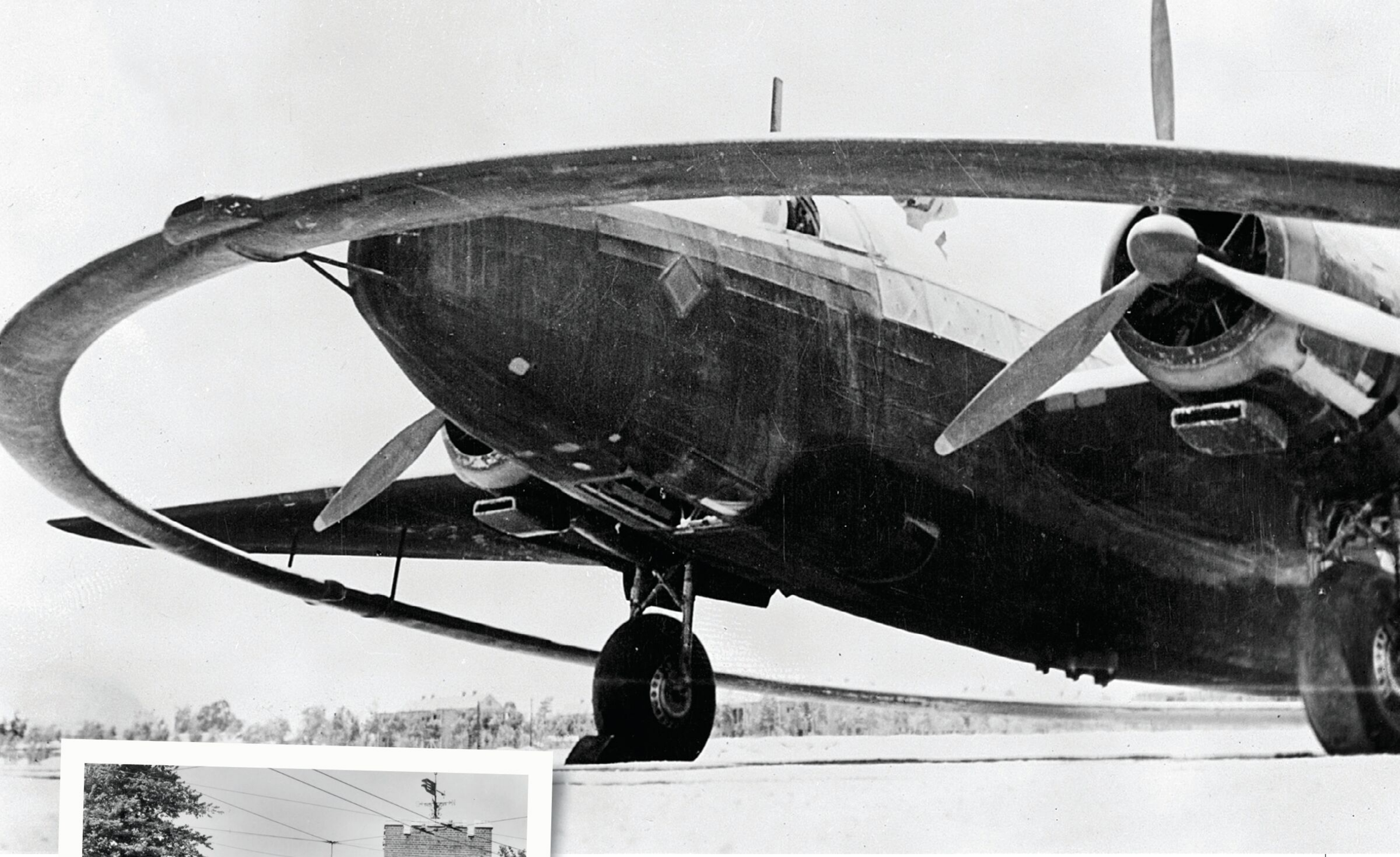
AERIAL MINESWEEPERS OF WORLD WAR II

WHEN GERMANY DEPLOYED MAGNETIC MINES EARLY IN THE WAR, BRITAIN COUNTERED WITH AIRCRAFT THAT COULD EXPLODE THEM BY MIMICKING A SHIP'S MAGNETIC SIGNATURE

BY CARL O. SCHUSTER

LORD OF THE RING
In a painting by Michael Turner, a specially modified Vickers Wellington uses its electrically charged, 48-foot-diameter ring to detonate a German magnetic mine during World War II.



ON SEPTEMBER 3, 1939, TWO DAYS AFTER GERMANY INVADED POLAND, THE GERMAN SUBMARINES U-13, U-14 AND U-17 STARTED LAYING THREE FIELDS OF MAGNETIC-INFLUENCE MINES ON THE SEA FLOOR JUST OFF BRITAIN'S EAST COAST.

FIGHTING BACK
Top: A Wellington DWI Mark II readies for de-mining duty in Egypt. Inset: The Royal Navy's mine warfare section at HMS *Vernon* developed the strategy for countering German magnetic mines.

Within days, four ships totaling 14,575 gross registered tons were sunk and another 10,391 GRT of shipping was damaged. Although mines were suspected, minesweepers dispatched to the area did not find any, leading most Royal Navy officials to believe that the losses were due to U-boat torpedo attacks, even though survivors did not report seeing torpedo wakes. The mystery remained unsolved until a mine was successfully recovered on November 21, 1939. HMS *Vernon*, the Royal Navy's shore establishment technology research center in Portsmouth, initiated an effort to learn the mine's triggering mechanism and recommend effective countermeasures.

Steel warships generate a magnetic signature as they steam through sea-lanes, cutting across the Earth's magnetic field. The German magnetic-influence mines were designed to capitalize on this, detonating when they detected that signature, even from considerable depths.

PREVIOUS SPREAD: ILLUSTRATION BY MICHAEL TURNER; ABOVE: IWM CM5312; INSET: AWM P05468.001; OPPOSITE TOP: IWM MH31337; RIGHT: IWM CM5313

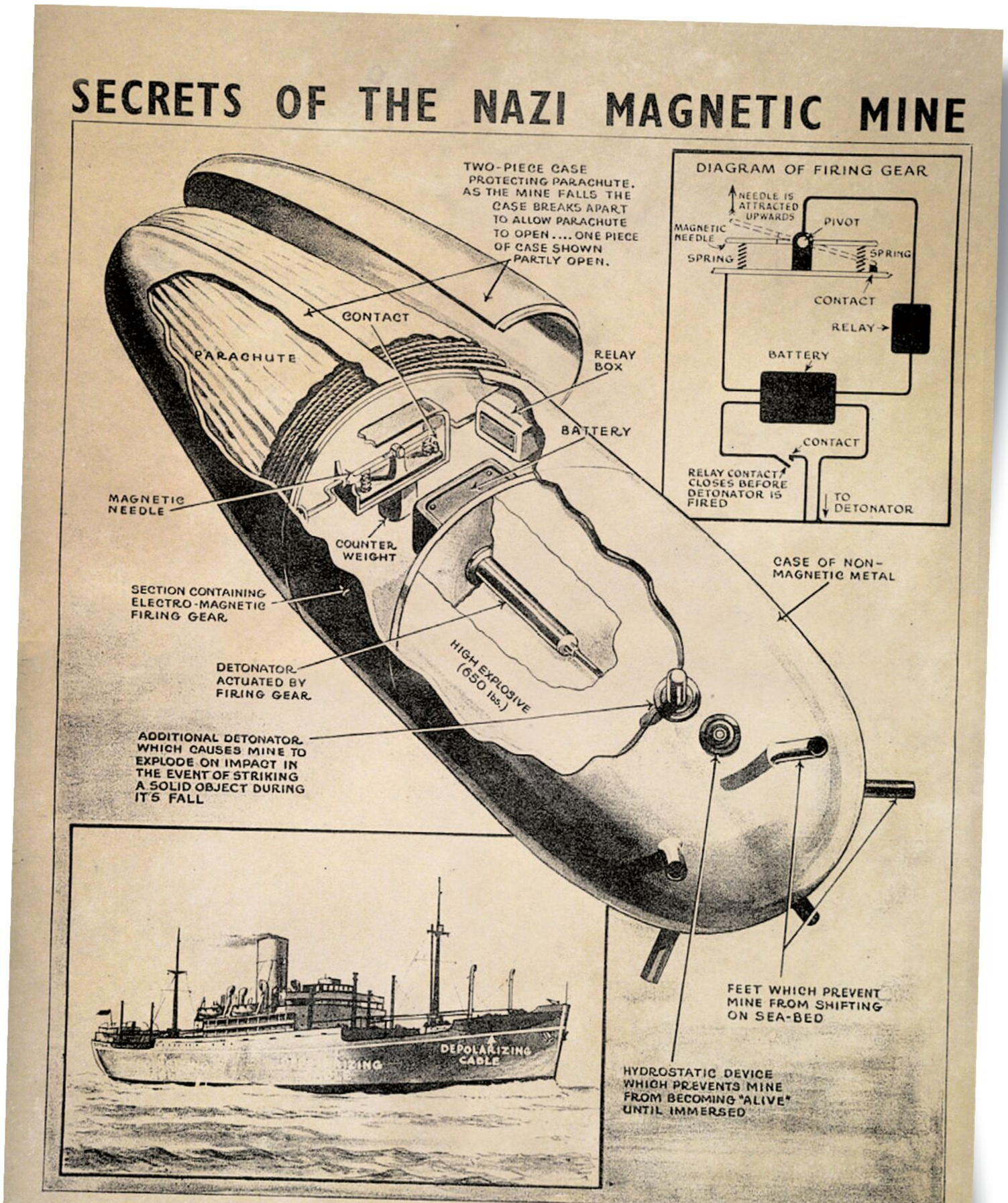
Britain worked to rapidly developed shipborne degaussing equipment and deperming operations to neutralize and remove ships' magnetic signatures, respectively. The Royal Navy also introduced shipborne magnetic minesweeping equipment and tactics in record time, but full-scale implementation lay months away. Moreover, building and crewing the large numbers of minesweepers required to cover all British ports and coastal waterways would take months that Britain did not have.

By year's end, Germany had deployed 470 magnetic mines that claimed 79 ships of 162,697 GRT. With so much coastline and waters to protect, it was imperative that Britain develop a fast-moving magnetic countermeasure system. The solution was to build an aircraft that replicated a ship's magnetic signature so that it could detonate mines from a safe distance as it flew over them.

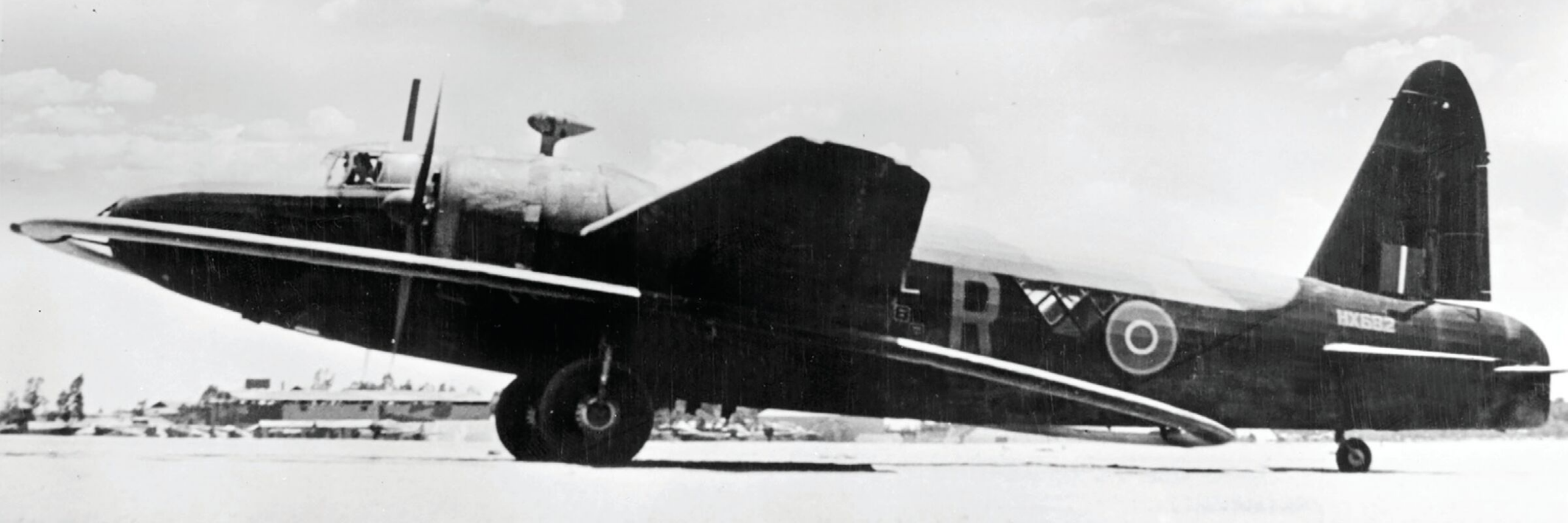
With that in mind, Royal Air Force Coastal Command asked the Vickers firm to modify its Wellington bomber for the aerial minesweeping role. It was a revolutionary idea. At the time, few naval leaders knew bottom magnetic-influence mines existed. Minesweeping therefore consisted of towing gear that cut the mooring cables of traditional contact mines so that they floated to the surface and could be destroyed.

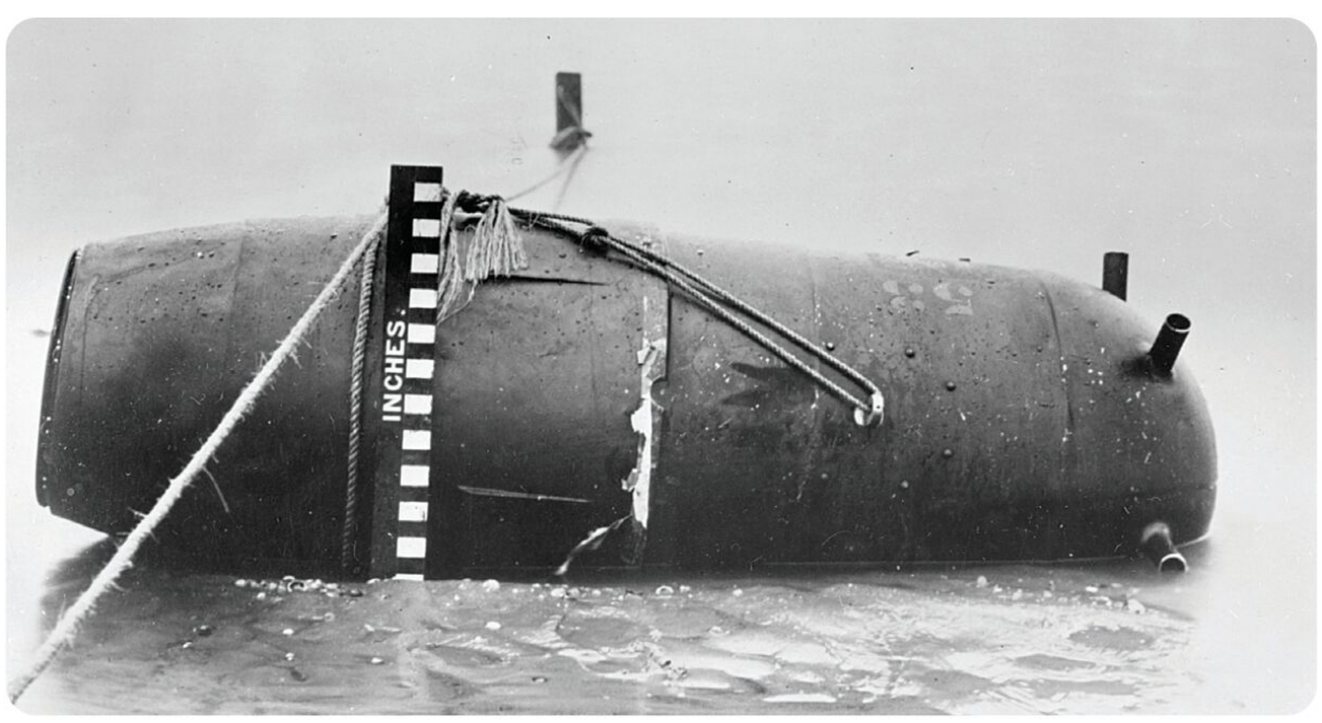
Royal Navy leaders at HMS *Vernon*'s mine warfare section had expected Germany to deploy magnetic mines. In fact, Britain had developed and deployed magnetic mines off the German coast in 1918 and off the Estonian coast in 1919 during its peripheral involvement in the Russian Civil War. HMS *Vernon* officials correctly believed that Soviet authorities had recovered some of those mines and turned them over to the Germans in the 1920s. The challenge was to determine the specific parameters of the German detonating system—the detonation threshold and timing. No countermeasure's effectiveness could be assured without that knowledge. The British had it by December 1939 and quickly identified the countermeasure requirements.

The Wellington was a natural choice for the aerial platform. Already in mass production, it had good range and with many crews experienced in maritime operations it offered a fast, cost-effective platform, provided the potential aerodynamic challenges could be solved. With that viewed as the most critical problem, Vickers first installed a 48-foot-diameter balsa wood ring outside the airframe, attaching it beneath the fuselage and



SECRET'S OUT
Above: An exploded view of a German magnetic mine. Below: This Wellington DWI was one of six that were assigned to No. 202 Group in Egypt to clear mines from the Suez Canal and the Mediterranean coast.





BEACHCOMBING
Top: A clearance team recovers a German magnetic mine from the British shore. Above: A German magnetic mine raised in 1939. Below: The Germans and British approached aerial minesweeping in a similar fashion.

wings. The ring contained aluminum strip coils that emitted magnetic impulses when charged by an electrical current. Aluminum was used to save weight and costs since copper wire was heavier and in short supply. Early flight testing revealed the ring had surprisingly little impact on the airplane's flight characteristics and handling.

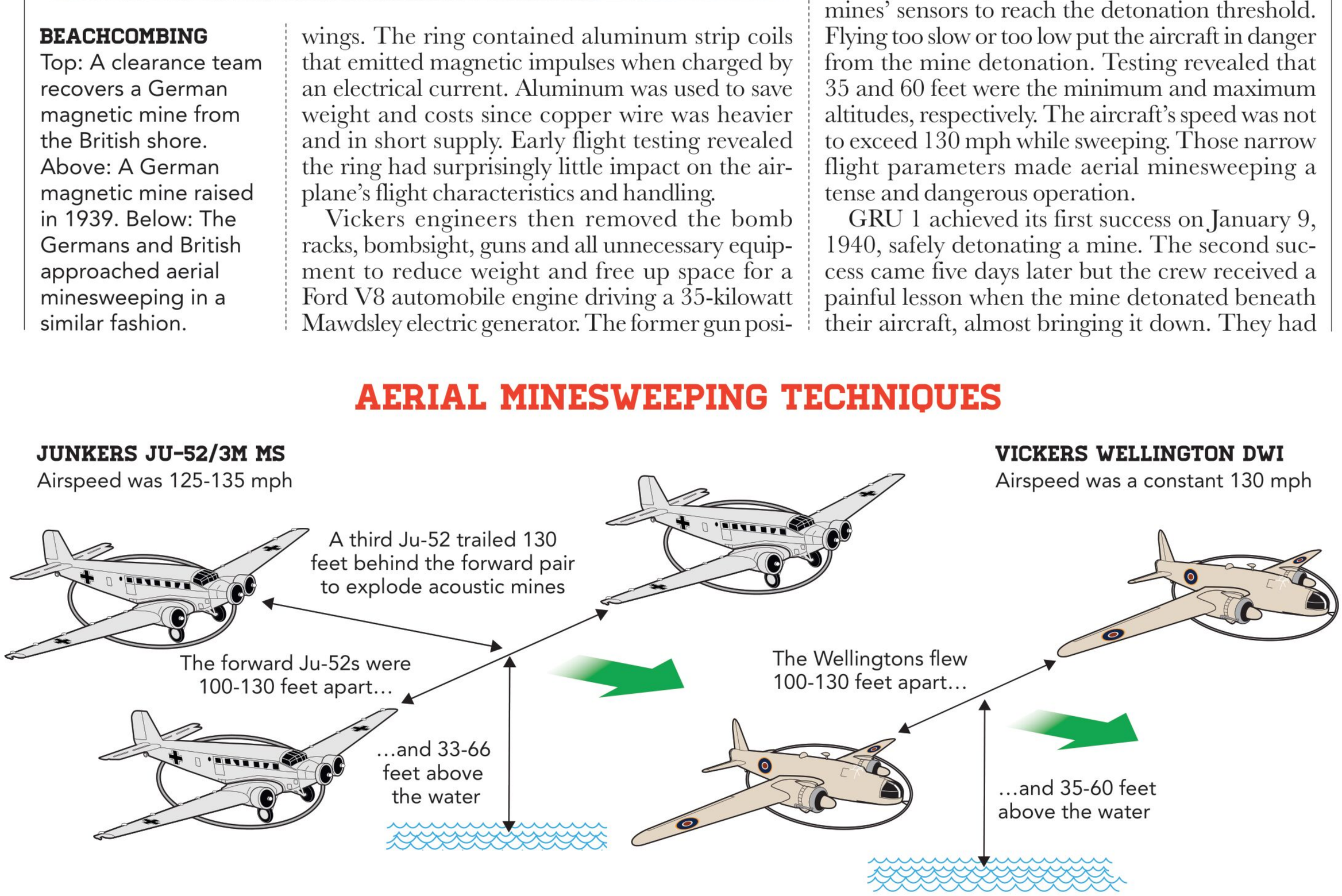
Vickers engineers then removed the bomb racks, bombsight, guns and all unnecessary equipment to reduce weight and free up space for a Ford V8 automobile engine driving a 35-kilowatt Mawdsley electric generator. The former gun positions were faired over to streamline the fuselage. Also, because the magnetic coil rendered normal compasses useless, the Wellington was fitted with a gyrocompass.

Testing in December 1939 against a disarmed German magnetic mine validated the concept. The prototype's success led to three more Wellingtons being modified on the production line, bringing the inventory to four by January 1940. Vickers built another 11 from production lines at other plants. The 15 aircraft were designated as Mark Ia DWIs (Directional Wireless Installation) and assigned to General Reconnaissance Unit 1 (GRU 1) to hide their true mission. Operating out of RAF Manston, GRU 1 was responsible for keeping the Thames Estuary clear of magnetic mines.

With the modified Wellingtons now operational, the next challenge was to establish the required altitude and transit speed for the "influence sweep" simulating a ship's magnetic signature. The planes had to fly low enough to ensure they could detonate the mines laying on the seabed. Speed was also an issue. Flying too fast would not allow the mines' sensors to reach the detonation threshold. Flying too slow or too low put the aircraft in danger from the mine detonation. Testing revealed that 35 and 60 feet were the minimum and maximum altitudes, respectively. The aircraft's speed was not to exceed 130 mph while sweeping. Those narrow flight parameters made aerial minesweeping a tense and dangerous operation.

GRU 1 achieved its first success on January 9, 1940, safely detonating a mine. The second success came five days later but the crew received a painful lesson when the mine detonated beneath their aircraft, almost bringing it down. They had

AERIAL MINESWEEPING TECHNIQUES



been flying below 35 feet, exploding the mine an estimated three-tenths of a second early. The Wellington was propelled upward about 40 feet by the blast, its hatches were blown off and the accelerometer recorded 10 Gs of force on the airframe. In a testament to the bomber's robustness, no structural damage was inflicted beyond the loss of the hatches.

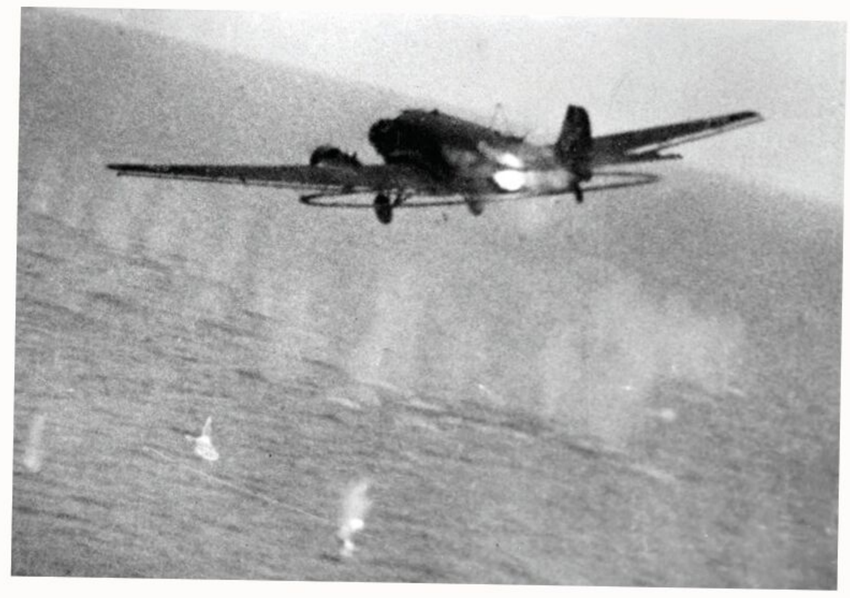
In addition to sweeping British waters, three GRU 1 Wellingtons swept the waters ahead of HMS *Hereward* when it evacuated the Dutch royal family to Britain in May 1940. Fighter escorts protected the unarmed minesweepers on missions in dangerous waters, but neither RAF nor Luftwaffe records indicate any were ever attacked.

Vickers' designers introduced several improvements in early 1940. The resulting Mark II DWIs used a lighter and more powerful de Havilland Gipsy Six engine powering a 96-kilowatt generator, for a weight savings of more than 1,000 pounds. The greater generating power also enabled them to reduce the coil ring diameter. The Gipsy engines produced more heat, leading the designers to install an air duct to improve engine cooling and a smaller one to guide air into the coil to prevent overheating.

The gyrocompass had proven unreliable and needed to be replaced. Vickers engineers discovered that mounting the normal compass in the tail isolated it from the coil's magnetic influence. By placing a compass indicator in the instrument panel they eliminated the need for the gyro, saving more weight and improving navigation. By August 1941, all Wellington DWIs had been brought up to Mark II standard.

The Royal Air Force formed a second aerial minesweeping unit under GRU 1 in April 1940, equipping it with two Mark Ia DWIs and the first Mark II DWI. Operations along the British coast were largely successful as the Wellingtons were used primarily as a quick-response countermeasures force against suspected minefields or to clear ports critical to ongoing operations.

Concerned about potential Italian mining of Egyptian ports and the Suez Canal, Britain deployed a Mark Ia to the Mediterranean on May 20 along with technicians and equipment to convert the five GRU 1 Wellingtons that followed to Mark II standards. Assigned to Middle East Command's No. 202 Group, the six planes swept for mines in the Suez Canal, off the Egyptian and North African coast and in the approaches to Malta. Ironically, as the Allies advanced across North Africa in 1943, the aerial minesweepers'



HAZARDOUS WATERS
Top: A Wellington DWI performs a sweep over Tripoli harbor after the city fell to the Allies on January 23, 1943. Above: A German Junkers Ju-52/3m MS minesweeper erupts in flames after being targeted by an RAF Hawker Typhoon off Lorient, France.

OPPOSITE FROM TOP: AWM P05468.013; IWM A30292; ILLUSTRATION BY STEVE KARP; ABOVE: IWM CM5201; INSET: IWM C4095

NAVAL MINE WARFARE IN THE ATLANTIC AND EUROPEAN THEATERS SANK MORE THAN ONE MILLION TONS OF ALLIED SHIPPING.

primary focus shifted to countering Allied mines originally laid to close the Axis' North African ports so that the harbors could be reopened.

Although not as well known as the German magnetic mining effort, Britain's mining of German waters also involved magnetic mines. The Kriegsmarine recovered one such mine off Jutland in late September 1939. While German losses to mines were not as serious as those suffered by Britain, the potential threat they posed to Germany's naval training areas in the Baltic and North seas necessitated a quick solution. Like the RAF, the Luftwaffe chose an existing aerial platform as a testbed, the Junkers Ju-52/3m transport.

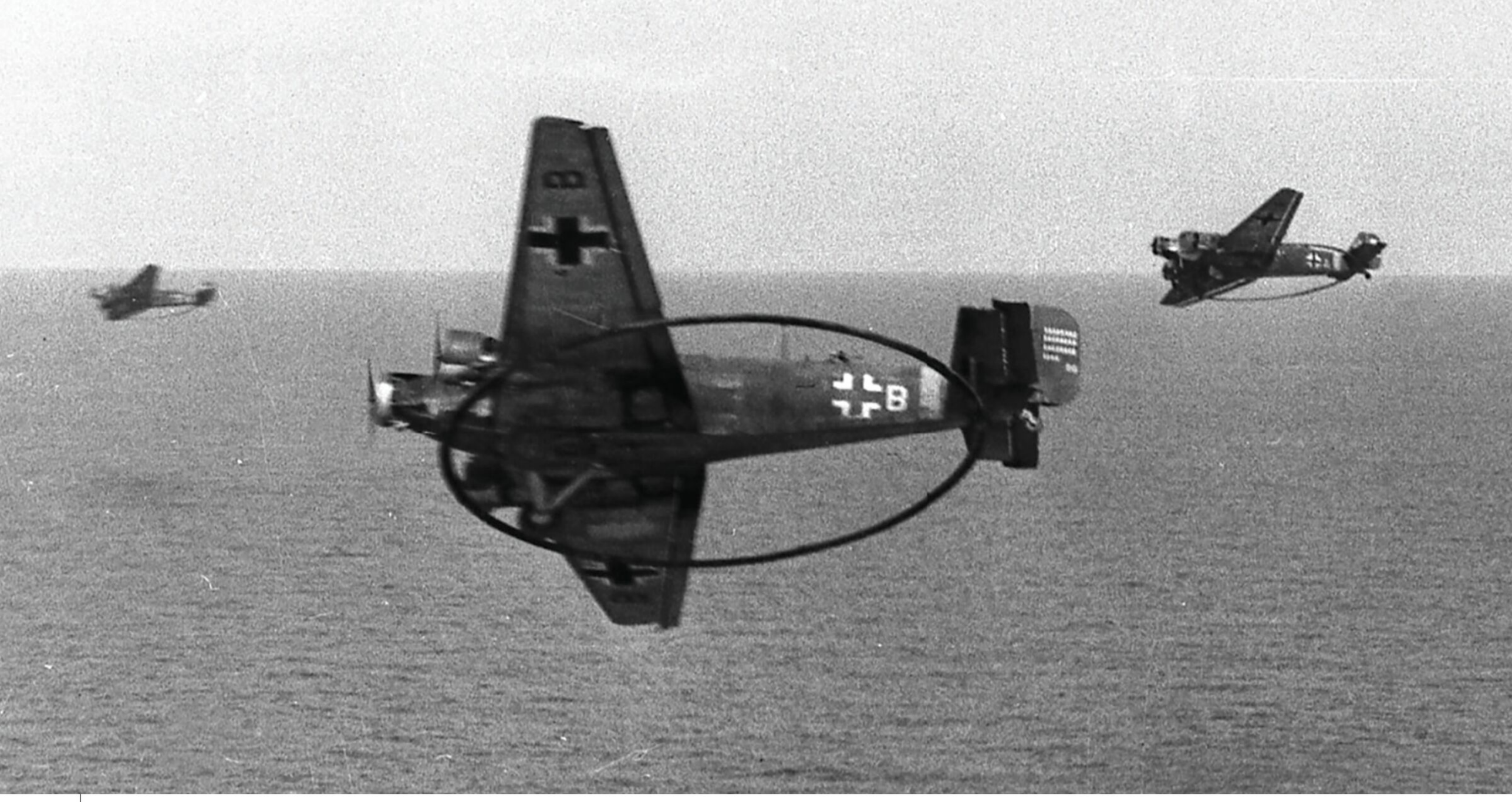
The prototype used a 51-hp diesel engine driving a 35-kilowatt generator borrowed from a searchlight unit to power the coil, but otherwise the program was similar to Britain's. A 14-meter (46-foot) balsa wood ring containing an aluminum coil was attached to the Ju-52's wings via plywood struts. The first flight took place in mid-October 1939, followed two weeks later by a successful test off the port of Vlissingen during which the Ju-52 detonated several mines while flying at an altitude of 10 to 20 meters (33 to 66 feet).

Production was slow due to the higher priority given to equipping units assigned to the 1940 western campaign. The first Ju-52/3m MS *Minensuche* (mine search) production aircraft was delivered in June 1940 and the first of six *Minensuchstaffeln* (mine search squadrons), *Sonderkommando Mausi* (special "mouse-catcher" unit), was formed that September. The Ju-52/3m MS aircraft were modified on the production line by installing a diesel- or gasoline-engine-driven 150-kilowatt generator in the cargo bay and connecting it to the aluminum coil. Since the British were deploying acoustic as well as magnetic mines, approximately half of the German Ju-52/3m MS aircraft were equipped with the *KK-Gerät* (*Knallkörpergerät*, or mine destruction device) to destroy acoustic mines. The *KK-Gerät* consisted of a container holding 30 10-kilogram explosive charges intended to neutralize acoustic mines by destroying their hydrophones. Early MS aircraft carried a single 15mm machine gun and two beam 7.92mm guns for self-protection.

German aerial minesweeping tactics differed slightly from British practice. Flight speed was almost identical at 125-135 mph but altitude was determined by water depth. The German magnetic sweep aircraft flew 40 meters (130 feet) above the seabed, requiring an altitude of 10-20 meters for most flights. Also, the Germans employed two magnetic-coil equipped MS aircraft in line abreast with 30- to 40-meter separation, followed by a single *KK-Gerät* aircraft trailing about 40 meters behind them. Typically, the mines detonated about 5-10 meters behind the magnetic sweeps, making for some exciting moments for the *KK-Gerät* pilots. Additionally, Germany's aerial minesweepers faced opposition in most of their operating areas and the Luftwaffe did not provide fighter escorts. As losses mounted, defensive armament was increased. By October 1943, the MS aircraft were toting a 20mm cannon in the dorsal position and 13mm machine guns in the beam positions, but losses continued.

Sonderkommando Mausi was re-designated *Minensuch Gruppe* 1 (Mine Searching Group 1) in October 1942 and became the administrative control unit for the MS squadrons. Like Britain, Germany used its aerial minesweepers as both a rapid-response force and for sea-lane clearance. As such, its MS squadrons deployed detachments to nearly every maritime theater, from the Baltic

SENDING A MESSAGE Armorers make final adjustments to mines before they are loaded into a Wellington bomber of No. 300 Polish Squadron at RAF Faldingworth. The message on the left-hand mine reads "From Polish Airmen" in both Polish and English.



and North Sea down to the Mediterranean. The northern French coast was the squadrons' most critical and dangerous area of operations, with RAF and later American fighters attacking flights trying to keep the vital French coastal waters clear of Allied mines. They remained active despite losses and declining fuel resources until war's end, and assisted Allied forces in Baltic and North Sea minesweeping in 1946.

With Allied mining on the rise after 1942, the Kriegsmarine modified several of its allocated seaplanes for aerial minesweeping. Four three-engine Blohm und Voss Bv-138C flying boats had all their armament removed and a diesel engine powering a 53-kilowatt generator installed in the nose. They used the same magnetic ring as the Ju-52/3m, only it was mounted above the nose and attached by aluminum braces. They were designated Bv-138MS but their crews called them *Mausi-Flugzeuge* (mouse-catching aircraft). Blohm und Voss also modified two four-engine Ha-139 floatplanes for minesweeping by attaching the magnetic loop to the nose and wingtips. A lack of spare parts limited the planes' utility and they were out of service by early 1943. Unarmed and flying individually, the seaplane minesweepers were used to clear mines in canals, rivers and estuaries from June 1942 to August 1944.

Naval mine warfare played a key role in the Atlantic and European theaters, sinking more than one million tons of Allied shipping and damaging nearly double that figure. Five percent of British and German warship losses were due to mines. All the combatants employed mines extensively and their sophistication increased as the war progressed, raising the importance and complexity of mine countermeasure operations.

The introduction and widespread deployment of bottom influence mines added a new threat dimension that had to be rapidly addressed. Aerial minesweeping was the only solution that offered an immediate response. The planes were effective, comparatively cheap and could be quickly deployed to distant locations and sweep large areas of water. Although their operations are not well known, the aerial minesweepers of World War II played a key role in keeping waterways and ports open and should be viewed as the forerunner to today's helicopter mine countermeasures units. ✠

Carl O. Schuster retired from the U.S. Navy as a captain in June 1999. He is an instructor in military history and international relations at Hawaii Pacific University in Honolulu. Further reading: The Wellington Bomber Story, *by Martin W. Bowman;* The Hidden Menace, *by Maurice Griffiths; and* Junkers Ju 52: Aircraft and Legend, *by Heinz Nowarra.*

"MOUSE CATCHERS"
Top: Three Ju-52/3m MS minesweepers patrol a stretch of sea. Above: A Blohm und Voss Bv-138MS is hoisted aboard a seaplane tender. The modified Bv-138s and similarly equipped Ju-52/3ms were the two main German aerial minesweepers.

LEFT: IWM HU106355; ABOVE: BUNDESARCHIV BILD 1011-643-4755-30A
FOTO OHMYER; ABOVE RIGHT: HISTORYNET ARCHIVES