

The XF-85 Goblin approaching the mother ship, EB-29B near the end of the first free flight, August 23, 1948, 20,000 feet above the Antelope Valley, California. A few seconds later the parasite struck and damaged the trapeze but did not hook on. Test Pilot Ed Schoch instead brought it to a landing on the dry lake bed below with its canopy broken. (Photo — McDonnell No. D4E-11094)

MONSTRO and the GOBLINS

By RICHARD D. POWERS

RESEARCH PROJECT 7117

Research Project 7117 was begun more than three years ago by the Author to document the development of parasite-type aircraft, of which the McDonnell XF-85 Goblin was perhaps the most interesting. It had the most extensive program for development yet carried out by any agency, and during its course examined all of the avenues possible to extend the state of the art. Although never carried beyond the experimental stage, sufficient tests were made to determine that the concept was feasible.

Parasite aircraft are defined, for this discussion, as those designed to be launched from, and retrieved by, another aircraft in flight. The definition intentionally eliminates many configurations such as the World War I airplane/balloon experiments, the Fieseler Fi 103, and drone aircraft. The earlier efforts such as the British deHavilland Hummingbird experiments of 1925, the Russian efforts in the early 1930's, and the Curtiss Sparrowhawk/AKRON/MACON operations have been well documented.[1] Richard D. Powers' review of parasite aircraft (RP7117) covers the three main concepts of the postwar era, all of which were American, and which included the Goblin, the wingtip coupling experiments, and the FICON project. This article is limited to the former. The author has in preparation articles on the US Air Force wingtip coupling and FICON operations, and would welcome the assistance of other Society Members having knowledge of these or other parasite aircraft projects.[2]

The McDonnell XF-85 was conceived at the same time as the Convair XB-36, in the early World War Two years, when the possibility of isolation of United States armed forces to the North American continental limits became a viable concern of the Army Air Forces.[3] The parasite was intended to provide fighter protection for the new intercontinental bomber, and although the upper echelon leaders of the postwar Strategic Air Command came to have serious doubts of the usefulness of the XF-85 because of its limited endurance, the project went forward and two research examples were built. Flight testing of the Goblin was limited to a series of seven flights over a period of eight months. Three successful hook-ons were made, and four flights terminated in belly landings on the dry lake bed at Muroc, California. The program was cancelled in April 1949 primarily because of difficulties in achieving successful retrievals with the trapeze skyhook.

Aircraft design has always been the art of compromise. In military aircraft, for instance, the requirements for long range and large payload usually resulted in large aircraft, while requirements for speed and maneuverability traditionally yielded smaller, light aircraft. Yet these mutually incompatible qualities were always necessary in at least two types, escort fighters and strategic reconnaissance airplanes. Escort fighters needed range comparable to the bombers they were protecting plus speed and maneuverability to successfully combat opposing interceptors. Recce types need the range to penetrate deeply into hostile territory and speed to elude the static and active defenses.

Occasionally there have been attempts to use two aircraft with differing characteristics to accomplish the desired mission, rather than to combine elements into a single aircraft that would (hopefully) achieve the desired performance. Thus the parasite aircraft

concept was born. The design objectives were met (in the case of the Curtiss F9C-2 and the McDonnell XF-85) by designing a small maneuverable aircraft that could be ferried to its operational area by a larger, long-range aircraft (the airships AKRON and MACON and the B-36). The fighters could be launched from the parent aircraft, complete the mission and return, be recovered and ferried back. This allowed each portion of the mission to be fulfilled by an aircraft that was nearly an optimum design. A price was paid for this improvement in efficiency; two aircraft were required to do the job of one, but further, the aerial launch and recovery techniques, upon which success depended, were extremely difficult to perfect, especially in less than ideal operational conditions.

The development of the McDonnell XF-85 Goblin parasite fighter really began on April 11, 1941.[4] On that date the Air Force issued a specification to industry calling for the design and development of an intercontinental bomber capable of carrying ten thousand pounds of bombs to targets five thousand miles away and returning without refueling, while cruising at speeds of 240-300 mph.[5]

The then current operational technique of daylight bomber operations was to send escort fighters along with the bombers to clear the air of opposing interceptors. The extreme range called for in this bomber specification created problems involving the escort that could be solved only by unconventional means. As aerial refueling had not yet been perfected, the escort fighter would have to carry all its fuel internally or in drop tanks, but the amount of fuel required would dictate a fighter so large that it would be virtually useless against more nimble interceptors. A problem of equal magnitude was pilot fatigue; a round trip of ten thousand miles would require thirty hours to complete at 330 mph and fighter missions of this duration were beyond the capability of any pilot, particularly under combat conditions.

In December 1942 the Air Force initiated Project MX-472 for the purpose of solving this escort fighter problem. Preliminary studies included remotely controlled drones powered by ramjets, but by autumn 1944 these ideas were discarded in favour of a *manned aircraft capable of being stored aboard the bomber.*

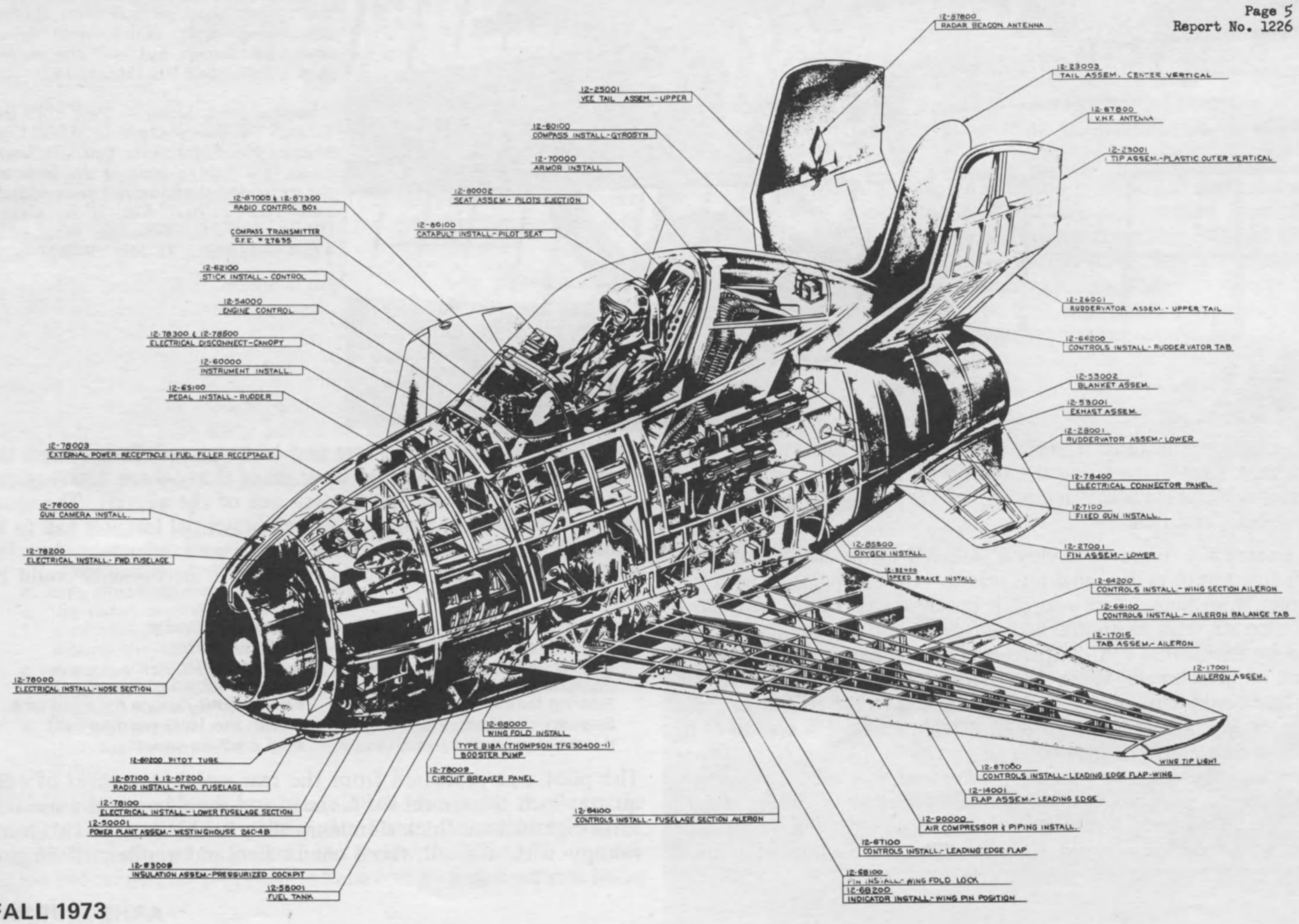
Late in 1944, McDonnell Aircraft Company of St. Louis, Missouri, answered an Air Force Request for Proposal with four versions of its Model 27. No other company showed significant interest and McDonnell was awarded the contract. Initially, the Air Force planned to use the parasite fighter with the B-29, B-35, and B-36, externally hooked on. By January 1945, however, the decision had been made to design a fully retractable fighter, although this precluded its use with the B-29.[6] On October 9, 1945 a letter contract was signed by McDonnell and the Air Force covering Phase I – Engineering, for the project.

Model 27E, the McDonnell designation for the XF-85, emerged as a short, squat, low wing monoplane with an X-shaped tail and a sweptback folding wing, powered by a single Westinghouse turbojet engine. The final design, although unusual, was the most efficient configuration that would carry the necessary equipment and still fit inside the B-36 bomb bay.

The design problem has best been described by Herman D. Barkey, the Project Engineer:

> "The XF-85 was designed as a parasite fighter to be internally stowed in either the number one or the number four bomb bay of a B-36 and was therefore limited to an overall length of 15 feet and a stowed width of 5½ feet. The parasite carried normal fighter armament and was capable of being launched in one and one-half minutes at the cruising speed of the B-36 and retrieved at similar speeds while operating at an altitude of 35 to 40 thousand feet." [7]

Final accomplishment of this problem resulted in a configuration



in which the fuselage was an aluminum alloy, semi-monocoque structure 14' 9-3/4" long, with a maximum width of 50" and a maximum height of 79-7/8". All equipment was housed in the fuselage to eliminate problems caused by folding the wings.

The Westinghouse J-34-WE-22 turbojet was installed as far forward in the fuselage as possible to maximize the distance between the aircraft center of gravity and the tail surfaces. A fifty-two-inch tailpipe extension carried the jet exhaust beyond the fuselage, with a special insulating blanket wrapped around to reduce heat transfer to the adjacent structure. Additional cooling was accomplished by diverting air from the intake duct around the engine and tail pipe.

Lubricating oil was contained in a five-gallon bladder type oil tank installed in the nose ring and fuel was contained in a single 115-gallon self-sealing, horseshoe-shaped tank located directly under the compressor section of the engine. An electric fuel pump, inside the tank, transferred fuel to the engine. The tank was kept cool by covering the tank wall nearest the engine compressor with heat-radiant material and by passing air between the compressor and tank.

An electrically operated skyhook, located in the nose of the aircraft just ahead of the cockpit, was to link the parasite with the mother ship. Since there was little previous experience with parasite aircraft, this skyhook was designed on the same principle used by the Curtiss F9C-2 Sparrowhawk mechanism. It required a point of attachment above the fighter's center of gravity so the airplane could hang on the trapeze attached to the parent aircraft. In extended position, the XF-85's attachment point was two- to seven inches ahead of the center of gravity and about sixty inches above it. The parasite was to be released from the trapeze by tumbling the skyhook head. When the wings were folded, release was prevented by a safety switch, and if an electrical failure occurred, the skyhook could be retracted by a backup pneumatic system operating off the gun-chargers.

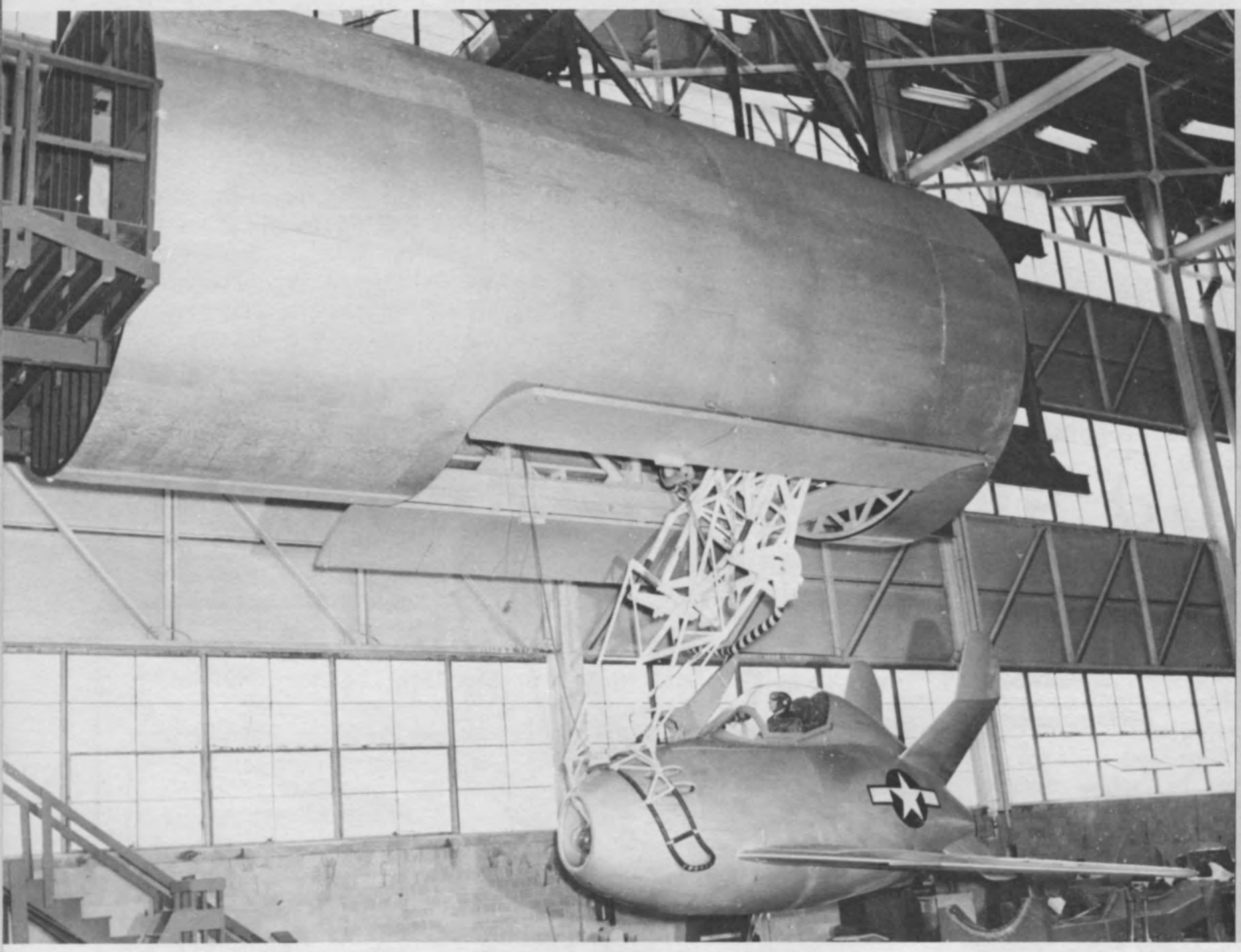
Armament was to consist of four .50 calibre type M-3 machine guns with 300 rounds of ammunition per gun. The ammunition was to be stored in a compartment just behind the cockpit, and the empty cartridges and links were to be ejected into an empty bay in the fuselage. The guns were aimed with a K-14 gunsight.

The cockpit of the XF-85 was about half the size of those in other fighters, with a volume of 26 cubic feet. The detail specification called for a pilot "not more than 5 feet 8 inches tall and weighing not more than 200 pounds when equipped with a parachute and anti-g provisions."[8] The cockpit was pressurized by bleeding air from the engine compressor, passing this through a heat exchanger, a cooling turbine and a mixing valve which regulated the mixture of cool, pressurized air with hot air directly from the compressor. A pressure differential of 2.75 psi for normal operations or 1 psi for combat could be selected by the pilot.

The escape system consisted of a T-4E powder charge fitted to the pilot's seat. Since the seat had to be placed directly over the engine, it was tilted back at an angle of thirty-three degrees from the vertical to reduce the frontal area of the aircraft. The small size of the cockpit meant that some unessential features had to be eliminated; for instance, rudder pedals were adjustable but the seat was not. Only a limited number of instruments could be provided:

- Radar beacon indicator
- Attitude gyro indicator
- Engine tachometer
- Turbine out temperature gauge
- Bearing temperature gauge
- Standby compass
- Airspeed indicator
- Airplane altimeter
- Cabin altimeter
- Accelerometer
- Gyro stabilized compass
- Fuel quantity gauge for main tank with low level warning light
- Fuel pressure gauge

The pilot was protected from the rear only, by a sheet of one-quarter inch thick steel for his head and shoulders, and a sheet of three-eighths inch thick aluminum alloy for his back. A two-piece canopy with a small, fixed windscreen and a sideward hinging hood was provided.



The XF-85 and B-36 mockup and the original trapeze configuration, at the McDonnell St. Louis plant on July 9, 1946, shortly after the mockup was reviewed by Air Force McDonnell and Convair representatives. (Photo — McDonnell No. D4E-5289)

Opposite page, upper — 46-524, the second XF-85, in its initial configuration, May 1948, with skyhook stowed. The wing stall fence is on the upper wing surface. The spring-steel wing skids, which were never used, are shown but not the center skid. (McDonnell No. D4E-10112)

Opposite page, lower — Test Pilot Ed Schoch in the cockpit of 46-524 at Muroc. No flight tests had yet been made, the fairing around the base of the extended skyhook has been added, and the center skid is in place. (Photo-USAF, Edwards AFB No. 426A-G-4144BU, 15 July 1948.)



A VHF communications transmitter and receiver (AN/ARC-5) and a radar beacon (AN/APN-61) were the only electronics equipment. Antennae for these were installed in the left and right vertical fin tips respectively, which were of a non-metallic construction.

All systems were electrically actuated, obviating the extra weight and fire hazard imposed by a hydraulic system. A small battery was provided for instruments, radio, and other small electrical equipment, and there were two external-power receptacles, one in the skyhook well for use when stowed aboard the parent aircraft and during the launch sequence, and another in the nose ring for use with an auxiliary power unit when testing on the ground.

The wings were fully cantilevered, of aluminum alloy stressed skin construction, designed to be folded and unfolded at the cruising speed of the B-36. For folding the wings, there were two hinges, one at each wing spar, with a locking pin at the main spar. The wingfold actuating circuit was incapable of operation unless the skyhook was extended. Nose flaps on the outer half of the wing leading edges extended automatically at speeds below 185 mph to improve lateral control.

An X-type tail, acting as both rudders and elevators, eliminated the need for a folding tail. The control surfaces acted as if the upper right and lower left surfaces were connected. Before flight testing began, dorsal and ventral fixed fins were added to improve directional stability.

The hoe-type speedbrake, installed in the bottom of the fuselage, was manually controlled by a (momentary-type) toggle switch on the throttle grip, and provided accurate speed control, particularly during retrieving operations. The speedbrake also had an automatic mode, cued by a Mach switch, to limit the airspeed to the maximum controllable speed.

The landing gear originally considered for the flight test program was soon discarded. This type, a fixed tricycle landing gear, would double the XF-85's drag. A swiveling nose wheel was also considered but problems with wheel-shimmy eliminated this. The final arrangement consisted of a centerline main skid, which extended ahead of the nose to prevent the aircraft nosing over, and two spring-steel skids located at mid-span on the wings to absorb the shock of a hard landing. The wing skids were removed prior to the first free flight and the center skid performed satisfactorally by itself, but at the request of the Air Force, runners were added to the wing tips to minimize damage caused by skid landings.[9]

After the Letter of Intent, a tentative order was placed for two XP-85 flight articles and one static test example, later augmented by a further 15 for service tests. The final letter contract, however, dated 18 June 1946, included only two stripped XF-85 parasite fighters, the definitive contract following on 2 February 1947. The stripped version had equipment essential only to its flight operation, plus some added to improve safety. The following changes were incorporated in the stripped version (as compared to the proposed design):

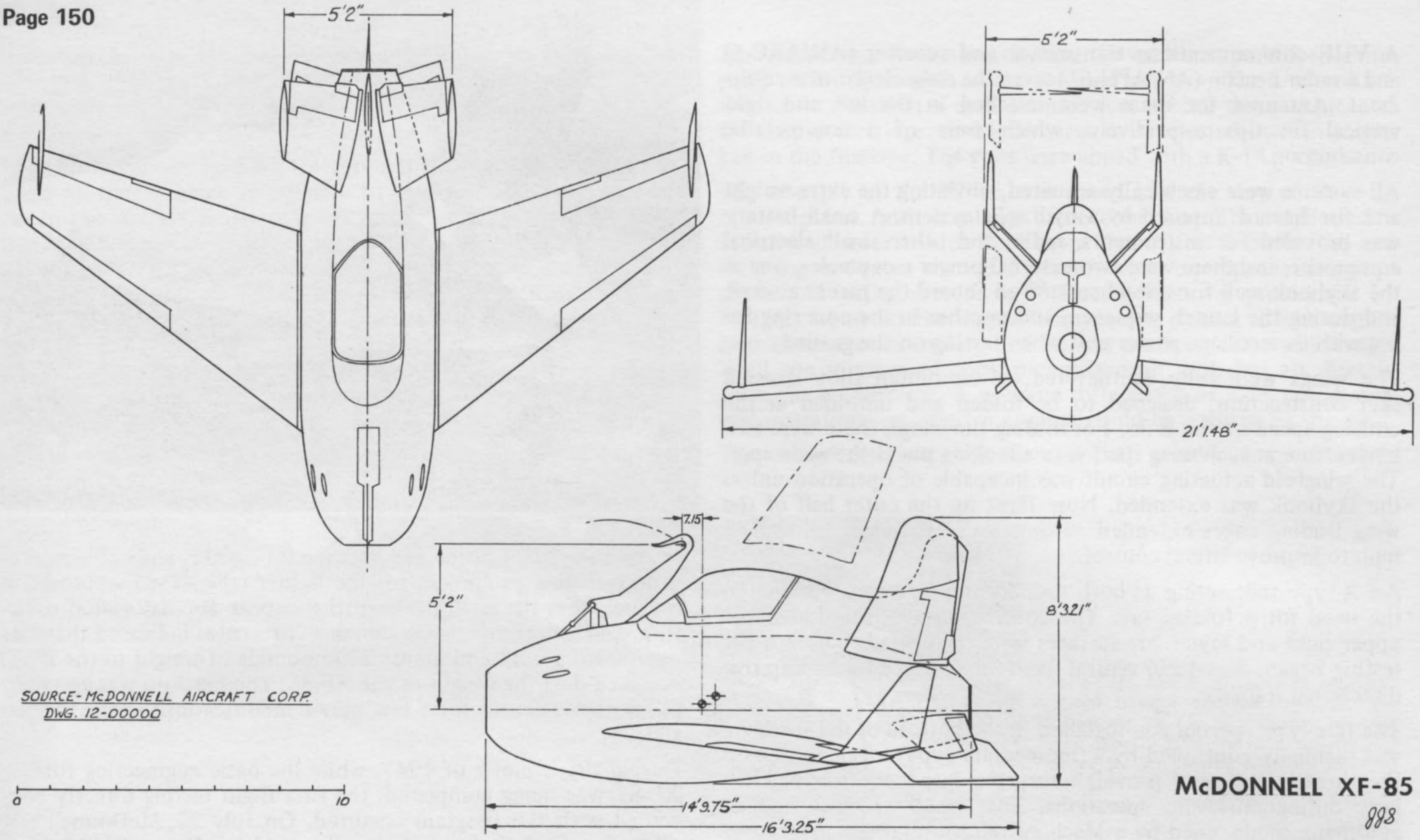
a. guns were omitted;
b. the dorsal fin was added;
c. a manual override switch was provided to control the deflection of the leading edge flaps;
d. only simulated armor was installed;
e. the radar beacon was eliminated;
f. a carbon-dioxide fire extinguisher was provided to spray CO_2 around the engine burner section if overheating was detected;
g. extra fuel tanks were provided, a 30-gallon integral tank in each wing and a 26-gallon bladder tank in the empty ammunition bay behind the cockpit;
h. nitrogen pressurization was supplied to the extra tanks to force their fuel into the main tank, the only one equipped with a fuel pump.

During the second week of June 1946, from the tenth to the twelfth, representatives of the Air Force, Consolidated-Vultee, and McDonnell met in St. Louis to review the XF-85/B-36 installation mockup. The proposed installation included provisions for heating the No. 1 bomb bay, storage for 2400 rounds of ammunition, refueling equipment for the fighter (the XF-85 was to draw its fuel from the B-36's tanks), the trapeze and associated structure, and a decompression chamber. Estimates indicated that this equipment would add about 2200 pounds of weight to the B-36, not including the weight of the XF-85. The mockup was accepted as reviewed, except for a few minor modifications to the oxygen stations.

During the summer of 1947, while the basic engineering for the XF-85 was being completed, the first flight testing directly concerned with the program occurred. On July 22, McDonnell test pilot Robert Edholm and Air Force Major Kenneth Chilstrom flew Lockheed F-80's in simulated hook-on approaches to a B-29 near Wright-Patterson Air Force Base. The F-80s were flown with their dive brakes extended and forty percent landing flaps to simplify the job of keeping formation. The tests took place at twenty thousand feet and speeds of 180 and 225 mph. Four different types of approaches were flown, each with a different combination of speed and B-29 configuration, to evaluate the possible stability and control problems that might be encountered.

The first approach was flown with the B-29 at 225 mph and with the bomb bay doors closed. The F-80s approached from dead astern and reached a minimum distance from the B-29 of about six feet. Slight turbulence was encountered, but there was no problem in controlling the fighter airplanes. The second approach was similar to the first except that the bomb bay doors were opened. The F-80 pilots reported that they could feel the turbulence caused by vibration of the doors, but again no control problems were encountered. Next, the bomb bay doors remained





McDONNELL XF-85

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open and the speed of the B-29 was decreased to 180 mph, but no change was noticed. The final approach was flown at 180 mph with the bomb bay doors open and the two inboard propellors feathered.

No great difficulty was experienced in approaching to within six feet of the bottom of the B-29, but the pilots recommended that the trapeze bar be placed at least ten feet below the bottom of the parent aircraft, out of the disturbed flow near the fuselage.

The unique configuration of the XF-85, caused by the size limitations of the B-36 bomb bay, made predicting the parasite fighter's aerodynamics difficult. Accordingly, the Air Force requested that the National Advisory Committee for Aeronautics conduct wind tunnel tests on one of the airframes in the 40' x 80' tunnel at Ames Aeronautical Laboratory, Moffett Field, California.

The first airframe, 46-523, was completed in late 1947. Soon afterward, on Nov. 9th, the component parts, not including the engine, were crated and flown from St. Louis to Moffett Fd. in a C-97. November and December were spent in assembling the airframe and installing such special test equipment as control-surface hinge-moment gauges, pressure measuring systems, and remote control drives for the control surfaces. It was ready for installation in the tunnel on January 8, 1948.

Then the first mishap, that set the program back only a few days, occurred. It was decided to hoist the XF-85 into the test section by attaching the skyhook to a crane, a method felt to be safe since the airframe had been moved from the assembly area to the test area in this manner.

Late in the morning, the crane's cable was attached to the skyhook and the XF-85 was lifted about three feet off the floor and bounced by hand to make sure the cable was secure. The attachment appeared to be safe, and when all swinging motion had ceased the airplane was slowly raised into the test section. The operation went smoothly until the XF-85 was about forty feet off the floor. Without warning, the hook latch slipped and the airplane fell. It struck the floor in a level attitude, crushing the forward part of the fuselage.

A detailed inspection revealed that the nose section of the fuselage, the air inlet structure, and the primary and secondary structure of the fuselage had all sustained major damage and needed rebuilding. An investigating board later determined that the accident was caused by an improperly assembled latching mechanism which slipped under the weight of the XF-85.

The damaged airplane was returned to St. Louis and its place in the wind tunnel was taken by the remaining XF-85, serial number 46-524. Tests were completed early in 1948 and the data indicated that with the skyhook extended the directional stability of the airplane was decreased by 75 percent. It was recommended that a ventral fin be added to the configuration, bringing the number of tail surfaces to six. It was also noted, in disagreement with previous small-scale model wind tunnel tests, that the leading edge flaps were relatively ineffective.

Meanwhile, some doubts had been expressed as to the usefulness of the parasite fighter. In an article entitled "Parasite Jet Fighter Due for Test," *Aviation Week* reported:[10]

> "New Air Force contract for service test quantity of the P-85 (sic.-by this time the contract for two aircraft had been signed – Author) assures the unique craft a thorough wringing out at the hands of Air Material Command test pilots and indicates air force determination to exhaust the potentialities of the "parasite fighter" as a tactical concept in long-range bomber defensive armament. However, there are strong indications that the idea is slated for eventual abandonment.
>
> "Gen. George C. Kenney, commanding general, U.S. Air Force Strategic Air Command, who will direct the tactical development and employment of the B-36A, is doubtful of the value the parasite fighter, because of difficulties of retrieving the planes after their small amount of fuel is used.
>
> "If combat continues, the bomber which slows down to latch on a spent fighter is in jeopardy. It would be difficult for a fighter to find the "mother" plane which he had

originally left and if he hooked on to another he would be taking the place of another parasite. With three fighters aboard the B-36A there is little if any space left for the stowage of bombs."

Unfortunately, Kenney's predictions would prove to be all too true, once flight tests were initiated.

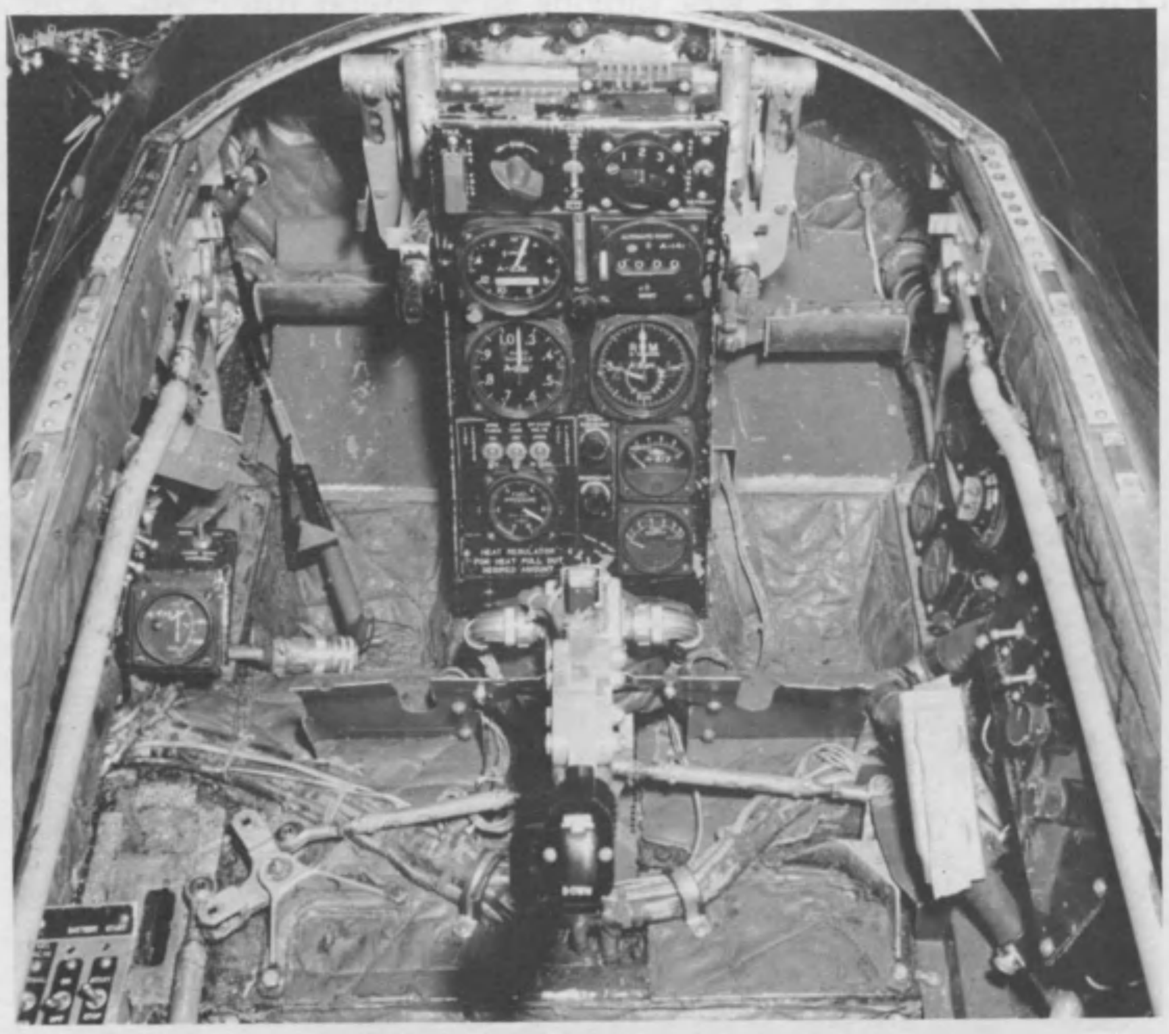
The contract for the instrumentation and Phase I flight testing was signed in January, 1948. Phase I was a limited objective program, with the purpose of developing reliable hook-on procedures. From February 10th to 12th the Air Force Engineering Review Board met to evaluate the XF-85. Apparently the design was satisfactory, for no large modifications were recommended.

46-524 was brought back to St. Louis and, after two months of final preparation, it was flown to Muroc Air Force Base on June 5th in a C-97 to begin flight testing. Awaiting the XF-85 was the parent airplane for the program, an EB-29B, 44-84111, nicknamed MONSTRO. The E prefix indicated that the B-29 was on bail to McDonnell.

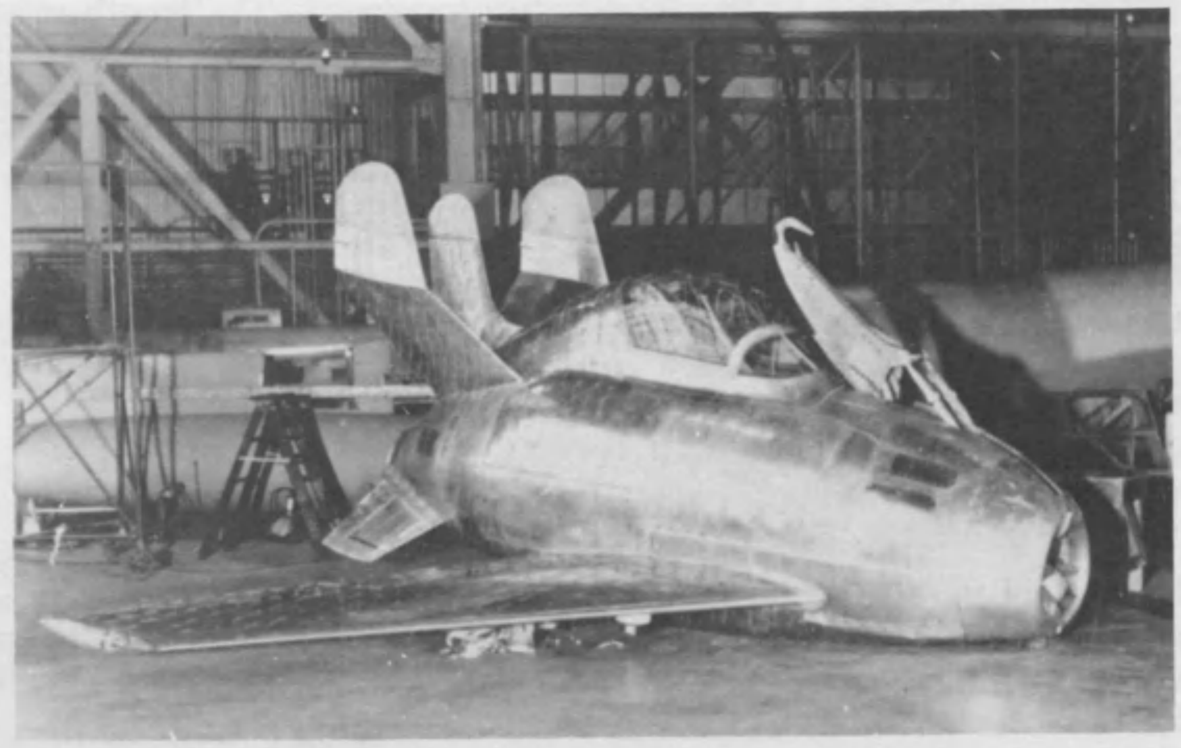
It had become apparent, early in 1947, that no B-36 would be available for the flight test program, and a suitable substitute had to be found. A B-29 was the largest airplane readily available but the arresting trapeze had been designed for the B-36 and a new one had to be designed for the B-29. A letter contract supplement to the XF-85 contract was submitted in April, covering the B-29 modifications. The engineering for the modification was completed in October, and in January 1948 the definitive contract was signed.

The greater part of the modification was installation of the arresting trapeze, now placed in the aft bomb bay to keep the XF-85 away from the B-29's propeller discs. Keeping the AKRON-MACON experience in mind, McDonnell engineers designed the trapeze with the bar horizontal and with a "horse collar" stabilizing gear to grab the nose of the XF-85 thus holding it rigidly during retraction and extension.

In the extended position, the trapeze was located nearly 10½ feet below the bottom of the B-29, requiring a double hydraulic extension and retraction mechanism. A redundant emergency retraction system was installed to ensure that the trapeze could be pulled up, since the B-29 could not be landed with the trapeze extended. Other modifications to the EB-29 were:



The cockpit of the XF-85 was cramped, only 26 cubic feet in size, with limited instrumentation. Central instruments were on the aft face of the skyhook well, others mounted on cockpit sides. (McDonnell D4E-12062)



Number 1 XF-85, 46-523, slightly bent after its fall in the Ames Aeronautical Laboratory test area while hoisting to the 40' x 80' wind tunnel. The skin was tufted to aid airflow visualization. (Photo – NACA A-12387)

a. the bomb bay doors and bomb racks were removed;
b. the tunnel in the rear bomb bay was removed;
c. a fairing was installed ahead of the bomb bay to keep the free air stream from windmilling the XF-85's engine when stowed;
d. radar equipment beneath the wing root was removed and the bomb bay extended forward thirty inches;
e. protector plates for the fuel lines of the B-29 were installed;
f. a CO_2 fire extinguisher was installed under the wing root to inject its contents into the XF-85's engine if required;
g. communications and oxygen outlets were installed.

The front bomb bay was used to house the emergency trapeze reservoir and emergency hydraulic pump. The aft pressurized compartment of the B-29 was converted to the control station for the trapeze by installing the trapeze control panel, a bench for the XF-85 pilot and mechanic, their oxygen and communication equipment.

The complex nature of the launch and recovery procedures required that the XF-85 pilot, the B-29 pilot, and trapeze operator be in contact at all times. These three crew members were therefore provided with a VHF radio system, all other crew members using the interphones. It was necessary to install an antenna for the VHF radio under the B-29 fuselage for use during launch and recovery. In all other flight modes the standard upper antenna was used.

An essential part of any flight test program is in-flight photography. Two 16mm cameras were installed on the B-29 for this purpose; one just ahead of the forward bomb bay below the fuselage, the other on the underside of the left wing, ahead of the aileron. Both pointed towards the trapeze bar, and streamline fairings minimized the drag of these cameras.

To ensure maximum visibility, a garish color scheme was now applied to MONSTRO. The entire aft end of the fuselage was painted yellow, and the wing tips and upper and lower surfaces of the horizontal stabilizer were painted with diagonal black and yellow stripes. The control surfaces were left in natural metal finish. In the early phases of the flight test program, as an additional visibility aid, the B-29 carried an M-16 smoke bomb, but this proved to be of little use. Although most of the free flights were performed in the vicinity of MONSTRO, visibility was constantly a factor which emphasized the need for a radar beacon in the operational aircraft. Had the program continued, smoke generating equipment similar to that used by skywriters was to be installed.[11]

Another modification was extension of the B-29's tail skid to

prevent the dragging of the XF-85 during takeoff. The length of the skid was doubled, and in even the retracted position it appeared much like a standard B-29 tail skid in the extended position.

The modifications were made by McDonnell at the St. Louis plant and the completed airplane was flown to Muroc by its McDonnell flight crew on Jan. 9, 1948, well ahead of the XF-85, to begin the flight test program. In its loaded condition, with 400 pounds of ballast in the nose compartment and 1396 pounds in the forward bomb bay, 4500 gallons of fuel, full compliment of oil, eight crewmen and with the XF-85 installed, MONSTRO weighed 112,600 pounds. The corresponding landing weight was 101,800 pounds.

Since the EB-29B lacked sufficient clearance between the fuselage and the ground to permit loading the XF-85, a special loading pit was constructed at Muroc, 24½ feet wide, 92 feet long, and 17½ feet deep at one end. There was an inclined ramp permitting the XF-85 to be lowered on its ground handling dolly.

For the flight test operations, the EB-29B was to have three crewmen in the forward compartment and five in the aft, all McDonnell employees, chosen on the basis of their service experience and familiarity with the program. Albert W. Courtial was the pilot. A former Air Force captain, he had become familiar with the B-29 as pilot in the Pacific theatre during WWII. After the XF-85 tests he went on to New York to fly for the Bell Aircraft Corp. John Y. Brown was copilot, and he also had flown during WWII, in the Royal Canadian Air Force and the U.S. Navy.

The trapeze operator was Lester Eash, the engineer in charge of the B-29 modifications and the trapeze installation. The other crew members included Quinton Harvey, flight engineer, Keith Curtiss and D.P. Gadsby, mechanics, and Charles Siler, observer.

The only pilot ever to fly the XF-85 was Edwin F. Schoch, a McDonnell test pilot. Schoch, a graduate of Virginia Polytechnic Institute in 1941, enlisted in the Navy and was commissioned Ensign in April 1942. He joined the flight program and in 1943 was assigned to VF-19, flying Grumman F6F Hellcats off the USS LEXINGTON. He served with VF-19 for one tour of duty, claiming four Japanese airplanes destroyed and was awarded the Navy Cross, Distinguished Flying Cross, and the Air Medal. He was flying Corsairs aboard the USS LAKE CHAMPLAIN with VFB-150 when the war ended. Schoch then joined McDonnell as a test pilot, and thereafter flew nearly every type of airplane built by the company except the XP-67. He was killed on a test flight of an F2H-3 in September 1951.

The first tests in the program took place in June 1948 soon after the arrival of 46-524. As with any new airplane the flight test program was designed to progress in carefully planned steps to minimize the risks involved, and a series of preliminary ground tests were performed to check the performance of certain components. The power control, cooling and installation of the engine were checked, the magnetic compass was swung, and the cockpit was tested for carbon monoxide leaks.

Sufficient instrumentation to record all the important flight parameters was fitted. The flight test photo panel and a recording camera were installed in the empty ammunition bay in the fuselage behind the cockpit. (The 26-gallon bladder fuel tank was not used at this time because of the fire hazard.) Instrumentation was supplied to measure control surface positions, control forces, aircraft attitude and angular rotation, and the temperature of several structural members. Camera operation was to be controlled by Schoch.

The initial flight testing of the XF-85 consisted of captive flights during which the parasite was lowered into the airstream on the trapeze, the engine started, and the airplane "flown" while still hooked onto the trapeze. There was only enough freedom of movement to enable Schoch to get the "feel" of the controls. In all of these preliminaries, the engine, fuel, radio, and electrical



The crew of the mother ship, MONSTRO. L.-R.– Albert Courtial, pilot; John Y. Brown, copilot; Unknown; Jim McEwan, flight test engineer; Charles Siler, observer, and Les Eash, trapeze operator. (McDonnell No. 2D4-4528.) Below, test pilot Ed Schoch with 46-523, March 1949. The canopy opened to the left. U-tube in top of canopy is cabin pressurization. Central skid not installed. (McDonnell No. 2D4-4656)

systems were to be thoroughly checked out before clearing for free flight. Eleven captive flights were scattered throughout the flight test program; the first took place on July 22, 1948 and four others were made before the first free flight on August 23.

Even these could be dangerous, as the following incident illustrates. The trapeze operator, Les Eash, at his station in the aft pressurized compartment between the gunner's blisters, had a good seat for the action. He recalled:

"With the XF-85 on the arresting bar and the horse collar raised, the pilot started the engine and made repeated lift-offs within the confines of the hook diameter. The airplane was in control, moving laterally on the bar and pitching up and down. Subsequently, the airplane appeared to go divergent and Ed called for lowering the horse collar in an attempt to catch the oscillating nose. The first attempt I punctured the nose cowling and oil tank, the second missed completely and on the third attempt luckily caught the nose as it was moving in a lateral direction. After getting back to the ground, all I could say was, 'It was a helluva J.C.' "[12]

The sequence of events on all flight operations was similar: The





MONSTRO and Goblin above the dry lake, now Edwards Air Force base, in October 1948 (probable date.) (McDonnell No. 4E-12155)

Below, 46-523 is shown here with the mother ship by the loading pit at Muroc near the end of the test program in April 1949. 46-523 was in its final configuration. (McDonnell No. D4E-13137)

XF-85 was installed on the trapeze in the loading pit and the trapeze retraction mechanism was tested on both primary and emergency systems.

Schoch rode in the aft compartment of the B-29 during takeoff. After launch altitude was reached, the XF-85 was partially lowered and, after Schoch entered the bomb bay, it was again retracted. After climbing into the cockpit, Schoch would give a signal for the parasite to be lowered. Once the parasite was lowered, the engine was started, the horse collar was raised, and the launch completed.

To maintain his proficiency during the flight testing, Schoch flew simulated approaches to the EB-29B in an F-80, forty approaches during the course of fourteen flights. For these, a simulated skyhook similar to an automobile radio antenna was installed just ahead of the cockpit, approximating the position of the XF-85's hook. In general, the two types of aircraft required similar techniques for the approach, though the difference in sizes made the handling quite different. Two chase airplanes were used, a Lockheed F-80 to follow the XF-85, and a B-29 to observe and photograph the launch and recovery procedures.

The flight characteristics of MONSTRO with the XF-85 in the stowed position were not much different from a standard combat B-29. With the trapeze extended, the airspeed dropped about forty miles per hour. Maintaining the launch speed of 200 mph required slightly more power than the maximum continuous rating. When the XF-85 was launched, a very slight nose down tendency required the application of a small amount of up elevator. Only a slight reduction of engine manifold pressure was possible after launch, if 200 mph was to be maintained.

The first XF-85 free flight in 46-524 was made on August 23, 1948. The launch was made at 20,000 feet and 200 mph. After the engine was started and the horse collar raised, Schoch pulled the lever that tumbled the skyhook head and gently pulled back on the stick to ease the initial rate of descent. The parasite dived away with no problems.

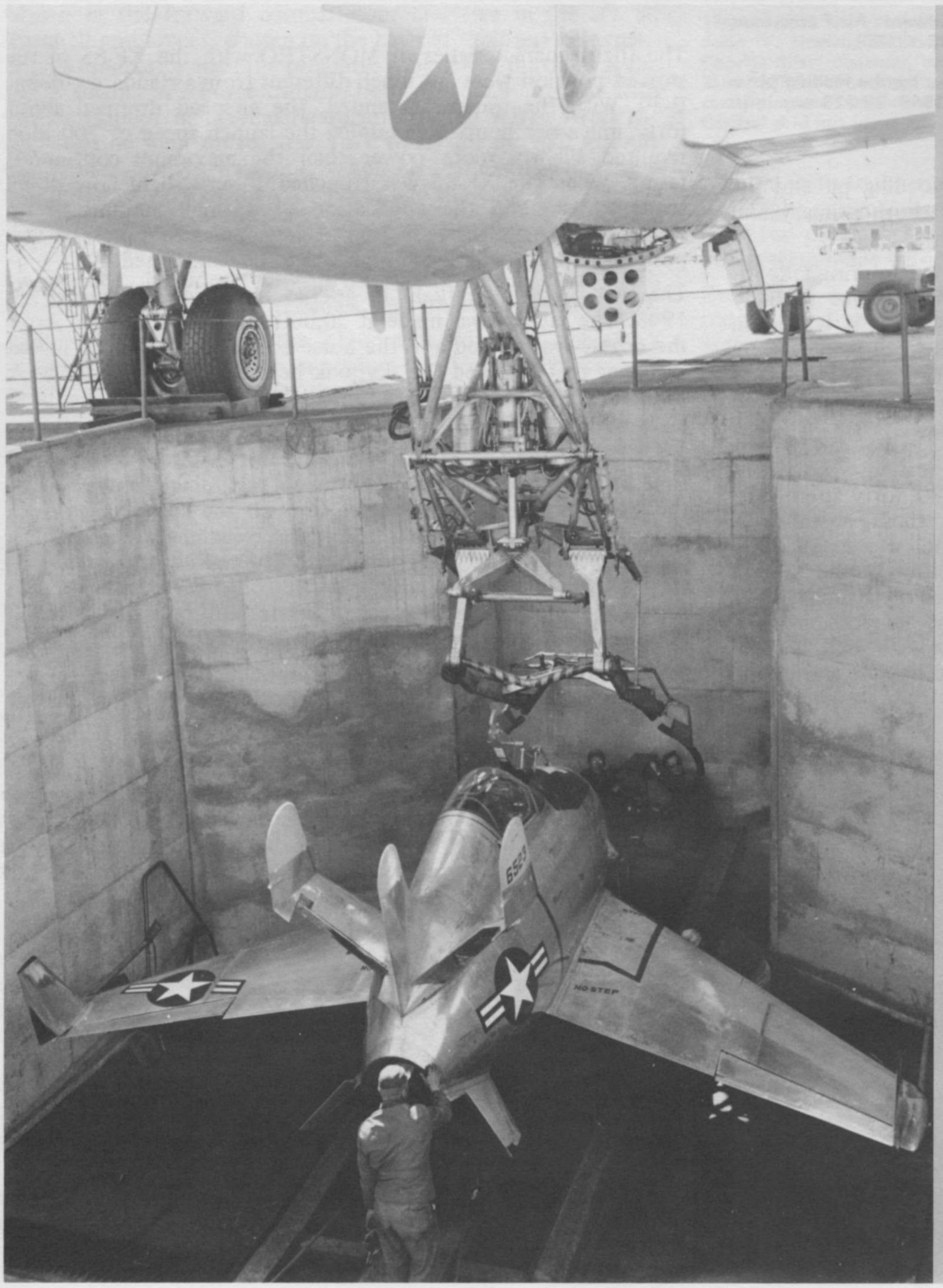
After a brief period spent feeling out the controls for the first time in free flight, Schoch performed a preliminary evaluation of the XF-85's flight characteristics through the speed range from 180 to 250 mph. He judged that it had excellent lateral stability and control, positive directional stability and control, and satisfactory longitudinal stability and control, but insufficient trim capability required him to exert a constant pull of 10 to 50 pounds on the stick in order to maintain level flight.

After about ten minutes of free flight, Schoch came back for the first hook-on. He maneuvered to a position off the port quarter









Above left, the front view of 46-524 in May 1948 at the McDonnell St. Louis plant. The skyhook was retracted, and wing skids are in position. The port in the nose ring was for the gun camera. (D4E-10110)

In the view above, of the XF-85 installed in the mother ship, the wingtip skids may be barely seen. The fairing under the EB-29B fuselage in front of the XF-85 nose was to prevent windmilling of the engine. (D4E-13006)

At left, the loading pit, with 46-523 being fitted to the complex trapeze structure. (D4E-13067)

The sequence of pictures on the opposite page, taken from the B-29 chase plane, shows the final hook-on attempt by Ed Schoch during the first free flight, 23 August 1948. It nearly ended in disaster as the XF-85 approached the trapeze, struck it, nosed up into the mechanism and shattered the canopy, and dove away, temporarily out of control. (D4E-11466 – 11468 and -114710)

of the EB-29B and made the approach with low closing speed to a point about five to seven feet below the trapeze, where the closing speed was eased off to zero. By this time, the necessity for maintaining a constant back pressure on the control column had tired him to a point where he found it necessary to keep both hands on the stick, and he could only increase the throttle by momentary use of his left hand. The difficulty experienced in adjusting the throttle and the bobbing motion of the XF-85 made a more rapid approach seem desirable, so Schoch dived away to try again.

This time Schoch made his approach from directly below the EB-29B, and at an angle of about forty-five degrees from the horizontal. He pre-set the engine throttle adjustment to 11,000 rpm, which he felt was sufficient to bring the airplane completely up to the trapeze. However, this increased power made the XF-85 approach at a higher closing speed than in the previous attempt, and the skyhook hit the trapeze bar too far aft to engage. The parasite bounced up into the horse collar, and the trapeze bar struck the canopy, shattering it and knocking off Schoch's helmet. The XF-85 fell away, temporarily out of control, and disappeared from the view of the EB-29B crew.

Losing a few thousand feet of altitude, Schoch regained control of the airplane and shortly determined that the airplane was relatively undamaged. Rather than abandon he decided to make a skid landing on the desert. Working with the pilot of the chase plane, Schoch checked out the stall speed of the XF-85 by using hand signals. Satisfied that the airplane was performing satisfactorily, he made a successful skid landing on the desert floor, touching down at about 140 mph. The airplane skidded for about two-thirds of a mile before coming to rest.

The damage was minor; some repair was required where the central skid crushed up against the fuselage, and these repairs were made at Muroc. Before the second free flight was attempted, some modifications were made to the vee tail to rectify the longitudinal trim problem. The upper ruddervator incidence was changed from -5 to -8 degrees and a trim spring was installed on



the control column, relieving the constant backpressure required of the pilot. The modifications were checked out in the fifth and sixth captive flights on October 11th and 13th.

The second free flight was made on October 14, and partial transcript of the communications between the four airplanes has survived. The release was made as before at 20,000 feet and 200 mph, and again Schoch encountered no problems in the launch. After this his first job was to check the stability and control with the system modifications. When the airplane was trimmed "full nose up," the control forces were very light in contrast to those encountered during the first flight.

Following preliminary evaluation, Schoch's first approach was initiated from dead astern the EB-29B, almost on the same level as the trapeze. The relative speed of the two aircraft was kept to a minimum. The transcript began:

"Where is he. . .?"

". . .Back a hundred yards. . ."

"I'm moving up now. . .moving pretty fast, can't we have more speed. . .?"

"We've got 200 on. . ."

"He's under the tail and slowed down. . .Halfway to the trapeze. . ."

"I'm coming up now. . .Steady . . .In close, in close. . ."

"He missed. Another three inches would have done it. . ."

"Where is he?"

"Under the nose. . ."

"Ed, we're a long way from Muroc. Hold off until I turn and head back."

Schoch had missed when, in anticipation of contact, he nosed the XF-85 down to engage the bar.

From the second B-29 the pilot called to Courtial, the mother ship pilot:

"Al, I'll talk about his position all the way in, then Ed won't have to do it. . .

"Fifty feet below your tail. . .approaching nicely. . .up slow. . .close enough for one of your boys to talk. . .Doing fine, holding six feet behind and three down. . .Come on Ed, you're doing fine. . .He's on!"

This successful approach was similar to the first, although Schoch found that during the last few feet he had to gradually increase power to maintain closing speed and move the airplane up to the trapeze bar. After engaging, the parasite pitched up slightly but quickly recovered to remain on the bar. This hook-on raised the hopes of everyone involved. The flight test report says, "It would appear from this first hook-on that the operation can be performed repeatedly".[13]

The next day two more flights resulted in the last successful hook-ons. They were short: Flight 3 lasted six minutes; Flight 4 lasted three minutes, having no other purpose than to practice hook-ons. No particular problems were encountered, although these flights again made it apparent that additional power was necessary to fly as close as one or two feet from the bar.

However, the difficulties in achieving successful hook-on were being realized. The report concluded that "it was not quite as easy as it appeared after the first hook-on, but it could be accomplished by a skilled pilot under favorable conditions.[14] Unfortunately, the required favorable conditions could hardly be expected to prevail in combat, and especially with a damaged airplane or wounded pilot.

A week later, on October 22, the fifth free flight was made. Its primary goal was to determine directional stability with the skyhook retracted. On all previous flights the hook well had been faired over and the hook remained extended. The release was made at 185 mph, not entirely satisfactory since Schoch had to pull up to a fairly high angle to lift off the trapeze. Directional stability was evaluated with the hook both extended and retracted, and Schoch found it to be satisfactory.

On his first approach to the trapeze, Schoch came in at 200 mph. All was normal until the airplane reached a position about four or five feet from the trapeze, at which point the XF-85 started to exhibit a tendency to roll or skid. At a position within two feet of the trapeze the airplane became extremely difficult to control, and Schoch fell away.

On the second approach, Schoch flew the airplane to within three feet of the trapeze. From this point, a lunge for the bar with a burst of power just missed and Schoch dived away to try again.

After a short period of relaxation, during which the EB-29B speeded up to 215 mph in a gentle dive, the third unsuccessful approach was started. This time the XF-85 was again brought to within two or three feet of the trapeze, but then started bobbing up and down so Schoch dived away once more.

The fourth try was made at 17,500 feet and with higher engine power. The increased power gave a higher closing speed and as Schoch nosed down to engage the trapeze bar the hook broke. By now it appeared the instability of the XF-85 near the trapeze made a successful hook-on impossible and once more Schoch made a skid landing on the desert floor, touching down at 145 knots. The damage was slight.

The directional stability problem had to be solved before flight testing could be resumed. With the skyhook extended, and the hook well uncovered, turbulent airflow in the vicinity of the trapeze apparently made the XF-85 directionally unstable. It gave the airplane a skidding motion, making hook-ons impossible.

There was a pause while a wind tunnel test was scheduled in the University of Washington facility. Several devices to improve the directional stability were tried, including a variable geometry ventral fin and a re-faired aft fuselage. From the tests it was determined that the best solution, short of complete re-design of the entire hook, was a blister-fairing around the base of the hook, plus additional vertical fins at the wing tips. And to give the pilot a better chance of hooking on, it was decided to extend the upper flange of the hook eye. This was accomplished by attaching a six inch extension with two shear pins.

The flight test airplane was returned to St. Louis to undergo modification. Both XF-85's were modified and the first airplane, 46-523, was also fitted with a re-faired aft fuselage in the vicinity of the dorsal fin. It was hoped that this fairing would reduce the turbulence around the rear fuselage and so reduce the snaking tendency. Thus modified, both airplanes were airlifted to Muroc, No. 524 on January 14, 1949, and 523 on February 23.

Flight testing was resumed on March 8th with 524's eighth captive flight, followed the next day by its ninth. The first captive flight of 46-523 took place on March 14. These seemed to indicate that the new configuration was adequate and the airplanes were ready for free flight.

524 made its sixth and last free flight on March 19th, somewhat marred by an accident. The takeoff and climb to launch altitude were made as usual, and Schoch transferred to the XF-85 according to flight plan. Shortly after the transfer was completed, Muroc Ground Control requested the EB-29B to fly a holding pattern because of a bombing run being flown by another aircraft in the area. The hold lasted for about thirty minutes, and all during this time the EB-29B crew could not communicate with Schoch. He was therefore unaware of the reason for the delay and it undoubtedly made him tense. After the trapeze was extended and during the check out procedure, Schoch inadvertently tripped the skyhook latch, leaving the XF-85 supported only by the horse collar. It created a binding condition between the collar



The first XF-85, 46-523, last to be flown, in its final configuration. Modifications included the wingtip vertical fins, the re-faired fuselage aft of the cockpit, blister fairings around the skyhook, and the extension to the upper flange of the skyhook. The tail surface trimtabs had been enlarged for better control. The airspeed boom is in the left wingtip, and a similar boom with yaw and pitch sensors was in the right wingtip. (D4E-13188)

and the fuselage and damaged the stabilizing collar actuators and linkages.

Schoch completed his launch with no further difficulty, but he could not attempt a hook-on. Before he landed on the desert, he made a preliminary evaluation of the new configuration and found it to be much improved. After a flight of nineteen minutes, Schoch touched down at 190 mph. Damage incurred in this landing was very minor and the airplane could have been made ready for flight with a minimum of effort.

The damage to the trapeze now created an emergency situation in the mother ship. Only the main sections could be retracted, leaving the stabilizing collar extended. Fortunately, although the collar dragged on the runway creating a shower of sparks, no damage was done to the airplane itself. While repairs to the trapeze continued, the engine of No. 524 was removed and checked for damage, but none was found. Number 523 was made ready for flight testing and the ejection seat gun assembly was transferred from airplane 524. For some reason this particular flight test program seems to have rated only one gun assembly. And there was a change to the number two engine of the EB-29B without the benefit of the usual ground support equipment. The new engine was tested in flight on April 7 and performed satisfactorily, and the decision was made to fly the XF-85 the next day.

Schoch flew four simulated approaches to the trapeze in the F-80 that morning. About two hours later the parasite was mounted on the trapeze, the system cycled and the airplane was ready for flight. It was to be the last one for either XF-85.

Takeoff and climb to launch altitude were uneventful, and at 21,000 feet and 175 mph the launch was completed. The first few minutes of free flight showed the airplane to be very responsive to small control applications about all axes. In the next fifteen minutes, the first hook-on of the day was attempted.

Schoch started the approach from a point about fifty feet below the tail of the EB-29B and approached the trapeze in a gradual climb with low closing speed. At a point about two feet aft of the trapeze the closing speed went to zero; gradual increases in engine rpm gave no appreciable closing and turbulence from the trapeze made much control manipulation necessary to maintain position, so the approach was discontinued.

The second approach was similar to the first. Schoch maintained a position directly behind and level with the trapeze for several minutes during which he applied considerable power to bring the skyhook up to the trapeze. The hook struck the trapeze about one foot below the hook eye and then deflected upward to the hook extension, breaking one of the shear pins. The trapeze was missed, and Schoch dived away to try again.

The third and final approach was similar to the others, except that the closing speed was lost at a point about four feet from the trapeze. The increased power and control manipulation had by now become very difficult to manage, so the approach was discontinued. By this time, a considerable amount of fuel had been expended and Schoch decided to land. He touched down at 175 mph and again the damage was very minor.

This seventh flight brought the flight testing of the XF-85 to a close. The decision to terminate the program had officially been made in the spring of 1949, although it was generally known that the Air Force had been doubtful of the program's chance for success since the end of 1947. The XF-85's shortcomings were not primarily the result of engineering deficiencies, but rather of the requirement that it fit inside the bomb bay of a B-36. This size limitation gave a small aircraft with limited endurance a definite disadvantage in combat. The configuration, although unconventional, had no outstanding vices, but rather displayed the usual difficulties that require more time and money to iron out than the Air Force was willing to spend.

The Phase I flight test goal had been to develop a satisfactory hook-on technique. Three basic types of approach had been considered.

An approach from dead astern and on a level with the trapeze

proved to be unsatisfactory, because too much turbulence from the trapeze was encountered. An approach at a forty-five degree angle to the horizontal proved to be too dangerous, because it gave the pilot little time for correcting his flight path before engaging the trapeze bar. A compromise between these types was finally found to be the optimum; a climbing approach with low closing speed was made to a point about ten feet aft of the bar, from which point a level final approach was made. This kept the XF-85 out of the turbulence as long as possible and allowed the pilot to approach the bar horizontally.

Although the XF-85 flight test program fell short of its goals, the difficulties involved may be appreciated by noting that a new aircraft with a unique configuration and unknown flying qualities had been used to perform one of the most difficult aerial maneuvers; that of in-flight recovery. The greatest difficulties were encountered during the last few feet of approach to the trapeze, yet this was basically the result of the trapeze/skyhook design. The bulky trapeze produced excessive turbulence which, when combined with the already disturbed flow near the B-29 fuselage, made the XF-85 very difficult to control. Also, the shock absorption of the trapeze was insufficient, tending to deflect the airplane away instead of absorbing the shock. The skyhook was in the wrong place in relation to the center of gravity in its extended position. With the suspension well above the c.g., there was a tendency for the parasite to float on the trapeze, making control difficult.

McDonnell proposed a new trapeze/skyhook arrangement, but it was not approved. The new design would feature a more streamlined trapeze, located further from the B-29 fuselage to greatly reduce the turbulence encountered, and the new skyhook would be much lower, almost directly in line with the pilot's eyes. This would let the parasite be towed by the trapeze, rather than hang from it.

As for the XF-85 itself, its flight characteristics were generally considered to be good, in spite of the unique configuration, although the longitudinal stick forces were high because of the short tail moment arm. It was apparently quite maneuverable; pilots of the F-80 chase planes remarked that the airplane was difficult to follow in turns. Several persons connected with the flight test department recall that Ed Schoch was enthusiastic about the handling qualities.

Both XF-85's were turned over to the Air Force late in 1949. 46-523 was given to the Air Force Museum on August 23, 1950 and is on display near the Convair B-36 for which it was designed. 46-524 was used for several years as part of an Air Force mobile display and was seen at many state fairs and similar functions. Later it was purchased by the Tallmantz Museum in Southern California and displayed there for several years Recently, it was moved to the static display at Offutt AFB, headquarters of SAC.

Perhaps hastening the demise of the XF-85 Parasite Fighter Program was the advent of the wing tip coupling concept, first proposed to the Air Force in 1947. This concept had several advantages over the XF-85: it used standard Republic F-84 aircraft, whose flight characteristics were known, but more importantly, in coupled flight, a B-50 could tow two F-84's and carry its normal bomb load with only about a 5% reduction in operating range. The experience obtained from the XF-85 program also proved valuable in parasite developments such as FICON. Perhaps the goals set for the initial test program were too ambitious. Maybe a better approach would have been to work the bugs out of the XF-85 in an initial flight test program and then to proceed to the development of a hook-on procedure. This was not the case, however, and the program was canceled. As the only aircraft ever designed from the outset to operate from another aircraft, the McDonnell XF-85 deserves a place in aviation history.

XF-85 FLIGHT TEST LOG

Date	EB-29B Flt. No.	XF-85 Flt. No.	Time	Wt. (lbs)	Purpose of Flight
7/22/48	4	524 Captive No. 1	–	5327	Captive Flight
7/30/48	5	524 Captive No. 2	–	5327	Captive Flight
8/2/48	6	524 Captive No. 3	–	5527	Power Off Stability
8/10/48	7	524 Captive No. 4	–	6017	Engine Run
8/18/48	11	524 Captive No. 5	–	6017	Engine Run & Stability
8/23/48	13	524-1	0:25	6017	First Flight
10/11/48	21	524 Captive No. 6	–	5900	Captive Flight Stability
10/13/48	22	524 Captive No. 7	–	5900	Captive Flight Stability
10/14/48	23	524-2	0:20	5900	Directional Stability & Hook On
10/15/48	24	524-3	0:06	5900	Hook On
10/15/48	24	524-4	0:03	5900	Hook On
10/22/48	26	524-5	0:36	5900	Directional Stability
3/8/49	38	524 Captive No. 8	–	5945	Captive Flight Stability
3/9/49	40	524 Captive No. 9	–	5945	Captive Flight Stability
3/14/49	41	523 Captive No. 1	–	5993	Captive Flight Stability
3/18/49	45	524-6	0:19	5945	Stability
4/8/49	49	523-1	0:30	5993	Stability

XF-85 SPECIFICATIONS

Note: All information given is for the stripped airplane except that marked (*), pertaining to the projected service type.

Engine – Westinghouse J34-WE-22, 3,000 lbs thrust at sea level.

Weights: (lbs)		
Empty	3984	(*)
Useful load	1616	(*)
Gross	5600	(*)
Performance:		
Max. speed, sea level	648 mph	(*)
Max. speed, 40,000 ft.	573 mph	(*)
Climb, sea level	12,500 fpm	(*)
Climb, 40,000 ft.	2,000 fpm	(*)
Service ceiling	48,200 ft.	(*)
Endurance at 40,000 ft.		
Full thrust	36 min.	(*)
Max. endurance	77 min.	(*)
Combat mission at 40,000 ft.		
Full thrust	20 min.	(*)
Cruise	32 min.	(*)
Ultimate load factor	11.0	
Limit maneuver load factor	7.33,-3.0	
Fuel system (gallons)		
Fuselage main	115	
Fuselage auxiliary	26	
Wing, each side	30	
Electrical system	28 VDC	
Dimensional data		
Fuselage length	177.75 in.	
Overall length	196.25 in.	
Overall height	99.21 in.	
Span, wings extended	128.00 in.	
Span, wings folded	66.60 in.	
Wing area	100.52 ft. sq.	
Airfoil – $NACA_1$-010		

ACKNOWLEDGEMENTS

This article would have been impossible to complete without the co-operation of Herman Barkey, John Y. Brown, and Les Eash, all of McDonnell Aircraft, who answered many questions about the project, and made many valuable comments about the rough draft of the article. Thanks also go to Gordon LeBert of the McDonnell External Relations Department for giving much help in obtaining photographs, copies of reports, and for offering many helpful suggestions.

NOTES AND REFERENCES:

1. See "The Navy's First Skyhook," by Richard K. Smith, J-AAHS, Vol. 6, No. 2, pp. 91-98, and "The Control of Airship Planes," by Capt. Donald Mackey, USN (Ret), J-AAHS, Vol. 8, No. 1, pp. 13-22.
2. See "Design Development of the XB-36," by Meyers K. Jacobsen, J-AAHS, Vol. 15, No. 4, pp. 224-235.
3. Chronologically, the wingtip coupling experiments were next. The concept of wingtip coupling was suggested to the Air Force in 1947 by two German engineers who had come to Wright Field after World War II, Bernhard A. Hohmann and Dr. Richard Vogt (who had been the chief engineer of the Blohm and Voss aircraft division). Simply stated, theory showed that smaller aircraft, fighters or even winged fuel tanks, could be hooked onto the wingtips of large bombers in flight, and that the increased span of this combination would effectively create a more efficient (higher aspect ratio) wing. The improvement in efficiency would allow the two parasites to be carried with almost no drag penalty. This was seen as a solution to the problem of providing fighter escort for long range bombers.

   The Germans experimented briefly with this concept in World War II. In late 1944, the DFS (German Research Institute for Gliders) attempted to fly two Klemm K1 35s coupled through their wingtips, to see if the theoretical gains could actually be realized. A few flights are known to have been performed, but the results are unknown as are the details of any further tests.

   Somewhat better known, but still relatively undocumented, was the FICON (FIghter CONveyer) project of 1951-1956. FICON was a method of combining the long range capability of the B-36 with the high speed, short range capability of the RF-84F. There were three phases of development.

   The FICON concept showed sufficient promise for the Air Force to order 25 RF-84Fs modified to the RF-84K configuration, the K being similar to the F except for such details as the drooped horizontal stabilizer, trapeze hooks and nuclear weapons delivery capability. The RF-84Ks were assigned to the 91st Strategic Reconnaissance Squadron (part of the 71st SRW) at Larsen AFB Washington, the only FICON squadron in the Air Force. The parent aircraft for the FICON operations were GRB-36Ds based at nearby Fairchild AFB. The 91st performed a few experimental FICON operations in December 1955 and commenced regular operations in January 1956. After a very brief period these were terminated due to a series of "incidents" involving the hook-up procedure. The special FICON equipment was removed from the Ks and they were thereafter used as conventional RF-84Fs. The assignments of the Ks after leaving the 91st (which was disbanded) is unknown, but several were reported in the Phillipines and Europe. The last known assignment was the Michigan Air Guard (107th TRS) at Detroit.

   Additional data on the wingtip coupling and FICON projects are needed:

   a. details of the coupling experiments carried out by the DFS with Klemm 35s in World War II, as well as any other German experiments in coupling at wingtips.
   b. any documentation on the Wright Field C-47/Q-14B or Republic B-29/F-84 wingtip coupling experiments; engineering reports, newspaper or magazine articles, etc.
   c. verification that a B-36 was modified for wingtip coupling, and information on the actual tests, viz., was the modification completed, were flight tests performed, why was the program canceled?
   d. photos, no matter how poor, of wingtip-coupled aircraft.
   e. information on the YF-84F involvement in the FICON project.
   f. correspondence with personnel of the 91st SRS or crewmen of the GRB-36Ds based at Fairchild AFB.
   g. photos of RF-84Ks in operational markings, whether by the 91st SRS, the Michigan Air Guard or other units.
   h. information on units that used the RF-84Ks after the FICON operations were stopped and the 91st SRS disbanded in 1957.
4. Actually the US Army Air Force. The author has chosen to use the term "Air Force" throughout this article for both the USAAF and the USAF. Similarly, the Goblin is always referred to as the XF-85 even though it was officially the XP-85 until 1948.
5. Bowers, Peter, and Swanborough, F.G., *United States Military Aircraft Since 1909,* New York: Putnam; 1963. See also Jacobsen; "Design Development of XB-36," Op. Cit.
6. Smith, Richard K., "An Escort Appended," *Flying Review International* December, 1967. This article contains much valuable information about the preliminary phases of the parasite fighter project.
7. McDonnell Aircraft Company, Report No. 1226: XF-85 Fighter Design and Development Summary," Sept. 1, 1949.
8. McDonnell Aircraft Company, Report No. S-145: "Model Specification for the XP-85 High Altitude Parasite Fighter," Feb. 8, 1946.
9. The Summary Flight Test Report No. 1181 states: (p. 80) "Preliminary captive flight tests indicated that the drag produced by the wing skids would prove detrimental to the flight characteristics of the airplane during the hook-on phase of the flight. Careful analysis of previous skid landings with other types of airplanes, mainly the Me 163, indicated that these wing skids would not be necessary for stability during the ground run of a skid landing. Therefore these skids were removed previous to the first flight of the XF-85."
10. *Aviation Week,* December 1, 1947.
11. Memorandum, John Y. Brown to Author, 18 August 1971.
12. Letter, Les Eash to Author, 7 October 1971.
13. McDonnell Aircraft Company, Report No. 1016: "Summary of Results on the XF-85 Parasite Fighter Program," Nov. 5, 1948.
14. McDonnell Aircraft Company, Report No. 1199: "Summary of Results on XF-85 Program," April 13, 1949.

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c. NACA Report Rn SA8123, "An Investigation of the McDonnell XP-85 Airplane in the Ames 40 by 80-ft. Wind Tunnel-Force and Moment Tests," September 27, 1948.
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f. McDonnell Aircraft Company Report No. 1088, "Proposed Modification to the XF-85 Airplane and Trapeze Mechanism." February 28, 1949.
g. McDonnell Aircraft Company, Report No. 1177, "Weekly Summary Progress Report for Week Ending 10 April, 1949."
h. McDonnell Aircraft Company, Report No. 1179, "Summary Report of EB-29B Utilization in Flight Testing the XF-85 Parasite Fighter," April 22, 1949.
i. McDonnell Aircraft Company, Report No. 1181, "Parasite Fighter Phase I Flight Test Report — Model XF-85," May 24, 1949.
j. Air Material Command, USAF Report TSEOA-4-1, "Observance of Turbulence Below B-29 with P-80 Aircraft."



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