support for his private research institute in Dresden, thanks to the high opinion Ulbricht held of him. A few state officials found the existence of a private institute in a socialist state odd, but could do nothing to alter the legal status or privileged position of the institute, which remained a fixture of the East German research landscape until 1989 and beyond.[15] In a 1962 letter to the deputy director of the State Planning Commission, the chancellor of the Technical University of Dresden, Dr. Schwabe, leveled searing criticism at these research institutes, writing, "I have the impression that precisely in this field of research [i.e., nuclear research], many scientists devote themselves to their area of interest without asking whether the economy will ever benefit from it and what resources are used for it." He felt that huge sums of money were being wasted, and "that it is false to allow the scientists themselves to determine the amount of money to be spent on scientific research."[16]

In spite of being given tremendous resources for their work, the physicists had limited power. Barwich, striving to preserve scientific autonomy, tried to forge an alliance with Klaus Fuchs, who became deputy director at the Central Institute for Atomic Physics: "I hoped that together we would form an 'opposition of the future'—naturally within the framework of party policies on nuclear research, atomic technologies, and the nuclear energy program—and that, working jointly, we would be able to virtually control physics in the GDR." These hopes were dashed. The most important Soviet spy to have infiltrated the Manhattan project (and recently released from prison in England), Fuchs owed his primary loyalty to the SED, not to the scientific community.[17]

Scientists, particularly at the Mining Academy of Freiberg (*Bergakademie Freiberg*), lobbied for East German access to uranium from the Wismut mines in Saxony, which were under complete Soviet control, but they were rebuffed time and again. It was very difficult to acquire even small amounts of radioactive substances for experimentation. Barwich's suggestion to import them from West Germany was ignored. East German scientists also found collaboration with the Soviet Union very inadequate. Indeed, the Joint Institute for Nuclear Research, an international center of atomic research in Dubna (established in 1956, and then the site of the world's largest particles accelerator) was dominated and exploited by the Soviets.[18] Heinz Barwich, who was in Dubna from 1961 to 1964 and who defected to the West in 1964, told CIA debriefers that there was a "color line" between the Russians and other East bloc scientists working at Dubna. Foreigners were excluded from the most important research projects, as well as from "'Russian-only' seminars" and certain areas.[19] The Soviets also blocked cooperation in nuclear research within the Council for Mutual Economic Assistance (COMECON).

From 1962 to 1965, the East German government decided to turn to conventional sources of energy and to shut down most of East Germany's nuclear research infrastructure. Historians such as Reichert have argued that they did so for economic reasons—because industry could not produce the necessary factories and equipment, or because atomic energy turned out to be too expensive for the generating of electricity. If true, this would mean that the atomic physicists bore part of the blame for creating a white elephant doomed to failure. However, recently declassified CIA documents provide strong evidence that the Soviets were principally responsible for shutting down East German nuclear research.

In the late 1950s, Heinz Barwich and Werner Hartmann (completely independently of each other) appealed to Ulbricht to do something about the problems of

East Germany's atomic research program, placing the main blame on Soviet unwillingness to support the East German program. Barwich alluded to "numerous instances of Soviet reluctance or outright refusal to supply needed materials and equipment, to provide adequate training for scientists, and to exchange scientific information." Khrushchev brushed off these complaints when Ulbricht presented him with a copy of Barwich's report in January 1959.[20]

A newly released CIA teletype transmitted to the director of the FBI and heads of other agencies on October 15, 1964, summarizes important revelations made by Barwich after he defected to the West. At a 1963 conference, the head of the Joint Institute for Nuclear Research in Dubna, Andronik Petrosyants, "defended the Soviet policy of disengagement of nuclear plant development from the satellites." This statement clearly indicates that Soviet officials had put the brakes on the development of atomic reactors across Eastern Europe. Petrosyants advocated that one 500-megawatt electrical fast reactor be built in Poland or Czechoslovakia to serve all of Eastern Europe. Representatives of all countries involved rejected this proposal, fearing that they would invest a lot of money in the project but receive too little power.[21]

According to Barwich, East German scientists "made an attempt to force Ulbricht to speak to Khrushchev about the new German plan for atomic power" in 1964. However, during the meeting, the Soviets told Ulbricht and Apel to break off work on the "pressurized water reactor." In response, the East German State Planning Commission cancelled funding that had already been approved for work on a reactor that was to be built in Rheinsberg. Soon after, Soviet authorities let it be known that this reactor was to be manufactured in the USSR. Another East German delegation negotiating with the Soviet Union on cooperation in basic research completely left out nuclear research. According to Barwich, "Thus it was again evident that the Soviets wanted East Germany to stop all nuclear research and in essence to close down the Rossendorf Institute [headed by Barwich]." Barwich was disgusted: "It has now become quite evident to me that the Soviet Union does not want East Germany or the satellites to become independent in the manufacture of atomic power equipment." Unhappy with these developments and increasingly isolated as the only major scientist who refused to sign a public statement supporting the building of the Berlin Wall, Barwich fled to the West in 1964.[22]

There were widespread complaints about the collapse of the nuclear program among atomic scientists, including Klaus Fuchs. Some scientists strove to attain at least a measure of autonomy in the production of atomic fuel, among other things through the development of a fast breeder reactor. However, at a dramatic meeting in Moscow in 1967, Brezhnev expressed his utter opposition to the development of a fast breeder reactor in the GDR, fearful of allowing East Germany to acquire the capacity to produce weapons-grade plutonium.[23]

What impact did the abandonment of its nuclear ambitions have on the GDR? Historian Burghard Weiss has argued that atomic energy could have solved East Germany's energy problems, which became quite severe with the energy crises of the 1970s. Certainly, the GDR was in an unfortunate position; it was poor in resources and dependent upon fluctuating Soviet supplies of petroleum. Moreover, East Germany needed to use the precious petroleum supplied by the Soviet Union (in ever-dwindling quantity) to develop and produce petrochemical products, including modern plastics. East Germany would have been spared the pollution caused by the burning of brown coal if allowed to develop nuclear energy. East German reactor designs might have been safer than Soviet designs.[24] However, nuclear energy has rightfully come to be viewed as an inefficient, expensive, and potentially dangerous form of energy. What is unfortunate is not so much the Soviet veto of an independent nuclear energy program as continued Soviet involvement in reactor-building in the GDR. Ultimately, the East German nuclear program must be seen as a wasted effort.

Although not as privileged as the atomic physicists, aeronautical engineers managed to sell the East German leadership on the benefits of a domestic aviation industry. The head of the German aeronautical research effort in the Soviet Union (1946–1952), Brunolf Baade, who joined the Communist Party while in the Soviet Union, enjoyed the full trust and confidence of the Soviet authorities. While in the Soviet Union, he appears to have won both East German and Soviet authorities over to ambitious plans for an East German aviation industry.[25] The German engineers spent their last months in the USSR (1953–1954) working on projects that would help launch this aeronautics program. According to Ferdinand Brandner, another aviation engineer in the Soviet Union, Baade was motivated first and foremost by nationalism, coupled with immense pride in the accomplishments and ability of the Nazi-era research teams from Junkers and BMW: "He wanted to keep the Junkers tradition alive and to preserve our valuable technical experiences in Russia for Germany, so that we would once again be one of the most technically advanced nations . . . Baade believed that with this enterprise we in the Eastern zone were keeping a big gift ready for a united Germany." Baade made a tremendous effort to keep the deported research teams together and move them to the GDR after their release from Soviet captivity. He was largely successful, thanks in large part to poor professional prospects in the West.[26]

Baade oversaw the rapid expansion of this research as the official technical head of the East German aviation industry, as well as the director of the program to develop the "152" passenger jet (based on a military aircraft developed in the Soviet

Union) and the director of the Research Institute of the Aviation Industry of the GDR. Hundreds of German specialists returning to East Germany went to work in aircraft research and production.[27] Baade, along with many colleagues who had gone to the Soviet Union, became a faculty member of the Technical University of Dresden's school of aeronautical engineering, created in 1956 and dismantled in 1961.[28]

Historian Hans-Liudger Dienel believes that aeronautical engineers had a good deal more influence on the political leadership in East Germany than in West Germany. The GDR invested significantly greater resources in aircraft manufacturing than did the Federal Republic. At its height, aircraft manufacturing employed twenty-five thousand in East Germany (versus only 14,000 in West Germany), becoming the most important and expensive industrial research and development project of the late 1950s in the GDR. Engineers were not solely responsible for these investments. Dienel names a welter of motives that also bolstered this policy: a desire to imitate the Soviet model (surely inappropriate in this case because of the great difference in size of the USSR and the GDR); the attractiveness of flying as the most modern form of transportation; competition with West Germany; and the preference for a public means of transportation over driving in privately owned automobiles. However, without the pressure of the engineers, it is unlikely that this megaproject would have come into existence in anything resembling this form.[29]

Assumptions underlying the building of the East German aviation industry were not without merit. An intriguing map published by historian Gerhard Barkleit shows that Baade hoped Berlin would become a major European airline hub. Hoping for rapid European reunification, Baade saw his plans fall prey to the Cold War. Domestic demand was far too weak to sustain the industry. Foolishly, a national airline was founded, linked to the creation of a dense network of passenger airline connections in a country the size of Michigan.[30]

The East German aviation industry sought viability as a supplier of civilian aircraft to the Soviet Union. The decision to shut down the East German aviation industry on February 28, 1961, was the direct result of the Soviet decision to stop importing planes from the GDR, as Barkleit has demonstrated. The parallels to the fate of the East German nuclear industry are quite striking. Huge resources were wasted as a result of this about-face. In internal memoranda, the SED blamed Baade and other members of the old intelligentsia for the failure of the civil aviation program, and they were attacked in factory meetings after the closing down of the program became known.[31] In the long run, the influence of the technical elite was weakened by this episode. Nonetheless, for about a decade, top scientists and a few engineers were able to influence state policies through the Research Council.

Support in High Places

Set up on June 6, 1957, the Research Council (*Forschungsrat*) was an advisory council that (subordinated to the Council of Ministers) provided the East German government with expert advice on technology policy. In the words of its first head (1957–1965), Peter Adolf Thiessen, "We don't decide, we advise."[32] He certainly had ample opportunity to do the latter. A chemist and former director of a major institute of the Kaiser Wilhelm Society, he was on friendly terms with Walter Ulbricht, who was very impressed by Thiessen's expertise and ambitious vision of the GDR's technological future. Ulbricht often met with other members of the Research Council as well.[33] Until the early 1960s, the Research Council had at least some influence on the direction that new research took, as well as on the way the SED leadership saw the technological "big picture."

Scientists and engineers hoped that the council would serve as a much-needed link between the research establishment and the state. Representatives of industrial research divisions came together in "working groups" (*Arbeitskreise*) that addressed specific technological topics. They reported to the plenary of the Research Council (consisting of forty-five members), which in discussions placed technological issues in a larger context, addressing economic and organizational issues, funding, pay, foreign trade, etc. Essentially, the council saw itself as in charge of the entire process of R&D, production, and marketing, and even played a role in higher technical education policy, industrial hiring, and related areas. Individual council members were responsible for particular industries, whose interests they advanced through the writing of working group reports and forwarding of recommendations (sometimes with modifications) to the full council.[34] For example, in his capacity as member of the Research Council, Paul Görlich (head of research at Carl Zeiss Jena) convinced the council to recommend comprehensive reforms that would help the fine mechanics and optics industry overcome the causes of its inability to keep up with the Western competition.[35]

Leading members of the technical-scientific elite such as Thiessen had a very exaggerated notion of the council's real power. They evidently envisioned the evolution of a technocratic system based on a symbiotic relationship between "experts" and party leadership. For example, Thiessen made much of the fact that the Ministerial Council had to provide an explanation each time it did not follow Research Council advice. Thiessen saw this (narrowly defined) executive power as something to be used only in an emergency situation. However, he considered the lack of jobs for many university and college engineering graduates a national emergency. Counting on the resources available to the SED dictatorship, he called for measures that would guarantee every graduate an appropriate job. He also prompted the Research

Council to advocate an infusion of science and technical innovation in industry.[36] These recommendations failed, not because of SED opposition, but because they were very difficult to implement (as discussed in chapter three). There were also tremendous obstacles to acting on the Research Council's recommendations regarding the semiconductor industry. The weaknesses of the East German economic system—rigid planning, over-bureaucratization, and endemic scarcities—stood in the way of implementation.[37]

The council was more successful in pursuing individual technical issues and carrying out technical projects in the working groups. In 1958, for example, the council argued that planned investments for the aviation industry were much too large.[38] The council played an important role in deciding to use silicon (rather than germanium) in microelectronics and to pursue solid-state technologies (which indeed eventually came to predominate over rival technologies).[39] On the other hand, the council seems to have dropped the ball with regard to the building up of microelectronics research. Werner Hartmann, who headed the first research institute in this area, was highly critical of the Research Council because he felt it was dominated by scientists who did not understand the needs of industry.[40]

The building of the Berlin Wall made it seem less important to curry the favor of engineers and scientists who could no longer easily abandon the GDR. In 1961 the Research Council lost its executive powers, and became a mere consultative body. Government officials and party members came to dominate its ranks. From this point onward, the Research Council ceased to be a body in which scientists and engineers could initiate policies. Increasingly, its work was confined to narrow technical projects, though it played a role in the development of research programs in key areas such as cybernetics and semiconductors.[41]

Patronage was another avenue of influence seeking. The older generation of scientists and engineers did not move into the political elite, with the notable exception of Erich Apel (1917–1965). Having worked for Wernher von Braun at Peenemünde during the Nazi period, Apel was taken off to the Soviet Union where he worked on the rocketry program from 1946 to 1952. Starting out as a division chief in the Ministry for Machine Building in 1952, he became a member of the Central Committee of the SED in 1960 (having only joined the party in 1957). As head of the State Planning Commission in 1963–1965, he became Ulbricht's most important economic advisor at a critical juncture in East German history. Much in the style of the Soviet patronage system, Apel developed a patron-client relationship with various research institutes, enterprises, and research directors. Visits, the exchange of letters, promises of resources and protection from bureaucratic tyranny were expressions of his self-styled role as defender and promoter of key industrial research programs. Werner Hartmann's Institute for Molecular Electronics enjoyed his protection. He did not, however, possess the power and resources to move mountains, and his ultimately rather ineffectual activities ended with his suicide in 1965.[42]

In the long run, figures such as Robert Rompe (1905–1993) were more influential; he was precisely the sort of crossover figure between the scientific community and the SED that played such an important role in the Soviet Union. A physicist, he had joined the Communist Party before the Nazi rise to power, and participated in the resistance. He was a member of the Central Committee of the SED from 1958 to 1989, a professor and institute director at the Humboldt University, and high official of the Academy of Sciences.[43] Working for the KGB and the Stasi, he played less the role of a protector of the scientific and engineering communities than of an enforcer for the SED and KGB.[44] However, it is difficult to discern in his recommendations a consistent point of view tied to any institution.

Electronics Plus Soviet Power Equals Communism?[45]

Nuclear and aeronautical research became the centerpiece of early East German technology policy at least in part because expertise in those areas was available and because the GDR feared the consequences if such experts fled to the West. By the late 1950s, however, this hodgepodge approach had been replaced by a vision of systematic modernization through key technologies. Here, the GDR was tapping into worldwide trends. Originating in the development of military systems during the Second World War and the writings of Norbert Wiener on "cybernetics," the "systems approach" became popular in military, government, and business circles during the Cold War, spreading across the globe. It envisioned the creation of systems composed of humans and machines functioning as part of a whole, regulated and guided by computers. It took automation to an entirely new level. Major direction included operations research (the use of mathematical methods to analyze operations within a system), systems analysis (used to analyze alternative projects), and systems engineering (used to design technological systems).[46] In the Soviet Union, automation and "cybernetics" were condemned by Stalin as anathema to socialism, but were embraced during the Khrushchev-era thaw.[47] In an era of increasingly "hot" proxy wars, Soviet military needs also spurred the development of electronics.

Following the Soviet lead, automation was declared a top priority of the East German economy under the second Five Year Plan (approved in 1956). The philosopher Georg Klaus (1912–1974) played an important role in the rehabilitation of cybernetics in the GDR, beginning in 1957.[48] This new priority lent new importance to computerization, and with it semiconductors, electronics, and microelectronics. Underlying this approach was the theory that capital goods industries are the locomotive of economic growth. Akin to electrification in Lenin's day, electronics came to be seen as a key technology, though it shared its prominence with plastics. (In much the same way that electronics was expected to revolutionize large segments of East German industry, so, too, was a "chemicalization" of industry supposed to bring about a systematic modernization of production and consumption.[49]) In 1964, it was declared, "Electronics, along with chemistry, determines the tempo of the technical revolution."[50]

Surprisingly advanced, innovative research on semiconductors, computers, and microelectronics was conducted in the GDR in the 1950s. However, East Germany lost its lead quite early on, and fell further and further behind over the course of time. The brilliance and innovative abilities of Falter, Hartmann, and Kortum were never fully deployed; all three suffered undeserved professional failure. What factors stood in the way of their success?

Falter: Keeper of the Crystal Fire

Semiconductors are essential to modern electronics because of their physical properties. Semiconductors are crystals that contain a mixture of an element or compound with semiconductor properties (such as silicon or germanium) and trace amounts of other elements. (The purity of these crystals is of utmost importance, necessitating the use of clean rooms in production.) Their conductivity can be altered by application of an external current. This makes it possible to use them as electronic switches, providing basic components of logic circuits. Semiconductors became very important with the invention of the transistor at Bell Laboratories in the United States in 1947. This was a period of great opportunity. In 1954, a small Japanese company with 120 employees and very limited manufacturing capabilities began to produce transistors. The Sony Corporation grew out of these very modest beginnings to become one of the biggest electronics corporations in the world.[51]

The East German semiconductor industry, which had existed continuously since the end of the war, was revitalized by a group of scientists. The early GDR was quite advanced in solid state physics, upon which semiconductor technologies are based. The heads of the three leading research institutes in this area, Karl Hauffe, Friedrich Möglich, and Robert Rompe, recommended in 1951 that an institute for industrial semiconductor research be established.[52] Called *Werk für Bauelemente der Nachrichtentechnik* (Works for Telecommunications Components) "Carl von Ossietzky Teltow" (abbreviated as COT or WBN), it was headed by Matthias Falter from 1952 to 1960. It was not affiliated with the Academy of Sciences or a university, but was subordinated to an industrial ministry and was staffed and run by industrial scientists. In 1960, the R&D division of WBN was detached and turned into the Institute of Semiconductor Technology (IHT), which Falter headed until 1964.

A Rhinelander, Falter was born in 1908, the son of an accountant. After high school (the *Realgymnasium*) he had to go to work in industry for a year, had to repeatedly interrupt his university studies to earn money, and in some semesters had a regular job and went to night school. After completing his doctoral degree in technical physics, he went to work for the famed Siemens Corporation. During most of the Nazi era, he worked in industrial research for another company, specializing in electronics. During his stay in the Soviet Union, from 1946 to 1951, he conducted research on semiconductors.[53]

Although Falter was given a National Prize in 1956 for his work at WBN, the files are full of reports seeking to explain poor results of this institute, as well as of semiconductor production facilities in Frankfurt an der Oder and specialized research facilities elsewhere.[54] According to the State Planning Commission, transistor technology was not yet available for use in television sets, radios, instruments for industrial use, and communications equipment in 1959.[55] A Soviet delegation reported in that year that the GDR was five to six years behind the rest of the industrialized world in semiconductor technology. The dependability and stability of East German electronic components were poor because of the lack of clean rooms and other equipment and production facilities that could guarantee extreme cleanliness and dependable temperature control—both absolute production requirements for semiconductors. The very low yield of usable components was attributed to the low level of automation of production and poor technological control of the production process. The report also criticized the scarcity of engineers and industrial scientists; the lack of an institution that was responsible for the construction of equipment and instruments for the semiconductor industry; the almost complete lack of cooperation among industry, universities, and the Academy of Sciences in semiconductor research; and the inability of East German production facilities to provide germanium and silicon in the quantity and quality needed.[56]

In a memorandum dated October 28, 1958, Falter and other top researchers at WBN blamed the system for WBN's poor performance. They argued that inflexible methods of planning and financing research were detrimental to the innovative process. Improvements could not be tried out without endangering plan fulfillment. Growth of factory bureaucracy also hampered research. Further, Falter complained that though WBN was forced to break off contact with West Germany in 1958, "no satisfactory cooperation" had come about with the Soviet Union. (A report of the State Planning Commission confirms this statement.[57]) The Research Council recommended the establishment of an international research center for semiconductor technologies, but the suggestion was ignored.[58] The council also asserted that WBN did not receive the support and guidance it needed from industrial and state authorities.[59] Various measures were taken to improve the situation and to revitalize the semiconductor industry, but little progress was made.[60] In late 1961, it was reported that transistors and other modern components for automation, computers, adding machines, and telephone relays were scarce.[61]

Top economic official Erich Apel sharply criticized the government in 1959: "semiconductor technology has been treated shamefully up until now."[62] However, the overwhelming tendency was to blame Falter for the problems of the semiconductor industry. For example, at a meeting at the State Planning Commission on September 22, 1959, Robert Rompe, a top figure in the East German physics establishment and a member of the Central Committee asserted, "The head of the Central Working Group, Professor Dr. Falter, has not always been able to adequately perform his duties."[63] Distrust of Falter and his institute stood in the way of improvement. When Falter's institute asked for an increase in R&D funds from 1.8 million marks (for 1958) to 11.24 million (for 1959), the request was met with incredulity and mistrust—the authorities asked themselves whether Falter and his employees were going to use these funds for other purposes.[64] The sharpest criticism was leveled against Falter by secret police informants (IMs). One accused him of a "sporadic" work style, a lack of organizational and people skills, and a tendency to lose sight of the main issues by getting wrapped up in unimportant matters.[65] It would be grossly unfair to take this sort of criticism at face value, given that we know almost nothing about this informant's identity and his or her relationship with Falter. One must assume that at least some Stasi informant's used their secret power to avenge themselves against disliked bosses and coworkers. What is clear is that Falter became a scapegoat for policy failures and deep-seated problems of the East German economic and political system. Falter was fired, then given a job with far fewer responsibilities, in 1964. Reports blame him for all the problems of the semiconductor industry, which lagged ten years behind that of other nations.[66] Worse accusations were yet to come, as will be seen in chapter 5.

The same pattern of neglect, Soviet hostility, failure, and blame was to repeat itself in the career of Werner Hartmann.

Werner Hartmann and the Origins of Microelectronics in the GDR

When Werner Hartmann returned from the Soviet Union in 1955, he was given the opportunity to create and build an industrial research institute (*Vakutronik*) in what was then one of the most exciting new high-tech areas: nuclear research. Around 1960, Werner Hartmann came to realize that the East German atomic industry was slowly being shunted aside by the SED leadership. His attention began to turn to

Figure 4.2
Visit of Nikita Khrushchev to the Vakutronik exhibit in the Leipzig Trade Fair, 1959. Left to right: Khrushchev, Hartmann, unknown. Photo credit: Renée Hartmann

another area that held great promise, but which was badly neglected in the GDR: semiconductors and electronics. The poor quality and constant uncertainty about availability of electronic components was the bane of high-tech research. Visiting production facilities attached to Falter's institute, as well as facilities in Erfurt, Hartmann concluded that the problems of this industry were profound: "Everywhere I went I encountered the good will of technical people. But what was almost completely lacking was scientifically grounded work, technological discipline and qualified personnel . . . People continued to use the 'formula of the master craftsman,' [i.e., older, traditional methods] who had been working this way since before the war." Hartmann spoke out on this issue at a meeting of the Scientific Council for the Peaceful Use of Atomic Energy and in memoranda. He was shocked at the difficulties in communicating problems to the SED leadership and very frustrated by their failure to act. He saw the system's inertia as rooted in over-bureaucratization.[67]

A 1960 memorandum Hartmann sent to Rompe and Apel (among others) apparently convinced them to adopt his perspective. Rompe suggested that Hartmann conduct some basic research on "molecular electronics" (an early term for microelectronics) at Vakutronik. However, Hartmann had set his sights higher. He got Apel's approval of a proposal to establish an independent institute, which would conduct research in this area.[68] Hartmann was named head of the first industrial institute for microelectronics, the Facility for Molecular Electronics (*Arbeitsstelle für Molekularelektronik*, or AME), which officially came into existence on August 1, 1961. As the top facility for integrated circuits in the GDR, AME was not just supposed to be an industrial research institute, but also a factory where trial runs were produced. Mass production was then handed over to the Semi-Conductor Works of Frankfurt an der Oder (*Halbleiterwerk Frankfurt/Oder*, or HFW). As the head of AME, Hartmann was theoretically in charge of coordinating microelectronics research and development for the entire GDR, though he was never really given such power. By appointing Hartmann, East German authorities appeared to be committing themselves to monolithic technology (as they called integrated circuits), which was to become the basis of microelectronics worldwide, and which Hartmann had recognized as the most promising of the available technologies as early as 1961.[69]

Before microelectronics, transistors and other electronic components were soldered onto bulky circuit boards to make complete electronic circuits, used in radios, television sets, and other electronic devices. In the USA, researchers searched for a better, more compact, more efficient technical solution. An early precursor of microelectronics, micromodule technology involved printing portions of circuits onto thin wafers of the same size and shape. These wafers were packed together into a cube. Calling this technology "kludge" (a term used in the IT community, meaning clumsy, awkward), Jack Kilby of Texas Instruments invented the first integrated circuit (patented in February 1959). Robert Noyce of Fairchild invented an integrated circuit based on planar technology a short time later. Both variations involved making all the elements of a circuit on a slice of a germanium or silicon crystal. The invention of monolithic integrated circuits (the basis of solid state electronics) unleashed a wave of miniaturization that has continued down to the present day. Bipolar TTL-technology (Transistor-Transistor-Logic) came to predominate. Unipolar MOS-field effect transistors were used for special purposes. In the United States, integrated circuits were first used for military applications and in the space program. However, within a few years, civilian use exploded.[70] If the GDR had poured resources into Hartmann's institute during this period, East Germany could have become an electronics powerhouse that could have rivaled, if not Japan, certainly South Korea. But this was not to be. Indeed, the building of Hartmann's institute, AME, turned out to be a Sisyphean task.

State support for AME was loudly proclaimed again and again. A kind of client-patron relationship developed between Hartmann and Erich Apel, who had risen to be one of two top economic aides to Ulbricht (along with Günter Mittag). Visiting AME on September 14, 1962, Apel gave orders to assembled top bureaucrats not to bother Hartmann and his employees with bureaucratic and political red tape. He also directed the Minister for Machinery, Helmut Wunderlich, to make sure that Prof. Hartmann's orders for machinery, equipment, and any other products of the industries Wunderlich oversaw be filled within two weeks.[71] It was noted at the time, "Apel has spoken with W. U. [Walter Ulbricht]. ME [microelectronics] is to be intensively promoted to avoid the mistakes with semiconductors."[72] At the sixth Party Congress of the SED in January 1963, construction on AME was scheduled for completion by the end of 1963 so that production could begin. AME was to start producing integrated circuits by 1965. Bizarrely, these directives seem to have had no impact whatsoever. Hartmann writes in his memoirs, "These resolutions led to no, absolutely no support in Dresden." (Local officials were in charge of supplying AME with many resources and of constructing buildings.) Hartmann sees this as attributes of the thought processes and behavior prevalent under socialism: "Back then, I came to realize for the first time that resolutions and directives were seen as goals unto themselves, and that the relevant issues were seen as having been taken care of, as having been seen through to the end."[73] Hartmann and the project were enmeshed in never-ending battles for money, adequate buildings, and equipment.[74]

One reason for the lack of support was that AME was a new kind of institute, which did not fit into the usual categories and hierarchies. Rompe blocked AME's joining the Academy of Sciences in 1961, claiming a lack of funds. Hartmann believed that the Academy would have been more supportive than the industrial bureaucracy turned out to be. Oddly, AME was temporarily placed under the Office for Nuclear Research and Technology, because funds were available there. From 1963 to 1964, AME was under the authority of the Economic Council (*Volkswirtschaftsrat*), which was dissolved in 1965 due to incompetence. In 1965, AME joined the socialist corporation for Components and Vacuum Technology (VVB), which was under the authority of the Ministry for Electrical Engineering and Electronics.[75]

An unusually critical report of a top-level unit of the SED from 1963 confirms that AME was grossly neglected by state offices: "The Facility for Molecular Electronics was left almost entirely to its own devices in setting itself up. There was no systematic support or intervention on the part of central state administrative agencies." The cause lay in the "lack of clear responsibility on the central state level." Between 1961 and 1963, at least thirteen top officials were in charge of AME at different times. In a December 1963 meeting regarding AME, representatives of the Economic Council (then in charge of AME), "behaved like interested members of the audience rather than like the responsible representatives of the central state administration." No central office developed a plan of development for microelectronics, so AME had to devise such plans itself without any state commitments.

This neglect is attributed to a "formal administrative style of work in the planning of scientific-technical work." "Due to the weakness of the central administration, the comrades in charge take refuge in writing things down on paper." The report attributed this writing of meaningless reports to a lack of scientific expertise and an overemphasis on production quotas, resulting from the planning system.[76] The economic plan contained mainly goals for production not research. As a research facility, AME had no production goals in the early years of its existence.

The construction of buildings for AME progressed very slowly because the institute was not on a list of economically urgent projects. Housed in buildings used during the war by the Luftwaffe, AME had trouble getting the resources it needed to renovate and expand these temporary quarters. Construction crews were scarce in the early 1960s, and those sent to Hartmann's institute often disappeared after a few days. Bribes improved the situation somewhat. Construction materials were hard to come by, and had to be procured through back-alley channels. In addition, the state administration neglected to make contracts on behalf of AME for the materials and equipment that it needed. It was difficult to recruit qualified personnel, whose number only rose to 210 in 1964. Hartmann felt that far more personnel was needed. According to Hartmann, almost superhuman efforts were needed to finish up work on the chemical laboratories and the department for the construction and assembly of integrated circuits in 1964–1965.[77] Not until 1966 were the first integrated circuits developed. Hartmann was obviously a very energetic man who, in addition to his other duties, personally wrote reams of letters and reports to Apel and other officials, trying to obtain the resources needed by AME.[78]

Despite Apel's and Ulbricht's benevolent attitudes toward AME, in 1964 Hartmann got into trouble with Günther Mittag, who was, along with Apel, one of the two most important economic policymakers.[79] Given the monumental problems he was up against, Hartmann had refused to agree to concrete deadlines in drawing up long-term plans for the institute. Mittag reacted with a blistering attack on Hartmann during a meeting of the Research Council on July 9, 1964. Hartmann recalls this incident:

> He accused me of having shirked my responsibility for microelectronics. Staff members of his division of the Central Committee who had spoken with me at AME supposedly told him that I refused to come up with any sort of work plan [at the institute]. He totally rejected my report. I became very angry during his diatribe, which became louder and louder. . . . I simply answered Dr. Mittag, "If the employees of AME and its head had not had such a strong sense of responsibility, nothing at all would have gotten done down to the present day."[80]

Hartmann asked for a formal inquiry concerning AME's problems. The Research Council agreed to conduct one, but never did. Intimidation and humiliation were part of Mittag's leadership style: He regularly dressed down top industrial managers in large meetings.[81] Such are the methods of dictatorship: They promote conformity, contribute to the isolation of the individual, and deflect potential criticism of the system onto individuals. Such practices were not unknown in Western firms and institutions, but it was a good deal simpler to change jobs in the West.

It is difficult to fathom why Erich Apel, who was present during the meeting, did not defend AME.[82] A few months later, he did see to it that AME was placed on a list of economically urgent projects, effective January 1, 1965. Apel's suicide in December 1965 robbed Hartmann of an important ally. Thereafter, Günther Mittag became the decisive economic policymaker in the GDR. He insisted on absolute obedience, but made decisions on the basis of information supplied by staff members who in Hartmann's opinion were deficient in their understanding of economic and technical issues and lacking firsthand knowledge of industry.[83]

Hartmann asserts that AME never received the support of officialdom during his tenure there: "All our efforts had insufficient or no results: These negative attitudes remained until the plenary session of the Central Committee of the SED in June 1977. This was because of a lack of understanding and foresight on the part of many scientists in the Academy and on the Research Council." The Academy of Sciences ignored microelectronics during this entire period. In scientific circles as well as among the political leadership, integrated circuits were thought to be an "exotic eccentricity" needed only in space travel, but too expensive for commercial electronics. For a long time, micromodule technology was thought to be a less expensive but technically equivalent alternative to microelectronics. At a meeting at the State Secretariat for Research and Technology in 1965, Robert Rompe had very negative things to say about microelectronics:

> Comrade Professor Rompe advocated giving up illusions with regard to the possibility of the development and economic significance of microelectronics. If the GDR is only going to produce calculators for domestic consumption, the use of solid state circuits is not needed. It is absolutely necessary to consider that the costs of developing solid state circuits are very high and the amortization of the costs appears hardly possible. Enthusiasm for microelectronics should not be allowed to lead to the neglect of economic considerations.[84]

This argument was closely linked to the idea that the GDR was too small a country to carry out such a big project in the long run. Visiting AME in January 1965, the Minister for Science and Technology, Herbert Weiz, asked, "Will electronics become a second aircraft industry?" Clearly, the SED had not yet recovered from that disaster.[85]

Hartmann attempted to convince the leadership of the importance of microelectronics, writing numerous articles, letters and speeches, arguing that costs would sink with the transition to mass production. Not until public discussions in West Germany in the mid-1970s did the SED start coming around to this view.[86] But in 1970–1971, there were tremendous cutbacks in state funding for electronics research.[87]

What technology did the GDR propose to use instead of integrated circuits? The SED leadership, in conjunction with Rompe and others, looked for cheaper alternatives. High hopes were placed in "thin film technique," which involved creating circuitry by spraying a thin metal layer onto glass or ceramic wafers. In the GDR variant of micromodule technique, only the passive elements were sprayed onto the wafers; active elements (transistors, for example) were then individually attached. This was a "hybrid technology," which combined the old transistor technology with some degree of integration. It is an odd reflection of the confused priorities of the leadership that they put Hartmann—an advocate of solid state electronics—in charge of their high-tech electronics program, rather than Falter, who continued to advocate hybrid technology until 1965.[88]

One of the most important reasons for the underfunding and general neglect of AME was this pushing of micromodule and thin film technologies.[89] At a 1965 meeting at the State Secretariat for Science and Technology, Hartmann and AME were severely criticized, while orders went out to concentrate resources on thin-film technology.[90] Historian Bernd Wenzel has argued that a grave mistake was made in putting serious effort into further developing these technologies, instead of using them as a stepping-stone to microelectronics.[91] Particularly fateful and wrongheaded was the decision to try to create a GDR-made alternative to silicon-based integrated circuits—a monolithic technique of a unique kind. Involving the spraying of *all* electronic components—including electronically active components—onto ceramic wafers, this East German research program turned into a latter-day search for the North-West passage, a chimeric impossibility.[92] The socialist combine (VVB) in charge of electronic components praised solid state technology over thin-film technology in a 1966 report. But an unknown official of a Research Council commission scribbled in the margin, "Thin-film technology is better for the GDR! The advantages of passive components in thin-film technology are combined with [microelectronic] components."[93] However, thin-film programs of the mid-1960s (KME-2, KME-3, KME-4) ended in failure. (These components were named after the enterprise where they were manufactured, Karl Marx Erfurt, or KME.) KME-3 components used in the computer R-21, manufactured by the East German Robotron corporation, were very prone to malfunction.[94]

The pursuit of thin-film technology was not totally absurd. In the US, it was a transitional technology that was eventually superseded by microelectronics. Even

Hartmann wanted to keep this door open, conducting some research in thin-film technology on the side at his institute. However, where Hartmann's approach differed from that of many bureaucrats and researchers was that he kept a close eye on developments abroad and based his analyses on careful, scientifically-oriented industrial research.[95] Thin-film technique eventually turned out to be a dead end. It should have been abandoned much sooner, particularly since thin-film research took money and resources away from microelectronics.

Could it be that Falter's and Hartmann's institutes suffered from such massive problems because they were new institutes? Certainly, it was hard to get the resources to construct modern building and facilities, to fully equip labs and manufacturing facilities from scratch, and to find highly qualified personnel. Falter and Hartmann did not have the political and social connections needed to acquire these resources. Carl Zeiss Jena did not have any of these problems, since it could build on considerable physical and human resources that survived the war. This prestigious old firm was considered a major source of innovation by the Soviets, then the East German leadership, and was therefore left intact. As the crown jewel of East German industry, Zeiss was given whatever it needed to create and maintain an enviable research infrastructure. This research was primarily in precision instruments—microscopes, photographic equipment, and instruments used in industry. However, Zeiss also had to react to the growing importance of computers and electronics. The career of Herbert Kortum illuminates the opportunities and challenges for pioneering research in these new areas at Zeiss.

Kortum: A Maverick in a Bureaucratic Setting

Herbert Kortum (1907–1979) is about as close to an eccentric inventor as one is likely to find in the conservative ranks of East German industrial researchers of the 1950s. Photos of him taken at Zeiss in the 1950s show a man in a suit with hair that hangs down an inch below his earlobes (figure 4.3)—more befitting of a natural scientist or a conductor than a member of East Germany's grey flannel crowd.[96] In a letter from the Soviet Union in 1948, he expresses his distress over his involuntary exile there. Later writings confirm that he was a highly emotional man, easily upset and not shy about communicating his feelings. He was a brilliant researcher who resisted becoming an administrator, which was the fate of most successful researchers as they approached middle age. However, for all his sensitivity and creativity, he, like many of his generation, had been deeply involved in military research under the Nazis. Herbert Kortum was one of many who helped construct the Nazi killing machine. As a teenager, he was a member of the *Stahlhelm* youth organization, and went on to join the SS in 1931. He headed an SS motorcycle unit in Jena

Figure 4.3
Herbert Kortum (second from left) at Carl Zeiss Jena, 1960s. Photo credit: Carl Zeiss Archive, Jena

in 1933–1935, but largely withdrew from active participation in the SS in 1935, evidently because of growing professional responsibilities at Zeiss.[97] During the Second World War, he was in charge of an office at Carl Zeiss that developed sophisticated electro-mechanical targeting devices for Luftwaffe bombers, including the "Kortum gyroscope."[98] He flew on testing missions, conducted over Jena in two bombers that stood at his disposal.[99] In 1941, he asked whether he could serve the SS in the capacity of an expert on economic and technical issues. In 1941, he asked to be allowed to join Reinhard Heydrich's infamous *Sicherheitsdienst*, which played a major role in the Holocaust. He was turned down because he was thought to be an opportunist, merely interested in promoting his career. A request for his promotion from the rank of *Untersturmführer* to the rank of *SS-Obersturmführer* was submitted in 1942. It was argued that he had made a "great personal contribution to the improvement of our Luftwaffe." In 1943, he received a medal, the *Kriegsverdienstkreuz I. Klasse*.[100]

The technical cunning, skills, and knowledge Kortum acquired during the war provided the basis for his post-war achievements in the areas of automation, computing, and control engineering. After his return from Soviet captivity, he became the head of development at Zeiss (under Paul Görlich, who was head of research). Together with Wilhelm Kämmerer, Kortum headed a team that developed and built the first GDR-made computer, the "Oprema," in 1954–1955. According to his own testimony, Kortum had read up on computer technology during the "cooling-off" period at the end of his years in the Soviet Union, but had not done any actual work on this project before 1954. He vehemently denies the internal Zeiss "legend" that he had begun actual construction of the Oprema before 1954—a story that he believes was used by some Zeiss employees to explain the rapid completion of the project (a feat not to be repeated). The Oprema was an electromechanical, programmable digital computer that used switches, called relays, to denote zero and one. "Oprema" was actually a set of identical twin machines (often spoken of in the singular), which were to remain the only computers of their kind in the GDR. They stayed at Zeiss, taking on a central role in the Zeiss computer center.[101] Kortum was later put in charge of a program to build a second-generation computer, which used electronic components instead of tubes. One of the main goals of this program, according to historian Erich Sobeslavsky, was to produce computers capable of supporting the development of gyroscopes for military aircraft, and Kortum was seen as the leading expert in this field, thanks to his Nazi-era work.[102] Thirty-two ZRA-1's, as they were called, were produced in 1959–1963 and successfully deployed in research, teaching, and industry. It is unclear to what extent they were indeed used for military purposes.[103] Kortum also oversaw the development of a large range of instruments and precision tools.[104]

Kortum found the post-Oprema years difficult, however. In 1958, deeply unhappy about conditions in research at Zeiss, he wrote a book-length report (almost 300 pages long!), which came to be known at Zeiss as the "Kortum Bible." Writing in a somewhat intemperate and highly personal style punctuated with dramatically underlined words and phrases, he outlined what he saw as the causes of the "confused situation" in research at Zeiss, along with a series of possible solutions. The driving force behind his critique was anger and sadness over being taken away from the kind of research work he craved. He felt that his main talents lay in finding weaknesses and problems in new apparatuses, and in solving particularly difficult problems. He had hoped to continue to be able to devote 70 to 80 percent of his time and energy to research, and only 20 to 30 percent to administrative work—as had been the case during his time in the Soviet Union. This had also been possible during the time when he was working on Oprema. However, the "misery" of over-bureaucratization, lack of personnel, and funding shortages at Zeiss forced him to essentially drop true research and devote himself to managerial and administrative duties. Putting in working hours that "constantly approached the limits of what is [physically] possible" did not avail him of the time he needed for research. However, he did not see this as just his own problem. Rather, he was convinced that the problems that dogged him were also to blame for Zeiss's poor performance during that period. He was deeply frustrated that his attempts to convince his superiors of the need for changes at Zeiss had until that point yielded nothing.[105]

Assuring his superiors of his loyalty to the GDR and to Zeiss, Kortum was nonetheless very frank in his critique of "faulty developments in the organization and directing of our enterprise." After Oprema, he never again enjoyed the freedom and support that that project had brought him. The way work was organized in his division changed dramatically. "Unfortunately, it has not been possible to get back to the work style that we used to cultivate." In particular, cooperation between different departments had greatly decreased, due (according to Kortum) to the desire of the factory administration to increase compartmentalization. The factory head had called Kortum's style of cooperation between departments "managerialism" (*Managertum*), a term that reeked of capitalist exploitation. It would seem, judging from Kortum's report, that what upset the head of the factory was Kortum's way of cutting through the chain of command and working together directly with workers and professionals who were not under his supervision. One can easily imagine that as a young man Kortum was a dynamic, charismatic individual who could motivate people to contribute to his project. This seems to have upset the hierarchical thinking of the administration.[106]

However, there was another set of issues in this disagreement. Kortum felt that the research and development divisions, which had enjoyed dominant influence at Zeiss up until 1945, had been relegated to a subordinate position after the war. One major cause, which he failed to acknowledge, was that production took priority over research throughout the East German economy. He hoped that it would be possible to establish new priorities at Zeiss that were starkly at variance from priorities in the rest of GDR industry. Evidently he believed Zeiss and government administrators would do what was necessary because of Zeiss's importance as a major exporter and a producer of instruments and apparatuses needed in automation.[107]

Kortum argued that greater resources had to be devoted to research and development. The prevailing pattern of underfunding and neglect had to be overcome. He advocated the purchase of new machinery and the building of new workshops and laboratories at Zeiss. He argued that the research and development divisions had to be greatly expanded through hiring and training of personnel. To be able to attract the best people, these divisions must be allowed to offer better pay, living quarters, and office space.[108]

Bitterly critical of bureaucratic modes of operation at Zeiss, he hoped to convince Zeiss administrators of the need for reorganization and rethinking of priorities. He depicts an almost Kafkaesque bureaucratic system that distracted R&D personnel from their research, hindered the completion of projects, and smothered innovation. One office, appropriately named the control directorate (*Kontroll-Hauptleitung*), was often extraordinarily slow to check over new products and allow them to go into production. According to Kortum, bureaucrats with little technological understanding were far off the mark in their constant and severe criticism of those working on technical projects. This demoralized technical personnel tremendously. The scapegoats of know-nothing administrators, draftsmen in particular were blamed for failures but never encouraged, offered help, or praised for successes. Kortum identifies fear of being blamed for failures as the chief motivating factor behind this oppressive bureaucratic culture. Bureaucratic procedures were used to absolve administrators from responsibility if innovations failed. Kortum was also very wary of attempts to promote innovation through top-down, theoretical constructs.

Without saying so directly, Kortum implies that political control from above did little to promote innovation, but rather smothered it. He goes so far as to wonder "whether a Zeiss would ever have come to be if such a style of work had been used [in the era of its founding]." He hoped for renewal through the expansion of the power and influence of himself, as director of development, and of the director of research. He does not indicate what might bring about a change of heart in the factory administrator (*Werkleiter*), who was, by his account, hostile to research.[109]

Kortum continued to be disappointed in the lack of change in power relations and methods of operation at Zeiss over the next couple of years. Frustrations over insufficient resources for ZRA-1 added to his unhappiness. This led him to the decision to try to break away from Zeiss, but without totally cutting off the connection. He proposed that two sections of his development division—those for computing and for automated length measuring instruments—be made into the core of a "central institute" for automation. (These central institutes were large research establishments independent of enterprises, but generally under the control of a VVB, or socialist corporation.) He proposed to take several top employees of his division, along with Oprema, ZRA-1, and the entire Zeiss computer center with him. The institute would work closely together with Zeiss, providing Zeiss full access to the computer center. Despite this close connection, he envisioned the institute serving the general purpose of conducting broadly applicable research and developing specific automation technologies for various industries. It was also intended to coordinate the activities of other (smaller) institutes that conducted research in this area.[110]

During a meeting in the summer of 1959, it came to heated exchanges between Kortum and members of the top administration of Zeiss, who vehemently rejected Kortum's proposal. They were concerned that Kortum would strip Zeiss of some of its most valuable resources and personnel without giving much in return. When pressed about his ultimate motives in trying to set up the institute, Kortum pointed to the problems he had outlined in his monumental report of 1958. In the meantime, he had come to the conclusion that the problems of the Zeiss R&D divisions were typical of East German industry, particularly in those areas where "pioneering development is linked to production." Only a decoupling of research and production and the creation of industrial research institutes could give scientists and engineers the freedom they needed to innovate, in his opinion. However, the Zeiss administration was absolutely opposed to detaching a segment of Zeiss's R&D divisions, and, in the end, they had their way.[111]

The Central Institute for Automation (*Zentralinstitut für Automatisierung*, or ZIA), founded on January 1, 1960, had little connection with Zeiss. Zeiss refused to let Kortum take Oprema with him. ZIA was set up in Dresden, rather than in Jena, after it became clear that it would be virtually impossible to construct the required buildings in Jena.[112] It was established as an industrial institute serving all of East German industry. Kortum was thus thwarted in his ambition to create an institute that was an improved version of Zeiss research and development facilities. ZIA proved to be rather ineffective because GDR factories often opted for low-tech automation methods in which ZIA had no particular expertise, and it was disbanded in 1964.[113] Thus, Kortum's plans came to naught.

Görlich and East German Laser Research

Paul Görlich occupied perhaps the most important research position in East German industry from 1952 until his retirement in 1971, first as Chief of Research, later as Director of Research and Development at Carl Zeiss in Jena (figures 4.4 and 4.5).[114] Paul Görlich embodied an industrial research tradition modeled on the university system. However, he owed his tremendous stature not only to this position, but also to his many connections and affiliations with major East German institutions and professional societies at home and abroad. Most notably, he played a major role in both the Academy of Sciences and the Research Council, and was a professor of solid state physics at the Friedrich Schiller University of Jena.

Like many East German researchers of his generation, Görlich came from a fairly modest background. A Saxon and the son of a post office official, he studied at a

Figure 4.4
Paul Görlich (standing), 60th birthday celebration, surrounded by colleagues. Photo credit: Steffen Görlich

Figure 4.5
Paul Görlich, 1966. Photo credit: Steffen Görlich

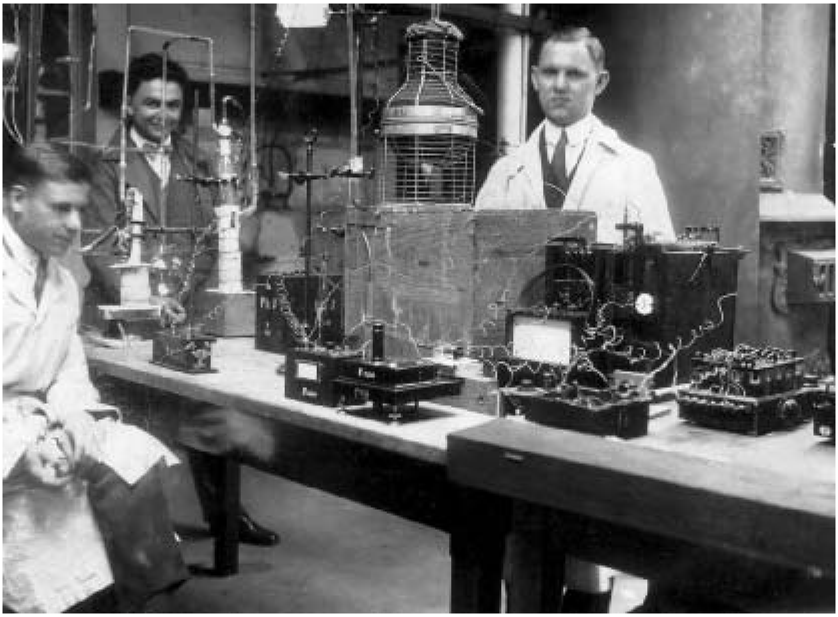

Figure 4.6
Paul Görlich (far left) at the Technical University of Dresden. Photo credit: Steffen Görlich

school of agronomy in the small town of Meissen. Working for a while as a farm manager, he returned to his home town, Dresden, to begin his studies at the Technical University at the age of 21 (figure 4.6). After completing his doctorate in industrial physics (in 1932), he went to work for Zeiss Ikon in Dresden. Thus began a professional life dedicated to Zeiss. An expert in the photo-electric effect, he headed a laboratory for photo-electric cells during the Nazi period.[115] This area of research straddles optics and solid state physics (the basis of modern electronics). He conducted cutting-edge research that was applicable to color movie recording and television cameras, but also to measurement and control engineering. On the side, he completed his second dissertation, the Habilitation, a prerequisite for a university professorship. Publishing his results in leading physics journals as well as in book form, he began to amass a very impressive publication record. Because his research was considered militarily relevant, he was freed from military service. He was a member of the Nazi Party from 1940 to 1945 (having applied for membership just after the beginning of the war), and received a minor medal for his work.[116]

After the war, he seems to have almost immediatedly adjusted to the new military and political realities. The Zeiss-Ikon research unit was evacuated to

Figure 4.7
Paul Görlich with Soviet physicist Petr Petrovich Feofilow, then an officer, 1945. Photo credit: Steffen Görlich

Heidenau, a small town in Saxony, in February to May 1945. Shortly after the Red Army invasion of Saxony, a Soviet physicist (Petr Petrovich Feofilow) serving as an officer, came to the town in search of information on this research and production. He spoke with Görlich, and the two struck up a lifelong friendship, attested to by his son, as well as by a 1945 photo that shows the two in a very genial, relaxed pose (figure 4.7). Görlich evidently felt quite well off at a time when most industrial scientists and engineers were in dire straights. Görlich's research continued with little or no interruption into the fall of 1946.

Görlich's most important later work was in the field of lasers. Lasers produce light that is coherent, or in phase, and thus very powerful. Originally, laser light was produced with a ruby rod. Laser light is produced by a kind of chain reaction, where electrons in the atoms in a medium such as gas are forced to jump from a lower state to a specific excited state and then reemit light of a particular frequency in a coherent way. The original interest in lasers derived from fundamental physics. While the quantum mechanical principle underlying the laser can be traced back to Einstein, the precursor to the laser, the maser (which produces microwave radiation rather than light) was not invented until 1953; the first laser was not invented until 1960 (in the United States). Research led to the production of laser light from a variety of different media. Thus, there were lasers produced in a gas, solid state lasers, and liquid lasers (among others). By the late 1960s, lasers had become a "hot topic." Articles about them filled popular and scientific journals. The "death rays" of comic books and movies captured the imagination of political and military leaders worldwide.

In the 1960s lasers were primarily intriguing scientific toys, used to produce holograms. In the 1960s, they also came to be used in military targeting devices; industrial and medical uses emerged; they came to be used in compact discs and dermatological procedures in the 1980s. They are used to a growing extent for optical data storage and have many medical applications. However, the uses for lasers were far more limited in Görlich's day.

Görlich provides an excellent counterexample to the stories of failure in pioneering high-tech research outlined in this chapter, as a recent study by historian Helmuth Albrecht makes clear. Albrecht's study on laser research in East Germany is worth briefly summarizing here. He shows that Görlich—one of the first scientists in East Germany to realize the significance of lasers—put the full weight of his authority and influence behind the push to begin early development of this technology in Germany. "Lasers will mean a complete revolution in optics," said Görlich in 1962.[117] In general, connections among industry and the Academy of Sciences, the universities, and the Research Council were often ineffectual. However, Görlich's position in these institutions made it possible to marshal the kind of concerted effort that was needed to get pioneering research off the ground. According to Albrecht, it was a French physicist speaking at an annual conference organized by Görlich who introduced the American invention to East German scientists. Görlich inspired a young researcher to build the first East German laser, which evidently took place under the radar of the Academy of Sciences administration. Görlich was able to get the Research Council to establish a Laser Commission in 1962. Nonetheless, Görlich's initiative would have gone nowhere without Robert Rompe's seal of approval.[118]

Görlich and Zeiss played a leading role in industrial laser research and production. The first East German-made, industrially produced laser, exhibited at the Leipzig Trade Fair in 1964, was produced by Zeiss. However, important laser research was also conducted at universities and at various institutes of the Academy of Sciences. Zeiss participated in much of this research, forming close contractual relationships with the Physics Institute of the Friedrich Schiller University of Jena and with institutes of the Academy of Sciences. Zeiss explored the adaptation of laser technologies to a broad array of industrial uses.[119] The GDR was thus not dependent on the Soviet Union for help in developing these technologies. To the contrary: East Germany was initially keen on keeping the Soviets, as potential competitors, in the dark about its laser research, though this proved impossible.[120] But as a result of massive efforts, the Soviets eventually pulled ahead of the GDR in this area.[121]

The biggest challenge to Zeiss came from military research. According to Albrecht, Rompe became a scathing critic of laser research for civilian purposes, maintaining that lasers were primarily of military use. Indeed, an institute of the Academy of Sciences with close ties to the East German military became a major center of laser research, and its head became the director of the Central Institute for Optics and Spectroscopics (the top East German laser institute) in the late 1960s. Zeiss also became involved in military research, particularly the development of laser rangefinders, used in targeting systems in East German and Soviet tanks. Nonetheless, Zeiss was able to fend off a large-scale militarization of laser research, and—together with its partner, the Friedrich Schiller University of Jena—remained the most important center of civilian laser research. The commercially successful LMA 1, a device for spectral analysis that used a laser, imitated American devices in some ways, but also had some features that were original, and better. Eventually the consensus emerged—even Rompe agreed—that the future of lasers lay primarily in their use in industrial and scientific instruments and devices, which was Zeiss's area of specialization. In Albrecht's estimation, the results of the Zeiss research complex were quite respectable in comparison with those from West Germany.[122]

Why did laser research succeed? According to Albrecht the relatively low costs of laser development made this a technology within the reach of the GDR: "One does not need major research facilities, an enormous budget, or hundreds of employees to build a laser in a laboratory and put it to work."[123] While expensive clean rooms had to be built for research and production facilities for microelectronics, laser technologies called for more modest investments. Moreover, lasers could be used to modernize instruments and devices that Zeiss built anyway. Knowledge of laser technologies could be acquired through professional journals.[124]

Zeiss resources also played a role. Görlich had one of the largest East German industrial research divisions at his disposal. However, he faced most of the same problems that plagued Kortum. As secretary of a Research Council working group on precision mechanics and optics, Görlich put together reports that cover much of the same terrain as Kortum's "bible": the neglect of this industry and lack of sufficient funding for research; lack of space; shortages of engineers and industrial scientists; scarcity of housing in Jena; and the deleterious effects of over-bureaucratization.[125] During the reform period (1963–1971), though, the state increased funds available for research at Zeiss.

Görlich himself was another major reason for the success of laser research in the 1960s. Being a man who wore many hats, he could bring together resources and coordinate research in many different institutions, as Albrecht has pointed out. His efforts benefited greatly from reform-era attempts to make cooperation among industry, university, and the Academy of Sciences more systematic, particularly through binding contractual relationships.[126]

He was an industrial scientist of great ability, but ability alone does not explain his success. What were the sources of Görlich's power? First is his important work in the Nazi era, and the prestige that gave him from Zero Hour onward. In the earliest days of Soviet occupation, he was identified by the Soviets as a major figure whose work should be continued, but in the service of Communism. Second were his international connections and prominence within the world scientific community. This gave him status within the GDR and placed him in the scientific vanguard. Third was his cooperative (though non-ideological) attitude. I return to illustration 4.6, which shows Görlich with newfound friend, a Soviet officer, shortly after the Red Army takeover of Saxony. It shows, not a sullen, vanquished Nazi collaborator, but a happy man, a man with his life ahead of him. It was clear that he wanted to dedicate that life to science, but was willing to serve Communist masters. The precise nature of Görlich's relationship with the Communist system will be explored in the next chapter.

Conclusion

In the Ulbricht era, the GDR tried to escape the dilemmas of its small size and precarious geopolitical situation by striving to recapture the position of hightech powerhouse that united Germany had occupied up until 1945. As Germans and Communists, SED leaders were culturally predisposed to embrace such a strategy. But much of the inspiration seems to have come from the impressive contingent of Nazi-era scientists and engineers who decided to remain in East Germany. They had long believed that high-tech solutions were the magic bullet capable of helping their country come out on top. Their deep bond of allegiance to a technology-promoting state survived the deep historical divide of 1945.

But the SED paid both too little and too much attention to the scientists' conceptions of technological development. Its resources limited by the GDR's small size and the inefficiencies of the planning system, the GDR needed to be selective and to ensure that sufficient funding and resources be made available for necessary programs. The SED failed on both accounts. Lacking the ability to evaluate these new technologies, Ulbricht relied on the advice of "bourgeois" experts of the older generation. Barwich, Falter, Hartmann, Görlich, and Kortum were brilliant industrial scientists who grasped the significance of new areas of "technoscience" (that is, areas of technology that made extensive use of scientific advances) and tried to make the GDR competitive in them. There were also engineering visionaries in the GDR, such as Baade. All of them, but Görlich and Hartmann in particular, were very skilled at making their specific research programs work. At times, the Ulbricht regime supported their efforts, at other times it undercut them.

Such "fits and starts" of technological development are typical of command systems, according to Loren Graham. A top-down system, such as that in tsarist Russia or the Soviet Union, can foster rapid development, but the effort is not sustained because spontaneous initiative is stifled.[127] In the early Ulbricht era, individual initiative was still alive, but was starved of independent resources to sustain it through times of state indifference or hostility.

Fluctuations in SED policies were very destructive. Programs were built up, only to be torn down, thus wasting precious resources. One basic problem was that the East German leadership lacked the ability to evaluate these new technologies, and was influenced by "bourgeois" experts of the older generation. The latter induced the SED leadership to press forward in too many areas, establishing expensive research facilities and competing with the West on too many fronts. As a result, funding and resources were spread too thin. A second problem was that the SED did not fully trust the old technical intelligentsia, and stood ready to jettison them and their programs if results were disappointing—not realizing that wavering commitment was a big part of what threatened the programs. A third cause of inconsistent policies was that there was considerable disagreement within the SED about technological priorities. Rompe was a major critic of high-tech programs. But he was no more adept at crystal ball-gazing than his colleagues. Indeed, he undercut the microelectronics program, which would have paid off many times over if properly promoted. Unlike in the Soviet Union, these disagreements appear to be indicative of personal views, rather than rivalries among institutes, disciplines, or major groups (such as the SED, the ministries, or industry).

Conflicted Soviet attitudes toward East Germany (and perhaps toward all the satellite states) were a fourth major factor that undercut consistent high-tech policies in the GDR. The Soviet leadership was interested in transplanting the Soviet model of technological and economic development to these nations, yet was anxious not to allow the Eastern Europeans to surpass their Soviet masters lest Soviet supremacy be challenged. The Soviets seemed particularly distrustful of the East Germans. They pulled the plug on East German aviation and nuclear industries, cut back on petroleum deliveries on several occasions, and failed to share technologies in semiconductors and microelectronics. Moreover, the Soviets blocked international specialization and technical cooperation within COMECON, forcing the GDR to conduct independent research in far too many areas.

SED policymakers achieved the worst of all worlds. Huge resources were sunk into high-tech projects, taking these resources away from alternatives, for example, consumer goods production or a widespread modernization of factories and equipment. But the efforts on behalf of high tech were insufficient, leading to the partial or total failure of these programs. The long-term consequences were very serious. The disasters of the East German microelectronics program in the 1980s could have been avoided if Hartmann's institute had been sufficiently promoted. These disasters eventually contributed strongly to the downward spiral of the East German economy, and ultimately to the fall of Communism.

Barwich, Falter, Hartmann, Görlich, and Kortum represented the era of the great institute directors—respected figures of authority who fought with the political authorities on behalf of their institutes or divisions. With their passing, a science-based, apolitical, internationally oriented culture of innovation began to die, paralleling a fundamental reorientation in East German industrial research.

Why did this happen? Was it part of a modernization process? Was the SED justified in trying to oust Nazi-era scientists and engineers? Were they perhaps as disloyal as they were made out to be? We turn to these questions in the next chapter.

Notes

1. Landesarchiv Berlin, Rep. Rep. 404, Nr. 177, "Information f. Genossen Gerhart Ziller zur Aussprache mit Angehörigen der Technischen Intelligenz im VEB Werk f. Fernmeldewesen" (1956), 3.

2. See Metzler, *Internationale Wissenschaft*. Also see chapter 1.

3. Author's interview with Hans Becker, July 2000.

4. Pröger, *Mikrostrukturen*, 8.

5. TSD, Nachlaß Hartmann, vol. G, 42.

6. "Big science" is scientific research that by its nature requires the use of large facilities manned by big teams of scientists, a characteristic of research in atomic science and certain other fields since the Manhattan Project.

7. Tandler, *Geplante Zukunft*, 58.

8. Meuschel, *Legitimation*, 130; see pp. 117, 123–181.

9. See Peter Hübner, "Menschen-Macht-Maschinen: Technokratie in der DDR," in *Eliten im Sozialismus: Beiträge zur Sozialeschichte der DDR,* ed. Peter Hübner (Cologne, Weimar, Vienna: Böhlau Verlag, 1999), 325–360, esp. 325–341; quotation on p. 331.

10. On the "scientific-technological revolution," see Meuschel, *Legitimation*, 183–184, 192–211.

11. See Michael Mastanduno, *Economic Containment: CoCom and the Politics of East-West Trade* (Ithaca, NY: Cornell University Press, 1992). On the addition of computer and integrated circuits to the CoCom embargo list, see p. 110.

12. Reichert, *Kernenergiewirtschaft*, 142. See also Weiss, "Kernforschung," 297–315.

13. See Thomas Stange, "Die Reinstitutionalisierung der Kernphysik in the DDR," in *Physik in Nachkriegsdeutschland*, ed. Dieter Hoffmann (Frankfurt am Main: Verlag Harri Deutsch, 2003), 155–165.

14. See Reichert, *Kernenergiewirtschaft*, 91–130, 141–144; Burghard Weiss, "Kernforschung und Kerntechnik in der DDR," in *Naturwissenschaft und Technik in der DDR*, ed. Dieter Hoffman and Kristie Macrakis (Berlin: Akademie Verlag, 1997), 303.

15. See Ciesla and Hoffmann, "Wie die Physik auf den Weißen Hirsch kam," 99–110.

16. SAPMO/BArch NY 4182, Nr. 968, 16 and 18.

17. See Barwich and Barwich, *Das rote Atom*, 141–142. Barwich is unfortunately rather vague in his description of his relationship with Fuchs.

18. See Barwich and Barwich, *Das rote Atom*, 139–140; Weiss, "Kernforschung," 309–312; Reichert, *Kernenergiewirtschaft*, 138, 179, 200–204, 218–230, 248–250; Tandler, *Geplante Zukunft*, 62–63.

19. NARA FBI (released by IWG in 2004) (65/230/86/15/07/105), File #134040, Sec. 1 (2 of 3), CIA report, dated November 6, 1964.

20. I have not been able to track down copies of these reports, but am relying on a report that came out of debriefings with Heinz Barwich. NARA FBI (released by IWG in 2004) (65/230/86/15/07/105), File #134040, Sec. 1 (2 or 3), CIA report, dated February 8, 1965. See Weiss, "Kernforschung," 309–310.

21. NARA FBI (released by IWG in 2004) (65/230/86/15/07/105), File #134040, Sec. 1 (2 or 3), CIA report, dated October 15, 1964.

22. NARA FBI (released by IWG in 2004) (65/230/86/15/07/105), File #134040, Sec. 1 (2 or 3), CIA report, dated October 15, 1964, 4, 5. Paul Maddrell has argued that Barwich had been working for the CIA for several years. See Paul Maddrell, "The Scientist Who Came in from the Cold: Heinz Barwich's Flight from the GDR," *Intelligence and National Security* 20, no. 4 (December 2005): 608–630. Maddrell's case is based exclusively on Stasi reports, which do not constitute a dependable source. Several factors make it appear unlikely that Barwich was spying for the CIA. First, he was denied a US visa in 1961. Second, it seems unlikely that he would have been allowed full access to top secret facilities if the Stasi knew him to be a spy. Third, CIA, State Department, and FBI records do not contain any indication that he was spying for the United States previous to his defection. On the other hand, he provided the CIA with a wealth of information after his defection. NARA FBI (released by IWG in 2004) (65/230/86/15/07/105), File #134040, CIA teletype, dated October 15, 1964; CIA report, dated November 6, 1964; CIA report, dated February 8, 1965; CIA report, dated June 16, 1965; CIA report, dated October 20, 1965; United States Mission Berlin, Dispatch No. 119, dated September 15, 1961.

23. See Weiss, "Kernforschung," 306, 312–313; Reichert, *Kernenergiewirtschaft*, 232–248.

24. See Weiss, "Kernforschung," 313.

25. It is not clear whether or not his intervention was decisive. The decision to build an East German aviation industry was made by early 1952, when a special division of the Ministry for Machinery was created to look into the reconstruction of the aviation industry "in keeping with the necessity of strengthening national defense." See Gerhard Barkleit and Heinz Hartlepp, *Zur Geschichte der Luftfahrtindustrie der DDR 1952–1961,* 2nd ed. (Dresden:

Hannah-Arendt-Institut für Totalitarismusforschung, 1995), 3. According to Barkleit, the relevant Soviet documents are not accessible.

26. Ferdinand Brandner, *Ein Leben zwischen Fronten* (Munich and Wels, Germany: Verlag Welsermühl, 1973), 211–212; see pp. 211–213. See also Mick, *Forschen für Stalin*, 179; Barkleit and Hartlepp, *Zur Geschichte*.

27. On Baade, see Sobolew, *Deutsche Spuren*, 246–247. On the employment of returning specialists in the aviation industry, see Ciesla, "Der Spezialistentransfer," 30. (Ciesla does not have an exact estimate.)

28. See Sven Schultze, "Die Herausbildung einer 'Neuen Technischen Intelligenz'—und die wissenschaftliche-technische Vernetzung zwischen Hochschule und Industrie am Beispiel der Fakultät für Luftfahrtwesen der Technischen Hochschule Dresden," manuscript, October 2001.

29. See Hans-Liudger Dienel, "Der Neuaufbau der zivilen Luftfahrt im deutsch-deutschen Vergleich," *Technikgeschichte* 63 (1996): 285–301; Barkleit and Hartlepp, *Zur Geschichte*; Burghard Ciesla, "Von der Luftkriegsrüstung zur zivilen Flugzeugprodukton," in *Beiträge zur Geschichte der Binnenschiffahrt, des Luft- und Kraftfahrzeugverkehrs*, ed. Hans J. Teuteberg (Bergisch Gladbach, Germany: Deutsche Verkehrwissenschaftliche Gesellschaft, 1994), 179–202; Mick, *Forschen Für Stalin*, 179.

30. See Barkleit and Hartlepp, *Zur Geschichte*, 30.

31. See Dienel, "Der Neuaufbau"; Barkleit and Hartlepp, *Zur Geschichte*, 16–29.

32. BArch, DF4, Nr. 362, transcript of recording of the meeting of the Research Council on January 29, 1959, 1.

33. See Tandler, "Geplante Zukunft," 82–97; Hübner, "Menschen-Macht-Maschinen," 341–342; Matthias Wagner, "Der Forschungsrat der DDR" (D.Phil. diss., Humboldt University of Berlin, 1992).

34. SAPMO/BArch DY 30 IV/2/6.07, Nr. 31, 7–48, 358–360.

35. Carl Zeiss Archive Jena, NG 1, "Gruppentagung Feinmechanik/Optik am 26./27.11.1959."

36. BArch, DF 8 Ton [contained in Findbuch, vol. 2], Nr. 357 (Appendix 4), 54–59. SAPMO/BArch DY 30 IV/2/6.07, Nr. 31, 60–70. The following dissertation could not be consulted: Christina Eibl, "Der Physikochemiker Peter Adolf Thiessen als Wissenschaftsorganisator," University of Stuttgart, 1999.

37. SAPMO/BArch DY 30/IV 2/6.04/103, 42–44. Hearings on this subject in SAPMO/BArch DY 30 IV 2/6.04/101, 49–53. See discussion in this chapter.

38. SAPMO/BArch DY 30 IV 2/6.07/63, letter from the Research Council to the State Planning Commission, dated October 13, 1958.

39. SAPMO/BArch DY 30/IV 2/6.07 31, 112–121.

40. TSD, Nachlaß Hartmann, vol. H, pp. 61–64.

41. See Tandler, *Geplante Zukunft*, 126–136; Hübner, "Menschen-Macht-Maschinen," 341.

42. On Hartmann, see chapter 5. On the Soviet system of patronage, see Bailes, *Technology and Society*, 345, 368–380; Graham, *Science in Russia*, 95–97; 174–185. Example of Apel's

attempts to resolve problems faced by the semiconductor industry: SAPMO/BArch DY 30/IV 2/6.07/63. On Apel's suicide, see Rainer Karlsch and Agnes Tandler, "Ein verzweifelter Wirtschaftsfunktionär? Neue Erkenntnisse über den Tod Erich Apels 1965," *Deutschland Archiv* 34 (2001): 50–64. His suicide had nothing to do with these issues.

43. Peter Nötzold and Bernd-Rainer Barth, "Robert Rompe," in *Wer War Wer in der DDR?*, ed. Helmut Müller-Enbergs, Jan Wielgohs, and Dieter Hoffmann, CD version (Berlin: Ch. Links Verlag, 2001).

44. See Dieter Hoffmann and Mark Walker, "Der Physiker Friedrich Möglich (1902–1957)—Ein Antifaschist?" in *Naturwissenschaft und Technik in der DDR*, ed. Dieter Hoffmann and Kristie Macrakis (Berlin: Akademie Verlag, 1997), 368–371; Werner Stiller, *Im Zentrum der Spionage* (Mainz, Germany: Hase und Koehler Verlag, 1986), 269; Kristie Macrakis, "Espionage and Technology Transfer in the Quest for Scientific-Technical Prowess," in *Science under Socialism*, ed. Kristie Macrakis and Dieter Hoffmann (Cambridge, MA: Harvard University Press, 1999), 92–93.

45. The original citation from Lenin is "Communism equals Soviet power plus electrification of the whole country."

46. See Agatha C. Hughes and Thomas P. Hughes, eds., *Systems, Experts and Computers. The Systems Approach in Management and Engineering* (Cambridge, MA: MIT Press, 2000). Of particular interest is David Mindell's chapter, "Automation's Finest Hour: Radar and System Integration in World War II."

47. See Gerovitch, *From Newspeak*. See also the introduction to this book.

48. Jérôme Segal, "Kybernetik in der DDR: Begegnung mit der marxistischen Ideologie," *Dresdener Beiträge zur Geschichte der Technikwissenschaften* 27 (2001): 47–75; Heinz Liebscher, *Fremd- oder Selbstregulation? Systemisches Denken in der DDR zwischen Wissenschaft und Ideologie* (Münster, Germany: Lit Verlag, 1995). On initial controversies about cybernetics and computerization, see Erich Sobeslavsky and Nikolaus Joachim Lehmann, *Zur Geschichte von Rechentechnik und Datenverarbeitung in der DDR 1946–1968* (Dresden: Hannah-Arendt-Institut für Totalitarismusforschung, 1996), 41–44.

49. The first and second Chemical Programs, begun in 1958 and 1964, pushed the development of petrochemicals, including plastics, though the GDR continued to produce coal-based chemicals. On economic priorities of the GDR in this era, see Steiner, *Von Plan zu Plan*, 89, 152–153.

50. SAPMO DY 30/IV A2/6.07 171, Die Durchführung des Beschlusses der Partei zur vorrangigen Entwicklung der Elektronischen Industrie der DDR, 10.4.1964, 1; see pp. 11, 15, 16.

51. See Michael Riordan and Lilian Hoddeson, *Crystal Fire: The Birth of the Information Age* (New York and London: W. W. Norton, 1997).

52. BArch DF4 40701, letter, dated November 8, 1951, from Karl Hauffe, Friedrich Möglich and Robert Rompe to Werner Lange; minutes of meeting held on November 1, 1951.

53. Archive of Bundebeauftrage für die Unterlagen des Staatsicherheitsdienstes der ehemaligen DDR (in following: BStU), MfS Archive Number 1902/67, vol. 1 [part 1] (file Matthias Falter), 22–31 (Abt. XVIII/1 der VB Dresden, report of September 14, 1964).

54. These include facilities at Carl Zeiss in Jena and at the Works for Communications in Oberschöneweide ("HF" or "WF").

55. BArch DF4 40751, State Planning Commission report of October 16, 1959. As a result, the old tube technology was still used in these areas. East German transistors and diodes produced in this era were too low in frequency for these uses.

56. BArch DF4 40751, Bemerkungen der sowjetischen Delegation auf Grund der Bekanntmachungen mit dem Stand, den Plänen der perspektiven Entwicklung der Halbleitertechnik in der DDR und den Bauprojekten der Unternehmen der Halbleiter, 22.12.59.

57. BArch DF4 40751, State Planning Commission report of October 16, 1959. According to the report, the Soviet Union was unwilling to share silicon transistor technologies, due to "difficulties due to the defense sector," 11.

58. Carl Zeiss Archive (Jena), NG 1, "Gruppentagung Feinmechanik/Optik am 26./27. 11.1959," 14.

59. BArch DF4 40751, memorandum, dated August 14, 1958. Also confirmed in SAPMO/BArch DY 30/IV 2/6.07, Nr. 71, 88–90.

60. BArch DF4 40751, State Planning Commission report of October 16, 1959; SAPMO/BArch DY 30 IV 2/6.04, Nr. 101 (1960 Conference of the Electrical Industry), 49–53; SAPMO/BArch DY 30 IV 2/6.07, Nr. 71, 101–123.

61. SAPMO/BArch DY 30/IV 2/6.07, Nr. 71, 62, 72–76.

62. Cited according to SAPMO/BArch DY 30 IV 2/6.07, Nr. 71, 110.

63. BArch DF4 40751, Protokoll über die Besprechung vom 22.9.1959 in der Staatlichen Plankommission, Forschung und Technik, quotation on p. 4.

64. BArch DF4 40751, memorandum, dated August 14, 1958.

65. BStU MfS Archive Number 1902/67, vol. 1 [part 1] (file Matthias Falter), 26–27. (Abt. XVIII/1 der BV Dresden, report of September 14, 1964.)

66. BStU MfS Archive Number 1902/67, vol. 1 [part 1] (file Matthias Falter), 17–18 (Abt. XVIII/1 der BV Dresden, report of August 22, 1964.)

67. TSD, Nachlaß Hartmann, vol. G, 96, quotation on p. 95.

68. TSD, Nachlaß Hartmann, vol. H, 6–7, 17–18. This memorandum ended up in the possession of the Ministry for State Security, which confiscated it for an investigation in 1974–1976. BStU MfS AP444/87 (file Werner Hartmann), 202–204 ("Bereitstellung von Bauelementen für die Elektronik," dated December 14, 1960).

69. Sächsisches Hauptstaatsarchiv Dresden (SächsHStA), collection Zentrum für Mikroelektronik, Nr. 1903/1, Bericht über die Ergebnisse der Arbeitsstelle für Molekkularelektronik und Darlegung der Konzeption für die weitere Arbeit, 23.9.1964, 15; Nr. 2158, Hartmann an Adolph Thiessen, 19.10.1961, 1, 2.

70. See Riordan, *Crystal Fire*, 254–275; "kludge" quotation on p. 258.

71. TSD, Nachlaß Hartmann, vol. H, 36.

72. SächsHStA, collection Zentrum für Mikroelektronik 2158, memorandum L-Nr. 108/62, dated September 14, 1962.

73. TSD, Nachlaß Hartmann, vol. H, 40.

74. TSD, Nachlaß Hartmann, vol. H, 24, 32–35.

75. TSD, Nachlaß Hartmann, vol. H, 19, 20.

76. SAPMO/Barch DY 30/IVA 2/6.07 171, "Konzeption," dated December 28, 1963, sec. 3, quotations on pp. 1 (first two quotations), 8, 11, 14. This was a report of the Working Group for Research and Technical Development, which reported to the Secretaries of the Economic Commission of the Politburo.

77. TSD, Nachlaß Hartmann, vol. H, 24, 32–35, 41, 47–50, 66–67, 70. Hartmann's account confirmed in SächsHStA collection Zentrum für Mikroelektronik, 1903/1, report, dated September 23, 1964.

78. SächsHStA collection Zentrum für Mikroelektronik 2157, Chronik der AME/AMD, vol. I.

79. Mittag was economic secretary in the Central Committee and a member of the State Council.

80. TSD, Nachlaß Hartmann, vol. H, 61–63.

81. See testimony of Christa Bertag (General Director of the Cosmetics Combine Berlin) in Theo Pirker, M. Rainer Lepsius, Rainer Weinert, Hans-Hermann Hertle, *Der Plan als Befehl und Fiktion* (Opladen, Germany: Westdeutscher Verlag, 1995), 248–249.

82. Apel had become vice-chairman of the Council of Ministers and head of the State Planning Commission. He was a member of the Central Committee and a candidate for the Politburo. He and Mittag were involved in a struggle for supremacy in economic policy.

83. TSD, Nachlaß Hartmann, vol. H, 64, 68.

84. SAPMO/BArch DY 30/IV A 2/6.07, Nr. 171, transcript of meeting on February 1, 1965 at State Secretariat for Research and Technology, 6.

85. See Burghard Ciesla, "Die Transferfalle: Zum DDR-Flugzeugbau in den fünfziger Jahren," in *Naturwissenschaft und Technik in der DDR*, ed. Dieter Hoffmann and Kristie Macrakis (Berlin: Akademie-Verlag, 1997), 193–211; Barkleit and Hartlepp, *Zur Geschichte*.

86. TSD, Nachlaß Hartmann, vol. H, 6, 41, 47–51, 77–80. For an example of one of Hartmann's publications, see "Warum integrierte Mikroelektronik?" *Nachrichtentechnik* 15, no. 1 (1965): 1–5.

87. See Gerhard Barkleit, *Mikroelektronik in der DDR* (Dresden: Hannah-Arendt-Institut für Totalitarismusforschung, 2000), 21.

88. See Matthias Falter, "Mikroelektronik, ein neuer Weg in der Schaltungstechnik," *Nachrichtentechnik* 15, no. 8 (1965): 282–287. Cited according to Bernd Wenzel, "Ein Beitrag zur Geschichte der Mikroelektronik unter besonderer Berücksichtigung der Entwicklung der Halbleiter- und Mikroelektronik in der DDR" (Dissertation B, Technical University of Dresden, 1989), 83. See Wenzel for comparison of Hartmann and Falter.

89. For details, see Dolorcs L. Augustine, "Werner Hartmann und der Aufbau der Mikroelektronikindustrie in der DDR," *Dresdener Beiträge zur Geschichte der Technikwissenschaften* 28 (2003): 3–32.

90. SAPMO DY 30/IV A2/6.07 171, Protokoll der Beratung über Grundfragen der Mikroelektronik am 1.2.1965, 9.

91. See Wenzel, *Ein Beitrag*, esp. 90–95.

92. Landesarchiv Berlin, Rep. 404, Nr. 525, Darlegung zur Perspektivplankonzeption der VVB RFT Bauelemente und Vakuumtechnik, dated April 4, 1966, 23.

93. Landesarchiv Berlin, Rep. 404, Nr. 525, Darlegung zur Perspektivplankonzeption der VVB RFT Bauelemente und Vakuumtechnik, dated April 4, 1966, 15–20, 22–27, quotation on p. 26; Stellungnahme zur Darlegung, dated May 18, 1966, 5–8.

94. TSD, Nachlaß Hartmann, vol. H, 251, 253.

95. TSD, Nachlaß Hartmann, vol. H, 56–57, 128, 168; SächsHStA collection Zentrum für Mikroelektronik 2160, memorandum L-36/63, dated August 28, 1963; SächsHStA collection Zentrum für Mikroelektronik 1903/1, Arbeitsprogramm Aktive Dünnfilmelemente, dated June 12, 1964, 1, 2. AME never devoted more than 10 percent of its total capacity to thin-film techology.

96. Carl Zeiss Archive (Jena), BACZ 27995. Also in Wolfgang Mühlfriedel and Edith Hellmuth, *Carl Zeiss in Jena 1945–1990* (Cologne, Weimar, and Vienna: Böhlau Verlag, 2004), 176. Grey flannel does not literally seem to have been popular in the GDR, yet the attitudes among industrial professionals were akin to those encountered by the character played by Gregory Peck in *The Man in the Grey Flannel Suit*.

97. NARA SSO SS Officer Dossier, Roll Nr. A 3343, SSO-203A, “Lebenslauf des SS-Oberscharführers Herbert Kortum,” dated December 17, 1934; letter, dated February 5, 1941.

98. Carl Zeiss Archive (Jena), Namenskartei (names catalogue), and Kortum. See also Pröger, *Mikrostrukturen*, 83.

99. NARA (National Archives and Records Administration) SSO SS Officer Dossier, Roll Nr. A 3343, SSO-203A, letter from Kortum to Chief of the SS Personnel Office, SS-*Gruppenführer* Schmidt, dated February 5, 1941. See also Pröger, *Mikrostrukturen*, 83. Kortum oversaw development of equipment that calculated when to drop a bomb and that assured the bomber would not be over the target on impact.

100. NARA SSO SS Officer Dossier, Roll Nr. A 3343, SSO-203A, letter from “Sicherheitsdienst des Reichsführers SS” to “Reichssicherheitshauptamt,” dated May 28, 1941, esp. 2; note, dated November 28, 1943; “Beförderungsvorschlag,” dated September 19, 1942; “Begründung,” dated September 23, 1942.

101. Carl Zeiss Archive (Jena), BACZ 27995; Carl Zeiss Archive (Jena), BACZ 24500, report from May 1958, 95–104. See also Mühlfriedel and Hellmuth, *Carl Zeiss*, 175–177.

102. See Sobeslavsky and Lehmann, *Zur Geschichte*, 30–32.

103. Carl Zeiss Archive (Jena), VA 1733. See also Manfred Möhring, “Einige Aspekte der frühen Informatikentwicklung n der DDR, insbesondere in Dresden und Jena,” *Dresdener Beiträge zur Geschichte der Technikwissenschaften* 19 (1991): 49–51; article on pp. 45–54.

104. Carl Zeiss Archive (Jena), BACZ 24500, report from May 1958, 87–88. Only 7.6 percent were rebuilt pre-1945 apparatuses; 29.5 percent were improved pre-1945 products.

105. Carl Zeiss Archive (Jena), BACZ 24500, quotations on pp. 1, 2, 2–3.

106. Carl Zeiss Archive (Jena), BACZ 24500, 4, 95–104; quotations on pp. 4, 101.

107. Carl Zeiss Archive (Jena), BACZ 24500, 168, 228–233.

108. Carl Zeiss Archive (Jena), BACZ 24500, 179, 181, 183–184, 253–274.

109. Carl Zeiss Archive (Jena), BACZ 24500, 177–178, 188–218, 248, 276–278; quotation on p. 217.

110. Carl Zeiss Archive (Jena), BACZ 23847, transcript of a meeting on July 31, 1959.

111. Carl Zeiss Archive (Jena), BACZ 23847, quotation on p. 9.

112. Carl Zeiss Archive (Jena), BACZ 23847, report, dated October 20, 1959; memorandum of meeting on September 9, 1959; transcript of a meeting held on November 21, 1959.

113. See Ralf Pulla, "Messen—Steuern—Regeln," in *Innovationskulturen und Fortschrittserwartungen im geteilten Deutschland*, ed. Johannes Abele, Gerhard Barkleit, and Thomas Hänseroth (Cologne: Böhlau, 2001), 213–246.

114. Carl Zeiss Archive (Jena), Namenskartei (name catalogue), Paul Görlich.

115. Examples of current uses of this technology are in the solar cells of pocket calculators and in the photo-electric eyes that open doors automatically.

116. BStU MfS, Archive number 14254/69 (file Paul Görlich), vol. 6, pp. 98–99 (report of Hauptabteilung XVIII/5/2, Berlin, dated October 11, 1966). Carl Zeiss Archive (Jena), BACZ 19601, "Prof. Dr. ing. habil. Paul Görlich." Nazi party membership information in: NARA NSDAP Ortskartei Roll # A-3340-MFOK-F079. His request to join went in on December 5, 1939. He became a member on February 1, 1940.

117. Mühlfriedel and Hellmuth, *Carl Zeiss*, 172.

118. See Helmuth Albrecht, "Laserforschung in Deutschland 1960–1970" (Habilitation thesis, University of Stuttgart, 1996), 59–82, 182–189. Also important: Reinhard Neunhöffer, "Jenaer Lasertechnik zwischen Wissenschaft, Wirtschaft und Staatssicherheit" (D.Phil. diss., University of Stuttgart, 2001).

119. Carl Zeiss Archive (Jena) VA 0984, letter, dated April 1, 1963, to Weiz; 1963 report entitled "Laser-Entwicklung im VEB Carl Zeiss Jena;" transcript of meeting on August 28, 1964. Carl Zeiss Archive (Jena) NG 105, "Zuarbeit von FEKoopr zur Vorbereitung des Referates des GD."

120. BStU MfS, Archive number 14254/69, vol. 2 (file Paul Görlich), 36–37 (report of Hauptabteilung III/6/S, dated October 24, 1962).

121. Carl Zeiss Archive (Jena) NG 119, "Einschätzung der Konkurrenz-Erzeugnisse auf dem Gebiet der Festkörper-Laser," dated February 24, 1965.

122. See Albrecht, "Laserforschung," 194–195, 264–316, 340–355, 414–423, 435. Zeiss also had contractual ties with institutes of the Academy of Sciences; see pp. 337–340, 365–367. On the LMA 1, see Manuel Schramm, "Präzision als Leitbild? Carl Zeiss und die deutsche Innovationskultur in Ost und West, 1945–1990," *Technikgeschichte* 46 (2005): 35–49, 40–41.

123. Albrecht, *Laserforschung*, 82.

124. Albrecht, *Laserforschung*, 159–173.

125. Of course, these reports were about the industry as a whole, not just Zeiss. Carl Zeiss Archive (Jena) NG 55, memorandum of meeting with Rompe on June 18, 1952; talk given on the same day by engineer Günther. Carl Zeiss Archive (Jena) NG 91, "1. Entwurf," 1959. Görlich makes particularly acerbic comments about the control directorate under point 3.32. Also Carl Zeiss Archive (Jena) NG 1, "Gruppentagung Feinmechanik/Optik am 26.27.11.1959."

126. Carl Zeiss Archive (Jena) VA 826, "Diskussionsbeitrag auf der Staatsratssitzung am 12.3.1970."

127. See Loren Graham, "The Fits and Starts of Russian and Soviet Technology," in *Technology, Culture, and Development: The Experience of the Soviet Model*, ed. James P. Scanlan (Armonk, NY, and London: M. E. Sharpe, 1992), 3–24.

5

The Old Guard under Attack: Three High-Tech Research Directors in the "Reform" Era and Beyond

Relations between state and technical elites began changing in fundamental ways in the 1960s, culminating in the emergence of a new, SED-dominated model of industrial research under Erich Honecker. The Ulbricht era has long been seen as a period in which industrial research enjoyed relative autonomy. Important elements of the research system and research culture of the Nazi era (which itself was derived from pre-Nazi industrial research) survived into this period: the dominance of science-based conceptions of industrial research; the importance of formal academic training for personnel; hierarchical organization modeled at least in part on the organization of universities; reliance on incentives and appeals to professionalism rather than compulsion to recruit and motivate research personnel and to direct research programs; reliance on state contracts; and relative flexibility in the design of specific research agendas.[1] Aspects of the culture and organization of Soviet industrial research that were adopted include the planning system, the cadre and nomenclature systems, the Academy of Sciences system; and emphasis on applied research. However, centralization was not as great; ideology played a far lesser role in East German industrial research; and links between research and production were closer than in the Soviet Union.

By the 1960s, the SED, or certain elements within the SED, and the secret police, or Stasi, became unhappy with the power and perceived autonomy of industrial research directors such as Hartmann and Görlich. Employing a complex mix of negotiation and coercion, the party and the Stasi tried to shift power relations in their favor. These developments paralleled "reforms" in the university system and in the Academy of Sciences designed to break the autonomous power of prominent academics and academicians (the "Third University Reform" of the late 1960s and the "Academy Reform"). These were touted as attempts to modernize the structure of the East German universities and research infrastructure, an argument that cannot be dismissed out of hand. Could such an argument be made for industrial research? Was the older generation of the research elite disloyal to the socialist system? Were they a caste of dinosaurs, resistant to change?

To discuss modernization of research management, we can look to the literature on the United States. Research management may sound like an oxymoron or a rather colorless topic, but in fact it has been one of the most important factors in success or failure of industrial research in the era since the Second World War. Thomas J. Hughes identifies it as the most important factor in the rise of U.S. industrial might in that period. He has identified at least four salient features of U.S. research style as it emerged from big military projects (such as SAGE, an air defense system, and the ARPANET, a precursor of the internet). The first is a "collegial, meritocratic management style" (as opposed to a hierarchical one). The second is the use of "transdisciplinary teams of engineers, scientists, managers." The third is custom design of system components that work together in a network rather than the use of interchangeable, mass-produced parts. The fourth is the acceptance of constant change rather than the search for technologies that will be in place for a long time. Hughes and economist William Baumol have suggested fifth and sixth characteristics: the application of high-tech innovations, originally developed for military uses to consumer products;[2] and the high degree of communication and interchange of elites among corporations, which tended to minimize company secrets and stimulate scientific exchange and technological progress.[3] All in all, the post-war research system represented a departure from earlier American practices—a rapid and radical modernization of research management.

How does this compare with German cultures of innovation? First, management style was highly hierarchical and patriarchal, though institutional structures were decentralized. An institute director, like the holder of a university chair, wielded tremendous power. Moreover, formal degrees counted for a great deal in Germany, a factor that increased inequality among research personnel. On the other hand, managers often rose from the ranks (unlike in France, for example, where they were recruited from the *grands écoles*). Second, traditionally, and up into the 1960s, little attempt was made to bring together engineers, scientists, and managers of different disciplines in Germany. Regarding the third point (the turn away from mass production), despite the popularity of Fordism (a rationalization strategy that took advantage of the efficiencies inherent in mass production) in the inter-war period, custom design was certainly common in certain fields. As in the United States, there was a bias in favor of high-tech solutions in Germany (a tradition that lasted well into the postwar era). However, large networks such as existed in the United States were uncommon in Germany. Fourth, though during wartime Germany was certainly capable of radical innovation, both Germanies returned after 1945 to an older tradition characterized by gradual innovation—in other words, refinement and improvement of technologies pioneered elsewhere. With regard to military research and consumerism (point five), the situation in Germany was quite different from that in the United States. After the war, both Germanies were forbidden to engage in military research, although both eventually returned to it to a moderate degree. But the German engineering tradition emphasized engineering for the engineer rather than for the consumer anyway, an attitude which lived on in the post-war period. And sixth, up until 1945, exchange of ideas and employees across company lines was rather common in Germany.[4]

The East German government's policies had certain modernizing aspects. Certainly the importance of big science and big technology (i.e., big projects involving large numbers of scientists or engineers and large-scale facilities and instruments) were recognized by the SED.[5] There was a definite desire to shake up the power structures that existed in the scholarly community and in the research establishment. It is important to ask whether the engineers and industrial scientists that the SED increasingly eased out of positions of power were disloyal to the system.

In attempting to answer these questions, this chapter looks at Werner Hartmann, Matthias Falter, and Paul Görlich as top research managers, focusing on critical phases of their careers.

Görlich: A Conservative Innovator Confronts Change

Paul Görlich's overall research strategy—and in fact his way of looking at the world—were quite conservative. He was an introverted, surprisingly private person, remembered with great fondness by surviving members of his family. According to his nephew, Klaus Jüttner, he had self-confidence, but was "of great personal modesty." His Catholic faith revealed itself, not so much in religious observance as in his work ethic. There was no trace of self-pity when he spoke of his years in the Soviet Union. His nephew's assertion that Görlich did not behave like a patriarch is confirmed by his son, Steffen Görlich, who says that his father educated him "not with strictness, but by providing a model." Irmgard Görlich, Paul Görlich's wife, describes him as a generous person with a "good heart." Görlich appears to have shielded his family from the conflicts of his professional life, and told his son very little about his past.[6] For him (as for many in that time and place), traditional family life provided a haven in a hostile world. He also very much fit into the bourgeois mold of an educated person. He was, for example, an accomplished pianist who loved to play Chopin.[7] His house was filled with books of all kinds.[8]

After the war and after his period of involuntary service in the Soviet Union (1946–1952), Görlich devoted himself more and more to research management and less and less to actual research. He was utterly dedicated to promoting the advance of research in his field, and did not allow himself to be distracted. Stasi records imply that he had little talent or inclination as a manager of people, and interacted less and less with the employees under his authority.[9] On the other hand, Hansjürgen Pröger has quite a different memory of him: "[He was] one of the last who were experts in their field and who [at the same time] embodied what one imagined a scientific superstar to be. Not one of those cold, calculating managers from the top floor, or a technocrat, but conscious of being part of the exclusive cream of highly paid GDR scientists. At the same time, he was not at all arrogant, but rather jovial, humorous, and generally in a good mood and approachable."[10] It is difficult to reconcile these two pictures, though one must bear in mind that some Stasi informants were intent on defaming those they reported on. What is clear is that Görlich delegated a good deal of day-to-day administrative and managerial work to his subordinates, such as Hubert Pollack.[11]

Görlich was first and foremost a traditionalist. Zeiss provided the safe and stable microcosm in which Görlich could pursue his professional goals. For Görlich as well as for many other top researchers at Zeiss, it was important to preserve, protect, and expand Zeiss, building on the tradition of the enterprise's nineteenth-century founder, Ernst Abbe. Their approach was conservative. Many at Zeiss were determined to try to prevent Zeiss from becoming involved in substantially new areas. Their priority was preserve the Zeiss tradition in optics (Görlich's field) and precision instruments, though they did understand the necessity of constant technical improvement and modernization.[12] An ideology of "German quality work" and precision reigned supreme at Zeiss. Görlich vehemently defended the Zeiss tradition during the period when the Jena firm had to defend its use of the Zeiss name against the West German Zeiss corporation.[13]

The rigid vision of Zeiss's mission in the world led Görlich and others to reject several high-tech projects. Görlich initially failed to grasp the importance of electronics for modern precision instruments.[14] He was hostile to Kortum's attempts to secure a leading role for Zeiss in the computer, automation, and electronics revolution.[15] Görlich made a serious error in not cooperating with Werner Hartmann's microelectronics institute, which urgently needed instruments not yet manufactured in the GDR. Zeiss was the logical choice of a partner, since printing and photographic techniques were used in microelectronics. However, Hartmann's 1963 attempt to establish a formal cooperative relationship in this area with Zeiss was brusquely rebuffed by Görlich, even though he had known Hartmann since the 1930s. Görlich is said to have forbidden his employees from speaking of this "idiocy," as he referred to microelectronics.[16] Zeiss refused to supply AME with microscopes and other specialized devices that officially could not be imported because of the CoCom embargo on high-tech exports to Soviet bloc nations,[17] but which, in fact, could be procured at very inflated prices through black-market channels with the help of the Stasi.

According to Pröger, most engineers and scientists at Zeiss were very dismissive of microelectronics for use, for example, in transistor radios. "Today I still see before me a head of development who said that it was all insanity; there was no reason to build such a small radio—and he made a gesture with his hand—because the speakers had to be much bigger for the sake of acoustics." Pröger believes that the reason that top personnel at Zeiss were so dead set against microelectronics was that they were afraid their own areas of specialization might be swept aside. As an expert on microstructures, Pröger tried, without success, to convince Görlich that microelectronics was going to become very important. Pröger met regularly with representatives of Hartmann's institute, but was under strict orders from Görlich not to make any concrete promises. But representatives of Hartmann's institute put Pröger under tremendous pressure. The stress made Pröger so ill that he was unable to continue. This brought the dialogue between Zeiss and Hartmann's institute to a screeching, though temporary, halt.[18]

Zeiss did not become involved in microelectronics until forced to do so by the Soviets. Leonid Brezhnev came to Jena in 1967 to give Zeiss its marching orders in person. (Secret talks had reportedly begun in 1966.[19]) Zeiss signed a contract with the Soviet authorities to produce special equipment for the microelectronics industry (called the "E" system)—one of many such contracts. According to Pröger, Zeiss was the only East bloc producer able to achieve the necessary degree of precision, making Soviet industry reliant on Zeiss.[20] Soviet interest in photo repeaters (used to print out circuitry) led to the formation of a collaborative research team from Hartmann's institute and Zeiss. They went on to win the National Prize for what became a very profitable export.[21]

This, however, was too little too late. The GDR found itself three to five years behind worldwide developments in this area.[22] Moreover, as Pröger has pointed out, confidence in Zeiss's ability to produce the necessary high-tech equipment was eroded. The result was that subsequent to falling behind, policymakers and industry specialists tended to think first of importing expensive equipment rather than asking Zeiss to produce it.[23] This became a considerable drain on resources once microelectronics became vitally important to the GDR's competitiveness in the world. Here, Görlich and others showed little foresight.

Other important elements of Görlich's vision of Zeiss's identity were overturned during the reform era (1963–1971) as well. Walter Ulbricht had visions of making Zeiss the heart of a military-university-industrial complex that would include the Friedrich Schiller University of Jena. According to Mühlfriedel and Hellmuth, increased state funding led to a wave of modernization and expansion at Zeiss. The number of personnel in research and development rose to 2,355 by 1965. Initial plans were overly ambitious. Proposals to modernize Jena by building a sports complex there that would accommodate 5,000 spectators and allowing Zeiss to hire 6,000 new researchers and 19,000 supporting staff were quietly dropped when it became obvious that the resources were not available.[24]

Playing a key role in the transformation of Zeiss was Ernst Gallerach, an enthusiastic supporter of NÖS (the "New Economic System") who became the director of Zeiss in 1966. Enjoying Ulbricht's full confidence, Gallerach decisively broke with the past at Zeiss. He tore the research division apart, creating small R&D divisions for different product groups—a change he insisted was necessary if the New Economic System was to be implemented. He also declared that the "patriarchal management style" had to go.[25] Earlier writings make it clear that Görlich must have been very much opposed to Gallerach's insistence that each line of production be profitable, a policy that led to the expansion of mass production and the curtailing of Zeiss's tradition of custom-made and small-run research and production.[26] In a scathing memorandum, signed by Görlich, Klaus Heuer (a top researcher) complained bitterly about Gallerach's cavalier attitudes toward research and development. Heuer threatened to resign from Zeiss if something was not done about the situation.[27]

Gallerach plunged the enterprise into entirely new fields and oversaw a Sovietization and militarization of research and production. One of the most notable examples is Zeiss's expansion into the production of magnetic tape devices used to store computer data (the ancestor of the computer hard drive). Used on Soviet-made MINSK 22 computers, they were much in demand in the Soviet Union. In private, top research personnel were quite critical of the decision to expand into this field because this meant fewer resources for traditional areas of strength at Zeiss.[28] Zeiss also began producing targeting systems for tanks[29] and microelectronics production equipment for the Soviets, entering into binding contractual arrangements with Soviet ministries and institutes. There is a good deal of evidence that Zeiss found it very difficult to adhere to the exact terms of these contracts, and that the Soviet reaction was harsh. According to a 1970 Zeiss report, "Our partner [the Soviet Union] rightfully accuses Carl Zeiss of a lack of regard for binding contractual commitments. Indeed, our partner holds contracts and other signed documents in extraordinarily high regard. . . . We are dealing with a very sensitive partner, who reacts with great irritation and feels insulted when its interests, who are the interests of its state, are not stressed enough by us. They see this as arrogance on the part of our enterprise [i.e., Zeiss]."[30] On more than one occasion, Soviet customers demanded specifications that Zeiss could not fulfill.[31]

A 1970 secret police document shows that militarization and Sovietization led to increasing dependence on espionage and the secret police. Zeiss needed a key piece of hardware for use in an electronic targeting system for tanks: a minicomputer of the type "PDP-8/L-E," developed in the United States by DEC (Digital Equipment Corporation). This top-of-the-line device, valued at about 160,000 DM, was subject to tight security regulations, and was available outside the United States only to NATO military forces. With the knowledge and consent of Hans-Joachim Pohl (then in charge of military research at Zeiss), division XVIII/8 of the Stasi was in 1969 given the mission of procuring one. A "tested unofficial source" acquired one, which, along with all the manuals and testing programs, was delivered to the Zeiss team headed by Pohl on December 16, 1969.[32]

At the same time, a "modernization" of Zeiss's production profile took place. There were sharp cutbacks in traditional areas such as camera lenses, glasses, binoculars, and astronomical instruments, which engendered discontent among department heads.[33] Zeiss instruments were increasingly equipped with lasers, electronics, and microelectronics. Another aspect of modernization that was very much emphasized by the industrial leadership in the reform era was the creation of "systems" that made use of devices that worked together. This was based on a view of technology as consisting of and being part of larger, systematically organized systems. This thinking was based on cybernetics and the cultural and political assumptions that went along with it. However, as Mühlfriedel and Hellmuth point out, the lack of demand for such systems and lack of interest in automation brought tremendous financial problems upon Zeiss, which had to be bailed out by the state in 1970–1971. Görlich, along with at least some of his colleagues, doubtlessly felt a certain sense of vindication when Gallerach, whom they detested, was ousted in 1971.[34]

Whatever his feelings, Görlich had been careful not to openly express displeasure with official policies. In fact, he quickly adapted to the changed climate, becoming a major proponent of the use of electronics and microelectronics in Zeiss instruments.[35] He raised no objections to the Third University Reform, whose repressive tendencies he must have been acutely aware of as a professor at the University of Jena.[36] All of this points in the direction of accommodation, even opportunism. But to truly understand what was going on, we must peel back the outer layers, and peer inside the inner workings of the Stasi-infiltrated socialist corporation.

An Innocent Victim? Görlich and the Stasi

"The operational indicators gathered in 1966 strengthen the suspicion of espionage. . . . Cooperation between Görlich and the English secret service is most likely."[37] This accusation is to be found in a 1967 Stasi (secret police) reports. Not until we know that Paul Görlich was suspected by the Stasi of being an agent for the British secret service can we begin to comprehend his position in the East German system. Little evidence has ever turned up supporting this suspicion. Eventually the case was dropped. However, the investigation was to have a subtle but profound impact on his career.

Stasi infiltration of Zeiss was motivated not just by the economic and technological importance of this great socialist corporation; the militarization of Zeiss unleashed fears within the SED and the MfS that Zeiss could become the target of Western intelligence keen on stealing East German research results and placing Western agents in positions of authority. These agents would then work to undermine East German research. Historian Rüdiger Stutz has shown that Zeiss general director Hugo Schrade was the subject of an elaborate Stasi investigation, during which he was accused of being a "super-agent" of the West. Schrade does not appear to have ever found out about the investigation, which came to nothing. His dismissal in 1965–1966 evidently had little to do with Stasi suspicions.[38] Such investigations were part of a Stalinist mentality of suspicion, as well as a tendency to blame individuals for the failings of the system. However, Zeiss's successes during the Schrade era helped undermine these accusations and save Schrade from prosecution. What drew Stasi attention to Görlich? The Stasi began an investigation of Görlich as the importance of laser research—both economically and militarily—became evident.[39] Stasi informants, known as IMs (*Inoffizielle Mitarbeiter*) were being deployed to many research institutes involved in laser research.[40]

Görlich's file makes clear that the Sovietization of Zeiss research and production played a role in the penetration of the venerable firm by the Stasi. Several reports are translations from Russian, presumably KGB, investigative reports, or cite information passed on to the Stasi by the KGB.[41] The KGB even plotted to plant an informant of its own in Görlich's proximity.[42]

Görlich fell under suspicion first and foremost because he was not a member of the SED, but maintained extensive international contacts. He traveled to the capitalist West several times a year. For Görlich, this was an absolutely essential part of his professional life; the West was the gateway to information about worldwide developments in his field, and the source of stimulating ideas. Görlich was particularly interested in maintaining close professional friendships with West Germans, whom he met at international conferences.[43] Travel and international contacts enhanced his international reputation, leading to more invitations abroad. Clearly, Görlich very much wanted to remain a respected member of the international scientific community. He was invited to join the editorial board of the West German physics journal, *Physikalische Blätter*, an invitation that he, however, felt he could not accept, presumably because the intense contact with westerners that this would entail was frowned upon.[44] Görlich used his contacts to arrange for the purchase of laser rubies in Switzerland, thus circumventing a Western CoCom embargo.[45]

Despite their benign nature, these contacts were highly suspicious to the Stasi. It was noted with disquiet that Görlich first suggested the creation of a Research Council commission for laser research after attending a 1961 conference of IUPAP (the International Union of Pure and Applied Physics) in the United States at the invitation of the U.S. National Bureau of Standards. This invitation was interpreted as part of a Western plot to find out more about East German laser research. Görlich was also thought to have been receptive to such advances.[46] And suspicions were raised by Görlich's relationship with an old friend, a scientist and owner of a company in Wiesbaden, who was thought by the Stasi to have ties to Western intelligence.[47] Görlich's insistence that it was good for East German scientists to publish papers in English was thought politically suspect.[48] Even flashes of humor, revealed in exchanges with foreigners—such as his wry remark, "Walter Ulbricht, the pointy-beard, isn't here; he always sends a representative"—were duly noted and criticized in Stasi reports.[49]

Stasi informants and officers reacted with hostility to Görlich's attempts to promote East-West ties within the research community. At a 1966 conferences, he attempted to persuade the organizers of the West German Physics Conference (Physikertagung) to meet with the East German Physics Society (Physikalische Gesellschaft) in the GDR. "This would be a wonderful thing, and we could show the politicians how to bring Germans together despite all their differences." A Stasi officer remarked in the report, "As on many other occasions, the tendency is evident to use scientific organizations to preserve pan-German scientific associations, thus buttressing the [West German] policy of [claiming to be] the sole representative [of the German nation]."[50] Görlich was described as "an enthusiastic proponent of the unity of German science" who "uses every opportunity to act as an intermediary between West and East." Görlich may well have continued to hope for German reunification. On one occasion he revealed that he admired Herbert Wehner, then head of the Social Democratic Party of West Germany, and a former Communist. On the other hand, Görlich was no supporter of Western-style democracy: "In his opinion, a government is only good if it determines what the people are supposed to do. And democracy is when the people is willing to follow this course."[51]

The officers making these reports searched for signs in Görlich's professional work that might reveal disloyalty to the GDR. Some of their critical remarks exaggerate aspects of Görlich's professional outlook, but they do have some grounding in reality. For example: "Görlich has unreservedly made himself the spokesman of the faction at Carl Zeiss that stands in the way of every development in a modern direction. In particular, he has failed to recognize new directions."[52] However, it takes a great deal of imagination to construe these shortcomings as the work of a foreign agent.

These reports also claim that Görlich was untrustworthy and opportunistic. However, a careful reading reveals that something else was going on. Görlich was feeling tired and old, and his belief in the system was beginning to crumble. Speaking (unbeknownst to him) with a Stasi informant on one occasion, Görlich criticized policies that made long-term research impossible. The Stasi informant urged Görlich to speak to high-level people about this problem, but "Görlich shrugged his shoulders in resignation, saying that he had already done enough, but apparently nothing could be changed." Görlich is paraphrased as expressing a profound sense of resignation:

> When he returned to the GDR from his work in the Soviet Union, he had been of the opinion that socialism is a thousand times better than capitalism. He was going to roll up his sleeves and get something tremendous going. He went about his work with real initiative, but during his time at Zeiss, he had gotten the wind kicked out of him. At the end of last year the moment arrived when, after a long hospital stay, he no longer has [sic] the strength to throw himself into things. He continued that it was now up to the young people to do that.[53]

Görlich was, according to this report, only too aware that East Germany was falling further and further behind the West technologically. He blamed this in part on specific policies: the building of the Berlin Wall, the prohibition of travel to the West, and attempts to stop importing goods from the West. But it clearly had also begun to dawn on him that the socialist system did not work very well: "In the West, competition and the general pace of development [force] even the smallest operation to produce world-class products (or go under), whereas in our country a tired pace lacking in energy is accompanied by slogans [exhorting East Germans to try to reach] the worldwide level [of technological development]."[54] It was a wornout, possibly depressed Görlich who told his employees in the laser laboratory that they had to make do with the insufficient resources provided by the state—"*es ist nichts mehr drin* ('It's all over')." On one occasion, Görlich suggested to a colleague that they together look for jobs in the West. Unbeknownst to Görlich, this colleague was a Stasi informant, who passed this comment on to his handler.[55]

Is it possible that Görlich was, indeed, working for the West? British intelligence had reportedly "shown interest" in Görlich in the late 1950s. Contacts of an East German double agent (code name "Bach") with British intelligence vaguely seemed to indicate that the latter had some sort of relationship with Görlich. Two supposed British agents visited a hotel in London where Görlich was staying, but it was unclear whether Görlich actually had any contact with them or even whether he was even there at the time.[56] Given the inaccessibility of British intelligence files, it is difficult to make any sort of definitive assessment of Görlich's loyalties. However, the fact that the Stasi could not find enough evidence to put him on trial or even interrogate him makes it seem highly unlikely that he betrayed the GDR.

It should also be emphasized that Görlich cooperated at all times with the Stasi, answering any questions that were posed to him in the manner expected of someone in his position. He was also a stickler for security. At many a meeting, it was he who reminded his employees of the need to be vigilant in this regard.[57]

Was Görlich an innocent victim of Stasi persecution? The answer to this question is complex. What emerges from Görlich's file is that he was actually an IM, or secret informer, for Soviet security—first the MGB, later its successor, the KGB. (This was first revealed in 2005 by a German journalist.[58]) He was recruited on October 30, 1948, during his involuntary stay in the Soviet Union. A translated Soviet report states, "In the period of his stay in the Soviet Union, he was given a positive evaluation, he took part in the work of the anti-fascist group of German specialists. In October 1948, he was recruited as a secret informant [*Inoffizieller Mitarbeiter*] with the alias 'Jochim' to inform on persons who were engaged in hostile activities." There are no details about his activities as an IM in the Soviet Union, but the report gives him a positive evaluation.[59]

Upon his return to the GDR in 1952, Görlich was initially inactive, but was reactivated in May 1955 as a KGB informant. His job was to use his rich web of contacts among foreign scientists and technical experts to gather "scientific-technical intelligence" for the KGB.[60] However, as an agent, he displayed "little initiative or ingenuity." The report goes on to say, "He was extremely circumspect, and often did not show up at a meeting place. It is considered that the results of his work do not correspond at all to the opportunities open to him."[61] He passed "no useful information" along to the KGB. In 1963, his work as a secret informant for the KGB was terminated.[62] A 1960 document declassified and released by the National Archives at the request of this author in December 2004 shows that U.S. Army intelligence strongly suspected that Görlich was a Stasi informant.[63]

Mitigating circumstances surrounded Görlich's relatively brief career as a KGB informant. As a former member of the Nazi Party, he likely would have been subjected to blackmail by the Soviet secret police during his stay in the Soviet Union. Görlich would have been particularly vulnerable to threats because he was accompanied to the Soviet Union by his future wife (then in her twenties). No case is mentioned in his files in which he betrayed a colleague. No dishonesty was involved. Görlich made it plain what master he was now serving, becoming part of the group of German specialists in the Soviet Union who publicly proclaimed their loyalty to the Communists. Once released from Soviet captivity, he reverted to a largely apolitical stance, showing that his true loyalties were to the scientific community. It is true that he again worked for the KGB in 1955–1963. However, he seems to have been a very reluctant informant indeed. He did not pass along intelligence of any value to the KGB, and evidently did not betray any of his friendships or professional relationships. The evidence found in his Stasi file exonerates him of any grave lapse of professional ethics or serious act of personal betrayal. The same cannot, unfortunately, be said of those who informed on him.

Among these was at least one close colleague, Hans-Joachim Pohl. Under the alias "Hans Schwarz," Pohl served the Stasi as a secret informant from November 3, 1966, to February 13, 1985.[64] Born in 1931, Pohl was a member of the new technical intelligentsia and a member of the SED since 1950. His career took off under Zeiss director Ernst Gallerach, whose confidence he enjoyed. By the time he began informing on Görlich (late 1966 or early 1967), Pohl was the head of the exploratory research division,[65] which was involved in the development of new technologies. He held a seat in the East German pseudo-parliament, the *Volkskammer*—a largely ceremonial honor.[66] Zeiss director Gallerach made him his deputy of military research.[67] Pohl was an ambitious young man on his way up (figure 5.1). Becoming a Stasi informant was a good career move. His secret police file states, "P. has made a career at Zeiss that is based on his professional and political activities."[68]

He was deployed to spy on Görlich at an international conference in Warsaw in July 1967. He reported that Görlich was very disappointed that Professor H., his

Figure 5.1
Visit of Walter Ulbricht and his wife Lotte to Carl Zeiss Jena, 1968. Hans-Joachim Pohl (far left); General Director Ernst Gallerach (far right). Photo credit: Carl Zeiss Archive, Jena

West German friend and "the only interesting partner for the symposium," had not come to the conference as planned. Pohl or another informant reported that Görlich exhibited behavior that was "entirely new." Görlich had always sought out conversations with foreign scientists and technical experts at such conferences. But now, strangely, he avoided contact with Westerners, and instead clung to Pohl.[69]

This report evidently set off alarm bells. Further investigation yielded an explanation for Görlich's strange behavior. In April 1967, Görlich had been a guest at the Seventh Congress of the SED in Berlin. He noticed that he was being watched, and approached the surveillance man to ask why. An unnamed secret informant—we do not know if it was Pohl—reported that Görlich seemed very upset upon his return to Jena:

> He said that the conference had exhausted him so much that he would have to take sick days. He cancelled all his appointments and said that he would not be traveling to Berlin or Dresden any time soon. In early May, Görlich returned to work, saying that if he got upset, he would immediately go back home. Further, he stated that he no longer had the strength to devote himself to Zeiss; he was going to drift with the current, merely reacting to things that had to be taken care of.[70]

Görlich continued to avoid contact with West Germans at international conferences. He may have suspected that his house was bugged and that his briefcases and suitcases were secretly searched at every opportunity. He certainly knew that his phone was tapped.[71] "Görlich has become insecure," it was reported.[72]

Görlich's behavior seems to have been interpreted as an admission of guilt for some kind of subversive activity. In the late summer of 1967, Robert Rompe (a top physicist and member of the Central Committee) told MfS officials that he had come to the conclusion "that Görlich is a traitor." It was Rompe who initiated steps to prohibit Görlich from traveling abroad.[73] This prohibition was justified in Stasi documents as a means of preventing Görlich from meeting with foreign agents.[74] Cut off from the international scientific community, Görlich became ever more isolated. The intimidated Görlich began to express much stronger support of GDR policies than ever before.[75]

The possibility of forcing Görlich into early retirement was discussed in Stasi circles. One of the main motivating factors cited were "the tensions between General Director comrade Gallerach and comrade Professor Pohl on the one hand and Professor Görlich on the other."[76] Thus, denunciation would appear to be an effective way to promote one's career and one's interests. Pohl reached his professional apex during this period. In November 1967, during a visit to Moscow with his work brigade, he visited Brezhnev, spending an hour with the leader of the Communist world.[77] And yet Pohl never again enjoyed the kind of support that Gallerach had given him. After Gallerach's fall from grace, Pohl was transferred out of exploratory research, became head of optics research, and then the head of the Jena Glass Works.

The possibility of bringing Görlich to trial on charges of espionage turns up again and again in his file, but in the end, he was allowed to retire with dignity. Perhaps his earlier connection with the KGB saved him. Or perhaps his successes and his international reputation were the decisive factor. He also had the good fortune to turn sixty-five and retire before Erich Honecker came to power. Matthias Falter and Werner Hartmann were not as lucky.

Falter: The Innovator as Criminal

We know far less about Matthias Falter's management style and about the circumstances of his Stasi investigation than about Görlich or Hartmann. He was not as prominent or as successful as they, nonetheless he had much in common with them. Like them, he was considered a bourgeois specialist, partly because of his (lower-) middle-class background, partly because he entered professional life before 1945, but mainly because he did not join the SED. He worked in electronics research during the Second World War, and as a result avoided military service. He did not join the Nazi Party, but he was a member of the German Labor Front (*Deutsche Arbeitsfront*, or DAF). During his stay in the Soviet Union (1946–1951), he worked on semiconductors. Returning to the GDR, he headed the leading research institutes in this area from 1952 to 1964. The massive problems that he encountered were discussed in chapter 4.

The Stasi investigation of Falter seems to have been initiated in connection with a more general investigation of the reasons for the lack of success of the fledgling semiconductor industry in the GDR. A 1959 report asks how it is possible that work on semiconductors began around the same time in East and West Germany, but that in just a decade, the GDR had fallen five to eight years behind the FRG. Unlike most industrialized countries, East Germany was not yet mass producing semiconductors. Rather, devices were individually assembled by hand, resulting in low quality and high costs. Investigators blamed saboteurs who engaged in "enemy activity influenced by [West German] corporations."[78] Falter was not the only suspect,[79] but as head of the most important research institute he was of great interest to the Stasi. He had not exactly ingratiated himself with high officials by repeatedly making promises his institute could not fulfill. Some Stasi reports are harshly critical of his management style. They paint a picture of a neglectful administrator who did not bother to look at lab reports and only seldom told research personnel what they were supposed to be doing. Instead of concentrating on the current level of East German research, he was in 1960 pursuing what was considered cutting-edge research even in the United States and England—micromodule technique. The report found no explanation for his "major accomplishments" of the past[80] (for which he had been awarded a National Prize). Other reports saw his many business trips to the West as highly suspicious.[81]

Although repeating some of these accusations, another report had more positive things to say about him and his attitudes toward the Communist system: "Professor Dr. Falter recognized the important of semiconductor technology for the further development of our economy early because of his experiences in the Soviet Union. He has engaged in a very strong fight to introduce this new technology. His energetic involvement and the way he talks [about this field] reveal that Professor Dr. Falter has positive attitudes toward our development."

It was also noted that Falter cooperated with the Stasi and was very attentive to security concerns. This report saw Falter's interest in the latest technologies in a positive light: "Everyone appreciates that Professor Dr. Falter is good at recognizing what the most important directions in semiconductor development will be." In this report, Falter is depicted as a well-liked boss who was "admired and held in esteem" by researchers at his institute, although some were unhappy with his "sporadic work habits" and his failure to provide "guidance" to staff members. The greatest worry of the writer of the report was that Falter could leave the GDR.[82] This soon changed.

In January 1964, the Ministry for State Security (MfS) orchestrated Falter's dismissal from his job as head of the Institute of Semiconductor Technology. The reason was the "suspicion of economic sabotage and espionage." The continuing investigation of these charges was transferred to Division XVIII of the MfS. The investigation was also stepped up considerably as large numbers of agents and IMs were assigned to it. It was given the case name "Resistance."[83] Investigators were looking for evidence that would allow them to put Falter on trial. The danger that they would do so was very real. A high-ranking employee of Falter's institute had already been put on trial and sent to prison. The charges against that employee were very similar to those being leveled against Falter, as one report ominously noted. These included a failure to make long-term research plans, overreliance on imports from the West, and overemphasis of trial runs.[84]

It was also asserted that Falter showed signs of lack of loyalty to Communism, in both professional and private life. Many reports reminded the reader that he was Catholic. They also mentioned that his family stopped displaying the flag on national holidays after the building of the Berlin Wall. The Stasi also felt that his personal habits and tastes revealed a Western orientation. He and his family watched Western TV channels and listened to Western radio stations. They received West German magazines, as well as food, clothes, and small presents from friends and family in the West. Falter only smoked Western cigarettes, and was interested in buying a Western car.[85]

In mid-1966, the Stasi proposed to take Falter to a "safe house" for ten days of questioning under Stasi arrest.[86] It is not known for certain whether this was done. If so, this was surely a frightening and traumatic experience for him. It was not until August 1968 that the Stasi determined that the evidence it had amassed did not point to an economic crime. The case was dropped.[87]

If Görlich's weak point was his conservatism, Falter's was his lack of managerial and organization skills. The Stasi proved adept in exploiting their victims' Achilles' heels. However, Werner Hartmann had neither of these weaknesses.

Hartmann: Charisma and Party Rule in East German Industry

As a research manager, Werner Hartmann was both an innovator and, like Falter and Görlich, an heir to traditional German academic culture. He was one of the first in the GDR to recognize the significance of microelectronics (i.e., solid state electronics), and he threw the full weight of his enormous energy, professional stature, and force of personality behind this project.[88] Overcoming almost insurmountable obstacles, he was responsible for the development and manufacture of the first integrated circuit in East Germany. He was successful because he approached his work with a combination of scientific knowledge, technological savvy, and managerial finesse. His brand of innovative traditionalism was his downfall, however. Having dedicated most of his life to serving two dictatorial systems, he ultimately discovered that some of his basic assumptions about the relationship between knowledge and power in this German dictatorship were wrong.

University colleagues warned him that scientists in East German industry were subject to greater political control than those at the university or the Academy of Sciences. They claimed that university life was more secure. Hartmann's enthusiasm for industrial science—particularly the application of scientific techniques to industrial processes—could not be deterred, however. He was unusual by East German standards in his quest to bridge the divide between theory and practice. On the one hand, he was critical of the research elite of the universities and academy institutes for neglecting the production process because of their aversion to the messiness of industrial conditions. On the other hand, he struggled to overcome domination of shop culture (which was typical in the GDR) and strove for science-based technology. He warned of the danger of "one-day wonders" that could result from unscientific methods. In the long run, the use of scientific methods prevented false starts and waste.[89]

Unlike Falter and Görlich, Hartmann took great pride in his managerial skills. He was in many ways a patriarch, typical of pre-socialist German academia and industry. He was personally very active at his institute, playing a central role in the recruitment and promotion of personnel. This encroached on the prerogatives of his institute's "cadre division" (a politicized personnel office). He handpicked his employees, interviewing all applicants for qualified positions (numbering about 2,500 between 1961 and 1974). He tried to recruit scientists and engineers who had previously worked for him or who were fresh out of college and would experience their first professional socialization at AME. He also preferred to promote AME employees to top positions at AME rather than recruit outsiders for these positions. Hartmann believed that, as a result, he was able to inculcate his employees with a stringent work ethic. A very communicative person, he also emphasized the importance of communication and cooperation. He coined the motto "AME=one laboratory," which was later changed into the more politically correct "AME=one socialist laboratory." His hands-on approach created powerful bonds of loyalty and made him a figure of authority at his institute. Hartmann believed that his position of authority was necessitated by the complexity of scientific procedures and the inexperience of most of the research staff at AME, as well as by the need for a spokesman on behalf of the institute.[90]

Hartmann also felt responsible for motivating his employees. He kept his profound worries over the institute's future to himself: "Every day, I had to play a balancing act, avoiding giving them completely false information on the one hand, and preventing complete resignation on the other. [I had to] radiate optimism and keep hope in the future alive at AME. I myself was often filled with doubt and on the verge of giving up." When times were good, Hartmann swept up his employees with his boundless enthusiasm. At meetings he sometimes spoke like someone inspired by "a sense of mission."[91]

Hartmann was very much convinced of the loyalty of his employees. He believed that the conflicts with Mittag in 1964 (discussed in chapter 4) had "brought all of us closer . . . and had in a real sense forged us into a good team in which we could count on each other." This sense of solidarity among AME employees is confirmed by the testimony of two former colleagues of Hartmann, Günter Dörfel and Hans Becker. Hartmann could at times be a harsh taskmaster, denying two engineers a bonus of 700 marks each for taking an unauthorized coffee break. One of them later thanked Hartmann for this treatment.[92] Although despised by a few, he was evidently loved by many.[93] Even the secret police admitted that he was an "idol" to many at AMD.[94]

The strong feelings of personal loyalty that Hartmann evoked were deeply troubling to state officials, particularly since he was not a member of the SED. At a 1965 SED meeting, it was asserted that division chiefs at AME "do not dare speak out against the views of" Hartmann and a recommendation was made that the party secretary at AME be named Hartmann's deputy.[95] During a tempestuous meeting on June 30, 1967, Minister for Electrical Engineering and Electronics Otfried Steger lashed out at him, saying, "So, it seems that two of your employees are conspiring against you. But it is up to you to figure out who they are." Hartmann wrote that he did not allow this claim to disturb him.[96]

Hartmann was resolute in his dealings with party and state bureaucracies. During his stay in the USSR in 1945–1955 he came to the conclusion that Communist officials only respected people who stood up for themselves. The negative example of Falter, who began work at AME in 1964, confirmed in his eyes the correctness of his approach. In a private conversation with Hartmann, Falter had "blamed his failure on his attempts to try to satisfy state demands, even when these seemed highly unrealistic."[97]

Hartmann was able to modify the dominant East German culture of innovation at AME. Gaining control over recruitment was an important precondition to change. He was able to socialize scientists and other research personnel to a work ethic, scientific method, and communicative work style that were in decline elsewhere in the GDR. A revival of familiar patriarchal relations of authority was essential to this endeavor. Hartmann's strategy, however successful, was not received well by the SED, which instinctively distrusted any initiative that did not come from above. Hartmann's initiative even extended into areas categorically monopolized by the SED, such as the formulation and display of slogans. Hartmann also had ideas of his own about the acquisition of the latest technologies.

Hartmann: Meanings of Imitation

Hartmann was acutely aware that one of the central problems of innovation in the East bloc was that of technology transfer. Under Lenin and Stalin, the Soviet Union had embarked on a path of imitation of Western (often American) technologies. Even that monument to Stalinist hubris, Magnitogorsk, was modeled on the U.S. Steel plant in Gary, Indiana.[98] However, it was quite unclear *how* the Soviet Union (and later, the GDR) should acquire Western technologies. Stalin brought foreign engineers to the Soviet Union, but later expelled them. He and his successors had to contend with the dilemma that the best methods of technology acquisition—importation of personnel, Western direct investments, and foreign technological assistance—carried with them the danger of political infiltration. The importation of capital goods was politically less problematic, but often too expensive. Two other methods were far less expensive, but only provided access to obsolete technologies, namely imitation based on Western prototypes or Western journals and handbooks. Détente opened the way to technology transfer from West Germany—an avenue pursued by Apel and Mittag. However, fear of political infiltration persisted, and the CoCom embargo prevented the importation of much-needed high-tech equipment from the West.[99] Shadowy companies in Austria, Switzerland, and elsewhere were willing to procure embargoed goods for the GDR, but at a high price. Thus, it was clearly advantageous for East Germany to attempt to conduct its own research and development to the greatest extent possible.

Hartmann was critical of a strategy of reliance on espionage to procure electronic components that were then copied in East bloc countries. In a memorandum dated April 10, 1964, he asserted that such "artificial and rushed development" did not lead to a mastery of new technologies. It condemned the GDR to the role of a straggler that was always years behind other industrial nations. Hartmann asserted that scientific and technical "provincialism" could be avoided through international cooperation.[100]

In a 1965 letter to the general director of his VVB, Hartmann pointed to the negotiations between an American consortium and the Polish government over a joint venture to produce computers in Poland as a good example of such collaboration. He quoted the director of Olivetti as saying, "There are no European solutions to the problems in the computer business; research costs are too high. We can only maintain our position if we cooperate with the USA." However, Hartmann was no Westernizer. He very much believed in the rationality of state-run research and development. This attitude was molded by his experiences in Nazi Germany and the Soviet Union. He advocated placing semiconductors and microelectronics under a common administration. This authority should be given extensive powers, enabling East German industry to react with greater flexibility and to compete on the world market. A fresh start was needed: "My colleagues wait for the chance to be freed to put their ideas into practice and to serve electronics in the GDR. All are prepared to devote all their strength to putting a well thought out, hard general staff plan into action."[101] Hartmann's use of military imagery here is noteworthy. He implies that he and other engineers and industrial scientists were good soldiers awaiting orders from on high. In fact, a joint administration for microelectronics and semiconductors was created in 1980 in the form of the "Socialist Combine for Microelectronics" (*Kombinat Mikroelektronik*). However, it did not bring about the major reforms and psychological renewal he hoped for, and, in any case, came too late for him.[102]

Given the lack of a state-imposed program of cooperation between enterprises, Hartmann attempted to forge close bonds with other enterprises on his own. AME formed collaborative research groups in various areas with the Semiconductor Works of Frankfurt an der Oder (known as HWF), which manufactured the devices and equipment developed by AME. Later, these groups were expanded into "technological centers," where research personnel from many institutes and enterprises worked together. Hartmann's idea of creating a central office for construction and production planning for the entire socialist combine was rejected because of rigid planning goals and lack of funding. AME, HWF, and other enterprises had to conduct such projects on their own. Hartmann was highly critical of this sort of autarky, which was so typical of the GDR: "Aside from visits and tours, they all started from scratch! A less economical, less scientific, or less technological mode of operation is hardly imaginable." This put a tremendous strain on AME, which had little information on technical requirements of the systems it needed to set up. For example, how clean did "clean rooms" have to be for microelectronics production?[103]

Trips to the West provided Hartmann and his employees with much useful information on microelectronics production. They learned a good deal about clean rooms on a trip to West Germany in 1964, as well as from Soviet sources. During a trip to the United States in 1965, Hartmann hoped to visit Fairchild, Texas Instruments, and Motorola and learn more about how to conduct experimental production runs of integrated circuits. However, this and a trip to Japan were called off at the last minute by nervous authorities. (The reason in unknown.) For a few years, no delegations from the microelectronics or semiconductor industries were allowed to go to the United States.[104]

Unable to travel to the West, Hartmann increasingly sought contact with the Soviet microelectronics industry. His knowledge of Russian and the Soviet Union stood him in good stead here. Once he got the necessary security clearance, he was informed of negotiations to establish joint research with NYYPE, a research institute in Moscow. Hartmann established good relations with the Soviet Minister for Electrical Engineering and Electronics, Schokin, who provided AME with a device used to measure dust, as well as information that helped set up experimental production facilities.[105]

But despite promises made by Soviet ministers and representatives of the GDR in 1965,[106] East German–Soviet collaboration in the development of integrated circuits failed to materialize. Although graciously received by Schokin on a visit to Moscow, Hartmann could not even get him to agree to allow East German specialists to attend Soviet semiconductor and microelectronics conferences. Two Soviets sent to work on projects at Hartmann's institute turned out to know a good deal less about microelectronics than their East German hosts. It is known that the Soviets did not really trust Hartmann. Despite his time in Soviet service and his excellent knowledge of Russian, he was not a Party member or a secret police informant.[107] Moreover, upon his release from Soviet captivity in 1954, Hartmann, along with ten other scientists and engineers, was singled out as a suspicious person who had to be "subjected to operational processing," as a document discovered by historian Paul Maddrell shows. In other words, the Soviet authorities were ordering the East Germans to initiate secret police investigations of these specialists. The reason given was "these people have links to secret services, were former counterintelligence officers in the Gestapo, displayed a hostile attitude at work, or have interesting connections with persons in foreign, capitalist countries."[108]

However, this was not the only factor in the difficulties Hartmann's institute encountered in trying to gain Soviet cooperation. Since 1967, the GDR had tried to get a semiconductor or microelectronics project with the Soviet Union going, "but it was a difficult and not very successful path," writes Hartmann. The general director of the socialist combine in charge of AME tried in 1968–1970 without success to find internships for AME researchers in Soviet factories and institutes.[109] This socialist combine reported in 1966 that COMECON nations had failed "to counter the cooperation among leading capitalist companies across national borders with an equivalent [level of] cooperation." Walter Ulbricht's recommendation to create a central COMECON research institute for electronics went unheeded as well.[110] A 1968 treaty on collaboration in this area between the USSR and the GDR changed little.[111] The Soviet leadership was leery of direct relationships between East German and Soviet institutions and enterprises because this could undermine the power of the central government.[112] The Soviet relationship with Zeiss was an exception (though only a partial one). In the area of microelectronics (as in other areas of technoscience), the Soviet Union was willing to take what technologies the GDR offered, but was absolutely unwilling to give anything of substance in return. This may have had something to do with the military significance of high-tech areas,[113] but was primarily motivated by a desire to maintain technological superiority over the satellite states. This was not something that the East German leadership wanted to believe, of course. It was easier to blame the failure of Soviet–East German cooperation on individuals such as Hartmann than to blame it on the Soviets.

In spite of the fact that they yielded little, Hartmann's contacts with Soviet institutions came at a high price. His new security clearance ("*SU-Verpflichtung*") precluded travel to the West (in Hartmann's case, from mid-1966 onward).[114] As a result, an entirely new research strategy was forced upon him and his institute. AME found itself in a trap. Cut off from the West, but unable to form a significant relationship with Soviet or Eastern European institutions, AME was forced to rely increasingly on the fruits of espionage—the preferred modus operandi of the Stasi.

During a meeting on June 29, 1967, the Minister for Electrical Engineering and Electronics suddenly took a cardboard box out of his briefcase. It contained a large number of integrated circuits (series SN 74) produced by Texas Instruments. AME was ordered to drop work on its own integrated circuits (AME-T10) and begin trying to create exact copies of these American devices. AME had no contact with

Soviet research facilities that had started work on the same task. In the area of microelectronics, the East German leadership had decided to embark on the path of secret copying of foreign (especially American) technologies. This was neither an easy nor a pleasant path for AME: "No other institution in the world had to develop microelectronics in such isolation as AME," wrote Hartmann in his memoirs.[115] AME was forced to directly copy hardware without the benefit of contact with engineers and scientists who had helped develop these technologies. The lack of know-how made this endeavor very difficult. Articles from Western journals were of little help. Hartmann, who had always had close ties with the international scientific and technical community, felt this loss very acutely. However, he remained the loyal servant of the system.

Reliance on espionage necessitated security measures that strangled communication even more. Increasingly, all discussion of microelectronics technologies was forbidden, whether between East Germans and experts from other East bloc nations, among researchers at East German enterprises and institutes, or even within AMD (as Hartmann's institute was now known). On June 6, 1967, Minister Steger classified all work at AMD as top secret (*Vertrauliche Verschlußsache*). The results were grotesque: "Minister Steger ordered AMD employees to continue to participate in the technological centers, but to maintain silence at meetings." Cooperation with other East German semiconductor manufacturers and with the Technical University of Dresden had to be broken off. Contact became sporadic between Hartmann's institute and HWF, the factory where AMD innovations were mass-produced. It became very difficult to gain approval for visits by HWF employees to AMD laboratories, where Hartmann's employees were supposed to explain how the innovations worked. The quality of production techniques and equipment at HWF plummeted due to this lack of contact with AMD. For example, in 1968, Hartmann discovered that HWF had built equipment for the production of photomasks (used to make the layout of the integrated circuit) that was "catastrophically bad and improvised in a primitive way." This caused major delays in getting AMD innovations into production. Hartmann complained about this to Minister Steger and even to the Ministry of State Security, but to no avail.[116]

Security measures were particularly tight regarding the use of patented or embargoed handbooks, documentation, and equipment. Hartmann was given photocopies of manufacturing instructions and other materials that clearly had been taken from American companies. Only department heads were allowed to see these documents, and were not allowed to discuss them among themselves or with other employees. This contributed to the breakdown of communication and the yield was almost nil. According to Hartmann,

> All in all, we got little out of this for our work. The material generally did not go beyond what we already knew from US journals, that is, it was already quite old. Or there were references to particular American aids and resources to which we had no access. This entire clandestine operation must have cost a good deal, paid for in hard currency. For the same amount of money, technical experts could have been allowed to travel abroad; research work in the GDR would have profited a good deal more.[117]

These policies reveal deep distrust of the Communist leadership toward information that was not filtered through institutions of Party and state.

Hartmann and his employees did their jobs well. By late 1968, they had succeeded in reproducing the integrated circuit from Texas Instruments that had been given to them by Steger. Hartmann reacted with optimism to AMD's greatly expanded role in the manufacture of integrated circuits since 1971. In part, he saw this as a major distraction from research and development, but also as an opportunity "to move the lab onto the production line," which—so he had read—American companies were increasingly doing. AMD custom-designed integrated circuits for the East German computer maker, Robotron. In 1972, AMD, which up until then had specialized in unipolar solid-state electronics, became involved in bipolar technology. Together with Robotron, AMD copied an American integrated circuit for pocket calculators, which went into production at another plant in 1974.[118] Nonetheless, developments in this area were excruciatingly slow, prompting Hartmann in 1982 to write in his memoirs:

> More than eight years have passed since November 7, 1973. Several billion Marks have been pumped into microelectronics. But there still aren't any inexpensive pocket calculators. In the FRG, there are already one to two pocket calculators per household. In the GDR, owning a pocket calculator is a rarity outside of scientific and technical circles, where people generally use Western calculators that they received as presents. . . . The mastery and the testing of this technology in November 1973 . . . should have, if energetically promoted, made it possible to catch up with the West in the spread of calculators. But!?[119]

There is no doubt that a country such as East Germany had little choice but to imitate foreign technologies. However, patent violations made it difficult to sell GDR products abroad.[120] It would have been much better if the GDR, in cooperation with other East bloc nations, had been able to develop its own microelectronic devices, based on foreign technologies. This was the path that many small Western nations successfully followed. However, this would have necessitated "close and confidential relations with the most important foreign component manufacturers," as was the case, for example, among electronics companies in Finland. East German enterprises would only have gotten useful information if they themselves had had something to offer.[121] However, the GDR became enmeshed in a vicious cycle. Espionage was thought to necessitate internal security measures that strangled communication and outside contacts, thus draining industrial research of its life-blood. Hartmann voiced strong criticism on this account. Although he recognized that the entire research system was undergoing profound changes for the worse, he remained loyal to it. Only later was he to discover how little his loyalty was valued by the SED leadership.

The Ghost of the Persecuted Scientist

The engineer in Loren Graham's *The Ghost of the Executed Engineer* was an enthusiastic Russian socialist who believed that enlightened engineers should develop technologies for the benefit of the masses. Hartmann was no such idealist (figure 5.2). He had struck his bargain, first with the Nazis, then with the Communists. His approach to research management was doubtlessly flawed in many ways. It could be called sexist and patriarchal. Nonetheless, he showed unusual courage in his attempts to set aside political orthodoxy and do whatever was necessary to create an environment conducive to innovation in high tech research. He emphasized methodical, scientifically grounded industrial research, as well as communication

Figure 5.2
Werner Hartmann in the 1970s. Photo credit: Hans Becker

and cooperation within his institute and without—two areas in which the Communist system was very deficient. He deferred to the political leadership in what he considered political matters, continuing to believe that his technical work was an apolitical realm that functioned best when left untouched by ideological considerations. He was blind to the Communist leadership's driving desire to penetrate more and more spaces in the public and private realms, as well as to the consequences this totalitarian impulse had for industrial research.

Hartmann became the subject of secret police surveillance as early as 1947, when he was still in the Soviet Union. Soon after his return, the surveillance operation "Tablet" was begun. But a massive investigation (code-named "Molecule") was not launched until 1974, when the significance of microelectronics—long overlooked by both the SED and the scientific-technical elite (the Academy of Sciences, the Research Council, and Robert Rompe)—finally began to dawn on the political leadership.[122] Hartmann was scapegoated for failures that he had worked mightily to prevent. Taken into custody several times in 1974–1976, he was relentlessly questioned for days at a time by the Stasi. These sessions were carefully orchestrated. Agents were given scripts with questions to ask, samples of the sorts of arguments that Hartmann would use to counter accusations, and suggested strategies in dealing with Hartmann's responses.[123] With evidence and analyses piling up, Hartmann's file grew to occupy at least forty-nine thick binders.

Stasi reports made the case that Hartmann was guilty of sabotage or gross negligence in his running of AME/AMD. These reports display considerable ignorance concerning the early development of this institute and Hartmann's activities. His role in the establishment of microelectronics research was used against him. The Stasi argued that Falter's institute, IHT, would have been the logical place to begin microelectronics research, and that research would have gotten off the ground much more quickly there. This is a very odd argument, given not only the massive difficulties at IHT, but also the Stasi's poor opinion of Falter and his institute. The Stasi reports go on to criticize and second-guess Hartmann with regard to countless decisions made over the years.[124] These reports leave unmentioned the failure of the state to give AME sufficient support and guidance.[125] Hartmann was also accused of abetting the sabotage activities of a division head at AME who was put on trial and imprisoned.[126]

The Stasi also accused Hartmann of sabotage and espionage on behalf of a foreign intelligence service. Unconvincing circumstantial evidence is cited. For example, during a 1972 trip to Hungary, Hartmann spent twenty minutes wandering around a lot overgrown with grasses and plants. The Stasi found his behavior there "odd," but could detect no meeting, no materials dropped off, or anything of the sort.[127] Hartmann's widow, Renée-Gertrud Hartmann, noticed this charge among so many when she read through his Stasi file. Able to laugh despite the tragic memories of her husband's persecution, she recalls that her husband had gone to the abandoned lot to relieve himself.[128] Much of the further evidence against Hartmann is equally unconvincing. The Stasi thought it suspicious that he went on frequent private trips to West Germany to visit family and friends. According to the Stasi, Hartmann reported being approached by "Americans" in 1955 (to none less than Walther Ulbricht!) and by a foreign agent in West Germany in 1957 (though he waited until 1964 to inform the Stasi).[129] Hartmann also records in his memoirs that he was approached several times in 1965 and 1966 on trips to West Berlin by a mysterious stranger named Viktor who asked Hartmann to help Heinz Barwich's son, who had been imprisoned in the GDR. "Viktor" also asked questions about East German research. Hartmann told him he was not prepared to betray his country, and eventually yelled at Viktor to leave him alone. Hartmann was unsure which side Viktor was working for.[130] It is unlikely he would have reported these incidents if he had been working for western intelligence. All in all, the accusations of espionage seem far-fetched.

However, an important part of the case against Hartmann was the accusation of disloyalty: "Professor H. rejects the socialist social order and the strengthening of its material and technical foundations."[131] The Stasi characterizes him as a bourgeois individualist, criticizing him for legitimate tax exemptions that he claimed, as well as for the fact the he had been married more than once. However, next to nothing is said about what in the West would have been criticized as bourgeois—ostentatious lifestyle, lavish house, fine clothing, and such. Rather, the meaning of "bourgeois" in these documents is almost exclusively *political*.[132] He did not devote himself to political activities in his spare time.[133] He cultivated friendships with the wrong people. These were the sorts of things noted in these reports.

Hartmann was also accused of harboring anti-Soviet attitudes. The Soviet secret police began diligently recording politically incorrect statements he made during his time in the USSR, and the Stasi continued monitoring him thereafter. His frequent use of the term "Russian" instead of "Soviet" was deemed offensive, as were numerous acid remarks. Once, he said to a "specialist" wearing a badge of the society for German-Soviet Friendship, "Why are you wearing that lead button . . . have you seen any signs of German-Soviet friendship? Take off that piece of trash." The Stasi was very frustrated that upon his return from the USSR, Hartmann did not speak in glowing terms about his time there in public appearances. He made many negative remarks in private, expressing bitterness over his "exile" there. He is supposed to have said in 1947 that the Soviets were preparing another war, and that the eastern German territories given to Poland after the war should be returned. Once, he went so far as to express this opinion: "It would be false to tell our people that we should learn from the Soviet Union." He also believed that the Soviets were determined to prevent the East Germans from developing modern electronic equipment, and were trying to torpedo this industry.[134]

An anti-Communist stance was ascribed to Hartmann. The building of the Berlin Wall left him "in despair and emotionally broken."[135] He apparently asserted in private that economic planning was detrimental to research and development.[136] He said in 1960 that he felt like a squirrel forced to run endlessly on a wheel because of the constant worsening of the situation of the East German economy. He expressed unequivocally his dislike of the division of people in East Germany into two categories: party members and non-members. By contrast, Hartmann came back from trips to Sweden and Finland full of enthusiasm for those countries. "He expressed [his consternation] that the GDR, with its much greater capacity, is not making progress, and that he would like to know where the money is going in our country." Stasi reports were also very critical of Hartmann's frequent use of English words and phrases, which "leave the impression that Professor H. sees the ideal of the 'american [sic] way of life' as superior."[137] This informant was probably a rather uneducated person who felt frustrated that he could not understand foreign words, which in fact were frequently used in German, even in the GDR.

All the basic elements of Hartmann's style of research management were roundly condemned by the Stasi as anti-socialist and bourgeois. It was asserted that Hartmann would have done a better job as head of Vakutronik if he had been loyal to the SED.[138] Again and again in these reports, political conformity is presented as a central element in effective leadership and technical success. Hartmann failed to produce the technology that he was supposed to produce, according to the Stasi's line of reasoning, because he did not truly recognize the leadership role of the SED and the superiority of socialism. His sins were many. In promoting the idea of a research and industrial facility for microelectronics (AME), he failed to go through official channels as he should have.[139] At AME, he supposedly employed "managerial methods of capitalist companies" and became a tyrannical boss who "suppressed all criticism."[140] He allegedly spent too much time writing articles for scientific and technical journals.[141]

Hartmann complained that the SED tried to force him to promote Party members who were not technically and professionally competent. Stasi informants complained that Hartmann was anxious to hire applicants who were not in the Party, even if they were not as qualified as Party members who applied for positions at AME. Hartmann was also accused of fulfilling his political duties (e.g., participation in meetings) in a perfunctory way. The Stasi felt that this emboldened his employees to shirk political responsibilities: "All his activities revealed his personal distance [to the SED], and in such a way that his employees noticed. As a result of this behavior, political work with a large segment of top personnel and rank-and-file employees of AMD was condemned to failure from the start. This is reflected in the political and ideological level of a large portion of the employees of AMD down to the present day." Hartmann's lack of enthusiasm for the *Neuererbewegung*, socialist "competitions," and "socialist cooperation" (*sozialistische Gemeinschaftsarbeit*) raised hackles. So did his attempts to attain as much freedom as he could through planning and control at AME.

He was sharply criticized for his "Western" orientation. One informant said, "When one tried to get him (H.) involved in GDR physics, he decides [sic] to travel to the West." It was noted that he often read Western journals and newspapers when he visited the exclusive Dresden Club. He listened to Western radio programs and watched Western television programs. He returned from a trip saying that he had the impression that the sun shone more brightly in Vienna, whereas in Prague everything was "dark and grey," like at home. Worse, Hartmann insisted that the GDR badly needed Western imports, particularly from West Germany, and should orient itself to the West.[142] The Stasi believed that Hartmann was dragging his heels on development at AME because he was hoping for a restoration of capitalism in East Germany.[143]

By contrast, Hartmann felt himself to be very much a loyal servant of the socialist system who had done his utmost to place the GDR at the forefront of technological developments. Granted, he was little interested in politics and "did not want to be subjected to Party discipline." Nonetheless, according to his former colleague Hans Becker, he saw socialism as the "more progressive" system, at least before he became aware that he was being investigated by the Stasi.[144] He accepted the rules of the system and publicly declared his loyalty to socialism on many occasions.[145] He took great care to abide by security measures. He tried to maintain good relations with the SED, despite many difficulties. In 1968, Minister Steger told him, "You are an objective impediment to the development of microelectronics," presumably because Hartmann would not join the SED. If fired, Hartmann intended to recommend the SED Party secretary at AME, with whom he got along well, to be his successor. Hartmann also tried to ingratiate himself with the powers that be by supporting the opening of a chapter of the Communist youth organization, FDJ, at AMD. In 1970, he named an SED member to head the computer center, as required by regulations. When asked in 1970 by the Nobel Prize committee in Stockholm to nominate candidates for the Nobel Prize in Physics, he named Max Steenbeck, as the SED wished, even though he did not think Steenbeck to be Nobel Prize material.[146]

Hartmann's widow, Renée Hartmann, recalls breakfast-table discussions with her husband about the political leadership: "My husband felt uncomfortable when I used overly negative words to describe the political leadership. I was nineteen years his junior! He belonged to the generation with a Prussian sense of morality, with a firm belief in honor and virtue and the importance of keeping one's word . . . He expected something similar from his opponents." He did not think in ideological terms, but counted on his "work ethic" and "achievements" to get him through difficulties with the authorities.[147]

However, Hartmann's Stasi file makes it clear that he became bitterly critical of the system in the 1970s. His anger over the neglect of the semiconductor and microelectronics industry was intensifying. In 1971, he compared Central Committee plans for the semiconductor industry with the demise of the aircraft industry, hinting that the Soviet Union was responsible. Within earshot of an informant, he complained that most of East German industry was being neglected because each member of the top leadership had a "hobby": For Ulbricht, it was Zeiss; for the Politburo it was the rebuilding of downtown Berlin; for Honecker it was Cottbus; and for Kleiber it was Robotron. Hartmann also made very critical remarks about security regulations in private. In 1967, he argued that classifying AMD as a top secret operation greatly hindered communication and the flow of information. He later tried to prevent the deployment of security people (presumably from the Stasi) to AMD. Hartmann also fought being given a security clearance for work with the Soviet Union (in 1966) because he would not be allowed to travel to the West anymore as a result. He feared that he would no longer be allowed to carry on correspondence with people living in the West either. He threatened to resign if that happened (which it did not). However, he got into a serious fight with a general director (presumably the general director of his VVB) because he (Hartmann) was forbidden to meet with an old friend in Berlin in 1972. He lost his temper when, in 1974, a West German scientific journal mailed to him was confiscated by East German officials. In 1974, nearing the Autobahn exit for West Berlin by car, Hartmann said, "Another 10 minutes and I would be home," a comment probably relayed to the Stasi by his chauffeur.[148] In a real sense, it was all over for Hartmann long before it was all over.

The end came very suddenly and very unexpectedly. On Tuesday, June 25, 1974, Hartmann went to a meeting in Berlin, arranged the previous day, with General Director W. Lungershausen. Hartmann was relieved of his duties as the head of AMD and forbidden to ever again enter AMD facilities. "I was never again to see AMD," he later wrote.[149] Sixty-two years of age, he was given a lowly position at an enterprise that produced silicon (*VEB Spurenmetalle Freiberg*). He took an 84 percent pay cut, which also reduced his pension. He had a very long daily commute from Dresden to Freiberg. According to his widow, Stasi agents often picked him up in the evening for interrogation sessions that sometimes lasted all night. These were "frequent," though there is no record of how many took place. Renée Hartmann suspects that he was drugged, but, again, nothing about this is to be found in Werner Hartmann's Stasi files. Desperately trying to help her husband, Renée Hartmann anonymously wrote a series of critical letters to members of the SED leadership. Max Steenbeck also personally appealed to the leadership to stop this persecution of Hartmann, but to no avail.[150]

The Stasi prepared its interrogations well. It amassed enormous files containing Stasi reports and documents from the AMD archives. Teams of interrogators were drilled on how to proceed. At first, Hartmann maintained his innocence, arguing that the many honors he had received (including, twice, the National Prize) proved that the top party leadership was pleased with his work. But his interrogators were relentless. In January 1975, the Stasi threatened to put him on trial. He might be charged with sabotage and serious economic crimes. More humiliatingly, he might be charged with "simple crimes" such as theft (of construction materials) or private use of company employees and vehicles. What might people say if a person of his stature were to be publicly unmasked as a common criminal? He was admonished to "give this serious thought." This would "not be a pleasant proceeding." "That means that he should realize that in the next hours a matter is to be decided which will affect his whole life." If he made the right decision, the charges would be dropped, and he could leave Stasi custody "a free man."[151]

What did the Stasi want from him? First, a confession. This, the Stasi got. During interrogations on April 27–29, 1976, Hartmann finally broke down and gave up all resistance to Stasi demands. He confessed to "a series of false decisions that led to economic damage" and that enabled a researcher at AMD to commit acts of sabotage. (This individual had already been imprisoned on charges of sabotage.) Hartmann also confessed to having passed secrets about Soviet nuclear research to West German intelligence on three or four occasions in 1957. If there was any truth to this confession, why was Hartmann not put on trial for treason? The Stasi was strangely merciful here: "one has to take into consideration that these acts took place nineteen years ago, so the danger to society is not present to the extent required [by law to call for trial]." The Stasi was also willing to forgo charges of sabotage and economic criminality, ostensibly because there was no proof of criminal intent or negligence. Hartmann's case was closed.[152]

Second, Hartmann agreed to do whatever was asked of him. This was to be a form of "reparation" for his supposed misdeeds. The Stasi wanted to look into his possible use as an informant. There is not a shred of evidence that he was actually deployed as one. He did, however, implicate others in espionage during the course of his confession. At least two of these people were West German citizens. There is no evidence that anyone named by him was detained or harmed.[153]

The Orwellian state had ensnared Hartmann by exploiting his greatest fear—loss of public honor. Tragically, he felt himself compelled to sacrifice private honor to public honor. He felt this acutely. According to his widow, he was initially in a state of denial following his ouster as head of AMD. But his confession changed all that: "He had been forced to criticize himself. He was ashamed." He became a "monolith," refusing to speak.[154] He became his own prison guard, locking himself away in "psychological solitary confinement."[155] Only work on his memoirs, which he completed on January 5, 1982, distracted him for short periods from his grief.

After he turned sixty-five and retired, he and his wife were allowed to travel to the West. The Hartmanns felt they did not have enough money to move to West Germany.[156] They finally made it to the United States as tourists. Back in Dresden, he told a visiting acquaintance (who was also a Stasi informant) that "if he were still young, he would go [to live in] the United States because he could develop his creativity there. In this connection he expressed regret that he had not experienced that during his career in the GDR and that talented professionals [in the GDR] languished."[157]

Hartmann was subjected to state-directed ostracism. Friends and former colleagues were "afraid to be seen with him." Only a few had the courage to maintain contact with the Hartmanns. Employees of what was formerly AMD (now called ZFTM) were forbidden to have any contact with Hartmann,[158] though several older colleagues ignored this injunction and came to visit from time to time.[159] A group of former colleagues came by to see Hartmann on his seventieth birthday. "He put on a white shirt and spoke as he had always spoken." But he was "psychologically broken," according to his widow: "His work, which was taken from him suddenly, was his life. He felt as if he had been forced to outlive his own existence. He was no longer capable of getting any happiness out of this reduced life. Afterwards, a fourteen-year-long life catastrophe had to be lived, hidden away behind closed doors. It was a tortured, distressing, dismal disintegration of a personality."[160] He attempted suicide twice.[161] At the end, he "lost his mind."[162] Hartmann died as a result of a prostate operation on March 8, 1988, in Dresden, just over a year and a half before the fall of the Berlin Wall.

Why did the Stasi persecute Hartmann with such zeal? Hartmann was certainly not popular with economic chief Günter Mittag, with whom he had crossed swords in 1964,[163] or with Otfried Steger, the industrial minister who oversaw AMD. According to Renée Hartmann, Steger was jealous of Hartmann, who was always the center of attention at gatherings and who knew foreign languages, unlike Steger.[164] Hartmann did not get along well with a few SED diehards at AMD, either. In general, Hartmann's constant complaints about the inadequacies of the economic system and fearless honesty were certain to rub people the wrong way in a system that prized conformity above all else. However, personality cannot have been the decisive factor, for Hartmann's case was by no means unique, as the cases of Falter and Görlich demonstrate.[165]

The secret police had for many years viewed members of the industrial research elite who were not in the SED—particularly members of the old intelligentsia such as Hartmann, Falter, Görlich and Schrade—as highly suspicious. Sharing this view, hardliners in the government were evidently finally able to do something about it in the 1960s, as power relations gradually shifted in their favor.[166] This is particularly clear in the case of Erich Apel. Historians Rainer Karlsch and Agnes Tandler argue that he committed suicide in 1965 because he was facing ostracism, scapegoating, public shame, and a fall from power. His impending disgrace was being orchestrated by members of the government who had joined the Communist Party before the war. They distrusted him for having once worked for Wernher von Braun on the V-2 project, for a time at facilities where labor camp inmates were used.[167] Monika Kaiser believes that it is possible that Apel was in fact killed because of his Nazi past, which would have caused the East German government great embarrassment if it had been made public. However, she considers other theories plausible, for example, that Apel was killed or committed suicide because as a supporter of far-reaching economic reforms, he was reviled by many hardliners (such as Erich Honecker and Günter Mittag). She is more skeptical of the idea that Apel committed suicide because of very difficult trade talks with the Soviets.[168]

It was Hartmann's bad luck that he did not reach retirement age until the Honecker era. Hostility toward the old intelligentsia intensified after Honecker's takeover in 1971. Hartmann had been put on a list of disloyal persons by the Soviets in 1954 but this damning evaluation was virtually forgotten and lay dormant in his files as long as Ulbricht was in power. Soviet suspicions of Hartmann were evidently taken more seriously because Honecker was attempting to reestablish close ties with the Soviet Union. At the same time Honecker initially cut high-tech programs, and did not see the need for people such as Hartmann.[169] Honecker did an about-face in 1974, when the importance of microelectronics suddenly became stunningly clear, as did the GDR's backwardness in this area. But rather than improving Hartmann's position, this made it worse. Self-criticism was not the forte of the Communist leadership, and the Stasi wanted to be able to present someone's head on a platter to Erich Honecker. Hartmann became a scapegoat.

Another factor was at work as well. Honecker was part of a faction that had fiercely fought Ulbricht's liberalization attempts in 1963–1971. They were much disturbed by what they saw as the destabilizing impact of these reforms. A subtle critique of Ulbricht-era policies and predilections runs through Hartmann's Stasi file. The thesis here seems to be that in that era, the Communist leadership had allowed the old intelligentsia, and in particular the specialists who had been deported to the Soviet Union, to pull the wool over their eyes. Of Hartmann, the Stasi wrote: "Professor H. disguises his hostile, anti-Communist attitudes well with deceit, concealment, political hypocrisy, and duplicity. This is how he was able to win the trust of party and state officials and the state institutions to which he answered, so that they entrusted him with key economic functions and positions in national and international organizations."[170]

Stasi reports assert that Hartmann was aided and abetted by Ulbricht-era officials and policies. It is alleged that he used the creation of "scientific industrial enterprises" (*Wissenschaftliche-Industrie-Betriebe*, or WIB) to undermine planning.[171] Hartmann's negotiations with a Western firm are called "legalized treason" in another document.[172] A more direct attack is aimed at Robert Rompe, the most powerful physicist in the Ulbricht era, and against the Research Council, which was an advisory council dominated by members of the old intelligentsia:

> The presentation of a special bonus to Professor Hartmann "for the establishment and construction of AMD" is completely incomprehensible in light of delays of several years and the continued dysfunctionality of AMD at that point. Ultimately it can only be explained by the "helping hand of the Research Council" and by Professor Rompe's preventing of oversight of work at AMD; otherwise, the shortcomings of Professor Hartmann's work would have been discovered by late 1964 at the latest![173]

The hardliners of the Honecker era considered even an SED stalwart and secret police collaborator like Rompe too independent.

It is clear from Hartmann's Stasi file that the East German scientists who had gone to the Soviet Union were viewed with particular suspicion by the Stasi. One informant claimed to have found out from American intelligence (presumably a double agent) that Vakutronik, the research-oriented enterprise headed by Hartmann in the late 1950s, had been infiltrated by American intelligence. Scientists who had returned from the USSR were considered the top suspects. It was noted later in this report that a West German scientist who had been taken to the Soviet Union kept up contacts with former colleagues there, and tried to induce East German scientists and engineers to defect to the West.[174] Later it was claimed that his job was to recruit former deportees now in East Germany to work for West German intelligence.[175] By ending the leading role of the deportees in industry, the Stasi was confronting the perceived danger posed by these covert anti-Communists. Their elimination was seen as necessary for the centralization and increased SED control of the economy in the Honecker era. This centralization went hand in hand with the ever-growing power and presence of the Stasi. At the same time, Hartmann and his ilk were an "objective hindrance" to the development of high-tech fields in the sense that the Soviets did not trust them. Thus, there may very well have been hopes that the Soviets would be more willing to share their technologies with the GDR if more politically reliable cadres were put in place.

The motive of the Stasi and SED in pushing aside the old intelligentsia was thus not emancipation from patriarchal structures. And indeed, none of the characteristics of modernization of research management outlined in the introduction to this chapter are observable in the GDR in this period. Instead, political criteria won out over economic or technical rationality and communication networks were torn asunder. As a result, the beginnings of an East German microelectronics industry were stifled, and a wonderful opportunity to get a head start and build up international connections was wasted.[176]

Conclusion

The careers of Görlich, Falter, and Hartmann demonstrate that industrial research was a realm of society in which a certain degree of self-determination continued to exist throughout the first twenty years of the existence of East Germany. Although the boundary between industrial science and politics became porous, it was not broken down. Industrial research was subordinated to political authority, but not yet fully penetrated by it (as it was to in the 1970s). Members of the industrial research elite had to accommodate themselves to a much changed economic system, but could continue to define themselves as scientists, managers, and men (rarely women) of industry.

In the realm of technoscience, it was still possible for research directors to cultivate cultures of innovation that combined traditional, international, and idiosyncratic elements. They had to accommodate themselves to reigning power relations, but saw the mandates of ideology and the planned economy as flexible and negotiable. They entered into negotiations with the SED very consciously, trying to find a place for their conceptions of what was needed to promote a dynamic innovative process. Granted, their desires to remain engaged with the international scientific and technical community was motivated in part by professional ambition (for themselves and for their staffs). But they were also very concerned with maintaining the flow of technological knowledge into East Germany. The model of innovation that they employed was characterized by creative re-invention and further development of Western technologies. By contrast, Hartmann specifically rejected reproduction of Western technologies, believing that would condemn East Germany to a permanent last place in worldwide competition. He also feared it would undermine the scientific methods needed to master new technologies and reinforce the amateurish, slapdash approach to technology that was becoming rampant in East German industry.

Each of the three research directors whose work was analyzed in this chapter had his own style of innovation. Görlich saw himself as an heir to a great corporate tradition. Personal, professional ambitions coincided with the prejudices of Zeiss conservatism. Thus, Görlich was a proponent of optics research and an opponent of computer (and related) research at Zeiss. A fine scientist, his greatest triumph was in promoting laser research. Falter fancied himself a great innovator, but had little patience or talent for more prosaic organizational tasks. Hartmann was a great managerial talent, able to instill his employees with a sense of mission. The application of scientific methods to experiments, trial runs, and the development of production techniques was also central to his conception of the innovation process. His introduction of microelectronics into the GDR was a considerable achievement.

The small margins of autonomy within which Falter, Hartmann, and Görlich operated were, however, gradually eliminated. The problem was in part that the SED saw their approaches to innovation as wrapped up with bourgeois individualism, which essentially meant a predisposition to doing things in a way not pleasing to the Party. Embracing scientific-technical revolution in 1967, the SED set about placing itself in the center of the innovative process. A similar expansion of SED power and curtailment of initiative from below took place in this period in the chemical industry, according to historian Georg Wagner-Kyora.[177]

The other side of the coin was the fear that the acquisition of Western technologies could subvert Communism, a fear learned from the Soviets. Particularly dangerous were face-to-face encounters of East Germans with Westerners, especially West Germans. They not only spoke the same language, but were often friends and former colleagues. These Westerners had a unique ability to seduce and subvert, igniting or reinforcing anti-Communist attitudes, perhaps even inducing East Germans to divulge secrets or commit acts of sabotage.

These fears led to a strengthening of the role of the Stasi. And it was the Stasi that brought about a profound revision of power relations in high-tech research. The critical moment was reached when serious scientists and engineers began signing on in significant numbers with the Stasi to inform on bosses and colleagues, and independent-minded industrial scientists such as Hartmann were replaced with more conformist personnel. A new era was being ushered in, one in which political loyalty, professional ambitions, and technological aspirations were becoming much more closely entwined. This is the theme of the next three chapters. No more was technology to be the domain of a bourgeois elite. The new technical intelligentsia was finally taking the helm in industrial research. The population was to be mobilized to participate in the uplifting collective experience of building socialism with the help of modern technology.

Notes

1. See Schmaltz, *Kampfstoff-Forschung*; Heim, *Kalorien*. See also chapter 1.

2. See Thomas P. Hughes, *Rescuing Prometheus* (New York: Vintage Books, 1998), 5.

3. See William Baumol, *Free Market Innovation Machine: Analyzing the Growth Miracle of Capitalism* (Princeton, NJ: Princeton University Press, 2002).

4. See Manuel Schramm, "Präzision als Leitbild? Carl Zeiss und die deutsche Innovationskultur in Ost und West, 1945–1990," *Technikgeschichte* 46 (2005); Meinolf Dierkes, Ute Hoffmann, and Lutz Marz, *Leitbild und Technik: Zur Entstehung und Steuerung technischer Innovationen* (Berlin: Edition Sigma, 1992); Ulrich Wengenroth, "Vom Innovationssystem zur Innovationskultur. Perspektivwechsel in der Innovationsforschung," in *Innovationskulturen und Fortschrittserwartungen im geteilten Deutschland*, ed. Johannes Abele, Gerhard Barkleit, and Thomas Hänseroth (Cologne: Böhlau Verlag, 2001), 23–32.

5. See Peter Galison and Bruce Hevly, eds., *Big Science: The Growth of Large-Scale Research* (Stanford, CA: Stanford University Press, 1992).

6. Author's interviews with Steffen Görlich and Irmgard Görlich, November 12, 2004, in Jena, Germany, and with Klaus Jüttner, November 13, 2004, in Dresden, Germany.

7. NARA FBI (released by IWG in 2004) (65/230/86/15/07/105), File #012560, Sec. 1, letter from Görlich to Ringleb, dated December 20, 1953. See also Pröger, *Mikrostrukturen*, 108.

8. Author visited Görlich's home in November 2004.

9. BStU MfS, Archive number 14254/69, vol. 2, 167 (report, translated from Russian, dated December 1957), 2. (All BStU documents in this section are from Paul Görlich's file, unless otherwise indicated.)

10. Pröger, *Mikrostrukturen*, 108.

11. BStU MfS, Archive number 14254/69, vol. 12, 82.

12. Carl Zeiss Archive (Jena), VA 1032, "Vorschlag des VEB Carl Zeiss Jena für die nächsten Aufgaben im wissenschaftlichen Gerätebau." Görlich advocates concentration on scientific instruments in Carl Zeiss Archive (Jena), NG 91, "1. Entwurf" [of a 1959 report of the Research Council], 36.

13. See Mühlfriedel, *Carl Zeiss*, 273–274.

14. On skepticism toward the use of electronics in Zeiss instruments, see Schramm, "Präzision," 39.

15. BStU MfS, Archive number 14254/69, vol. 6, 101–102 (report, dated October 11, 1966). (All the following reports from Görlich's file originated with Hauptabteilung XVIII/5/2 unless otherwise noted.) See also Pröger, *Mikrostrukturen*, 84.

16. TSD, Nachlaß Hartmann, vol. H, 51. Also SächsHStA Bestand Zentrum für Mikroelektronik 1070, letter, dated October 15, 1964, Hartmann to Schmidt (head of *HWF*).

17. SächsHStA Bestand Zentrum für Mikroelektronik 1904a/2, letter, dated July 20, 1970, Hartmann to Steger, 20.7.1970, 2. SAPMO DY 30/IV A2/6.07 171, transcript of meeting on fundamental issues of microelectronics, February 1, 1965, 9; State Secretary for Research and Technology, memorandum, dated May 15, 1965.

18. See Pröger, *Mikrostrukturen*, 143–147; quotations on pp. 145, 146. Neither Pröger nor I could find any documents relating to Zeiss's relationship with Hartmann's institute at the Zeiss Archive in Jena.

19. See Knut Kaschlik, "Zwanzig Jahre Mikrolithografie-Entwicklung bei Carl Zeiss Jena," in *Schaltkreise: Die Anfänge der Mikroelektronik im VEB Carl Zeiss Jena und ihre Folgen*, ed. Katharina Schreiner (Jena, Germany: Thüringer Forum für Bildung und Wissenschaft, 2004), 22.

20. See Pröger, *Mikrostrukturen,* 149–151.

21. TSD, Nachlaß Hartmann, vol. H, 112, 113, 53. Negotiations leading to contract with the Soviet Union for development of photo repeater in Carl Zeiss Archive (Jena) VA 826, "Direktive für das Auftreten der Delegation des VEB Carl Zeiss Jena."

22. SächsHStA Bestand Zentrum für Mikroelektronik 1904a/2, letter, dated November 10, 1965, Hartmann to Heinze, 3.

23. See Pröger, *Mikrostrukturen*, 147.

24. Carl Zeiss Archive (Jena) NG 148, "Beschlußfassung über die Konzeption zur weiteren Konzentration der Forschungs- und Entwicklungskapazitäten." See also Mühlfriedel, *Carl Zeiss*, 203–212.

25. See Mühlfriedel, *Carl Zeiss*, 184–200.

26. Görlich criticizes the idea that all lines of research and production should be profitable in an earlier report: Carl Zeiss Archive (Jena), NG 91, "1. Entwurf" [of a 1959 report of the Research Council], 23.

27. Carl Zeiss Archive, VA 826, "Aktennotiz," dated November 10, 1970.

28. Later, they were made compatible with ESER computers, a COMECON line of computers. See Mühlfriedel, *Carl Zeiss*, 251; Lothar Löscher, "Der Magnetbandspeicher—ein Beitrag von Carl Zeiss Jena zur DDR- und RGW-Rechentechnik (ESER)," in *Schaltkreise: Die Anfänge der Mikroelektronik im VEB Carl Zeiss Jena und ihre Folgen*, ed. Katharina Schreiner (Jena, Germany: Thüringer Forum für Bildung und Wissenschaft, 2004), 37–47.

29. See chapter 4.

30. Carl Zeiss Archive (Jena) NG 142, report stamped April 14, 1970.

31. Carl Zeiss Archive (Jena) NG 142. See also Hans-Joachim Pohl, "Zur Entwicklung des VEB Carl Zeiss Jena im NöS," in *Politkrimi oder Zukunftsmodell? Neues ökonomisches System im VEB Carl Zeiss Jena*, ed. Katharina Schreiner (Jena, Germany: Thüringer Forum für Bildung und Wissenschaft, 2002), 107–108; Pröger, *Mikrostrukturen*, 149.

32. BStU Zentralarchiv MfS-HA-XVIII, Nr. 13337, 55 ("Erfüllung eines Beschaffungsauftrages für das V-System im VEB Carl Zeiss Jena," dated January 2, 1970).

33. Carl Zeiss Archive (Jena) NG 148, "Beschlußfassung über die Konzeption zur weiteren Konzentration der Forschungs- und Entwicklungskapazitäten." See also Mühlfriedel and Hellmuth, *Carl Zeiss*, 203–212.

34. Görlich had already retired on January 1, 1971. See Mühlfriedel and Hellmuth, *Carl Zeiss*, 203–217, 233. Görlich's antipathy toward Gallerach is mentioned in BStU MfS, Archive number 14254/69, vol. 12, 82.

35. Carl Zeiss Archive, VA 1770, speech given by Görlich at the Higher School for Electrical Engineering of Ilmenau on January 23, 1964; NG 105, speech given by Görlich on October 26, 1967 at the conference, "Tag der Forschung."

36. Carl Zeiss Archive, WB 2747, biography of Görlich, dated March 23, 1970, 10.

37. BStU MfS, Archive number 14254/69, vol. 6, 262 ("Analyse der operativen Ergebnisse zum Vorgang 'Laser' 1966," Hauptabteilung XVII/5/2, report, dated April 12, 1967, 23). (All BStU documents in this section are from Paul Görlich's file, unless otherwise indicated. Both the page number within the file and within the document are given.)

38. Rüdiger Stutz, "Vom 'Feindagenten' zum Vorzeigemanager: Der erste Kombinatsdirektor des VEB Carl Zeiss Jena in der Wahrnehmung von SED und Staatssicherheit (1946–1966)," *Historical Social Research/Historische Sozialforschung* 30, no. 2 (2005), special issue *Unternehmer und Manager im Sozialismus*; 130–159.

39. BStU MfS, Archive number 14254/69, vol. 1, 10 (form entitled "Gründe für das Anlegen/Einstellen" [May 1962]).

40. BStU MfS, Archive number 14254/69, vol. 1, 62 (report of Hauptabteilung III/6/S, dated May 20, 1963, 10).

41. BStU MfS, Archive number 14254/69, vol. 2, 166–170 (report translated from Russian, dated December 1957); vol. 7, 98–99 ("Auskunft," translated from Russian, dated April 27, 1967); vol. 7, 100–102 (report, dated June 19, 1967); vol. 7, 168–169 (report, dated August 18, 1967, 14–15); vol. 11, 259 (report, dated October 8, 1968, 8).

42. BStU MfS, Archive number 14254/69, vol. 7, 216 (report, dated September 8, 1967, 1).

43. BStU MfS, Archive number 14254/69, vol. 6, 108 (report of Hauptabteilung XVIII/5/2, dated October 11, 1966, 15).

44. BStU MfS, Archive number 14254/69, vol. 7, 166–167 (report of Hauptabteilung XVIII/5/2, dated August 18, 1967, 12–13.)

45. BStU MfS, Archive number 14254/69, vol. 1, 42 ("Auszug aus einem Bericht des GI 'Sparrow' vom 13.11.1962," report of Hauptabteilung III/6/S, dated November 17, 1962); vol. 1, 43 ("Vermerk" of Hauptabteilung III/6/S, dated October 29, 1962).

46. BStU MfS, Archive number 14254/69, vol. 1, 39–41 (report of Hauptabteilung III/6/S, dated October 31, 1962); vol. 1, 44–46 (report of same division, dated February 1, 1963); Archive number 14254/69, vol. 6, 97 (report of Hauptabteilung XVIII/5/2, dated October 11, 1966, 2).

47. BStU MfS, Archive number 14254/69, vol. 6, 217 (report of Hauptabteilung XVIII/5/2, dated April 1, 1965, 13).

48. BStU MfS, Archive number 14254/69, vol. 6, 230–231 ("Zum Sprachenproblem in der Zeitschrift 'Physica Status Solidi,'" 2–3).

49. BStU MfS, Archive number 14254/69, vol. 6, 241 ("Analyse der operativen Ergebnisse zum Vorgang 'Laser' 1966," dated April 12, 1967, 2).

50. BStU MfS, Archive number 14254/69, vol. 6, 82, 84 (report of Hauptabteilung XVIII/5/3, dated October 13, 1966, 1, 3).

51. BStU MfS, Archive number 14254/69, vol. 6, 264, 260 ("Analyse der operativen Ergebnisse zum Vorgang 'Laser' 1966," Hauptabteilung XVII/5/2, report, dated April 12, 1967, 25, 21).

52. BStU MfS, Archive number 14254/69, vol. 6, 101 (report of Hauptabteilung XVIII/5/2, dated October 11, 1966, 6).

53. BStU MfS, Archive number 14254/69, vol. 6, 103 (report of Hauptabteilung XVIII/5/2, dated October 11, 1966, 8).

54. BStU MfS, Archive number 14254/69, vol. 6, 104 (report of Hauptabteilung XVIII/5/2, dated October 11, 1966, 9).

55. BStU MfS, Archive number 14254/69, vol. 11, 255 (report, dated October 8, 1968, 5).

56. BStU MfS, Archive number 14254/69, vol. 6, 110–112 (report, dated October 11, 1966, 15–17); vol. 6, 262–265 ("Analyse der operativen Ergebnisse zum Vorgang 'Laser' 1966," Hauptabteilung XVII/5/2, report dated April 12, 1967, 23–26); vol. 7, 285–288 ("Analyse des Materials aus der Zusammenarbeit des GM 'Bach' mit dem englischen Geheimdienst auf vermutliche Quelle des Geheimdienstes in der DDR," dated October 23, 1967); vol. 11, 258–270 (report, dated October 8, 1968, 8–20).

57. BStU MfS, Archive number 14254/69, vol. 11, 211–212 (transcript of a meeting of the Research Council, dated July 17, 1968, 2–3). Carl Zeiss Archive (Jena) NG 119, transcript of meeting of "1. FEEf-Kolloquium," dated February 4, 1965, 1.

58. See Heinz Voigt, "Wie sich doch die Zeiten ändern. Oder: Stasi-Spitzel heute Laudator für einen der damals Bespitzelten," *Gerbergasse* 18, no. 3 (2005): 22–24.

59. BStU MfS, Archive number 14254/69, vol. 7, 98–99; quotation on p. 98 ("Übersetzung aus dem Russischen: Auskunft," April 27, 1967).

60. BStU MfS, Archive number 14254/69, vol. 6, 206 (report, dated April 1, 1965, 2).

61. BStU MfS, Archive number 14254/69, vol. 6, 106 (report, dated October 11, 1966, 11).

62. BStU MfS, Archive number 14254/69, vol. 11, 254 (report, dated October 8, 1968, 4). Also vol. 7, 98 ("Übersetzung aus dem Russischen. Auskunft," April 27, 1967, 1).

63. NARA, Records of the Army Staff, CIC, RG Nr. 319, IRR Personal Name Files, Box 621, File # AC646094, "Summary of Information," dated May 16, 1960. As early as 1952, unconfirmed reports to this effect had begun surfacing. NARA, Records of the Army Staff, CIC, RG Nr. 319, IRR Personal Name Files, Box 621, File # AC646094, card, dated June 1954.

64. BStU MfS/BV Gera, Nr. 180/85, Part I, vol. 1, 8 (signed statement, November 3, 1966), 91 ("Auskunftsbericht," June 17, 1968). This fact was first revealed in Voigt, "Wie sich," 22–24.

65. He headed "Erkundungsforschung."

66. Carl Zeiss Archive (Jena) CZ 039.

67. BStU MfS, Archive number 14254/69, vol. 16, 15 ("Sachstandsbericht," dated October 28, 1968, 7). Pohl's involvement in one research program for the Soviets in Carl Zeiss Archive (Jena), NG 122, memo, dated January 20, 1970.

68. BStU MfS/BV Gera, Reg.-Nr. X/630/66, Archiv-Nr. 180/85, 74 ("Pohl, Hans-Joachim, April 15, 1970").

69. BStU MfS, Archive number 14254/69, vol. 7, 148 (report, dated July 12, 1967, 6); also 140 ("Operativplan," dated June 27, 1967, 3).

70. BStU MfS, Archive number 14254/69, vol. 7, 156 (report, dated August 18, 1967, 2).

71. BStU MfS, Archive number 14254/69, vol. 6, 240–266 (“Analyse der operativen Ergebnisse zum Vorgang ‘Laser’ 1966,” dated April 12, 1967). Author’s interview with Irmgard Görlich, November, 2004.

72. BStU MfS, Archive number 14254/69, vol. 7, 169 (report, dated August 18, 1967, 15); see p. 161 of file (p. 7 of report).

73. BStU MfS, Archive number 14254/69, vol. 7, 210 (“Vermerk” September 1, 1967).

74. BStU MfS, Archive number 14254/69, vol. 12, 82.

75. This included positive statements concerning the Warsaw Pact invasion of Czechoslovakia in the wake of the Prague Spring. BStU MfS, Archive number 14254/69, vol. 11, 222 (report, dated August 24, 1968, 1). Also vol. 11, 256 (report, dated October 8, 1968, 6).

76. BStU MfS Archive Number 14254/69, vol. 12, 82.

77. Carl Zeiss Archive, NG 121, transcript of Exploratory Research heads meeting on October 23, 1967, 1.

78. BStU MfS Archive Number 848/61, vol. 1 [part 1], Reg. Nr. Zentraler-O.-V. (file Matthias Falter), 42 (report, dated December 14, 1959, 3); also p. 40 of file (p. 1 of document).

79. BStU MfS Archive Number 848/61, vol. 1 [part 2], Reg. Nr. ZOV TV-Nr. 3 (file Matthias Falter), 9-14 (“Operativplan zur Absicherung der leitenden Mitarbeiter des Institutes für Halbleitertechnik Teltow,” Abteilung III/4, dated April 12, 1960). (All the following reports on Falter are from Abteilung III/4 unless otherwise noted.)

80. BStU MfS Archive Number 848/61, vol. 4 (file Matthias Falter), 12–16 (report, dated April 5, 1960).

81. BStU MfS Archive Number 1902/67, vol. 1 [part 1] (file Matthias Falter), 88 (report of Abteilung XVIII/1, dated March 9, 1965, 8).

82. BStU MfS Archive Number 848/61, vol. 4 (file Matthias Falter), 28–36 (report, dated April 22, 1960), quotations on pp. 29, 31, 32 of file (pp. 2, 4, 5 of document).

83. BStU MfS Archive Number 1902/67, vol. 1 [part 1] (file Matthias Falter), 32–34 (“1. Operativplan zum ZOV ‘Widerstand’—Teilvorgang 6—Prof. Dr. Falter” of Abteilung XVIII/1, dated September 28, 1964), quotation on p. 32 of file (p. 1 of document). Also BStU MfS Archive Number 1902/67, vol. 1 [part 1], 92 (“Auskunftsbericht,” dated March 21, 1965).

84. BStU MfS Archive Number 1902/67, vol. 1 [part 1] (file Matthias Falter), 81–82 (report of Abteilung XVIII/1, dated March 9, 1965, 1–2).

85. BStU MfS Archive Number 1902/67, vol. 1 [part 1] (file Matthias Falter), 140–141. (“Abschlußbericht” of Abteilung XVIII/1, dated December 6, 1965, 15–16).

86. BStU MfS Archive Number 1902/67, vol. 1 [part 1] (file Matthias Falter), 202 (“Strafrechtliche Einschätzung,” Hauptabteilung IX/3, dated May 15, 1966, 22).

87. BStU MfS Archive Number 1902/67, vol. 1 [part 1] (file Matthias Falter), 204–205 (“Schlußbericht” of Abteilung XVIII/2, dated August 31, 1968).

88. See chapter 4 for a detailed account.

89. TSD, Nachlaß Hartmann, vol. H, 71, 51–53, 64; quotations on pp. 65, 66.

90. TSD, Nachlaß Hartmann, vol. H, 31, 54, 70, 126–129, 171–172, quotations of mottos on pp. 55, 56. Hartmann's account confirmed in: SächsHStA Bestand Zentrum für Mikroelektronik, 1903/1, report, dated September 23, 1964.

91. TSD, Nachlaß Hartmann, vol. H, 94, 148–149.

92. TSD, Nachlaß Hartmann, vol. H, 50, 127, quotation on p. 63. See also interviews with Günter Dörfel and Hans Becker, July 2000.

93. Interview with Renée Gertrud Hartmann, July 2000.

94. BStU MfS Dresden AOP 2554/76, vol. 3, 150 ("Information" of Bezirksverwaltung Dresden, Abt. XVIII, dated June 28, 1974).

95. SAPMO/Barch DY 30/IV A 2/607 171, Protokoll der Beratung über Grundfragen der Mikroelektronik am 1.2.1965 im Staatssekretariat für Forschung und Technik, 8.

96. TSD, Nachlaß Hartmann, vol. H, 63, 133.

97. Interview with Günter Dörfel, July 2000.

98. See Graham, *The Ghost of the Executed Engineer*, 57.

99. On Soviet technology policy, see Bruce Parrott, *Politics and Technology in the Soviet Union* (Cambridge, MA: MIT Press, 1983). On East German technology policy, see Kopstein, *The Politics of Economic Decline*. On CoCom, see Mastanduno, *Economic Containment*.

100. SAPMO/Barch DY 30/IV A 2/6.07 171, memorandum L 15/64, dated April 10, 1964.

101. SächsHStA Bestand Zentrum für Mikroelektronik 1904a/2, Hartmann to Heinze, November 10, 1965, 2, 3, 4.

102. TSD, Nachlaß Hartmann, vol. H, 78.

103 TSD, Nachlaß Hartmann, vol. H, 53–54, 105–109, quotation on pp. 105–106.

104. TSD, Nachlaß Hartmann, vol. H, 71–75, 81–86, 89–91, 109–110.

105. TSD, Nachlaß Hartmann, vol. H, 95, 108, 109.

106. SAPMO/BArch NY 4182 , 43 ("Bericht über die Ergebnisse der Verhandlungen . . . vom 20. bis 24.9.1965").

107. TSD, Nachlaß Hartmann, vol. H, 4, 89, 110, back of 112.

108. "Report on the Specialists returning from the Soviet Union," trans. Paul Maddrell, *Cold War International History Project* 12/13 (Fall/Winter 2001): 352–359. *Original source*: SAPMO/BArch, DY 30/3732, dated December 31, 1954.

109. TSD, Nachlaß Hartmann, vol. H, 150, quotation on p. 89.

110. Landesarchiv Berlin, Rep. 404, Nr. 525, Darlegung zur Perspektivplankonzeption der VVB RFT Bauelemente und Vakuumtechnik, April 4, 1966, 32.

111. See Barkleit, *Mikroelektronik*, 28. The only concrete project that got off the ground was Carl Zeiss's development of special equipment for lithographic techniques. However, according to Barkleit, the Soviets did not hold up their end of the bargain.

112. See Kaiser, *Machtwechsel*, 95–96.

113. See Jörg Roesler, "Industrieinnovation und Industriespionage in der DDR: Der Staatssicherheitsdienst in der Innovationsgeschichte der DDR," *Deutschland Archiv* 27

(1994): 1032. See also Jörg Roesler, "Wirtschaftspolitik der DDR—Autarkie versus internationale Arbeitsteilung," *Dresdener Beiträge zur Geschichte der Technikwissenschaften* 25 (1998): 2–14.

114. TSD, Nachlaß Hartmann, vol. H, 97.

115. TSD, Nachlaß Hartmann, vol. H, 121, quotation on p. 86. Steger's orders to begin copying of Texas Instruments devices are mentioned in BStU MfS AP 444/87 (file Werner Hartmann), 165 ("Betr.: Durcharbeitung des übergebenen Materials," dated September 25, 1974, 23).

116. TSD, Nachlaß Hartmann, vol. H, 131, 147; quotations on pp. 130 and 140. Hartmann states that the abbreviation for his institute changed in 1969, but begins using the abbreviation "AMD" in the passages about the years 1967–1968(126).

117. TSD, Nachlaß Hartmann, vol. H, 131, 169.

118. TSD, Nachlaß Hartmann, vol. H, 131, 149, 152, 202, 213, 222, 251–253, quotation on p. 195 (quotation from *Electronic Design*, September 18, 1975). For the technical details, see Augustine, "Werner Hartmann und der Aufbau," 3–32.

119. TSD, Nachlaß Hartmann, vol. H, 243; see pp. 224–225.

120. Example in Carl Zeiss Archive (Jena), NG 148, letter from the general director of Zeiss, Schrade, to the general director of the socialist combine (VVB), dated September 30, 1965.

121. See Tarmo Lemola and Raimo Lovio, "Possibilities for a Small Country in High-Technology Production: The Electronics Industry in Finland," in *Small Countries Facing the Technological Revolution*, by Christopher Freeman and Bengt-Åke Lundvall (London and New York: Pinter Publishers, 1988), 148. On the strategies of small countries, see the entire volume.

122. An earlier investigation, code named "Tablet" and started in 1955, was dropped in 1962. Its name came from the Soviet suspicion that Hartmann had received tablets used to make invisible ink. BStU MfS Dresden AOP 2554/76, vol. 2, 4–5, 9–10 ("Abschlußbericht" of Bezirksverwaltung Dresden, dated June 13, 1957, and "Abschlußbericht" of KD Dresden Stadt, dated November 28, 1962). The Stasi—not realizing the importance of microelectronics—was under the impression that Hartmann had been given an insignificant position when he was made head of AME. BStU MfS Dresden AOP 2554/76, vol. 2, 16 ("Sachstandsbericht" of Bezirksverwaltung Dresden, Abt. XVIII/1, dated December 18, 1965).

123. BStU MfS-HA XVIII, Nr. 11113 (file Werner Hartmann), 7–15 (report, dated May 10, 1976). BStU MfS AP 444/87, 38–42 ("Gedanken, die nach der Durchsicht des als Analyse vorliegenden Materials zur Vernehmung des Prof. Hartmann bestehen," MfS Berlin HA IX/OfS and BV Dresden, Abt. XVIII/1, dated January 9, 1975).

124. BStU MfS Zentralarchiv MfS-HAXVIII, Nr. 9910, 1–71 (report of HA XVIII/8/3 and BV Dresden, Abt. XVIII/1, dated May 27, 1974); BStU MfS Dresden AOP 2554/76, vol. 7, 4–227 ("Untersuchungsbericht," undated).

125. See chapter 4.

126. BStU MfS Zentralarchiv MfS-HA XVIII, Nr. 11113, 8 (report, dated May 10, 1976, of Hauptabteilungen XVIII/8 and IX/OfS, 2). This division head implicated Hartmann in his alleged acts of sabotage according to: BStU MfS Dresden AOP 2554/76, vol. 8, 262–263 ("Abschrift," dated May 13, 1975).

127. BStU MfS AP 444/87, 98 ("Ungarnaufenthalt vom [blackened out] 1970," 4).

128. Interview with Renée-Gertrud Hartmann, July 2000.

129. BStU MfS AP444/87 (file Werner Hartmann), 68, 71–73 (report of HA IX/OfS and BV Dresden, Abt. XVIII/1, dated January 9, 1975, appendices entitled "Etappe 1961–1974 als staatlicher Leiter AMD," 7 and "Zur Spionage," 1–3).

130. TSD, Nachlaß Hartmann, vol. H, 102–104.

131. BStU MfS-HAXVIII, Nr. 9910, 2 (report of Hauptabteilung XVIII/8/3/ and BV Dresden, Abt. XVIII/1, dated May 27, 1974, 2).

132. BStU MfS AP444/87, 43–46 ("Gedanken," dated January 9, 1975, appendix "Zu seiner bürgerlichen Denk- und Lebensweise").

133. BStU MfS AP444/87, 56 (report of HA IX/OfS and BV Dresden, Abt. XVIII/1, dated January 9, 1975, appendix "3. Etappe von 1955–1960," 4).

134. BStU MfS-HA XVIII, Nr. 9910, 5–36 ("Sachstandsbericht" of Hauptabteilung XVIII/8/3 and BV Dresden, Abt. XVIII/1, dated May 27, 1974), quotations on pp. 7, 10–11 (7, 10–11 of document).

135. BStU MfS AP444/87 (file Werner Hartmann), 63 (report of HA IX/OfS and BV Dresden, Abt. XVIII/1, dated January 9, 1975, appendix "Etappe 1961–1974 als staatlicher Leiter AMD," 2).

136. BStU MfS AP444/87, 14.

137. BStU MfS AP444/87, 72–113 ("Analyse OV 'Molekül': Faktenbericht zur feindlichen Grundeinstellung," dated March 3, 1974), quotations on pp. 81 and 108 (pp. 10 and 37 of document).

138. BStU MfS AP444/87 (file Werner Hartmann), 54 (report of HA IX/OfS and BV Dresden, Abt. XVIII/1, dated January 9, 1975, appendix "3. Etappe von 1955–1960," 2).

139. BStU MfS AP444/87, 142 ("Stellungnahme, Einschätzung und Ergänzung der Ausarbeitung von Prof. Hartmann vom 2.4.75," dated July 5, 1975, 12).

140. BStU MfS Zentralarchiv MfS-HAXVIII, Nr. 9910, 12 ("Sachstandsbericht," dated May 27, 1974, 12).

141. BStU MfS AP 444/87, 7 ("Stellungnahme," dated July 5, 1975, 7).

142. BStU MfS Zentralarchiv MfS-HAXVIII, Nr. 9910, 81, 83, 107, 109, 112 ("Analyse OV 'Molekkül': Faktenbericht zur feindlichen Grundeinstellung," dated March 4, 1974, 10, 12, 36, 38, 41); quotations on 106, 74, 79 (pp. 35, 3, 8 of document). On Hartmann's supposed prejudices against applicants who were not SED members: BStU MfS Dresden AOP 2554/76, vol. 7, 272–277 ("Zur Kaderarbeit von Prof. Hartmann," undated; second document with the same name).

143. BStU MfS Zentralarchiv MfS-HA XVIII, Nr. 9910, 9–12, 16, 21, 24 ("Sachstandsbericht," dated May 27, 1974, 9–10, 16, 21, 24).

144. Interview with Dr. Hans Becker on July 7, 2000.

145. An example can be found in SächsHStA Bestand Zentrum für Mikroelektronik, 1904a/2, "Referat von Herrn Prof. Dr.-Ing. habil. Hartmann anlässlich der Feierstunde zum 1. Mai 1965 am 29.4.1965 im Kinosaal."

146. TSD, Nachlaß Hartmann, vol. H, 122–123, 131–138, 168, 177, 185, 187, 239. Hartmann's depiction of his nomination of Steenbeck confirmed in SAPMO/BArch DY 30 JIV 2/2/1315. Hartmann's depiction of incident with Steger confirmed in BStU MfS Dresden AOP 2554/76, vol. 6, 73 ("Abschrift. Quelle: 'Andre,'" dated July 2, 1968).

147. Interviews with Renée Gertrud Hartmann on July 5, 10, 17, 21, 24 and 31, 2000.

148. BStU MfS Zentralarchiv MfS-HAXVIII, Nr. 9910, 89–90, 92, 96, 104, 105 ("Analyse OV 'Molekkül': Faktenbericht zur feindlichen Grundeinstellung, dated March 4, 1974," 18–19, 21, 25, 33, 34); quotation on 104 (p. 33 of document). BStU MfS AP444/87, 138, 139 ("Stellungnahme," dated July 5, 1975, 8, 9).

149. TSD, Nachlaß Hartmann, vol. H, 262. Hartmann's firing discussed in BStU MfS Dresden AOP 2554/76, vol. 3, 140–144 ("Information" of Bezirksverwaltung Dresden, Abt. XVIII, dated June 25, 1974; "Information" of the same date).

150. "Rehabilitierungsfragebogen" (rehabilitation questionnaire) of the Gauck Bureau, appendix 2, question 17, written by Renée Gertrud Hartmann. Also interviews with Hartmann on July 5, 10, and 24, 2000.

151. BStU MfS AP 444/87, 38–39 ("1. Gedanken, die nach der Durchsicht des als Analyse vorliegenden Materials zur Vernehmung des Prof. Hartmann bestehen," MfS Berlin HA IX/OfS and BV Dresden, Abt. XVIII/1, dated January 9, 1975, 1–2).

152. BStU MfS-HA XVIII, Nr. 11113, 7–15 ("Bericht über die Ergebnisse der Befragung des ehemaligen Leiters . . . Werner Hartmann" of Hauptabteilung XVIII/8 and IX/OfS, dated May 10, 1976). Detailed, signed confession in BStU MfS Dresden AOP 2554/76, vol. 4, 207–213 ("Befragungsprotokoll," dated April 29, 1976).

153. BStU MfS-HA XVIII, Nr. 11113, 13–15 (pp. 7–9 of document).

154. Author's interview with Renée Gertrud Hartmann on July 5, 2000.

155. Quotation from "Rehabilitierungsfragebogen" (rehabilitation questionaire) of the Gauck Bureau, appendix 2, question 17, written by Renée Gertrud Hartmann, 2.

156. Author's interview with Renée Gertrud Hartmann, July 2000.

157. BStU MfS AP444/87, 290–293 ("Bericht des IM-VL [blackened out] während des Treffs am 8.1.85," dated January 10, 1985).

158. Author's interviews with Renée Gertrud Hartmann on July 5 and 24, 2000.

159. BStU MfS AP 444/87, 294 ("Tonbandabschrift" of Abt. XVIII/1, dated November 29, 1984).

160. Account of birthday visit confirmed in BStU MfS AP 444/87, 294. Quotations from author's interview with Renée Gertrud Hartmann on July 5, 2000.

161. "Rehabilitierungsfragebogen" (rehabilitation questionaire) of the Gauck Bureau, appendix 2, question 17, written by Renée Gertrud Hartmann; quotation on p. 3.

162. Author's interview with Renée Gertrud Hartmann on July 5, 2000.

163. See chapter 4.

164. Author's interview with Renée Gertrud Hartmann on July 21, 2000.

165. I arbitrarily requested the Stasi files of three top industrial researchers in high-tech research, and found that all three had been investigated for espionage and/or sabotage. It is

impossible to say whether this is a pattern or a coincidence. It will not be easy to determine how widespread such investigations were, given that requests for MfS records are processed very slowly. It took a decade for my request for Hartmann's file to be processed.

166. See Kaiser, *Machtwechsel*, esp. 105–113.

167. See Karlsch and Tandler, "Ein verzweifelter Wirtschaftsfunktionär?" 62.

168. See Kaiser, *Machtwechsel*, 105–132.

169. On Honecker's priorities, see Kaiser, *Machtwechsel*, 105–132.

170. BStU MfS HA XVIII, Nr. 9910, 9 ("Sachstandsbericht" of Hauptabteilung XVIII/8/3 and BV Dresden, Abt. XVIII/1, dated May 27, 1974, 9).

171. BStU MfS HA XVIII, Nr. 9910, 14.

172. BStU MfS AP444/87, 163 ("Betr.: Durcharbeitung des übergebenen Materials," dated September 25, 1974, 21).

173. BStU MfS AP444/87, 160 (p. 18 of document).

174. BStU MfS AP444/87, 77–79 (report of HA IX/OfS and BV Dresden, Abt. XVIII/1, dated January 9, 1975, appendix "Zur Spionage").

175. BStU MfS-HA XVIII, Nr. 11113, 14 ("Bericht über die Ergebnisse der Befragung des ehemaligen Leiters . . . Werner Hartmann" of Hauptabteilung XVIII/8 and IX/OfS, dated May 10, 1976, 8).

176. Similar opinion in Buthmann, "Die strukturelle Verankerung des MfS," 59–60, 68; article on pp. 39–68. Different line of reasoning in Klenke, *Ist die DDR*.

177. See Georg Wagner-Kyora, "Vom nationalen ins sozialistische Selbst. Identitätskonstruktion in Berufsbiographien von Akademikern in der mitteldeutschen Chemieindustrie 1916–1990" (Habilitation thesis, University of Halle, 2000), sec. 5.

6

Red Prometheus: Technological Fantasies in Popular Culture and Propaganda

A television tower stands at sunset like a futuristic vision over East Berlin (figure 6.1). The last rays of sunlight reflect off the great stainless steel ball two hundred meters above the ground, creating a beacon of socialism, beckoning all to participate in the creation of a better society.[1] Built in 1965–1969, the TV tower was created as a powerful symbol of the coming together of the socialist project and technological progress. Technology became an important component of socialist myth-building in East Germany.[2] From the late 1950s onward, Walter Ulbricht was possessed with a vision of awakening the East German people from their Stalinist slumber and unleashing powerful creative forces that would catapult East Germany into the position of technological and economic leader vis-à-vis West Germany.[3] Technological fantasies had the potential to mobilize society, encouraging young people to study engineering or science, integrating engineers into society, and motivating workers to become innovative. Technology played a growing role in the conception of a socialist modernity, as well as in the national identity of East Germans. Technology contributed to a gendered understanding of both socialism and nation.

East German culture was filled with enthusiastic and naïve depictions of technology found in a broad range of media, including newspaper accounts, TV and radio programs, public murals, comic books, literature, memoirs, films, and architecture. Hobbies, toys, and school curricula also celebrated technology. The analysis of a cross-section of this cultural production reveals a great deal about integrative forces and tensions in East German society, bases of self-conception, and avenues of ideological mobilization. Three themes stand in the foreground.

Of interest, first of all, are the cultural influences that molded East German technophilia. In the Soviet Union, popularization of science was, from the revolutionary era onward, used to combat religious beliefs and to promote belief in progress under socialism. Scientific and technological utopianism, a major cultural force in the early days of the Soviet Union, was crushed by Stalin. However, as Asif Siddiqi has demonstrated, popular enthusiasm for spaceflight continued into the

Figure 6.1
East Berlin television tower on the Alexanderplatz, at sunset. Photo credit: Gerd Schnürer, Berlin

Stalin era, and grassroots spaceflight advocates had an impact on policy.[4] The association of a sense of awe with the fruits of scientific and technological endeavor and belief in progress are found in many societies, including the United States, though the ideological content is quite different.[5] Germans took great pride in their nation's scientific and technological accomplishments from the nineteenth century onward. Technology was the one aspect of modernization that warring political camps could agree upon during the Weimar era. According to Michael Neufeld, enthusiasm for space flight in this period grew out of nationalism, faith in progress, and a love of "escapist entertainment" tied to the emergence of mass culture, consumerism, and American-style advertising.[6]

Popular depictions of science and technology in the GDR reveal the transnational flow of ideas. In a recent study on fashion in the GDR, scholar Judd Stitziel rejects "one-dimensional, one-sided, and top-down models of Americanization and Sovietization," suggesting that instead "it is more fruitful to examine the transnational nature of many cultural phenomena in the GDR."[7] Whereas consumerist transnationalism created the opportunity for invidious comparison with the West, cultural transnationalism in the form of science fiction distracted the viewer or reader from immediate material desires.[8] The Soviet bloc and the West were much more evenly matched when it came to the competition of ideas purveyed in a science fiction medium than with regard to competition in the production of consumer goods, particularly given the excellent performance of the Soviet Union in the "space race." Moreover, futuristic dreams could easily be modified to conform to the ideals and aspirations of socialist society. Western popular forms could be recrafted to fit into a socialist and East German mold, fused onto older German tropes, and possibly infused with nationalist feelings. East German writers engaged in a dialogue with these Western creations, only occasionally rejecting them outright.

There were also peculiarly East bloc genres, notably the factory novel and its cinematic offshoots. Their significance lay in the understanding of citizenship as rooted in the factory. This was the principal site of participatory "democracy," as understood in Communism, though this participation was channeled and controlled in such a way that it could not threaten the system.[9] In fiction and film, conflicts could be solved within the context of the factory. Factory life was ultimately empowering. This is one example of the SED strategy of creating a pseudo-participatory realm through the popularization of technology that could serve as a substitute for a civil society. Technology thus served as a major integrative force in socialist society. It ceased to serve this function around 1965 with the emergence of critical approaches to technology.

Of interest is, secondly, the way the popularization of technology reflects and contributes to the gendering of technology. What is usually termed "technology" (i.e., technologies involved in industrial production, computers, automobiles, etc.) has come to symbolize modernity and male supremacy. Military technologies in particular have become an important part of "hegemonic masculinity." Men are not by nature more technologically skilled than women, but "it is the ideology of masculinity that has this intimate bond with technology." Technologies developed by women are not necessarily user-friendlier, less militaristic, more ecological, or more humanist than those developed by men. Nonetheless, the marginalization of women in discussions and imaginings of technology has tended to reinforce traditional gender roles.[10] In East Germany, early hopes to mechanize household work were abandoned, and women continued to bear a considerable burden at home under Communism.[11] The popularization of technology helped reinforce gender hierarchies and contributed to a gendered sense of community (organized around the factory) in the GDR. However, by the late 1960s and early 1970s, these hierarchies came into question.

Third, we must ask to what extent technophilia became genuinely popular in the GDR. The SED played a very obvious role in its propagation. This is particularly clear with regard to architecture or the SED-controlled press, but is also true of literature, which was subject to political influence and strict censorship.[12] The response of writers to the SED promotion of socialist realism and the "factory novel" in 1948–1956 was lukewarm. Much more successful was the "*Bitterfelder Weg*," an

SED-directed campaign promoted at literary conferences in Bitterfeld in 1959 and 1964. Its aim was to overcome the "alienation between artist and people." Workers enthusiastically took up the pen, and a few writers heeded exhortations to go work in the factory to see what life was really about. Nonetheless, the worker-writer movement died within a few years. On the other hand, professional writers embraced modern technology and made it an important literary theme.

It is somewhat difficult to determine how receptive the East German population was to glorification of technology. Many formal theories view popular culture as a top-down phenomenon, manipulated by elites or predetermined by unequal social relationships. Michel de Certeau and John Fiske believe that the masses can defend themselves against manipulation from above.[13] The best approach is to remain open to the possibilities of both top-down and bottom-up creation and diffusion of popular culture. This chapter begins with SED-orchestrated cultural manifestations and moves out to manifestations of popular culture whose popularity is manifested by ticket sales, copies sold, and other quantitative measures.

Teaching Technology, Teaching Socialism

In the era of "scientific-technical revolution," the conception of socialist man underwent a subtle but highly significant transformation. Technological knowledge and ability joined solidarity with the working class as major components of the socialist personality. Teaching technology became an important aspect of teaching socialism. The factory was seen not only as the basic unit of society but as a socializing institution where the new socialist man and new socialist woman were forged. Learning about technology not only prepared students for factory work and encouraged working adults to improve their skills, but was a shared experience that brought society and the nation together. Technology joined socialist indoctrination and traditional notions of *Bildung* and culture[14] to form the core of East German educational ideals. The GDR followed the Soviet lead in making the polytechnical school (*Polytechnische Oberschule*, or POS) the standard school for all East German children in 1959. Comprising grades one through ten, these schools emphasized vocational training and work-study programs in industry. Students heading for engineering colleges often attended vocational schools where they were able to complete both a high school degree (*Abitur*) and a vocational apprenticeship. Only the POS graduates with the best grades could attend the EOS (*Erweiterte Oberschule*), an academic high school. In the 1960s, even EOS students were given full vocational training. The EOS also emphasized general instruction in technology, as well as mathematics and science.[15] Some of the "special schools" in the GDR (schools for high-performing students, similar to "magnet high schools" in the

United States) were schools with technical specializations. A “special school” in Jena had close ties with Carl Zeiss.[16] Zeiss also provided technical support for the POS curriculum to schools in the Gera district. Zeiss donated a telescope for one school observatory, for example. Zeiss general director Ernst Gallerach wrote in *Neues Deutschland* that the goal was not just to recruit skilled workers and engineers, but also to help develop the “socialist personality.”[17]

Continuing education of the already technologically savvy East German population in technology was promoted in the media. The media were instructed to support official propaganda in its efforts to popularize science and technology. The SED-controlled daily newspaper, *Neues Deutschland*, regularly ran articles with headlines such as “Cybernetic Computer System Aids Planning and Management,” “Mathematics Permeates Our Lives,” and “Electron Waves—Micro-Tools of the Future.”[18] Numerous TV programs presented recent developments in science and technology. Scholar Werner Gruhn found that East German television tended to emphasize concrete technological advances whereas West German television devoted more attention to science. Overall, he found that there were fewer shows on science and technology on East German than on West German TV—a surprising result.[19] However, according to another study, such programs were far more popular in the GDR than in the Federal Republic.[20]

East German science and technology programs tended to not be very critical as far as the socialist world was concerned, ascribing problems such as pollution to capitalism. In 1970, an international group of experts argued in the “Club of Rome” report that resource scarcity placed limits on industrial growth. In 1975, an East German TV program asked, “How long will the natural resources of the earth last?” According to media specialist Alfred Kirpal, the program characterized the coup that toppled Chilean president Salvador Allende as a typical example of the havoc wrought by capitalist exploitation of natural resources. By contrast, socialist use of resources was not subjected to critical discussion.[21] A second example of a television program that was critical of the ways capitalist countries exploited technology can be found in the Zeiss Archive. Zeiss assisted in the making of a 1966 documentary with the improbable English-language title, “We Take the Brain.” This referred to an episode at the end of the Second World War. Jena, later handed over to the Soviets, was initially liberated by U.S. forces. The American seizure of Zeiss employees there is depicted as kidnapping. An American official is quoted as saying, “We have an optical industry in America, but it is based more on mass production.” Zeiss stood for quality. The viewer is led to believe that the United States was trying to seize this German capability for itself. The film goes on to describe the innovations that ostensibly placed Zeiss at the forefront of the optics industry in the 1960s. Capitalist “counterfeiters and brain robbers” continued to try to bring their mighty competitor low through dishonest means. In 1965, the West German "pseudo-corporation," which also called itself Carl Zeiss, brought a lawsuit against Carl Zeiss Jena in an attempt to gain a monopoly over the use of the Carl Zeiss name. Naturally (according to this East German TV program), it failed.[22]

East German technology was also to be celebrated through an "internationally unique network of museums." In 1965, the Mining Academy of Freiberg along with a local Freiberg museum spearheaded plans for a German National Museum for Mining and Metallurgy. Up until this point, the only German museum for mining was in the West German city of Bochum. (A section of the German Museum in Munich was also devoted to mining.) East German advocates wanted to end the West German monopoly in this area. The museum in Bochum pursued the goal of preserving "pan-German culture"; this was considered an affront to the GDR. Exhibits in the Freiberg museum were to deal with the German contribution to the development of mining up until 1945, and the East German contribution thereafter. Scientific foundations of mining and metallurgy, production, the role of the working class, and the treatment of this technology in literature and art were to be themes of the museum. According to its statute the museum was to contribute to a "consolidation of socialist national identity," to the development of a "socialist attitude towards work," and to "the political and scientific-technical education of all citizens." Not only the "anti-human," but also "anti-national" goals of the reactionaries in German history were to be revealed in the exhibits. These were also supposed to "introduce students to the whole range of German national culture," thus raising their "cultural level, which will have a positive impact on their later work in production." The museum was to oversee the historical preservation of now-defunct mines and other production facilities. The museum was also to give pedagogical assistance to schools, mostly on the EOS level. In cooperation with other cultural institutions, art, literature, and music relating to mining and metallurgy were to be promoted. This would form part of a "true German folk culture," thanks to the fact that "in our republic, everything serves the great humanist goal of the educated nation." The main argument here is that technology is a major component of national culture and *Bildung*, and as such serves to strengthen national identity. However, this bombastic project never got off the ground. Though buildings to house it were purchased for a million East German marks, the project was cancelled under circumstances that are as yet unclear.[23]

Technical education—in schools, but also disseminated through newspaper articles, television programs, and museums—lay the foundations for participation in factory life and contributed to the formation of the socialist personality. In addition, technology was a source of national pride. Belief in the superior ability of socialism to promote technological progress and modernization was thus also anchored in a belief in German technological prowess as a cultural legacy.

The Soviet Union created the most awe-inspiring symbol of the technical superiority of socialism: Sputnik. Even Sputnik, however, could not submerge East German technological nationalism.

Beyond Sputnik: East Germany Reaches for the Stars

The 1957 launching of Sputnik, the first manmade satellite to orbit the earth, was widely perceived as a powerful symbol of Soviet technological might throughout the world. In East Germany, it represented the great technological achievements of that socialism was capable and that East Germany should strive for. A poster announcing the Fifth Conference of the SED in 1958 (figure 6.2), cites Sputnik in a subtle way.[24] In the background is the launching pad with the booster rocket which would carry Sputnik into outer space.[25] An engineer or foreman stands in the foreground, holding blueprints. A planner of a great technological future, he is by

Figure 6.2
Poster announcing the Fifth Party Congress of the SED, 1958. Photo credit: SAPMO/BArch, PlakY 3/951

implication (pictured as he is on an SED poster) also an agent of socialist transformation. Blond and German in appearance, he is clearly meant to be an East German, not a Russian. In East German propaganda and popular culture, the Soviet model may loom in the background, but East Germans are shown as the creators of East German technologies.

A later example of the hybridization and nationalization of the Sputnik legacy is the popularity of the East German cosmonaut, Sigmund Jähn. He left the earth on Soyuz 31 on August 26, 1978, together with a Soviet crew member, Valery Bykovsky (figure 6.3). As a "research cosmonaut," Jähn orbited around the Earth, conducting experiments on docked Soviet spacecraft and returning to Earth after almost eight days in space. "The First German in Space An East German Citizen," proclaimed the banner headline of the SED organ, *Neues Deutschland*. Jähn was reported to have dedicated his flight to the thirtieth anniversary of the founding of the GDR (on October 7, 1979). Thus, Jähn's flight was portrayed as a national

Figure 6.3
East German cosmonaut Sigmund Jähn with fellow crew member, Soviet cosmonaut Valery Bykovsky. Photo credit: Eulenspiegel Verlagsgruppe

triumph, as well as a manifestation of friendship between the GDR and the Soviet Union.[26] Jähn carried with him a small doll of the "Sandman," a figure who every evening at bedtime introduced a bedtime story and said goodnight to children across East Germany on the popular East German children's television program, *Sandmännchen*. "Sigi" Jähn, as he was affectionately known, actually pulled the doll out during the live telecast from space on August 29. Surprisingly, his Soviet crew mate Waleri Bykowski pulled out a Soviet doll, Masha, who got along so well with the Sandman that they were wed by Jähn on the spot.[27] Thus, for one shining moment, fantasy became real, satisfying the yearnings of children of all ages and creating a collective experience that became a part of national memory.[28]

The East Berlin TV tower became a more lasting anchor of national identity. Sputnik was one of many inspirations for its design. However, as historian Peter Müller has made clear, many alternatives were considered. There were many detours on the path that led to the building of this focal point of East Berlin geography on the spacious Alexanderplatz, a favorite of shoppers and tourists. Müller depicts the project as the result of the almost accidental intersection of two endeavors: to build a television tower and to build a monumental center in Berlin. A large tower was needed that could broadcast color TV programs as well as FM radio. It would improve reception and reach areas of Berlin and particularly Brandenburg that were under the imperialistic domination of Western stations.

The "Sixteen Principles of Urban Planning" of 1950 called for the building of urban centers dominated by monumental streets (the "Central Axis"), a central square, and a central, monumental building. In the era of Stalinist monumentalism, the party leadership envisioned a piece of Soviet wedding-cake architecture (figure 6.4), modeled perhaps on the Soviet Palace in Moscow, which was to become a central focal point of downtown East Berlin, possibly occupying the place of the Berlin Stadtpalais (blown up after the war). Hampered by financial limitations and the inefficiency of the construction industry, the Communist leadership became more flexible in its conceptions, and even ran a major architectural competition in 1958–1959.[29]

One of the most intriguing entries was that of Hermann Henselmann, who later became the Chief Architect of Berlin. His iconoclastic design contained no "central building," but an assembly hall, a building for the parliament, and a great tower with a ball, which was to be both a monument and a television tower (figure 6.5). He took his inspiration from the workers' song, "Brothers, to the sun, to freedom, brothers, up to the light." He saw the tower as reaching up from the darkness into the light. He wished his tower to be associated with Sputnik, as well as with the name "Signal Tower," taken from the *Internationale*: "Peoples, hear the signal! Arise, for the last battle!" Doubtlessly, he was also influenced by West German

Figure 6.4
Proposal (1957) for a monumental central building in East Berlin, modeled on Soviet architecture. Photo credit: Campus Verlag

television towers such as that in Stuttgart, built in 1954–1956 (and thus the first large television tower anywhere), as well as various Western and Soviet uses of spheres in architecture. His design thus spoke the transnational language of global architectural trends. Initially, his proposal was resoundingly rejected because it gave technology too prominent a place in the iconography of the socialist state. The journal *Deutsche Architektur* criticized "[his] false evaluation of technology and its role in the life of socialist society."[30] In a statement of self-criticism, Henselmann admitted that his design was somewhat "utopian" in character—a term that at that time had negative connotations in the GDR.[31] On the other hand, Henselmann's design was very popular among the visitors to the public exhibit of the competition entries, judging by comments in the guest book.[32]

By 1964, a radical change in the political climate had taken place, and the Politburo accepted a plan to build a TV tower on Alexanderplatz. It is somewhat unclear what role Henselmann's 1958 design played in the design of the final TV

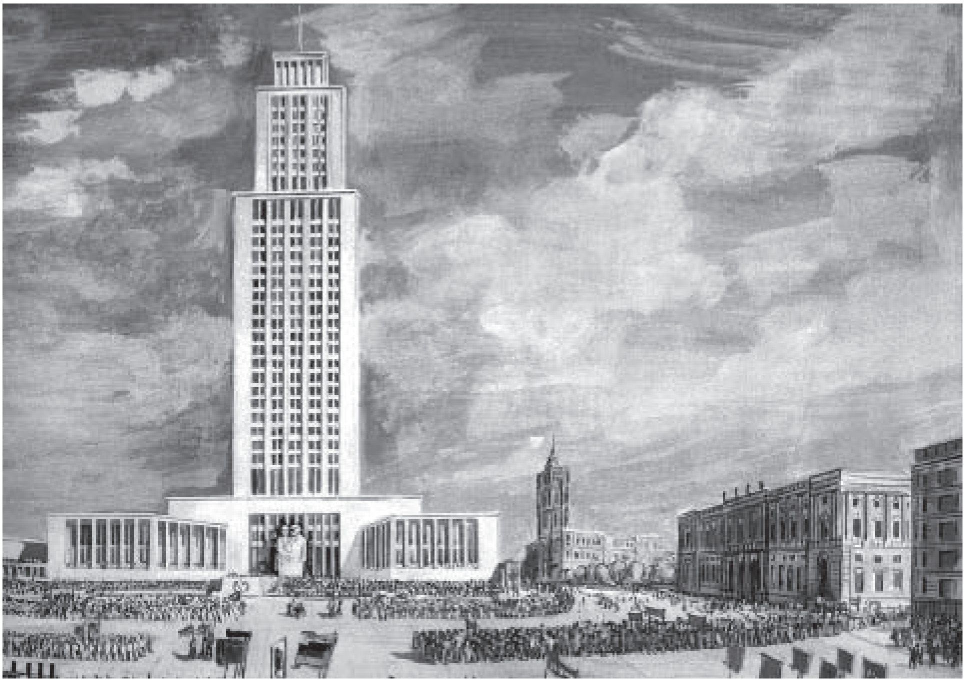

Figure 6.4 (continued)

tower, which included his sphere, but had a somewhat different tower, and which others claimed to have designed. Unlike Henselmann's "Signal Tower," the East Berlin TV tower was seen as a piece of technology first, a monument second. It also made color television broadcasts possible, and thus fit into the SED's visions of creating a consumer society in the GDR. Ulbricht said about the adoption of the plan, "The city needs a face, a sensation." Construction was begun in May 1965 and completed, with unusual speed, in October 1969, just in time for the twentieth anniversary of the founding of the GDR. The most important state and party officials attended the dedication of the tower, which was presided over by Ulbricht himself. *Neues Deutschland*, the organ of the SED, ran headlines reading "The Tower—Symbol of Our Achievements."[33]

Historian Peter Müller judges the television tower (figure 6.6) to be the most important architectural symbol of socialism in the GDR. Indeed, for many GDR citizens, the TV tower became the focal point of their mental map of Berlin, as did other major icons of technology, in an East Germany whose mental geography underwent profound changes in the 1960s. Within the confines of national bound-

Figure 6.5
Hermann Henselmann's proposed design for the East Berlin Alexanderplatz, an entry in an official competition of 1958–1959. Photo credit: Peter Müller, *Symbol mit Aussicht* (Berlin: Huss-Medien GmbH, Verlag Bauwesen, 2000)

aries, technology unfolded its boundless possibilities, opening out inner spaces and building up into the sky in a way that took on special significance after the building of the Berlin Wall. It should not be forgotten, however, that one of the most important aspects of the tower for its many visitors was the view it afforded of the entire city—including West Berlin. From the observation deck (figure 6.7), a very different perception of the geography of Germany emerged from the one intended by the Communist leadership.[34] Ultimately, therefore, public perceptions could subvert the intended meaning of such symbols.

The foldout panoramas of industrial landscapes and large-scale technological projects in the volume, *Weltall Erde Mensch* (written by Alfred Kosing and thirteen other authors), give a sense of the boundless possibilities of technology and the sheer space that technological modernity provides. This was an enticing concept for East Germans, who were now living behind the Wall. *Weltall Erde Mensch* (Space, Earth, Man) was, until 1974, presented to every young East German eighth-grader upon his or her *Jugendweihe*, a secular alternative to confirmation encouraged by

Figure 6.6
Television tower and East Berlin skyline. Photo credit: Peter Müller, *Symbol mit Aussicht* (Berlin: Huss-Medien GmbH, Verlag Bauwesen, 2000)

Figure 6.7
Observation deck of the East Berlin television tower. Photo credit: Peter Müller, *Symbol mit Aussicht* (Berlin: Huss-Medien GmbH, Verlag Bauwesen, 2000)

the state.[35] Copies of this work sat on the bookshelves in many East German households, and in many cases still do. The first edition was published in 1954, with revised editions following every year or so until the twenty-first edition, published in 1973. The 1965 edition (used here) very much reflects the preoccupations of the era of "scientific-technical revolution" in the GDR.[36]

Weltall Erde Mensch begins with the stark sentence, "This book is the book of truth."[37] This is intended as a refutation of the claim that the Bible is the book of truth. It is also an assertion that dialectic materialism (an aspect of Marxist-Leninist thought) is based on a scientific approach to the world.[38] It is in this sense that the book presents itself as "an important aid in developing a scientific view of the world."[39] An overview of natural history from the atom to the emergence of the human race is presented over two hundred pages. A Marxist-Leninist interpretation of history takes up another hundred pages, which is followed by a short chapter on the founding of the GDR. Over a hundred pages are then devoted to present-day technology, mainly GDR technology. The major feats of technology discussed in the text are illustrated with large, fold-out panoramas in vivid colors (unlike the small black-and-white pictures in the historical section).

One of the main messages is the technological superiority of socialism. Socialist technology is portrayed as not only the servant of the true needs of the people, but as truly scientific and systematic. All negative characteristics of technological development are attributed to capitalism. The message is that technology is only dangerous if in the hands of capitalists. Thus, we are told that popular horror stories about robots have a rational message because automation in the hands of capitalists destroys jobs and serves modern military technologies. The reader is reassured, "In socialist society, fear of robots is unfounded." Moreover, under socialism, technology can fully develop, unconstrained by the narrow interests of capitalist enterprises.[40]

The pictures and text speak of a total reordering of society through the partnership of technology and socialism. A planned city (figure 6.8) is shown, logical in design, brightly colored, and aesthetically pleasing, providing jobs and comfortable lives. The industrial smoke stacks are in the distance, a downtown area with shops, hotels, and administrative buildings in the middle, and a residential area stretching from the foreground into the valley. Large apartment complexes are provided with an Olympic-sized swimming pool, small shops, movie houses, and restaurants. In the foreground are suburban houses with patios out back. Someday, the image seems to promise, workers will have the kind of suburban lifestyle that the West German and American middle classes enjoy. A proclamation of the Communist Party of the Soviet Union is quoted in a side bar. Yet their promises of improvements in housing seem primitive in comparison with the lovely image of the (presumably East German) planned city: sewers are to be built; peasant houses are to be provided with "necessary comfort" (presumably indoor plumbing); families are to be freed from the "overcrowded or bad apartments" they now live in.[41] The model here is not in fact the Soviet Union, but Western consumer societies. Plans for Soviet model cities such as Stalingrad (though not its grim post-war reality) influenced the design of the East German model socialist city, Stalinstadt, later renamed Eisenhüttenstadt. However, the image in *Weltall Erde Mensch* barely resembles Eisenhüttenstadt, but rather is strikingly Western.[42] So, too, is a panorama about modern transportation. It illustrates the centrality of private automobile ownership and urban roadways in East German urban planning.[43]

Socialist utopianism also plays a major role in *Weltall Erde Mensch*. The "fully automated factory" (figure 6.9) is depicted as a goal of socialism, meaning a perfectly functioning system, in line with East German enthusiasm for cybernetics. Meticulously well planned, pristinely clean parts of the factory (colored bright blue) are laid out across immaculate lawns. Controlled by an "electronic brain" (the central computer), the factory "hardly [needs] supervision." A few human operators sit in offices in the small administrative and computer building, from where they run the entire operation. A lone repairman in a truck so small as to be scarcely visible seems to have nothing to do. In a corner of the picture is a cafeteria and a large, heated, outdoor swimming pool. However, both appear empty (aside, perhaps, from a single, tiny figure sitting in the shade of an umbrella). No ripples (and certainly no human beings) disturb the glassy surface of the brilliantly blue pool. Tiny human figures—a man and a woman—stroll around the production complex. Casually dressed and pointing out interesting sights, they appear to be nothing more than tourists in the industrial landscape.[44] This is the dream of a world in which workers will no longer need to work, an early example of which may be found in René Claire's 1931 film, *À Nous la Liberté*.

A futuristic landscape on another page includes a monorail connection to a vacation area (figure 6.10). A dam with a hydroelectric plant has created a beautiful, turquoise-blue reservoir, surrounded by bright yellow beaches. There are water

Figure 6.8
Planned city, from the 1965 edition of *Weltall Erde Mensch*. Photo credit: Eulenspiegel Verlagsgruppe

Figure 6.9
A "fully automated factory," *Weltall Erde Mensch*. Photo credit: Eulenspiegel Verlagsgruppe

Figure 6.10
Vacation area on a large reservoir, with industrial city in the background, *Weltall Erde Mensch*. Photo credit: Eulenspiegel Verlagsgruppe

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Figure 6.8


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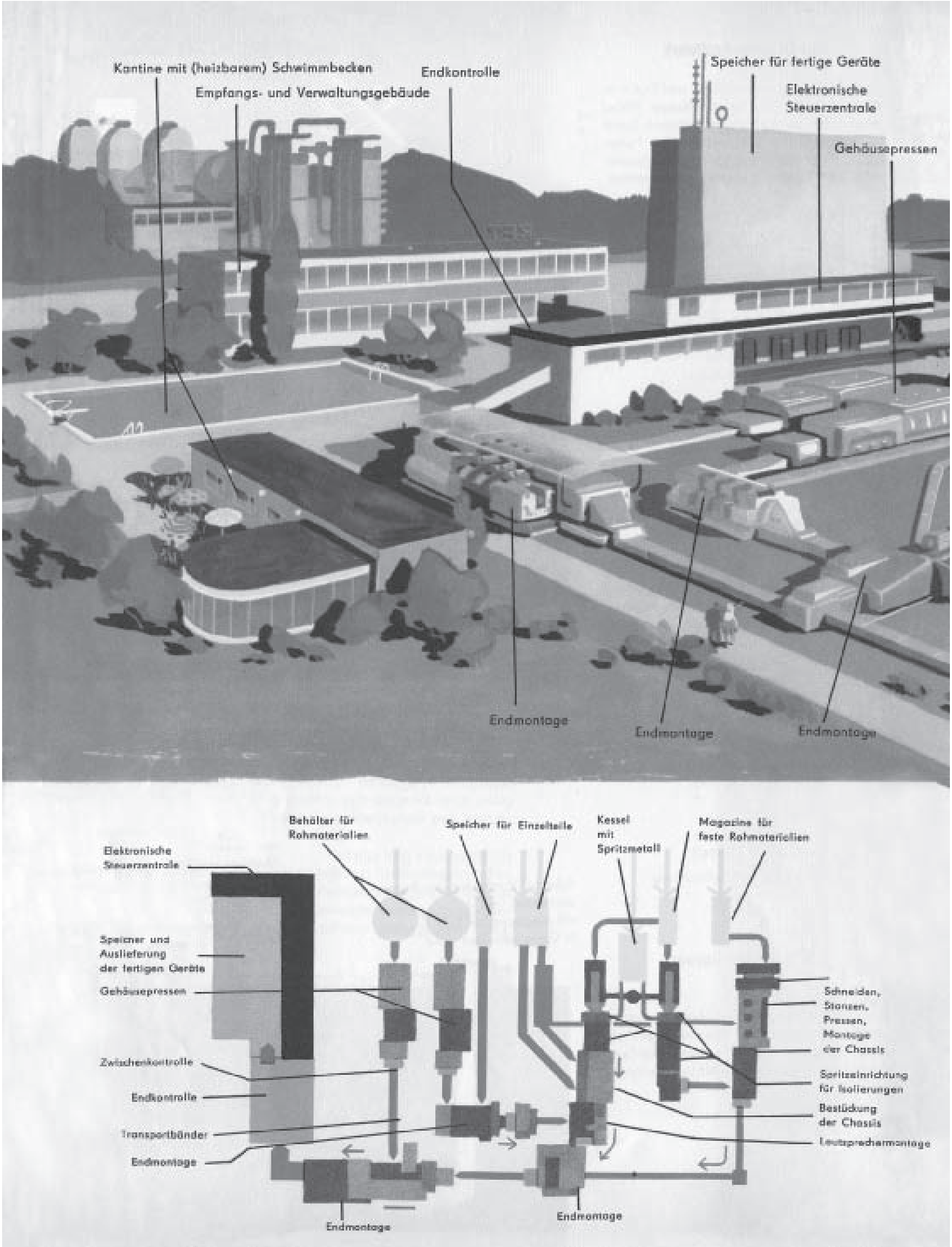
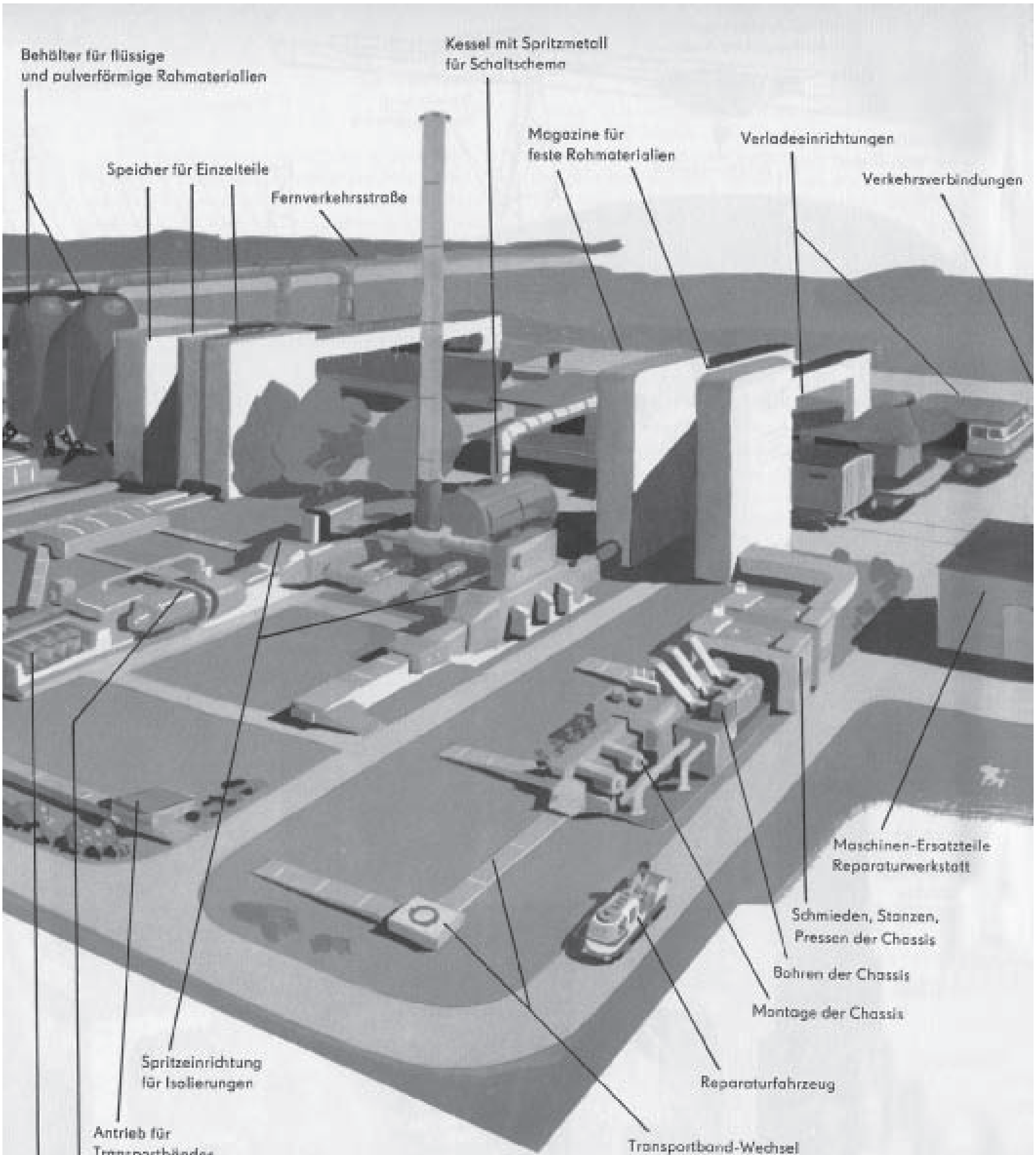

Kantine mit (heizbarem) Schwimmbecken
Empfangs- und Verwaltungsgebäude
Endkontrolle
Speicher für fertige Geräte
Elektronische Steuerzentrale
Gehäusepressen
Endmontage
Endmontage
Endmontage
Behälter für Rohmaterialien
Speicher für Einzelteile
Kessel mit Spritzmetall
Magazine für feste Rohmaterialien
Elektronische Steuerzentrale
Speicher und Auslieferung der fertigen Geräte
Gehäusepressen
Zwischenkontrolle
Endkontrolle
Transportbänder
Endmontage
Schneiden, Stanzen, Pressen, Montage der Chassis
Spritzeinrichtung für Isolierungen
Bestückung der Chassis
Endmontage
Endmontage

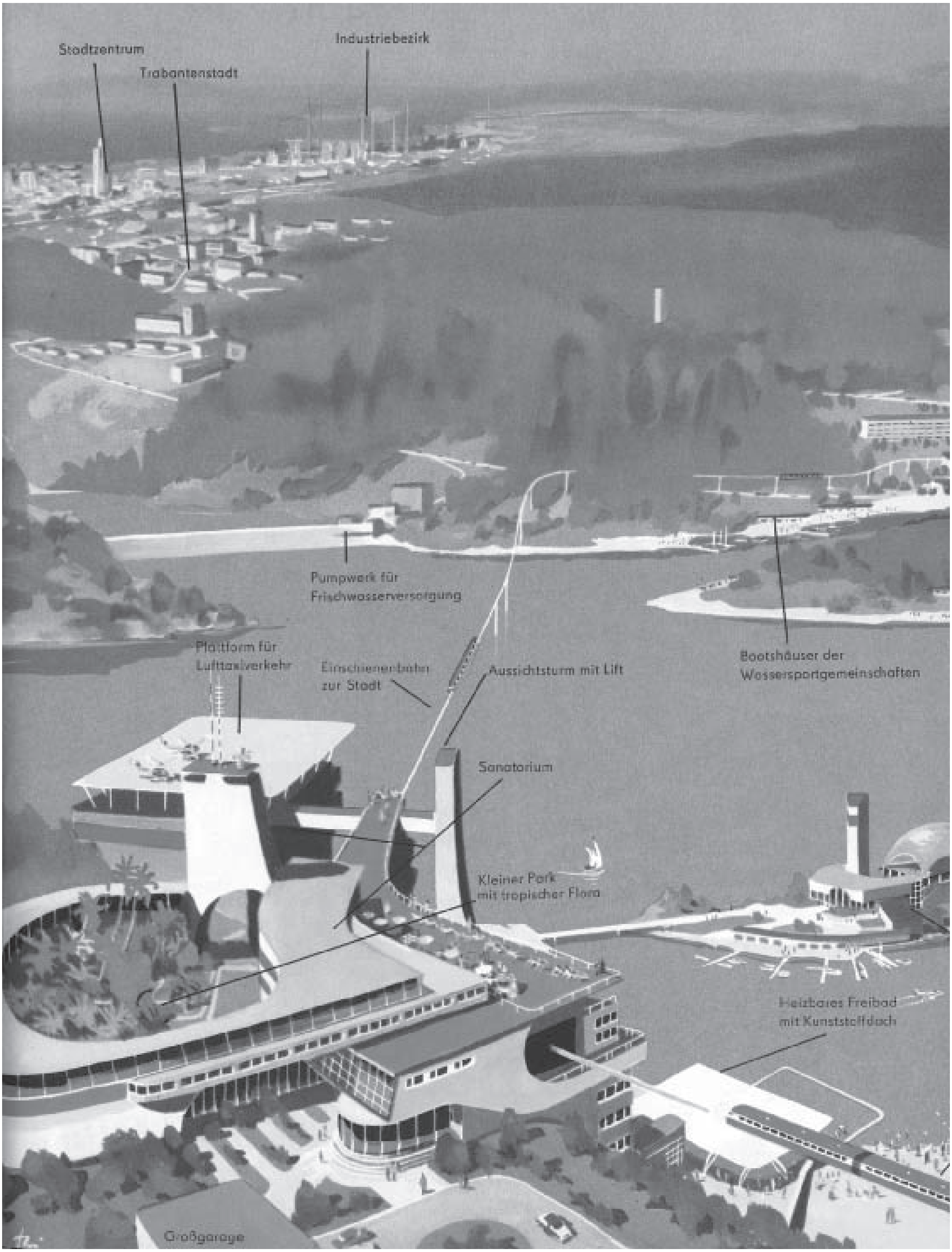
Figure 6.9



Gelb = Ausgangsmaterialien
Grau = Bearbeitungs-Automaten
Blau = Zwischen- und Endkontrollen
Schwarz = Elektronische Zentrale
Hellrot = Speicher für fertige Geräte
Dunkelrot = Transportbänder

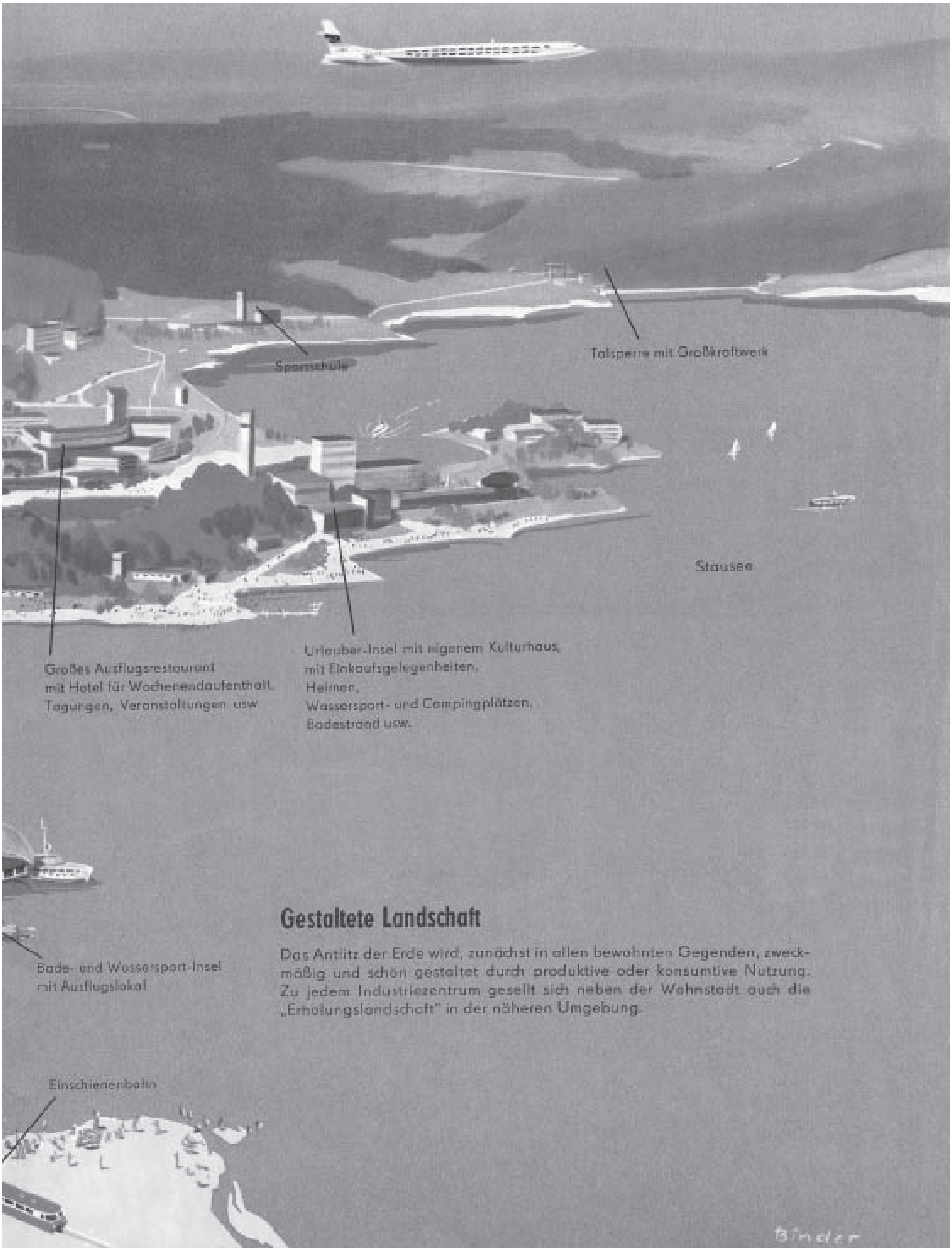
Ausschnitt aus einer vollautomatisierten Fabrik

für Kleinempfänger – als Beispiel. Trotz hoher Kapazität sind die Anlagen verhältnismäßig klein; sie liegen zum Teil unterirdisch und im Freien und benötigen kaum Überwachungen. Wenige Mitarbeiter lenken von den zentral gelegenen Verwaltungs- und Steuerräumen aus den gesamten Produktionsablauf und das Zusammenspiel mehrerer solcher Betriebsabschnitte.



Stadtzentrum
Trabantenstadt
Industriebezirk
Pumpwerk für
Frischwasserversorgung
Plattform für
Lufttaxiverkehr
Einschienenbahn
zur Stadt
Aussichtsturm mit Lift
Bootshäuser der
Wassersportgemeinschaften
Sanatorium
Kleiner Park
mit tropischer Flora
Heizbares Freibad
mit Kunststoffdach
Großgarage

Figure 6.10



Gestaltete Landschaft

Das Antlitz der Erde wird, zunächst in allen bewohnten Gegenden, zweckmäßig und schön gestaltet durch produktive oder konsumtive Nutzung. Zu jedem Industriezentrum gesellt sich neben der Wohnstadt auch die „Erholungslandschaft" in der näheren Umgebung.

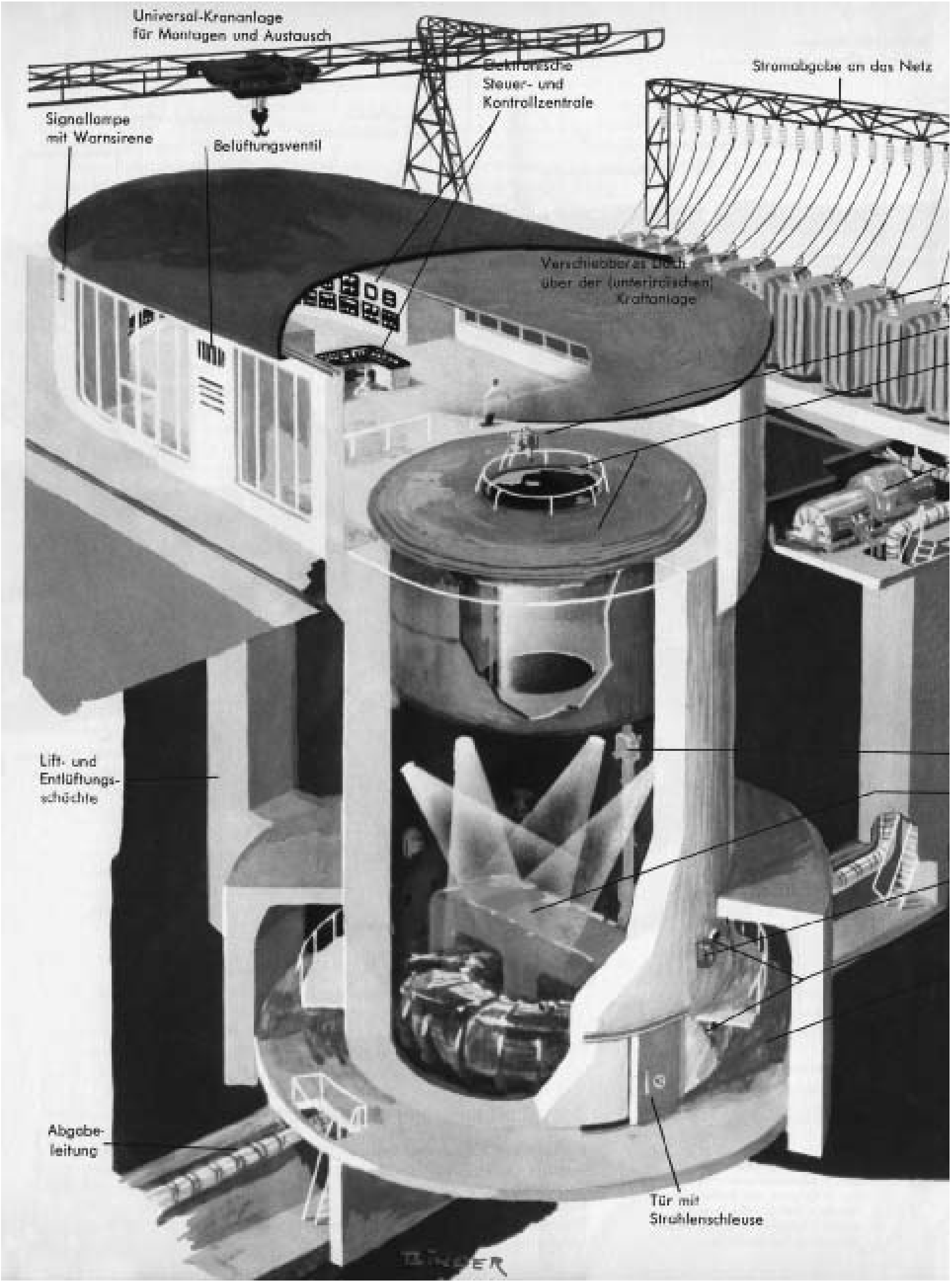


Figure 6.11
Toroidal Containment Machine, or Tokomak (fusion reactor), *Weltall Erde Mensch*. Photo credit: Eulenspiegel Verlagsgruppe

sports facilities, a recreation facility covered by a glass dome, and a covered, heated pool (which seems to have figured large in the East German imagination). A heliport provides an alternate form of transportation.[45] This illustration combines an idyllic image of vacation areas in America or the Mediterranean with a worldwide fascination with new technologies and designs—heliports, monorails, glass domes.[46]

Computerization of society is predicted here, but the challenges to the Communist system that would result from the information revolution are not. A translating machine—akin to the "universal translator" of *Star Trek*—is shown. (This fascination with computer translators originated in Soviet applications of cybernetics to linguistics.[47]) In the future, travelers and people attending conferences will carry around portable models. "A person speaks and hears in his native language!" Interestingly, this translator is shown as making it possible for East Germans (depicted here as a woman) to understand Russians (here, a rather stern-looking man in Moscow). Computers will also solve the problems of bureaucratization: There will be "offices, but no bureaucracy." Rather, computers will help to rationally direct and organize the domestic economy and international economic relations between socialist states. A computer station is depicted in which there are a chair and keyboard but no human operator. The implication is that human subjectivity can be done away with.[48]

Weltall Erde Mensch focuses on technological progress in areas associated with East German strengths. Chemistry, an area of undisputed East German achievement, is presented as a master science of modern-day life. The successes of the chemical industry allow the GDR to reclaim the painful loss aviation, at least in the imaginary realm: The picture of an airplane carries a caption that does not identify the country where it was manufactured, but points to the plastics and alloys used in its production. Schönefeld Airport is also shown in loving detail in a foldout picture.[49]

Interestingly, Soviet technologies are only discussed at length in a long section on energy sources, thus identifying the great brother's most significant role as energy supplier. A long section is devoted to atomic energy, and even fusion as a source of energy is discussed. Quite unexpected is the picture of a fusion power plant, based on experimental Russian technologies. In the futuristic depiction of this plant, we see a Toroidal Containment Machine, or Tokomak (figure 6.11), which later spawned experimental fusion reactors in the West, but which has never led to a technology that could produce energy efficiently. Oddly, neither the term Tokomak nor any indication of its Soviet provenance are mentioned here.[50]

Space exploration is presented as one of the great technological achievements of the era. Yet here, of all places, Soviet achievements are not mentioned, and the cosmonaut in one photo is not named or even identified by nationality. This silence is made possible by a sleight of hand. Space travel is discussed in connection with computers, an area in which East Germany could point to successes. Certainly, the GDR did produce a considerable amount of hardware for the Soviet space program.[51] The failure to mention the Soviet space program places aerospace technologies in a predominantly German context, a German space above the earth. Perhaps this is where the space station of the future flew as well (figure 6.12). This worthy piece of science fiction shows a doughnut-shaped station with a rocket launching area in the middle. It is probably based on Wernher von Braun's 1952 sketch of a wheel-shaped space station that would spin to create artificial gravity.[52] It floats above the earth, shown in dreamy hues of green and blue, partially covered by clouds. Hundreds of cosmonauts can live and work on the station, apparently untroubled by weightlessness (perhaps because of the rotations of the doughnut). A space ship is shown taking off into the inky, star-studded black of outer space, bound for another planet.[53]

Joy in the boundless possibilities of technology is not dimmed by depressing thoughts. Pollution and the dangers posed by atomic energy are very much downplayed. Technology is not in itself dangerous, but only becomes a threat in the hands of capitalists. During the course of the next decades, with the spread of socialism, this danger will disappear.[54]

Suffused with a view of technological progress both socialist and Germanocentric, *Weltall Erde Mensch* conveys a sense of a growing technological nationalism. In a section entitled "The GDR—the Fatherland of good Germans," the reader is reminded, "One of the noblest characteristics of socialist man is the love and loyalty to the socialist fatherland, socialist patriotism."[55] Out of patriotism, young people should be willing to defend their country militarily, but also to pursue a scientific or technical education. The aspirations planted in the heads of young people were primarily collective projects. Though socialist ideals remained a major theme of later works distributed to eighth graders, the place of technology in them was very different. *Weltall Erde Mensch* was replaced in 1975 by a much more narrowly ideological work that paid scant attention to technology, a reflection of the changing priorities of the Honecker era.[56]

As *Weltall Erde Mensch*, the East Berlin television tower, the SED poster, and the publicity surrounding Sigmund Jähn illustrate, the cultural impact of Sputnik was multilayered. The Soviet Union had demonstrated its technological superiority to the West, but this did not diminish the achievements of the GDR. Ceding military prowess to its socialist big brother, East Germany could stylize itself as a nation of engineers and "research cosmonauts." The SED was creating a truly modern Germany, as shiny and new as the East Berlin television tower. The future promised to bring even greater things: a reordered landscape and a reordered society that would satisfy not only the needs but also the desires of its people. It was suggested that decaying and damaged urban landscapes would give way to gleaming structures and efficient organization of urban spaces. Outmoded, dirty, inefficient factories would be replaced by clean, rational factories where machines did all, or almost all, the work. Leisure and pleasure rather than arduous toil would become central to human existence. Even autocratic bureaucrats and unintelligible Russians would no longer terrorize the population, as computers took over their role, or at least made their demands intelligible. Images of Western consumerism slipped into this futuristic vision, mainly because the West possessed more powerful dream machines, from Disneyland to world's fairs, and from rapidly transforming cities to regally financed research and production complexes. However, these images were placed in the distinctly socialist context of a completely reordered landscape and society. The futurism of the images implied gratification postponement. This became a part of a distinctly East German approach to material culture, complementing the spread of actual East German products such as plastics.[57]

The popularity of officially propagated technophilia can in some cases be gauged directly, as in the case of popular reactions to Henselmann's design for the Alexanderplatz, or the throngs of visitors to the outlook tower. In other cases, it can be inferred indirectly, for example from the popularity of the children's program, *Sandmännchen*, or from the wide distribution of *Weltall Erde Mensch*. The successes of official propaganda and public architecture in molding popular fascination with technology are also reflected in former East Germans' memories of that period and the nostalgic artifacts of that era and writings about them.[58]

Boldly Going Where No Socialist Has Gone Before!

Science fiction was a potent medium for the popularization of the ideas contained in SED propaganda, but was also a potential conduit for subversion of those ideas, particularly since East German science fiction was awash in complex transnational flows of ideas, as well as being the heir to science fiction of the Imperial, Weimar, and Nazi eras. There was no science fiction writer in the GDR who had the stature of Poland's Stanislav Lem. There was no science fiction film director in the GDR who had the stature of Andrei Tarkovsky of the USSR. Nonetheless, East Germany, like other East bloc nations, produced a large body of science fiction literature, as well as five films. The English term "science fiction" was generally not used in East Germany, in part because of the SED's aversion to social criticism, and particularly criticism of technology, which was often a part of Western science fiction. The older

Figure 6.12
Space station of the future, *Weltall Erde Mensch*. Photo credit: Eulenspiegel Verlagsgruppe

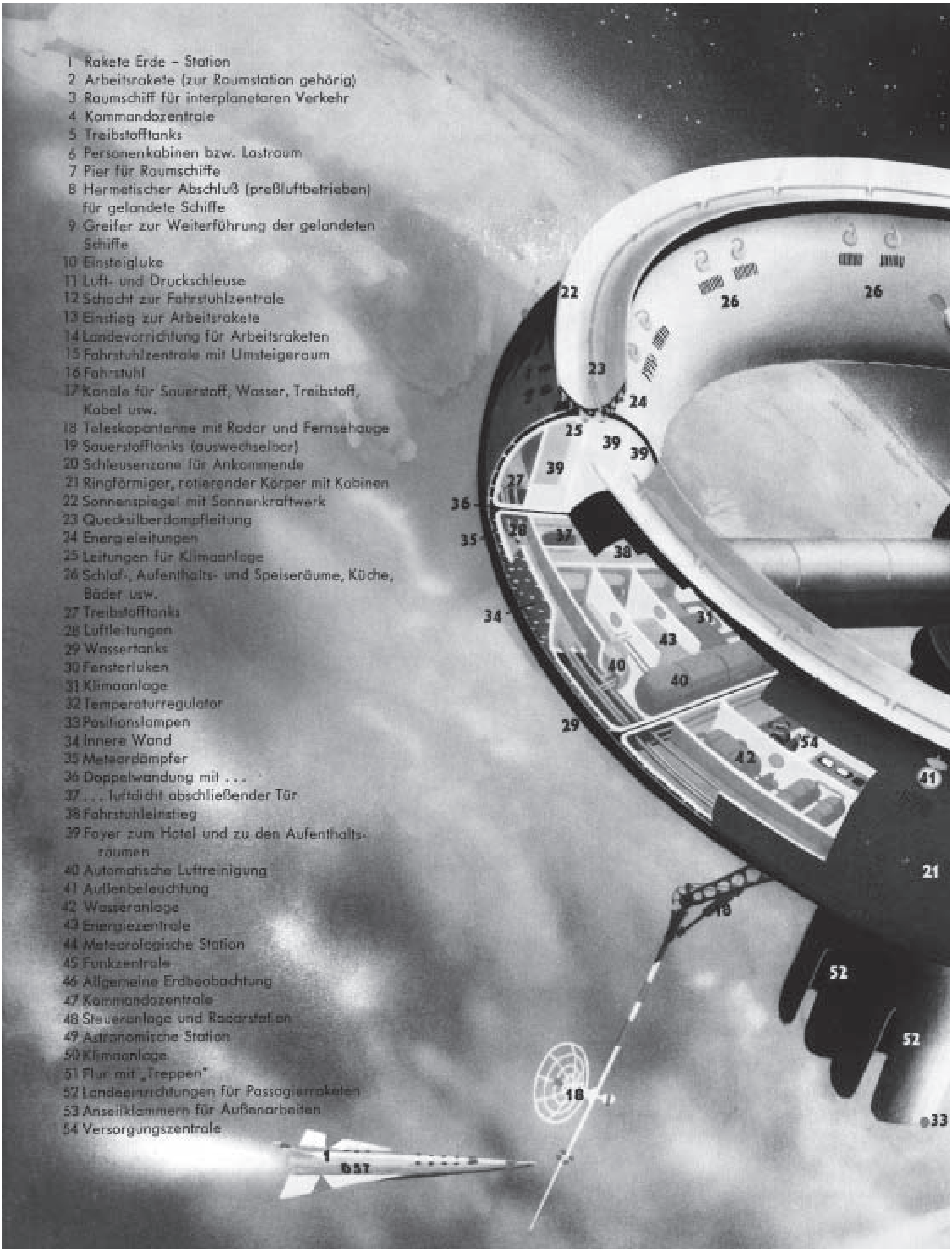

1 Rakete Erde – Station
2 Arbeitsrakete (zur Raumstation gehörig)
3 Raumschiff für interplanetaren Verkehr
4 Kommandozentrale
5 Treibstofftanks
6 Personenkabinen bzw. Lastraum
7 Pier für Raumschiffe
8 Hermetischer Abschluß (preßluftbetrieben) für gelandete Schiffe
9 Greifer zur Weiterführung der gelandeten Schiffe
10 Einsteigluke
11 Luft- und Druckschleuse
12 Schacht zur Fahrstuhlzentrale
13 Einstieg zur Arbeitsrakete
14 Landevorrichtung für Arbeitsraketen
15 Fahrstuhlzentrale mit Umsteigeraum
16 Fahrstuhl
17 Kanäle für Sauerstoff, Wasser, Treibstoff, Kabel usw.
18 Teleskopantenne mit Radar und Fernsehauge
19 Sauerstofftanks (auswechselbar)
20 Schleusenzone für Ankommende
21 Ringförmiger, rotierender Körper mit Kabinen
22 Sonnenspiegel mit Sonnenkraftwerk
23 Quecksilberdampfleitung
24 Energieleitungen
25 Leitungen für Klimaanlage
26 Schlaf-, Aufenthalts- und Speiseräume, Küche, Bäder usw.
27 Treibstofftanks
28 Luftleitungen
29 Wassertanks
30 Fensterluken
31 Klimaanlage
32 Temperaturregulator
33 Positionslampen
34 Innere Wand
35 Meteordämpfer
36 Doppelwandung mit …
37 … luftdicht abschließender Tür
38 Fahrstuhleinstieg
39 Foyer zum Hotel und zu den Aufenthaltsräumen
40 Automatische Luftreinigung
41 Außenbeleuchtung
42 Wasseranlage
43 Energiezentrale
44 Meteorologische Station
45 Funkzentrale
46 Allgemeine Erdbeobachtung
47 Kommandozentrale
48 Steueranlage und Radarstation
49 Astronomische Station
50 Klimaanlage
51 Flur mit „Treppen"
52 Landeeinrichtungen für Passagierraketen
53 Anseilklammern für Außenarbeiten
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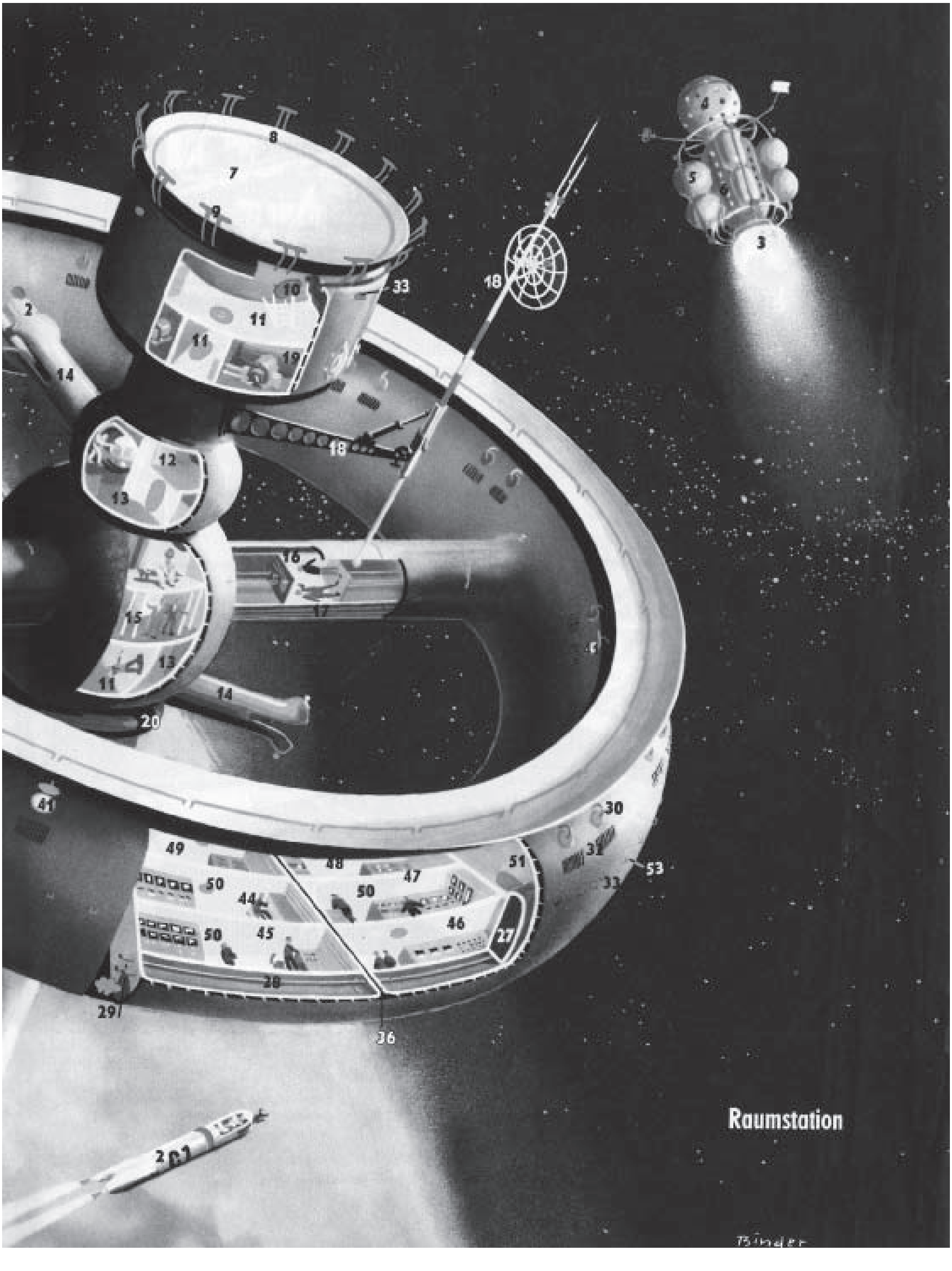
Figure 6.12


Raumstation
Binder

German terms "utopian literature" and "utopian film" were generally preferred because they carried with them the connotation of a better, brighter future in which a superior society had been built on the foundations of advanced technology. East Germans brought their fine sense of irony to the term "utopian," however. By the 1970s, many East German writers were exploring futuristic dystopias in their supposedly "utopian" novels.[59]

The golden age of science fiction utopianism in East Germany was the "long" 1960s—the era after the launching of Sputnik, which unleashed a fascination with space travel.[60] Imaginary voyages to outer space not only made the exploration of future worlds passible, but freed East Germans trapped behind the Wall. Socialism would create the technology that would allow them to break out of earthly boundaries and travel upward and outward to unexplored realms.

The SED was evidently anxious to promote this imaginary space. According to historian Burghard Ciesla, the central planners allowed all the glue produced in the GDR in one year to be used to create a Venusian landscape for the country's first science fiction film, *The Silent Star*. Released in 1960, it was a pioneering effort, short on special effects, but conceptually quite advanced. It owed much to the genius of Stanislav Lem, the author of the novel on which it was based. Five years before the premiere of *Star Trek* on American TV, *The Silent Star* depicted the mission of an international, racially mixed crew. According to Ciesla, the film, released in 1962 under the title *First Spaceship on Venus*, was shorn of its progressive attitude toward race for its American release. Apparently the United States was not ready for scenes in which an African communications officer interacted as an equal with the white head of the expedition. The film's pro-socialist stance was also discretely edited out in the United States, along with references to the film's East bloc origins.[61] Just three years later, *Star Trek* premiered in the United States, featuring an international, multiracial crew that coincidentally included an African communications officer, Uhura (meaning "freedom" in Swahili). *Star Trek* went on to become a potent representative of liberalism and internationalism. The SED and East German movie industry needed to worry about this imaginary ideological space race, for some East Germans watched West German television.[62] East German filmmakers responded to the Western challenge by presenting a socialist vision of the future in their films about outer space (just as Americans presented their beliefs in science fiction).

"*Nie wieder Kosmos!*" ("No more outer space!") is the cry of the cosmonaut Captain Daniel Lagny at the beginning of the 1972 East German film, *Eolomea*.[63] Dan is presented as a man with conflicted feelings about the sacrifices involved in space exploration, a man torn between earthly pleasures and dedication to a higher mission. Assigned to a space station in the asteroid belt, he longs for his lover back on earth, the alluring young blond scientist, Dr. Maria Scholl, head of the station

"Earth Center." Dan is disturbed by the suffering of a space explorer, and asserts that space exploration (which can be read here as the quest for technological progress) exacts too high a price on the individual: "Do you know what? This whole cosmic adventure of mankind is nonsense." The pilot replies, "No one asks about the price of knowledge." But Dan asks, "What about the victims?" The pilot asserts, "They aren't victims, but volunteers," to which Dan responds, "Do you think that people do things voluntarily?" It appears he has decided to end his career in space. In the end, though, he chooses the path of self-sacrifice, deciding to join a group of space explorers who have set out for a mysterious planet twelve light years away. Many believe there is intelligent life on this distant world known as "Eolomea." "Eternal springtime" exists on this better world. It will take over 136 years to reach Eolomea. The crews will die of old age on the way there, but their children will carry on the mission. The driving motivation behind this sacrifice is the desire to allow humankind to come into contact with an extraterrestrial civilization—one that is possibly superior to their own. "There were always people who aimed for a distant goal without calculating whether they would reach it." In the rush of events, Dan is unable to say goodbye to Maria. "Too bad, Maria," he says with some pathos. Dan must choose between Earth/Maria and a (literally and figuratively) higher goal.

The film has certain allegorical elements. The march to socialism is a difficult one. Each individual has to make sacrifices for the sake of progress and humanity, renouncing earthly pleasures and comforts. The voyage to a better world (quite literal in the film) will not be over in the lifetimes of those now alive. Rather, they are sacrificing themselves so that their children will live in that better world. The idea of the "generation ship" goes back to John Desmond Bernal's 1929 novel, *The World, The Flesh, and the Devil*. In "Eolomea," the theme is turned into a story about a utopian quest, led by socialists.

Granted, this is not a piece of two-dimensional propaganda. The filmmakers should be given some credit for not having created cardboard figures. Dan is very human. He longs for a life of comfort and pleasure, a home and family. His decision to give all that up for the sake of all humankind comes out of a working through of conflicted feelings and wrestling with his conscience. Thus, this is a fairly refined presentation of socialist ideology that takes into account human psychology.

Technology plays a major role in this story. The work of scientists and engineers is depicted as vitally important to the creation of a better world. The Soviet Union plays a major role in organizing the march into the future: The organizer of the mission is from the Soviet Union. The implication is that what East Germans have to offer is the vision, know-how, and tenacity to make big things happen.[64] Thus, *Eolomea* presents a socialist allegory that is distinctly East German. The personal quest for identity is tied to technology, national identity, socialism, and also gender. These themes recur in other forms of East Germans science fiction as well.

East Germans Save the Universe! (Or least one small corner of it)

Far, far away, intrepid East German explorers, Dig and Dag, save a planet from extinction. They are the heroes, or perhaps one should say protagonists—given their chubby, short, elf-like appearance—of *Mosaik*, a wildly popular comic book series. A quarter of a million copies were published each month in the late 1950s, and publishing figures continued to rise thereafter. Much beloved, many readers considered *Mosaik* to be free from socialist ideology. Indeed, as literature expert Thomas Kramer has shown in a recent book, its intellectual roots lay in large part in pre-socialist bourgeois culture (from the Imperial to the Nazi eras). *Mosaik* turned its attention to technology in the late 1950s and early 1960s. This shift of focus was not entirely voluntary, nor devoid of socialist content. In the late 1950s, the staff of *Mosaik* was informed that it was required to propagate "scientific-technical revolution." Soon thereafter, the two central characters of *Mosaik* were abducted from Earth, and sent on adventures in outer space. However, the writer, Lothar Dräger (assisted by his illustrator, Hannes Hegen, as well as a small staff), cleverly blended different cultural elements to create a genuinely popular vision of a socialist modernity based on technology.[65] Thomas has uncovered some of the intellectual roots of *Mosaik*'s technophilia. Dräger was the son of an engineer, and in younger years an avid reader of stories populated by heroes who were engineers.[66] His conception of Germany as a land of technology also has both pre-socialist bourgeois roots and Nazi roots. The appeal of this message evidently lay at least in part in the anti-ideological ideology of the "apolitical" engineer. Hoping to escape ideology, young East Germans succumbed to a fascination for pre-socialist technophilia.

The heroes of the series, Dig and Dag, are average "guys" (often addressed as "*Jungs*"). Short and plump, they fight evildoers and promote technological progress, not with superior intellect or unusual courage, but with a can-do attitude and solid education. They can explain modern technologies, and work together with scientists. But their successes come from a practical ability to get the job done. They represent the dominant, pragmatic, experience-based school of engineering, which works hand in hand with theoretical science. In one episode, they assist a chemist (figure 6.13). When they mix chemicals, a reaction causes a small explosion. The chemist nonchalantly continues the experiment, however, eventually achieving good results.

Dig and Dag form a team that has little to do with women. The scientists, workers, and even the agents of the other (capitalist) side are almost all men. Women

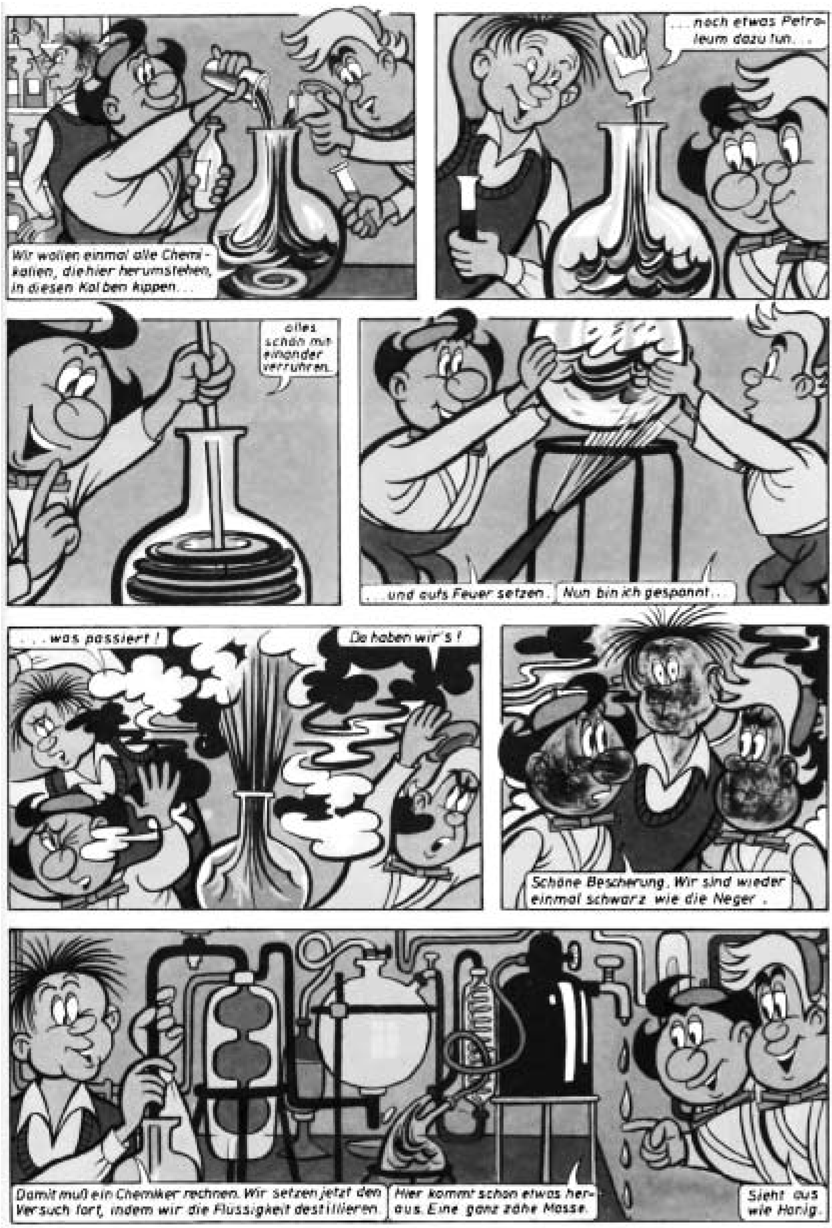


Figure 6.13
Dig and Dag assist a chemist, from "Ein rätselhafter Fund" (*Mosaik*). Photo credit: Tessloff Verlag

Figure 6.14
Female photographer in "Alarm in der Raumstation" (*Mosaik*). Photo credit: Tessloff Verlag

appear almost exclusively as bartenders, saleswomen, waitresses, mothers, fashion models, photographers (figure 6.14), stewardesses, members of an audience, and part of crowd scenes. Thus, all are in service roles.[67]

Interspersed among the exciting adventures, chases, and slapstick comedy scenes are schoolbook-like explanations of technology on Dig and Dag's home base in outer space, Neos. Not surprisingly—given the doctrine that technology is the same everywhere[68]—these alien technologies are largely identical to contemporary East German technology (with an occasional futuristic touch). This vision of technology is very much dominated by factories, machines, science, and men. Double-paged panoramas with captions and labels dutifully explain steel mills, aircraft, airplane engines, plastic production, strip mining, oil drilling, and an oil refinery. There are short sections on the history of flight and aerodynamics. Technologies of the future include atomic ships, atomic trains, and atomic jets (figure 6.15).[69] (Amazingly enough, the inspiration for these came from a 1946 American study entitled *Applied Atomic Power*, where precisely such uses of atomic power were advocated.[70]) On

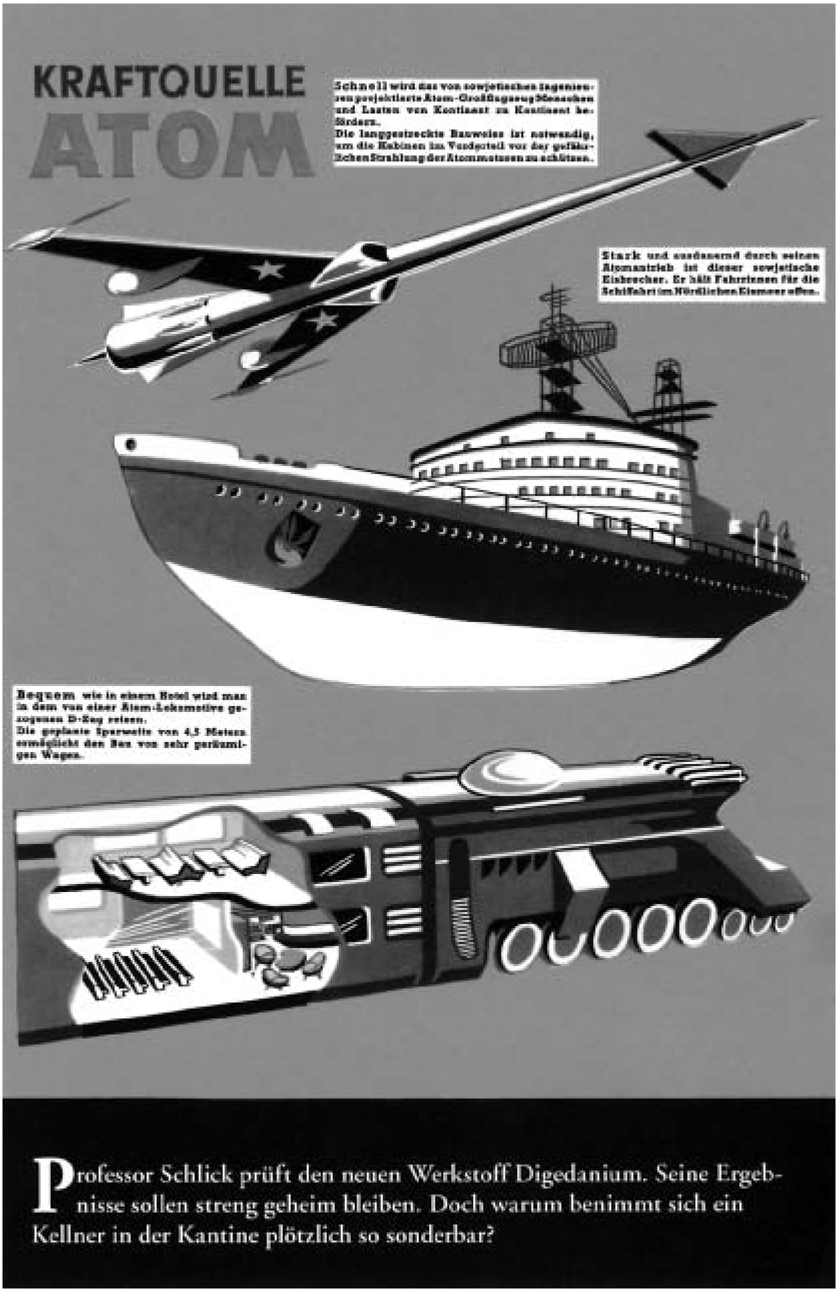


Figure 6.15
Atomic plane, ship, and train, from "Geheimsache Digedanium" (*Mosaik*). Photo credit: Tessloff Verlag

Figure 6.16
Dig and Dag drive through ruins on a distant planet in "Die neue Sonne" (*Mosaik*). Photo credit: Tessloff Verlag

the other hand, Western consumerism as well as household technologies are largely absent from *Mosaik*. This is astonishing, given the high-level significance of East-West competition in the area of consumerism in this era, as exemplified by the 1959 "Kitchen Debate" between Richard Nixon and Nikita Khrushchev. Granted, the GDR had dropped a project to mechanize the East German household a couple of years earlier.[71] In its own way, "Mosaik" contributes to the suppression of consumer desires by privileging industrial technologies.

A good example of the themes of the superiority of socialist technology and East German excellence in technology is found in "The New Sun," an episode of *Mosaik*. Here, Dig and Dag discover a civilization destroyed by atomic war. They drive through the eerie, moonlit ruins of a city reminiscent of Berlin or Dresden after the war (figure 6.16). They are to discover that on this planet, indigenous capitalist forces brought about conflict, militarization, war, and nuclear holocaust. They inspect the stock exchange, where the business transactions took place that led to war. A chaos of mangled girders, overturned and broken furniture and scattered papers greet them. The evil forces of capitalism "wanted to destroy others," but were killed in the war they started. The planet has another problem: Its double sun has almost burnt out. (The cover image of the double sun, figure 6.18, was probably inspired by Chesley Bonestell's image of Beta Lyrae, as well as another artist's depiction of a double star, both of which appeared in *The World We Live*

In, a series of *Life* magazine articles in 1952–1954, reprinted in a 1955 Time-Life volume, and later in a West German edition.[72]) A dying scientist had left an audacious technical solution that he was unable to put to use: A new sun, powered by atomic energy, was to replace the old suns. The clever little East German heroes, Dig and Dag, rocket off to put the new sun in place (figure 6.17). And nuclear technology, the source of destruction in the hands of capitalists, becomes a major force for good in the hands of socialists (figure 6.18).[73] This plot reflects the

Figure 6.17
Admiring the newly installed atomic-powered sun, cover of "Die neue Sonne" (*Mosaik*). Photo credit: Tessloff Verlag

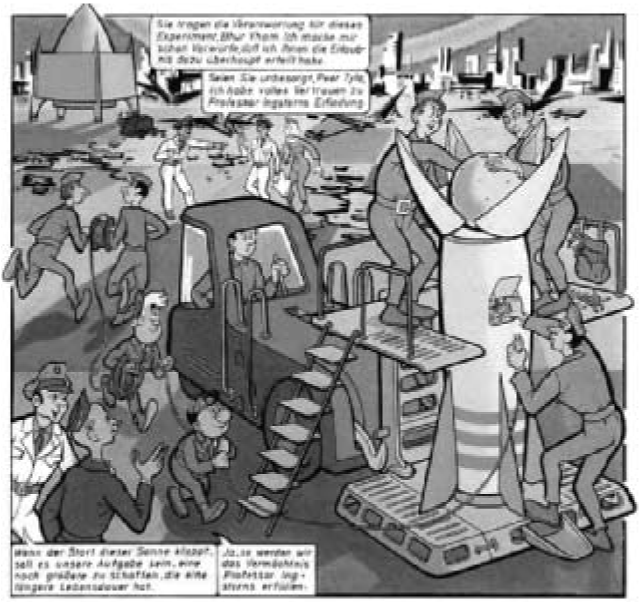


Figure 6.18
Dig and Dag getting ready for their space flight to install an atomic-powered sun in "Die neue Sonne" (*Mosaik*). Photo credit: Tessloff Verlag

intense international enthusiasm for nuclear energy during this period, and was inspired more specifically by novels by Stanislav Lem and other (mainly East bloc) authors.[74]

Racial hierarchies are also established. The planet Neos is divided into two camps similar to the Soviet bloc and the West on earth. They are engaged in a struggle to dominate the Third World, a struggle depicted as a fight between good and evil. In "Petroleum Pirates," Dig and Dag end up in a tropical rain forest where they encounter natives, depicted as dark "primitives" with head dresses, painted faces and bodies, hoop earrings, neck rings, and loincloths (figure 6.19). Trying to illegally tap into petroleum reserves in the area, "oil thieves from the other side" (figure 6.20) cause an explosion. Our heroes come to the rescue of the child-like natives (figure 6.21). Competent East German experts are able to turn off the flow of petroleum (figure 6.22). Thanks to petroleum reserves and the assistance of the East Germans, the rain forest undergoes radical industrialization (figure 6.23). The natives are depicted as happy beneficiaries.[75] Little or no thought is given to problems that might result from extremely rapid development, such as cultural dislocation, ecological degradation, or disenfranchisement of the poor.

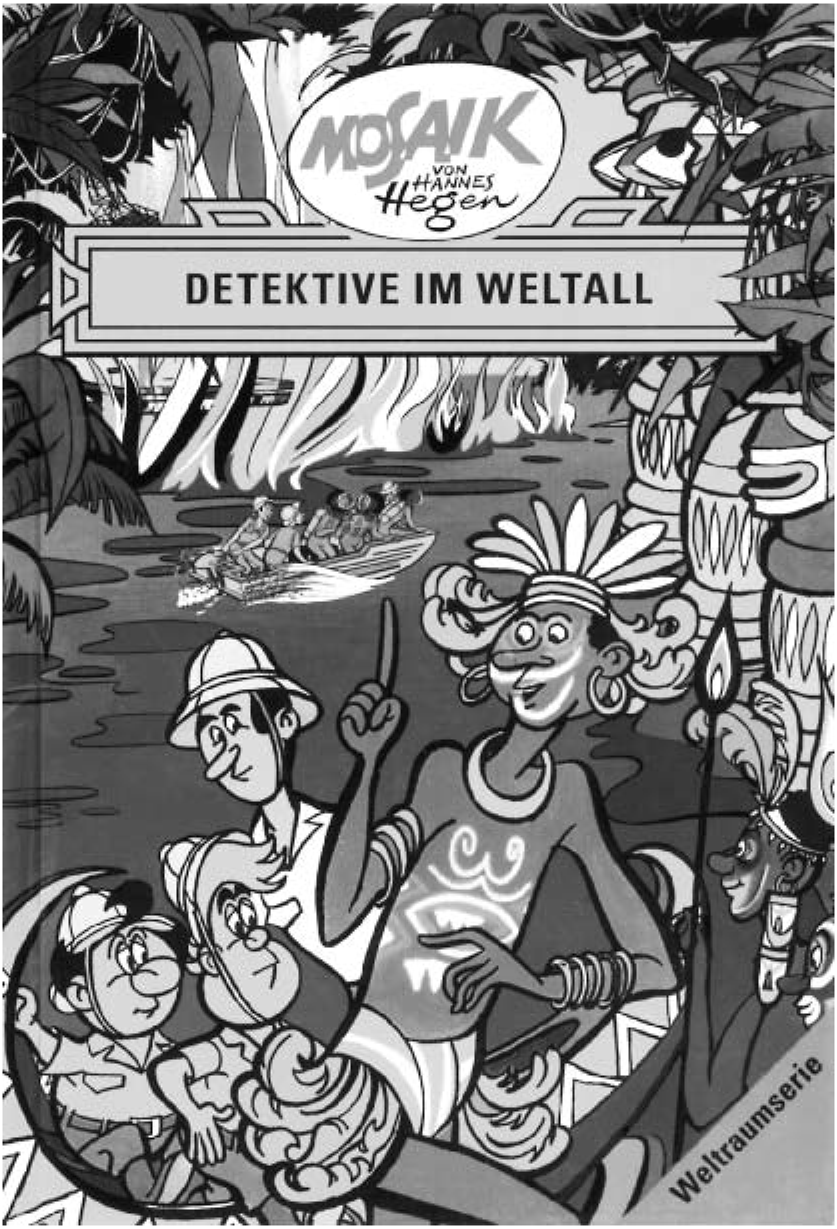


Figure 6.19
Cover of "Detektive im Weltall" (*Mosaik*) featuring a scene from "Erdölpiraten" (Petroleum Pirates). Photo credit: Tessloff Verlag

Figure 6.20
"Oil thieves from the other side," "Erdölpiraten." Photo credit: Tessloff Verlag

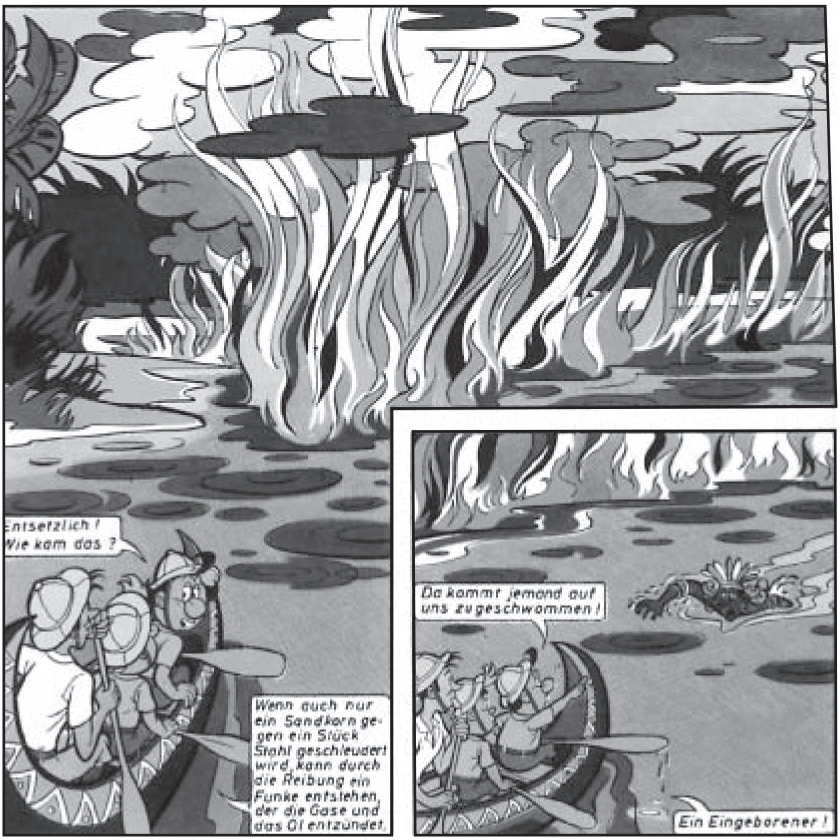


Figure 6.21
Dig and Dag rescue a native from an oil-rig explosion, "Erdölpiraten." Photo credit: Tessloff Verlag

Figure 6.22
East German experts shut off the flow of petroleum, thus stopping the fire, "Erdölpiraten." Photo credit: Tessloff Verlag

This *Mosaik* issue is thus not only nationalistic, but also imperialistic. The first part of the story conforms with Marxist-Leninist doctrine. The natives are inferior to the East Germans because of their culture. They believe in false gods and have a low standard of living. One native, named Palipapu (a name redolent with primitive associations), saved by the East Germans, proves particularly open to their brand of modernization. He acts as an intermediary, assuring the tribal chief that the East Germans can be trusted (figure 6.24). Once provided with modern technology and an understanding of how to exploit natural resources such as petroleum, the natives will become modern. As Dig explains to the chief, "You are going to live in a bright house on a broad clearing and wear clean clothes. Streets and street-car lines will go through the rain forest and open up the whole wide world to you. And you have petroleum to thank for all this, though you thought it was useless."[76] Palipapu appears in blue overalls and a short-sleeved white shirt, looking crisp and optimistic (figure 6.25). All signs of his tribal affiliation are gone. However, a lumbering accident causes a painted shield to be thrust onto the back of his overalls, leaving the bright image of a minor deity on his clothing (figure 6.26). The deity's name, Kakerlaki, which is similar to the German word for cockroach, conveys the author's feeling of disgust toward this symbol of primitiveness and superstition. Palipapu's companions (natives who have left the old ways behind them) tease him that he now has his "head on backwards," a phrase meant both

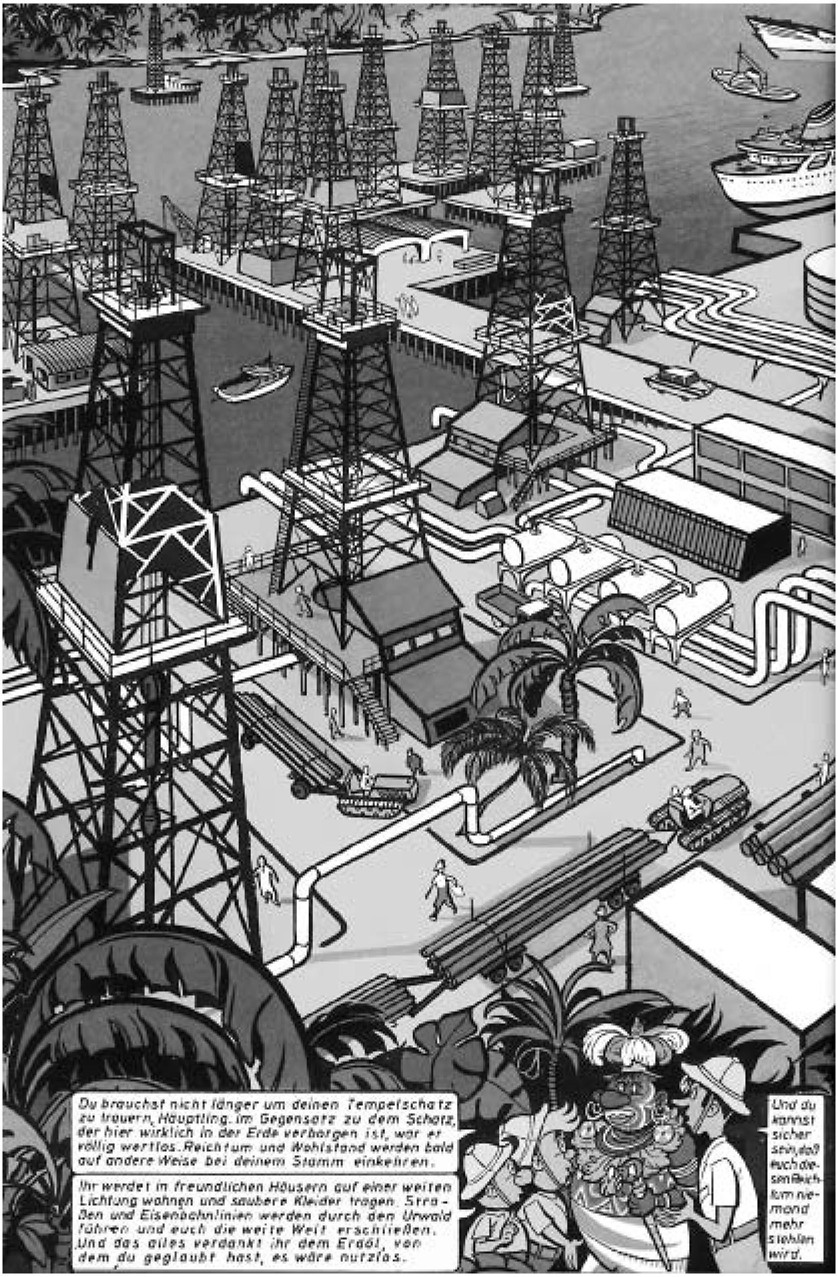


Figure 6.23
Industrialization of the rain forest, “Erdölpiraten.” Photo credit: Tessloff Verlag

Figure 6.24
Palipapu serves as intermediary for the East Germans, “Erdölpiraten.” Photo credit: Tessloff Verlag

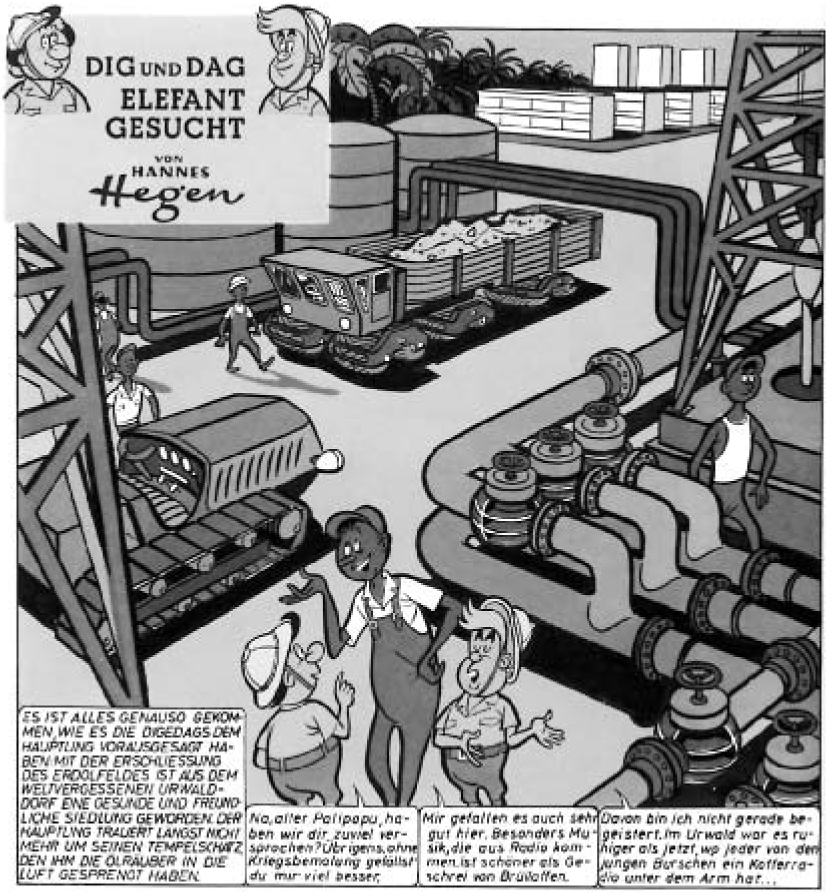


Figure 6.25
“Modernized” Palipapu with modern industrial complex in the background, “Erdölpiraten.” Dig: “I like you much better without the war paint.” Photo credit: Tessloff Verlag

Figure 6.26
Due to a lumbering accident, Palipapu is "branded" with a tribal symbol, "Erdölpiraten." Photo credit: Tessloff Verlag

literally (because there is a picture of a head on his back) and figuratively (meaning "in a bad way"). It is difficult to judge whether Palipapu is more upset by their taunts or by the return of his tribal identity. This identity—both cultural and religious in nature—has left an indelible imprint on him. He may have become modern in many ways, but he can never completely escape his cultural identity. This image suggests a concept of culture close to that of Philosopher Johann Gottfried von Herder—culture lies at the root of who we are, and is a fundamental part of our identity.[77] In this *Mosaik* episode, the natives cannot escape their primitive identity, while Germans are associated with modernity. Specifically, practical, hands-on technical ability is at the core of German identity. There is a certain socialist element in the story: Socialism has made East Germans capable of creating a better world. However, the basic intellectual framework here is racist and imperialist. Its roots lie in the realm of older imperialist fantasies, Nazi-era racialist imaginings, and in the racialization of socialist ideology under Stalin.[78]

How does *Mosaik* compare with Western popular culture of that era? There certainly were parallels in the racism of West Germany and other Western nations. In an analysis of Walt Disney's *Donald Duck* comics in the 1950s, Scholar Jaako Suominen points to highly racist depictions of the inability of Africans to assimilate modern technologies. For example, in one *Donald Duck* adventure, an African—shown as a far more ape-like, primitive character than Palipapu in *Mosaik*—ties a refrigerator to the top of an elephant so as to be able to have a comfortable seat.[79] The common root of these images from *Donald Duck* and *Mosaik* lies in frustration over the apparent failure of certain groups, defined in racial terms, to modernize.[80] Here we see the cultural impact of conceptions of modernization common to both liberal capitalism and Marxism and reinforced by Cold War competition.

Racist imagery of this era also appears to be fueled by fear that the peoples of the developing world will cause Germans harm. This theme is overt in West German cartoons of this era, which depict Africans using the technology provided by the West against the Westerners. In one cartoon, two white men sit, surrounded by African natives in tribal costume, in a giant toaster, apparently about to become toast. "Now you see what they do with all the things for the Third World," says one European to the other. Such nightmare visions were unthinkable in the GDR, where censorship upheld the myth of brotherhood with downtrodden peoples. Nonetheless, the *Mosaik* imagery suggests East German anxieties about the Third World. Purely as a matter of speculation, one can point to a possible source of such anxieties: the GDR's struggle to gain diplomatic recognition from new Third World countries in the era of the Hallstein Doctrine, under which West Germany threatened to break off relations with any country that recognized the GDR.[81] For example, giving in to West German pressure, newly independent Guinea reversed its establishment of diplomatic relations with the GDR in 1960.[82] This forms part of the cultural backdrop to the racist imagery in *Mosaik*.

With regard to the role of women in the building of a technological modernity, *Mosaik* hardly differs from Western popular culture of that era. This is somewhat surprising, given the official message of gender equality and the increasing role of women in engineering. *Mosaik* lends insight into how deeply ingrained attitudes equating technology and masculinity were reproduced under socialism.[83] It also shows how a systematic bias against consumerism was popularized. A Stalinist vision of the development of the economy through heavy industry endured. It was combined with an embrace of the ideology of "scientific-technical revolution," which built on an older belief (going back to the Nazi period) in high-tech research as a panacea for economic problems.

The central vision in the *Mosaik* series is the fantasy of reattaining Great Power status through technology. At the time, East Germany appeared uniquely positioned to do that: it was building on the German heritage, and had broken with the evils of capitalism to join the progressive (socialist) side. Not surprisingly, given the tremendously important role ascribed to technology in *Mosaik*, the development of technology is presented here as a higher duty, performed with a sense of idealism, and as part of a collective effort. Engineering serves a higher goal. A certain amount of slapstick is involved, but it is not truly disruptive. By contrast, as Suominen has pointed out, in Disney's *Donald Duck* comics in the 1950s, inventors are building for the fun of it, and the results of their labors are often ridiculous. They are individuals—some fools, some geniuses—who are suddenly inspired to innovate.[84] Unlike *Donald Duck*, *Mosaik* does not call into question the ability of modern society to make good use of technology or the basically benevolent nature of science and technology. There is an element of East-West symmetry: During the Cold War, the figure of the "evil scientist" is often working for the "other side." However, there were also countless depictions of evil or stupid *Western* scientists in the West, whereas in the GDR, scientists and engineers working under socialism are generally depicted in very positive terms.[85]

This cultural technophilia is also very strong in the East German factory novel, a genre based on Soviet models that has no real parallel in the West.

The Romance of the Factory: Everyday Engineering in Film, Fiction, and Memoir

Along with utopian conceptions of engineering and technology, there was an older, more prosaic socialist tradition of glorification of engineering and technology. Everyday working life in the factory was a central theme of East German art, literature, cinema, and theater. Socialist realism generally put the spotlight on workers as heroes of the workplace. But, engineers, along with other members of the new intelligentsia, played an increasingly important cultural role in the era of the two Bitterfeld literature conferences. The 1959 conference in Bitterfeld called upon writers to study the factory firsthand by going to work there and called upon factory workers to take up writing. This movement was largely dead by the second literary conference in Bitterfeld in 1964, which tried to apply the economic reforms of the "New Economic System" to literature. At Ulbricht's urging, planners and managers became major protagonists of TV shows, novels, and movies. Modern managers—

the product of the New Economic System—were often depicted as having to overcome the resistance of an older generation of Communist bureaucrats to promote technological progress.[86]

Technology was often romanticized in the East German literature of the 1960s. Technology was seen as a central component of progress: It could be used to help human beings overcome "base instincts" and to reinforce the socialist community.[87] Some of the imagery, as analyzed by literature expert Wolfgang Emmerich, is astonishingly naïve. A train is treated like something sacred in a novel by Christa Wolf. In another novel, author Franz Fühmann describes a ship being built, its various parts likened to the organs of the human body. He goes on to praise automation as "amazing." An automatic welding machine is lovingly described as a strange but fascinating animal. In a 1965 poem celebrating the achievements of Soviet cosmonauts, Volker Braun uses erotic imagery to describe the hardware. A three-stage rocket has "legs, breasts, and eyes," and "you are the pilot."[88] Here, as is so often the case in this literature, the master of the technology is male. One poet proposed to stop writing poetry and start building radar equipment. By contrast, Western literature of this era, ranging from Max Frisch's novel, *Homo Faber* (1957) to Friedrich Dürrenmatt's *Physicists* (1962) is deeply critical of role of science and technology in twentith-century society and profoundly skeptical of the ability of human beings to use science and technology for the benefit of humanity.[89]

Around 1965, more critical, differentiated attitudes toward technology began to emerge in East Germany, though far less generally than in the West.[90] There was a growing tendency to depict members of the new intelligentsia as complex, imperfect human beings with conflicting motivations. A case in point is Erik Neutsch's widely read novel, *Spur der Steine*, the film version of which was banned in the GDR shortly after its release (in 1966) and not shown again until after the fall of the Berlin Wall. The head of a construction brigade (working on the site of a chemical factory), Balla, is an independent-minded worker who is depicted as an anarchist, perhaps even a bit of a cowboy. (According to historian Joshua Feinstein, *Spur der Steine* is constructed as a sort of latter-day Western.) The enterprise's young Party Secretary (Horrath) helps the workers of Balla's brigade circumvent the inflexible dictates of the central economic plan and of the enterprise administration. In return, he expects Balla's support in introducing twenty-four-hour shift work, which will bring technological advances, but which entails sacrifices on the part of the workers. However, the Party Secretary undermines his own credibility and endangers his career through an adulterous love affair with a young female engineer, Kati. Fearing Party sanctions, he initially refuses to admit that he is the father of her unborn child. Nonetheless, Balla, who is also in love with Kati, cannot compete with Horrath. The principal female character is a passive romantic interest. It is the men who wrestle with the opportunities and problems presented by technology (and the feminization of the engineering profession) in *Spur der Steine*.[91]

According to German literature expert Wolfgang Emmerich, a "radical turn away from belief in the civilizing [potential of] technical progress" took place among GDR intellectuals in the late 1960s. Christa Wolf asserted that the modern pursuit of "faster, better, more" led to alienation and a loss of human values. For Volker Braun, the origins of this attitude lay far back in human history. He used the Prometheus myth to talk about the dangers involved in the human desire to tame the forces of nature. Braun and many others were not very critical of the Communist world, equating the evils of modern technology first and foremost with "atomic bombs in the hands of evil capitalists," in the words of Emmerich. Christa Wolf criticizes the East in *Störfall*, written in reaction to the Chernobyl disaster. However, she embraces the older, conservative rejection of Western "civilization" as only superficially rational, but indifferent to true human needs, in many of her works.[92] She, like other East German writers, tends to shy away from the much more difficult and perilous critique of technological development under Communism.

Despite growing criticism of technology, many popular novels of the Honecker era continued to depict engineering as a higher calling, though in a more psychologically subtle, differentiated way than in the 1960s. In *The New Sufferings of Young W,* novelist Ulrich Plenzdorf explores a young man's search for love and meaning in 1970s East Germany.[93] Leading a stifling existence in a small town, seventeen-year-old Edgar Wibeau drops his factory apprenticeship, leaves his mother, and runs off to East Berlin. Here, he hopes to find greater freedom and an outlet for his creative impulses. No longer will he live according to his mother's expectations, or the norms of socialist society. He holes himself up in a friend's small garden house on a plot in a community allotment garden.

He strives to rise above the conformism of factory and home, and prove himself to be a uniquely endowed individual, a "genius" (all the while referring to himself with self-deprecating humor as an "idiot"). He has a brief, but intense affair with a married woman, writes an ode to blue jeans, reads Johann Goethe's *Sufferings of Young Werther* (the model for Plenzdorf's novel), and draws (rather badly). A temporary job as a construction worker provides him with the opportunity to demonstrate his unrecognized brilliance to the world. He throws himself into the secret attempt to design and build a better industrial paint sprayer—an endeavor in which his coworkers failed. Sadly, this attempt to become "famous" ends with his accidental electrocution. Wibeau may be naïve and immature, but his boisterous idealism is depicted as admirable. Technology is what gives this teenager direction and what helps him to become a man that other men (i.e., his coworkers) and the woman he loves could admire. Like Goethe's Werther, he is fated to die. But his short life, dedicated for one shining moment to something he truly believes in, goes out with a glorious bang.

Technology is, in Plenzdorf's work as well as elsewhere, nothing less than a concrete manifestation of socialism (much as love or obedience are seen by various Christian churches as concrete manifestations of God). What emerges from the novel is a simplistic vision of technology as a way of bypassing social and psychological problems. Technology allows Wibeau, as an inventor, to transcend the confines of the socialist system, while at the same time making a contribution to society.[94] The playful, individualistic message of the novel is rather strong. Here, inventing is depicted as a kind of play. It could be argued that in fact Wibeau's death is nothing more than a grotesque form of slapstick.[95] At the same time, technology reconciles the individual with society, turning an aimless youth into a man who serves the collective.

Technology also brings male and female elements in society into harmony. However, gender hierarchies are clear here: Men play the leading role as creators of technology. Thus, the romance of the factory leads to a marriage of unequals. The divorce, so to speak, comes in the literature and films produced by women.

The End of Utopia

Brigitte Reimann's novel, *Franziska Linkerhand*, though written in the 1960s and published just a year after *The New Sufferings of Young W*, represents a leap to a different intellectual world.[96] This popular work attempts to portray in a highly realistic manner the tensions, problems, and failures of East German society. Reimann demystifies technology, fundamentally questioning the link between masculinity and technology. Reimann had, inspired by the *Bitterfelder Weg*, gone to work in a factory and written about it. But she did not remain within the socialist realism of that literary movement. Her own complicated and courageous life helped her to move beyond the stereotypes and myths of her society. *Franziska Linkerhand*, a partially autobiographical novel, represents her attempt to come to an understanding of herself as an individual and as a woman in socialism. It was published after her death, at age thirty-nine, of cancer. It is thus impossible to know how she would have felt about the changes made by GDR censors. The uncut manuscript, first published in 1998, contained passages evidently cut because of the implied criticism of socialism or the Soviet Union. Though less critical, the censored version, first published in 1974, nonetheless represents a dramatic break from the past and a portrayal of East German society that has psychological subtlety. Due to its impact on GDR culture, it is this earlier edition that will be analyzed here.[97]

Like many other heroes of East German fiction, drama, and film, Franziska Linkerhand dreams of creating a better world through technology. Franziska is much inspired by a professor (Reger) who is trying to carry on the tradition of Walter Gropius by building beautiful buildings. In becoming an architect, she rebels against her father, a publisher caught up in the intellectual world of the nineteenth century (and who eventually flees, along with Franziska's mother, to the West). She tells him:

> And do you think I don't know why you never ask about my work? You think we engineers are lacking in the spark of esprit, workmen without ideas, incompetents and bunglers. The ancients did everything better, Michelangelo was a titan, and Pöppelmann deserves adoration, yes, yes, yes, I know it all by heart, and perhaps you're right—if only you would consider, just once, that we don't build for kings and don't have a king's treasure chest at our disposal, that we—that you, you lost the war, and that 40% of our city was destroyed by bombs.[98]

She also rejects the "stupid female everyday life" that her mother has lived, as well as her mother's extreme prudishness. This leads to an attraction to unsuitable men. Fleeing a disastrous marriage to Wolfgang, a factory worker, she decides to go help build "Neustadt," a fictional model socialist city that bears a resemblance to Hoyerswerda, where Brigitte Reimann lived and worked for a time.

Franziska is filled with grand dreams: "I was dizzy with happiness, dizzy with ambition, I felt young, young and free as never before, intoxicated with the desire to assert myself and build houses that give their inhabitants a feeling of freedom and dignity, that move them to cheerful and noble thoughts."[99] Franziska sees the building of Neustadt as an "adventure," an incredible opportunity, much like the building of Brasilia (the strikingly modernistic capital of Brazil, built in 1956–1960 as a model city). However, she has become an architect in a period in which this profession has become narrowly technical, and in which the methods of industrial mass production have come to dominate the construction of housing.[100]

Her idealism is thwarted by her boss, a narrow-minded bureaucrat who has replaced every thought of creativity with a grim sense of duty: "While a student, he had written poetry, now he secretly read poetry, as if it were forbidden, he denied his yearning for poetry, for simple pleasures: life is serious, a series of duties, and society expects complete fulfillment of duty." He dislikes, distrusts, and resents those who, like Professor Reger, enjoy life, enjoy their work, believe they can do great projects with ease, and are overly generous with public money. He tells Franziska that Neustadt is no "field for experimentation." There is "no time for playfulness." He asserts, "We have only one job: to build a place to live for our working people—

as much, as fast and as cheaply as possible,"[101] a turn of phrase that echoes policy statements by Khrushchev and Ulbricht.

Franziska is not insensitive to such an argument. She observes the hardships of close living quarters—small apartments shared by several people. Nevertheless, she feels that rigid policies and professional indifference have contributed to the desolation of Neustadt. She dislikes the monotonous, grey lines of buildings lining the empty streets. The only refuge from the inhuman coldness of the modern apartment complex where she lives is a restaurant, where she spends much of her free time, including Christmas Eve. The only movie house in town has been closed. At night, she dreams of beautiful, wide streets. She draws up architectural plans for public buildings in her free time, hoping that her boss will adopt them.

While Franziska believes that technology could improve the lives of the residents of Neustadt, she is also painfully aware of the damage that technology, carelessly deployed, can inflict. She is overcome by the stench of pollution produced by the town's industrial plants when she first arrives. She rejects a completely scientific, mechanistic worldview, and is skeptical about the dream of control through cybernetics (widely espoused in SED circles in the 1960s): "You'd like to put an electrode in the head of every human being, and a wiring diagram in their pockets, so that they could steer themselves, and register feedback and control themselves. Oh! Get away from me with your computer brains!"[102]

Franziska rejects the notion that technology is an innately male domain, though she has certainly had to adapt to this idea, "for she had worked together only with men for six or seven years, had adapted to male norms, had learned a more reserved way of speaking. She was seen as an exception—not, though, this she knew, as a natural part of this other world. The bird with bright feathers. A note of bitterness: They make things difficult for a woman . . . I must achieve excellence to be seen merely as good."[103] Despite the formal and legal equality between men and women in the GDR, there are unwritten rules that allow men to dominate. The novel does not break completely with older prejudices, however. Specifically, it contrasts serious, hard-working Germans with musical, sensuous African-Americans.[104]

Reimann does confront the stereotypical relationship between intelligentsia and proletariat with a psychologically and sociologically complex interpretation. Franziska Linkerhand longs for solidarity with the proletariat, yet finds that a cultural chasm separates her from actual workers. The husband she runs away from, Wolfgang, a factory worker, does not understand her love of learning, her professional zeal and idealism. He spends all his money, and even some of Franziska's, on beer, leaving little for food and rent. He becomes physically abusive, punching her in the nose for waking him after a night of drunken revelry. Their mentality and their use of language is entirely different. Later, after Franziska moves to Neustadt, she finds it difficult to get to know the female factory workers who live in her building. She helps a young factory worker who is training for a better job with her math homework. Franziska's sympathy is awakened by the girl's tales of the hardships of growing up in a poor family. But an altercation ensues when the girl starts criticizing the privileges of the intelligentsia: "They even blow powdered sugar into your behinds," the young woman says sarcastically.[105]

These gender and class conflicts do not necessarily reflect the failure of socialism, which may yet succeed in remolding the psyche, the author hopes. During the course of the novel, Franziska becomes close to her boss, the duty-bound bureaucrat Horst Schafheutlin, all the while ignoring his unspoken but obvious romantic interest in her. She comes to understand his politically orthodox standpoint, as well as his inability to be happy. Reimann's GDR is a GDR of individual histories, many of them tragic. There is no personal salvation through socialism. The novel ends on a rather indeterminate note, due only in part to the fact that Reimann died before she could finish the manuscript. The message is that there are no guarantees in life. One must dedicate oneself to creating a better world in socialism, even though one cannot be sure what one's endeavors will lead to.

In this novel, the rejection of technological utopianism goes hand in hand with a rejection of rigid gender construction and illusions concerning the creation of a classless society.

Conclusion

In East German technophilia, the complex interplay of transnational, socialist, and national influences can be seen. Cold War ideological competition and the creation of a sense of the superiority of one's own side did not by any means preclude imitation, and in fact encouraged it, though the basic argument was at times turned into its mirror image. This is particularly true of science fiction, where images of strange worlds and utopian possibilities crossed borders, even the East-West divide. Tropes such as that of the evil scientist made transnational voyages, or perhaps are part of an older, pre-socialist cultural legacy. Only the surface characteristics of the villains and dystopias (capitalist or Communist, eastern or western) changed as they crossed borders. Racist imagery was also dredged up from the imperialist and Nazi past. However, it was the specific situation of confrontation with resistance to modernization in the Third World that evidently reactivated these images, both in the East and in the West. Similarly, the image of the evil (or stupid) scientist was revived in the face of the threat of nuclear holocaust. The youth movement of the early 1960s and early 1970s also traveled eastward, posing a potential threat to SED domination. In *The New Sufferings of Young W.* and, to a certain extent, in *Franziska Linkerhand*, this threat was disarmed with a rededication to socialist ideals through technological work. Edgar Wibeau was the closest thing to a hippie acceptable to the censors because his version of "Do your own thing" involved finding his place in the socialist system.

Consumerism was another transnational phenomenon, one that threatened to undermine the order of the planned economy. The presentation of technology as a spectacle, the "technological sublime," to use David Nye's term,[106] served as a collective substitute for consumerism. However, the SED's attitudes toward consumerism were highly conflicted. Stalinist visions of dams and huge factories were no longer fully satisfying. High-tech dreams were very compelling. But why should the GDR strive for technological progress if not, ultimately, to improve the standard of living? The East Berlin TV tower was both an inspiring symbol *and* a transmitter that made the introduction of color television in the GDR possible. Visualizations of consumerism could undermine state policies, however. Thus, alongside the vision of progress through collective achievements such as the building of planned cities with new housing complexes, there existed (even in a semi-official publication such as *Weltall Erde Mensch*) an imported vision of single-family suburban ranch houses with patios out back. Such dreams seeped into collective consciousness in part simply because they were so powerful. But the SED preferred to use popular culture, purveyed through consumer culture and media, to sell a national identity based on high tech, because this was the more controllable and more attainable dream.

East Germany dreamt of again becoming a Great Power through technology. SED high-tech policies sought this. This vision was successfully popularized through publications such as *Weltall Erde Mensch*, newpapers, symbolic architecture, comic books, science fiction, participation in the Soviet space program, and television programs. The image of the East German found in the media was of a German tamed through socialism, turned into an unheroic but technically very competent figure.

The factory was the building block of the nation. Individuals were to be drawn to the factory, either literally or through the imagination. There, they could become active members of society without unleashing unwanted and destructive political forces. A productivist conception of citizenship helped get around both the lack of political participation and the weakness of consumerism as a rallying point of East German society.

In constructing this sense of the collective, gender hierarchies were largely left intact. Throughout the Ulbricht era, technology was generally either explicitly linked with men, or was depicted as neutral and (as in the case of the East Berlin TV tower) implicitly male. Older associations were at work here. The mystique of science, the memory of German engineering and scientific feats, and professional exclusivity were all bound up, both with the idea of technology as awe-inspiring and with the perception of cutting-edge technology as masculine.

In the 1970s, intellectuals such as Brigitte Reimann began questioning this whole constellation of ideas: the maleness of technology, the ability of socialism to produce superior technologies, and the wisdom of a productivist definition of community, organized around the factory and legitimized with science and technology. It was as a woman, and therefore as an outsider, that Reimann's character, Franziska Linkerhand, proposed a modernization that was both technological and humanist. This specifically feminist viewpoint appears to have been of considerable importance. In *Rumba auf einem Herbst*, a novel banned and destroyed by the authorities in 1966, Irmtraud Morgner had attempted a feminist critique of the "technology cult."[107]

How popular were the works discussed in this chapter? Certainly all were popular in terms of copies printed or tickets sold, though exact numbers are hard to find.[108] The interviews in the following chapter give a broad sense of the enthusiasm that young people felt toward technology. Technological greatness was not only the dream of the SED, but also of the populace. In the Cold War climate of the 1960s, citizens in both East and West strongly identified with their own side and felt great pride in the goals and achievements of their respective systems. Both East Germans who were dedicated socialists and those who resisted identification with the Communists saw themselves as part of the project of building a better tomorrow through technology. Cultural technophilia was ultimately extremely important because it played a central role in anchoring the socialist project in national identity. This is a facet of the socialist dream that has been underestimated, perhaps because it is so difficult to fathom the largely uncritical stance and the apolitical, technocratic vision of society that were central to the East German vision of technology. However, it is also important to recognize that belief in the transformative power of technology helped anchor the socialist project in modernity, committing the socialist world to a Western conception of progress, thus inadvertently opening the door to a self-reflexive contemplation of that very conception of progress.

Notes

1. See Müller, *Symbol mit Aussicht*, 56.

2. This aspect of socialist myth-building has often been underestimated, for example by Alan Nothnagle in *Building the East German Myth* (Ann Arbor, M1: The University of Michigan Press, 1999). By contrast, Sigrid Meuschel pays due attention to technology in *Legitimation*, 192–211.

3. See Kaiser, *Machtwechsel*, 61.

4. See James T. Andrews, *Science for the Masses: The Bolshevik State, Public Science, and the Popular Imagination in Soviet Russia, 1917–1934* (College Station, TX: Texas A&M University Press, 2003); Richard Stites, *Revolutionary Dreams: Utopian Vision and Experimental Life in the Russian Revolution* (New York: Oxford University Press, 1989); Asif Siddiqi, "The Rockets' Red Glare: Spaceflight and the Russian Imagination, 1857–1957" (Ph.D. diss., Carnegie Mellon University, 2004).

5. See David Nye, *American Technological Sublime* (Cambridge, MA: MIT Press, 1994).

6. See Peter Fritzsche, *A Nation of Fliers: German Aviation and the Popular Imagination* (Cambridge, MA: Harvard University Press, 1992); Astrid Deilmann, *Bild und Bildung: Fotografische Wissenschafts- und Technikberichterstattung in populären Illustrierten der Weimarer Republik* (Osnabrück, Germany: Der Andere Verlag, 2004); Bernhard Rieger, *Technology and the Culture of Modernity in Britain and Germany, 1890–1945* (Cambridge and New York: Cambridge University Press, 2005); Michael J. Neufeld, "Weimar Culture and Futuristic Technology: The Rocketry and Spaceflight Fad in Germany, 1923–1933," *Technology and Culture* 31 (October 1990): 725–752.

7. Judd Stitziel, *Fashioning Socialism* (Oxford and New York: Berg Publishers, 2005), 9.

8. See Katherine Pence, "'A World in Miniature': The Leipzig Trade Fairs in the 1950s and East German Consumer Citizenship," in *Consuming Germany in the Cold War*, ed. David Crew (Oxford and New York: Berg Publishers, 2003), 21–50.

9. On the significance of the factory in East German history, see Martin Kohli, "Die DDR als Arbeitsgesellschaft? Arbeit, Lebenslauf und soziale Differenzierung," in *Sozialgeschichte der DDR*, ed. Hartmut Kaelble, Jürgen Kocka, and Hartmut Zwahr (Stuttgart: Klett Cotta, 1994), 31–61.

10. See Judy Wajcman, *Feminism Confronts Technology* (University Park, PA: Pennsylvania State University Press, 1991), quotations on pp. 143, 137; Nina E. Lerman, Ruth Oldenziel, and Arwen Mohun, eds., *Gender and Technology: A Reader* (Baltimore, MD: Johns Hopkins University Press, 2003); Ruth Oldenziel, *Making Technology Masculine: Men, Women, and Modern Machines in America, 1870–1945* (Amsterdam: Amsterdam University Press, 1999).

11. See Zachmann, "A Socialist Consumption Junction," 73–99.

12. See Simone Barck, Martina Langermann, and Siegfried Lokatis, *"Jedes Buch ein Abenteuer": Zensur-System und literarische Öffentlichkeiten in der DDR bis Ende der Sechziger Jahre* (Berlin: Akademie-Verlag, 1997).

13. See John Fiske, *Understanding Popular Culture* (Boston: Unwin Hyman, 1989); Michel de Certeau, *The Practice of Everyday Life* (Berkeley: University of California Press, 1984); Dominic Strinati, *An Introduction to Theories of Popular Culture* (London and New York: Routledge, 1995).

14. See Nothnagle, *Building*, 39–92.

15. See John Rodden, *Repainting the Little Red Schoolhouse: A History of Eastern German Education, 1945–1995* (Oxford: Oxford University Press, 2002), 103–105, 129–132; Laitko, "The Reform Package of the 1960s," 53–55.

16. Carl Zeiss Archive, NG 105, "Patenschaftsarbeit mit der Spezialschule VEB Carl Zeiss."

17. *Neues Deutschland*, July 6, 1968.

18. *Neues Deutschland*, January 5, 1968; January 6, 1968; July 20, 1968.

19. See Werner Gruh, *Wissenschaft und Technik in deutschen Massenmedien* (Erlangen, Germany: Verlag Deutsche Gesellschaft für Zeitgeschichtliche Fragen, 1979).

20. See Alfred Kirpal and Andreas Ilsmann, "Die DDR als Wissenschaftsland? Themen und Inhalte von Wissenschaftsmagazinen im DDR-Fernsehen," *Diskussionsbeiträge: Institut für Medien- und Kommunikationswissenschaft. Technische Universität Ilmenau* 13 (August 2004): 17–18.

21. See Kirpal and llsmann, "Die DDR als Wissenschaftsland?" 15–16.

22. Carl Zeiss Archive, CZ 0 39, transcript of the East German television show, "We Take the Brain," H.

23. SAPMO/BArch DY 30/IV A2/9.04, Nr. 280, letter from Eberhard Wächtler to Arwed Kempke, dated July 12, 1966 (first quotation on p. 2); statutes of the "Deutsches Nationalmuseum für Bergbau und Hüttenwesen" (quotations on pp. 3, 4, 6); speech given on July 28, 1966 (last quotation on p. 10).

24. Available at SAPMO/BArch, PlakY 3/951.

25. I deduce this from images of Sputnik.

26. *Neues Deutschland*, August 27, 1978, 1.

27. See Horst Hoffmann, *Sigmund Jähn: Der fliegende Vogtländer: Autorisierte Biographie* (Berlin: Das Neue Berlin, 1999), 217, 432–433. See also the website of the Berlin-Brandenburg Radio network (Rundfunk Berlin-Brandenburg), http://www.sandmann.de/_/all/sm/beitrag_jsp/key=7_12969.html.

28. See the use of the *Sandmännchen* episode featuring Jähn in the feature film, *Goodbye Lenin*.

29. See Müller, *Symbol*, 47–53.

30. "Vom Frankfurter Tor zum Brandenburger Tor," in *Deutsche Architektur* 9, no. 3 (1960): 125, quoted in Müller, *Symbol*, 60, 62.

31. This was the era in which Ernst Bloch's utopian take on Marxist-Leninism was roundly criticized as revisionist. See Angela and Karlheinz Steinmüller, *Vorgriff auf das Lichte Morgen: Studien zur DDR-Science-Fiction* (Passau, Germany: Erster Deutscher Fantasy Club e.V., 1995), 61–63.

32. See Müller, *Symbol*, 62.

33. *Neues Deutschland*, October 4, 1969, 4. Quoted in Müller, *Symbol*, 126; see pp. 68–83.

34. The irreverent East Berliners also noted that a cross appeared on the ball of the TV tower on sunny days, inspiring the tower's nickname, "Saint Ulbricht."

35. See Detlef Urban, and Hans Willi Weinzen, *Jugend ohne Bekenntnis? 30 Jahre Konfirmation und Jugendweihe im anderen Deutschland 1954–1984* (Berlin: Wichern-Verlag, 1984).

36. Alfred Kosing et al., *Weltall Erde Mensch: Ein Sammelwerk zur Entwicklungsgeschichte von Natur und Gesellschaft*, 13th ed. (Berlin: Verlag Neues Leben, 1965). Gisela Buschdorf-

Otto was the editor up through the ninth edition of 1960. That older version contained little about modern technology. Kosing et al. wrote the tenth and later editions.

37. Kosing, *Weltall*, 5.

38. See Gouldner, *The Two Marxisms*, 42, 45, 73, 203–205, 224, 270.

39. Kosing, *Weltall*, 6.

40. Kosing, *Weltall*, 415–416, 450, 456, quotation on p. 392.

41. Kosing, *Weltall*, 433 and previous (unnumbered) page.

42. See Werner Durth, Jörn Düwel, and Niels Gutschow, *Architektur und Städtebau der DDR*, vol. 1: *Ostkreuz: Personen, Pläne, Perspektiven*, 2nd ed., (Frankfurt and New York: Campus Verlag, 1999), 356–431, esp. picture on p. 412. If Eisenhüttenstadt is the model, then the degree of idealization is extreme.

43. Kosing, *Weltall*, between pp. 448 and 449. See Barbara Schmucki, "Verkehrsnot in unseren Städten! Leitbilder in der Verkehrsplanung Ost- und Westdeutschlands (1945–1990)," *Technikgeschichte* 63 (1996): 321–341.

44. Kosing, *Weltall*, between pp. 400 and 401; "electronic brain" on p. 389.

45. Kosing, *Weltall*, between pp. 448 and 449.

46. Examples can be found in Disneyland, built in 1959, as well as in the World's Fairs of the era (Seattle in 1962, New York in 1964).

47. See Gerovitch, *From Newspeak*, 232–241.

48. Kosing, *Weltall*, 395–400. Quotations on pp. 397 and 395.

49. Kosing, *Weltall*, between 336 and 337, between pp. 352 and 353, 393, 404.

50. Kosing, *Weltall*, between pp. 400 and 401; 415–449.

51. See Kosing, *Weltall*, 393–395; Horst Hoffmann, *Die Deutschen im Weltraum* (Berlin: edition ost, 1998), esp. pp. 233–281.

52. See Arthur C. Clarke, *Man and Space* (New York: Time Incorporated, 1965), 57 (sidebar, illustration).

53. Kosing, *Weltall,* between pp. 448 and 449. The artist was Eberhard Binder-Staßfurt (1924–2001), an East German book illustrator known for his illustrations of children's books.

54. Kosing, *Weltall*, 441, 449.

55. Kosing, *Weltall*, 474.

56. Heinrich Gemkow, ed., *Der Sozialismus, Deine Welt* (Berlin: Verlag Neues Leben, 1975).

57. See Eli Rubin, "The Order of Substitutes: Plastic Consumer Goods in the Volkswirtschaft and Everyday Domestic Life in the GDR," in *Consuming Germany in the Cold War*, ed. David Crew (Oxford and New York: Berg Publishers, 2003), 87–119. For a general treatment of the emergence of a distinctive East German consumer culture, see Ina Merkel, *Utopie und Bedürfnis: Die Geschichte der Konsumkultur in der DDR* (Cologne, Weimar, and Vienna: Böhlau Verlag, 1999). On convergence of "dreamworlds" in East and West, see Susan Buck-Morss, *Dreamworld and Catastrophe: The Passing of Mass Utopia in East and West* (Cambridge, MA: MIT Press, 2000).

58. Thus, many East Germans are still in possession of their old copies of *Weltall Erde Mensch*. The existence of an "official website" of *Sandmännchen* attests to the continuing affection that many feel for that show. The episode featuring Jähn was specifically featured as an example of *Ostalgie* in the movie *Goodbye Lenin*.

59. See Steinmüller, *Vorgriff*, 60–65.

60. See Steinmüller, *Vorgriff*, 19–27; See Sonja Fritzsche, "East Germany's *Werkstatt Zukunft*: Futurology and the Science Fiction Films of *defa-futurum*," *German Studies Review* 29, no. 2 (May 2006): 367–386.

61. See Burghard Ciesla, "Droht der Menschheit Vernichtung? Der Schweigende Stern—First Spaceship on Venus: Ein Vergleich," *Apropos: Film 2002. Das Jahrbuch der DEFA-Stiftung* (2002): 124, 132–133, article on pp. 121–136.

62. *Star Trek* ran on West German television from 1966 to 1969. See Sonja Fritzsche, "East Germany's *Werkstaff Zukunft*," 384n.35.

63. *Eolomea* was directed by Herrmann Zschoche, based on a screenplay by Angel Wagenstein.

64. Despite his French name, Daniel Lagny would strike many as East German. French surnames are common in the former Prussian areas, and French first names were popular in East Germany. In any case, Dan is portrayed in a way that would encourage East Germans to identify with him.

65. See Thomas Kramer, *Micky, Marx und Manitu* (Berlin: Weidler Buchverlag, 2002). Lothar Dräger was long denied credit for his central role in the making of *Mosaik*. Circulation figures on p. 73. For an example of the perception of *Mosaik*'s lack of ideological content, see November 1, 2001, review of reissued *Mosaik* issues on amazon.de by Andreas Bauermeister, who would have been about twenty-three years old in 1989. He writes, "I liked it [*Mosaik*] a lot because it was free of GDR propaganda." http://www.amazon.de/exec/obidos/ASIN/3730215116/qid=1109350782/sr=1-1/ref=sr_1_10_1/302-3542990-2236862

66. See Thomas, *Micky*, 210–212.

67. See Hannes Hegen and Lothar Dräger, *Mosaik von Hannes Hegen: Detektive im Weltall* (reprint, Berlin: Buchverlag Junge Welt, 2003); *Mosaik von Hannes Hegen: Ein rätselhafter Fund* (reprint, Berlin: Buchverlag Junge Welt, 2002); *Mosaik von Hannes Hegen: Geheimsache Digedanium* (reprint, Berlin: Buchverlag Junge Welt, 2003). These volumes contain reprints of *Mosaik* (1959–1960), 33–44.

68. This was a Khrushchev-era doctrine. See Gerovich, *From Newspeak*, 155.

69. Hegen and Dräger, *Detektive, Fund, Geheimsache*. Also see atomic train station in Karl Böhm and Rolf Dörge, *Gigant Atom* (Berlin: Verlag Neues Leben, 1957), between pp. 272 and 273.

70. See Edward S. C. Smith, A. H. Fox, R. Tom Sawyer, and H. R. Austin, *Applied Atomic Power* (New York: Prentice-Hall, 1946), frontispiece. The proposal to use atomic power for trains, planes, and ships was endorsed in this work by H. D. Smyth (author of a major U.S. government report on the Manhattan Project) and Leslie Groves (head of the Manhattan Project).

71. See Zachmann, "A Socialist Consumption Junction" 94–98.

72. See Lincoln Barnett, *The World We Live In* (New York: Time Incorporated, 1955), 283, 284–285. The illustrators were, respectively, Antonio Petruccelli and Chesley Bonestell. German edition: Lincoln Barnett, *Die Welt in der wir Leben* (Munich: Bertelsmann 1956). Bonestell was a pioneer in the visualization of what outer space might look like. See Willy Ley and Chesley Bonestell, *The Conquest of Space* (New York: Viking Press, 1949).

73. Hannes Hegen and Lothar Dräger, *Die Neue Sonne*, *Mosaik* 27 (1959).

74. See Kramer, *Micky*, 218–221.

75. Hegen and Dräger, *Detektive im Weltall*.

76. Hegen, *Detektive im weltall*, 50.

77. Johann Gottfried von Herder, "Materials for the Philosophy of the History of Mankind," 1784. In *Modern History Sourcebook*, http://www.fordham.edu/halsall/mod/1784herden-mankind.html.

78. See Susanne Zantop, *Colonial Fantasies: Conquest, Family and Nation in Pre-Colonial Germany, 1770–1870* (Lincoln, NE: University of Nebraska Press, 1990); Eric D. Weitz, "Racial Politics without the Concept of Race: Reevaluating Soviet Ethnic and National Purges," *Slavic Review* 61, no.1 (2002): 1–29; Eric D. Weitz, *A Century of Genocide: Utopias of Race and Nation* (Princeton, NJ: Princeton University Press, 2005).

79. Jaakko Suominen, "Machines in Duckburg: Inventing in Walt Disney's Comic Book *Donald Duck* in Finland during the 1950s," presented at the European Social Science History Conference, March 2006.

80. See examples in Peter Schütt, *"Der Mohr hat seine Schuldigkeit getan": Gibt es Rassismus in der Bundesrepublik?: eine Streitschrift* (Dortmund, Germany: Weltkreis-Verlag, 1981).

81. See Alexander Troche, *Ulbricht und die Dritte Welt: Ost-Berlins "Kampf" gegen die "Alleinvertretungsanmassung"* (Erlangen: Palm & Enke, 1996).

82. See Schütt, *Der Mohr*, 29.

83. See also Zachmann, *Mobilisierung*.

84. Suominen, "Machines."

85. See Roslynn Haynes, *From Faust to Strangelove: Representations of the Scientist in Western Literature* (Baltimore, MD: Johns Hopkins University Press, 1994). An example for the West might be the television series, *The Avengers*, which features many mad, dangerous or foolish scientists, some of whom are working for the "other side"—the Soviet bloc—and some of whom are not.

86. See Peter Zimmermann, *Industrieliteratur der DDR: Vom Helden der Arbeit zum Planer und Leiter* (Stuttgart: J. B. Metzlersche Verlagsbuchhandlung, 1984), esp. 192–225. Wolfgang Emmerich, *Kleine Literaturgeschichte der DDR*, 2nd edition (Leipzig: Gustav Kiepenheur Verlag, 1997), 129 and 186.

87. See Carl Wege, *Buchstabe und Maschine: Beschreibung einer Allianz* (Frankfurt am Main: Suhrkamp Verlag, 2000), 170–209.

88. My translation of Volker Braun, *Texte in zeitlicher Folge*, vol. 1 (Halle and Leipzig: Mitteldeutscher Verlag, 1989ff.), p. 53, cited according to Wolfgang Emmerich, "'Die

Technik und die Kehre': Affirmation, Protest und Regression im literarischen Technikdiskurs der DDR," in *Der Technikdiskurs in der Hitler-Stalin-Ära*, ed. Wolfgang Emmerich and Carl Wege (Stuttgart and Weimar: Verlag J. B. Metzler, 1995), 239; see also pp. 234–239.

89. See Wege, *Buchstabe*, 172; Friedrich Dürrenmatt, *Die Physiker: Eine Komödie in Zwei Akten* (Zurich: Verlag der Arche, 1962); Max Frisch, *Homo Faber: Ein Bericht* (Frankfurt am Main: Suhrkamp, 1957).

90. In the West, criticism of technological developments such as automation, as well as of environmental degradation, was widespread. Plastic became a symbol of all that was false and alienating about technological modernity.

91. See Peter Zimmermann, *Industrieliteratur*, 184–190; Joshua Feinstein, *The Triumph of the Ordinary: Depictions of Daily Life in the East German Cinema, 1949–1989* (Chapel Hill, NC, and London: University of North Carolina Press, 2002), 183–192.

92. See Emmerich, "'Die Technik,'" 243–254, quotations on pp. 245, 246, 249; Christa Wolf, *Störfall: Nachrichten eines Tages* (Berlin: Aufbau Verlag, 1987).

93. Ulrich Plenzdorf, *Die neuen Leiden des jungen W.* (Rostock, Germany: Hinstorff, VEB, 1973). English edition: Ulrich Plenzdorf, *The New Sufferings of Young W.*, trans. Kenneth Wilcox (New York: Frederick Ungar Publishing, 1979).

94. Nonetheless, Wibeau's individualism shocked some SED leaders. See Zimmermann, *Industrieliteratur*, 272–275.

95. In Goethe's work, Werther commits suicide because he cannot reconcile himself with the prospect of a life without the woman he loves, in a profession he dislikes. Wibeau, by contrast, seems to have overcome his frustrations and found a genuinely meaningful life. Thus, his death is not necessary. He dies through a freakish accident, caused by his own carelessness. I thank Dick van Lente for this insight.

96. Brigitte Reimann, *Franziska Linkerhand. Roman* (Berlin [GDR]: Verlag Neues Leben, 1974).

97. Brigitte Reimann, *Franziska Linkerhand* (unabridged new edition, Berlin: Aufbau-Verlag, 1998).

98. Reimann, *Franziska Linkerhand* (1974), 141.

99. Reimann, *Franziska* (1974), 130.

100. See Jörn Düwel, *Baukunst voran! Architektur und Städtebau in der SBZ/DDR* (Berlin: Schelzky & Jeep, 1995), 130–135, 254–259.

101. Reimann, *Franziska* (1974), 151, 154.

102. Reimann, *Franziska* (1974), 179.

103. Reimann, *Franziska* (1974), 207.

104. Reimann, *Franziska* (1974), 410–411. A "Negro," a "guest from Harlem, probably," is depicted as wearing "canary-yellow shoes" and moving about like a "puma" or a "tap-dancer"—in other words, as an animal or a minstrel. It turns out that he is a trade representative from "Ghana, I think, or was it the Ivory Coast?"

105. Reimann, *Franziska* (1974), 171.

106. See Nye, *American Technological.*

107. See Barck, Langermann, and Lokatis, *Jedes*, 276–283. During the era of the New Economic System, such a critique was evidently considered absolutely unacceptable, whereas in the Honecker era, technology was no longer a central element of ideology that had to be defended at all costs.

108. For attempts to assess the popularity of some of the manifestations of popular culture covered in this chapter, see Kramer, *Micky,* 73, 221; Zimmermann, *Industrieliteratur*, 184–185; Barck, Langermann, and Lokatis, *Jedes*, 171; Kirpal and Ilsmann, "Die DDR," 17–18; Stefan Soldovieri, "Socialists in Outer Space: East German Film's Venusian Adventure," *Film History* 10 (1998): 394; Sonja Fritzsche, "East Germany's *Werkstatt Zukunft*," 367 and literature cited there.

7

Careerists and Conformists, Individualists and Technology Enthusiasts: Engineers and Computer Scientists in the Honecker Era

The Honecker era did not see the triumph of the socialist engineer, though most Nazi-era professionals had retired by then. The unity of the profession was undermined by five factors. The first was growing individualism in East German society. The second was the loss of prestige and autonomy among engineers and industrial scientists. Under Honecker, the development of consumer society and the social state took center stage in his vision of the gradual evolution of a better socialism.[1] Fascination with technology ebbed, and the prestige of engineers declined markedly.[2] Engineering had become a mass profession in the late Ulbricht era. The number of graduates of university engineering programs rose from 3,183 to 5,181 (62.8 percent) between 1965 and 1970, and then skyrocketed in the following five years, increasing by 135.6 percent (to 12,205) between 1970 and 1975. According to census data, the number of engineers went from 159,921 in 1964 to 281,210 in 1971.[3] Turning away from the idea of scientific-technical revolution, Honecker-era officials almost halved the number of engineering graduates by 1980.[4] (The number of college engineering graduates fell from 14,521 in 1965 to 9,185 in 1978.) By the 1981 census, the number of engineers fell to 142,273, a drop of 11 percent vis-à-vis 1964.[5] Nonetheless, there still were more engineers in East Germany than in West Germany.[6]

The late 1960s and early 1970s saw the opening of the engineering profession to women, a third area of change. The breaking of masculine domination in engineering could hardly have been more dramatic. In 1964, 7.5 percent of engineers were women. By 1981, almost a third of engineers (31.1 percent) were women. Feminization was particularly striking in certain specializations, such as chemical engineering, veterinary engineering, pharmaceutical engineering, and textile engineering, where well over half of the engineers were women. Women were also well represented among industrial scientists, making up 40.4 percent of chemists.[7] Many of the swelling ranks of engineers—particularly women—found themselves shunted into underqualified jobs and non-engineering work.[8] Between 1950 and 1970, the percentage of engineers in administrative posts rose from 9 percent to 18 percent, while the percentage of engineers engaged in the "technical preparation of production" (research and development, technical draftsmanship, project planning, production technology, and standardization) fell from 60 percent to 40 percent.[9]

Fourth, neglect of large swaths of industry contributed to deprofessionalization of engineers and dequalification of engineering work, while a concentration of resources on a very narrow range of (mainly high-tech) projects created haves and have-nots within the profession. East German philosopher and writer Rudolf Bahro explored this phenomenon in his dissertation, based in part on interviews with numerous engineers and other university- and college-educated industrial employees.[10] This work contributed to his increasingly critical views on SED rule in the GDR, which found their clearest expression in *Die Alternative*, whose publication led to an eight-year prison term and forced emigration to West Germany for Bahro.[11] Sociologist Manfred Lötsch managed to stay within the boundaries of permissible criticism in works that explored barriers to innovation in East German industry. He cautiously explored the idea that the GDR needed an elite, arguing that incentives and social differentiation would encourage professionals to perform at a higher level.[12] The hunt for causes of the lack of innovation in East German industry became something of a cottage industry (dominated by sociologists) in the 1980s.[13]

In the post-Communist era, former East German industrial manager Ludz Marz analyzed the problems of East German engineers and managers with the use of the theories of Pierre Bourdieu. He asserted that socialism had undermined professionals' cultural capital: The value of academic training was eroded by the greater importance of on-the-job experience in the face of obsolescent factories and equipment. Recent university graduates began their first jobs with great enthusiasm, only to discover that only experienced workers could make the aging machinery work. Managerial know-how and chain-of-command authority were undercut by the system of job security, as well as by the importance of informal networking in a system with deficient channels of communication. And functional differentiation and division of labor—fundamental characteristics of modern society—were eroded by the intertwining of economic and political functions.[14]

A fifth fundamental change that had a major impact on the engineering profession was the growing dominance of the SED over industrial engineering and science. By the Honecker era, political affiliation could make or break a career in technology. (Academic credentials were also essential, but the vast majority of technical experts already had them). Data from the Central Cadre Data Repository (*Zentraler kaderdatenspeicher*, or ZKDS), as analyzed by Heinrich Best and Axel Salheiser, show this clearly. (See table 7.1.) This gargantuan store of data on all managerial-level state and industrial employees (compiled by the East German authorities in 1979–1989) indicates that there were 5,363 managers in industrial research. Of

Table 7.1
Industrial and industrial ministry employees in managerial positions (Industrial Research)

	Total	SED members (absolute)	SED members (percent)
Area of work			
Science and technology	3,137	2,290	73.0%
Research and development	1,926	1,369	71.1%
Development construction	300	171	57.0%
Total	5,363	3,830	71.4%

Source: Central Cadre Data Repository, analysis by Heinrich Best and Axel Salheiser.

these, 71.4 percent were SED members at the time the data were compiled (1979–1989). Those born between 1946 and 1955 were the most likely to be SED members, nearly 77 percent.[15]

Among engineering professors at the Mining Academy of Freiberg, twenty-six out of forty-one first hired by 1960 were not members of the SED, but in 1961–1971 only four out of nineteen hired were not members, and in 1972–1981 only two of fourteen were not.[16] SED influence over the technical elite was thus quite extensive. This helped create a new basis of negotiation between engineers and the state. Some bridled at this transparent subjugation.

Careerism, "apolitical" enthusiasm for technology, and withdrawal into the private realm were three of the strategies that East German engineers and industrial scientists used to deal with heightened political control, the loss of technological utopianism, decaying infrastructure, and the narrowing of their sphere of action in professional life.

Considerable methodological problems are involved in studying these themes. The style of discourse in the public realms of party, state, and factory were becoming quite calcified by the 1970s and 1980s. Reports and other internal enterprise and government documents of the Honecker era are often highly formulaic and lacking in detail. Autobiographies and biographies of technical personnel are hardly available. The extensive East German sociological studies of the period are framed by theoretical approaches that render the results questionable. I therefore turned to the methods of oral history, designing a questionnaire that was used by my two German assistants, who conducted the interviews.

My Oral History Project

Andrée Fischer (a former East German editor) and Christa Scheff (a former West German psychologist and software expert) conducted two separate sets of interviews in 1997–1999 (forty-three in total), using the same questionnaire and procedures, based on methodologies designed by me especially for this project.[17] The questionnaires established the main themes and insured a high degree of comparability. However, the interviewees were given ample opportunity to formulate thoughts in their own words and draw their own conclusions. The interviews were open-ended, allowing the interviewees to reflect upon their professional lives in the GDR and recount particularly significant experiences. Recordings of the twenty-five in-depth interviews with software engineers, conducted by Scheff and generally lasting one to one and a half hours, were provided to me on cassette tapes and later transcribed by me. Fischer provided transcriptions of her eighteen interviews with female engineers from a variety of industries.

Oral history creates documents whose value is much enhanced by critical reflection on the methodology employed and the context in which they were created, as well as by comparisons with other kinds of sources. The two interviewers brought different abilities, attitudes, and a somewhat different understanding of their role to the project. Scheff's approach was more scholarly and professional; Fischer's approach was more literary and led by a desire to explore East German identity. Scheff and Fischer sought out and found rather different groups of subjects. All of the software engineers interviewed by Scheff were employed at the time of the interview.[18] Her sample is thus representative of the most successful segment of the East German technical elite. Many of the participants in Fischer's part of my project were unemployed or employed in a "make-work" job (*ABM-Stelle*) or in a job for which they were overqualified at the time of the interview.[19] All were women.

What unites these interviews is a common set of questions. These interviews tell a great deal about why the participants entered their professions, the contours of the hierarchies at the workplace, whether they saw themselves as innovators, how they negotiated with the factory bureaucracy, the place of their profession in their lives, whether their first loyalty lay with their profession or with the political system, and the impact of the end of Communism on their professional lives. A wealth of different sources will be used to determine how representative these interviews were and to place them in a larger context.

Where Geeks Fear to Tread: The Development of Information Technology in the GDR

Software specialists were chosen as the subjects of one part of this project because information technology was a new field, one lacking in rigid administrative structures, open to innovation, and more likely than traditional engineering fields to attract women. Moreover, it was a field in which the GDR excelled, relatively speaking.

Nonetheless, the GDR was a relative latecomer to computing. An early center of research was the Institute for Automatic Data Processing of the Technical University of Dresden (headed by Nikolaus Joachim Lehmann). The adoption of the New Economic System and growing official enthusiasm for cybernetics led to a concerted effort in the area of computer development, starting in 1963–1964. It was hoped that computers would greatly improve the planning process and the flow of information in industry and state bureaucracies. According to historian Erich Sobeslavsky, methods used by Western corporations were the model here, for the Soviet Union was not very far along in practical applications of computers. However, computers also began to be used extensively by the secret police to administer data on the population. Overwhelming the financial and material capabilities of the GDR, the computer program consumed 2.6 billion marks between 1966 and 1970, but nonetheless failed to achieve its goals.[20] Ulbricht-era dreams of building a cybernetically controlled system of socialist management failed because the East German economy was incapable of producing the necessary hardware and software. The storage capacity of East German computers of this era (notably the Robotron 300) was very limited, so they generally had to be programmed in machine language, often at the enterprise or workplace where they were used.[21]

Originally, the Soviet Union and the GDR developed computer technologies quite unlike those in the West, but, after a period of rancorous debate, the Soviet Union decided to put its resources into the copying of Western technologies, and East Germany followed suit. The GDR was the first country among the Eastern European satellite states to embark on the production of so-called "third generation" computers, relying on "reverse engineering." The MfS (Ministry of State Security) procured Western hardware and software, which was then copied in violation of patent and copyright laws. The East German computer industry got a much more solid grounding with the founding of Robotron, a socialist combine with headquarters in Dresden, and an agreement within COMECON to create a "unified system of electronic computing technology" (*Einheitliches System der Elektronischen Rechentechnik*, or ESER) in 1969. The first computers developed as part of the ESER project were copies of IBM 360s. Software development became very important with the introduction of these computers, whose hard drives were large enough to allow the use of program packages. East German software for ESER computers largely ran on IBM 360s or their equivalent.[22]

Despite a certain level of technological sophistication (albeit of an imitative sort) and the high priority accorded to the development of computer-based technologies in economic planning, the availability of mainframes, small, mini- and microcomputers (such as 8-bit office computers), PCs, and CAD/CAM work stations was quite limited. This is attributable to inadequate production capacity in the GDR, a breakdown in cooperation within COMECON, and the necessity to export hardware and software to the USSR in exchange for commodities such as oil. In addition, it was not in the interest of the regime to allow the proliferation of information technologies, as can be seen in their decision to stop production of home computers. The introduction of CAD/CAM (computer-aided design and computer-aided manufacturing) systems and CIM (computer integrated manufacturing) did little to raise efficiency because they were applied to hopelessly outdated manufacturing processes.[23]

The development of software was the province of a group of socialist corporations, each of which had a monopoly on software for particular applications. For example, Robotron developed computer software, while software for economic planning and management was the domain of the Combine for Data Processing (*Kombinat Datenverarbeitung*). Individuals were forbidden to develop software without obtaining official permission to do so, although some computer scientists wrote programs at home for friends and colleagues in their spare time without going through official channels. Not surprisingly, given the small size of the GDR, the enormous costs involved in developing software and the slow collapse of international cooperation within COMECON and the Western CoCom embargo, the East German software industry was largely imitative. All traces of the Western origins of “TP” (the Eastern version of WordStar), “Disc Control Program,” or “DCP” (based on MS/DOS) or “Procad” (a rip-off of the CAD program “Medusa”) were removed from software, but nothing was done to stop the use of pirated copies of Western programs in the GDR or the smuggling of Western computers across the border. Some open-source software such as Unix was used.[24] Thus, East German computer science could be characterized as well organized, but rigidly hierarchical, and as rather technologically advanced, and grounded in violations of international law and ethical standards.

It would be wrong to blame the backwardness of East German hard- and software on the lack of technical competency on the part of engineers and other technical personnel in this branch. It has been argued that, on the contrary, technical shortcomings of East German computers (for example, their limited storage space) forced software engineers to develop greater “initiative” and “ability to improvise.”[25] Like the computer industry, the educational system that trained computer scientists reveals much of the same tendency toward rigidity, enforced homogeneity, and hierarchical structures. On the other hand, it was well organized, relatively favorable to women, and fairly advanced in certain areas. In this industry, male-dominated “shop culture” was gradually eclipsed by “school culture” by the 1970s. The completion of a university or technical college (*Fachschule*) degree program became a prerequisite for a career in computer science by the 1970s.[26]

Women were drawn in greater numbers to computer science than to traditional branches of engineering. Women made up over half of students enrolled in the major "Information Processing" (which focused on software) from 1975 onward and over half of graduates in most years, but only 19.4 percent of all engineering students in 1970 and 29.2 percent in 1985. (See table 7.2.) On the other hand, male students evidently predominated in the more hardware-oriented major "Information Technology."[27] In West Germany, by contrast, only 6.4 percent of all engineering students were women in 1975, and 10.8 percent in 1985. While women constituted 19 percent of all West German computer science majors in 1979, their percentage dropped to 15 percent by the early 1990s.[28]

Table 7.2
Full-time GDR students in selected majors by gender, 1970–1985

Year	Major/field	Total enrollments	Women	Women as %
1970	Mechanical engineering	12,747	2,019	15.84%
	Electrical and electronics eng.	10,572	1,146	10.84%
	Information processing	921	438	47.56%
	All engineering	35,683	6,923	19.40%
	Mathematics			
1975	Mechanical engineering	7,540	1,942	25.76%
	Electrical and electronics eng.	9,007	1,959	21.75%
	Information processing	1,071	674	62.93%
	All engineering	31,388	10,892	34.70%
	Mathematics	2,338	980	41.92%
1980	Mechanical engineering	7,758	1,591	20.51%
	Electrical and electronics eng.	9,393	1,211	12.89%
	Information processing	583	297	50.94%
	All engineering	33,075	9,758	29.50%
	Mathematics	986	363	36.82%
1985	Mechanical engineering	9,038	1,699	18.80%
	Electrical and electronics eng.	9,226	1,261	13.67%
	Information processing	1,024	550	53.71%
	All engineering	35,136	10,246	29.16%
	Mathematics	1,174	565	48.13%

Source: My calculations according to *Ergebnisse der Hochschulstatistik*, ed. Ministerium für Hoch- und Fachschulwesen, Sektor Rechnungsführung und Statistik Berlin, 1969–1975/76; *Statistisches Jahrbuch des Hochschulwesens der DDR*, ed. Ministerium für Hoch- und Fachschulwesen, Sektor Rechnungsführung und Statistik Berlin, 1977–1989.

The number of IT specialists in the GDR can only be estimated since the statistical category "software personnel" could contain clerical or administrative personnel. According to this data, the number of employees in software development rose 30.5 percent, from 14,425 in 1987 to 18,824 in 1988, and then remained at roughly the same level (18,840) until 1989. About a fifth of these worked for Robotron or the Data Processing combine.[29] The other four-fifths were scattered across a great variety of sectors, including industry and state and party bureaucracies. Thus, East German IT specialists were not loners beginning their careers building computers in a garage, as the iconic success stories of IT entrepreneurs in the United States were. Rather, they were formally trained specialists who went to work in rigidly hierarchical bureaucracies. Nonetheless, as this chapter will show, there was a tremendous range in their backgrounds, goals, and sense of professional identity.

There is a certain amount of diversity among the twenty-five IT specialists interviewed by Scheff. Ten are women, fifteen are men. All are former East Germans, except for one who came from a foreign (socialist) country. Most worked in Berlin. Thus, Dresden (the most important other city for IT) was somewhat neglected by this study. Six were in their forties when the Berlin Wall fell, having been born in the 1940s. Thirteen were in their thirties, having been born in the 1950s. Six were born in the 1960s, and were under thirty in 1989. Of the twenty-five, only two had nothing higher than a technical college degree; the rest had university degrees. Only five were employed in the East German computer industry; the others worked in other industries, or for state institutions (such as the central bank), schools, or universities. Eight were in top or middle management (director; division director, or *Bereichsleiter*; department head, or *Abteilungsleiter*; head of a major computer center); four were in lower management positions (the ranks from project manager, or *Projektleiter* down to *Sachgebietsleiter*); and nine had non-managerial IT positions (programmer, engineer, research assistant). Three did not begin professional work until after 1989.

The computer scientists interviewed by Scheff differ markedly in various respects from the female engineers interviewed by Fischer. Whereas Scheff recruited her interviewees from among people still employed in the IT sector in the late 1990s, Fischer mainly sought out unemployed women and women in temporary make-work jobs (known as *ABM-Stellen*, or *Arbeitsbeschaffungs-Maßnahmen-Stellen*). In terms of careers, background, and professional ethos, these women present quite a different picture from the successful software engineers. Fischer's interviewees included sixteen East German women and one woman from the Soviet Union who moved to the GDR in the 1960s. Twelve worked primarily in Berlin. Two were born in the 1930s, ten in the 1940s, three in the 1950s, and two in the 1960s. Mainly the products of technical colleges,[30] they tended to have narrow technical specializations in traditional industrial fields.[31] Fourteen never attained supervisory or managerial-level positions. Two were in lower-ranking managerial positions (assistant team leader, assistant department head); and one was a head of product development (*Entwicklungsleiter*), a middle management position.

"Something Totally New Is Coming": Background and Choice of Profession

Were East German IT specialists forced into their profession? Were they a cross-section of the population, recruited purely according to ability? For the IT specialists interviewed by Scheff as part of my study, the answer to both of these questions is no. Most were the children of university graduates and nine the children of engineers, whereas only six (born mainly in the 1940s) came from genuine working-class backgrounds.[32] This reflects a general trend toward declining social mobility in the Honecker era.[33] According to a 1984 study of the East German Central Institute for Higher Education (*Zentralinstitut für Hochschulbildung*), 70 percent of students studying electrical engineering had at least one parent with a college or university education.[34] Of the twenty-five computer scientists interviewed, only five started out as blue- or white-collar workers and were given the opportunity to get a college or university degree in a part-time program.

Several men became interested in engineering in their childhood (one by "nursery school age"), often inspired by their fathers or other male relatives. One man was drawn to electronics: "It began sometime in my childhood, specifically when someone gave me an electronic building set." Technical hobbies were typical childhood pastimes, mentioned by several of the male participants but only one female participant in the study. Not surprisingly, given the general unavailability of home computers, early experiences with computers were rare. Russian and ideological instruction were among the least favorite subjects in school. On the other hand, sports were popular, and a few interviewees were seriously involved in competitive team sports. The women in our study were as athletic as their male counterparts. One described her girlhood hobbies as "sports, sports, sports." She was seriously involved in track and field, cross-country skiing, judo, and rowing. She took flute and mandolin lessons, but gave these up to be able to devote more time to sports. However, she also did some acting, and loved "reading, reading, reading," particularly contemporary GDR fiction and the German classics. A male participant in our study said that as a boy, he had been a "stay-at-home" who loved to read, particularly world literature and history. Science fiction was mentioned by only one respondent, who also loved classic German literature. He was fortunate to have grandparents who owned "entire bookcases filled with such literature." To be able to read these books, he learned to read Gothic type. Another software engineer learned Latin in his spare time when he was young. Thus, some were still anchored in traditional German bourgeois culture.

The women had much less early, hands-on experience with technology, though, like the men, they had shown an early interest in mathematics, and often science as well.[35] The women in my study chose their future profession later than the men who, with one or two exceptions, knew quite early that they wanted to work in a technical field. In one case—that of a software engineer born into an upper-middle-class family in the early 1950s—the parents had very conventional ideas about a woman's role. "A woman will become a housewife," they told her. She was forced to take piano lessons even though she had "no desire" to do so. She preferred building things, preferably "something logical," and was interested in mathematics, sports, reading, choral singing, and English in school. She recalled, "My parents were of the opinion, 'A woman, studying [at the university], that's crazy.' " Her interest in technology was awakened by her teachers. "They tried to influence my parents," she recalls. She was offered the chance to attend a university in another (socialist) country, but her parents did not allow her to go. (As a minor, she needed their permission.) She then decided to do an apprenticeship in data processing. Earning excellent grades, she was encouraged by her teachers to apply to a university program. Finally, her parents gave in and allowed her to do so.

For a computer specialist born the same year, but from a working-class background, the expectation would have been that she learn a trade. Initially, she wanted an office job, and considered commercial training. She changed her mind, deciding on an apprenticeship in data processing, after the father of a friend told her, "Something totally new is coming—electronic data processing. There will be computers, etc., etc., etc. The machines will calculate everything. Humans will no longer have to do that. And that will be the future." As it turned out, she did not enjoy programming very much, but decided to go on to the university. Here again, the fatherly advice of an older colleague played an important role: "My God, girl [*Mädelchen*]. With your grades and everything—don't you want to study [i.e., at the university]?" She majored in IT.

Two IT experts, women ten to fifteen years younger than those just mentioned, took it for granted that they were headed for the university. One said that her mother wanted her to go to medical school, while her father thought she should major in computer science. She took her father's advice, realizing that she could work in any number of fields with this specialization. The second software engineer was very athletic as a teenager, and hoped to become a sports and mathematics teacher or a sports and biology teacher. However, she was not accepted for the program to which she applied because (she asserts) "boys were favored." Many of her relatives worked in the field of electrical engineering, which was precisely why she rejected that option. She became familiar with heavy machinery and industrial manufacturing procedures during a required practical training stint. She decided to major in automation engineering/technical cybernetics because it combined so many different fields: mechanical engineering, electrical engineering, electronics, safety engineering, and cybernetics.

Three of the ten female software engineers interviewed by Scheff for my study were essentially forced into a technical profession. An accident made it seem unlikely that one participant in the study would be able to become a forest ranger, her dream profession up until the seventh grade. And so she decided to go to a "special school" (a specialized boarding school for talented students) run by the Semiconductor Works (*Halbleiterwerk*) in Frankfurt an der Oder. One day a week was devoted to hands-on instruction in the factory. She developed something of an aversion to this setting, declaring, "I never wanted to become someone like these idiotic engineers ["*Hornviecher von Ingenieuren*"] at the Semiconductor Works, that is, electrical engineers, construction engineers." She dearly wanted to become a child psychologist because she loved working with children. As a straight-A student, she fulfilled the formal academic criteria for admittance. However, she was not classified as of the working class. She could have made up for this deficit by serving as an FDJ (Communist youth organization) secretary at the university. When she refused, she was denied admittance to this major. She reacted with defiance: "I was outraged and frustrated, and said [to myself], now you'll take a profession where you close the door at night, and all of you can go to hell." (She meant that she would choose a profession in which she would not need to work at home or do overtime.) She chose her father's profession, electrical engineering, and selected a university where a friend was studying. It was an "emotional decision, not a rational decision." In fact, she discovered a passion for computing, which "was a great deal of fun . . . It began to fascinate me." Nonetheless, she later hated her job, and put her growing family first.

Another woman was "upset" that she was not allowed to become a nursery school teacher. However, she adapted fairly quickly, finding great satisfaction in data processing: "It was a tremendous amount of fun for me back then." She especially liked her first job, teaching apprentice data processors. Her second job, a straight data processing position, seems to have given her a sense of satisfaction as well: "The technical work . . . was fun."

Another woman who participated in this study originally wanted to become a doctor, but changed her mind after a traumatic incident in the hospital where she was working. Withdrawing her application for medical school at the last minute, she went to work in the physics department of a major university while waiting to start her studies there. She discovered a love of computer programming that stayed with her over the years. She became quite professionally ambitious. When asked whether her professional work had fulfilled her "hopes and wishes," she responded in the affirmative.

Though most of the men in the IT segment of our study decided to go into a technical or mathematical field quite early, a few were quite torn because they were also strongly attracted to another profession. One computer specialist played viola quite seriously for ten years and applied to the conservatory. His family was not pleased, feeling that he should study "something sensible." He was attracted to engineering because he had as a boy thought of becoming an air transportation engineer and because his father was a civil engineer. He finally chose the IT industry, a decision that he sometimes regrets. Sometimes when he listens to Rostropovich playing Bach or Tchaikovsky, tears come to his eyes. Other male interviewees would have rather become painters, rock musicians, and transportation workers or engineers. These men had always been interested in technology, science, or mathematics, and thus ended up in professions they were reasonably well suited for. A fifth man, however, was forced to give up his interest in foreign languages and desire to do a degree in international economics, a path he hoped would allow him to travel to other East bloc countries. He believed that this was due to the fact that he had only done one and a half years of military service rather than the usual three. Coming from the "wrong background" also prevented several interviewees from being able to major in the area they wanted to. In one such case, the man enrolled at the Technical University of Dresden in a major he did not really like, and was able to change to a major that he preferred.

Fischer's interviews with seventeen female engineers from various technical fields present a somewhat different picture. These women had much stronger ties to the working class than did the IT specialists in Scheff's group. Fourteen of them began their careers as factory or office workers, completing an apprenticeship and later going on to college or university studies. Seven came from working-class backgrounds, and three from the lower middle class. Four were engineers' daughters; one was an architect's daughter.[36] For workers' daughters, going to work in the factory, doing an apprenticeship and later using college studies to rise professionally seemed like the most natural thing in the world. "Because my brother had done an apprenticeship as a mason, it was also my wish to work in construction," said one woman. The daughter of a skilled worker grew naturally into her father's profession: "It was the greatest disappointment to my father when his third daughter was born. And so he was overjoyed that I was interested in technical things and didn't just play with dolls and such. And that was the real reason for my interest. He took me everywhere with him, I learned from an early age to use a screwdriver, hammer, or some such." Others indicated that they had long been interested in science or mathematics, or that they had always enjoyed building things.

One interviewee angered her family by not going on to do a college-preparatory high school degree (*Abitur*), but rather doing an apprenticeship as a construction draftsman. ("I have to say honestly, I was so sick of school that I said, I want to get out of here—much to the irritation of my family, I must say.") Her mother had gone back to complete ninth and tenth grade, starting at the age of twenty-eight, and had eventually done a degree in mechanical engineering (though she was a single mother!). The daughter eventually followed in her mother's footsteps, doing an engineering degree as her employer asked her to. Eventually, she found her work "fun," a term used by many of the interviewees to describe their work.

Two non-working-class participants in Fischer's study hinted that engineering might not have been their first choice. The architect's daughter indicated that she had to leave school after tenth grade because she was not considered to be of the working class. She became an engineer, she says, because she craved economic independence, but also because "the engineering profession was a well-regarded profession back then." After an apprenticeship, she completed a very prestigious university program and went on to a brilliant career in industrial research.

A policeman's daughter was also forced (in the early 1950s) to look for a job after tenth grade because she was not considered to be of the proletariat. She was the only girl among the apprentice masons of a large factory. "I was always very tall, and when I had a cap on, people didn't notice that I was a girl." She was treated like "one of the guys" at work. She would have liked to study music, but was happy with her technical profession. The pride in being able to prove oneself as a woman in what had been a man's profession, along with the prestige of engineering and the camaraderie of the workplace, very much helped to reconcile women with this profession.

"I felt comfortable there": Conditions at the University

How did the IT specialists evaluate the education they received? The participants came from a broad variety of majors (seven studied computing, computer science or cybernetics; two, data processing for industry; three, mathematics; two, physics; one, physics and mathematics education; nine, an engineering specialization). Those who had attended East German universities during the 1980s found their studies as methodical and rigidly organized as they had been in high school. Students were divided up into seminar groups of about twenty that were supervised by secretaries of the FDJ. Here was the smallest unit of the university community, upon which state control of the universities was built, but which also provided students with help with their studies as well as a social network to fall back on. The Higher School for Electrical Engineering in Ilmenau seemed cold and foreboding when one young woman first arrived, but she felt much better once she met her seminar group: "I felt comfortable there." Socialization at the universities promoted group solidarity and egalitarianism. Those (like four of the male computer scientists interviewed by Scheff) who were sent to the Soviet Union to study missed out on the East Germany college experience. However, this was a distinction that provided many professional opportunities.

On the other hand, the East German universities were deficient in terms of technology. There were no PCs at the universities in the late 1970s. Only computers that worked with punch cards were available. Students handed in their punch cards and came back the next day to pick up a print-out with a list of errors. By the late 1980s, PCs were available, but only in very limited number. Students had to sign up to use them for a few hours per week.

Our interviewees found university training in information technology to be very theoretical and mathematically oriented. Virtually all felt they had received excellent preparation for their future professional life. Some made a virtue out of necessity, arguing that their more theoretical training was superior to that of West Germans, who had a more practical and pragmatic education. East Germans, they believed, had a better sense of overarching principles, and were also more thorough and better organized than their West German counterparts and (post-1989) colleagues.

Most of the female engineers interviewed by Fischer felt more insecure about their training, probably because most were unable to find permanent jobs after the fall of Communism. One complained about the quality of teaching in courses taught by senior employees at the factory, though she was quite happy with her mentor at the factory. Another did not address East-West differences in the quality of training, but did extol the virtues of the more praxis-oriented technical college education, as opposed to university engineering programs: "In industry, these [technical college-educated] engineers were favored over those who came from the technical university because those from the technical university were theoreticians. They had never seen a construction site."

Most of those interviewed for my study by Scheff and Fischer believed that men and women were treated as equals at the university or in college. However, women in male-dominated fields were at a disadvantage, particularly in earlier decades.[37] As the first woman to graduate from her technical college (in the 1950s), one woman interviewed by Fischer had to contend with the prejudices of older (presumably Nazi-era) faculty: "At the engineers' academy, I had difficulties as a girl. . . . That was an entirely different generation, opposed as a matter of principle to women in this profession, in technical professions." According to one interviewee, women were "not taken seriously at all" at the Higher School for Electrical Engineering in Ilmenau, where they were in the minority. Fellow students said that she must have slept with someone to get a good grade. In the heavily male physics department of the Humboldt University, one woman felt that there was discrimination: "A woman had to do more to gain recognition." The main problem for some women was the lack of the kind of hands-on knowledge of technology that men possessed: "We had to go to it like everyone else. There, the motto was, if you want to study, then you have to know how this and that function. You have to know how to cut a screw thread, and we learned how." Most of the women in Fischer's group underwent an apprenticeship, which increased their confidence in their technical abilities.[38] Many of the younger women (born in the 1950s or later) felt they had been exposed to technology for much of their lives: "In school all the girls, just like the boys, had already had polytechnical training, that is, instruction in industry, and we worked in the factory with technology just like the boys: drilling, working with a lathe, filing, etc." Nonetheless, women tended to choose majors that involved less use of tools and machines. (See table 7.2.)

Many young female engineering students also had to deal with the problem of childrearing, which in the GDR was thought of, along with housework, as more the responsibility of the woman.[39] Up through the early 1960s, it was relatively rare for a woman to have a child while pursuing a degree. Childcare was difficult to obtain in that early era, but the demands on women were unrelenting. One woman in our study worked full time while pursuing an engineering degree in the evenings. When, in 1968, she had a child, she had to board the baby at a crèche until the child was nine months old, picking her up only on weekends. Another woman, who attended the University of Halle full-time, had to place her baby in a home in another city during the last year of her studies (1964) because no daycare slots were available in Halle.

By the 1970s, such hardships were unknown.[40] An engineer born in 1956 recounts that in the 1970s, "most female students had their first child during their studies. Conditions were ideal at the university." Married students with babies were given apartments of their own, while single mothers often shared dormitory rooms with other mothers: "[There was a] daycare center, there was a pediatrician, everything was nearby, everything was perfectly organized, the facilities were open in the evenings until late. And since we lived close to each other, there were always friends and acquaintances around who were willing to babysit from time to time in the evening." This student's one difficulty was that her child was sick quite often. However, her child was born while she was working on her thesis, and no one minded that she went to the laboratory at odd hours, sometimes with the baby in tow. She recalled, "Everyone who worked there took care of her at one time or another."

By the 1970s, easy access to childcare facilities, well-organized part-time college and university programs, and favorable conditions at the workplace made it possible for working women with children to pursue a college or university degree. One engineer-economist had her third child while she was in the middle of a special part-time college program for women (*Frauensonderstudium*). She went to college one day a week and worked the other days. Up at 5:00 a.m., she would take the older children to school and the baby to the daycare center (located on their street). The warm meal of the day was lunch, eaten at work or school. The eldest child was in charge of buying groceries. When she was able to get home at 4:00 p.m., she would pick up the baby. When she was delayed, the middle child picked up the baby. Once, he forgot to do so, and so she went off at 6:00 p.m. to pick up the baby, who had been taken home by an employee of the daycare center—which was considered a normal procedure. The mother studied while her children did their homework, and often stayed up until midnight studying. Once a month, she was given the day off from work to study. She eventually divorced her husband, who had contributed little to raising the children and taking care of the household. Such part-time students missed out on the college experience.

"Fantastic! Come work with us!": Launching a Career in Engineering

There were distinctly meritocratic elements in the system of state-supervised job placement. Graduates with top grades tended to get the best jobs, though individual initiative also played a role. However, gendered thinking, family obligations, and the vagaries of ever-changing state policies also helped determine whether a graduate would get a dead-end job, or one that would set the stage for an outstanding career. Four male IT specialists who began their careers in the Ulbricht era very much profited from the computer boom of that era. One began his first job in hopes of becoming a pioneer in this field. He went on to participate in the building of the first generation of GDR computers. A second software engineer was sent to Robotron's training center after he was hired. They learned how Robotron computers worked, down to the smallest details, and watched while a computer was completely taken apart. "It was a very, very good foundation," he believed. The third Ulbricht-era IT expert found his first job in state-run industry "boring," and soon left. He was able to find a graduate assistantship at a major university, which allowed him to get his doctorate. The fourth started at a computer center, where he worked "with bit and byte." He soon rose into middle management.

By the early Honecker era, the situation had deteriorated for software specialists looking for their first jobs. From 1971 onward, students who had not yet completed their studies were generally obliged to sign a contract stipulating that they would remain in the job to which they were assigned after graduation for three years. However, it was possible to evade this regulation.[41] Several of the younger computer scientists in our study demonstrated a fair amount of initiative during their job searches. One found the prospect of working for the Academy of Sciences enticing. "I simply walked in. I had to bluff my way past the guard. And then I walked into one institute after another and asked whether they needed a physicist. . . . At the end, there was only one institute left, out-of-the-way and at the far end [of the building]. And that was the Institute for Cosmic Research." Several of his professors were upset by his "unusual behavior." However, he was hired, and there were no long-term negative consequences.

The one foreigner among the interviewees believed that career possibilities were greater in East Germany than in his native (Eastern European) country. Due to his initiative, he landed a job at a top research institute. This would not have worked back home: "If I had started and said to the ministry upon completion of my studies [in the Soviet Union], 'I want a job in the Academy,' they would have tapped their foreheads [a gesture indicating stupidity]. 'Go work for a couple of years cleaning up shelves and closets, and since you have a degree you can come back in a couple of years, when you have a bit of experience.' " The tremendous opportunities he was given from the start greatly motivated him: "It motivated me and gave me greater strength and self-confidence . . . to have been told, 'Fantastic! Come work with us.' " Put to work on an area never before computerized, he was given considerable freedom. "Often my colleagues said, if he wants to do that, let him. Let's see what comes of it."

Others were confronted with far more restrictive conditions, and were not in a position to change their professional situation. One female software engineer began her career as a data programmer. She was sent by her employer to study at the university, and honored her commitment to return to her home factory upon finishing her degree. Her unwillingness to test the rules doubtless had something to do with her narrow range of experiences, coming from a working-class background and having been originally a white-collar worker. Back on the job, she found herself performing duties not unlike those she had had before attending the university: "I arrived, full of ambition, from the university and thought, 'now things will get going,' but nothing got going." Working again as a programmer, she was often asked to punch cards for colleagues. She felt totally dissatisfied with this situation: "I wanted work commensurate with my education and not support tasks for gentlemen who had already established themselves there [professionally].” She suffered the same fate as other women in her enterprise who were stuck in supporting roles, and were almost never promoted to managerial positions. “And they [her female colleagues] were happy to do this and be left alone . . . but not me!” She goes so far as to say that these women had “fictitious jobs.” At work, they often read books and magazines brought from home. These women showed no solidarity toward her, nor did they sympathize with her when she expressed her discontent. Her superior did “not have very objective attitudes towards women. . . . They were always saying, ‘Women must subordinate themselves.’ Or ‘Women should not be in managerial positions.’ When one said something, one was called a ‘women’s libber,’ even though I am not one.” This interviewee was not able to fully demonstrate her talents until after the fall of Communism, when she became the head of a polytechnic computer center.

A similar pattern emerges from Fischer’s interviews with seventeen female engineers from different fields. First, most had done apprenticeships and then were selected by their employers to do technical college degrees part-time; they took their obligation to remain in their jobs for a certain period (generally three years) very seriously. One woman found that when she returned after completing her degree (in the 1980s), the colleague she worked with had changed from a supportive friend to a hostile enemy who saw her as a competitor. Rather than helping to smooth her transition from the fairly theoretical college experience to the challenges of life in the factory, he did everything in his power to undermine her and assure repeated failure: “The man intentionally let me get myself in trouble. Although he—we sat in the same office—although he saw that something was wrong, he let me finish it up. And then afterwards, he lay into me, you can’t imagine. . . . This went on for a year and a half, and afterwards I was really ill.” This woman’s sense of duty paid off. The man retired, and she went on to a successful career in this enterprise.

Second, most of these female engineers consciously decided from the start to subordinate their careers to the needs of their husbands and children, as many East German women did.[42] Husbands’ careers came first. Four of the seventeen female engineers changed jobs and moved so that their husbands could take desirable jobs. Six changed jobs to improve their family’s housing situation, to shorten their commute, or to find daycare for their children. Two took off a year to take care of their children in infancy. From 1976 onward, women could take off a “baby year”—while receiving generous financial support—after the birth of a second child or successive children.[43] These disruptions caused many of these women to miss out on professional opportunities. One interviewee gave up on her dissertation and quit her university assistantship, though she “would have liked to stay in research.” A decisive factor was the lack of good housing for university employees, and the prospect of better housing if she worked in industry: "And somehow prosaic things became decisive in life, such as: Now I'd like to have an apartment with a bathroom; maybe I'd like to have a second child, which might not be possible in our present apartment." She felt propelled by issues that she thought hardly affected her husband or other men: "Well, men are certainly a bit freer from family matters, though almost all men were married, some had children. It is always clear that the 'woman's burden' is carried by the mother, by the woman." Unfortunately, she ended up in a job in plastics, a field that did not interest her, living in Bitterfeld, where the air pollution was quite vile: "In Bitterfeld there was, along with the familiar smells, a stench that shocked me." Her children's frequent illnesses (she had had a second child) prevented her from making very much headway in her profession. She ended up spending ten years in a very dissatisfying job.

Another interviewee, who moved with her husband to Berlin, was placed as a first-year teacher in the school with the worst disciplinary problems in all of East Berlin. She found a job at the Academy of Sciences on her own. She was later able to do an engineering degree during working hours as part of a special program for women, studying under renowned scientists at the Academy.

Most of the women interviewed by Fischer were quite happy with their on-the-job training, and felt they were given the same opportunities as men in their first jobs. One female electrical engineer was delighted to land a job at the Semiconductor Works in Frankfurt an der Oder, a leading electronics enterprise, just after finishing college (in the late 1960s). She saw nothing wrong with being asked to work shifts, which meant she had to work nights during part of her pregnancy. She had six weeks off before giving birth and six weeks afterwards. She found her work there "definitely a good start."

By contrast, a young woman who got her first job after the introduction of the "baby year" encountered a pervasive pattern of discrimination in her industrial research position. According to social scientist Heike Trappe, such gender discrimination was widespread in the GDR, the result of social policies that tended to cement gender roles.[44] The woman in our study was off from work for two years when she had two babies in rapid succession. In her research division, young women were given "harmless topics that can be put aside for a while" if they gave birth or had to stay home to care for a sick child. This young engineer discovered after turning in the results of her research that she had been given the same topic as someone else, though there was really only one solution to the problem. She found this disheartening. Older female colleagues were not given better topics, either. Challenging and important research projects went to men.

Despite the egalitarian system of higher education, all careers were not created equal in the GDR. The two sets of interviews analyzed here point to at least two patterns in the early careers of East German technical specialists. On the one hand are the career-oriented individualists, found mainly among the male IT specialists. This group reported a high level of motivation, desire for self-realization through their profession, and willingness to ignore rules to get ahead. Their efforts generally resulted in a high level of professional satisfaction.

On the other hand, most of the female engineers (particularly in Fischer's sample) were constrained in their search for work by their own perceptions of family responsibilities. Some were more easily discouraged than others. Some showed considerable initiative in seeking new jobs. But even these encountered a glass ceiling, a subject that will be explored in greater depth here.

Some of the factors behind successes or failures in launching a career are not visible in these interviews: ability, grades in college or at the university, professional opportunities in high-tech versus low-tech sectors of the economy, overproduction of engineering graduates, differences in the professional prospects of graduates of university and technical college programs, and political affiliation. Some of these factors (such as academic performance) are hard to gauge. (Given the impossibility of verification, no questions were asked about grades in college.) Others will be discussed in connection with the following discussion of three career types: that of the careerist, the "pure" technical expert, and the family-centered or niche-centered model.

Technical Professionals in Management: A Careerist Ethos?

In the West, successful engineers became managers as a matter of course.[45] This was particularly true of high-tech and high-stress fields such as software development, a field in which knowledge quickly became obsolete. In the GDR, there tended to be more of a dichotomy between technical specialists and functionaries. Managers from the level of department head (*Abteilungsleiter*) on up were to a certain extent a self-selecting group, generally willing to join the SED and forgo contacts with Westerners, if necessary. How did the nine technical personnel in my study who rose to be department heads or higher see the balance between political and professional loyalties in their professional lives?

The former general director for research and development of an organization that will remain unnamed here describes his professional life, both in the era of the GDR and in the period after 1989, as a mixture of technology, "organization," and "economics." What he found interesting about his work was precisely that it was never purely technical—he would have found that "lifeless." He asserts, "My attitude toward the solution of problems, that is, concerning how to grasp, locate, and solve problems, has not changed." He sees himself as a technical expert, and cultivates a "technically founded management style": "I perceive myself as ready to discuss problems, technical problems, with my employees, to suggest a solution, to evaluate the solution, and to provide leadership to my employees. . . . Thus, I do not see myself as a leadership personality that is uninterested in technical work."

This manager presents himself as not just having been a member of the SED, but also a true believer in Communism who was bitterly disappointed: "I served the state back then because I couldn't do better, didn't know better. . . . The bitterest thing that I have experienced in my life thus far is this disappointment, which did not involve my profession, but my identity, my ideological thinking. That I was too stupid to understand [what was going on in] the background." It is unfortunately not possible to judge whether this is an honest attempt to come to grips with the past or just an attempt to deflect charges of opportunism. It is certainly quite striking what a smooth transition this interviewee made from the old system to the new.

This is also true of a second interviewee who became the head of a company in 1990. Under Communism, he had a senior position in a research division. He oversaw the development and deployment of telecommunications software used to link fifteen computer centers, thus creating the first computer network providing services to East German industry. He depicts himself as having been a technical expert first, a functionary second. He only mentions his membership in the SED in passing. However, he saw the power that came with moving up in the hierarchy as essential to putting his ideas into practice. His position gave him influence over what would be included in the state plan for science and technology, and thus gave him the financial wherewithal and staff to carry out the projects he wanted to do, particularly in the area of network solutions and remote processing.

Similarly, a third interviewee, a former technical director of an important East German enterprise, saw power as essential to the realization of important technical projects. He started his career working on the first generation of East German computers, but soon began pursuing a managerial career because he saw his greatest talents there. New responsibilities opened new doors because they brought "more freedom of decision." Asked about his greatest professional triumphs, he answered, "I don't want to name a specific function . . . the important thing was that something new came into being, that there never was a 'no,' and that we always somehow achieved results, good results, too." He was not interested in a purely political career, but had always wanted to preserve his close connection with technical work. It had bothered him that technically competent managers such as himself were forced to take orders from functionaries who did not understand technology. He nonetheless admitted to a certain degree of political opportunism. He went as far as to admit having done "something against my convictions" to attain a particular position, though he would not provide any details. "I will not do that again, I've learned my lesson."

There were few women in the ranks of middle management in the GDR, and even fewer in top management. According to Salheiser, 14.9 percent of top and middle managers in East German industry (from department heads on up) were women.[46] The explanation lies primarily in the realities of gendered family roles, which were left largely unquestioned by the SED and the East German media, and the special "privileges" granted to women (the "baby year," days off from work to take care of the household, etc.) that reinforced those gender roles.[47] The overwhelming majority of female engineers interviewed by Fischer volunteered that they had had absolutely no interest whatsoever in a career in management. The main reason was family responsibilities. Women were also hesitant to join the SED because that meant having to attend many after-hours meetings. Only four out of seventeen female engineers interviewed by Fischer joined.

A female head of product development (*Entwicklungsleiter*), interviewed by Fischer, was the only woman in her socialist combine in such a position. She evidently achieved professional success through academic and technical achievements rather than as a manager. She completed both her first and second doctorates (*Aspirantur A und B*), received several patents and developed several machines. She was a member of the SED, and held an office in a Communist organization. Neither marriage nor motherhood stood in the way of her career: "I was able to combine children, family, and profession well because the family stood behind me and the children were (and are) healthy and intelligent." She asked for no special treatment as a woman: "I wanted to show from the start that we women are equals [of men] in technology. I did not want privileges, but also did not want discrimination." She believed that as a woman, the worst barrier she had faced was the "envy and animosity of [those who are] average." Thanks to her achievements, she found a good job in industry after 1989, though the kind of professional advancement she had hoped for was not possible.

East German managers, particularly those from the department head level and above, faced all kinds of pressures, as the life story of a female computer scientist (referred to here as Mrs. Müller) shows.[48] A child of the working class, she completed an industrial apprenticeship in data processing by the age of seventeen. Ambitious, she decided to do a university degree in information technology: "My God," she said to herself, "it would not be bad to try to work one's way up [in the world]." Finding her first job after college a dead end, she soon changed jobs. Her new workplace was stressful, particularly for a recently married woman with a two-year-old at home. Neither playing it safe nor opportunistically seeking approval, she was very candid in her criticism of the way things were done in her department. After her boss's unexpected retirement, she was offered his job. She felt she could manage this because her husband was unusually supportive: "If my partner had not been cooperative, it wouldn't have been possible, even in the GDR." Where she encountered massive problems was with her female colleagues, whose superior she now was. "Coincidentally, there was a [female] colleague, who had been in the same firm where I did my apprenticeship. And she said, 'Oh, her, she was an apprentice when I was already a skilled worker. She can't tell me what to do.'" Mrs. Müller had to struggle mightily to establish her authority against the "mobbing" of an entire clique of female workers.

Her worst problems were yet to come. She was able to resist pressures to join the SED. However, she lost her job as department head when it was discovered that she was still in contact with a childhood friend who had emigrated to West Germany. She steadfastly refused to break off with her friend: "I simply couldn't understand that such a good person [pause], that I should simply cut her out of my life." She was demoted to a job in which she performed the "most primitive" of tasks, for a greatly reduced salary. She felt humiliated: "That one colleague [who has previously given her trouble] naturally rejoiced. And said, 'I told you so.' So it was awful. It was awful." Since it now said in her cadre file that she was politically undependable, she could not get another job. Finally, she filed for permission to emigrate to West Germany and quit her job. The two years that she was forced to wait for permission to leave the country were a "horror" for her, not least because she hated being unemployed.

A software engineer born in the 1950s in another East bloc country claimed that as a foreigner, he had escaped some of the scrutiny that East German engineer-managers came under. He made considerable efforts to maintain contacts in professional circles worldwide through correspondence and invitations. As a foreigner, he was able to travel to the West. He claimed to have enjoyed special treatment. This, he asserted, enabled him to achieve considerable freedom to conduct his research and allowed for upward professional mobility *without* necessitating political compromises—that is, joining the SED and abstaining from professional contacts in the West. According to his own testimony, he became the director of a small software-producing enterprise during the Communist period, one built upon détente-era economic ties with West Germany. This story could not be verified. If true, it represents an absolute exception.

In general, however, political conformism was the *sine qua non* of a management career in the GDR, even in technical fields. The three top managers discussed at the beginning of this section tried to argue that they owed their first loyalty to technology, rather than to politics. Nevertheless, they made considerable compromises for the sake of their careers. Their ability to conform to rules and norms served them well after 1989. By contrast, the two women whose careers were discussed here appeared to see their professional lives in different terms. They had a more inner-directed sense of what made their professions valuable to them, and were not as focused on professional advancement at all costs. This is possibly indicative of gendered behavior patterns. Men were far more likely to rise into middle and top management positions. Men were also in general more likely to join the SED, and they constituted almost two-thirds of the party membership in 1985.[49] However, many men—as well as many women—in technical fields were not careerists, and yet they took their professions seriously. We now turn to them.

The "Pure" Technical Expert: Hobbyists or Professionals?

Several of the engineers and IT specialists interviewed for this study expressed a passion for technology. Inspired by his father, an independent craftsman who had served as a radio operator in the First World War, one participant in our study (here referred to as Mr. Schmidt) became fascinated with electronics at age thirteen or fourteen. He spent much time indoors, building devices from electronic components. Eventually, he studied computer technology and went to work for Robotron. Mr. Schmidt explicitly rejected careerism. ("I'm not the career type.") Rather, he loved technical work, which for him was both his profession and his hobby. "I do what interests me . . . I get excited about the new possibilities that present themselves when a new technology comes out, when there is a sudden leap in some area, then I try within the limits of my abilities . . . to get involved." In the 1980s, he learned D-Base and wrote computer software for friends who owned western PCs in his free time. He did not own his own PC, but had access to those of his customers. A request for official approval of this after-hours small business venture was "more or less approved" by 1989. He generally worked for a couple of hours after his family went to bed, often turning in at 1:00 or 2:00 a.m. In addition to writing software, he read technical journals in his field, took training courses, and worked on his English. His wife also "live[d] for her profession." They carved out a sphere of relaxation and intimacy in their lives. "I always looked for niches," he recalled. They built their own house, which took up much of their free time. He ascribed his work ethic to his upbringing. His parents had also always worked during the evening and on weekends. "Since one could never go to the doctor, one was never ill. I still have that mentality." Mr. Schmidt contrasted this with the socialist mentality, which he characterized with the following words, "One goes to work early and puts down one's hammer after an hour, and that is that until the next day."

Another male IT expert in my study fits the mold of the "pure" industrial scientist. As an assistant at a university in the 1970s he found the meetings and activities of Communist organizations he was expected to participate in "nonsense." In the early 1980s, he changed to a job as a systems programmer at the Academy of

Sciences, where he did not have such obligations. He explained his lack of interest in becoming a department head then and in later years in the following terms, "I have absolutely no desire to do management. I prefer to pursue a problem." As a department head, he would have "lost [his] freedom" and no longer would have been able to "work independently." In his present position (in the 1990s), his supervisors barely told him what to do. He felt "completely free. . . . That was fun." In this phase of his life, he could reduce his work hours, leaving him time to paint, spend his time with friends, drinking beer. His playful approach to technology is underlined by his response to a question about role models. He named a world master in the computer game "Robocop."

For others, building things at home was not so much a hobby as a necessity. One of the interviewees, a software engineer at an important research institute, was not able to buy himself a PC in the 1980s because he did not have access to hard currency. Since he needed access to a PC at home, he tried to build one from electronic components but it was not very successful.

Four or five of the women interviewed evinced the sort of love of getting one's hands dirty, turning screws, and figuring out the logic of circuit boards that the male participants in the study did, though these women did not always have the kinds of opportunities to revel in hands-on technical work that most male engineers did. Single and childless, one of the participants in this study carried a tremendous responsibility as the only engineer in a large industrial complex in charge of designing heating and sanitary technology. At first, she had tremendous problems gaining the acceptance of the construction crews:

> A woman must certainly establish her position when she first comes to a construction site. And then word spreads that she is a rookie, so they naturally test her pain threshold. . . . One is rather afraid at the beginning, but I always had the luck that I really had people behind me who helped me tremendously . . . Because at the beginning, I was totally discouraged. When a woman overcame a certain barrier and when the people on the construction site noticed she was capable, then she was actually accepted on the construction site, even by the construction workers.

Looking back, this woman expressed tremendous pride in her completed projects

> that ranged from a small one-family house to the new office building of our firm and a combined heat and power station. Then I did the restoration of the . . . [X] Fire Department, which was listed as a historic site. And we built a fire department depot, and after that a heating plant in . . . [X], in the Urals. We built it at minus 50° Centigrade and with I don't know how many meters of snow.

Her job was difficult because there was no one in her enterprise whom she could consult, and mistakes were only discovered during construction. However, as she emphasized, "Everything that I built still stands."

A woman who worked as an engineer in television broadcasting remained single because her work allowed her so little free time. There were phases during which she worked fourteen-hour days for two weeks before she got time off. She recounts, "I'm sure I put my private life in a subsidiary role because I was consumed by my profession, and [my] relationships, many relationships, failed as a result. Because what man has understanding for such working hours? Logically enough, my longest relationship was with a colleague, who showed understanding, but in the end, he couldn't stand it any longer either." She loved her work in television, but was unwilling to seek promotions by joining the SED. She had a hobby that was quite unusual for a woman in the GDR—she loved to participate in motor rallies, organized by an East German motor club (*Allgemeiner Deutscher Motorsportverband*, or ADMV).

In the GDR, female engineers were generally to be found in specializations and jobs that involved the pen and the computer more than factory machines. Women were found in lesser numbers in high tech and traditional forms of engineering, in 1964 making up only 2.8 percent of all mining engineers, 2.3 percent of all mechanical engineers, 2.9 percent of all electrical engineers, 2.1 percent of all engineers in fine mechanics and optics, and 1.7 percent of all engineers in heavy industry (but 31.8 percent of all textile engineers). In 1981, still only 4.8 percent of mining engineers, 13.6 percent of mechanical engineers, 10.4 percent of electrical engineers, but 22.5 percent of engineers in fine mechanics and optics were female.[50] Women dominated fields where office work predominated, such as "engineering economics" or technical design (*Konstruktion*).[51] Gendered conceptions of technology played a major role here. This is expressed in the observations of a female mechanical engineer who ended up in product development (*Entwicklung*): "Work in product development or product design . . . those were the areas where a woman could work without a problem, could work without much of a problem. As a woman, it was more difficult to work directly in production. Since I had worked in the production of heavy machinery, where there were hardly any women because of the heavy work, it wasn't easy for me."

However, if we define industrial technology not just as the use and development of machines, but also as the application and development of knowledge to industrial research and production, then several of the female participants in this study must be included among those who dedicated themselves to technology first and foremost, eschewing careerism and their private lives. One interviewee, the mother of two children and an engineer in the machine-building industry, had to overcome all sorts of difficulties to find the challenging work she craved. She gave up one job and worked part time for a while for the sake of her children. She had to prove herself to her boss, who had tremendous prejudices against women. After his retirement, she was promoted to assistant department head. She quit after ten years, feeling that she had gotten into a rut. Her next job, in a major import enterprise, was far more challenging. "It was so varied that every day was a challenge for me . . . I had to improvise a lot, read a lot. There were things that I had never dealt with before." She attended training sessions, sometimes in other cities. "It was a totally wonderful period [of my life]," she recalls. At first, she thought she was up to the challenge of a managerial career. "That was a phase in which one has such ambition, in which one wants to do so many things—office, family." In time, however, she came to realize that she was "not born to be a leader," that she preferred her professional work, which involved things such as trade negotiations, to a managerial-level career. One factor that made a high degree of involvement in her career possible was that her husband was very supportive. "We went grocery-shopping together, cleaned the apartment together, he picked up a child when necessary. Yes, I was an emancipated woman, I must say. He always accepted that I was working full-time." Her children were also quite supportive: "My children say today that they are happy to have grown up that way."

On the other hand, a female computer scientist who participated in our study sacrificed the time she spent with her family for the sake of her career. She often worked overtime and on Saturdays. Some days she didn't see her children before they went to bed an night. At work, she introduced a new accounting system and a new system of tracking production and materials, writing the programs herself. She often encountered tremendous resistance to change, but by working with colleagues she was able to gain acceptance for her systems. This was the most satisfying aspect of her work. She also demonstrated tremendous competence with computer hardware. When her office first got a PC, it was discovered that the Robotron operating system that came with it would not work. She was able to figure out how to change the chip and install a new operating system. She kept her technical know-how up to date through training, computer journals, conversations with colleagues, and Western manuals. "One knew what had to be done." She never regretted the choices she had made.

Joy in technical competence could take on somewhat different forms in men, in women, and in different fields, but it unites the individuals discussed in this section. In the context of a system that guaranteed job security, it could provide job satisfaction, but also an incentive to perform well. However, the planning system greatly limited the scope of action of these highly motivated professionals, potentially turning them into mere hobbyists.

An East German Mommy Track?

For most of the female engineers in Fischer's set of interviews, as well as for one male engineer interviewed by Scheff, private life came first. The reasons varied greatly. Some happily embraced the opportunity to expend less time and energy on their work, while others were forced onto a "mommy track" by circumstances and sexist attitudes.

Many, such as the following interviewee, simply chose to put their families first:

> For me, my child was always my first concern. When I got home, homework was looked over and discussed, [and we talked about] what happened during the day. I wanted to know what my child did during the day, when I wasn't there. We managed quite well. It was and still is clear that we talk about everything. Nothing remains secret. Openness is the rule in our home. Things have gone quite well with the children in this regard. And, when my son stayed with his father [after she divorced her first husband], he came to me with his problems.

She nevertheless took her profession seriously. For example, she read professional journals at home. Her daughter, who was also interviewed, thought her mother had done a good job of combining profession and family:

> I was always proud of my mother, of her work, that she was able to assert herself among men. It never occurred to me to say that I didn't like that my mother worked, that she worked hard. . . . When I was little, it wasn't that bad; she didn't come home very late when I was a small child. . . . When I was bigger, and she came home later, I understood why she came later. . . . [But] she always had time for me.

Several women put their children first and still managed to have satisfying careers, though not without compromises. This was the case with one civil engineer, born in the 1940s who said, "It was always fun to do something new, something different because after a while, it gets old, work is boring." Due to family responsibilities, she decided not to pursue a higher engineering degree (*Diplom*), but changed jobs within the large industrial enterprise for which she worked. She went to considerable lengths to keep her children out of state-run daycare and after-school programs, staying at home for a couple of years when her children were quite small, finding a neighbor willing to babysit, refusing to do overtime, and giving her children a key to the apartment at an early age. According to historian Gunilla-Friederike Budde, this resistance to the state-run model of childcare was not at all unusual among educated women of the older generation in the GDR.[52]

Some women, such as one electrical engineer who ended up giving up technology (which she loved) for an administrative job, deferred to their husbands for the sake of their children: "Only one of us can advance [professionally]. There is no other possibility in a marriage if there are children. . . . And I must say, I never really regretted it. For sure, in the early years regret surfaced from time to time because he was away a great deal and I was alone quite often. . . . But today, when I look at my children, my grandchildren and everything else, I'm happy that I subordinated myself." She was also happy, though, to have continued to work in a job that gave her at least some satisfaction. She was particularly happy to be able to work with computers, which compensated somewhat for her having had to give up the engineering work she loved. She was also proud to be able to show off her technical prowess to her children, who were fascinated with electronic building sets.

Other women, less adept at planning their lives, or less fortunate in their choice of a spouse, felt that they had been forced by circumstances to give up professional goals. Some husbands saw the household and children as the primary responsibility of their wives.[53] One software engineer interviewed by Scheff, born in the 1950s, could not accept a professorship she was offered in a provincial city because her husband took a job in East Berlin. She found it disquieting that her husband joined the SED and made "increasing compromises, politically." She herself could not find a job that corresponded to her training and abilities because she would have had to "get [her] hands dirty," which would have meant working for the army, the Stasi, or in top-security, high-tech facilities developing defense or security technologies. She refused to join the SED or to cut off contact with friends in the West. She found herself in a dead-end job, one of the only two people in her enterprise able to work on a Unix computer, but denied any possibility of promotion or interesting work. Her situation worsened when she insisted on working part-time, so as to spare her two children long days in state-run childcare facilities. Her desire to apply for emigration to West Germany angered her husband, who called this "treason." For her the fall of Communism meant liberation and new professional opportunities.

Our study includes one man who put his private life first. Born in the 1960s, he reported that he worked "only as much as necessary" so as to be able to spend as much time as possible with his wife and three children. His wife quit her job and stayed at home for six years when their children were small. She was quite discontent, and they discussed a better way of dividing up the childcare, but found that under the East German system this was not possible. He did make sure, however, that when he got off from work at 4:00 p.m., he went straight home and devoted himself entirely to his family. Sometimes they went swimming or played tennis during the week, and went cycling or paddle-boating, or played soccer over the weekend. He brought no work home, and did not work on a PC or read technical journals. As a result, he failed to keep up with developments in information technology. Nevertheless, he did quite well in his administrative position in the East Berlin transit system, the BVB (*Berliner Verkehrsbetriebe*), and has been working for the former West Berlin BVG (*Berliner Verkehrsgesellschaft*) since the fall of Communism. He said he was not entirely happy with his profession, and dreamed of some day "moving to the country," becoming a tour guide, or running a youth hostel.

For women, too, domestic niches were appealing. The overwhelming majority of female engineers interviewed by Fischer sewed, knitted, or crocheted in their spare time. Arts and crafts such as ceramics were also popular in this group. Those who had access to gardens (a small minority) were enthusiastic gardeners. Most reported that they seldom read technical journals at home. Hobbies could take on very undomestic forms, however. One female IT specialist, a single mother, left her sleeping child under the care of her mother many evenings so she could play in a rock band at youth clubs.

A few of the women participants in our study reveled in the social life and the sense of collective solidarity of the factory. This orientation appears to have been quite compatible with a heavy emphasis on motherhood. One woman who did administrative work for a troop of construction workers always enjoyed the informal discussions of their project around a big breakfast table every morning. She liked being in the know, but also enjoyed the camaraderie. Another woman recalls, "I loved going to work. I loved being with colleagues and loved working in mixed teams, that is, men and women together. We were a crack team. We worked together very well."

One woman (here called Mrs. Schwarz) was married to a man who was resentful of her engineering degree and her being paid more than he was. "He said, 'Well now you're something better.' He couldn't stand that." Eventually, he abandoned her and their daughter. Her day would begin at 6:00 a.m., when she quickly dressed and took her baby to a daycare center. After the end of her workday (4:30 p.m.), she would pick up her child. Mrs. Schwarz's mother would get groceries for them. From second grade on, the child was responsible for dressing herself and going to school on her own in the morning. (Mrs. Schwarz set an alarm clock for her.) After a teacher complained that the child was coming to school "dirty," Mrs. Schwarz insisted that she be allowed to start work an hour later. Her daughter did her homework somewhat haphazardly, and her grades were inconsistent. Mother and daughter spent their evenings and weekends together. Mrs. Schwarz became the head of her work group, which had been named top "Collective of Socialist Work" in her factory. She organized and participated in all sorts of activities and outings with his group, such as bowling, going to the theater, going to restaurants, or celebrating Christmas together. Though not a member of the SED, Mrs. Schwarz joined the union (the FDGB) and the Society for German-Soviet Friendship (*Gesellschaft für Deutsch-Sowjetische Freundschaft*, or DSF), and she became the head of the "Women's Commission" (associated with the FDGB and controlled by the SED) in her factory. She was proud of her work on behalf of the women in her factory and felt that this did not detract from her relationship with her daughter. (Meetings were generally held during working hours.) Her daughter joined a Protestant youth group in high school, much to the anger of school authorities. However, it is unclear whether she did so with or without the approval of Mrs. Schwarz. It is not known how the daughter felt about her mother's activities. Only two other women interviewed for this study held offices in Communist-dominated organizations, though many were members.

Most of the female engineers in our study put their private lives first. Although these women felt more responsible for their children and the welfare of their families than did their husbands, they nonetheless very much wanted to work, and expressed a high degree of satisfaction with their jobs (with one or two exceptions). They found work in technology-related areas stimulating and empowering. And they were willing to invest time in part-time engineering degrees. Thus, they found a balance between work and family, rather than choosing one over the other.

Attitudes toward the Socialist System and Its Demise

The participants in this study were not asked directly about their attitudes toward the socialist system. Nonetheless, such attitudes were revealed in answers to other questions, particularly those concerning the impact of the political system on professional life, reception of Western technologies, the international competitiveness of the GDR, political control, the secret police, and the fall of the Berlin Wall.

Since East-West transfer of technology played an important role in the development of computer software and hardware, access to information about Western technologies was a professional necessity for computer scientists. Only three of the people interviewed by Scheff (but none of those interviewed by Fischer) were allowed to travel to the West professionally, two as "travel cadres" (*Reisekader*), one because he was a citizen of another East bloc country. All three were of the opinion that they had gained a great deal from their travels, not only because they had direct access to Western technologies through these contacts and, in some cases, cooperation with Western experts, but also because they got to know the mentality of the West Germans and the ways of Western institutions such as banks.[54]

A few IT specialists felt that access to Western technical literature was very good during the Honecker era. But, a software engineer who worked at a research facility of lesser importance until 1989 asserted that the Western journals she had access to contained little information on programming techniques, so she and her colleagues had to "muddle through." Judging from the complaints of engineers, it was very difficult to obtain Western technical journals in most East German industry, aside from the high-tech areas. East German trade fairs such as that in Leipzig had served as a meeting place of East German and West German technical specialists in the Ulbricht era, but such contacts were more or less forbidden in the 1970s.[55]

The computer scientists who participated in this study were well aware of, and in many cases involved in, the acquisition and copying of Western hardware and software. One had at her disposal a Western computer purchased through an Austrian company that helped the GDR circumvent the CoCom embargo. Western computers were made available to institutes of the Academy of Sciences in the 1980s, but it was up to the research personnel to acquire the necessary software. That was "not a problem." Employees got their hands on software with the help of private contacts in the West. The institutes exchanged this Western software among themselves.

Many software engineers typically argued that although the GDR had been technically inferior to the West, East German computer specialists had substituted human know-how where technology was deficient. Thanks to their more theoretical and systematic academic training, East German software developers were more creative than their Western counterparts, so the argument goes. One participant in our study was critical, though, of the "indescribable" efforts that were necessary to get better performance out of mediocre machines. "From the perspective of the larger interests of society, I would say, naturally we wasted time and work and energy in corners of programming where one would have to ask today, 'What's the point?' "

By contrast, a few interviewees categorically rejected the notion of a dichotomy between state inefficiency and highly productive engineers. One computer scientist believed that the strategy of imitating Western technologies undermined the ability to innovate: "In my opinion, we were always behind because there were no truly new ideas, at least I didn't witness them. Rather, one looked: What the West does, we have to do, too. And then one tried to copy it with the least possible delay. The point of comparison was then the number of years we were behind [global developments] in each project." He asserted that the GDR was not ahead in any field. Another engineer, an employee of TRO (the Transformer Works, Karl Liebknecht, in Berlin) involved in automation had the following to say on the subject:

> I got the impression from western technical journals, which were available in libraries, that everything [in the GDR] was a copy of what was available elsewhere. Or we went back to projects that had been begun in the early 1960s, then disappeared into the bottom drawer, and were dusted off again in the 1980s. The thinking was, 'That once looked promising. We ought to work on it again.' . . . [That's the way it was] unless one was at a showcase factory. . . . We often cursed because we were forced to reinvent the bicycle or had to improvise a solution to make something work because it was not possible to do it in a way that would have been logical from a technical standpoint.

Several interviewees realized that there were many illogical and inefficient aspects to the system they had to work within, but they "gave up" because it was "senseless" to try to change things. Another interviewee notes that some things were part of the economic plan, which was "binding law," and others were dictated by the Soviet Union. She and others accepted these mandates on the basis of what they knew then. Interviewees were proud to have achieved so much with so few resources. There was an occasional out-and-out defender of the East German system, for example one engineer who had worked in construction. She felt that under capitalism, the conditions are much more lawless and unsafe. "If a site manager in the GDR had allowed what goes on today, then he would have been caught, he would have been called to account."

Most of the IT specialists and a few of the engineers interviewed by Fischer suspected that they were watched by the secret police. Most did not take this political control very seriously. "That sort of thing didn't bother me. One knew where one lived, one knew that there were certain rules of the game. I had no problems with that." There was "self-censorship" at work, which eased considerably after Mikhail Gorbachev came to power.

Only a few very unusual individuals, though not unique to the engineering profession, clashed with the Stasi-dominated system. One such was the computer scientist (Mrs. Müller) discussed earlier, who refused to break off with a childhood friend living in the West, and as a result lost her job as a department head. She and her family were put under severe pressure during the two years that they had to wait to leave the country for the West: "They harassed my child at nursery school and said to him, if you leave, you will lose your Granny." They waited what seemed like an interminable period of time for permission to emigrate. Under constant surveillance, they fell prey to terrible fears: "I was always afraid that my husband would some day not come home from work. There were [cases of] automobile accidents and such, where no one could explain how they happened. . . . Such things happened in our wider circle of acquaintances."

An IT expert in top management (referred to here as Mr. Weiss) saw the role of the secret police in entirely different light:

Mr. Weiss: If I asked you today about the Federal Intelligence Service [*Bundesnachrichtendienst*, now the intelligence service of all Germany], the relationship [to the population] is the same. If I ask you, what does the Federal Intelligence Service know about you, and you say, you don't know, right? And if you had asked me, what does the Stasi know about me, then I would have said, I don't know. But they know for sure—the Federal Intelligence Service for certain knows something about you, and also about me. The way the thing with the Stasi is played up today is purely political.

Interviewer (Scheff): You did not feel severely constrained, either professionally or personally?

Mr. Weiss: Not at all. That [the Stasi] was just part of the whole thing. It was a ritual.

This interviewee maintained that until 1989 travel restrictions in West Germany were similar to those in East Germany. (He was among the privileged few who were allowed to travel regularly to the West before 1989.)

The fall of the Berlin Wall elicited starkly differing reactions and had very different consequences for the various participants in this study. Some of the most successful computer scientists interviewed felt disappointment and fear. For one, the opening of the Wall meant "the total breakdown of everything that I had done up until then . . . It was tough." Another reacted similarly: "It was clear to me that it would destroy my work . . . For me personally, it was a day of mourning." Others greeted the news with numbness and disbelief. One woman tried to ignore events. She had no real desire to see West Berlin. Her daughter had to convince her to go over to collect the one hundred deutsche marks "greeting money," paid once a year to visitors from East Germany. "For me it was nothing special," she recalls.

By contrast, several of the IT specialists were overjoyed. Criticism of the East German system had been building up among experts in this field. "It entered the political realm, so that we said, 'Nothing more can be done with this system.' " This male engineer and his friends concluded that East Germany needed to open up, decentralize the economy, and allow greater freedom of expression. They went to a mass demonstration on the East Berlin Alexanderplatz on November 4, 1989, though the engineer's family begged him not to. He embraced the fall of Communism: "I am among the people who welcome it unconditionally, found it bitterly necessary, but never expected it to happen."

"Mrs. Müller" (who had by then been in the West for several years) had a very emotional reaction to the opening of the Wall: "I sat sobbing in front of the television set." What she felt at that moment was profound bitterness toward the elites who were the mainstay of the Communist system, and who she believed would find ways to profit from the new system: "What we [those who left the GDR before 1989] had to fight for, they [those still living in the GDR in 1989] now got for free. That also goes for people who were guilty of splitting up families. [As a result of being forced to emigrate] we didn't know, will we be able to see our parents, if they get sick at some point."

"They Were Two Different Worlds": Careers after the Fall of Communism

Just as there are striking differences in attitudes toward the GDR's dictatorial system and its demise, so, too, are there tremendous divergences in the paths of the careers of IT personnel and engineers after 1989.

The fall of Communism has been likened to a grand-scale historical experiment. The introduction of an entirely different system and culture had a greatly varying impact on different groups and different individuals. The post-1989 careers of the participants in this study provide some insight into some of the factors that led to success or failure in the post-Communist system. The mass firings and bankruptcies of former East German enterprises after 1989 were a widespread cataclysm that wrought senseless destruction along with much-needed destruction, and brought down top-notch professionals along with the dead weight. A consideration of how technical specialists fared under the new system gives a sense of the differences and commonalities of East German and West German society, and the place of the engineer in each.

Just as Mrs. Müller feared, at least some of the top careerists in the engineering field in the GDR moved into entrepreneurial roles in reunited Germany. Among these are the three IT experts in top management who participated in this study. All three helped found small companies after 1989. One of these participants claims, "If you survey other colleagues who had similar positions to mine, they have positioned themselves nationally the way I have . . . And it is also characteristic that those who tried during the GDR to break down the wall with wooden hammers have run into problems today." In other words, he claims that those who tried to resist the dictatorial system were trouble makers who had problems both under the old system and in reunited Germany. Contemporary sociological studies do not confirm such an assertion, though more research is needed.[56]

Several of the female engineers interviewed by Fischer as part of my study fall into the category of demotivated or thwarted individuals who did not thrive professionally in the GDR. One engineer who admitted not having been very "determined" during the Communist period found that things became "stressful" at work in the period of privatization of state-run industry, when an Austrian company took over her enterprise. She found it threatening that women started coming to work "so dolled up, with hats and everything possible." After the Austrian company went bankrupt in 1994, she found a job through a state-financed make-work program (*Arbeitsbeschaffungsmaßnahmen*, or ABM). Only then did she learn to use a computer. However, she found her work too difficult: "It was incredibly interesting, really, but it was really stressful." She does not seem seriously perturbed about being out of work after the end of the ABM job: "My main life was never work."

One former engineer-economist was terribly upset over the bankruptcy of her firm and the resulting loss of her old workplace "collective," as well as over the more general collapse of the emotional security she had felt in East German society: It was so terrible at the beginning, so terrible. I sat at home, I cried. I didn't know what to do with myself. I didn't know how to react. I was always [part of] the masses. I am of the opinion that [the socialist system] was originally a good thing. That it then all went down the drain is another issue. . . . I still have the same attitudes that I have had since childhood."

Both sets of interviews illustrate problems that former East German women had on the job market of reunited Germany—particularly the unwillingness of German companies to hire women with children and the deficiencies of the childcare system under the new system. Women found that the expectation that they would do overtime and the greater demands placed on them during the workday made it difficult for them to combine family and career. Nonetheless, three interviewees felt they should have made greater efforts to advance their careers before 1989, even though that would have meant some sacrifices at home.

The interview with Mrs. Müller, who, had emigrated from East Germany to West Germany after a series of traumatic events, shows in a striking way that drive, determination, and skills made a big difference in getting ahead professionally in the new system, but also points out hurdles that women faced in reunited Germany.[57] She and her family moved to a small West German town, where her husband found a job. Mrs. Müller at first could not find work, in part because she had no experience on a PC, in part because there were few job openings in this small town, and in part because the childcare facilities there were only open half days. "Always sitting at home. And no money. That was a horror," she recalls. She finally found a job, but not one befitting a university graduate with experience such as herself. The barriers she faced in finding a better job were cultural: "[East and West Germany] were really two different worlds. . . . I didn't know what Value-Added Tax is, what a discount is . . . Also the way people spoke on the phone. Who had a home phone [in the GDR]? Even there I had an inferiority complex. . . . I had to start from the beginning. . . . What one had to learn was simply self-confidence. Not to apologize for everything. 'Pardon me that I'm alive.'—That is how one was raised in the GDR." Things went much better for her after she divorced her husband, found all-day childcare for her son, and found a new job. She found her new colleagues and superiors very supportive. At the time of the interview (1998), she was about to move to a new job, on the recommendation of her boss. "He said, I can well imagine you [in that job]. . . . And he praised [me], he said that I had worked my way up, had acquired knowledge. . . . My dedication has really paid off. I must say, I really like my job." Nonetheless, she sees little possibility of attaining the kind of middle-management position she desires: "As a woman, one has to perform at 150 percent capacity to achieve the same thing as a man." Still, she was proud to have "achieved what I dreamed of when I was a girl: to supervise projects and to teach this to other people and to receive feedback showing that they learned something from me. That is the best part. And I receive it. I really like to deal with people."

Conclusion

Under SED rule, the socialist engineer was expected to be the agent of technological progress as well as an active member of the socialist community, starting on the factory level. Young people who decided to become engineers were influenced by a culture that promoted the ideal of progress through technology, by school curricula that exposed students to factory work, but also by parents, whose idea of engineering as a good career was rooted in pre-Communist German culture. Granted, among the large numbers of young people channeled into engineering were some who would have preferred to become cellists or nursery school teachers. The men interviewed for this study had generally either known since childhood that they wanted to become engineers, or they saw engineering as an acceptable second choice. Among the women were more cases of individuals who were essentially forced into engineering. Many young East German women who became engineers did not do so voluntarily.[58] And yet this is by no means the entire story. The women in our study who did not originally want to become engineers generally came around to the feeling that engineering was "fun," stimulating, even empowering. Positive experiences at the university or in college—high-quality academic training plus group solidarity in the "seminar groups"—helped mold disparate individuals into engineers. Even strong individualists such as the woman who wanted to become a forest ranger, not "one of those idiotic engineers," were won over to a certain degree. These reactions attest to individuals' receptiveness to the strong pull of cultural forces around them.

Although crowned with major successes, the SED's policies on recruitment of women into engineering ran into problems, caused by both the unintended creation of false incentives and the survival of older cultural attitudes. The GDR overcame masculine domination of engineering to a greater extent than did West Germany. This is not just a matter of numbers. In both East and West Germany, there was a tremendous cultural shift in attitudes regarding women in engineering, but a comparison with studies on West Germany shows that East Germany was ahead in eliminating gender barriers in this field.[59]

Nonetheless, gender inequalities persisted in East Germany. East German women made greater sacrifices than men for the sake of their families. The female participants in our study were less likely than their husbands to work overtime, ask the family to move to another city for the sake of their careers, or read technical journals in the evening. They shied away from the added burdens of a managerial career and the political duties this entailed. Most were reluctant to join the SED. The most successful women in our study had supportive husbands who lessened the burden at home, thus enabling them to pursue their careers to a greater extent. However, women encountered widespread sexist attitudes (though probably not as virulent as in West Germany), rooted in part in the expectation that women put their families before their careers. More women than men found themselves shunted off into supporting roles and administrative work. However, the interview material reveals not only unhappiness over inequality, but also frustration over the inflexibility of the system, which did not allow women to seek the sort of family-career balance they desired (e.g., with regard to non-state-run child care options or part-time work).[60] Gender differences tended to undermine both sides of the model of the "socialist engineer," diminishing both women's professional attainments and women's willingness to participate in the organized life of the factory (i.e., political work, inventors' movement, collaborative work with workers), though not in the informal social life that centered around the factory.

Achievement and social solidarity were undermined by other kinds of inequality as well. Those who got part-time technical college degrees lost out on the professional socialization that took place at the university and that contributed to a sense of prestige and ambition. Engineers who graduated in the 1960s or before had greater job opportunities than those who were part of the engineering glut of the 1970s. Engineers in low-tech, underfinanced industries had far less motivation to excel than others. One form of inequality—income differentials—could have stimulated achievement, but reforms in this direction were half-hearted and ineffectual.[61]

The greatest divider among engineers was political participation. SED membership, and the onerous political burdens that went along with it, were virtual prerequisites for a managerial career. The three top managers interviewed here claimed to have tried to stand up to the state bureaucracy in pursuing technological innovation, but they were also the enforcers of state and party policies. Identification with the centers of power came out in the remarks of one of the top managers, who indicated that those who had resisted SED rule had lost out twice, both before 1989 and after 1989, because they were unwilling to recognize the existing power relations. These managers were opportunists.

Careerism and political complicity were anathema to most of the other participants in this study, who either put technology or their private lives first. Only in exceptional cases did these alternate value systems put them on a collision course with the system, as was the case with Mrs. Müller. Her story also points to another factor that undermined political and professional conformism: growing individualism. People who put friendship before career, or who played nights in a rock band, represented a value system that helped bring down SED rule. The bored and disaffected did not loudly trumpet the ways in which they opted out of the system, and yet they, too, undermined solidarity and achievement. After the fall of Communism, the engineering profession fractured, in part along these cleavages. However, the collapse of East German industry took down with it many fine careers.

What is missing among the categories of people in this study are political idealists or fanatics such as were to be found in an earlier era in the Soviet Union.[62] Such an engineering tradition was alien to Germany. What had long predominated there was the tradition of "pure" engineering, which in the GDR was increasingly eclipsed by careerists who had aligned themselves with the system.

Notes

1. See Meuschel, *Legitimation*, 221–229.

2. See Eckart Förtsch and Clemens Burrichter, "Technik und Staat in der Deutschen Demokratischen Republik" in *Technik und Staat*, eds. Armin Hermann and Hans-Peter Sang (Düsseldorf: VDI-Verlag, 1992), 220–221.

3. The figure for 1971 may be overinflated because it includes all industrial employees with college or university engineering degrees, whereas the figure for 1964 only includes employees in engineering positions. Statistisches Bundesamt, *Ergebnisse der Volks- und Berufszählung am 31. Dez. 1964* (Berlin [GDR] 1967), 233–235; *Volks-, Berufs-, Wohnraum- und Gebäudezählung am 1. Jan. 1971,* vol. five: *Wirtschaftlich tätige und nichtwirtschaftlichtätige Wohnbevölkerung*, Berlin (GDR) 1972, 114–119.

4. In 1980, 6,568 students graduated from university engineering programs; in 1985, 7,196 graduated. See *Statistisches Jahrbuch der DDR* (Berlin: Staatsverlag der DDR, 1981), 305; *Statistisches Jahrbuch der DDR* (Berlin: Staatsverlag der DDR, 1986), 309.

5. Number employed in engineering jobs. Statistisches Bundesamt, "Wirtschaftlich Taetige nach ausgefuerter [sic] Taetigkeit und Altersgruppen 1981," printout, dated May 10, 1983 (VD 6.2./500/83).

6. See Zachmann, *Mobilisierung*, 361.

7. Statistisches Bundesamt, "Wirtschaftlich Taetige nach ausgefuerter [sic] Taetigkeit und Altersgruppen 1981," printout, dated May 10, 1983 (VD 6.2./500/83); *Ergebnisse der Volks- und Berufszählung am 31. Dez. 1964* (Berlin [GDR] 1967), 233–235.

8. See Zachmann, *Mobilisierung*, 314.

9. See Erbe, *Arbeiterklasse*, 142. Author cites as source: W. Draeger, "Wachsender Bestand an Ingenieuren erfordert neue Maßstäbe für ihren effektiven Einsatz," *Sozialistische Arbeitswissenschaft* 20 (1976): 32.

10. Rudolf Bahro, "Über die Entfaltungsbedingungen der Hoch- und Fachschulkader in volkseigenen Betrieben der DDR," manuscript. His dissertation was rejected by the Technical University of Merseburg in 1975.

11. See Rudolf Bahro, *Die Alternative: Zur Kritik des real existierenden Sozialismus* (Cologne: Europäische Verlagsanstalt, 1977); *The Alternative in Eastern Europe*, trans. David Fernbach (London: NLB, 1978).

12. See Manfred Lötsch, ed., *Ingenieure in der DDR* (Berlin: Dietz Verlag, 1988). Manfred Lötsch, *Die Intelligenz in der sozialistischen Gesellschaft* (Berlin: Dietz Verlag, 1980); Manfred Lötsch "Sozialstruktur und Wirtschaftswachstum: Überlegungen zum Problem sozialer Triebkräfte des wissenschaftlich-technischen Fortschritts," *Wirtschaftswissenschaft* 29 (1981): 59–69.

13. The data from many of these studies is available via GESIS, the "Gesellschaft Sozialwissenschaftlicher Infrastruktureinrichtungen." See Rudolf Welskopf, "Potential oder Ohnmacht—soziologische Anmerkungen zur Intelligenz in Forschung und Entwicklung," in *Intelligenz*, *Wissenschaft und Forschung in der DDR*, ed. Hansgünter Meyer (Berlin and New York: Walter de Gruyter, 1990), 125–140; Hansgünter Meyer, "Soziologische Forschung in der DDR," *Berliner Journal für Soziologie* 3/4 (1992): 263–286.

14. Lutz Marz, "Beziehungsarbeit und Mentalität," in *DDR-Gesellschaft von Innen*, eds. Eva Senghass-Knobloch and Hellmuth Lange (Bonn: Friedrich-Ebert-Stiftung, 1992); "Dispositionskosten des Transformationsprozesses," *Aus Politik und Zeitgeschichte*, supplement to *Das Parlament* (1992): 3–24.

15. This data comes from the "Zentraler Kaderdatenspeicher" (ZKDS). It is being analyzed as part of the project "Führungsgruppen und gesellschaftliche Differenzierungsprozesse in der DDR," which is part of the Special Research Area 580 at the Universities of Jena und Halle-Wittenberg, and which is directed by Heinrich Best. The data was provided to me by Axel Salheiser. See Heinrich Best and Stefan Hornbostel, "Die Analyse prozess-produzierter Daten am Beispiel des Zentralen Kaderdatenspeichers des Minisrrates der DDR," *Historical Social Research/Historische Sozialforschung*, special issue: *Funktionseliten der DDR* 28/1–2 (2003): 108–127; Axel Salheiser, " 'Du und deine Elite!'—Leitungskader im Elektroniksektor der DDR-Industrie zwischen fachlicher Qualifikation und politischer Loyalität," *Historical Social Research/Historische Sozialforschung*, special issue: *Funktionseliten der DDR* 28/1–2 (2003): 187–215. See also Sabine Ross, " 'Karrieren auf der Lochkarte': Der 'Zentrale Kaderdatenspeicher' des Ministerrats der DDR," in *Gesellschaft ohne Elite? Führungsgruppen in der DDR*, ed. Arnd Bauer Kämper, Jürgen Danyel, Peter Hübner, and Sabine Ross (Berlin: Metropol, 1997), 109–130.

16. My data, based on Bergakademie Freiberg Hochschularchiv (BAF), professors' files (*Professorenkartei*). Date of first appointment to a post at the BAF, regardless of rank.

17. Both sets of interviews were approved by the Institutional Research Board of St. John's University in 1997.

18. Scheff used professional contacts to seek participants. These yielded further leads. She also enlisted the assistance of scholar Mathias Weber, who put her in touch with IT company heads from the former GDR.

19. Fischer sought interviewees through ads placed in state employment offices, as well as through personal contacts.

20. See Sobeslavsky and Lehmann, *Zur Geschichte*, data on p. 83.

21. See Heike Belitz et al., "East Germany," in *Eastern European Computer Markets*, ed. Stig Franzen and P. Pasdrone (Framingham, MA: International Data Corporation, 1990), 28–33, manuscript provided by author; Heike Belitz, Ulrich Köhler, and Mathias Weber, *Der ostdeutsche Markt für Software 1990* (Kronberg, Germany: International Data Corporation Deutschland, 1990), 8–9. On the earlier history of computing in the GDR, see Friedrich Naumann, "Computer in Ost und West: Wurzeln, Konzepte und Industrien zwischen 1945 und 1990," *Technikgeschichte* 64 (1997): 125–144.

22. See Alexander Nitussov and Boris N. Malinovskiy, "Economic Changes in the Sixties and the Internationalisation of the Soviet Computing," in *Computing in Russia*, ed. Georg Trogemann, Alexander Y. Nitussov, and Wolfgang Ernst (Braunschweig, Germany: Vieweg, 2001), 163–167; Klaus Krakat, *Schlußbilanz der elektronischen Datenverarbeitung in der früheren DDR* (Berlin: Forschungsstelle für Gesamtdeutsche Wirtschaftliche und Soziale Fragen, 1990), 21–25. On the acquisition of Western computer technology through espionage, see Macrakis, "Espionage and Technology," 110–113.

23. Sobeslavsky and Lehmann, *Zur Geschichte*, 52–54; Belitz et al., "East Germany," 6, 37–45.

24. Belitz et al., "East Germany," 6–7, 37–45, 55–57. On the monopoly of socialist combines in software production, see Belitz, Kohla, and Weber, *Der ostdeutsche Markt*, 11–14; Krakat, *Schlußbilanz*, 21–25.

25. Krakat, *Schlußbilanz*, 28.

26. It became possible to major in computer science or computer engineering at the Technical Universities of Dresden, Karl-Marx-Stadt, Magdeburg, Ilmenau, and Leipzig and at the University for Architecture and Civil Engineering in Weimar. The top engineering college in this area was the Engineering School for Computer Science and Computer Engineering in Dresden.

27. Data broken down by gender does not seem to be available for this major, evidently because Information Technology did not exist as a separate department. On sources of data on GDR universities and technical colleges, see Anke Burkhardt and Doris Scherer, *Materialien zur DDR-Hoch- und Fachschulstatistik: Dokumentation bildungsstatistischer Quellen der Projektgruppe Hochschulforschung Berlin-Karlshorst* (Berlin: Projektgruppe Hochschulforschung Berlin-Karlshorst, 1993). On the various computer science majors, see Belitz et al., "East Germany," 58a.

28. For data on West German engineering students, see Hedwig Rudolph, "Ingenieurinnen: Vorberufliche Sozialisation und berufliche Erfahrungen,"in *Ingenieure in Deutschland, 1770–1990*, ed. Peter Lundgreen and André Grelon (Frankfurt am Main and New York: Campus Verlag, 1994), 94, article on pp. 93–105. For data on West German computer science majors, Gudrun Trautwein-Kalms, "Qualifizierte Frauen und Neue Arbeitsformen: Erfolge, Rollback—Und Neue Chancen?" in *Es rettet Uns Kein Höh'res Wesen—Feministische Perspektiven der Arbeitsgesellschaft*, ed. Brigitte Stolz-Willig and Mechthild Veil (Hamburg: VSA-Verlag, 1999).

29. See Belitz, Köhler, and Weber, Der ostdeutsche Markt, 16–19.

30. In nine cases, the highest degree was an engineering degree from a technical college. One had a technical college degree and a university degree with teaching certification (*Staatsexamen*). Six of the interviewees had a university *Diplom*, of whom one also had a doctorate and a second graduate degree (*Aspirantur A und B*). The Soviet-born engineer had studied at a polytechnic.

31. These included heating and sanitary technology (two), mining technology (one), mechanical engineering (two), chemical machine-building (one), machine-building for the energy industry (one), physics engineer at the Academy of Sciences (one), television broadcast engineer (one), machine-tools engineer (one), chemical engineering (two), and software engineering (one); one became an IT specialist in military procurement, another a technologist in the clothing industry; two (one with an engineering degree, the other with a degree as "engineer-economist") were in charge of price calculation, one in the construction industry, the other in a mine construction enterprise.

32. Where the mother and father both worked, I took the higher status of the two as the indicator of social origins. In sixteen of the twenty-five cases, at least one of the parents had a profession that normally required a university degree, a category in which engineers were included.

33. See Heike Solga, "Die Etablierung einer Klassengesellschaft in der DDR: Anspruch und Wirklichkeit des Postulats sozialer Gleichheit," in *Kollektiv und Eigensinn in der DDR*, ed. Johannes Huinink et al. (Berlin: Akademie Verlag, 1995), 45–88.

34. See Rainer Fritsch and Erika Rommel, *Die Praxis der Hochschulen bei der sozialen Zuordnung der Studienbewerber und Aspekte der Sozialen Herkunft von Hochschuldirekt- und Fernstudenten*, Forschung über das Hochschulwesen, vol. 49 (Berlin: Zentralinstitut für Hochschulbildung, 1987), appendix 4. In a widely discussed study, prominent GDR sociologist Manfred Lötsch presented rather different data. However, he and his team of researchers looked at data for the mothers' and fathers' professions separately, rather than asking whether *either* the mother or father was college- or university educated. See Lötsch, *Ingenieure in der DDR*, 56.

35. All the participants in the study named mathematics as one of their favorite subjects in school.

36. In two cases, the parents' professions were unknown.

37. Gender differences were particularly noticeable in the preference of women for software engineering and computer programming, which contrasted with the male preference for specializations that combined the study of both the hard- and software.

38. However, many women opted for programs that put them in the factory only in the summer months, greatly reducing their technical training. This was the "apprenticeship with university-preparatory high school degree" (*Berufsausbildung mit Abitur*) option. Data show that women in many skilled manual professions (such as equipment installer, toolmaker, machine tools worker, electronics workman, electrician, etc.) preferred this option.

39. See survey data in Jutta Gysi and Dagmar Meyer, "Leitbild: Berufstätige Mutter—DDR-Frauen in Familie, Partnerschaft und Ehe," in *Frauen in Deutschland 1945–1992*, ed. Gisela Helwig and Hildegard Maria Nickel (Bonn: Bundeszentrale für politische Bildung, 1993), 161.

40. Childcare became generally accessible in the GDR by the mid-1970s at the latest. See Budde, *Frauen*, 318.

41. See Zachmann, *Mobilisierung*, 353–354.

42. See Budde, *Frauen*, 345–349; Trappe, *Emanzipation*. 129–167.

43. In 1986, women were given the right to a year off from work after the birth of their first child.

44. See Trappe, *Emanzipation*, 75, 210–215.

45. On U.S. careers, see Layton, *The Revolt,'* 13–15. On Germany and France, see Patrick Fridenson, "Les Patronats Allemands et Français au XXème Siècle: Essai de Comparaison," in *Eliten in Deutschland und Frankreich im 19. und 20. Jahrhundert/Elites en France et en Allemagne aux XIXème et XXème siècles*, vol. I, eds. Rainer Hudemann and Georges-Henri Soutou (Munich: R. Oldenbourg Verlag, 1994), 162–163. In France, an engineer generally could *not* rise into management.

46. This refers to industrial managers of the period 1979–1989, listed in the ZKDS (Central Cadre Data Repository). See Salheiser, " 'Du und deine Elite!,' " 193.

47. See Budde, *Frauen*, 327.

48. For extensive excerpts from the transcript of her interview, see Dolores L. Augustine, " 'Es sind zwei Welten Gewesen': Eine Informatikerin in der DDR und in der Bundesrepublik," in *Europa und die Europäer: Quellen und Essays zur modernen europäischen*

Geschichte. Festschrift für Hartmut Kaelble zum 65. Geburtstag, ed. Rüdiger Hohls, Iris Schröder, and Hannes Siegrist (Stuttgart: Franz Steiner Verlag, 2005), 115–120.

49. See Anne Hampele, " 'Arbeite mit, plane mit, regiere mit'—Zur politischen Partizipation von Frauen in der DDR" in *Frauen in Deutschland 1945–1992*, ed. Gisela Helwig and Hildegard Maria Nickel (Bonn: Bundeszentrale für politische Bildung, 1993), 287. Women made up 35.5 percent of all SED members in 1986.

50. Statistisches Bundesamt, "Wirtschaftlich Taetige nach ausgefuerter [sic] Taetigkeit und Altersgruppen 1981," printout, dated May 10, 1983 (VD 6.2./500/83); *Ergebnisse der Volks- und Berufszählung am 31. Dez. 1964* (Berlin [GDR] 1967), 233–235.

51. See Zachmann, *Mobilisierung*, 349.

52. See Budde, *Frauen*, 320–321.

53. See survey data on housework and childcare in the GDR in Gysi and Meyer, "Leitbild," 158–159, and Hildegard Maria Nickel, " 'Mitgestalterinnen des Sozialismus'—Frauenarbeit in der DDR" in *Frauen in Deutschland 1945–1992*, ed. Gisela Helwig and Hildegard Maria Nickel (Bonn: Bundeszentrale für politische Bildung, 1993), 245.

54. In general, travel cadres gained a great deal of economically and technically useful information on trips to the West. See Jens Niederhut, *Die Reisekader* (Leipzig: Evangelische Verlagsanstalt, 2005), 120–122.

55. See Stokes, *Constructing*, 65–79; Pence, "A World," 21–50.

56. See Dieter Lindig and Gabriele Valerius, "Neue Selbständige in Ostdeutschland," in *Sozialer Umbruch in Ostdeutschland*, ed. Rainer Geißler (Opladen, Germany: Leske & Budrich, 1993), 190–195; article on pp. 179–196.

57. See also Irene Dölling, Adelheid Kuhlmey-Oehlert, and Gabriela Seibt, eds., *Unsere Haut: Tagebücher von Frauen aus dem Herbst 1990* (Berlin: Dietz, 1992); Dinah Dodds and Pam Allen-Thompson, *The Wall in My Backyard: East German Women in Transition* (Amherst: University of Massachusetts Press, 1994); Angela Joost, *Arbeit, Liebe, Leben: Eigene Arrangements* (Königstein an der Taunus, Germany: Ulrike Helmer Verlag, 2000).

58. See Zachmann, *Mobilisierung*, 274.

59. On West Germany, see Doris Janshen, Hedwig Rudolph, *Ingenieurinnen: Frauen für die Zukunft* (Berlin and New York: Walter de Gruyter, 1987), 149–188, 200–254.

60. On the SED's strategy of pushing women into full-time work, combined with state-run daycare for their children, see Trappe, *Emanzipation*.

61. Example of attempt to use pay differentials to improve performance: SAPMO/BArch, FDGB-BUVO A5401, "Analyse über Erfahrungen und Ergebnisse bei der Durchsetzung der leistungsorientierten Lohnpolitik . . . ," dated June 1983. Complaints about insufficient use of pay increases as an incentive in a document release by the KDT just after the fall of the Berlin Wall: SAPMO/BArch, DF-4, 23713, "Bericht des Büros an die 9. Beratung des Präsidiums der Kammer der Technik am 6.Dezember 1989."

62. See Schattenberg, *Stalins Ingenieure*.

8

High Ambitions: Careerism and High-Tech Research during the New Cold War

The SED leadership embarked on yet another quest for technological greatness from the late 1970s onward, thus returning to the grand project of the Ulbricht era. When Honecker had come to power in 1971, he had immediately decreased funding for high-tech research and made the expansion of the social state and consumerism the centerpiece of his programs.[1] Priorities changed in the late 1970s, as high-tech research again came to be seen as a panacea. There were major differences from outlook of the 1960s, however. Ulbricht had sought a dynamic relationship between the state and the technical intelligentsia, curtailing but not eliminating the latter's independence. By contrast, the Honecker regime pursued a policy of attempting to crush all spontaneity in society and to make the SED the sole initiator of technological change. Centralization of industry, particularly through the formation of combines, promoted this process.[2] As the "sword and shield" of the party, the Stasi became the servant of the SED that watched over and attempted to control the development of technology in the factory and laboratory on behalf of its master.[3] This applied particularly to the emerging high-tech islands of the East German economy, while low-tech, traditional industries were neglected and allowed to wither. The increasing importance of military research on behalf of the Soviet Union intensified the controlling impulse of SED and Stasi.

The transition to a new understanding of the relationship among party, state, and technical experts was eased by the triumph—part demographic, part politically induced (as in the case of Werner Hartmann, discussed in chapter 5)—of the new intelligentsia. Many younger engineers and industrial scientists tried to avoid political subjugation (as was seen in chapter 7). However, there were enough ambitious careerists pushing their way to the top of the industrial hierarchy, willing to pledge themselves to the SED, and in some cases make commitments to the secret police, in pursuit of professional advancement. Having long chafed under the bridle of the authority of the old intelligentsia, they were willing to go to considerable lengths to achieve their own positions of power. Nonetheless, top research personnel continued to also see themselves as engineers and scientists, and tried to negotiate a path for themselves, and for the industrial research they saw as important, between political dictates and what they saw as technological needs. How much freedom did they have, how much freedom did they seek, in their constant negotiations with the centers of power?

No East German enterprise embodies high-tech aspirations, entwined with militarization and secret police connections, better than Carl Zeiss Jena. It was here that the Soviets chose to try to create a high-tech partner. It was Zeiss that inherited the mantle of overseer of the East German microelectronics program. And few members of the industrial research elite better exemplify the temptations, frustrations, and opportunities that the new generation of top research personnel encountered at Zeiss and in the East German high-tech industry than Klaus Mütze, head of civilian research, then head of the microelectronics program, at Zeiss. His career will be a major focus of this chapter.

Militarization of Research at Zeiss

Militarization presented Zeiss with unique opportunities, but also with profound challenges, placing tremendous strain on the civilian programs that had historically been Zeiss's main strengths (microscopes, measuring devices, scientific instruments, and the like). Ultimately, militarization totally transformed Zeiss, its research style, and the relationship between its research personnel and the SED. Soviet defense minister Dmitri Ustinov came to Jena at the height of the Reagan-era intensification of the Cold War (April 6, 1983) to deliver the message that the Soviet leadership (headed by Yuri Andropov) wanted Zeiss to embark on an ambitious program of development of cutting-edge military technologies. The East German leadership fully backed this program, which was to put Zeiss in a rather unique position in an economy where military goods made up only one percent of production. Zeiss was promised greatly expanded resources. Total investments in Zeiss increased from about 200 million marks in 1980 to about 300 million marks in 1984, and about 920 million marks in 1987. According to historian Gerhard Barkleit, Zeiss military production reached 510 million marks (15.7 percent of all sales) by 1983, while sales in civilian products (including industrial equipment) reached 2.75 billion marks (81.4 percent of the total), but consumer goods only 96 million marks (2.9 percent). Military production at Zeiss was to be doubled by the early 1990s. To some extent, this dramatic expansion took the form of takeovers of smaller enterprises, which were incorporated into the Zeiss combine (formed in 1976). But a proposed hiring wave fizzled out due to a general labor shortage, as well as problems to be discussed shortly. Military research, most of it conducted in the secretive "Research Center

U," established in 1976 and later expanded into a research and production facility, included infrared seekers (devices used to home in on a target) for air-to-air missiles; seekers for sea-based surface-to-air missiles (a project that had to be abandoned); night vision equipment for tanks; real-time aerial photography transmission systems; targeting systems for tanks; and equipment for the Soviet space program. This range of projects makes clear how deeply involved Zeiss became in the East-West arms race of the 1980s. Particularly challenging were projects in areas in which Zeiss had never before conducted research (notably the seekers for sea-based surface-to-air missiles).[4]

Zeiss became one of the premier East German producers of hardware for use in espionage and domestic eavesdropping and security. These research programs are important because they were expensive and employed some of the best minds in East German industrial science in that period. Zeiss was one of the top producers of such products in the world. Under long-term agreements, Zeiss developed a broad range of sophisticated equipment for the Stasi: a pyroelectric sensor used to detect the presence of a human being in an area under surveillance by measuring the heat given off by the body; listening devices; thermal imaging (i.e., the use of thermographic cameras to detect infrared radiation); low-light-level surveillance cameras; a machine that could automatically identify handwriting; and electronic components for "special" (i.e., national security) uses. Pentacon (in Dresden) had for years been a main producer of special cameras for the Stasi when it was made a part of the Zeiss combine (on January 1, 1985). The Carl Zeiss plants in Jena produced miniature photographic lenses, used, for example, in miniature cameras for buttonhole photography, that were among the best in the world.[5] Zeiss was not alone in the field of spy technologies. While Zeiss devoted 7.7 million marks a year to research and development on behalf of the Stasi, Robotron devoted 14 million marks. Also heavily involved were a combine for microelectronics in Erfurt (KME), the combine for telecommunications electronics, and the machine tools combine of Schmalkalden, among several others. The Stasi research and development division or operative-technical sector (*Operativ-Technischer Sektor*, or OTS), a Stasi division that developed spyware, worked together with East German industry to develop machines used to print forgeries of U.S., U.N., and Western European passports.[6]

The growth of military and other forms of special research at Zeiss reduced the resources available to civilian research, as reports on Zeiss clearly show.[7] Top personnel were transferred from civilian to military and spy technologies, and budgets ran low. Research Center W fought for at least one civilian project, a technical center devoted to electronic components. Zeiss General Director Wolfgang Biermann raised strenuous objections to the expansion of military research in 1983, but failed to carry the day. Consulting with top managers at Zeiss, he advised Erich Honecker and Günter Mittag in the fall of 1986 to scuttle the project to develop seekers for sea-based surface-to-air missiles (a project made difficult by a lack of Soviet cooperation). They followed his advice, also agreeing to transfer the resources that were freed up into an ambitious microelectronics program.[8]

Given the tremendous scarcity of industrial capacity, the East German economy faced rigid guns-versus-butter trade-offs. The radio industry felt so overwhelmed by military contracts that it refused to take on any more.[9] OTS complained that GDR industry was too strongly focused on consumer goods. OTS argued that in the United States and the Soviet Union, technological advance came primarily through military research. Consumers were ultimately the beneficiaries. In the GDR, however, industry saw national security (military and Stasi) projects as "the fifth wheel on the wagon," and resisted taking them on. The East German army (NVA) was said to have complained about the same problem.[10]

Did military and security technologies spawn civilian spin-offs, as they did in the West?[11] The Stasi resisted this. For example, division XVIII of the Stasi (in charge of the economy) was opposed to selling devices developed for the Stasi to the public as burglar alarms, evidently because it did not want the populace to gain knowledge of this technology.[12] Far more promising was the potential dual usage of microelectronics. However, it seems unlikely that the civilian microelectronics program benefited much from military research in the sense of putting to use technologies developed for military user. First, different kinds of electronic components were used in military and civilian technologies. Second, by the 1980s very little original microelectronic research was being conducted; rather, Western microelectronic components were being copied in the GDR. Thus, innovation was not generated from within the system, but came from without. Third, security measures surrounding military research virtually precluded spin-offs. Moreover, security concerns appeared to dictate a concentration of resources and efforts on independence from Western imports. (It was feared that the sudden disappearance of Western components—principally due to embargo—would not only cause disruptions in research and production, but also a weakening of military preparedness.) The resulting quest for autarky inhibited innovation because it tended to encourage imitation of Western technologies. On the other hand, had it not been for the military importance of microelectronics, it is doubtful that the SED would have devoted such extensive resources to this program.

The End of a Dream: The Failure of the Microelectronics Program and the Collapse of the GDR

The dream of the triumph of socialism through high-tech wonders, pushed aside in the early years of the Honecker era, was revived in all its glory in the crisis period of the 1980s. Honecker's decision to pursue consumerism and a social state, along with the lack of Soviet support, the OPEC oil crises of the 1970s, large-scale borrowing from the West, and the increasing decay of an inefficient economy, combined to push East Germany toward the brink of bankruptcy by the early 1980s.[13] Productivity was declining, as was the East German industry's ability to compete abroad, even in the high-tech areas that were its forte.[14] Gerhard Schürer (head of the State Planning Commission) convinced Erich Honecker that microelectronics would lift the GDR out of its morass. There were many pragmatic arguments in favor of developing microelectronics, among them that the East German machine-tools industry could only remain internationally competitive if it incorporated modern electronics into its machines. Schürer also hoped to build up CAD/CAM production (computer-aided design and manufacturing systems, used in the design of machines).[15] However, it was also argued that microelectronics would create the "preconditions for the transition to Communism" and help combat imperialism. According to Barkleit, this "magical thinking" reached a high point with the ceremonial presentation of the first 1 MB memory circuit and of the first 32-bit microprocessor produced in the GDR to Honecker in September 1988 and August 1989.[16] Mittag greatly contributed to economic problems by convincing the majority of the political leadership that no cutbacks were necessary, that the GDR could have both high-tech research and consumerism, though he tried to deny that this had been his strategy in his 1991 memoirs and later interviews.[17] In the end, the microelectronics program contributed to the downfall of the GDR.

The central decisions that led to this disaster were made by what Kristie Macrakis has described as the power trio of state, SED, and Stasi.[18] A revitalization and tremendous expansion of the East German microelectronics program was decided on in 1976–1977 by the SED. Industry, stripped of independent thinkers such as Werner Hartmann and Paul Görlich, showed little initiative. Beaten into submission, Hartmann's old institute, AMD, was submerged into larger organizations and subjected to hierarchical structures, though it was still at the heart of microelectronics research in the GDR. Under changing names, it was taken over by the Microelectronics Combine in 1978 and by the Zeiss combine in 1986. In general, industry reacted passively, though Combine VEB Radio Works Erfurt did speak up, trying in 1977 to make it clear to state bureaucrats that far larger investments than those envisioned were going to be necessary.[19]

Unable to license the technologies it needed because of the CoCom embargo, East German industry copied Western electronic components, relying ever more heavily on an espionage network run by the Stasi to smuggle in single exemplars or arrange for the illegal importation of manufacturing facilities.[20] This strategy caused several problems. First, patent infringements made it difficult to sell German equipment in the West. Second, purely imitative "research" demoralized personnel, whose work was robbed of creativity. Third, the costs and difficulty of copying foreign microelectronic components increased exponentially as miniaturization progressed. As a result, the microelectronics program became a black hole that devoured ever-increasing sums of money (14–30 billion East German marks in 1977–1988), in the end contributing in a major way to East Germany's near bankruptcy. This in turn added to the leadership's sense of insecurity at a moment when it needed a steady hand. The microelectronics program overwhelmed the resources of the GDR. This might not have happened if the Soviet Union had been willing to share technology and engage in an international division of labor through trade. Ironically, Gorbachev proved no more inclined than his predecessors to give the East Germans the support they so dearly wanted and needed, thus condemning the East German microelectronics program to failure.[21]

Political scientist Olaf Klenke sees the GDR's attempt to pursue what was essentially an autarky policy in microelectronics as doomed to failure, given the very high R&D costs. Klenke is quite correct in his thesis that the GDR could only have succeeded if it had secured technology transfer from abroad through international cooperation with Western multinational corporations and fully participated in an international division of labor, importing many microelectronic devices and only itself producing a narrow range of products. He believes that greater reliance on international cooperation could have greatly improved the GDR's chances of succeeding in microelectronics. In fact, the GDR did undertake some projects with Japan, and détente brought greater cooperation with West German companies. The CoCom embargo stood in the way of certain kinds of cooperation, but the biggest barriers were political. In particular, the GDR did not attempt joint ventures with Western corporations, even though other Eastern European countries had taken this step.[22] Such a strategy might have been thwarted by the CoCom embargo in the end anyway.

Barkleit uses the microelectronics program to analyze power structures in the GDR. According to him, there were genuine debates, disagreements, and negotiations in connection with the building up of the East German microelectronics industry. These were absolutely dominated by the ruling trio of the state, SED, and Stasi. Only occasionally did industry assert a distinct point of view (Zeiss General Director Biermann was particularly vocal), and with little success. SED domination was never questioned by state bureaucrats or by the Stasi. The disagreements were most often within the SED or within the state, and generally between individuals rather than between factions or institutions. The Stasi was very loyal to the SED. To the extent that it had a point of view, it was narrowly security-related. Unofficial informants (*Inoffizielle Mitarbeiter*, or IMs) showed no more ideological fervor than other actors, but at times put economic and pragmatic criteria first.[23] The Stasi nonetheless had a distinct impact on research: It imposed on the East German high-tech industry a model of innovation based on espionage, military-like security, and imitation, thus preventing the emergence of a model of innovation based on international division of labor, transfer of technology from the West through legal means, and a culture of exchange of ideas.

How did the research directors in this era, the heirs to Görlich and Hartmann, fit into the power structures of this era? How did the involvement of the Stasi in high-tech research change engineers' and scientists' understanding of their roles in the economy and in their enterprise? The story of Klaus Mütze provides interesting insights here.

Dedicated to the Zeiss Tradition: Mütze and Civilian Research at Zeiss

In September 1976 Dr. Klaus Mütze took over as head of research at Carl Zeiss Jena (a post he held until after the fall of Communism), thus becoming perhaps the most important industrial research director of the Honecker era. The old intelligentsia had stepped down over five years earlier, with the January 1, 1971, retirement of Paul Görlich. From 1971 to 1976, Karlheinz Müller had served as head of the Zeiss research center, with Mütze as head of development. Mütze was truly the son of a new era. Born in Saxony-Anhalt in 1933, he left school and began an apprenticeship as a machinist at the age of fifteen. In 1951, he went off to Karl-Marx-Stadt to attend the Technical College for Mechanical and Electrical Engineering. After completing his degree there, he went on to do a university engineering degree and, eventually, a doctorate. First hired by Carl Zeiss Jena in 1960 (at age 26), he worked his way up though the ranks. Originally, his career goal was to become a university professor, but he became convinced that it was better to combine a career in industry with part-time teaching at an engineering college. His bearing was that of an academic. He was greatly esteemed at Zeiss as a "very good technical expert, but particularly as an excellent organizer and manager [*Leiter*], who works single-mindedly and intensively." He was considered very effective in moving innovations from the research and development stage to the production stage, a stage that was generally the weak link in the Communist system. Always well prepared for major meetings, he displayed considerable self-confidence there. He was a very effective speaker who sought out opportunities to address the public. He was considered intelligent, quick on his feet, even impulsive. At the same time, he displayed considerable calm and self-control under fire.[24]

Mütze took over the Zeiss research center at a challenging moment. Traditional areas of research, which Gallerach had cut back on during his time as general director (as discussed in chapter 5), were revived. This was very much to the liking of

Mütze, who was interested in continuing the Zeiss tradition in areas such as scientific instruments.[25] R&D, which had been scattered among several divisions in Gallerach's time, had been recentralized in the Research Center W, founded in 1971. However, Zeiss was facing profound changes, as the SED and the Soviet Union came to view it as their last hope on several fronts. Zeiss was expected to help solve many of the major problems facing the GDR: faltering performance in Western markets, lack of consumer goods, and problems in the microelectronics program. Zeiss was a mighty industrial complex that by 1985 encompassed over a dozen subsidiary industrial facilities and employed a workforce of 32,942. A socialist combine since 1976, Zeiss also directed eight other juridically separate state-owned companies (VEBs) that employed a further 20,106 persons. Several universities and institutes of the Academy of Sciences also worked closely with Zeiss on major research projects.[26] But Zeiss was not up to the task of fulfilling all these demands, in addition to feeding the insatiable maw of the Soviet military complex. With the rise of military and other high-security research since the late 1960s a separate research unit emerged (Research Center U), cloaked in secrecy. In the mid-1980s, about one thousand Zeiss employees worked in "special" research (according to a study conducted at the Stasi university), while Research Center W had 3,344 employees.[27] Mütze knew little of this research, and did all he could to preserve his ignorance.[28] Until 1986, when he became the head of a new microelectronics program at Zeiss, his activities focused on the Zeiss tradition of optics and precision instruments, where he and others saw Zeiss's future.[29]

Within the context of this tradition, Mütze was a forward-looking modernizer who embraced innovation and strove to maintain Zeiss's ability to compete on the world market. He belonged to a generation of top Zeiss managers who fully recognized that Zeiss's excellence in optics and precision instruments no longer guaranteed that its products would sell abroad. He understood the central importance of electronics.[30] Zeiss was slow to integrate electronics into its instruments, and struggled mightily from the early 1970s onward to catch up in this area. Electronics were not a simple add-on, but necessitated a fundamental reconceptualization of instrument design.[31] The transition from optical-mechanical tachometers (i.e., devices that measure distances, used for example in sports or surveying) to electro-optical tachometers (which the West German Carl Zeiss Corporation brought on the market in 1968) came in 1971–1972, resulting in the development of the EOK 2000 (an electro-optical short-distance tachometer), which came out in 1974–1975. This device became obsolete very quickly because of the use of mid-1960s electronics. Mütze realized in 1974 at an international exhibition that more modern microelectronic components had to be used. In developing the next-generation EOT 2000 (an electronic tachometer), the research center had tremendous difficulties getting the permission of the General Director and the political leadership to import necessary components. Mütze was also upset that the scientists heading this project at Zeiss took a long time to figure out how the electronic and optical aspects fit together. The device displayed at the Leipzig Trade Fair in 1977 was a makeshift laboratory prototype that proved to be nonfunctional. With difficulty and delays, electronic components were imported from France for EOT II, which went into production in 1981.[32]

In an attempt to overcome the problem of the lack of good electronic components in the GDR, Mütze sought Western partners willing to develop components for use in Zeiss instruments. For example, French automobile maker Renault developed electronics and software for use together with a Zeiss stereo comparator in an industrial photogrammetry system (used to determine 3-D coordinates on an object from 2-D photographs, in this case used in automobile design).[33] However, there were limits to such international cooperation. In 1980, Hewlett-Packard approached Mütze with a proposal to provide the microelectronics for Zeiss lithographic instruments (used in the production of microelectronic components). Mütze agreed, but the plan was vetoed by Zeiss General Director Biermann.[34]

Mütze was very concerned about not spending too much money on imported components. He very much believed that (as a speaker at Zeiss expressed it), "If the GDR wants to continue to be a leading industrial state, then we have to dedicate ourselves to microelectronics without reservation," which meant greatly reducing dependence on the imports.[35] Zeiss began producing a limited number of electronic components for its own use in the mid-1970s, but was pressed into service as the main microelectronics producer in 1986.[36]

Unlike earlier Zeiss Research Director Görlich, Mütze was, as an approved "travel cadre," given no trouble regarding his frequent trips to the West and the Middle East (sixteen trips in 1971–1979).[37] This was because Mütze had fully committed himself (at least outwardly) to the SED and the system.

Mütze and the Stasification of Zeiss

An ambitious young man, Mütze joined the SED in 1965. (He was already a member of the FDGB, the FDJ, the KDT, and the Society for German-Soviet Friendship.) In 1977, he signed on as a Stasi informant ("unofficial employee for security," or IMS).[38] The secret police had become deeply involved at Zeiss as a result of Zeiss's importance as a high-tech research enterprise, increased Soviet reliance on Zeiss, militarization of Zeiss production, and reliance on the Stasi to provide embargoed Western technologies to be copied at Zeiss. For a new generation of top researchers, collaboration with the secret police might have seemed essential, not only to their careers, but also to the well-being of Zeiss. Nonetheless, their relationship with the SED and the Stasi was anything but simple, as the case of Mütze clearly illustrates.

Mütze's collaboration with the Stasi was typical of what was going on at Zeiss during that period. Wolfgang Biermann, general director of Zeiss from 1975 to 1989, and a member of the Central Committee of the SED, ushered in a period of intense politicization and strengthening of hierarchical relationships at Zeiss. Called "General" by Zeiss employees, he ushered in a militarization of management practices. His employees feared his "daily tirades,"[39] which greatly undermined the "collegial atmosphere" that had been the norm at Zeiss.[40] His personal aide, Katharina Schreiner, later defended him as someone who was trying to shake up what had become a complacent, poorly performing management. However, she also portrayed him as a man of boundless ambition, who saw Jena as a way-station on the way to a top-level career in the SED. With a constant eye to the central party apparatus in Berlin, he sought to bring Zeiss under the absolute control of the SED, all the while pretending that orders originated with him, not from above.[41] It is beyond doubt that under Biermann, the rules of the game changed at Zeiss. Absolute political loyalty was demanded of all senior personnel. Biermann even fired the head of the Zeiss planetarium because he was not a member of the SED. Biermann was on very good terms with the Stasi. Of the top Stasi official at Zeiss, he said, "He had style, that was a new generation that no longer used theirs fists and rustic methods. He did his job in a scientific and cultivated way."[42] Zeiss employees were subject to security checks. Personnel with security clearances (*Geheimnisträger*) and travel cadres were subjected to particular scrutiny, and were generally allowed no contacts—not even family members—in West Germany. The MfS had veto rights over the hiring of personnel to fill many positions in high-tech research. By the mid-1980s, half of all applicants for high-security positions at Zeiss were rejected.[43] Legions of secret police informants were recruited among Zeiss employees. According to a 1984 secret police report, there were 375 Stasi informants among the 48,500 Zeiss employees.[44] This is actually a somewhat lower rate than among the general population.[45] However, studies on Stasi informants in East German high-tech industry by Gerhard Barkleit and Anette Dunsch and by Reinhard Buthmann show that IM's were often recruited from among upper-tier managers.[46] These informants were particularly powerful figures, commanding both overt and subterranean power sources.

What did the Stasi hope to accomplish with its establishment of a dense network of informants in industry (particularly the microelectronics and chemical industries)? As the "sword and shield" of the SED, the secret police followed the party's orders,[47] endeavoring to preserve and protect the party's hold over industry and protect industry from inner and outer enemies: "The most important political-operational goal and mission is to quickly discover the intentions, plans, and activities of foreign and domestic enemies, to prevent enemy activities, rule out unexpected actions of our opponents, and render enemy forces harmless. The preventative aspect is gaining in importance."[48] Fundamental to Stasi policies was the neo-Stalinist idea that conformity with party policies brought economic growth, while economic and technical problems were the result of politically false attitudes, or even sabotage. Particular vigilance was thought to be necessary with regard to East German personnel allowed to travel to the West (as travel cadres, trade negotiators, etc.).[49] Fear of foreign espionage at Zeiss, and in high-tech industry in general, was great in secret police and SED circles, particularly the fear that information would leak out that could be used to strategically block Zeiss from gaining access to essential electronic components and raw materials.[50] This anxiety was rooted in the intensification of East-West tensions and expansion of the CoCom embargo in the 1980s. The Stasi claimed it had specific information about "activities of imperialist secret services" at Zeiss.[51]

Nonetheless, Mütze was initially rather reluctant to cooperate with the secret police. According to his Stasi file, when first approached, in 1966, he said he "did not agree with the methods of such work," and questioned the authority of the MfS to make such demands. He made it clear that he was not willing to do anything behind the backs of his superiors and colleagues. "Only with the permission of his supervisor could he give a precise answer." He went so far as to openly discuss the matter with colleagues at an administrators' meeting.[52] It is thus quite clear where Mütze's loyalties lay in 1966. It should also be noted that he suffered no ill consequences as a result of his display of courage.

Eventually, however, he agreed to become an unofficial informer. Had he decided to cast aside his principles for the sake of his career? Or had he simply become convinced that Zeiss managers had no choice but to cooperate with the Stasi? Had he gotten the permission of his boss? We cannot know for certain the answer to these questions. (Dr. Mütze refused this author's request for an interview.) However, the context and subsequent events give some hints. In December 1971, having hammered away at Mütze with frequent visits to his office and home, a relentless barrage of questions, and an overt attempt to recruit him, the Stasi thought he would soon agree to become an IM judging from the very positive evaluation of Mütze as a "candidate" for official status as *IM*. Mütze continued to speak with Stasi agents when they showed up, but resisted traveling to Berlin to meet with them, and did not become the sort of "partner" they wanted, one willing "to support the MfS in the defense against adversarial activities, particularly the clarification of possible strongholds"—in other words, the denunciation of suspected traitors.[53] Surprisingly, Mütze held out against their recruitment efforts until January 1, 1977, when he finally wrote out and signed a declaration of his willingness to became a Stasi informer, and chose the pseudonym "Michael."[54]

His relationship with the MfS remained complex. On the one hand, the Stasi appreciated Mütze's outward display of loyalty to the SED. It was noted with satisfaction that "M. [Mütze] stands firmly on the foundation of our Workers' and Peasants' State," and that he had expressed support for East German participation in the suppression of the Prague Spring in 1968.[55] Politically, his behavior was irreproachable. He assiduously avoided "ideological missteps." "Even in internal circles or in one-on-one conversations, Mütze always consistently espouses the official position on all issues of the day in the style of the lead article in *Neues Deutschland* [the official organ of the SED]," according to the secret police informant known as "Max I."[56] Some nonetheless distrusted Mütze. "Rolf I" pointed out in a report to the Stasi that Mütze had been professionally socialized under the supervision of Zeiss managers who put technology first, that Mütze had joined the SED relatively late, and that he was "inwardly in no sense stable." It took stern warnings to force him to put up a flag on national holidays in his neighborhood. "Rolf I" expressed the opinion, "I could personally imagine that his 'just-a-scientist' attitude, which one might better describe as a 'just-an-engineer' attitude, blinds him to the real situation, particularly with regard to the class enemy."[57] Constantly spied upon, even after he began working for the secret police, Mütze provided no basis for accusations of disloyalty.

Nonetheless, Mütze was a constant source of frustration for the Stasi. First of all, he met with his secret police handler far less frequently than desired or usual—only four or five times a year in 1977–1979—despite his handler's constant complaints.[58] The handler threatened to break off the relationship in late 1977, and reported to his superiors, "It must be concluded that the unofficial informant [Mütze] is working for us solely for careerist reasons. He knows that we have influence over his managerial function, trips to the West, and part-time work at the University of Jena. [Judging] from experiences up until now, he can only be won for this . . . [illegible word] work under pressure. His political-ideological behavior is not that of a Communist."[59] Mütze claimed that professional responsibilities precluded more frequent meetings during the work week, and that he needed to rest and spend time with his children on weekends.[60] Mütze seemed particularly reluctant to report in to the Stasi after trips abroad.[61] Mütze appears to have been trying to avoid providing intelligence on foreign business and technical and scientific contacts. After a trip to France in 1979, he claimed that he had not had time to speak with persons he was supposed to report on.[62] Someone assigned the task of spying on the spy—an IM reporting on Mütze's activities during an earlier trip to Paris—told his handler, "During the day, there were different sorts of tasks to take care of, and therefore no surveillance was possible."[63] Were these incompetent spies, or people trying to undermine their own missions? The latter seems rather likely.

The Stasi was also very annoyed that Mütze tried to avoid discussing Zeiss employees' political attitudes or providing information that could have been used in investigations of espionage, sabotage, or other acts of treason or disloyalty.[64] Indeed, there is evidence that Mütze shielded Zeiss employees, evidently because he felt a strong sense of solidarity with the production and research staff that he had been a part of: "It must be emphasized that Mütze works very closely with the employees of the plant's research and production collectives and that in terms of mentality he is on the same wavelength as they."[65] He did discuss the performance of underlings, but generally from a managerial and technical point of view, and often in quite positive terms. He reassured the Stasi that an ambitious researcher who sought professional recognition through articles in international journals would not betray secrets.[66] Mütze defended a Zeiss manager who did not provide political leadership, pointing out that the latter was good at motivating his team, which achieved good results.[67] When a Stasi officer tried to use his authority to tell Mütze to crack down on an individual whose "arrogance" the officer abhorred, Mütze leaped to the defense of the employee, whom he called a "fighter": "[Name blackened out] fights against views that much is not solvable, and yet must be solved. . . . I would not allow anyone else the right to judge this matter unless they are better. That is, [that they] show greater achievements."[68]

However good his intentions, Mütze nevertheless passed on some potentially damaging material. He pointed out that one Zeiss employee who traveled to the West to take care of customers constantly tried to get customers to request his return; Mütze called this individual "untrustworthy,"[69] probably with the expectation that his permission to travel to the West would be revoked. Mütze criticized the mediocre performance of an employee in an SED-dominated organization.[70] More seriously, Mütze answered questions in connection with an investigation of an alleged case of "treason."[71] He also expressed the opinion that it could not be precluded that a certain Zeiss employee committed "acts of treason" in connection with Western contacts and travels.[72] When asked point-blank, "Who are the spies at Carl Zeiss?" Mütze answered (after a long pause), "I don't have any sense of what contacts the people have. The criteria for my answer are honesty, candor . . . My evaluation is based on character." He went on to name individuals whom he did not trust, evaluations that were based on only the most general and subjective of impressions.[73]

Mütze was also expected to report on his superiors, particularly the top administration of the socialist combine.[74] His meetings with Stasi officers were ostensibly unknown to General Director Biermann.[75] Nevertheless, Mütze appears to have been very careful, and uninterested in using his power over others. For example, he reported "only positive expressions of opinion" during a formal social occasion attended by top combine and party functionaries.[76] Only one report in Mütze's file contains negative material on Biermann, and it is not at all certain that Mütze supplied this information. The report depicts a meeting at which members of the senior management received a profanity-laced dressing-down from Biermann. Mütze was also on the receiving end of a diatribe about unnecessary orders of Western equipment. He was told by Biermann to get his "academic crazies" into line, and was told he would never again get a penny of hard currency, even if that meant that the research center had to build equipment out of plywood. However, according to this report, some of the assembled managers later made fun of certain expressions used by Biermann behind his back: "Others don't take Comrade [name blackened out] seriously and they try to do only what is absolutely necessary. With this method of leadership, he inhibits the initiative of many people, because these comrades are not used to such expressions before such a forum."[77] This reaction reveals a surprising degree of fearlessness on the part of senior managers such as Mütze.

Surprisingly independent-minded in many ways, Mütze—like many others—nevertheless contributed to the stabilization of what was essentially a military model of industrial research. The most harmful aspect of Mütze's collaboration with the secret police was his support of the draconian security system at Zeiss. Granted, he tried to ensure that security measures did not impede research at Zeiss. Meeting with Stasi representatives in September 1980, Mütze argued that Zeiss was perfectly capable of maintaining high standards of security under rules established by Biermann. The research center security department (known as "WS") paid particular attention to high-security research in areas such as microelectronics, as well as state contracts and "Z themes" (priority projects). WS recommended security measures, but "fundamental decisions regarding secrecy regulations and possible specific application of the state security doctrine are to be determined by Prof. Mütze." The Stasi representatives came away from the meeting satisfied that Mütze was doing his job well.[78] Nevertheless, the MfS was clearly in charge of security and could step in at any time to override the Zeiss administration's security regulations.[79]

Mütze was telling the truth when he said, "I follow a tough policy with the travel cadres for the Western world."[80] His file is filled with cases in which he questioned the wisdom of allowing a particular researcher to continue to travel to the West. This could be over as petty a matter as a divorce, separation, or even serious quarreling with a spouse: A scientist or engineer without a spouse at home could not be counted on to return to the GDR.[81] (Homosexuality was also grounds for forbidding travel to the West.[82]) It is unclear what role Mütze played in another case: It was thought that one Zeiss employee had overstepped his authority in working out a deal to give a Western customer a price break in return for an offer to provide several months' training to another Zeiss employee at that Western company. When the culprit's permission to travel to the West was permanently revoked, he had to find another position at Zeiss.[83] In several other cases, Mütze advocated the termination of travel cadre status for even more subjective reasons.[84] Also very onerous were the restrictions on Western contacts, which were strictly enforced for travel cadres (361, or just over 10 percent of the 3,500 individuals working in Research Center W) and personnel with security clearances (510, or roughly 15 percent of all Research Center W staff). Such employees had to notify Zeiss if they had any Western contacts (including relatives).[85] This triggered investigations, which in thirty-seven cases (during an unknown period of time) led to termination of travel privileges.[86] Employees were told they were expected to sneak out the back door and spend the night at a hotel when a Western relative unexpectedly came to visit them at home.[87]

Buthmann has shown that such policies caused widespread discontent at Zeiss and made it difficult to recruit and retain top personnel.[88] Indeed, Mütze's Stasi files show that he was quite aware of the scarcity of qualified R&D personnel at Zeiss. In 1978, a desperate search was going on to fill at least two key management positions. Mütze saw problems in the development of important Zeiss instruments as at least partly related to the lack of decisive managerial leadership in these areas. Zeiss could find no one who had the necessary technical and scientific background, fulfilled security qualifications, and was sufficiently assertive. Desperation (and perhaps a certain glimmer of humor) displays itself in his report to the Stasi: "In these meetings we have not yet found a solution. We have gone through the cadres for the Soviet Union, the reserve cadres, the cadres-in-training, second cadres, assistants to our present division chiefs, we still don't have a solution, will meet again next week. Everything that we have discussed up until now, we rejected in the end." Mütze clearly felt that at least one manager who was in the SED was not very competent. On the other hand, Mütze thought highly of a couple of scientists who could not be promoted into managerial positions because they were not party members ("but both are not in the party, that is the central problem"). However, neither in this nor in a later report does he complain about the difficult personnel problems caused by security regulations and political imperatives. He comments on, but does not speculate on the causes of, the pattern of indifference and lack of motivation among research personnel: "After a vacation, a visit to the health spa, and another vacation, Prof. [name blackened out] assumed his responsibility in [name of department]." He was on vacation during the defense of a proposed plan. Two other colleagues were on vacation, and another out sick. The one man left in charge of the defense was utterly overwhelmed, and the poorly prepared plan was shot down by state bureaucrats.[89] A year later, Zeiss was still looking for a new manager in this department.[90] A lack of good managers and a high rate of personnel turnover plagued other research units as well. In a 1979 report, Mütze reports on these problems just after having spoken about discontent among managers and their families concerning regulations on contact with Westerners—and yet he does not note the connection between the two sets of issues.[91] Surely this reflects not naïveté, but rather a reluctance to address political taboos.

In his reports to the Stasi, Mütze failed to comment on Zeiss's declining performance since the 1970s in what had been its core research agenda. Historian Manuel Schramm has shown that Zeiss was genuinely innovative and able to compete on the world market until the mid-1970s. The LMA 1 (which came out in 1965), the first scientific instrument that Zeiss equipped with a laser, built upon Zeiss strengths in microscopes and precision instrument building. It was based on a technology developed by an American company, but Zeiss researchers had made improvements, giving the device better optics and making it more user-friendly. It was a successful export item. Schramm believes that the older values of quality and precision still guided research strategies at that time. Due to a lack of further work and continued improvements, the LMA1 lost out to the competition in the 1970s. There are other examples of excellent incremental innovations at Zeiss that were not further developed, often because of a lack of personnel. Increasingly, according to Schramm, Zeiss merely imitated Western technologies without improving them in ways that would have made them more attractive to customers. Personnel complained in the 1970s of overly great bureaucratic control and a dearth of laboratories and equipment.[92] This is representative of the ways in which traditional fields of research and development at Zeiss suffered under the new model, which involved militarization, Stasification, slavish imitation of Western technologies, and over-bureaucratization. Mütze studiously avoided discussing these issues.

Mütze and other top Zeiss managers did not seem to see military and Stasi research as particularly promising, though they never would have openly complained about these things. They eagerly supported Biermann's recommendation to shut down research on sea-based surface-to-air missiles in 1986 and to shift resources into civilian research.[93] Indeed, the microelectronics program opened up tremendous professional opportunities for Mütze. He was rewarded for his loyalty to the SED and the Stasi with a promotion to head of the microelectronics program at Zeiss.

Unfortunately, the records released thus far provide only the sketchiest impressions of his evolving relationship with the SED and the Stasi during his time as head of microelectronics research at Zeiss. Only two thin secret police reports remain from that period, and they read like official declarations of policy. In them, he echoes the arguments that the SED leadership was making about microelectronics. Just ten days before the fall of the Berlin Wall, he declared that to remain an industrialized country, the GDR had to embrace worldwide trends: expansion of communications (including computerization), automation, consumerism, ecology, and improvements in energy production and transportation. "If we recognize the importance of these trends, there is no alternative to the widespread application of microelectronics." He specifically mentioned the importance of the use of electronics in East German–made machinery, particularly Zeiss products.[94]

By 1988–1989, Mütze was acutely aware that the GDR could not afford to continue to pour money and resources into this program, however. He counted on the completion of the project to develop and put into production a 4 MB memory circuit—with the help of the Soviet Union (a dubious proposition). But he stated categorically, "The GDR is not at present going to go beyond the 4 MB memory circuit." He asserted that if the GDR gave up developing new generations of general-purpose integrated circuits, it had to concentrate on the production of application-specific integrated circuits (ASIC), which were customized integrated circuits used for specific purposes, a technology that required a relatively modest R&D capacity. He was confident that the GDR would be able to make substitutes for those electronic components that were under embargo.[95] Hope was, of course, a professional necessity in this period.

Professional Ethos and Totalitarian Impulse in High-Tech Industry

Even for engineers and industrial scientists who were not in top positions, the bureaucratic control of the SED increased greatly during the Honecker period. One Zeiss researcher writes:

> Managerial positions were systematically filled with SED members who were true to party principles, and who of course had to write reports for the party and were slaves to party discipline. New hierarchical levels were created, and staffed with more or less productive "circles" that called the shots. Poor technical knowledge was compensated for with bureaucratic procedures, and the creative element fell by the wayside more and more [as a result of] legwork, painstaking reports, brigade plans, and competitions for socialist titles. Honesty in plan fulfillment and the bonus system also suffered.[96]

According to historian Axel Salheiser, 77.6 percent out of a total of 2,224 Honecker-era department heads in the electronics industry were members of the SED; 92.5 percent of the middle tier (2,209 in number) were in the SED; and 100 percent of all top managers (of whom there were eighteen) were party members. But higher education was more than ever a prerequisite for a management career in the electronics industry as well: 92.4 percent of the department heads, 96.8

percent of upper management, and 100 percent of top managers had a college or university degree, overwhelmingly in science or engineering. Over 90 percent were men. It is not surprising that managers in the electronics industry were more highly educated than their counterparts in other industries (since a good scientific and technical background was needed to make decisions in this high-tech area). However, it is quite striking that there were more SED members among electronics industry managers than among managers in other industries. Using other indicators as well, Salheiser shows that political loyalty was the most important component in electronics industry careers.[97]

Some tried to avoid political obligations and to escape into purely technical work. "Most were happy if they found a niche, even members of the Research Council," recalls Hans Becker, thinking back to his days at ZMD (Forschungszentrum Mikroelektronik Dresden), as Hartmann's old institute (now part of Zeiss) was known in the late 1980s, and also remembering the reduction of the role of the Research Council to insignificance.[98] However, it was difficult to be "just an engineer." Those not willing to curtail contacts with Westerners were consigned to less interesting and less well paid jobs. Bonuses and promotions were to a certain extent dependent upon "social" activities, by which were meant political and paramilitary activities such as the *Kampfgruppen* (in charge of protecting the factories in case of civil unrest), but also participation in SED-dominated organizations.[99]

At Zeiss, pride in the firm's heritage was doubtlessly bolstered by its rise to great prominence in the 1980s, yet there were also factors that undermined a sense of elitism. In particular, it is surprising how low earnings were. On average, the gross monthly earnings of East German university graduates in research or engineering was 1,442 East German marks in 1989, while their West German counterparts earned 5,826 DM (deutsche mark, the currency of West Germany) gross per month.[100] Not precisely comparable, but nonetheless interesting, are the figures for monthly earnings at Zeiss. In 1985, employees of Research Center W earned an average of only 1,090 East German marks per month. Almost two-thirds of this personnel were college or university graduates, and nearly a third skilled workers (who in the GDR tended to earn nearly as much as engineers).[101] A sense of professional identity and professional pride was undermined by other factors as well, most notably the decline of qualified work. According to Salheiser, 60.6 percent of all electronics industry factory foremen (*Meister*), a position for skilled workers, had college or university degrees.[102] Few Zeiss employees could travel to conferences or other meetings in the West. Contacts with colleagues in Eastern European countries were closely controlled. Even contacts among Zeiss employees were constrained. Personnel in civilian research rarely had contact with those in military research.[103] The latter only had access to information on what was going on in "special" research and production on a "need-to-know" basis.[104] Thus, discussions of professional matters were highly restricted, much more so than, for example, in the U.S. defense industry during that era.

The Stasi had the power to enforce these and other security measures, as well as to punish technical personnel for alleged acts of "sabotage." A report on Stasi industrial cases (mainly in high-tech industry) that led to convictions before East German courts of law in 1985 mentions eight engineers, scientists, and managers who were prosecuted and sentenced to prison terms ranging from three and a half to fourteen years for undisclosed crimes. This report also lists five cases in which courts demanded that a fine be paid to the Stasi. In two cases, the punished party appears to have been an East German citizen, in three cases a foreigner or a foreign company (the West German corporation, AEG, was one). A total of about 2.4 million (West German) DM in such fines were paid to the Finance Department of the MfS in 1985. (Reports for other years have not been found thus far.) Lesser punishments were meted out for offenses deemed less serious. These included nonrenewal of travel cadre status and transfer to another job. In one case, an important person working in top-secret military research was accused of "conspiratorial" contacts with Westerners. Essentially given a choice between being put on trial and becoming a Stasi informant, he or she chose the latter.[105]

These restrictions and controls had an impact on notions of how researchers in responsible positions and lower managers should conduct themselves, as can be seen in reports by Mütze on civilian research personnel. One report states, "[name blackened out] loves good music (Bach) and is very well-read. According to the information of the IM, [he] is also thought to have familiarized himself with the classics of Marxist-Leninism."[106] Mütze reported that another scientist, a member of the SED, "is very athletic. He is active in canoeing, tourism, and hiking with a folding boat, and participates in a number of athletic events, such as the [word illegible] run. He has transmitted this athletic attitude to his family. His wife and two sons are fully involved in this tightly organized, Spartan, training-oriented life. Something perhaps characteristic: In this family, no one smokes, or drinks coffee or alcohol."[107] Stable family life was considered an important attribute: "I think that he has a good relationship with his family. . . . There are well-ordered conditions in his family. If I am not mistaken, they go on vacation together, go on weekend expeditions together. In my opinion, that is an orderly [set of] circumstances, there are no problems. . . . these are clean circumstances." The same manager was praised for his willingness to work all weekend long if necessary.[108] One female employee was criticized because she had to leave work punctually at the official end of the work day so as to be able to get home to take care of her children.[109] Marital difficulties were seen as a considerable liability. One scientist was criticized for often coming to work in shabby clothes "because the attractiveness of his wife required much money." It was approvingly noted that he had later divorced her and married someone else. A profound knowledge of the Russian language and Russian "mentality" earned one Zeiss employee praise.[110] In addition to underlining political loyalty, these reports demonstrate conventional family values, tied to the wish that Zeiss employees be willing to work long hours. A couple of reports reveal admiration for self-discipline, mixing militaristic undertones with a modern preoccupation with fitness. More extensive material from various sources would be needed to judge whether this is what was generally expected of employees in East German high-tech industry during this period.

Certainly, the actual behavior of engineers and scientists in high-tech industry differed greatly from the ideal described here. A set of reports from 1988 demonstrate what the Stasi was trying to achieve on a day-to-day basis, and how technical personnel reacted to the Stasi presence in industry. These reports deal with the building and outfitting of a factory for Robotron by a Swiss company (as general contractor), a West German construction company, and a West German equipment supplier, Fuba. The factory was to produce multilayer printed circuits, used in military projects and equipped with CAD/CAM technology (computer-based industrial design systems). Authorized at the highest level (Politburo and Council of Ministers) in 1987, the project was to be completed in 1990. The goal was to make the GDR self-sufficient in the production of these circuits, which had been imported from the West up until then, at a cost of about 50 million valuta marks (the currency unit used in foreign trade, pegged at about a 1 : 1 exchange rate with the West German DM). This project, along with a second plant of the same kind, cost 350 million valuta marks. It was also a sensitive project. The building of the factory and supplying of equipment did not involve the violation of the CoCom embargo, but the acquisition of necessary software (a so-called artwork system, or software used for integrated circuit layout design) would. This, along with the project's value and high priority and the dangers posed by interaction of East German personnel with West Germans, made this project the object of particular Stasi scrutiny.[111]

One of the main functions of the Stasi was to ensure the smooth and timely work of the foreign companies. Unofficial informants imbedded in the project assured the Stasi that construction work was going very well, that the buildings were of excellent quality and would be finished early. The equipment supplied by Fuba was deemed state-of-the-art. Software was the problem. Fuba originally wanted to supply out-of-date software that was not under embargo. Having been called before West German customs officials to answer questions about the East German project and to insure that no embargoed items were being supplied to the GDR in January 1988, Fuba management felt nervous about getting embargoed "artwork system" software for Robotron. However, a Stasi IM, referred to by his pseudonym, "Lauer," used his "personal, confidential relations" with a Fuba representative to gain cooperation. They socialized in private, bringing along their families. The IM was put in touch with independent agents, and told to use a code word in contacting an Israeli firm that might be willing to supply the embargoed software. It was reported in October 1988 that Robotron had not yet been able to get the necessary artwork system. Unexpectedly, the United States lifted the embargo in early 1989, allowing Fuba to legally sell the software to the GDR.[112]

The secret police was also in charge of investigating the West Germans with whom Robotron was negotiating and ensuring that they were dealing honestly with the GDR. The Stasi studied "an in-depth picture of [each West German individual's] personality." When a Fuba manager suggested that Robotron contact a third party willing to circumvent the embargo, the Stasi pondered the possibility that Fuba might be working together with Western intelligence in preparing a trap. The Stasi investigated the Fuba manager, along with other Westerners with whom Robotron was dealing, seeking to identify potential saboteurs. Officials were happy with the results of that investigation, which evidently uncovered no saboteurs.[113] The Stasi was also on the lookout for any Westerners who were willing to work for the Stasi, but seem not to have found anyone. They did, however, manage to recruit some unofficial informants from among Robotron employees on the project team, concentrating efforts on those in important positions.[114]

The Stasi wanted to prevent any sort of potentially subversive contacts between Robotron employees (some of whom received training in West Germany) and employees of the Western companies. The worst case scenario was, of course, defection to the West. One East German industrial scientist being trained on the new equipment at Fuba did slip away and declared to the West German authorities his intention to stay in the West. This was attributed to his "deficient political-ideological attitude," as well as to his desire to escape being pressed into service as an IM. Also upsetting to the secret police were the valuable "gifts" that representatives of the West German companies gave to a Robotron employee during negotiations. These included a camera worth 12,000 marks, a 5,000-mark drill, and whisky. Surprisingly, the Robotron representative was an unofficial informant, who was quoted as saying, "Take everything that is worth taking!" and, "What I learned during the visits to Western firms, I would never have learned in the GDR, or only in ten years." The Stasi was concerned that dangerous contacts could arise at dinners and on excursions that brought East and West Germans working on the project together. The number, variety, and quality of the activities that Robotron employees organized for their West German guests, despite Stasi opposition, but with permission of their boss, the IM "Lauer," demonstrate a certain resistance to neo-Stalinist thinking. In 1988, employees of the West German companies were invited to the Semper Opera House, a dinner at the Hotel Bellevue, and a soccer match featuring Dynamo Dresden; employees of East and West German construction firms played a soccer match and socialized afterwards; there were housewarming parties for West Germans who were beginning a long stay in Dresden; and West and East Germans made bets with each other. In 1989, one Robotron employee who took the West German guests on tour of Dresden did not, in the opinion of his superior (an IM), report as extensively as he should have about those contacts. He was forbidden from organizing any further expeditions. On the other hand, the training program in West Germany went well from the point of view of the Stasi (aside from the defection). The West Germans behaved in a very professional manner; there was little fraternization; and the East Germans were treated respectfully.[115]

The Stasi also became involved in much more mundane, day-to-day management issues. In some cases, it would appear that the Stasi was essentially playing the role that the labor market, incentives, and internal hiring, promotion, and firing procedures played in the West. For example, one of the Robotron employees assigned to work together with the Westerners in setting up this factory drank excessively at his workplace, even during negotiations with the Western companies. Stasi officials let an IM in a managerial position know about the problem, and the latter warned the alcoholic that he was in danger of being demoted. He was also forced to get rid of the many liquor and beer bottles strewn around the office. In the end, he lost his status as a travel cadre for Western countries (which presumably disqualified him from further work on the project).[116] In another case, a manager in this project who was also an IM and a member of the SED was accused of "poor performance," lack of discipline, dishonesty, "insufficient political motivation," inability to encourage teamwork, and inadequate technical background for the project. The Stasi wanted his superiors (also IM's) to force him to step down from his function within this project. His immediate boss had been dragging his feet for at least a year, however, allegedly because he wanted to insure his own continued status as a travel cadre by making sure the man below him was not very capable.[117]

One report contains a rather critical evaluation of the Robotron combine's administration. It was accused of not having done enough to find personnel that could be assigned to the factory-building project, and of having been remiss in allocating funding to East German subcontractors. The IMs who leveled this criticism were invoking the special status that their clandestine relationship with the secret police gave them to criticize the top management, something they would never been able to do had they not been working for the MfS.[118]

Stasi operatives also pointed to environmental concerns raised by the building of the factory. In April 1989 a Stasi informant overheard conversations in public places that seemed to indicate that the populace was worried the new plant would cause pollution. People on the streetcar and in the supermarket (*Kaufhalle*)—whom he said he could not identify—expressed concern about gases and vapors emanating from the plant, as well as the negative impact on the microclimate in the Elbe River valley. First Secretary of the SED in Dresden (and later premier of the GDR, November 13, 1989–March 18, 1990), Hans Modrow, visited the factory construction site in Dresden-Gorbitz on May 3, 1989. He promised that the government would look into what pollution could be expected and what to do about it. He expressed his intention to work on the public relations aspect of the problem. Fuba was also asked to provide equipment that would cleanse the runoff from the plant. The real problem—clearly addressed in this report—was that there were no good procedures in the GDR for disposing of the copper- and chemical-laden sludge left over after the production process. It is quite possible that the reports of Stasi informants helped set the stage for an acknowledgment of the problem.[119] If so, this stands in sharp contrast to the attempts of the Stasi to hush up problems of pollution and workers' health problems in the chemical industry.[120]

In sum, it is clear that during the Honecker period, the Stasi and SED greatly increased their control over day-to-day technical and managerial decisions in high-tech industry by coopting engineers and industrial scientists, particularly those in key positions. The intention on the part of the secret police was totalitarian: to orchestrate an innovative process from above and prevent any interference in this process. The Stasi saw itself as combating both sabotage and human failings, and even inefficiencies or blind spots of the system. Thus, at least segments of the secret police had developed a more sophisticated way of seeing the world, one that acknowledged imperfections in the socialist system, though these were seen as minor problems that simply required a bit of fine tuning.[121] This corresponded to the more sociological ways of seeing barriers to innovation that had developed in the SED in the 1980s (discussed in chapter 7). These insights did not lessen the totalitarian impulse, however. The case study of the high-tech factory demonstrates that the Stasi believed in the "Big Brother" style of management, trying to micromanage interpersonal relations down to the smallest detail, taking charge, for example, of getting rid of beer and liquor bottles that might offend West German subcontractors. If anything, the more modern, self-reflexive way of thinking in certain SED and Stasi circles reinforced the urge to seek total control, which could be legitimized as being based on superior understanding of the workings of society.

The reality, of course, was not totalitarian. Individuals resisted secret police interference in many different ways and for many different reasons. They were in some cases driven by individualistic, selfish motives, as in the case of the bribe taker, or the case of the boss who dragged his feet about getting rid of an incompetent employee for fear that a more able person might become a rival. There are some signs (such as in the pollution issue or in criticism of the heads of Robotron for not devoting enough attention to the factory-building project) that IM's were using the Stasi as a kind of substitute civil society—a way of complaining to party and state about perceived problems.[122] There was also resistance to police state oppression. The defector to the West wanted to escape being forced to become a Stasi informant. In other cases, recalcitrant employees were motivated by a more liberal view of the world, a belief that it was better to win over people from the other side by demonstrating positive human attributes (perhaps through a friendly soccer match or bet). They were shielded by a superior who was an IM. Though the Stasi blanketed this project with unofficial informants, it did not succeed in converting all of them to its authoritarian views. Individuals were constantly testing what they could get away with vis-à-vis the Stasi. Such actions did not so much challenge the power of the secret police as subtlely subvert it. The examples cited here constitute a form of *Eigen-Sinn*, a term coined by Alf Lüdtke that means something like a stubborn resistance to dictatorship, an expression of a sense of identity that can run counter to the mandates of the dictatorial system. The scope of this rebelliousness was limited by caution. In the examples cited here, There was no mention of the big issues facing the East German economy. For example, no Stasi informants or others pointed out that international cooperation was extremely beneficial, and could have pointed a way out of the straitjacket of autarky policies. The contrarian attitudes and action of technical personnel were nonetheless significant. Historian Thomas Lindenberger writes, "Such 'unsocialist' phenomena signify inherent limitations of the ability of the dictatorship of the party to control."[123] They do not necessarily coalesce into organized resistance, but disrupt dictatorial rule in hardly noticeable, very decentralized, unpredictable, and ultimately uncontrollable ways. Moreover, *Eigen-Sinn* can potentially be activated into some kind of true resistance. This happened slowly in the GDR.

By the late 1980s, criticism of the regime was spreading like wildfire through the factories, offices, schools, and homes of East Germany.

The GDR's Final Hour

By the late 1980s, the GDR was facing a crisis of epic proportions. Plagued by inefficiency, low productivity, and declining ability to compete in the world market, its economy was stretched to the breaking point by massive social welfare programs and huge expenditures for high-tech programs. Starved of resources for decades, most of East German industry was burdened by obsolete, crumbling factories and equipment, pollution, and periods of inactivity caused by breakdowns in the supplies of components and raw materials. Under Gorbachev, the Soviet Union was no longer willing to provide the support that it had in the past. Historians Jeffrey Kopstein and Charles S. Maier have argued that what ultimately brought the East German economy to its knees was the lack of political will to make cuts in the welfare state, consumer-price subsidies, wages, and building projects—cuts that would have allowed greater investments in industry.[124]

The crisis that precipitated the collapse of the GDR began when, having been promised that the Soviet Union would not intervene, Hungary began opening its border with Austria on May 2, 1989. East Germans began streaming into Hungary, and from there into West Germany, motivated by a desire to free themselves from political oppression and to be able to travel, but also by discontent over the economic situation. In the subsequent crush of events—the mass exodus of East German citizens, the authorities' attempts to stem the flood, and the spreading mass protests in East Germany—economic problems greatly reduced the ability of the East German leadership to gain control over events. Ultimately, the decisions not to resort to the "Chinese strategy" (i.e., a massive crackdown using brute force, like that at the Tiananmen Square massacre) and to push Erich Honecker out of power were political in nature—just as Gorbachev's decision to liberalize the Soviet Union was essentially political.[125] Nonetheless, the urgency of East Germany's economic problems very much weakened the position of the SED. According to Alexander Schalck-Golodkowski, head of the Commercial Coordination Unit (*KoKo*) of the Ministry for Foreign Trade, the GDR would have been utterly bankrupt by early 1990 and would have had to default on its international loans, had the system not come crashing down shortly before that happened.[126]

The extent of the crisis was not publicly revealed, yet the population was all too aware of the shortages and declining quality of consumer goods that accompanied this downward spiral. Complaints concerning a whole range of consumer goods became quite loud in the late 1980s, and increasingly undermined the SED's credibility, as historian Jonathan Zatlin has shown.[127] This encompassed the high-tech sector as well. Reports of two IMs brought widespread complaints about the lack of GDR-made computer programs for PCs to the attention of the Stasi.[128] Opticians and consumers also complained that the delivery times for prescription lenses for eyeglasses were far longer than the promised six weeks and that many had to be sent back to the optical works where they were made because they were defective. The vice chairman of the Council of Ministers, Werner Krolikowski, addressed this problem in a letter to the general director of the Zeiss combine, of which the optical works were a part. This is an indication of how serious the problem was considered.[129] According to Stasi reports, consumers believed that the quantity and quality of goods for sale was worse than at any time in recent memory.[130] This was the result of the deteriorating production facilities, but also of long-term decline of motivation in East German industry. Discontent over economic problems and swelling enthusiasm for Gorbachev and the experiment beginning in the Soviet Union combined to produce a growing sense of unease in the GDR. This mood spread to high-tech industry.

Stasi reports make the connection between problems in research and production on the one hand and, on the other hand, poor employee morale or political disaffection at Robotron and Zeiss in 1988. Though this was a time-honored refrain in Stasi and SED reports, the very detailed accounts add to the plausibility of the Stasi's analysis. For eight years, Robotron had been working on a 14-inch computer hard disk storage unit. Between 1980 and 1988, the project had cost about 71 million marks, including about 10 million valuta marks for the importation of equipment from the West. Two hundred and fifty employees were part of this project's R&D team. Like so many projects of its kind, this was an attempt to reproduce a technology introduced in the West years before, and already obsolete. In 1980, U.S. manufacturer Seagate Technology had introduced a 5-megabyte, 5¼-inch hard drive that superseded the 14-inch hard drive. But East Germany had difficulties reproducing even the older technology. Robotron failed to reach the 1988 plan goal of producing 762 units of model K 5501, which was a 15- to 35-Byte hard disk storage unit. Only 444 were produced, of which 356 could be delivered to customers. However, 140 were returned to Robotron because they were defective. Three million marks' worth of these hard disks were sitting in a warehouse, unsold and unsellable. The Soviet Union was not interested in purchasing any. This model had acquired such a bad reputation that top management at Robotron thought it best to discontinue it. Long delays in the development of a 60- to 150-megabyte 14-inch hard disk, the K 5502, were caused by difficulties in figuring out the manufacturing technologies. Plans to start producing 100,000 next-generation hard disks a year in 1990 seem illusory. Even if successful, this 5¼-inch, 50-megabyte hard disk would have been ten years out of date by the time it was produced.

These problems were not lost on Robotron personnel. It was thought that the decision to continue work on the 14-inch hard disk was based on a desire to hold on to the workforce needed to produce the 5¼-inch hard disk from 1990 onward. Members of the research teams expressed the opinion that, given the lack of production capacity in East German industry, it would be better to shift resources to the production of other products. Personnel in this project displayed "tendencies towards resignation, indifference, as well as lack of trust, and saw their present work as pointless." Managers were dismayed that neither the general director of Robotron nor the Minister for Electrical Engineering and Electronics had taken action to terminate this project.[131]

At Zeiss, the gem of East German high-tech industry, performance had been declining and discontent had been mounting for years, as secret police documents published by historian Buthmann show. The quality of Zeiss products and the volume of Zeiss's exports to the West had been declining since the early 1980s, including areas of traditional Zeiss strength, such as optics and precision instruments. However, this was not acknowledged. Top management got into the habit of regularly manipulating data to disguise these problems. Reports falsely claimed that Zeiss was fulfilling state economic plans. Biermann was easily able to prevent state and party officials from exposing this whole corrupt system. But senior administrators became increasingly convinced "that the attempts to fulfill the plan were not worth it, that things cannot be managed any more, the situation cannot be changed since conditions in the combine are not conducive to [fulfilling] the lofty goals/demands." Many employees felt "that there is a contradiction between the perpetual announcements of successes in our mass media and the actual situation in our combine." They felt that the root causes of poor performance were not being addressed. Also, the "deceit" perpetrated by Zeiss management through the falsification of data was not lost on them. This caused many Zeiss employees to become pessimistic about the future prospects of the East German economy.[132] Another document shows that Zeiss research teams also at times tried to conceal problems in very important research projects from top management.[133]

Fear of retribution and resignation prevented managers from speaking up about Zeiss's problems. One IM expressed this as follows:

> Every questioning of decisions, whether openly expressed, hinted at, or falsely attributed, leads to such drastic repercussions for the individual that everyone vastly prefers, even when the evidence of a false decision is overwhelming [not] to get into such a discussion. The point has come where the decision-makers, and even more so the broad masses of the collective, are lacking in any motivation to try to bring about change. This lack of motivation is stems from the realization, reinforced time and time again, that it is futile to try to introduce changes. This means that the Zeiss system that we have come to know, is worn out and is starting to destroy itself.

The result was (according to the report) not a monolithic hierarchy, but, paradoxically, the emergence of entrenched, rigid "blocks," presumably centered around different areas of research and production. "[Zeiss] is lacking in that organizing force that every organization needs to redirect the conflicting interests toward the common goal." This Stasi report reflects an astonishing degree of self-reflection, soul-searching, and analytical thinking.[134]

Indicative of the depth of problems at Zeiss is the fact that not even production goals for military hardware for the Soviet Union were being met at Zeiss. According to a document unearthed by Buthmann, Zeiss was supposed to produce 164 tank targeting systems in 1989, but by September had only produced fifty-eight; it appeared that thirty systems for the Soviet Union were not going to be ready. Given the wrath that could be expected to rain down on East German enterprises unable fulfill contracts with the Soviet Union, particularly military contracts, one can imagine that Zeiss was doing everything it could. However, Zeiss research teams were flummoxed by the manufacturing techniques. But why? One major problem at the Zeiss "D" plant in Gera, where much of this military production took place, was that middle management tried to avoid responsibility for decisions, and in fact tried to avoid decision-making entirely. According to one Stasi report, "It doesn't matter what kind of problems are involved, whether production problems, political-ideological problems, or individual organizational problems . . . The majority of top administrators, if not directly called on to do so, refrain from personally contributing productive ideas." Due to the long hours spent in meetings and other tasks assigned to them by the plant manager, managers tended to neglect their managerial duties.[135] Focusing primarily on day-to-day concerns, managers increasingly displayed a "hectic and contradictory" decisionmaking style, which led to "mistakes and deficiencies in work organization and work morale." This was worsened by intermittent bottlenecks in the supply of components, and very uneven flow from one production stage to another of partially assembled machines for personnel to work on. Rank-and-file employees also complained about being excluded from decision making, about the general lack of organization at the plant, and a lack of information about what was happening.[136]

By December 1988 discontent at this Zeiss plant in Gera was beginning to take on political forms. In the elections for the department-level SED organization, there were almost as many votes against the official candidates as for them. This was interpreted, probably correctly, as an attempt to force the factory's SED organization to respond to the complaints of the grass roots. Party work fell into ever-growing disarray. One SED cell did not meet for two years. Several SED officials and members resigned from the party. Reasons included "the general political situation in the GDR, unsatisfactory information policies of the mass media, shortages and injustices in the supplying [of goods] to the population, morale at the plant (for example, bad working atmosphere, poor organization of work)." Other topics of conversation included the expense of the new Wartburg (the luxury-class East German automobile); the advantages of getting and holding on to Western currencies; the lack of travel freedom; and the East German authorities' decision to ban *Sputnik*, a Soviet publication that under Gorbachev started addressing heretofore forbidden topics, in October 1988. In protest, many plant employees resigned from the Society for German-Soviet Friendship, following the lead of citizens across the GDR.[137]

Thus, the factory reflects the rise and fall of socialist society in East Germany. This was the central site where citizens were supposed to come together and forge a sense of collective identity, the basic unit of socialist society. As the collective dream of technological greatness collapsed, so, too, did the function of the factory as focal point of East German society. At Zeiss, this dream had been tied to a sense of loyalty to Zeiss, a belief in historical continuity reaching back to 1846, a fiction that ignored Zeiss participation in the horrors of the Nazi era. However illusory, this cohesive vision nonetheless helped Zeiss find an important place in socialist society. The destruction of that tradition through militarization, Stasification, overexpansion, and oppression of middle management by Wolfgang Biermann fatally weakened sound managerial practices and undermined Zeiss's ability to continue to be an innovative powerhouse and major exporter. By the late 1980s, Zeiss's exports to the West were sharply declining.[138]

Conclusion

The impact of SED and Stasi attempts to assert total control over high-tech industry was complex. On the one hand, politically desirable hierarchies were reinforced. At Zeiss, party membership became a virtual prerequisite for a management career. The Stasi was able to gain the cooperation of managers in key positions. IM's may have enjoyed particular professional mobility under Biermann's aegis (as Mütze's career would seem to indicate), but the story is more complicated than that. Mütze tried to play it both ways. He tried to protect himself and advance his career by cooperating with the secret police, but also sought to preserve Zeiss's traditional strengths and protect Zeiss employees from the Stasi. In the end he failed at both. A product of the system, he was blind to its profound flaws.

Mütze's worst failing was that he missed the larger picture. A guardian of the Zeiss tradition in optics and precision instruments in small things, he averted his eyes from the on-going militarization of Zeiss, which was slowly destroying the core of what Zeiss did best. Later, Mütze allowed himself to be seduced into taking charge of the microelectronics program at Zeiss. Gargantuan and ill-conceived, this program further eroded those areas in which Zeiss had been internationally competitive. Mütze also supported the oppressive security system at Zeiss and the very restrictive travel cadre system that conferred the privilege to travel only on those with spotless political records, thus denying most research personnel the international contacts that would have had a stimulating impact on their work. He did not complain because by this period such issues were taboo.

Under the stress of Stasi and SED surveillance and control, technical managers and professionals, too, had to concentrate on small, local issues. Here they might be able to preserve some modicum of autonomy. Here the specialists might have the last word. The big issues, though of central importance to technical experts, were off limits.

Only Zeiss General Director Biermann could address such issues. He lost out in his attempt to reject the massive military program for the Soviets that began in 1983. He was successful, however, in getting the program to develop seekers for sea-based surface-to-air missiles canceled, and in taking on the microelectronics program. Whether the latter was good for Zeiss is debatable. Biermann's attempts to falsify performance at Zeiss were highly counterproductive. In a very mixed, somewhat contradictory review of Biermann's accomplishments and failings, Schreiner writes:

> That Wolfgang Biermann as General Director was so unusually successful was doubtlessly due to the pitilessness and lack of compromise in his leadership style, the ability neither to lose himself in the pitfalls of the economic system, nor to let himself be ground down, but, unperturbed by self-doubt or even human understanding of the problems of subordinate managers, to go his own way and *to push through what had been instructed to by the party and state leadership*. . . . The command economy needs commanders, only thus can it function. On the other hand, there is no question that the lack of democracy in the top management team connected with this led in the end to collapse.[139]

How did the growing power of the SED and Stasi look from the perspective of the masses of engineers and industrial scientists in high-tech industry? A minority joined the SED or became IMs. Only political conformists were allowed to travel to the West. Others were cut off from this enriching professional experience. At Zeiss, restrictions on contacts with Westerners were tight. Those who did not conform were shunted off into less interesting jobs. But almost all engineers and industrial scientists experienced deprofessionalization in one form or another: a lack of creative work, low earnings, placement in jobs not meant for college or university graduates, virtually compulsory participation in SED-organized activities. Fearing punishment, many conformed. Mütze was probably not alone in Stasi circles in hoping that educated cadres would become conformists who practiced self-discipline and had an "orderly" family life. Not only those who signed on with the MfS but also those who escaped into private niches helped stabilize the system.

Many employees (and even some unofficial informants of the Stasi) complained vociferously about the problems they saw around themselves, the resignation, the corruption. When these complaints went unanswered for years on end, many succumbed to resignation, and became primarily interested in looking out for their own interests and safety. Even middle management retreated into an attitude of utter passivity. Individualistic, egotistical, or cynical attitudes expressed themselves in all sorts of ways. Sometimes these were punished, as in the case of the alcoholic. But if the offender occupied a high enough position or was deemed useful to the Stasi, he might well be able to get away with it. Thus, the man who negotiated so successfully with the West Germans was not punished or called to order for taking bribes, protecting an incompetent underling, or allowing his employees to socialize with West Germans. Only at the very end, when Gorbachev rekindled hope for change, did overt protests begin.

Cooperation with the Stasi did not represent a way out of the dilemma. The Stasi enabled the GDR to build up a gargantuan microelectronics program by procuring prototypes and manufacturing equipment, but in so doing may have done the GDR a disservice by diverting resources from the rest of industry and by driving the GDR into financial ruin. But for most high-tech industry engineers and industrial scientists the only alternative to this program was to recognize that the dream of technological greatness was dead, and to concentrate on individual survival.

Notes

1. See, for example, Jörg Roesler, "Einholen wollen und Aufholen müssen: Zur Innovationsverlauf bei numerischen Steuerungen im Werkzeugmaschinenbau der DDR vor dem Hintergrund der bundesrepublikanischen Entwicklung," in *Historische DDR-Forschung*, ed. Jürgen Kocka (Berlin: Akademie-Verlag, 1993), 276–279.

2. Combines were like socialist conglomerates, usually twenty to thirty enterprises from the same industry, run by a general director who also headed the combine's flagship enterprise. See Kopstein, *The Politics of Economic Decline*, 95–99.

3. On debates as to whether the Stasi was a loyal servant of the SED (the "sword and shield" thesis) or an institution with goals and a power base of its own (the "state-in-state" thesis), see Catherine Epstein, "The Stasi, New Research on the East German Ministry of State Security," *Kritika* 5, no. 2 (Spring 2004): 323–328, and literature cited therein.

4. See Gerhard Barkleit, "Moderne Waffensysteme für die Sowjetunion," in *Deutsche Fragen: Von der Teilung zur Einheit*, ed. Heiner Timmermann (Berlin: Duncker & Humblot, 2001), 39–52; document in Buthmann, *Kadersicherung*, 201–207; Edith Hellmuth, "Investitionen als Indikator von Entwicklungsschwerpunkten im VEB Carl Zeiss Jena von 1978 bis 1987," in *Schaltkreise*, ed. Katharina Schreiner (Jena, Germany: Thüringer Forum, 2004), 102–141; Mühlfriedel and Hellmuth, *Carl Zeiss*, 318–319, 337–338.

5. BStU Archiv der Zentralstelle MfS-OTS, Nr. 1502, 5–13 ("K 5—Aktualisierung Pflichtenheft JO 4.03," September 26, 1984); 15–17 ("Langfristige Entwicklungskonzeption 1986–1990. Erzeugnisgruppe SON (O13)"); 70–95 ("Abschlußbericht Av-4 zum Thema TR," June 3, 1987, and "Pflichtenheft Teil II," June 4, 1987). BStU Archiv der Zentralstelle MfS-OTS, Nr. 1008, 2 (letter from Schmidt to Heise, September 1989). BStU Archiv der Zentralstelle MfS-OTS, Nr. 361, 138–143 ("Carl Zeiss Jena"). BStU Archiv der Zentralstelle MfS-OTS, Nr. 2151, 85–87 ("Pflichtenheft").

6. BStU Archiv der Zentralstelle MfS-OTS, Nr. 361, 33–37 ("Auszüge aus den Aktennotizen zur Besichtigung der Abteilungen des OTS," February 10, 1987), 122–147.

7. See documents printed in Buthmann, *Kadersicherung*, 215, 230.

8. See Mühlfriedel and Hellmuth, *Carl Zeiss*, 295–296, 298, 371; Hellmuth, "Investitionen," 119; Barkleit, "Moderne Waffensysteme 41, 48."

9. BStU Archiv der Zentralstelle MfS-OTS, Nr. 949, 54 ("Spezielles Leistungsangebot 1989," January 28, 1988).

10. BStU Archiv der Zentralstelle MfS-OTS, Nr. 361, 64 ("Auszüge aus den Aktennotizen zur Besichtigung der Abteilungen des OTS," February 10, 1987).

11. See, for example, Hughes, *Rescuing Prometheus*.

12. BStU Archiv der Außenstelle Gera, BV Gera, Abt. XVIII, Nr. 2960, 4 (letter from Erler to head of HA XVIII, November 28, 1983).

13. See Steiner, *Von Plan*, 191–226; Kopstein, *The Politics of Economic Decline*, 73–110; Klenke, *Ist die DDR*, 51–55. This crisis began in the 1970s.

14. See Bernd Görzig and Martin Gornig, *Produktivität und Wettbewerbsfähigkeit der Wirtschaft der DDR* (Berlin: Duncker & Humblot, 1991), 31–36; Bentley, *Technological Change in the German Democratic Republic*, chap. 2; Raymond Bentley, *Research and Technology in the Former German Democratic Republic* (Boulder, CO: Westview Press, 1992); Günter Kusch Rolf Montag, Günter Specht, and Konrad Wetzker, *Schlußbilanz—DDR: Fazit einer verfehlten Wirtschafts- und Sozialpolitik* (Berlin: Duncker & Humblot, 1991), 46; Steiner, *Von Plan*, 191–226.

15. On Schürer's role, see Charles S. Maier, *Dissolution* (Princeton, NJ: Princeton University Press, 1997), 60, 70–78. According to Maier, Honecker was ill-informed and vacillating. On use of microelectronics in East Germany machinery, see Klenke, *Ist die DDR*, 57.

16. See Barkleit, *Mikroelektronik*, 41, 27–28.

17. See Günter Mittag, *Um Jeden Preis* (Berlin and Weimar: Aufbau-Verlag, 1991), 248, 249–250; also see interview with Mittag in Theo Pirker, M. Rainer Lepsins, Rainer Weinert, and Hans Hermann Hertle, *Der Plan als Befehl und Fiktion* (Opladen, Germany: Westdeutscher Verlag, 1995) 20–28.

18. See Macrakis, "Espionage," 120.

19. See Barkleit, *Mikroelektronik*, 22–23, 36–53.

20. See Macrakis, "Espionage," 85–106.

21. See Barkleit, *Mikroelektronik*, 26, 28–34. High end of estimate of total costs of microelectronics program from Klenke, *Ist die DDR*, 93.

22. See Klenke, *Ist die DDR*, 83–102.

23. See Barkleit, *Mikroelektronik*, 46–54, 126–137.

24. BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 11–12 ("Kurzbiographie," June 6, 1966), 18–20 ("Lebenslauf des Studenten Klaus Mütze"), 78–79 ("Max," November 1, 1973), 87 (report, dated June 14, 1974); 102 ("Max," October 31, 1979), 107 ("IMS Wolfgang," March 13, 1980); quotation on p. 181 ("Vorschlag zur Werbung," Hauptabteilung XVIII/8/4, January 10, 1977).

25. BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 78 (report by "Max," November 1, 1973).

26. See Mühlfriedel, *Carl Zeiss*, 233–235, 242, 290–294, 372, tables 38 and 39.

27. BStU ASt. Gera MfS JHS 22052, 80 (Artur Wenzel and Rainer Sodeik, "Beitrag zur politisch-operativen Sicherung strategischer Vorhaben der Volkswirtschaft und Landesvertei-

digung," manuscript, Ministerium für Staatssicherheit Hochschule, November 4, 1986). Data on military research includes only personnel in *research*, not in production. For data on Research Center W, see Mühlfriedel, *Carl Zeiss*, 372, table 38.

28. BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 94 ("Treffbericht IMS 'Max'" am 28.1.1976).

29. See Mühlfriedel, *Carl Zeiss*, 315.

30. BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 88 ("Niederschrift des U-Häftlings Hartmann [UV 'Ernst'] 1975).

31. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 31–36 (report, dated November 17, 1977).

32. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 58–67 ("Tonbandabschrift," undated), 143 ("Treffbericht," February 13, 1979), 233 ("Treffbericht," March 12, 1980).

33. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 132–140 ("Treffbericht," November 24, 1978).

34. BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 111 ("Kontaktbestrebungen durch USA-Firmen").

35. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 182–183 ("Treffbericht," August 28, 1979).

36. See Mühlfriedel, *Carl Zeiss*, 319.

37. BStU Zentralarchiv MfS-HA XVIII, Nr. 10120, 116–117 ("IM Einschätzung," October 2, 1979). He was not made a "ZZ cadre," which would have given him approval to visit the Soviet Union, because this would have precluded permission to visit the capitalist West. BStU MfS ASt. Gera XV/1890/77 "Michael," Part I, vol. 1, 6 (report, dated May 6, 1970).

38. BStU MfS ASt. Gera XV/1890/77 "Michael," Part I, vol. 2, 11–12 ("Kurzbiographie," dated June 6, 1966), 186 ("Verpflichtung," January 17, 1977).

39. Buthmann, *Kadersicherung*, 94.

40. Mühlfriedel, *Carl Zeiss*, 342. See also Pröger, *Mikrostrukturen*, 240–248.

41. See Katharina Schreiner, *Das Zeiss-Kombinat: Fragmentarisches Zeitzeugnis 1975/1989* (Jena, Germany: Jenaer Forum für Bildung und Wissenschaft, 1999), 20–26.

42. See Pirker, Lepsius, Weinert, and Hertle, *Der Plan als Befehl*, 229.

43. See Buthmann, *Kadersicherung*, 48–68, 80, 87, 94–95, 104–110.

44. BStU Zentralarchiv MfS-HA XVIII, Nr. 6900 (report, dated September 14, 1984), 13, 14.

45. See Jens Gieseke, *Die hauptamtlichen Mitarbeiter der Staatssicherheit* (Berlin: Ch. Links, 2000), 114.

46. See Gerhard Barkleit and Anette Dunsch, *Anfällige Aufsteiger: Inoffizielle Mitarbeiter des MfS in Betrieben der Hochtechnologie* (Dresden: Hannah-Arendt-INstitut für Totalitarismusforschung, 1998), 35; Buthmann, *Kadersicherung im Kombinat*, 58.

47. On the establishment of policies, see Hans-Hermann Hertle and Franz-Otto Gilles, "Zur Rolle des Ministeriums für Staatssicherheit in der DDR-Wirtschaft," in *Der Schein der*

Stabilität: DDR-Betriebsalltag in der Ära Honecker, ed. Renate Hürtgen and Thomas Reichel (Berlin: Metropol Verlag, 2001), 173–189; Franz-Otto Gilles and Hans-Hermann Hertle, *Überwiegend Negativ* (Berlin: Zentralinstitut für Sozialwissenschaftliche Forschung, 1994).

48. BStU MfS Zentralarchiv HA XVIII, Nr. 5519, 5 ("Planorientierung für die politisch-operative Sicherung der Volkswirtschaft der DDR 1989," October 1988).

49. BStU MfS Zentralarchiv HA XVIII, Nr. 8649, 32 ("Protokoll über die Beratung des Leiters der Hauptabteilung XVIII am 15.11.1988 zur Einschätzung der politisch-operativen Lage im Sicherungsbereich"). See also Niederhut, *Die Reisekader*, 48–74.

50. BStU ASt. Gera MfS JHS 22052, 80 (Artur Wenzel and Rainer Sodeik, "Beitrag zur politisch-operativen Sicherung strategischer Vorhaben der Volkswirtschaft und Landesverteidigung," manuscript, Ministerium für Staatssicherheit Hochschule, November 4, 1986), 80–85.

51. BStU Zentralarchiv MfS-HA XVIII, Nr. 9110, 8 ("Konzeption zur Beratung beim Stellvertreter Operativ der BV Gera, Gen. Oberst Weigelt, am 4.3.1982, 10.00 Uhr").

52. BStU MfS ASt. Gera XV/1890/77 "Michael," Part I, vol. 1, 4 (note from [name of MfS official illegible] to Schumann, June 30, 1966).

53. BStU MfS ASt. Gera XV/1890/77 "Michael," Part I, vol. 1, 15–18 (report, dated December 20, 1971).

54. BStU MfS ASt. Gera XV/1890/77 "Michael," Part I, vol. 2, 186 ("Verpflichtung," January 17, 1977).

55. BStU MfS ASt. Gera XV/1890/77 "Michael," Part I, vol. 1, 6 (report, dated May 6, 1970).

56. BStU MfS ASt. Gera XV/1890/77 "Michael," Part I, vol. 2, 102 (report by Max I, October 31, 1979).

57. BStU MfS ASt. Gera XV/1890/77 "Michael," Part I, vol. 2, 95 (report by Rolf I, October 19, 1977).

58. BStU Zentralarchiv MfS-HA XVIII, Nr. 10120, 114 ("IM Einschätzung," October 2, 1979). The reports filed by his handler mention numerous attempts to talk Mütze into more frequent meetings. The unofficial informants in Barkleit and Dunsch's study generally tended to report to their handlers about fourteen times a year. See Barkleit and Dunsch, *Anfällige Aufsteiger*, 24.

59. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 30 ("Treffbericht," November 18, 1977).

60. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 88–94 (report on meeting with IMS "Michael" and IMK "Berg," June 20, 1978).

61. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 172 (report on meeting with IMS "Michael" and IMK "Berg," August 28, 1979).

62. BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 100 ("Wolfgang," November 20, 1979).

63. BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 103 ("Heinz Stein," November 1, 1979).

64. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 131 ("Treffbericht," November 27, 1978), 158 ("Treffbericht," March 13, 1979).

65. BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 94 ("Treffbericht," February 10, 1976). Examples of protecting Zeiss employees: BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 97 (report, dated January 31, 1978); 193 ("Einsatzkonzeption für den IMS "Michael," May 20, 1982).

66. BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 174–176 (report, dated May 20, 1976). Further examples in BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 12–14 ("Einschätzung zum Gen. [name blackened out]," February 2, 1977), 151–157 ("Treffbericht," March 13, 1979); 237–240 ("Treffbericht," March 12, 1980).

67. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 204 ("Treffbericht," February 13, 1980).

68. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 2, 233 ("Treffbericht," March 12, 1980).

69. BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 176 (report, dated May 20, 1976).

70. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 87 ("Treffbericht," June 22, 1978); 90–92 ("Treffbericht," June 20, 1978).

71. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 42–43 ("Treffbericht," December 14, 1977).

72. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol 2, 165 ("Treffbericht," March 4, 1976).

73. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 242 ("Treffbericht," March 12, 1980).

74. BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 188 ("Analyse zum IM 'Michael,' " May 27, 1980), 193 ("Einsatzkonzeption für den IMS 'Michael,' " May 20, 1982).

75. BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 183 ("Bericht über die Werbund des IMS 'Michael" am 17.1. 1977," January 24, 1977).

76. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 151–152 ("Treffbericht," March 13, 1979).

77. BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 121 "Information über die Kombinatsleitungssitzung am Dienstag, den 16.06.81").

78. BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 113–116; quotation on p. 114 ("Bericht über den Erfahrungsaustausch im VEB Kombinat Carl Zeiss Jena," September 15, 1980).

79. See document in Buthmann, *Kadersicherung*, 226–229.

80. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol 1, 236 ("Treffbericht," March 12, 1980).

81. BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 170 (report, dated April 5, 1976).

82. BStU Zentralarchiv MfS-HA XIX, Nr. 1444, 353–354 ("Information," May 10, 1989).

83. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 184 ("Treffbericht," November 5, 1979).

84. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 242 ("Treffbericht," March 12, 1980).

85. See Buthmann, *Kadersicherung*, 75.

86. BStU ASt. Gera MfS XV/1890/77 "Michael," Part I, vol. 2, 115 ("Bericht über den Erfahrungsaustausch im VEB Kombinat Carl Zeiss Jena," September 15, 1980).

87. See Pröger, *Mikrostrukturen*, 216.

88. See Buthmann, *Kadersicherung*, 73, 76–80, 88–89, 94, 103–110.

89. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 110–120; quotations on 113, 117 ("Zur derzeitigen Situation im WES," October 26, 1978).

90. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 190 ("Treffbericht," November 5, 1979).

91. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 163–167 ("Treffbericht," May 28, 1979).

92. See Schramm, "Präzision als Leitbild?," 35–49.

93. See Mühlfriedel and Hellmuth, *Carl Zeiss*, 295–296, 298, 371; Hellmuth, "Investitionen," 119; Barkleit, "Moderne Waffensysteme," 48.

94. BStU ASt. Gera MfS XV/1890/77 "Michael" [no volume number given], 1 ("Einschätzung von grundsätzlichen Bedingungen für die weitere Entwicklung bzw. Ausbau der Mikroelektronischen Industrie in der DDR," October 30, 1989).

95. BStU ASt. Gera MfS XV/1890/77 "Michael" [no volume number given], 2 and 3. Quotation from BStU ASt. Gera MfS XV/1890/77 "Michael" [no volume number given], 1 ("Einschätzung," September 4, 1989).

96. Pröger, *Mikrostrukturen*, 116.

97. See Salheiser, "Du und Deine Elite!," 190–211.

98. Author's interview with Hans Becker, former employee of Werner Hartmann at the Facility for Molecular Electronics (AME), later ZMD, Dresden, July 2000.

99. An interesting example can be found in Pröger, *Mikrostrukturen*, 206.

100. See Görzig and Gornig, *Produktivität und Wettbewerbsfähig keit*, 45.

101. See Mühlfriedel and Hellmuth, Carl Zeiss, 373, 375.

102. See Salheiser, "Du und Deine Elite!," 196.

103. See Pröger, *Mikrostrukturen*, 114, 171–172.

104. See Barkleit, *Mikroelektronik*, 62–63.

105. BStU Zentralarchiv MfS-HA XVIII, Nr. 5143, 1–5 ("Sicherheitspolitisce Ergebnisse im Jahr 1985," December 18, 1985).

106. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 56–57 ("Treffbericht," July 13, 1978).

107. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 68–70 ("Einschätzung Gen. Dr. [name blackened out]").

108. BStU ASt. Gera MfS XV/1890/77 "Michael," Part II, vol. 1, 120 (report, dated October 26, 1978).

109. BStU ASt. Gera MfS XV/1890/77 “Michael,” Part II, vol. 1, 157 (report, dated March 13, 1979).

110. BStU ASt. Gera MfS XV/1890/77 “Michael,” Part II, vol. 1, 71–73.

111. BStU Archiv der Außenstelle Dresden, BV Dresden, Abt. XVIII, Nr. 12027, vol. 2, 3–8 (“Information über bisherige Ergebnisse der politisch-operativen Sicherung . . . ,” dated June 23, 1988). On price of project, see Klenke, *Ist die DDR*, 68.

112. BStU Archiv der Außenstelle Dresden, BV Dresden, Abt. XVIII, Nr. 12027, vol. 2, 3–8 (“Information über bisherige Ergebnisse der politisch-operativen Sicherung . . . ,” dated June 23, 1988); BStU Archiv der Außenstelle Dresden, BV Dresden, Abt. XVIII, Nr. 12027, vol. 2, 9–10 (“Information,” January 22, 1988); 24 (“Information,” October 31, 1988); 13 (title page missing; clear from context that the report was submitted no earlier than April 1989).

113. BStU Archiv der Außenstelle Dresden, BV Dresden, Abt. XVIII, Nr. 12027, vol. 2, 6.

114. BStU Archiv der Außenstelle Dresden, BV Dresden, Abt. XVIII, Nr. 12027, vol. 2, 36 (“Sicherungskonzeption,” January 26, 1988).

115. BStU Archiv der Außenstelle Dresden, BV Dresden, Abt. XVIII, Nr. 12027, vol. 2, 15–16, 24–26.

116. BStU Archiv der Außenstelle Dresden, BV Dresden, Abt. XVIII, Nr. 12027, vol. 2, 7.

117. BStU Archiv der Außenstelle Dresden, BV Dresden, Abt. XVIII, Nr. 12027, vol. 2, 23, 25 (“Information,” October 31, 1988).

118. BStU Archiv der Außenstelle Dresden, BV Dresden, Abt. XVIII, Nr. 12027, vol. 2, 14.

119. BStU Archiv der Außenstelle Dresden, BV Dresden, Abt. XVIII, Nr. 12027, vol. 2, 14.

120. See Hertle and Gilles, “Zur Rolle,” 186–187.

121. Hertle and Gilles point to this partial modernization of the Stasi’s worldview in “Zur Rolle,” 173, 179.

122. Hertle and Gilles also discuss this phenomenon in “Zur Rolle,” 187.

123. Thomas Lindenberger, “Die Diktatur der Grenzen: Zur Einleitung,” in *Herrschaft und Eigen-sinn in der Diktatur: Studien zur Gesellschaftsgeschichte der DDR*, ed. Thomas Lindenberger (Cologne, Weimar, and Vienna: Böhlau Verlag, 1999), 25; article on pp. 13–44. See Alf Lüdtke, “ ‘Helden der Arbeit’—Mühen beim Arbeiten: Zur mißmutigen Loyalität von Industriearbeitern in der DDR,” in *Sozialgeschichte der DDR*, ed. Hartmut Kaelble, Jürgen Kocka, and Hartmut Zwahr (Stuttgart: Klett-Cotta, 1994), 188–213.

124. See Maier, *Dissolution*, 60, 70–78; Kopstein, *The Politics of Economic Decline*, 197–202.

125. See Maier, *Dissolution*, 79, 146; Hartmut Zwahr, *Ende einer Selbstzerstörung* (Göttingen, Germany: Vandenhoeck & Ruprecht, 1993), 71–87, 98–102. Zwahr makes clear how close it came to a massacre in Leipzig. On Gorbachev, see Stephen Kotkin, *Armageddon Averted: The Soviet Collapse 1970–2000* (Oxford: Oxford University Press, 2001).

126. See Stefan Wolle, *Die Heile Welt der Diktatur* (Berlin: Ch. Links Verlag, 1998), 202.

127. See Jonathan Zatlin, “The Vehicle of Desire: The Trabant, the Wartburg, and the End of the GDR,” *German History* 15/3 (1997): 358–380.

128. BStU Zentralarchiv MfS-ZAIG, Nr. 17288, 49 (“Information,” September 21, 1987), 52 (“Information,” July 17, 1987).

129. BStU Zentralarchiv MfS-HA XVIII, Nr. 13135, 65–66 (letter from Krolikowski to Biermann, July 9, 1986).

130. See Maier, *Dissolution*, 77.

131. BStU Zentralarchiv MfS-ZAIG, Nr. 17288, 40–43 (memorandum from head of the MfS district office in Suhl, June 20, 1988).

132. See Buthmann, *Kadersicherung*, 210–213; quotations on p. 211. Mütze also participated in manipulation of Zeiss data: BStU Archiv der Außenstelle Gera, MfS XV/1890/77 "Michael," Part I, vol. 2, 75–77 ("Information über ein Gespräch mit dem Direktor W, January 18, 1982").

133. See document in Buthmann, *Kadersicherung*, 242.

134. Document printed in Buthmann, *Kadersicherung*, 238.

135. See Buthmann, *Kadersicherung*, 245–248.

136. Buthmann, *Kadersicherung*, 245–248, and BStU Zentralarchiv, MfS-ZAIG, Nr. 17288, 9 ("Information über die Lage im Kominatsbetrieb D des VEB Kombinat Carl Zeiss Jena," December 13, 1988).

137. BStU Zentralarchiv, MfS-ZAIG, Nr. 17288, 4–10, quotation on p. 3.

138. See Mühlfriedel and Hellmuth, *Carl Zeiss*, 373, table 41.

139. Schreiner, *Das Zeiss-Kobinat*, 26–27. My italics.

Conclusion

Engineering and technology played a crucial role in East German history. The Soviets showed the way by partially reviving the legacy of Nazi Germany as the greatest technological power in Europe. This legacy was to be harnessed to the great project of building socialism, as well as to the task of defending the Soviet Union and socialism. Economic growth, fueled by technological advances, promised to provide the material basis for the advance of the working class. Under Ulbricht, technology was central to the demonstration of the superiority of the socialist model, particularly vis-à-vis West Germany. After an initial strategy of emphasizing consumerism and the welfare state, the Honecker régime also embraced techno-socialism: the idea that technology was a main source of progress within socialism. What the Communist leadership of East Germany failed to grasp was that their pursuit of a narrowly defined technological progress limited their parameters of action.

Scientists and engineers played a major part in the pursuit of technological triumphs. After the end of the Second World War, many remained in the Soviet zone of occupation. In their dealings with the Soviets and with German Communists, these technical specialists sought to reproduce certain aspects of their relationship with the Nazis. As we now know, the Nazis were not opposed to science per se. They embraced and promoted research, particularly when it had military applications. The Nazis generally used incentives rather than force or fear to induce scientists and engineers to work for them. Given considerable freedom in their research, scientists and engineers threw themselves into their work with little consideration of the moral implications. Recent research has cast doubt on the theory that scientists became involved in bitter struggles with state institutions and the military, thus contributing to the "polycratic chaos" of Nazi Germany. A high degree of cooperation among state, industry, scientists, and engineers existed up and down the line.[1]

Engineers and scientists who had worked in Nazi research expected a continuation of this modus vivendi under Communism. The experiences of those deported to the Soviet Union apparently fulfilled these expectations in important ways. Their work seemed as essential to the Soviet military build-up in the early Cold War as it had been to the waging of war under the Nazis. These experts became convinced that they were so important that those in power would continue to give them considerable freedom in their research. Indeed, most sent to the Soviet Union were allowed to engage in creative seeking of their own technical solutions to problems they were presented with. Accustomed to the excitement and challenge of conducting research under difficult circumstances, they generally thrived in the Soviet Union. Tight security, though vexing, seemed normal to them, and perhaps even added to the allure of top-priority research. They were generally left alone politically. Living and working conditions were in any case expected to become better and freer once they were back home, which for many meant East Germany. Their loyalty was to Germany—whether democratic or dictatorial—and so many gave little thought to going to work for Communist East Germany. Those who had not suffered deportation felt similarly.

After the deported were allowed to return, this older generation of engineers and industrial scientists sought to regain the privileges and freedoms that they had enjoyed under the Nazis, as well as a professional ethos that reflected their accomplishments. Ulbricht was tremendously impressed with the technical and scientific ability of these older technical specialists, and was anxious not to lose them to the West. He, along with the rest of the SED, did not completely trust them, however, not only because they had worked in Nazi military research, but also because they were considered bourgeois and generally refused to join the SED. The party therefore sought to create a new technical intelligentsia whose loyalty to socialism and the ruling party was above question. Overt opposition was crushed. The universities and the engineering organization, the Chamber of Technology, integrated themselves into the socialist system. Nonetheless, both institutions worked to maintain a separation of political and technical-scientific environments similar to that which had existed during the Nazi period. An autonomous set of values remained largely intact throughout the first half of East German history, based on the German tradition of science-based engineering, pre-Communist professionalism, hierarchical and patriarchal structures in German academia, and the traditions of student life in Germany. The resulting balance between traditional and politicized elements at technical colleges and universities was upset when the Third University Reform of 1968 broke the independent power of the professoriat and ushered in a period of much greater SED domination.

However, the creation of a new technical intelligentsia was not just a matter of subjugation, but also part of a process of mass mobilization. This started in the schools, with polytechnical training, and continued in factories, where talented workers were selected for college or university engineering programs. The new engineer was to be created at colleges and universities through ideological training and the creation of a sense of group solidarity. The factory was presented as the center of the socialist community, where workers and engineers came together to build socialism. Uncritical depictions of the wonders of modern technology in the media, the arts, and literature were accompanied by a subtle subtext that linked technophiliac fantasies with visions of male mastery over technology and East German technological supremacy. This was true both of more conventional socialist depictions of the factory and of science fiction, which was part of a transnational exchange of ideas. More critical ways of looking at technology did not emerge until the Honecker era.

While promoting a technology-centered model of socialist modernity, particularly in the "long" 1960s (an era that made technological advance a top priority, stretching from the launching of Sputnik in 1957 to Ulbricht's fall in 1971), the SED was engaged in an ongoing struggle to break the autonomy of the higher technical professions. In the late 1940s and 1950s, engineers and industrial scientists of the older generations resisted the rise of women, younger colleagues educated in the Communist period, and the encroachment of political demands (such as planning and report writing) into the workplace. Eventually, these battles were lost. The Chamber of Technology, founded in 1946, was not a true professional organization. The Research Council took up certain issues, such as full employment of all engineering graduates, but was highly ineffectual. This lack of effective representation of professional interests moved the negotiations between technical professionals and the party-state down to the local level. Thus, engineers and industrial scientists found themselves facing ongoing conflicts with factory SED party organizations, but also opportunities to speak out on issues of concern. The style of the era was one of fairly frank debate. A dialogue between very unequal partners took place on the national level as well, as the SED struggled to bring local factory fanatics to heel, force the technical intelligentsia to accept the socialist system, but also respond to the voices of individual technical specialists speaking out on issues of importance to them. Top economic advisor Erich Apel tried to champion the interests of the technical intelligentsia, out of a belief that listening to them would improve the innovative ability of the East German economy. With his suicide in 1964, industrial research lost its most important advocate, though individual members of the SED leadership continued to have pet programs.

Engineers and industrial scientists who had worked for the Nazis had a special insider relationship with Ulbricht, and they transferred to the SED leadership their vision of huge leaps in development through major new technologies. In the early years, the top industrial research personnel played a role in the big decisions in high-tech industry, as can be seen in the cases of programs in civil aviation, nuclear energy, the semiconductor industry, microelectronics, lasers, and automation. Ultimately, however, these programs failed or faltered, first because the Soviet Union evidently did not want the GDR to become a high-tech powerhouse, second because the old intelligentsia was demoted from its privileged position during the New Economic System, third because policymakers disagreed about basic priorities and about which new technologies were the most promising. In comparison with the Soviet Union in the Stalin era, in the GDR there was a striking lack of conflict among institutions, research fields, and research institutes regarding industrial research, however. What few controversies existed were very limited in scope. The difference of opinion between Hartmann and Falter over whether germanium or silicon was best, or the debates over whether to develop microelectronics, were not at all the larger-than-life struggles seen in the USSR. These disagreements were short, personal, and often not very confrontational. There were no persistent patterns of conflicts between particular institutions, or among state, party, and Stasi. The fronts were fluid. The stakes were not very high. Most important, ideology was seldom used to gain advantage over the other side. The most prevalent pattern was that politically influential individuals became interested in a project, the SED leadership approved funding amid much fanfare, and then when there were no immediate spectacular successes, the leadership lost interest and funding was reduced. Many high-tech programs simply fell victim to politicians' short attention spans. The problem became worse under Honecker, who wanted to save money on research so as to be able to curry the populace's favor with consumer goods, housing, and benefits.

The Stasi also had a tremendous impact on high-tech research, which the secret police viewed as its special charge (along with the chemical industry). Just as the old intelligentsia had captured the imagination of the SED leadership with its ideas about cutting-edge technologies as capable of bringing about leaps in development, so, too, did the Stasi adopt the vision of the GDR as a high-tech land. The Stasi not only lavished its attention on the electronics industry, supplying it with embargoed prototypes and manufacturing equipment, but also brought about a whole new understanding of the relationship between technical expertise and political power in the GDR. The Stasi's neo-Stalinist belief in the connection between economic-technological problems and sabotage led to elaborate investigations of top research directors. The latter incurred the distrust of the watchdogs because of their Nazi past, their refusal to join the SED, their desire to have a voice on big policy issues, and their relative autonomy. Frustration over Soviet unwillingness to cooperate with the GDR in areas such as microelectronics may also have played into the paranoid thinking of the Stasi: Why else would the great socialist motherland deny her assistance other than because of distrust of these bourgeois scientists and engineers?

These investigations simmered on the back burner for years, but seem to have greatly picked up in intensity during the reform period of the 1960s. At the moment when industry was given much more autonomy in economic decisionmaking, the SED tried to gain greater *political* control over industry. This parallels the university reforms of 1967–1968, which tightened the grip of the SED over the universities, as well as the reform of the Academy of Sciences in the same period. These developments may well have been the long-term results of the building of the Berlin Wall.

Greater Stasi control over industry meant the recruitment of large numbers of unofficial informants in high-tech industry (as well as in the chemical industry). Stasification went hand-in-hand with militarization (especially after 1983), production of spy equipment, and greatly increased reliance on industrial espionage and clandestine embargo-running (orchestrated by the MfS). These developments started in the Ulbricht era, but intensified under Erich Honecker, who promoted greater political orthodoxy and loyalty to the Soviet Union. Fear of strategic measures on the part of the United States to cut the GDR off from essential technologies led to the promulgation of extreme security measures by the Stasi and SED in industrial research facilities. Unlike in many historical examples (such as Nazi Germany and the Soviet Union under Stalin), outward threat and militarization did not bring state and scientific-technical specialists closer together.[2] The result of the SED's reactions to Cold War tensions, as described by Hartmann, was a smothering of the communicative culture essential to the innovative process—that is, discussions among colleagues of different departments, dialogue and cooperation between enterprises, and the opportunity to learn of technologies from the source, through travel to the West. The same process can be observed at Zeiss. The strengthening of SED and Stasi control also undermined meritocracy by making political loyalty the primary criterion for career advancement. Research work became far less creative. Conformism was expected, even in matters relating to the family and sexuality. Under General Director Biermann, a culture of fear spread. Increasingly preoccupied with following orders, Zeiss plant managers and middle management became quite reluctant to show initiative or to actively try to address problems in R&D and high-tech production. The Zeiss administration became ossified and corrupt. Particularly striking is the retreat into a narrow, egotistical particularism that was blind to the larger issues, not only on the department or division level, but even on the level of the combine. Ultimately, Biermann was a creature of the SED. Paradoxically, it was the Stasi informants themselves who at times addressed the big, thorny issues. In doing so, they were not expressing the opinion of the Stasi, but were speaking out as engineers, industrial scientists, and managers. Their clandestine connections with the secret police afforded them protection from punishment for their frankness and provided them with a way of speaking to the rulers. Paradoxically, the IM*s* contributed to both the strengthening and the questioning of dictatorial control in its concrete manifestations. In any case, their voices were hardly heard outside of the fortress walls of the MfS.

East Germany could have attained greater successes in high-tech research if the Stasi had not been allowed to wield so much power in this realm. Communication and debate were tamped down, greatly weakening the inner dynamism of industrial research. Self-reflexivity was greatly reduced as well. One could consider the alternate paths that were not tried, though this leads us into speculation. Tolerance toward independent thinking in industrial research would have greatly benefited the GDR. The major issues needed to be debated, if only in small circles. How different would things have been if Hartmann had been on close terms with Ulbricht, like Thiessen? What if Apel had won out in his struggle with Mittag? What if the SED had listened to Werner Hartmann's ideas about the development of microelectronics? In that earlier era, CoCom restrictions were not as great as in the 1980s.[3] The experiences of Romania and Poland seem to indicate that the GDR need not have remained as isolated from the non-socialist world as it did. Whether the Soviet Union would have allowed a strategy of greater East German integration into the world market is another question. Brezhnev and Honecker certainly cut off many possibilities for the GDR.

Another avenue of inquiry would be to ask whether East Germany's high tech strategy was really so wise, or whether it was a relic of an earlier era. West Germany could afford to pursue a high-tech strategy and consumerism at the same time. East Germany could not. Would a consumerist model based on a much broader diffusion of resources (employees, funding, technology) have been possible in the GDR? Could the GDR have produced more exportable consumer goods? Here, the alternatives were hardly considered. A more successful GDR might conceivably have survived as an independent country after 1989.

Perhaps these alternatives are an illusion of hindsight. If so, a mystery remains. As we know from history, dictatorships do not necessarily have a stultifying impact on science and technology. Why was Nazi Germany so much more successful? The size and resources of the country before the destruction, division, and dismantling at the end of the war and in the immediate post-war period is one set of factors. However, the Nazi model itself worked better than the East German model. The Nazis essentially allowed the science and engineering community to survive, part of a perverted form of civil society stripped of Jewish and oppositional elements, and provided incentives to work on military projects or projects with military applications. Frighteningly enough, most scientists and engineer were very happy to work for the Nazis, because this meant they could continue their current projects or move to even better positions. The ideology of the "apolitical engineer" and "apolitical scientist," coupled with strong nationalist sentiment, promoted the belief in a deep divide between state and scientific and engineering communities. Experts tried to ignore the uses to which their work was put. This model continued to exist, in modified form, well into the 1950s in the GDR. Hartmann and Görlich experienced the consequences of its destruction.

The Stalinist model was successful for very different reasons. As recent research on Soviet science and technology has shown, not even the terrible deprivations and bloody tyranny of the Stalin era could destroy the incredibly dynamic nature of the innovative process there. Terrible mistakes were made, but there were also great triumphs. Why was the GDR so different? There are some obvious differences in the historical context. For Soviet scientists and engineers who had participated in the monumental struggle against the Nazis in the Second World War, no sacrifice was too great for their homeland. This intense sense of nationalism and idealism lived on into the early Cold War. In Germany, any idealism felt by scientists and engineers working for the Nazis turned to dust at the end of the war. Soviet scientists enjoyed incredible prestige in their society, and were given immense resources for their work (particularly if there were military applications). In the GDR, military research came late, priorities and overall economic strategies were ever-changing, and by the 1970s, engineers and industrial scientists felt underpaid and underappreciated. In Stalin's Soviet Union, fierce competition between scientists and technical experts from different fields or institutes fueled the innovative culture. Unlike in the Soviet Union, East German institutions, schools, and enterprises in technical fields do not seem to have fought it out on ideological battlegrounds. Professional rivalries certainly took on ideological forms, but largely on a personal level, and often clandestinely (as in the case of secret police informants). There were hardly any struggles over ideological issues, particularly from the mid-1960s onward. Instead, technical specialists advanced their professional ambitions by proving themselves more conformist and more loyal to the SED than their rivals. Paralyzing conformism stifled both debate and innovation. At least a partial explanation for this pattern lies in the SED's and Stasi's attempts to take over the innovative process. Technological advance was redefined as loyalty to the SED. The Stasi used growing reliance on espionage in the innovative process to force its very strict standards of political behavior on industrial research personnel. Competition to innovate was replaced by competition to be most politically correct.[4]

However, some of the problems that the GDR experienced in the 1970s and 1980s also made themselves felt in the Soviet Union. There were immense qualitative differences between the Soviet research of the 1930s through the 1950s and the computer revolution of the 1960s through the 1980s. In that era, industrial research became an ever-repeating Sisyphean race to new mountain tops that constantly emerged with each new generation of electronic and microelectronic components. The Soviet Union also found it enormously difficult to keep up technologically, largely because of the explosion of research costs as a result of the computer and information revolutions.

It is also quite possible that the Soviet Union experienced the same sort of decline due to secret police oppression as the GDR. In the Soviet Union, the KGB archives are all but inaccessible to researchers, making this a difficult topic to explore.

One problem unique to the GDR was that the Soviet Union was not only unsupportive, but on several occasions torpedoed high-tech programs in East Germany.

In the light of these factors, one might conclude that the dream of technical supremacy was hopelessly unrealistic and ultimately rather destructive. Huge resources were devoted to high tech projects that perhaps would have better served other purposes. Military research and production brought the GDR little. Sterile technological modernism smothered discussion of issues such as gender inequality and pollution. A gargantuan security apparatus ostensibly protecting the high-tech sector caused a breakdown in communications, management, and morale. Women were mobilized into the ranks of the technical professions, only to face rampant gender discrimination and tremendous conflicts between work and family.

On the other hand, these effects were neither one-sided nor inevitable. Though much hobbled by a grotesquely inefficient system, high-tech industry had many beneficial aspects and could have achieved even more under somewhat different historical circumstances. If microelectronics had been developed early, it could have become a high-powered locomotive that would have pulled along other developing industries, as well as bringing in hard currency that could have aided modernization and the overcoming of the GDR's dependence on brown coal. One wonders if it would not have been possible to negotiate with Gorbachev over the scaling back of military research and production. A critical discussion of technology sprang up in the mid- to late 1960s. Through individual strategies, rank-and-file engineers and industrial scientists tried to overcome the deformations of research culture. A few were able to retreat into a niche identity as "purely" technical specialists. The spread of technical education had a modernizing impact on East German society, providing perhaps the most widespread set of non-socialist standards (except, perhaps, those of organized religion) for measuring the successes and failures of the GDR. Many tried to avoid entanglement with power structures by refusing to join the SED, foregoing a career in management, and avoiding working in sectors where there were tight security restrictions. Women and men felt empowered by technology, and many were indeed happy to participate in the building of a socialist modernity. Though unemployment climbed into the double digits in wide stretches of East

Germany after reunification, many of those in cutting-edge fields such as software engineering were able to find work.

Reflecting over her husband's professional triumphs and the ultimate collapse of the GDR, Irmgard Görlich, the widow of Paul Görlich, asked me, "Was is all in vain?"[5] Walking through the bustling streets of Jena and Dresden, I would have to say no. Unemployment is lower and the economies of these two cities are doing much better than those of many other parts of former East Germany, thanks to high-tech industries that people like Görlich and Hartmann helped to build. They were part of the "worst generation" in German history, and yet, like their West German counterparts,[6] they did much to modernize their country. Perhaps they would have done even better if given the chance.

Notes

1. See Schmaltz, *Kampfstoff-Forschung*; Heim, *Kalorien*.

2. See Michael Gordin et al., " 'Ideologically Correct' Science," in *Science and Ideology*, ed. Mark Walker (London and New York: Routledge, 2003), 59, article on pp. 35–65.

3. See Mastanduno, *Economic Containment*.

4. The role of Marxist philosopher Georg Klaus in cybernetics in the GDR is an example.

5. Interview with Irmgard Görlich, November 12, 2004.

6. See Konrad Jarausch, *After Hitler: Recivilizing Germans, 1945–1995* (New York: Oxford University Press, 2006).

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Index