

# Database

## Short Stirling

In 1936 the British government issued a specification for a new kind of bomber able to deliver a sizeable bomb load over long distances. The result was the Short Stirling – the first of the RAF's four-engined heavies. MICHAEL BOWYER tells the big bomber's story

### This month

Welcome to *Aeroplane's* 22nd Database section, our regular in-depth examination of a specific subject, which this month focuses on the Short Stirling:

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No Stirlings survive — but we have the technology . . .

**ABOVE RIGHT** The Stirling won distinction as the RAF's first purpose-built four-engined monoplane bomber.



**B**Y THE MID-1930s new, more efficient technologies had encouraged the development of faster bombers carrying ever-greater loads over long distances, essential for the RAF, of which bombers would form the backbone. Operational requirements called for a mainstream twin-engined bomber force supplemented by a few long-range bombers to attack capital ships and specialised distant targets.

The former was prescribed in Specification P.13/36, the B.12/36 (from which the Stirling emerged) being 25 per cent larger and 50 per cent heavier to carry double the P.13/36's load. The 2,000lb Armour Piercing (AP) bomb would be its heaviest and largest weapon.

A need for 100 large B.12/36s, inevitably four-engined, was agreed in April 1936. The aircraft was to carry an 8,000lb load for 3,000

miles, 14,000lb for 2,000 miles, and fly at 230 m.p.h. at 15,000ft. Protection would be provided by three power-operated turrets; four guns at the rear, two at the front, and two in a retractable ventral "dustbin". Wingspan was limited to 100ft, not because of hangar entry dimensions as generally thought, but to keep the aircraft's overall size and weight in check in order to curtail take-off and landing runs and hard runway



requirements and allow easier storage in 150ft-wide hangars. The maximum weight for a 700yd take-off run was set at 36,000lb; or 46,000lb if assisted take-off could be devised.

Studies in May and June 1936 showed that a B.12/36 crew would need meal facilities, rest bunks and a toilet if they were to undertake journeys of up to 3,000 miles. The need for a rapid initial climb to operational height to reduce fuel consumption during cruising would influence total tankage. A wide-track undercarriage, with tyre pressure of 35lb/in<sup>2</sup>, would allow operation from grass fields.

On July 9, 1936, manufacturers were invited to tender to B.12/36. Short Brothers, privately designing a four-engined landplane based upon its superb flying-boats, received a late invitation. Most favoured by the Ministry was a Vickers four-engined, elliptical-wing Wellington variant with four load-spreading undercarriage units. A design by Supermarine, the only completely original layout, which also had an elliptical wing, was placed last in the line of "favourites" and soon just ahead of Short's late-entry "Night Bomber".

Being involved with the Handley Page Hereford through its Short & Harland tie-up, Short proposed four Napier Dagger sleeve-valve engines for its 86ft 6in-long, 112ft-span B.12/36, and gave the design the company type number S.29. Four tiers each of five bombs would be carried in four cells placed well forward, the fuselage cross-section allowing easy crew and troop movement, as the B.12/36 specification was to be a bomber/transport. Short estimated a loaded weight of 38,100lb and a maximum permissible weight of 53,100lb.

The new design's size, weight, untried engines and bomb carriage drew criticism, so Short was asked to redesign the aircraft and reduce its wingspan. In April 1937 the company submitted a proposal for a 102ft-span wing, the shortest desirable. Told that 100ft was the maximum, the company reluctantly reduced it to 99ft 1in. The all-up weight now seemed likely to be 41,600lb, and maximum permissible weight 56,900lb. Conventional bomb stowage was in three 42ft-long, 19in-wide cells, supplemented by six inner-mainplane cells. There was provision for 28 x 500lb high-explosive (HE) bombs or 7 x 2,000lb AP bombs. Power would come from four Bristol Hercules radials or Napier Daggars.

The Air Staff now favoured the Supermarine Type 337 bomber, relegating the S.29 to a fall-back position in case their first choice failed. His Majesty's Treasury needed much



**ABOVE** The half-scale Pobjoy-engined S.31 sits on trestles, dwarfed by production Stirlings at the Short factory at Rochester on January 22, 1942. It was scrapped in 1943.



**ABOVE** The Stirling prototype, L7600, suffered an undercarriage collapse on its maiden flight on May 14, 1939, after a brake seizure on landing. The damage was extensive enough for the aircraft to be declared a write-off.



**LEFT** John Lankester Parker, who was at the controls of L7600, was first employed by Short in 1916 as a part-time test pilot, becoming CTP in 1918, and a director of the company in 1943. He tested every type until 1945, when he handed the job over to his deputy, Geoffrey Tyson.

persuading to support two projects, and not until October 6, 1937, was funding sanctioned. Reginald J. Mitchell's untimely death placed a question mark over the Supermarine bomber, and engendered a belief that its elliptical wing may bring production problems, so Short's contender took prime place.

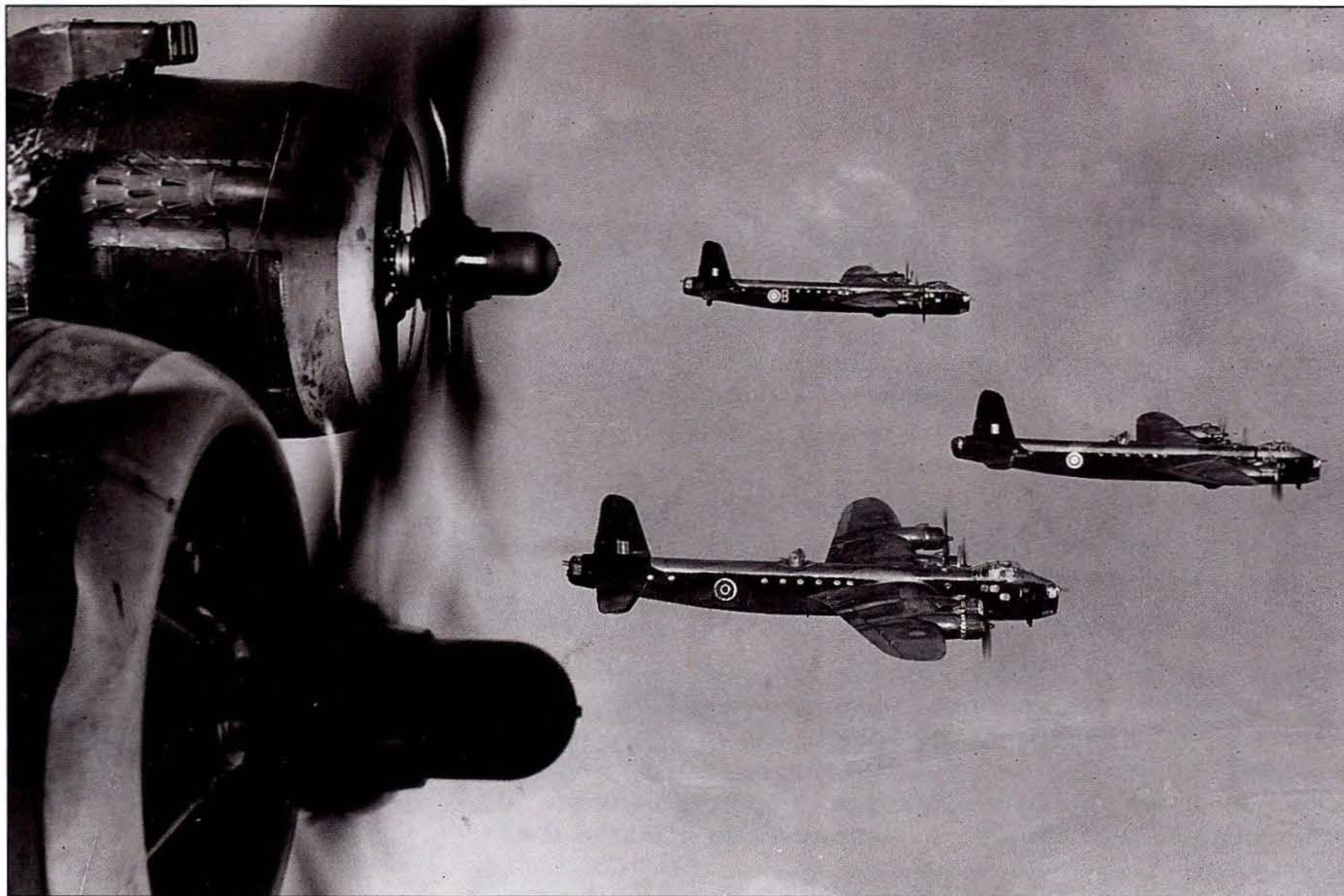
The final requirement of December 1937 called for a cruising speed of 230 m.p.h. at 15,000ft during a normal loaded 1,500-mile sortie, and take-off to clear 50ft optimistically not exceeding 500yd. For a 2,000-mile operation, now carrying a 4,000lb load, take-off was listed as 700yd, and the landing run was not to exceed 800yd. Assisted take-off might allow an 8,000lb load for a 3,000-mile sortie. An altitude of 10,000ft had to be maintained on three engines, 20,000ft was to be reached in a 25min climb, and service ceiling was set at 28,000ft.

Short suggested higher speeds of 325 m.p.h. maximum and 280 m.p.h. cruising, while the Air Staff limited take-off weight to 45,700lb. Short's chief designer, C.T.P. Lipscomb, soon stated that a much higher take-off weight of 60,000lb would be needed in order to attain the specified range and load requirements, and suggested double Gouge flaps to shorten the take-off run. The high structure weight stemmed not only from the design's flying-boat origins, but from stressing for catapult launch using either rocket assistance or a track system. This requirement was abandoned in August 1938, leaving the new bombers overstressed and over-



**ABOVE** This magnificent shot of the Queen's Island factory in 1945 shows Short production in full swing, with Stirlings and Sunderlands awaiting final touches before ferrying to their units.





weight. Assisted-take-off ideas lingered until 1941, when runways for bomber airfields were accepted on a scale of one 1,800yd runway and three of 1,100yd. The 1,500yd maximum chosen later would have been suitable for Short's original design.

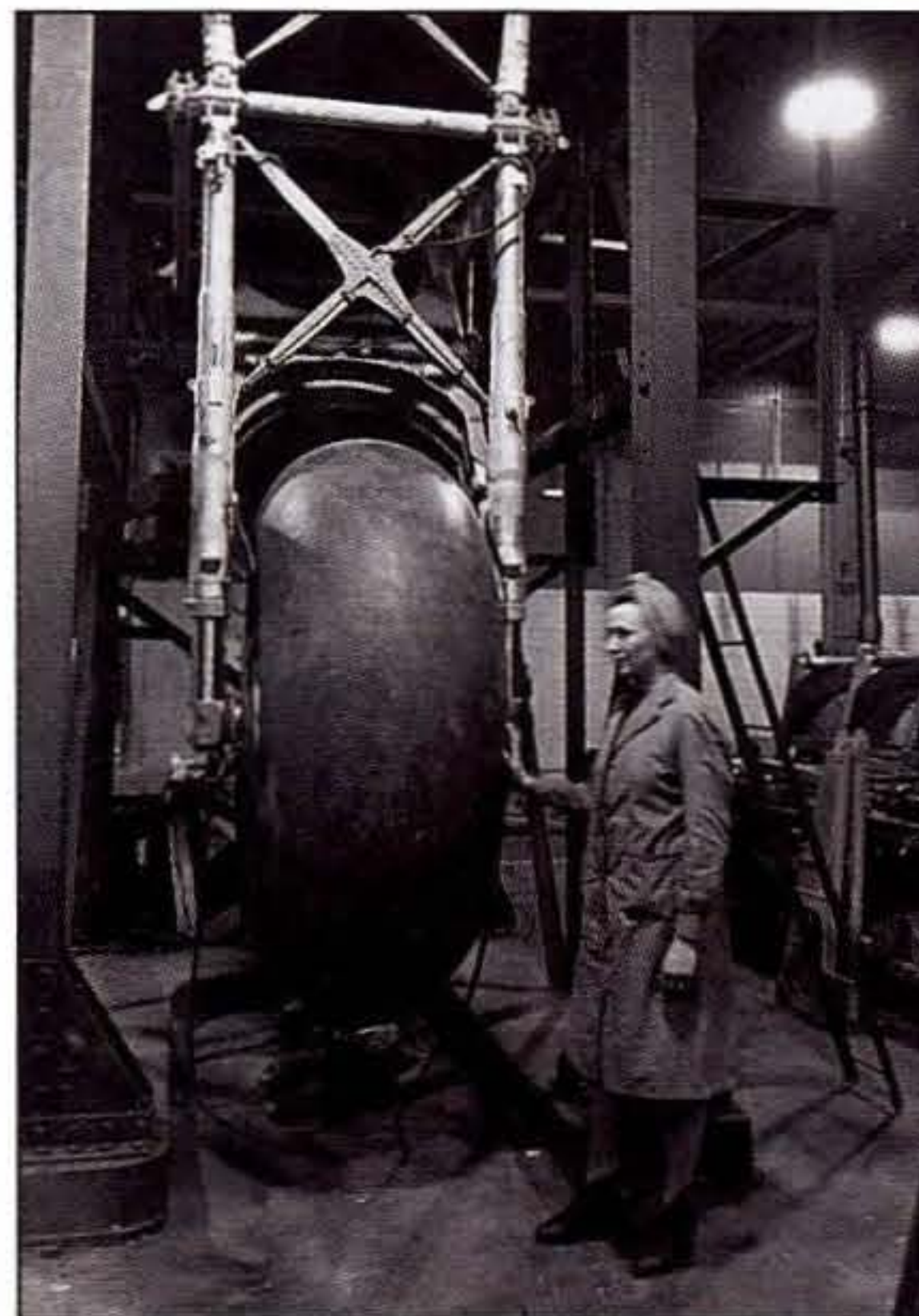
Increasingly concerned about take-off run, the company built a half-scale wooden replica, the S.31, powered by four 114 h.p. Pobjoy Niagara engines, first flown from Rochester Airport on September 19, 1938, by John Lankester Parker and Hugh Gordon (see *Nothing Ventured*, February 1991 *Aeroplane*). Testing confirmed a long take-off run and a pronounced swing to the right. Once airborne the S.31 handled like a fighter, with the short, broad-chord wings conferring a good rate of roll.

After pilots of the Aeroplane and Armament Experimental Establishment (A&AEE) at Martlesham Heath had flown the S.31, the Air Ministry asked for a reduction in the S.29's take-off run, suggesting a 3° increase in wing incidence. The low angle of attack was intended to reduce the drag imposed by the deep wing section, which accommodated fuel and bombs, but design and construction was too advanced for radical change. Instead, the tall undercarriage was further lengthened, and tested on the S.31 from November 1938.

The P/1 production specification for the bomber (now named Stirling) was issued in January 1939, and accepted reduced loads. A 1,500-mile cruise carrying 4,000lb load and 2,000lb for a 2,000-mile sortie were stipulated. On January 3, 1939, agreement was reached for a normal loaded weight of 50,844lb and an

**ABOVE A pair of Bristol Hercules XI engines roar in the foreground, while three other Stirling Is of 1651 Heavy Conversion Unit formate on each other. The Stirling in the lead, N6069, was lost on a raid on Hamburg in July 1942.**

**RIGHT A huge undercarriage leg of a Stirling towers over one of the workers at the Austin Motors factory at Longbridge in January 1942. Standard Dunlop tyres on a Stirling measured an impressive 70.2in in diameter.**



**“The Stirling was too slow for daylight operations, and its low ceiling prevented the use of armour-piercing bombs. However, it could accommodate six sea mines; the Halifax could carry only two”**

even higher maximum of 67,000lb.

Excessive demands on engine production led to a plan for Canadian-built Stirling IIs powered by Wright Cyclone engines. Several Mk Is re-engined with Cyclones proved inferior even to early Mk Is, so the Mk II was abandoned. Short had its sights on a different Mk II, the S.34 “Stirling II” to Specification B.1/39, alias “The Ideal Bomber”. With increased wingspan, projected Bristol Hercules high-altitude engines and seemingly excellent load/range characteristics, it reached only the mock-up stage. A slimmed rear fuselage carried twin fins, and set amidships were two Boulton Paul twin 20mm-cannon turrets, forward of which was a capa-

cious bomb bay. Bomber Command had already chosen its new types, however, and the B.1/39 faded.

The Stirling's weight increased repeatedly with various equipment additions, raising the normal loaded weight to 57,000lb. Air Ministry calculations suggested that even a normal 63,000lb required a 1,000yd take-off run and a tyre pressure of 43.5lb/in<sup>2</sup> for grass-field operations.

The prototype, L7600, had Bristol Hercules I engines, the intended IIs being unavailable. On Sunday, May 14, 1939, with the workforce at home, the bomber's flying career started well in John Lankester Parker's skilled hands but soon ended dramatically. On touchdown the light

alloy back arch of the undercarriage collapsed and L7600 was wrecked. Steel tubing was substituted in the second aircraft, L7605, which made a successful first flight, four months late, on December 3, 1939.

The A&AEE, now at Boscombe Down, received L7605 on April 22, 1940, for four months' assessment. Stirling production was already under way at Rochester, and began at Short & Harland, Belfast, in June 1940. The first production Stirling, N3635, flew on May 7, 1940, and like the next nine aircraft had Hercules IIs giving 1,100 h.p. at 5,000ft, which was unsuitable for operations. Changing them was difficult, as they were installed in monocoque nacelles.

Tested at a take-off weight of 57,400lb, L7605 unstuck after 640yd and cleared 50ft after 1,200yd. At 64,000lb that became 1,500yd. It took 12½min to reach 10,000ft, and the highest speed attained at that altitude was 249.5 m.p.h. TAS (true air speed) before performance fell away. With the aircraft loaded to 64,000lb, a top speed of 246 m.p.h. was attained at a mere 4,000ft. At the higher loading the best cruising speed was around 184 m.p.h. at 10,000ft. Service ceiling was 15,000ft. A 10,000lb bomb load could be carried with 1,096gal of fuel aboard; a 14,000lb load reduced that to a mere 584gal. The following figures illustrate how far production aircraft fell short in terms of expected flying performance:

#### Specification

8,000lb for 3,000 miles  
14,000lb for 2,000 miles  
Cruising speed 230 m.p.h. (15,000ft)

#### Actual

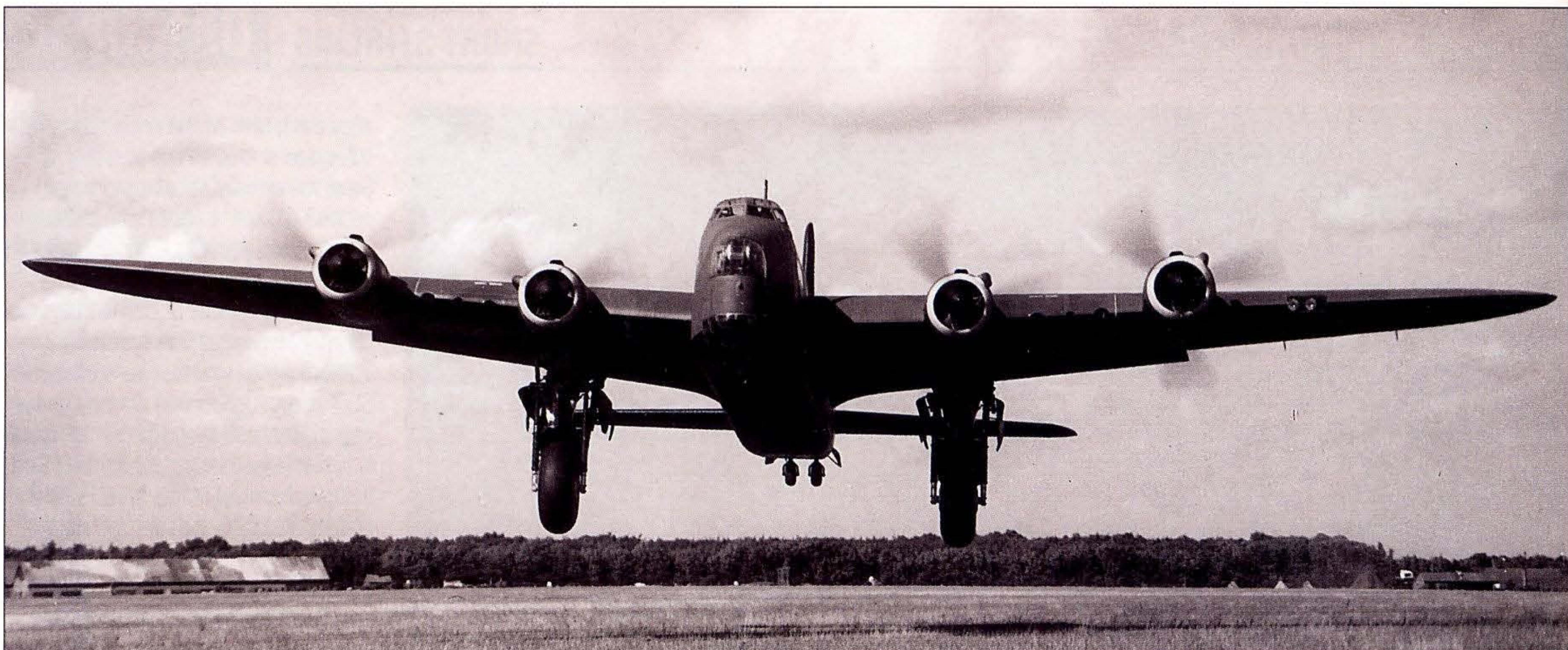
5,000lb for 1,930 miles  
14,000lb for 740 miles  
Cruising speed 184 m.p.h. (10,000ft)

Improved performance from superior engines was forecast.

The Stirling was too slow for daylight operations, and its low ceiling prevented the use of armour-piercing bombs to maximum effect. However, it could accommodate six slender sea mines, whereas the Handley Page Halifax could carry only two. September 1940 brought a demand for a superior dorsal turret to replace the beam guns and ventral turret.

Production was hard hit late on August 14, 1940, when 15 Heinkel He 111s of KG100 bombed the works at Belfast, wrecking four completed Stirlings and causing splinter damage to others. The next afternoon Dornier Do 17Zs of KG3 attacked Rochester Airport, destroying six Stirlings and crippling several others. Widely





dispersed production was quickly devised, using Gloster's Hucclecote works for final assembly until new factories were established around Swindon. Assembly and flight testing took place from South Marston.

Short had envisaged a small production run. Instead, increased orders demanded a fourth major production batch, and Austin Motors at Longbridge near Birmingham was chosen. The first Longbridge Stirling was completed in March 1941, by which time production Mk Is had more powerful Hercules XIs adding 3,000lb to the all-up weight. The FN7A dorsal gun turret was a standard item of the Mk I Series III, whose engines were fitted in a steel frame, N3662 being the first production example.

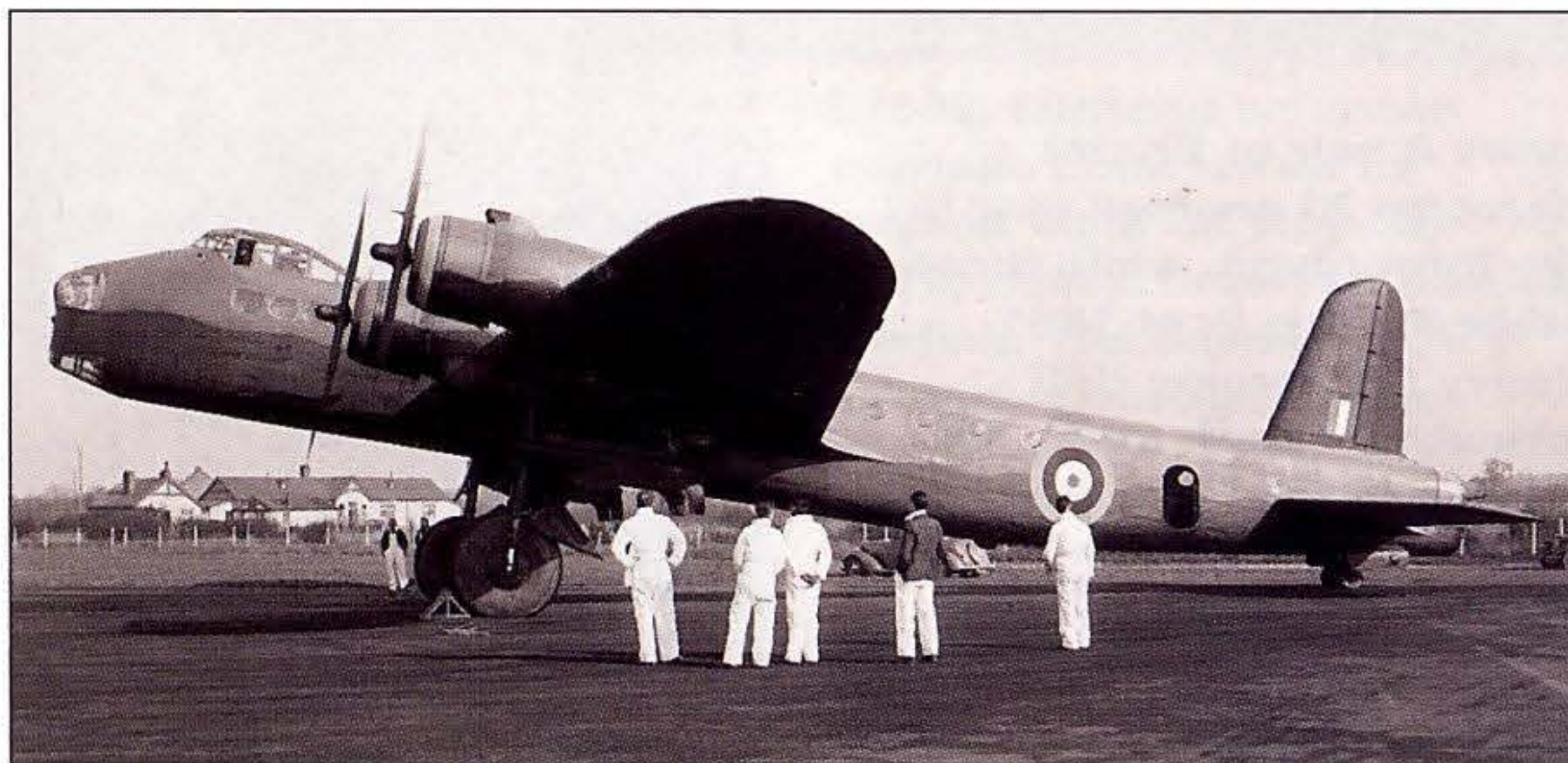
In 1941 Short designed an enlarged Stirling, the Short S.34, to Specification B.8/41, related to the Shetland flying-boat. A six-engined version also came to nothing.

More important were the Stirlings with Hercules VI "power eggs", whose superior cooling was expected to enhance higher-altitude performance. The decision to fit them was made in May 1941, and tests started in June 1942 using R9309. They proved disappointing, however, and improved cooling tests were halted on September 6 when an engine fire caused R9309 to crash at Porton Down, near Salisbury. Stirling I series II R9188, a modified replacement, flew within a few weeks. In BK648 and BK649, true prototype IIIs, cable throttles replaced the troublesome Exactor hydraulic system, and were fitted in subsequent marks. In the Mk III the ceiling rose to over 17,000ft, but speed showed little improvement.

Output remained unacceptably slow, so in March 1943, under Defence of the Realm Regulation No 78, the Ministry of Aircraft Production (MAP) took control of Short Bros, imposing mass-production methods and a Mk III modification programme.

With loss and accident rates increasing, a conference on July 30,

**ABOVE** A fine shot of a Stirling I taking off in the summer of 1941, illustrating well the twin-tailwheel arrangement, extended Gouge flaps and higher-positioned outer engines. **BELOW** W7426 was built at the Austin Motors factory, where it is seen here undergoing engine trials. The aircraft went to 15 Sqn, and on to 1651 CU after a minor accident in March 1942.



**LEFT** Only one "Silver Stirling" was built, being converted from PJ958 at Belfast and first flown in May 1945. It was furnished and insulated for 30 passengers to Ministry Specification C.18/43, but had difficulty competing favourably with the civil version of the Halifax.

1943, decided that Stirlings should be withdrawn from front-line bomber squadrons by April 1944. Spare Mk IIIs would be converted into GT Mk IV glider tugs/troop transports, a tow coupling being installed under the rear fuselage and a floor hatch being cut for paratroop drops. Shorn of the defensive turrets, the Mk IV could tow a loaded Airspeed Horsa or carry supply containers. Output switched to the Mk IV tug at the end of 1943, and

others were produced by modifying Mk IIIs.

The C Mk V entered production in mid-1944 as an unarmed, dedicated transport which could carry up to 40 troops, mixed freight or 12 stretchers. Its top-hinged nosecone allowed loading using a fitted beam and tackle. A 9ft-wide starboard side aft door and ramp permitted stowage of two jeeps, or one and a six-pounder gun. Converted into the S.37 "Silver

## Short Stirling Mk I data

**Powerplant:** Four 1,600 h.p. Bristol Hercules engines

**Accommodation:** Two pilots, navigator/bomb-aimer, wireless operator/front gunner, flight engineer/gunner, two gunners

### Dimensions

Wing span	99ft 1in
Length	87ft 3in
Height (tail down)	22ft 9in
Wing area	1,322ft <sup>2</sup>

### Weights

Empty	44,000lb
Maximum gross	59,400lb

### Performance

Maximum speed	260 m.p.h.
Service ceiling	15,500ft
Range	2,330 miles

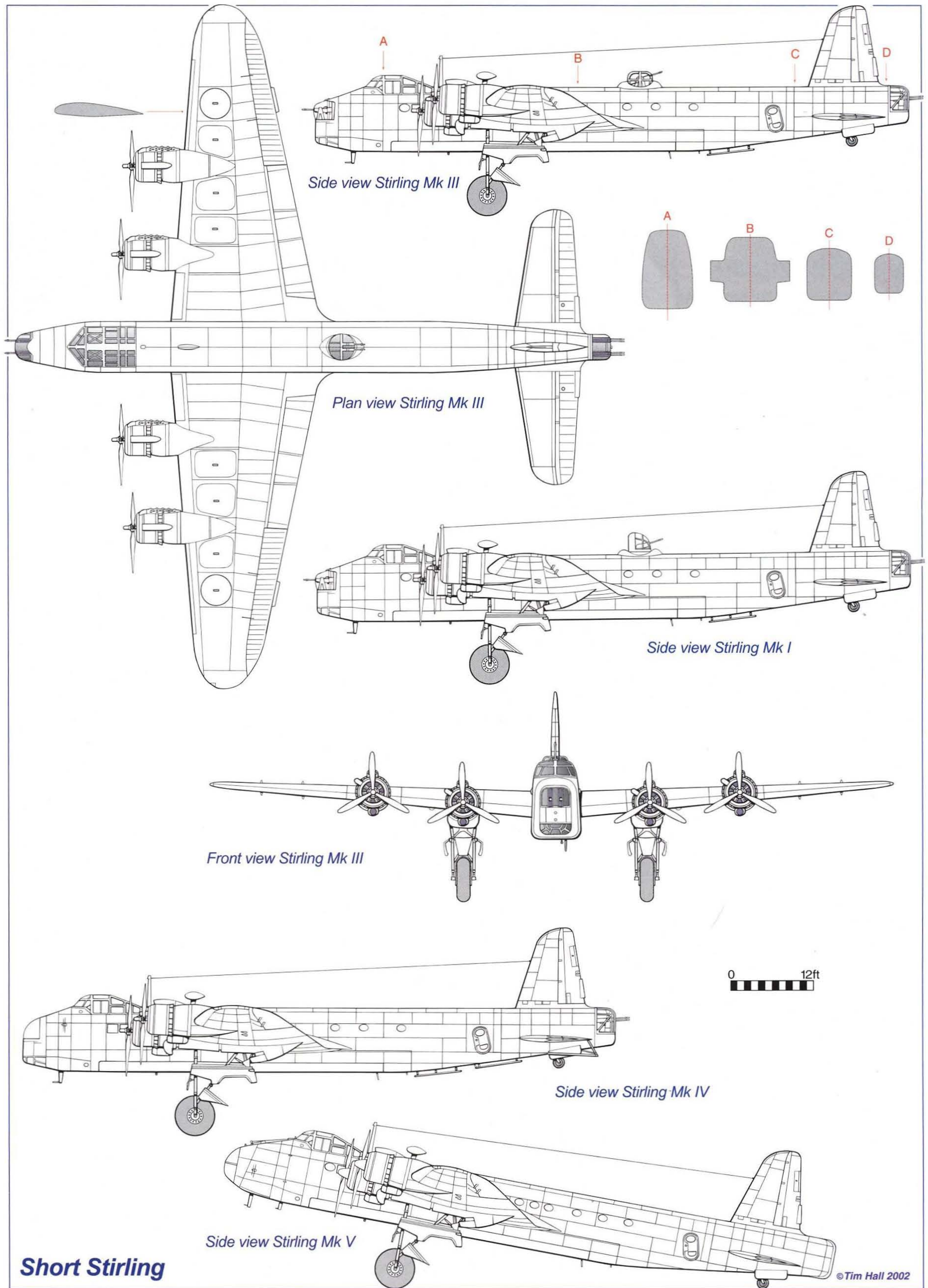
**Armament:** Three power-operated turrets with Browning 0.303in machine-guns. Maximum bomb load 18,000lb

Stirling", PJ958 was a civilian-style transport, but a similarly-converted Halifax was rated superior. A dozen C.Vs were converted by Airtech in 1947 as OO-XAK to OO-XAV for the Far East runs by Trans-Air of Belgium (see *Stirling Civil Servants*, November 1982 *Aeroplane*). Several were sold to the Egyptian government, which converted them back into bomber transports, thereby completing the cycle of development.



**ABOVE** In early 1947 a number of Stirling Vs were bought and converted for civil use by the Belgian airline Air Transport. Two of the fleet are seen here at Blackbushe sometime in 1949.





Short Stirling

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## TECHNICAL DESCRIPTION

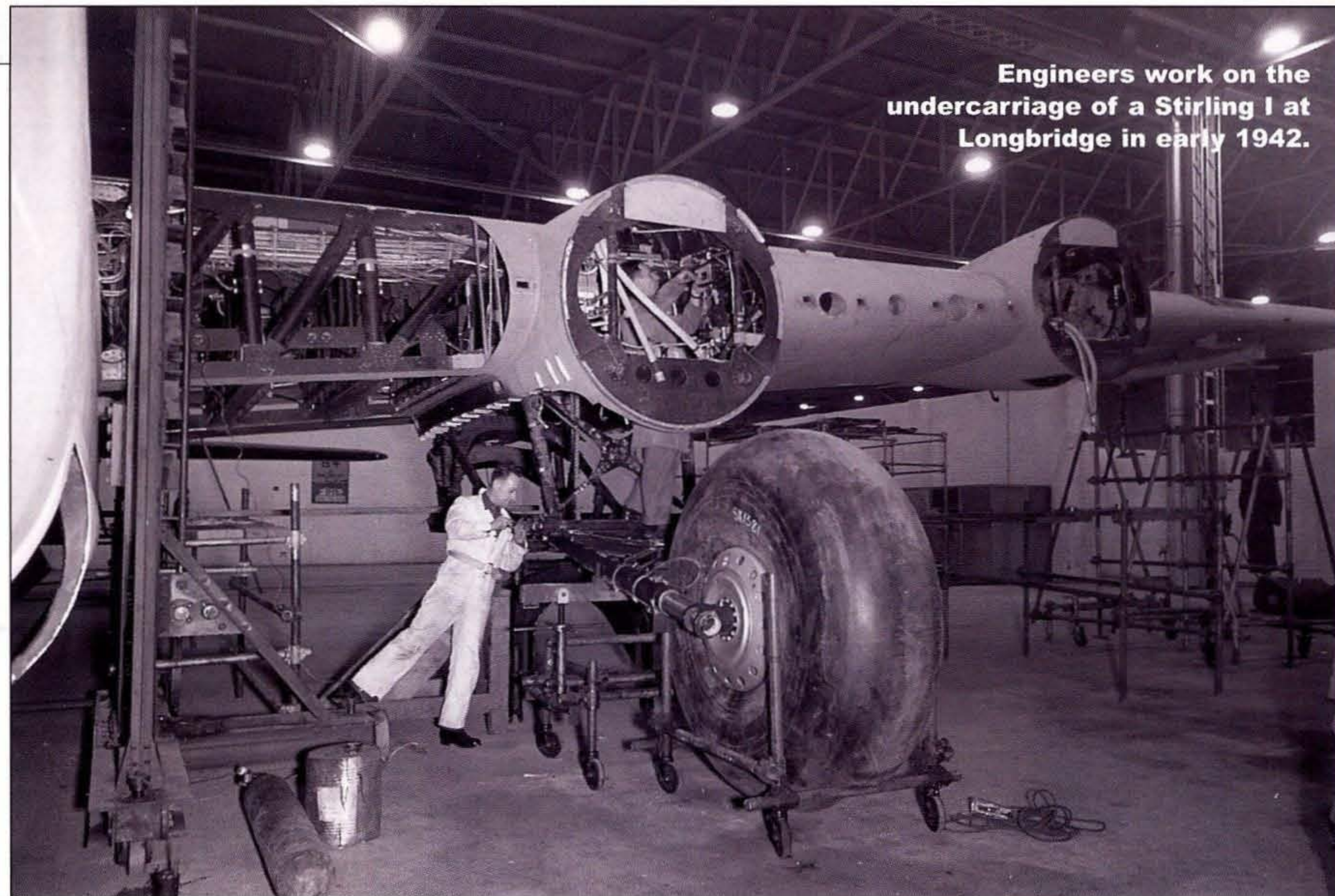
**The Stirling has often been maligned for its technical shortcomings, but it was in fact a strong and highly complex aircraft, explains MICHAEL BOWYER**

**T**HE STIRLING'S construction and strength owed much to the Short Empire flying-boats, one significant difference being the Stirling's lattice-braced ribs for torsion-box bracing in the spar truss (see cutaway, pages 52–53). Originally, the fuselage layout was for a crew of six, before the innovative addition of a flight engineer to monitor engine performance. The crew then numbered seven; two pilots, navigator/bomb-aimer, front gunner/wireless operator, two air gunners and a flight engineer/air gunner.

### Mainplanes

Mid-set, the 99ft 1in-span two-spar all-metal cantilever wing was of similar planform and construction to that of the Short C-Class flying-boat, and was designed for one-piece assembly. With a gross area of 1,322ft<sup>2</sup> and a deep Göttingen 436(Mod) section allowing wing tanks and wing bomb cells, it had a spar line dihedral of 4° 15' – 2° 25' along the top wing surface. The wingtip was 15ft 6in above ground, the aircraft's maximum height being 28ft 10in (22ft 9in tail down).

The spar flanges were of extruded T-section, the top and bottom flanges being connected by a tubular girder arrangement similar to that in the flying-boat. Inter-spar bracing was of the same tubular form as the spar, with watertight bulkheads attached to the spar truss ends for lateral flotation in case of ditching. Aluminium-alloy sheeting was flush-riveted to the spars and ribs, the top wing skinning being carried across the fuselage. Gouge flaps (total area 405ft<sup>2</sup>) slipped out of each mainplane trailing edge



Engineers work on the undercarriage of a Stirling I at Longbridge in early 1942.

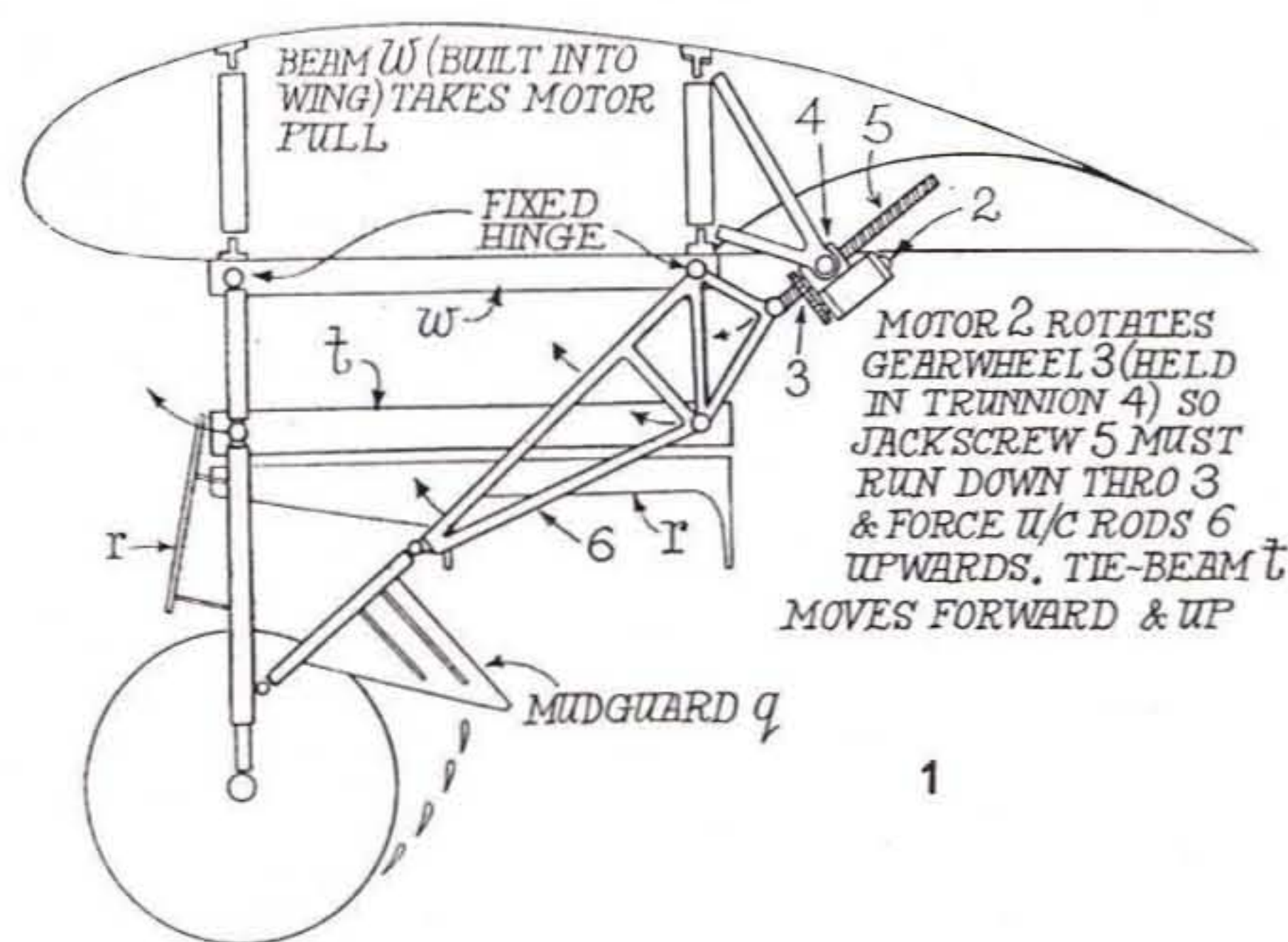
# Stirling Anatomy

along five roller ribs, the flaps' chord being equal to 48 per cent of wing total chord. The armoured wing leading edge to combat barrage cable could also carry cutters, and was sometimes covered with Kilfroast de-icing paste.

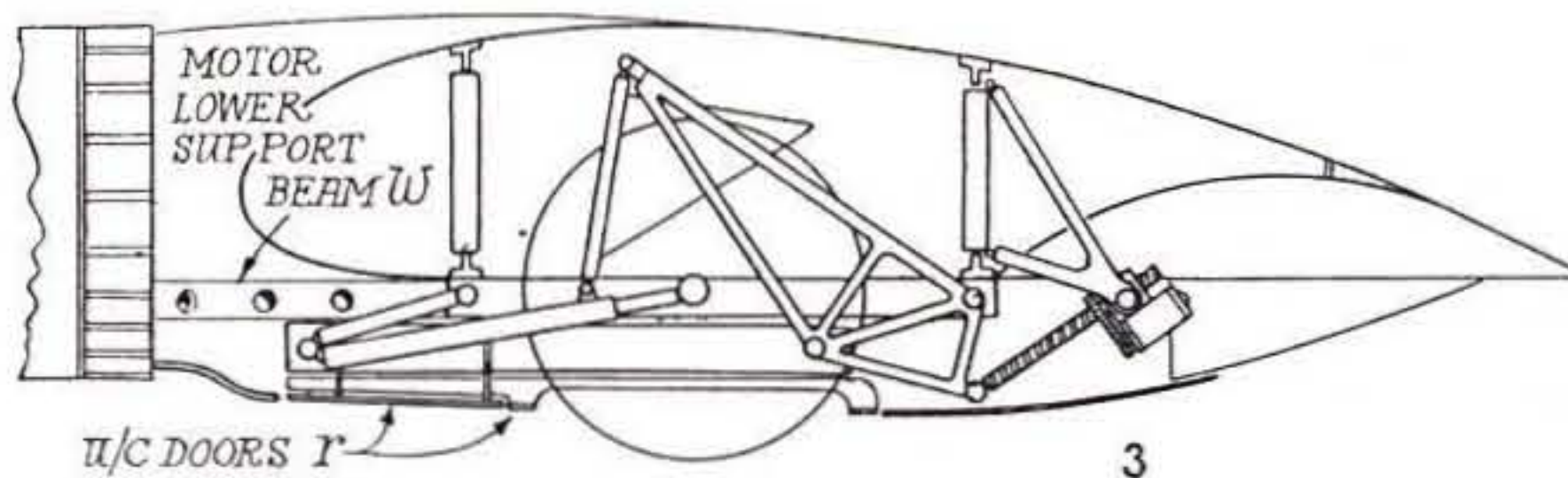
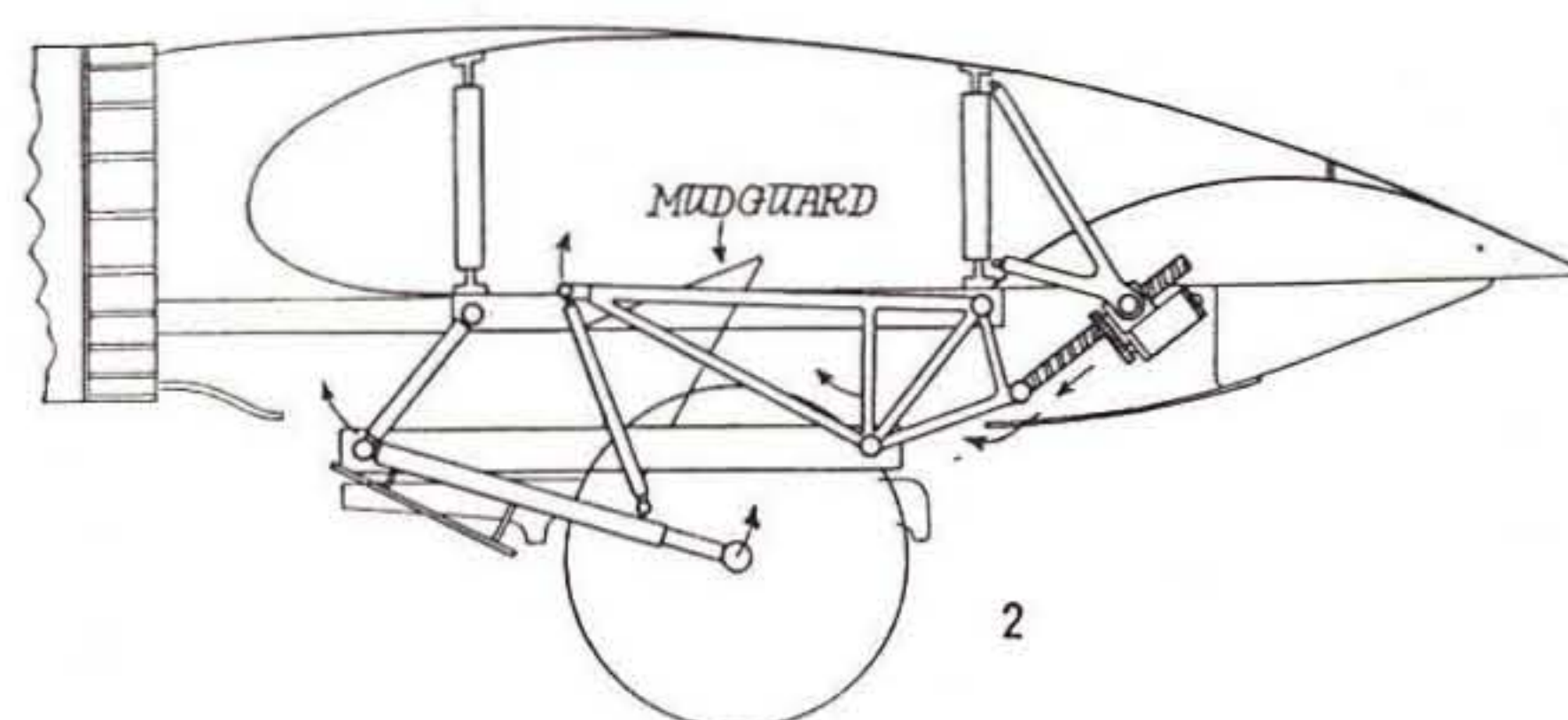
Each mainplane had four main fuel tanks within the spar truss, two more between the spar and flap shroud, and another in each wing root leading edge, giving a total fixed tankage of 2,254gal. All were self-sealing except for two leading-edge tanks, three wing bomb-cell optional tanks holding a total of 269gal and three 200gal tanks which could be carried in the bomb bay. The total possible tankage for ferrying was 3,292gal. Wing cells could carry 250lb, 500lb, Type "B" anti-shipping bombs, incendiary canisters or Type "B" water ballast containers.

### Fuselage

The unusual ratio of the 87ft 3in-long fuselage to the 99ft-span wing was a result of the latter's reduction from 112ft, and left the fin and rudder highly exposed. The all-metal 6ft 7in maximum width rectangular-section fuselage was built in four sections to facilitate unit production. Instead of interrupted stringers at every frame, as previously featured in Short aircraft, each included continuous stringers. Sections were joined by tension bolts through the webs at the Z-section end frames, the longitudinal continuous stringers being attached to



**LEFT** The Stirling's complex undercarriage structure was implemented to increase the angle of attack by 3°. These J.H. Clark diagrams appeared in the February 27, 1942 issue of *The Aeroplane*.



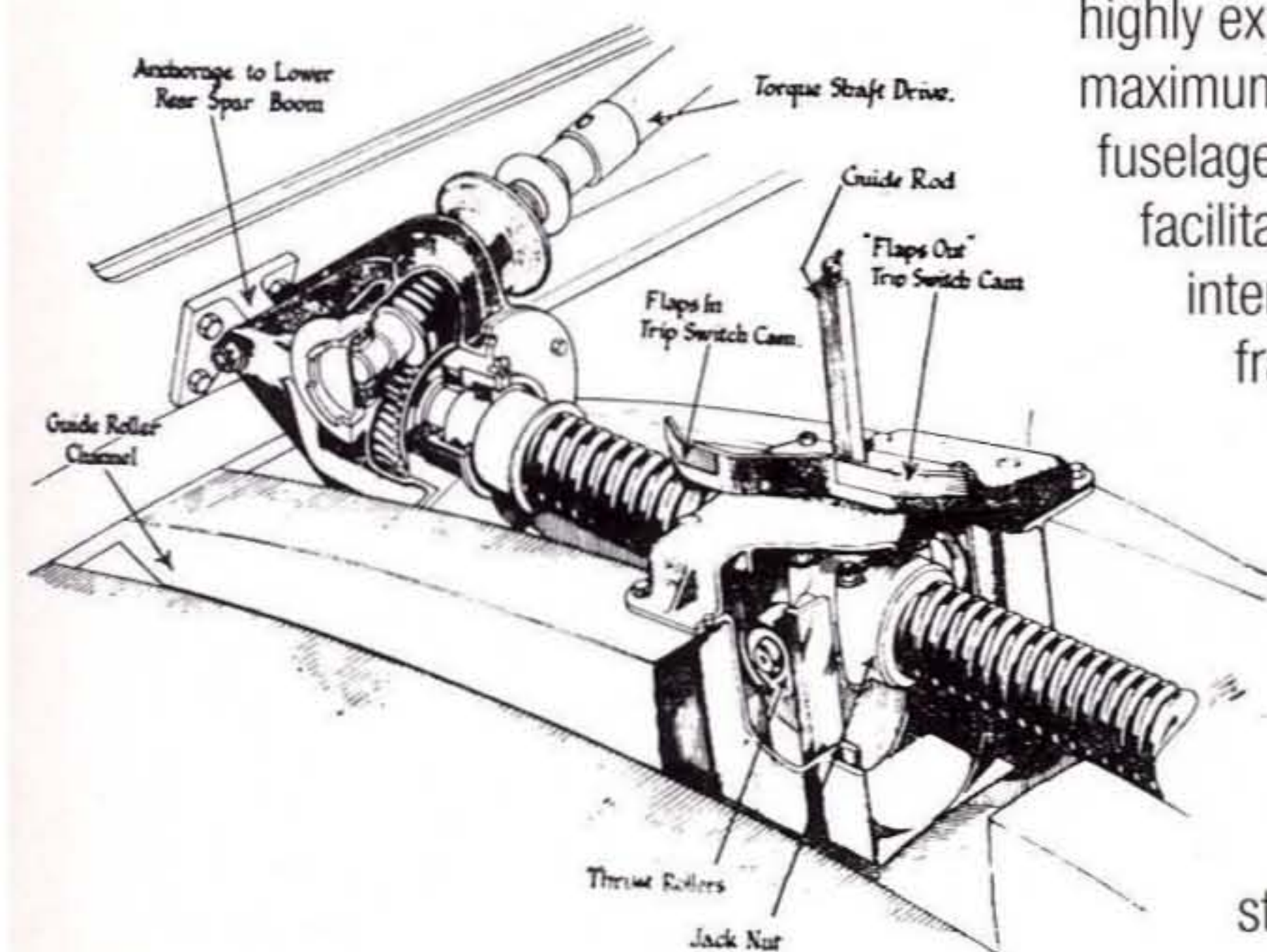
**BELOW LEFT** The special Gouge flaps were operated by a worm drive actuated by an electric motor. Trip switches stopped the motor when the flaps reached the "fully out" and "fully in" positions.

notched frames; a cross between V- and U-sections. All joints were jogged flush then flush-riveted. The 42ft 7in-long bomb bay had six long doors covering cells 19in wide, the unit being hung from three fuselage strengthening girders.

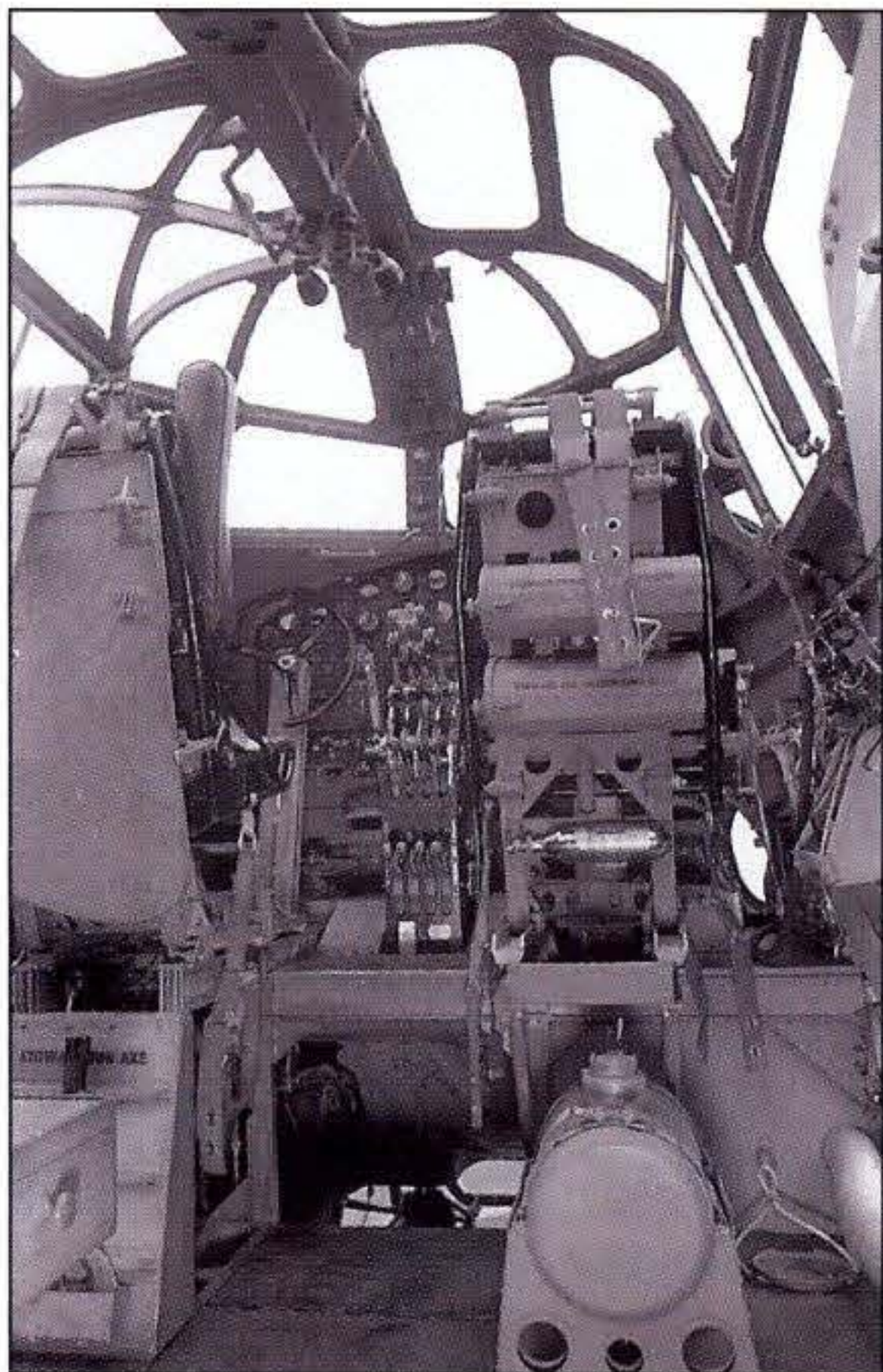
The nose section contained the bomb-aimer's station and glazing, front air gunner's platform, an FN5 gun turret and coaming leading to the cockpit coupé. Steps from the flight-

deck in the second section led down to the bomb-aimer's capacious station. Spar booms in the lower centre section coincided with positioning of the main deck on the three girders. Armour protected the pilot's seat, above which was an escape hatch. The camera hatch in the floor was near a parachute exit covered with duckboarding.

Having a flight engineer reduced the cockpit engine controls. Two

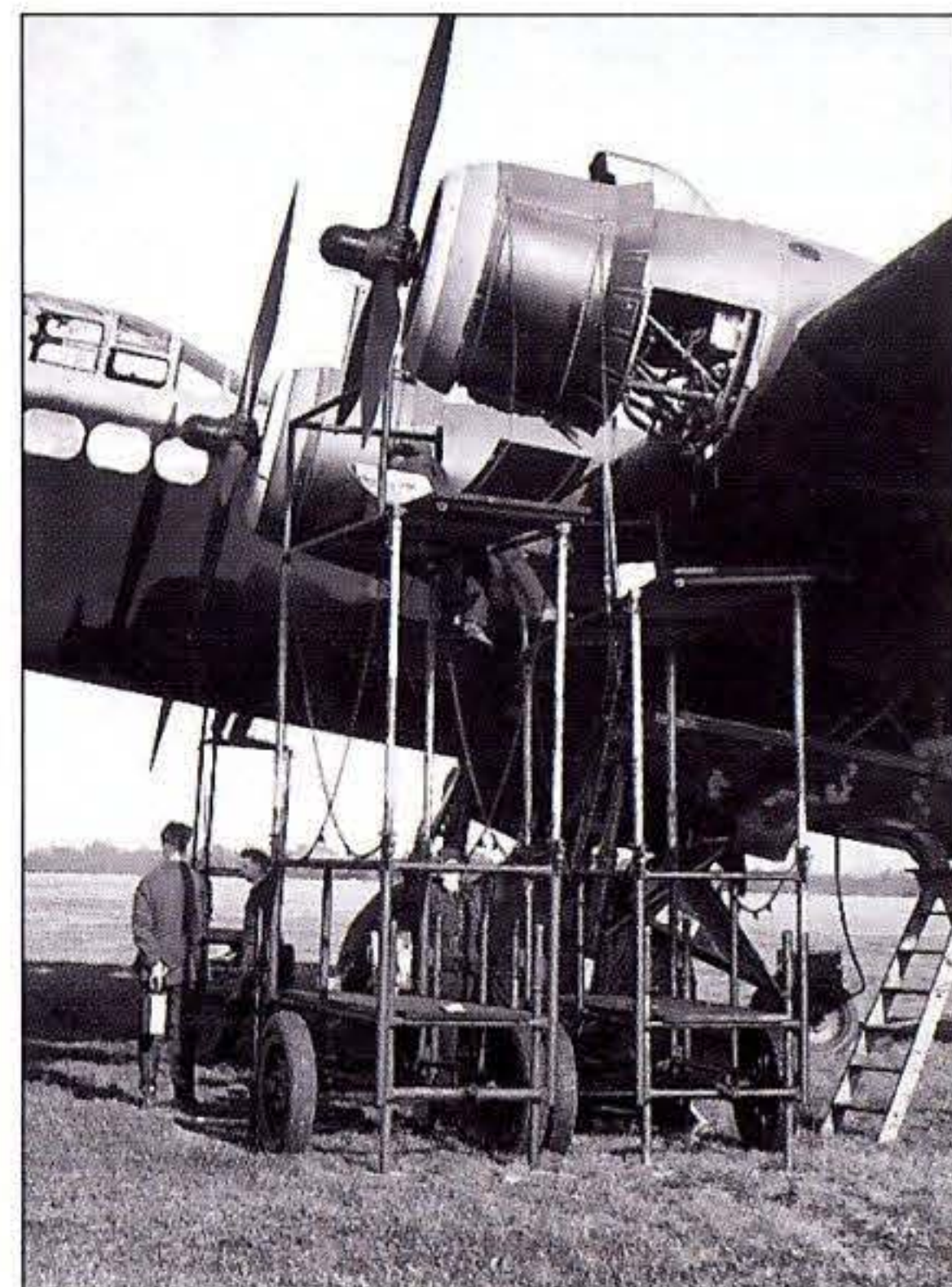
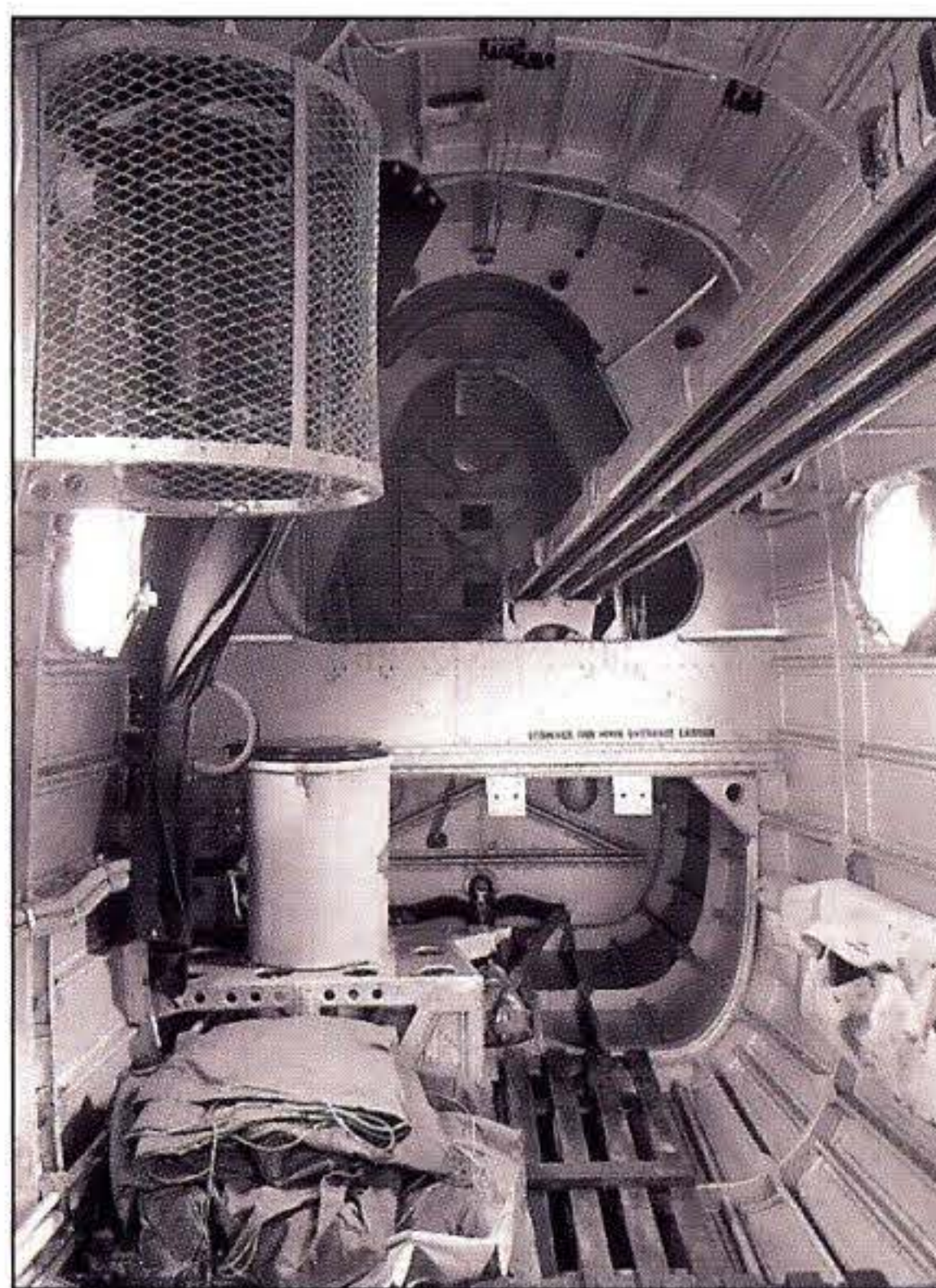






**LEFT** The Stirling's cockpit offered a good view in all directions, and was spacious compared to that of the Lancaster and Halifax. Note the armour plating behind the pilot's seat, which could be flipped up to protect the pilot from fighter attacks.

**RIGHT** The rear of the fuselage housed the Elsan chemical toilet and the master compass, the latter being located in the wire mesh cage at the top left of the picture. The rail running in from the right is the ammunition track feeding bullets to the rear turret.



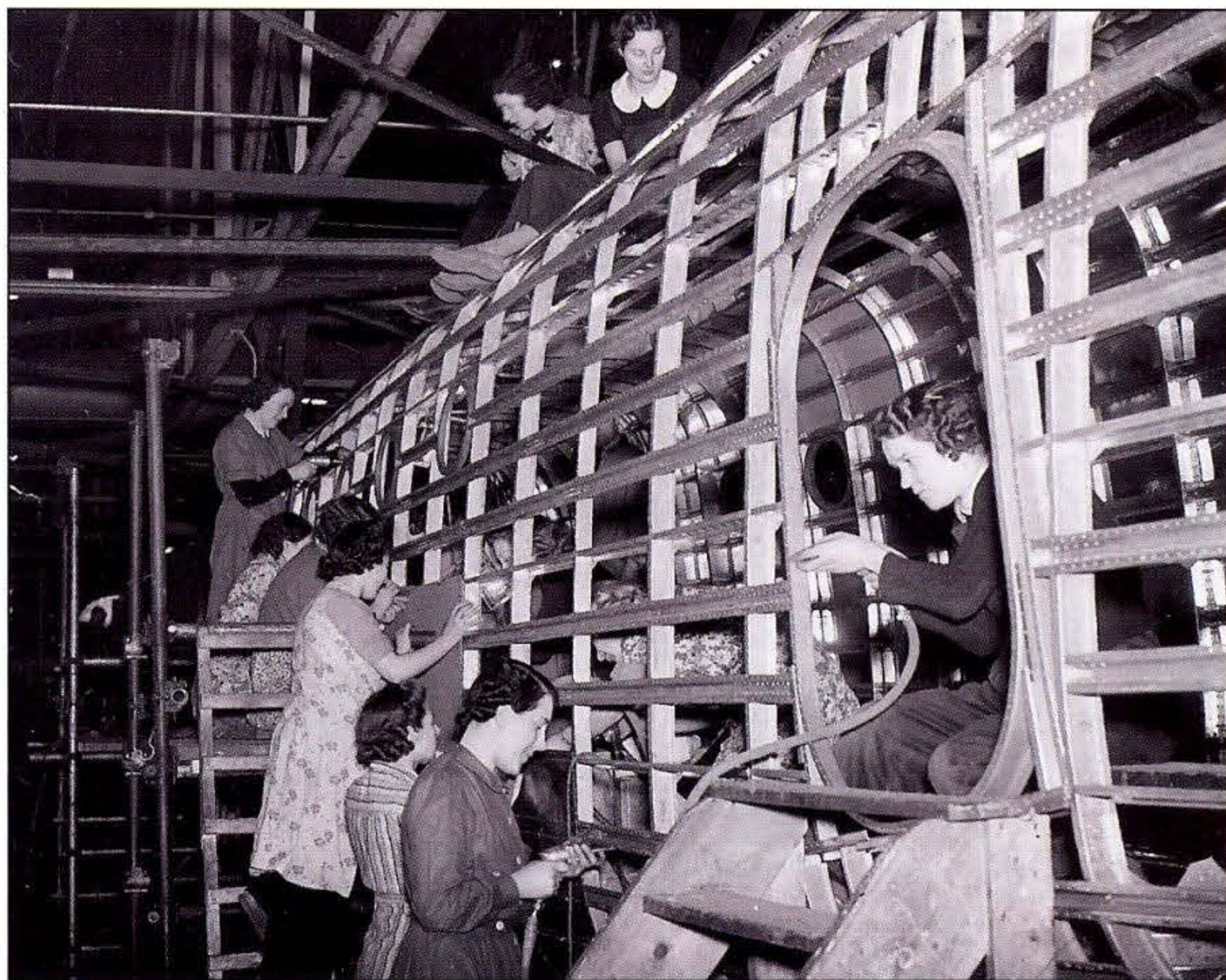
**FAR RIGHT** Groundcrew service the Bristol Hercules engines on a Stirling I in the autumn of 1941, using gantries specially devised for use with the big bomber.

**RIGHT** An interior view looking aft from behind the centre section. The ladder serves the dorsal turret, and is fixed to the floor next to a stretcher and what the picture's original caption refers to as a "box of gubbins".



**RIGHT** Women made up the majority of the workforce that built the Stirlings so desperately needed by Bomber Command in the early days of the war.

**BELOW RIGHT** The 46½ft wing panels were each built as one piece before being fitted to the fuselage. Note the holes where the four main fuel tanks would later be placed.



**BELOW** The tail and rear fuselage portion of the Stirling. The fuselage was built in several sections and bolted together on final assembly. The four-gun armoured tail turret was reached through a narrow walkway.

"ship's wheels" and the usual flight instruments were supplemented by a standard beam approach indicator and a direction-finding visual loop indicator. To the left of the first pilot were the autopilot panels and the P4 compass. The superb view from the coupé allowed a controller, protected at chest height with armour plating, to give a commentary during fighter attack.

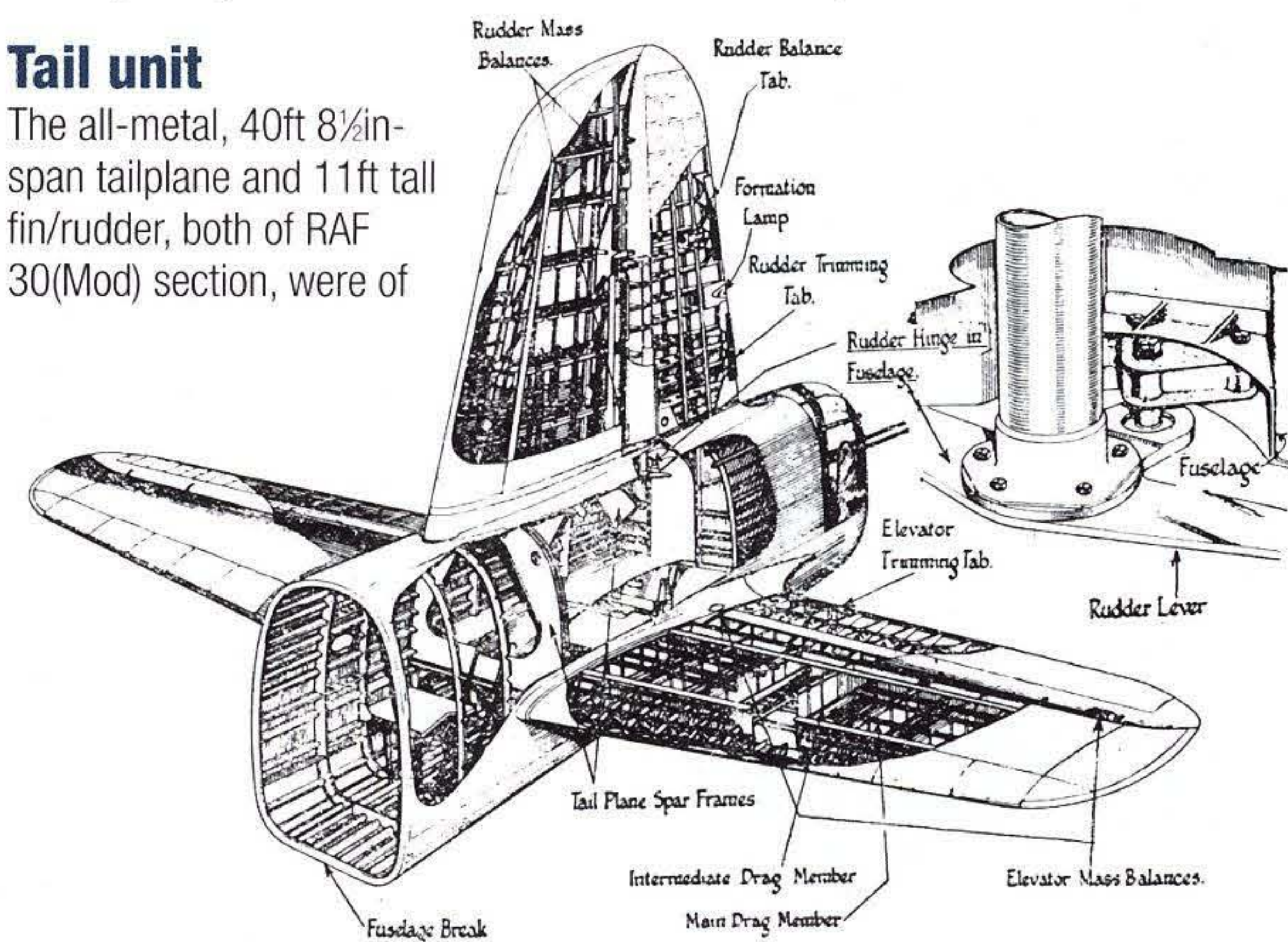
Separated from the cockpit by an armoured bulkhead, the flight engineer and wireless operator were in a cabin just ahead of the wing leading edge, forward of which was the navigator's station. The flightdeck began immediately forward of the bomb cells. A retractable astrodome was fitted, along with a starboard-side bunk.

Within the third section was an FN7A or FN50A dorsal turret or FN55A handgun window mountings, side windows (fewer in later aircraft), the top escape hatch, flare launch equipment, a parachute floor exit aft of the bomb bay and the port aft side entrance door. Some aircraft had a shielded belly gun or an H<sub>2</sub>S radome.

In the tail section were an Elsan toilet, steps leading to a platform allowing the rear gunner to cross tailplane fittings and the tailwheel retraction bay to the FN4A (later FN20A) four-gun tail turret.

## Tail unit

The all-metal, 40ft 8½in-span tailplane and 11ft tall fin/rudder, both of RAF 30(Mod) section, were of





Stirlings mark by mark

**B Mk I**  
**Series I** First 80 examples. FN25A belly turret provisioning, FN4A tail turret initially. 10 with Hercules II (empty 39,194lb), few with Hercules III/X (empty 41,938lb)  
**Series II** Hercules XI in welded steel frame. Many later had FN7A dorsal turret. FN20A tail turret in some  
**Series III** Hercules VI/XVI power eggs. All built with dorsal turrets, FN7A or FN50A  
**Mk II**  
1,600 h.p. Wright Cyclone R-2600-A5B; intended Canadian production. 3 only  
**B Mk III**  
Hercules VI/XVI engines, Series III airframe, revised window layout. FN20A tail and FN50A dorsal turrets. Some had belly gun or H<sub>2</sub>S  
**GT Mk IV**  
Turrets removed. Prototypes EF506, LJ512. Modified Mk IIIs and production  
**C Mk V**  
Hercules XVI. Right swing even more pronounced owing to modified nose. Fuselage length increased to 90ft 6<sup>3</sup>/<sub>4</sub>in. Empty weight 43,500lb, loaded 70,000lb. Service ceiling 18,000ft, range up to 3,000 miles

**Stirling production**  
Prototypes: L7600, L7605

**Mk I**  
N3635-N3684, N3700-N3729, N3750-N3769 (N3645, N3647-N3651 destroyed by bombing; N3657 & N3671 converted to Mk II for trials) N6000-N6049, N6065-N6104, N6120-N6129 (N6025-N6028 & N6031 destroyed by bombing) R9141-R9170, R9184-R9203, R9241-R9290, R9295-R9334 (R9188 converted to Mk II and then Mk III) W7426-W7475, W7500-W7539, W7560-W7589, W7610-W7639 (W7432 & W7455 Mk III conversions) BF309-BF358, BF372-BF416, BF434-BF454, BK592-BK628, BK644-BK650 (BK648 & BK649 Mk III prototypes) DJ972-DJ977 (replaced aircraft destroyed by bombing) EF327-EF369, EF384-EF400, EF413

**Mk III**  
BF455-BF483, BF500-BF534, BF561-BF580, BK651-BK652, BK686-BK727, BK759-BK784, BK798-BK818, EE871-EE918, EE937-EE975, EF114-EF163, EF177-EF217, EF231-EF277, EF289-EF316 (some conversions to Mk IV) EF401-EF412, EF425-EF470, EF488-EF518 (some conversions to Mk IV) EH875-EH909, EH921-EH961, EH977-EH996, EJ104-EJ127, LJ440-LJ483, LJ501-LJ544, LJ557-LJ596, LJ611-LJ653, LJ667-LJ670 (some conversions to Mk IV; LJ512 Mk IV prototype, LJ530 Mk V prototype) LK375-LK411, LK425-LK466, LK479-LK521, LK535-LK576, LK589-LK624 (some conversions to Mk IV) MZ260-MZ264 (replaced aircraft destroyed by bombing)

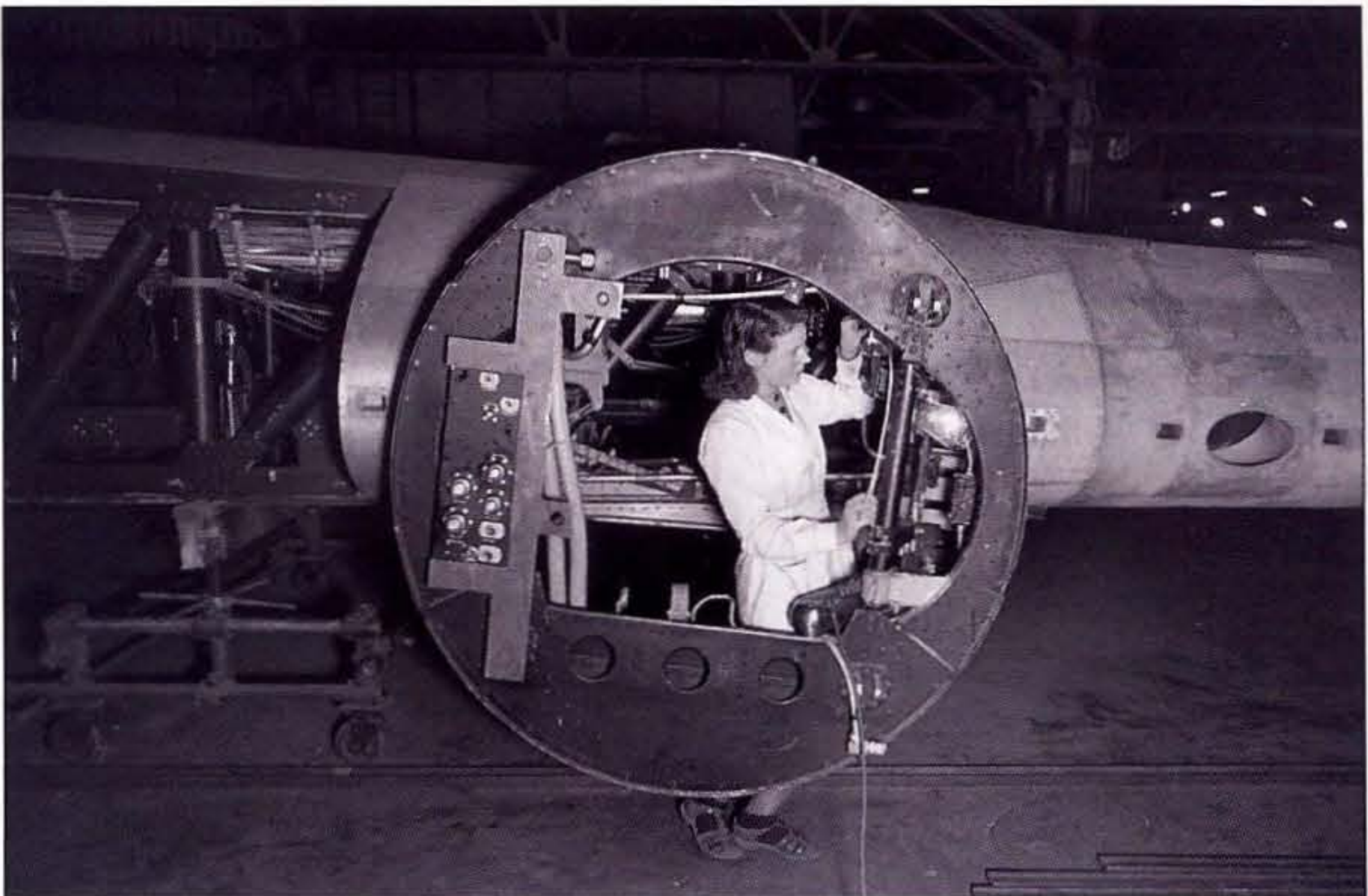
**Mk IV**  
EF317-EF323, LJ810-LJ851, LJ864-LJ899, LJ913-LJ956, LJ969-LJ999, LK114-LK156, LK169-LK211, LK226-LK257, LK270-LK313, LK326-LK370, PK225-PK237, PW255-PW266, PW384-PW425, PW438-PW465, TS261-TS266 — earlier aircraft rebuilt

**Mk V**  
PJ878-PJ923, PJ935-PJ959, PJ971-PJ999, PK115-PK118, PK171-PK186

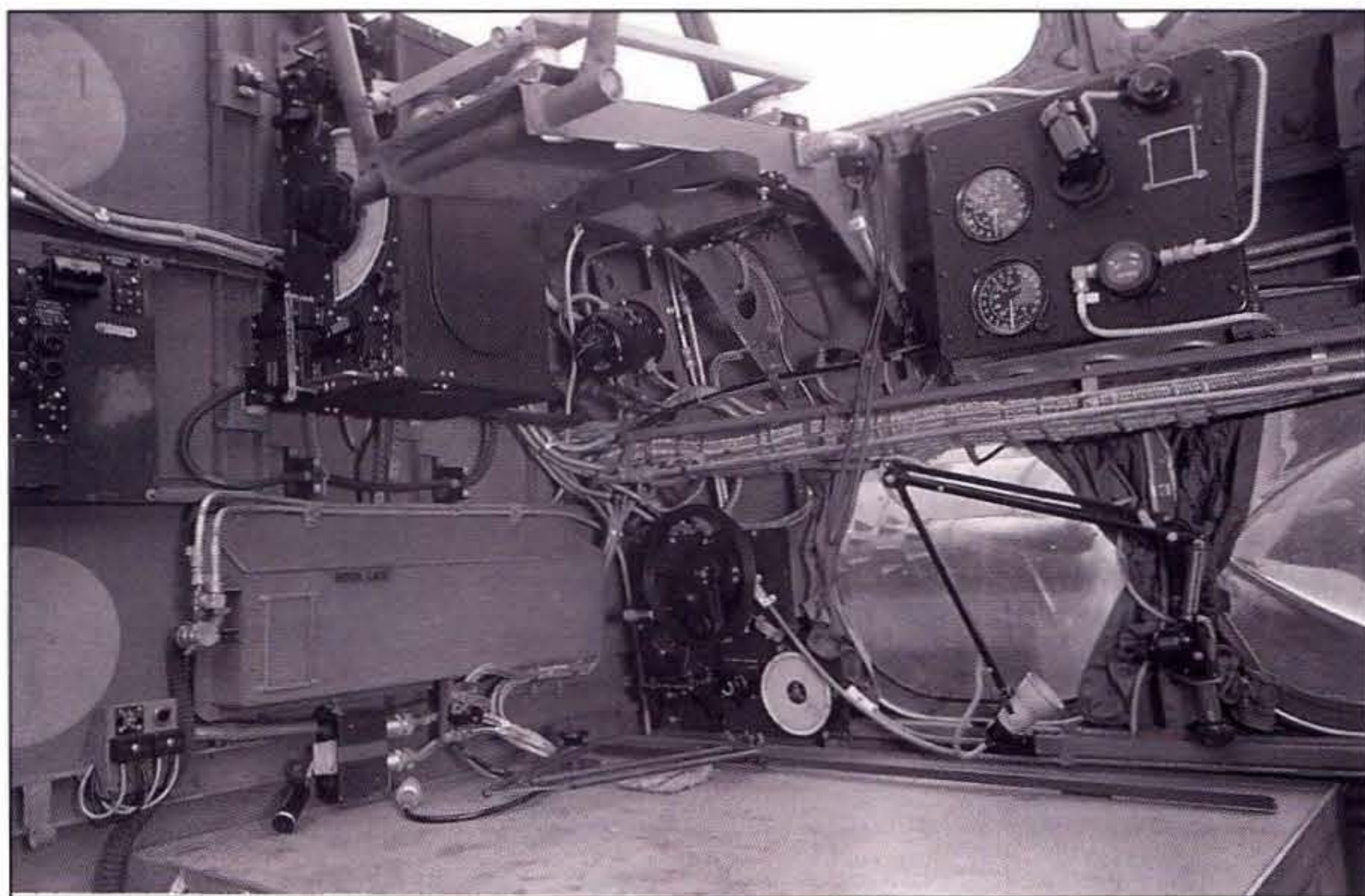
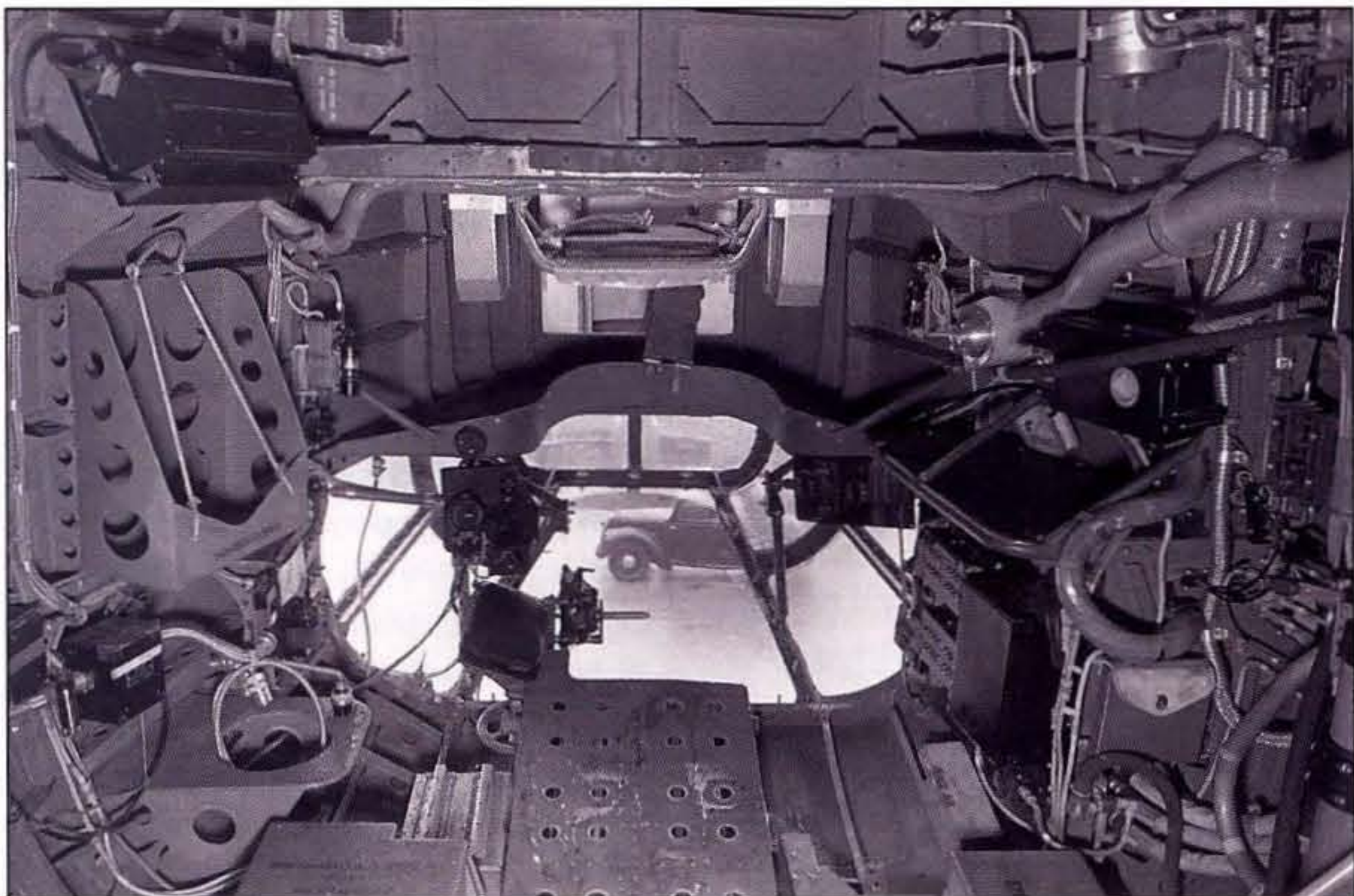
Production by marks

Mark	Production source	No	Total by mark
Prototype	Rochester	2	2
Mk I	Short*	264	720
	Short & Harland**	265	
	Austin Motors	191	
Mk II	(conversions)		3
Mk III	Short	264	1,036
	Short & Harland	343	
	Austin Motors	429	
Mk IV	Short	11	461
	Short & Harland	450	
Mk V	Short	1	161
	Short & Harland	160	
Grand total			2,383 (2,372 delivered)

\*Short includes production in the Swindon area; \*\*Short & Harland (Belfast) includes production at sub-sites



ABOVE A lady technician works on an engine nacelle of a Stirling at Longbridge in January 1942. Austin Stirlings were said to be lighter but with heavier controls than Short examples.



TOP The bomb-aimer's station was positioned directly below the nose turret, again providing plenty of room and a wide field of view. Note the selector switches to the right of the bomb-aimer's position.

ABOVE The navigator's table was situated behind and slightly below the pilot's seat, and consisted of a table for map-reading and basic instrumentation. The forward blister window makes this a Stirling Mk I.



LEFT The wireless operator sat at a table above the bomb cells forward of the wing.





**LEFT** Twin tailwheels linked by chain and sprockets were used to avoid a large single wheel taking up space needed for the tail turret.

similar construction to those of the C-Class flying-boat, but smaller. Much exposed, the vertical surfaces were readily effected by crosswinds. Twin fins and rudders, beneficial during take-off and landing, were rejected on grounds of weight. Enlarged fin and rudder surfaces likely to have reduced the strong tendency to swing on take-off and landing were thought likely to initiate other handling problems.

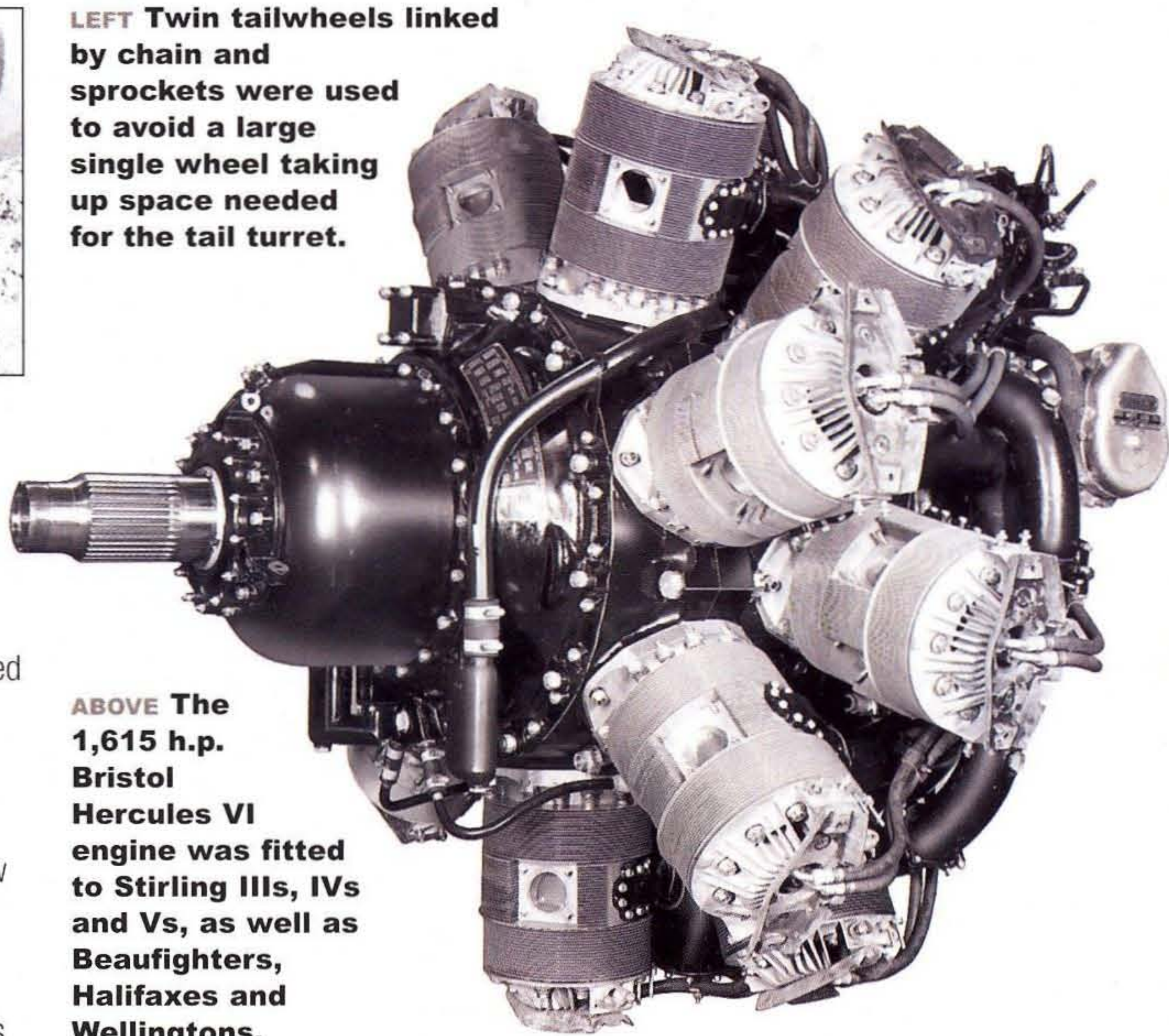
### Undercarriage

The Stirling's most unusual feature was the 25ft 7.85in-track patented undercarriage and its huge 70.2in-diameter Dunlop Type 1BB1 standard tyres (70.45in 1BB11 heavy tyres were also used). The main oleo leg retracted into a crate which swung forward into the inner nacelle as the supporting rear member neatly folded. Fairing doors closed over the whole unit, completely hiding the

complexity within. Should the electrics fail, both assemblies could laboriously be wound down by hand. The often troublesome twin retractable tailwheels (of the twin track, anti-shimmy Marstrand type in later Stirlings) were often fixed "down" at training units.

### Powerplant

The Stirling was powered by four Bristol Hercules 14-cylinder two-row sleeve-valve air-cooled engines. Most Mk Is had Hercules XIs each weighing 1,870lb dry and fitted in welded steel frames, and Mk IIIs, IVs and Vs had Hercules VIs weighing 1,930lb dry, or Mk XVIIs, more easily removed from the firewall. Hobson 132/ME carburettors differentiated the Mk XVIIs, with automatic fuel/air mix linkage to the throttle. The Mk VI/XVI revised cooling system featured a 12in-diameter oil cooler below the cowl and a longer air



**ABOVE** The 1,615 h.p. Bristol Hercules VI engine was fitted to Stirling IIIs, IVs and Vs, as well as Beaufighters, Halifaxes and Wellingtons.

intake with ice guards above. Each engine had a 25½gal oil tank (32gal in the Mk III *et seq*). Both inner engines had a 24V 1,000W (1,500W on later marks) generator. The port inner engine supplied power for the nose and mid-upper turrets, the starboard inner powering the tail turret.

De Havilland Hydromatic Type 55 propellers of 13ft 6in diameter were standard, some glider tugs featuring engine cooling fans attached to fairing spinners.



■ See also *Forties Favourites* 3, July 1987 *Aeroplane*

**Despite being a far from ideal bomber, the Stirling provided stout service for the RAF in a variety of roles throughout the war. MICHAEL BOWYER details the Stirling's RAF career**

**F**ORMATION OF THE FIRST Stirling squadron, No 7, at Leeming in No 4 Group under Wg Cdr Paul Harris, was ordered on July 14, 1940, with the Stirlings intended to replace Whitleys. On August 3 Sgt Graham H. Blacklock (not George, as stated in *The Stirling Story* by the author) flew N3640 to Leeming, the first Stirling to enter squadron service. By late September there were five more at Leeming, including N3644, the first with Hercules IIIs.

Numerous teething problems were encountered: leaking oil coolers, jammed tailwheel doors, cold air streaming into turrets and various main undercarriage and electrical



malfunctions. On September 29 engine trouble overtook N3640. Unable to maintain height, it crashed in Westmorland. Next day the A&AEE proclaimed the Stirling "unsuitable for operations in the foreseeable future", and expressed concern about the Exactor hydraulic throttles. Short

stated it was too late to change them, but that Mk II Stirlings with Wright Cyclone R-2600-A5Bs would have rod-and-chain throttle controls.

Illogically placed in the Merlin-engined Whitley Group, 7 Sqn with only three aircraft moved to Oakington in Cambridgeshire with the

**ABOVE** Stirling I Series I N6101 was built in Belfast, and is seen here operating at Waterbeach in 1941 with 26 Conversion Flight (CF), which later merged with 106 CF to become 1651 Conversion Unit.



## SERVICE HISTORY

Bristol-engined 3 Group in late 1940. Extensive electrics made it necessary to gather many electricians, experienced pilots being drawn mainly from Wellington squadrons. Personnel for the new Flight Engineer aircrew trade were locally trained. Aircraft delivery was slow, and on January 31, 1941, only seven of Bomber Command's 674 aircraft were Stirlings, along with just three Halifaxes.

In Downing Street Winston Churchill was becoming increasingly impatient to bomb Berlin with Britain's biggest bomber. The Prime Minister demanded action, but many problems had yet to be overcome. On February 9 Fg Off R.W. Cox of 7 Sqn encountered a major undercarriage malfunction while flying N6003 on a local sortie. For 4hr 50min "V-Victor" droned around, defying all attempts to lower the wheels. A safe belly landing proved just how tough the Stirling was.

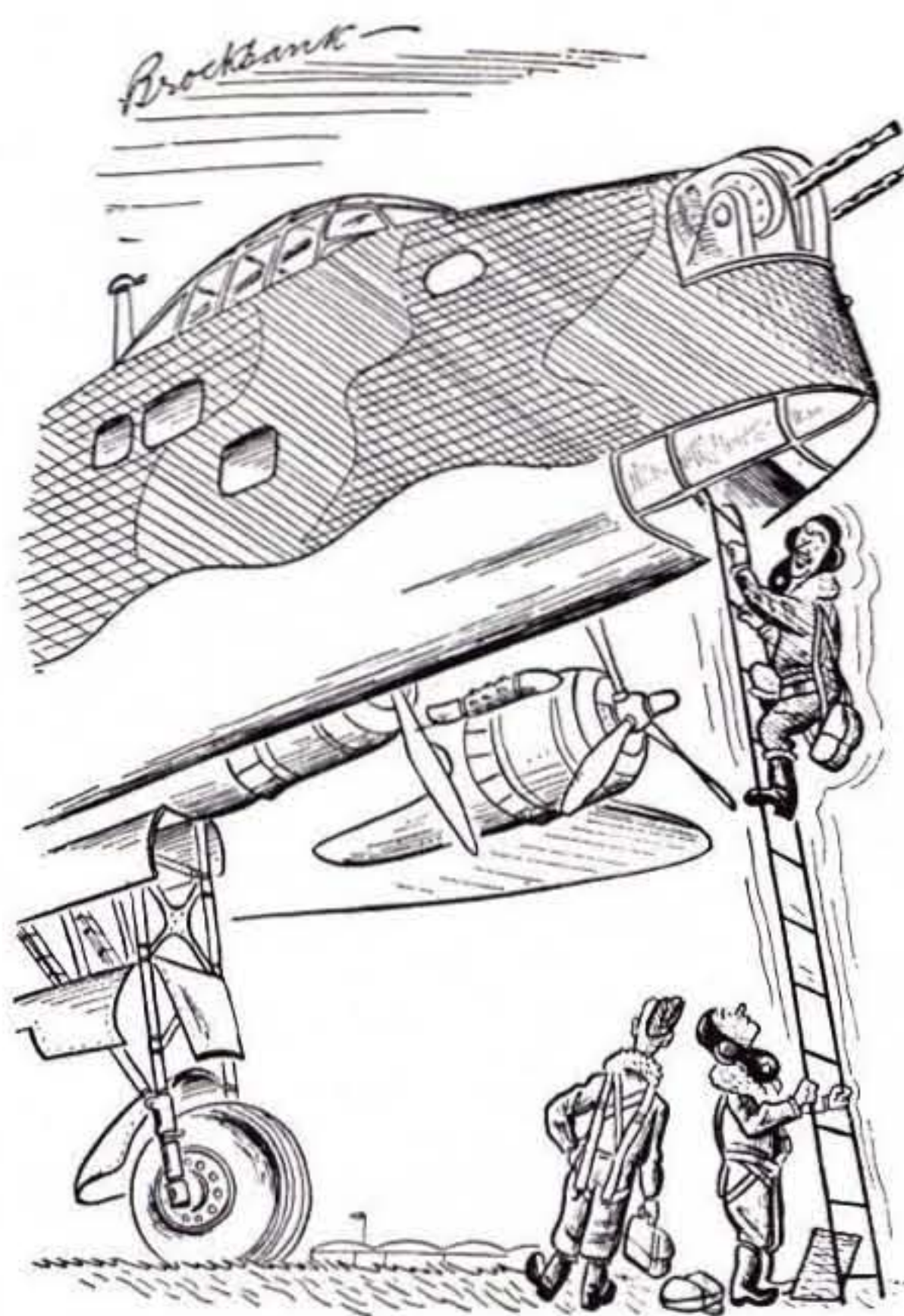
On February 10, 1941, Flt Lt Howard Smith and Flt Lt Graham Blacklock set off in N3641 ("D-Dog") on the type's first operational sortie to an oil depot at Vlaardingen near Rotterdam, with N3644 (Sqn Ldr W. Lynche-Blosse) and N3642 (Sqn Ldr J.M. Griffiths-Jones). Not until March 17 was the first raid to Germany (Bremen) undertaken, by Lynche-Blosse in N3652. On March 27 a Stirling penetrated to Cologne, by which time Stirling tyres had converted Oakington into a quagmire. The bombers moved, temporarily, to firmer chalk grassland on Newmarket Heath, from where, on April 9, three set off, at last, for Berlin in an attempt to please the Prime Minister. The outcome was disastrous; two crews aborted with technical problems and N6001, flown by Flt Lt V.F.B. Pike, was shot down near Wesermünde. The next day, with 33 Stirlings so far delivered to the RAF, the second Stirling squadron, No 15, was established at Wyton.

Six nights later Flt Lt Williams in N6010 of 7 Sqn bombed Berlin, and on April 28 Fg Off Witt attacked Emden during the Stirling's first cloud-cover daylight operation. Very boldly, 15 Sqn opened its Stirling campaign on April 30 by despatching four Stirlings to Berlin. Only N6018 reached the city, and when, on May 10, two more tried, again only one reached Berlin, a 1,200-mile round trip. Wing Commander Dale, flying the other Stirling, was shot down over the Netherlands. On June 12 the two squadrons between them notched up the 100th Stirling operational sortie.

To tempt German fighters, Stirlings were committed to daylight Operation *Circus* on July 5. With plentiful fighter support they attacked industrial targets in northern France. Anti-aircraft



RAF MUSEUM 5929-1



"Of course, I'm all right when it's in the air; it's climbing into it that makes me dizzy."

fire rather than German fighters produced the biggest threat, although Messerschmitt Bf 109s managed to dive through the fighter screen and engage the bombers. Little was achieved for considerable effort and spectacular losses, *Circus* participation ceasing on July 21, 1941. Night raids were resumed in slowly increasing strength, the deepest penetration yet occurring on October 28/29, 1941, when five crews from each

**TOP** Charles E. Brown took a fine series of 1651 CU Stirling photographs in April 1942. Within a year all three Stirlings in this picture had crashed.

**ABOVE** Stirling I N6086 *MacRobert's Reply* makes a low pass over other Stirlings of 15 Sqn at Wyton in November 1941.

**LEFT** The Stirling was often satirised for its size, as this illustration by Russell Brockbank demonstrates.

squadron attempted a raid on Pilsen's Skoda works but were thwarted by violent winds.

With 60 Stirlings available, a third squadron was formed, 149 at Mildenhall, helped by 7 Sqn's No 26 Conversion Flight, which moved to Waterbeach in November and on January 2, 1942, became No 1651 Conversion Unit (CU). No 149 Sqn despatched its first operational sorties on November 26.

The German battlecruisers *Scharnhorst*, *Gneisenau* and the cruiser *Prinz Eugen*, berthed in Brest since the summer, seemed ready to sail by November 1941. A dozen Stirlings of 7 and 15 Sqn were fitted with *Trinity*, the forerunner of *Oboe*. Flying along a

radio beam, they would receive a signal to start a timed run to target. Stirlings had previously dropped AP bombs in their anti-ship role only once before, on July 23, against the *Scharnhorst* at La Pallice. *Trinity* was first tried on December 7, tested several times, and needed more development. On December 18 Britain's latest bombers, 18 Stirlings leading Halifaxes and Manchesters with fighter support, raided Brest in daylight. Although 16 Stirlings dropped 64 2,000lb AP and seven 250lb GP bombs, the warships, protected by hundreds of AA guns and a smoke screen, remained almost unscathed. Three Stirlings were lost. On December 31, 1941, Bomber Command held 51 Stirlings, of which 22 were unserviceable. In January 1942 the technically superior FN50 dorsal turret (in Lancasters entering service) was introduced on production lines.

To lure the ships from Brest, the enemy was encouraged to believe that Britain planned to invade Norway. A commando raid was made on the Lofoten Islands, and ten Stirlings carrying 2,000lb bombs left Alconbury (Wyton's satellite) for Lossiemouth from where they were tasked to sink the *Tirpitz*. Bad weather prevented operations, however, and they started back for home on January 7, 1942, among them N6086/LS-F, named *MacRobert's Reply*. Lady MacRobert, who had lost three sons in action, gave money for the purchase of three Hurricanes and a Stirling in reponse to her tragic losses. On January 8, 1942, taking off from Peterhead, N6086 suddenly swung and careered into a Spitfire. After the bomber had been dismantled, two 60ft Queen Mary low loaders carried LS-F on the long journey to the Short Brothers



## Stirling Operations Summary

**Total sorties:** Day 290; missing 13; Night 10,784; missing 474 Overall loss rate 4.7 per cent (for comparison, Halifax 3.3 per cent, Lancaster 2.9 per cent, Mosquito 0.5 per cent)

### Stirling squadrons

Sqn	Code letters	Period of use	Bases
7	MG	Aug 1940–Aug 1943	Leeming, Oakington (detached Newmarket/satellite Bourn)
15	LS/DJ	Mar 1941–Dec 1943	Wyton (sats Alconbury & Warboys), Bourn, Mildenhall
46 <sup>†</sup>	XK	Jan 1945–Apr 1946	Stoney Cross
51 <sup>†</sup>	TB	Jun 1945–July 1946	Leconfield, Stradishall
75	AA/JN	Oct 1942–Apr 1944	Newmarket Heath, Mepal
90	WP/XY	Dec 1942–Jun 1944	Ridgewell, Tuddenham
138 <sup>**</sup>	NF	Jun 1944–Mar 1945	Tempsford
148 <sup>**</sup>	—	Nov 1944–Dec 1944	Brindisi
149	OJ/TK	Nov 1941–Sep 1944	Mildenhall, Lakenheath, Methwold
158 <sup>†</sup>	DK	Jun 1945–Jan 1946	Lissett, Stradishall
161 <sup>*</sup>	MA	Sep 1944–Jun 1945	Tempsford
171	6Y	Sep 1944–Oct 1944	North Creake
190 <sup>*</sup>	G5/L9	Jan 1944–May 1945	Leicester East, Fairford, Gt Dunmow
196 <sup>***†</sup>	ZO/7T	Aug 1943–Mar 1946	Witchford, Leicester East, Tarrant Rushton, Keevil, Wethersfield, Shepherd's Grove
199	EX	Jun 1943–Mar 1945	Lakenheath, North Creake
214	BU/PX	Apr 1942–Jan 1944	Stradishall, Chedburgh, Downham Market
218	HA	Dec 1941–Aug 1944	Marham, Downham Market, Methwold
242 <sup>†</sup>	KY	Feb 1945–Nov 1945	Stoney Cross, Merryfield
295 <sup>*</sup>	8Z/8E	Jun 1944–Jan 1946	Harwell, Rivenhall, Tarrant Rushton
299 <sup>†</sup>	5G/X9	Nov 1943–Mar 1946	Stoney Cross, Keevil, Wethersfield, Shepherd's Grove
513	JC	Sep 1943–Dec 1943	Witchford
570 <sup>*</sup>	V8/E7	Jun 1944–Jan 1946	Harwell, Rivenhall
620 <sup>***</sup>	QS/D4	Jun 1943–July 1945	Chedburgh, Leicester East, Fairford, Great Dunmow
622	GI	Aug 1943–Dec 1943	Mildenhall
623	IC	Aug 1943–Dec 1943	Downham Market
624 <sup>**</sup>	—	Jun 1944–Sept 1944	Blida (North Africa)

### Notes

\* Transport squadron used GT Mk IV

\*\* Special duty squadron used Mk IV (Special Duties)

\*\*\* Bomber squadron, later transport squadron

† Used C Mk V. Other transport squadrons used GT Mk IV

B Mk I used by Nos 7, 15, 149, 214, 218, 620 before Mk III. Others used Mk III

## “Two Bf 109s tackled ‘P-Peter’ over the sea; one was destroyed. Eventually, Frank Griggs landed the battered N3751 at Stradishall, where it overshot, its starboard wing torn away”

greater accuracy was needed. Higher percentages of incendiaries carried by all bombers, and particularly Stirlings, set ablaze much of Lübeck and Rostock. The Stirlings of 214 Sqn first operated on May 25; on May 30, 1942, 69 Stirlings were fully serviceable, leaving another dozen unserviceable in the squadrons. By dusk, 3 Group was fielding 88 Stirlings, including eight of No 1651 CU, for the astonishing “thousand bomber raid” on Cologne. Possibly 75 Stirling crews attacked Cologne between 0037hr and 0204hr, unloading 76.1

tons of HE, 3,106 30lb incendiaries and 61,280 4lb incendiaries. A year later these small bombs were credited with causing the most devastation in German cities. The overall force loss was 3.8 per cent, the Stirlings recording 2.5 per cent. When, on June 1, 1942, 77 Stirlings headed for Essen in the second “thousand bomber raid”, 62 crews attacked, one Stirling did not return and another crashed at base.

The night of June 27/28, 1942, brought a remarkable sortie. Flak crippled the starboard outer engine of

N3751 “P-Peter”, flown by Sgt Frank Griggs of 214 Sqn, then an attacking fighter fell to the mid-upper gunner after Sgt Sewell, the rear gunner, was killed, the radio operator wounded, and the intercom put out of use. A second fighter shot away the starboard inner propeller before also being shot down. Two Bf 109s tackled “P-Peter” over the sea, and one of those was destroyed. Eventually, Frank Griggs landed the battered N3751 at Stradishall, where it overshot, its starboard wing torn away.

In August 1942 7 Sqn transferred

to the nascent Path Finder Force in a backup role while still attacking with incendiaries and HEs. Operations started on August 18/19, with Flensburg as the target.

Late October saw 154 Stirlings in hand, with an average of 96 in squadrons which, in the period October–December, raided targets in Italy, supporting the Eighth Army's north African offensive. Raids began on October 23/24, 13 crews of 7 Sqn leading the 122-aircraft Main Force,

**BELOW** Stirling I Series II EF369 “Z-Zebra” was operated by 7 Sqn at RAF Oakington during the summer of 1943, as part of the Path Finder Force.

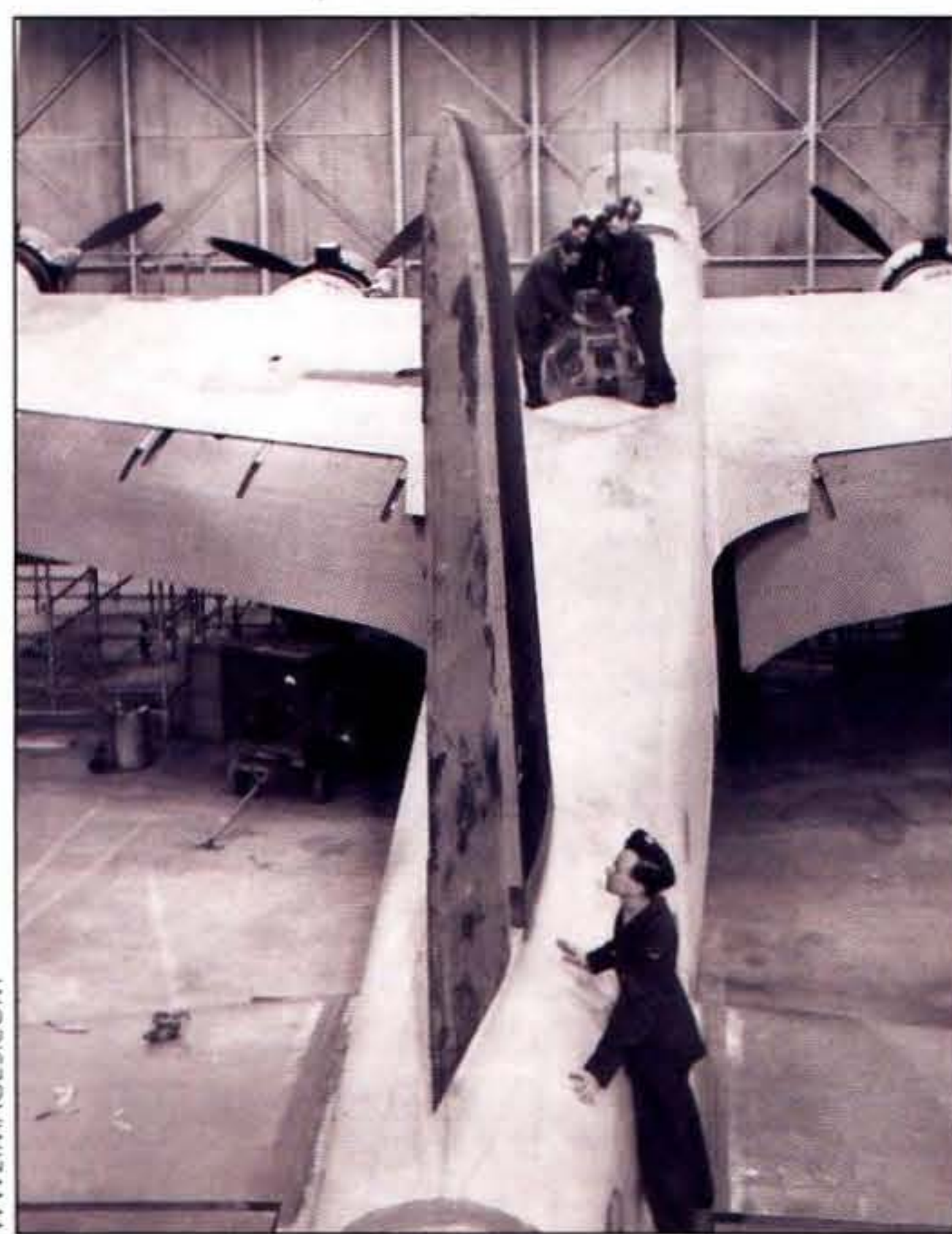






including another 38 Stirlings. Dense cloud along the western mountain area made these operations very hazardous, and the Stirling's low ceiling prohibited direct transit above the Alps. Milan was bombed following a large-scale Lancaster dusk attack. These attacks on Italy brought harrowing moments to many Stirling crews. On November 28 Flt Sgt Middleton of 149 Sqn was severely wounded when BF372 was badly flak damaged. Showing great courage, he managed to fly to the English Channel, allowing all but himself and two of his crew to bale out. Moments later the aircraft crashed into the sea, with all hands lost. Middleton, posthumously awarded the Victoria Cross (VC), lies in Beck Row Cemetery, Suffolk, near Mildenhall.

On December 9, 1942, Austin Motors delivered the first production Mk III. A further 16 reached the RAF in January 1943, and 15 Sqn first operated them on February 7. During February—March 1943 several other squadrons also received Mk IIIs, for



**ABOVE** Stirling I N6124 "R-Robert" of 149 Sqn takes off from a wintry Mildenhall in 1941. It failed to return from a raid on Stuttgart on May 5, 1942, crashing at Agincourt in the Pas de Calais.

**LEFT** When in need of repair, Stirlings were sent to the Short Brothers Repair Organisation, or SEBRO, near Cambridge. Here a Mk I Series III is inspected before being painted and sent back to an operational unit.

which high hopes were held. It was midsummer before conversion from Mk Is was complete, 7 Sqn converting instead to Lancasters in July 1943 and bidding farewell to the Stirling in September.

On March 5, 1943, with seven Stirling squadrons holding 92 serviceable and 49 unserviceable aircraft,

a new Bomber Command assault was launched led by *Oboe* Mosquitoes. With Krupp of Essen the target, a mighty onslaught against western Germany was being launched using 442 aircraft, of which 51 were Stirlings (including 15 Mk IIIs). Two failed to return. Stirling production had increased sufficiently to allow 7, 15

**Owing largely to its height from the ground, the Stirling was not an easy aircraft to work on, the groundcrew often having to lie down on the wings to refuel the tanks located near the trailing edge, as the wing was too steep to keep a footing on.**



and 218 Sqn to hold up to 27 aircraft each, others being established at 18. With strength greater, the first 100-Stirling operation took place on May 23/24. New Conversion Units were forming, and full third Flights were being added to some squadrons, allowing crews, operationally experienced, to form the nuclei of new squadrons.

Output was increasing much faster, and Main Force squadrons participated in seven major raids in May. On June 1, 1943, establishment was for 104 Stirlings in 3 Group, and 96 were fit. Of 24 in 7 Sqn, 21 were available. More airfields accommodated Stirlings, among them Chedburgh, Downham Market, Lakenheath, Mepal, Ridgewell and Witchford.

Seven main raids flown during July entailed dropping vast incendiary loads. The horrific Hamburg assault on the 24th was marked by nine Stirlings of 7 Sqn, which were followed by 155 Stirling bombers, 106 of which attacked from 15,000ft, each dropping an average load of 5,650lb. Halifaxes averaged 6,900lb and Lancasters 10,100lb, the latter operating between 19,000ft and 20,000ft and Halifaxes at 18,000ft, all well in excess of the Stirlings which, during July, flew 5,040 operational hours during 1,026 sorties, 90.7 per cent of which were rated effective. Stirling losses totalled 30, and still the force was increasing. New squadrons, 620, 622 and 623, were formed from upgraded "C" Flights. In addition, 196 and 199 Sqn converted to Stirlings.

August 1943, the peak month in the bomber's career, proved to be tough, with 62 Stirlings missing from operations. Two failed to return from a raid on Peenemünde, where 50 out of 54 claimed to have made an attack. The average load was only 3,956lb, whereas Lancasters averaged two-and-a-half times that amount.

On August 12/13, 1943, Flt Sgt Aaron of 218 Sqn was running in on Turin when his aircraft was hit by fire. Aaron received severe injuries. With an alpine crossing impossible and helped by his crew, he flew to Bône in North Africa, where, after several attempts, he crash landed. He died soon after, becoming the second Stirling pilot to be posthumously awarded the VC. Operations continued until late November 1943, when the 3 Group Ladder Plan came into effect, whereby squadrons gradually withdrew to convert to Lancasters, 15 Sqn being first to do so.

The run-up to D-Day saw Stirlings bombing railway targets in France and Belgium and supporting the Resistance forces. On June 5/6 pairs

**Text continues on page 55**



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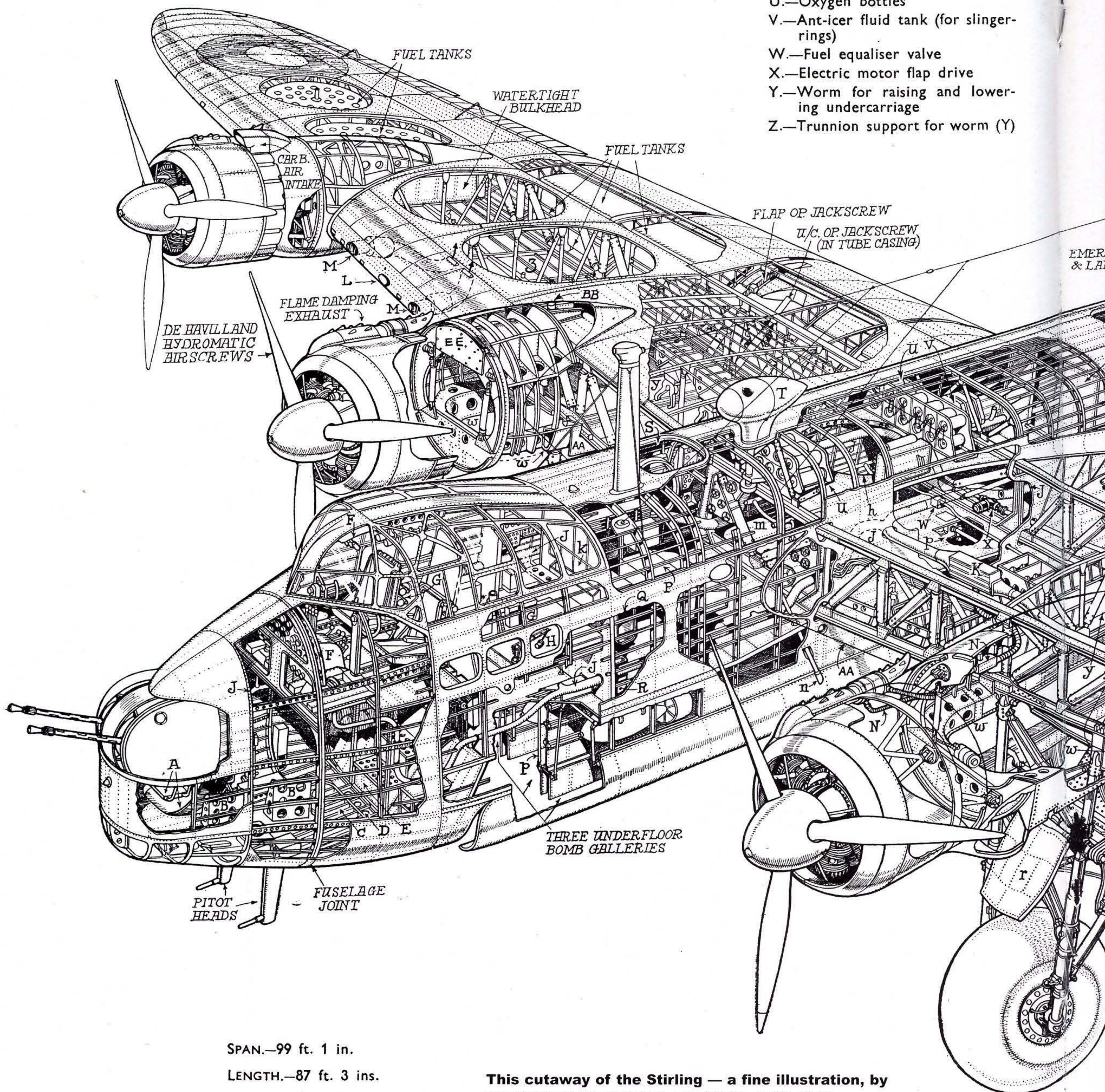


# THE SHORT STIRLING (Four 1,600 h.p. Bristol)

- A.—Gunner's seat and canvas screen
- B.—Parachute stowage
- C.—Emergency hatch
- D.—Recognition lights
- E.—Stairway
- F.—Dual controls

- G.—Oxygen stowage
- H.—Navigator's chart table
- J.—Warm air conduit
- K.—Gallay steam-air heater
- L.—Air inlet to Gallay heater
- M.—Oil cooler inlets

- N.—Steam circuit (exhaust to Gallay heater)
- P.—Radio operator's compartment
- Q.—Fresh water tank
- R.—Water bottles
- S.—Astro hatch
- T.—D.F. loop
- U.—Oxygen bottles
- V.—Ant-icer fluid tank (for slinger-rings)
- W.—Fuel equaliser valve
- X.—Electric motor flap drive
- Y.—Worm for raising and lowering undercarriage
- Z.—Trunnion support for worm (Y)



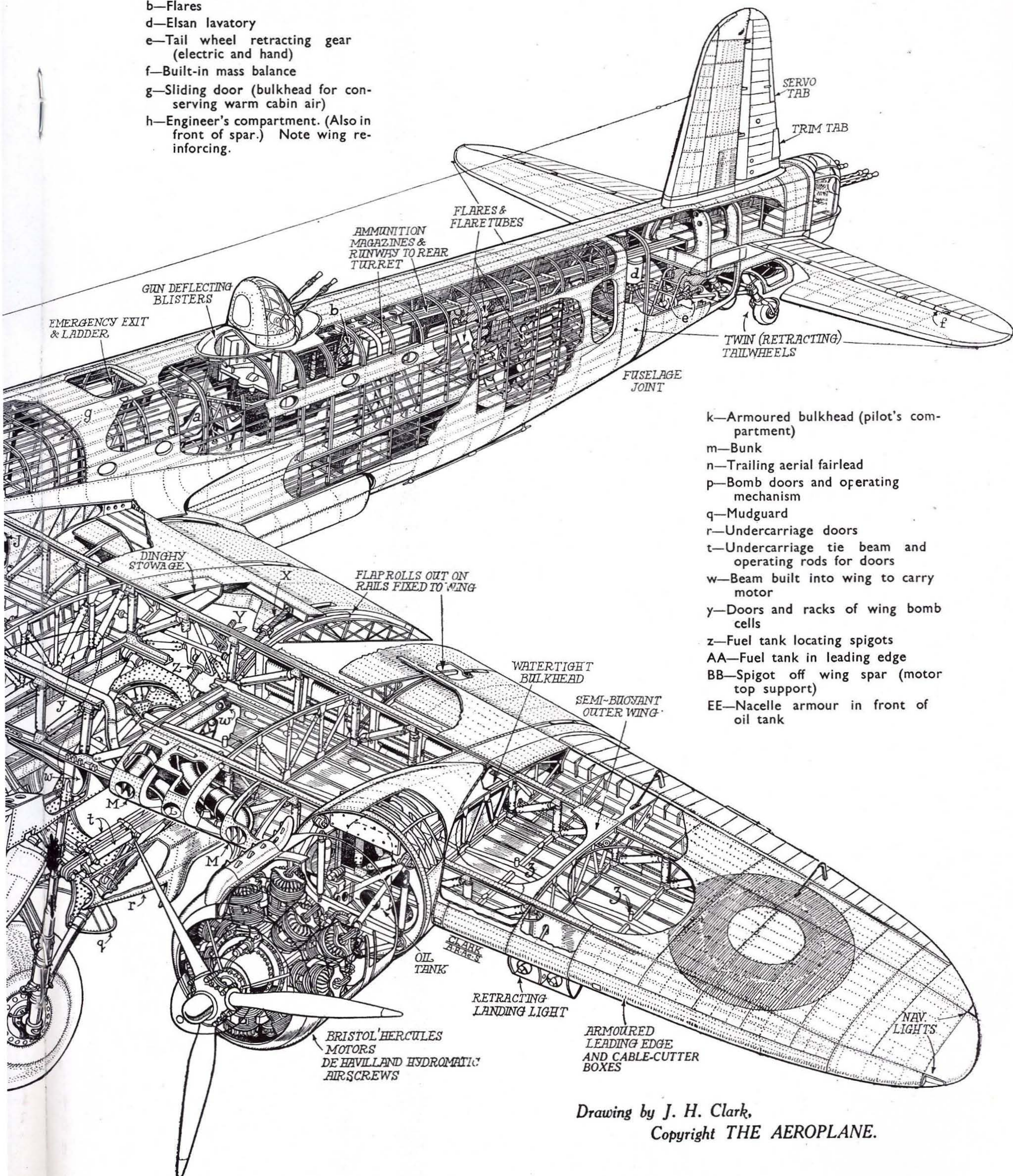
SPAN.—99 ft. 1 in.  
 LENGTH.—87 ft. 3 ins.  
 HEIGHT.—22 ft. 9 ins.  
 WING AREA.—1,460 sq. ft.  
 ASPECT RATIO.—6.72.

This cutaway of the Stirling — a fine illustration, by master technical artist J.H. Clark, both of its complexity and of its endless fuselage — first appeared in *The Aeroplane* of February 27, 1942, a full year after the type's operational debut.



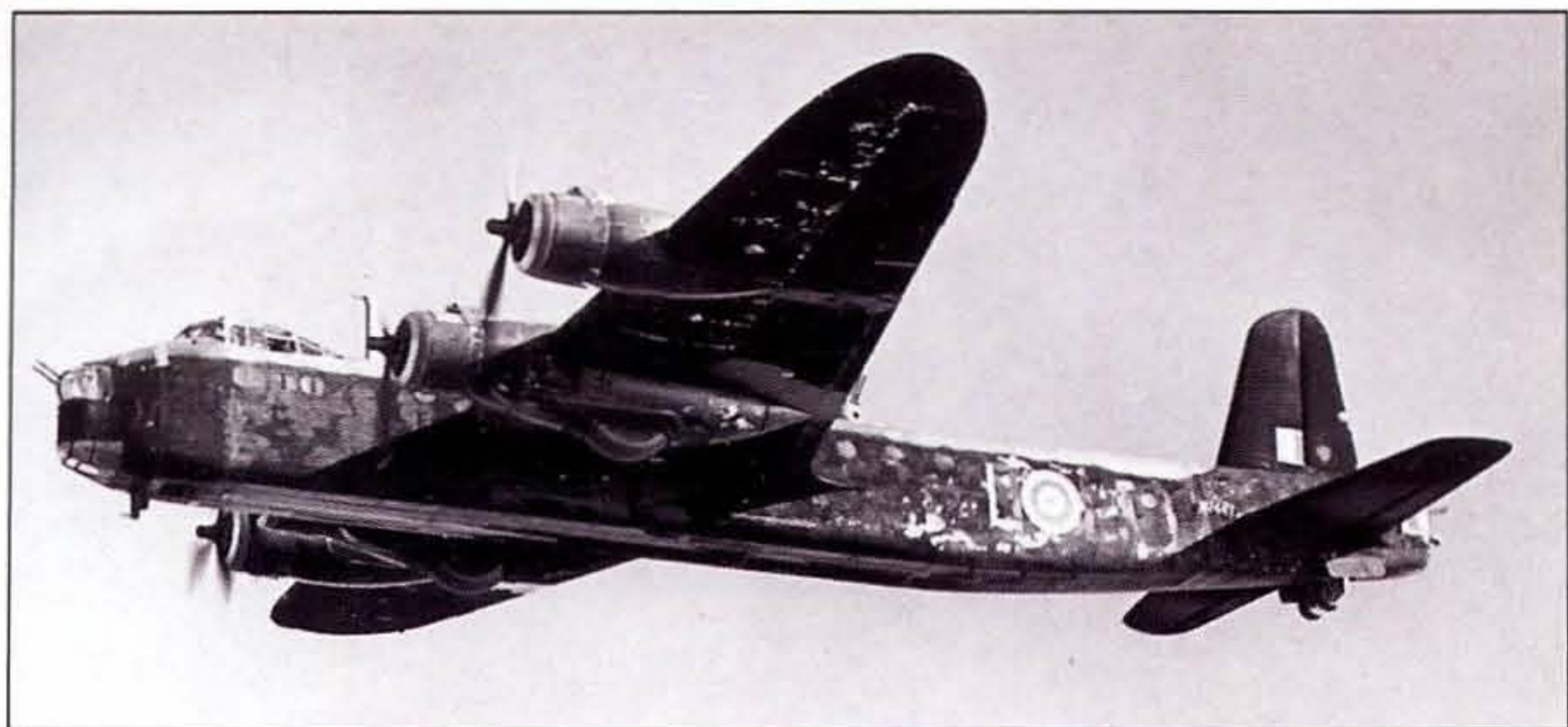
# Bristol Hercules motors, D.H. Hydromatic airscrews)

- a—Two seats on ladder leading to midships turret
- b—Flares
- d—Elsan lavatory
- e—Tail wheel retracting gear (electric and hand)
- f—Built-in mass balance
- g—Sliding door (bulkhead for conserving warm cabin air)
- h—Engineer's compartment. (Also in front of spar.) Note wing reinforcing.



Drawing by J. H. Clark,  
Copyright THE AEROPLANE.

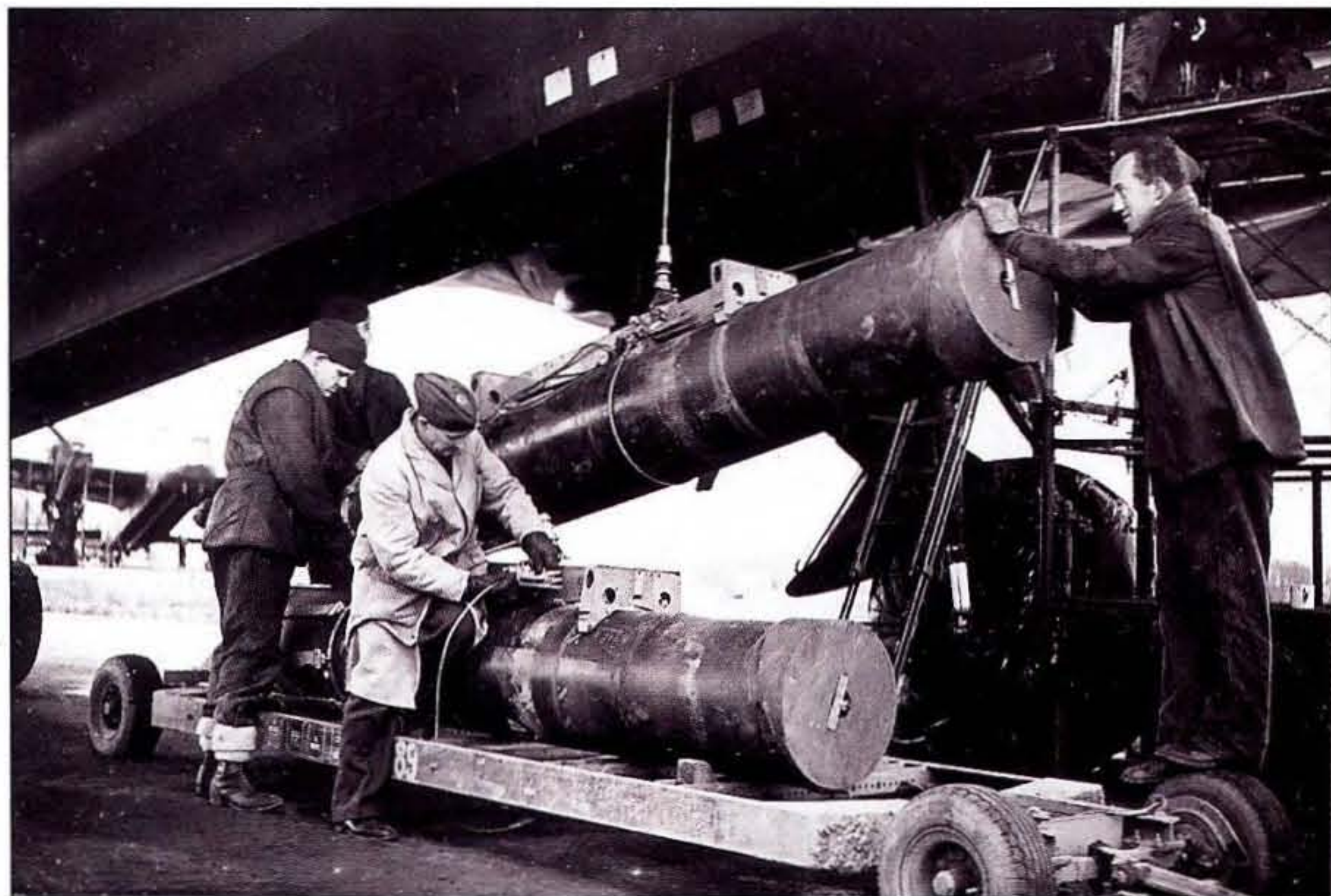




**ABOVE** Longbridge-built Stirling I W7447 was looking rather tatty by March 1942, when this picture was taken during its tenure with 1651 CU. Note the locked-down twin tailwheels.



**ABOVE** In August 1942, N3705 of 7 Sqn made a forced landing at Gorinchem in Holland, causing minor damage to the nose. It was taken to Rechlin and tested extensively by the Luftwaffe.



**ABOVE** From the end of March 1942 Stirlings were used for "gardening" — sowing sea mines in enemy ports. It was dangerous work and exacted a heavy toll in crew losses.

#### Continued from page 50

of 199 Sqn aircraft began *Mandrel* jamming operations while others produced "feints". Day attacks on V1 sites followed, the last Bomber Command bombing involvement coming when three out of four aircraft of 149 Sqn, based at Methwold, attacked Le Havre on September 8, 1944.

An activity in which the Stirling played a very prominent part was the nightly minelaying campaign that began on March 23/24, 1942. From

dangerously low levels, and facing flak ships, mines were sown off Biscay ports, in coastal waters between Belgium and Denmark, in the Skagerrak and off Baltic ports. Extremely accurate navigation was needed to "garden" narrow channels within shipping roads. When mining ceased in July 1944 Stirlings had flown 3,801 sorties, 3,196 effectively, laying 13,845 mines for the loss of 84 aircraft.

The glider-towing Stirling GT Mk IVs came to the fore in 1944. The first

## Pathfinder Stirlings

ON AUGUST 17, 1942 four bomber squadrons, one from each of Bomber Command's heavy groups, were taken to form the new Pathfinder Force (PFF) that eventually became the RAF's No 8 (Pathfinder) Group. No 7 Squadron with its Stirlings was the contribution from No 3 Group. The new force did not immediately have group status but instead worked under the direct control of Bomber Command HQ plans staff, with orders passing through the HQ of No 3 Group. The job of AOC went to Air Cdre Donald Bennett, a highly experienced pilot and air navigator. No 7 Squadron were the only Stirling unit to operate in the Pathfinder role before the squadron was re-equipped with Avro Lancasters in the summer of 1943.

The first Pathfinder-led raid on August 17/18 was cancelled due to bad weather, but on the next night the PFF led an unsuccessful raid on Flensburg by 118 aircraft. Less than a week later, on August 24/25, five Pathfinder aircraft were lost, of which three were No 7 Squadron Stirlings, when Frankfurt was attacked by a force of 226 bombers. From this inauspicious beginning, in the years to come the PFF went on to achieve great things in target marking for the Main Force.

However, it took the foresight of Don Bennett to add almost 8,000ft to the Stirling's meagre operating height of about 13,000ft in PFF service. This was achieved by the simple expedient of reducing the quantity of 0.303in machine-gun ammunition, halving the fuel reserve, and removing all the armour plating including the substantial door between the front cabin and the aft fuselage.

By the time 7 Sqn made its final Stirling sortie on August 10, 1943, the squadron had flown 826 Stirling PFF sorties from its base at Oakington in Cambridgeshire for the loss of 37 aircraft. In fact, 7 Sqn suffered the highest percentage losses of all the RAF's Stirling squadrons.

**JONATHAN FALCONER**

two, converted Mk IIIs, emerged in August 1943. Production conversion began at 23 MU at Aldergrove and sub-sites in October, squadron delivery starting in January 1944. On June 5/6, 1944, four Mk IV squadrons based at Fairford and Keevil towed 71 Horsas to Normandy as part of the D-Day landings.

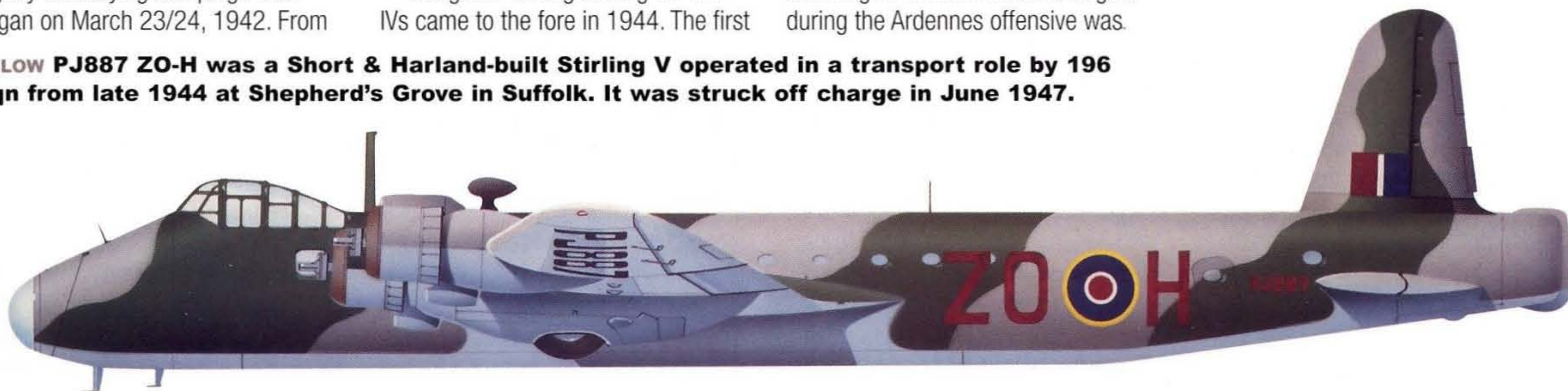
When sufficient Stirlings were available, Harwell's Albemarle squadrons, 295 and 570, converted to Stirlings in time to participate in the Arnhem venture. On September 17, 137 Stirlings set forth, mainly towing Horsas and well protected by fighters. For five more days, with mixed success, they supplied the airborne forces, then on September 21, during Operation *Market Garden* (see also *An Australian Over Arnhem*, October 1994 *Aeroplane*) German fighters broke through the protection and shot down eight Stirlings.

After pausing, repairing, re-equipping and training new crews, the transport Stirling squadrons moved east to Earls Colne, Great Dunmow, Matching, Shepherd's Grove and Wethersfield. Limited night bombing of communications targets during the Ardennes offensive was

followed by further intensive training, trains of Stirlings and Horsas streaming across East Anglia. On March 24, 1945, came the final and largest airborne assault, Operation *Varsity*, supporting the Rhine crossing, in which 189 Stirlings towed Horsas.

Following VE-Day, May 8, 1945, Stirling IVs moved personnel and supplies within Europe, gradually extending activities to the Mediterranean. From September 1944 the more sophisticated Stirling C Mk V trickled into RAF service before venturing to India, where two Flights, Nos 1588 and 1589, provided theatre support. In June 1945 Transport Command was rapidly enlarged, and Stirling Vs based at Stradishall and Shepherd's Grove operated scheduled services from Lyneham to the Near East and India (see *Stirling Work*, April and May 1995 *Aeroplane*). On July 17, 1946, Mk V maintenance in India ceased and Yorks replaced the Mk Vs. Many Stirlings retired to 23 MU Aldergrove and sub-sites, transports gathering at 273 MU, Polebrook, to end their days, the last in autumn 1947. **A**

**BELOW** PJ887 ZO-H was a Short & Harland-built Stirling V operated in a transport role by 196 Sqn from late 1944 at Shepherd's Grove in Suffolk. It was struck off charge in June 1947.







# Flying the Stirling

The Stirling was a manoeuvrable bomber with responsive controls, but, as **MICHAEL BOWYER** explains, it suffered from inadequate ceiling capability and difficult landing characteristics



**"**I FELT SAFE in the tough old bird." "I expected bombs to fall on us from bombers above." "The Stirling was amazingly manoeuvrable for its size." "As rear gunner I travelled forwards and from side to side simultaneously because the fuselage flexed so much . . . You could hold a party in the bomb aimer's compartment!" The author gathered these comments when compiling *The Stirling Story*, and the Mk I's Exactor unpressurised liquid-transmission throttles were not forgotten!

Short had installed Exactors in their large flying-boats; very different from Stirlings, as test pilot John Lankester Parker found during the take-off of the first production aircraft, when an engine cut owing to rapid throttle movement. Inherent right swing and the over-long fuselage exposed the vertical tail to side loads and taxed the strength of the undercarriage.

Geoffrey Tyson, Short's test pilot, wrote that:

"Slamming open the throttles on airfields with not much more than a 1,200-yard run, and some grass, was certainly a cause of many accidents. Additionally, the Stirling had a built-in tendency to swing to starboard due to slipstream effect. If the wind was from a starboard vector the opening of the starboard outer throttle (and sometimes the starboard inner too) had to be staggered behind the port ones to prevent swinging. Inexperienced pilots were reluctant to do that. The Stirling with its stalky undercarriage, tall rudder which presented a



**TOP** The Stirling was well-liked by its pilots for its agility, but was prone to being temperamental, especially if fitted with Exactor hydraulic throttles.

**ABOVE** The first and second pilots of a Stirling in the light and roomy cockpit.

**RIGHT** Short test pilot Geoffrey Tyson became John Lankester Parker's deputy in 1940, becoming Chief Test Pilot in 1945, and moving to Saunders-Roe in 1946.

bigger keel surface to a crosswind and high c.g. was more prone to weathercocking than other bombers. Throttles were left primed in the forward position and the first job on sitting in the seat was to re-prime them;



it was almost a religion." Another pilot recalled how "blissfully easy" the rod-and-chain equipped Mk III seemed.

Pipes connecting transmitters to receivers were long and could crack, and joints developed leaks. Air in the

system pushed the carburettor to "open" take-off boost even with the throttle held against the running stop. Magnetos and fuel would then, during ground runs, have to be switched off.

Instructions issued by the A&AEE in February 1941 stated that before engine start each throttle lever had to be moved to priming position slightly beyond full-throttle position, held there for about 10sec against the Exactor spring, then slowly brought back to "closed". As each engine fired on the starter magneto it needed to be switched on without moving levers, and with the propeller in fine pitch. During run-up to 2,500 r.p.m. the propellers were set to "coarse", then back to "fine".

Just before take-off the flaps would be set to one third of total travel, the elevators trimmed, brakes fully applied, throttles primed and power set to 2,000 r.p.m. The gills would then be closed, brakes released and throttles opened, starboard leading, and leaving one at halfway to be opened.

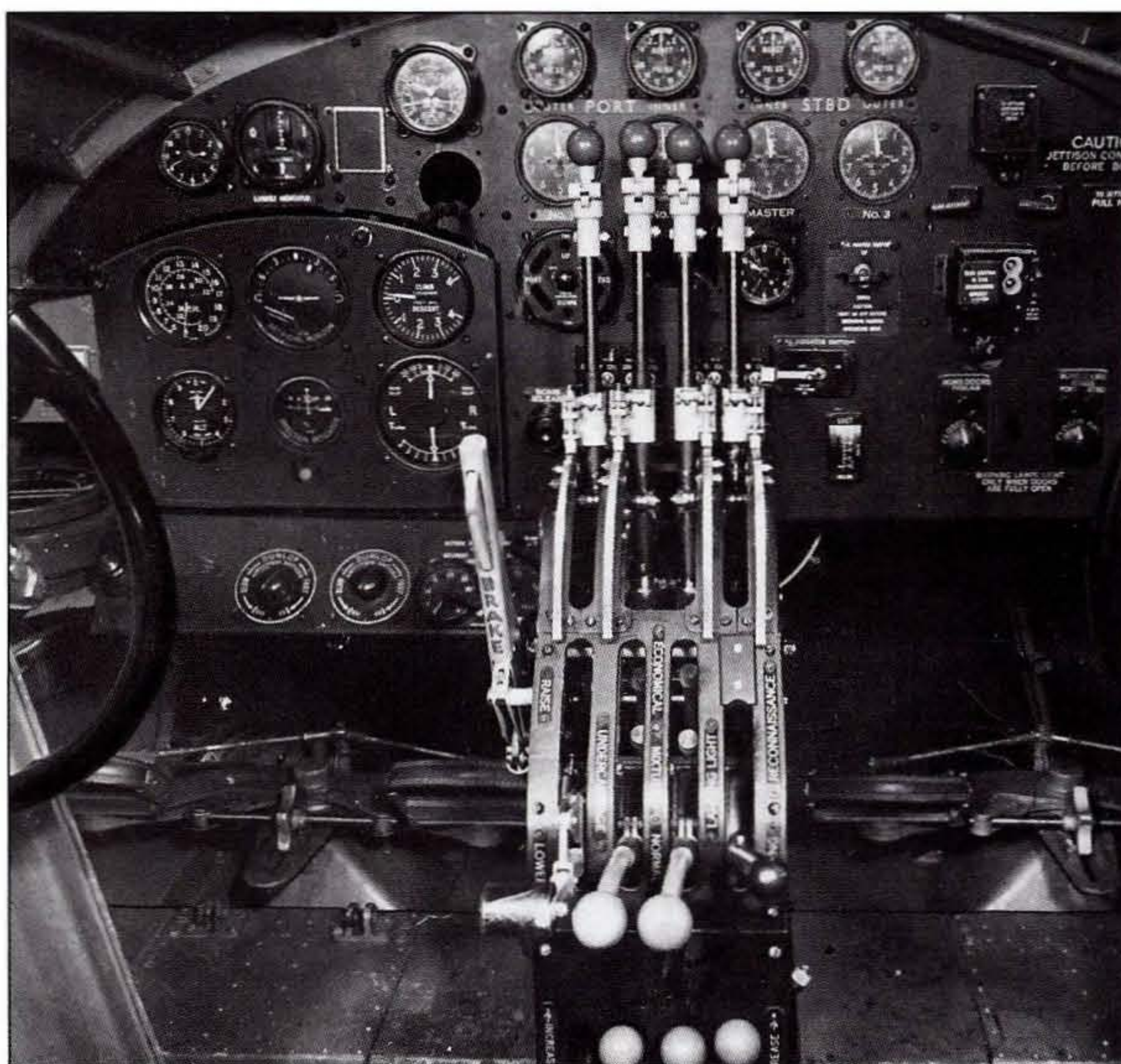
During take-off the Hercules XI running at 2,800 r.p.m. delivered 1,590 h.p. and at 2,900 r.p.m. the Mk VI gave 1,615 h.p. With the c.g. 120in aft when well loaded (the c.g. range was between 109.5in and 121in aft of the c.g. datum point), the tail would be raised as soon as possible, then, at 100–110 m.p.h. indicated air speed, depending on weight, the aircraft would be eased off. Following the 53–55sec undercarriage retraction the cowl gills would be opened, with retrimming



taking place as the flaps slowly closed. Climb-out at around 150–180 m.p.h. would follow. The Hercules XI developed 1,315 h.p. at 2,000ft, usually reached in 2½min, and 1,020 h.p. at 7,500ft at 2,500 r.p.m., the setting for maximum economic cruise. There was sufficient rudder control for hands-off climb. From engine start to 10,000ft took 27min, a 70-mile track and 200gal of fuel.

In the Mk III in medium supercharger state (MS), and gills open, climb rate was 750ft/min at 2,000ft. In full supercharger gear (FS) with engines at 2,500 r.p.m. the climb rate was 430ft/min at 8,000ft. The Mk III's economical cruise in MS was around 224 m.p.h. at 11,600ft. It took 21min to reach 12,000ft and had a service ceiling of about 16,000ft. Boost could be set at +2lb/in<sup>2</sup> or +6lb/in<sup>2</sup>, the latter being useful during combat. After bombing, the return would begin at around 61,000lb and 160 m.p.h.

For towing, a Stirling GT Mk IV would taxi to the runway where the nylon rope would be quickly attached and the slack taken up. When traffic



lights by the runway flashed green, the combination would roll, the glider becoming airborne after about 200yd. Starting at 57,000lb, the Mk IV with gills closed, with maximum weak mix and at 2,400 r.p.m., could attain 235

**ABOVE** The instrument panel of the Stirling was fairly simple and uncluttered, most of the engine gauges and dials being located on the flight engineer's station.

m.p.h., which could be held at 11,800ft. A fuel load of 2,245gal could give a range of 2,360 miles at 11,000ft. The C Mk V with a top speed of 280 m.p.h. at 6,000ft cruised at about 190 m.p.h.

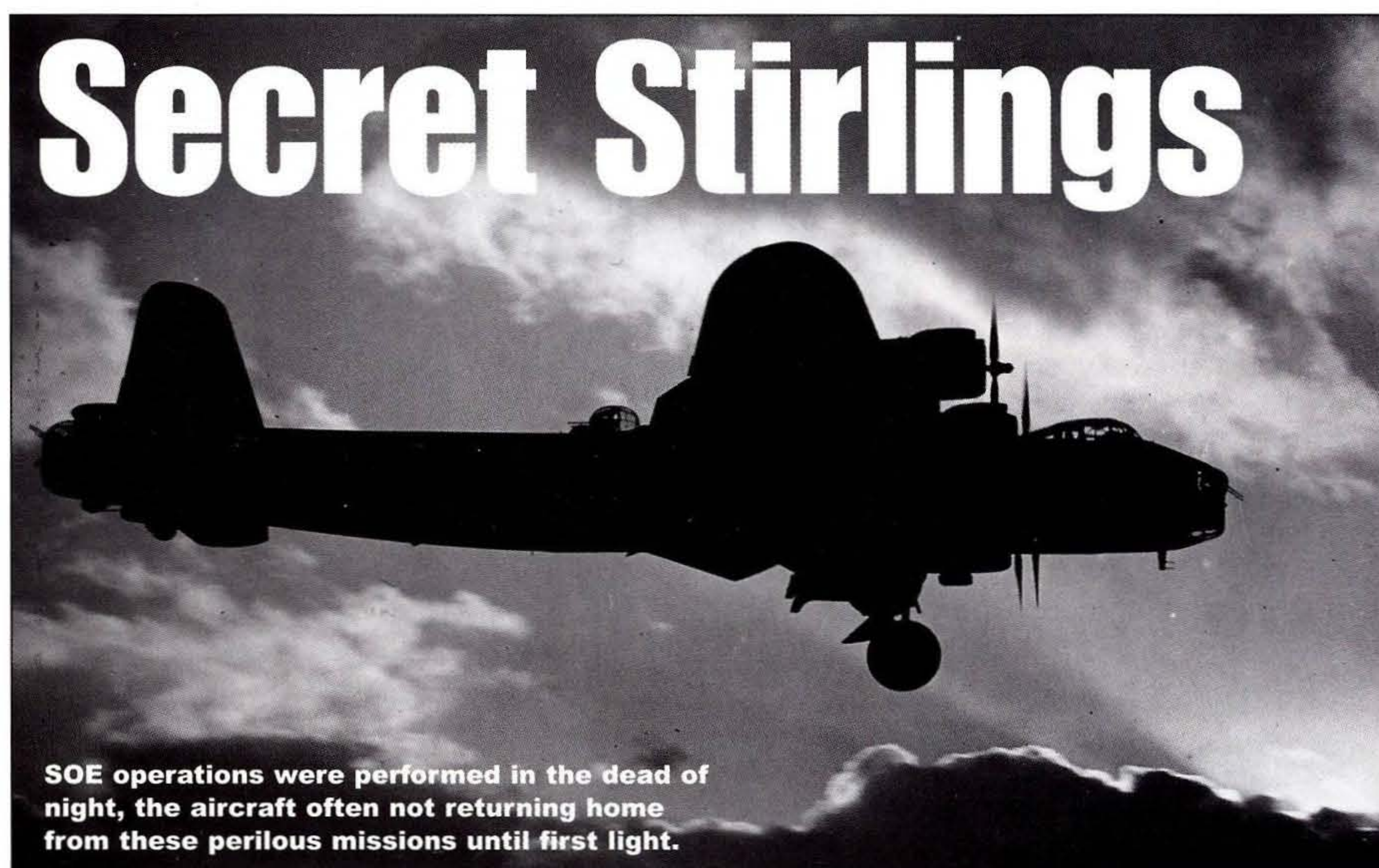
Stirling bombers could land at weights of up to 60,000lb. Circuit entry would be at 160–170 m.p.h., obtained on 2,400 r.p.m. in Mk Is given +3lb/in<sup>2</sup> boost. With propellers in fine pitch, speed would be reduced to about 140 m.p.h., flaps half extended, with retrim following. The undercarriage would be lowered just before turning on to approach at 130–135 m.p.h. After retrim the flaps would be fully extended, putting the nose up, and the throttles were used to hold the best glide at 120 m.p.h. "Crabbing" on approach was common in a crosswind, and needed careful handling. On completing a three-point landing the throttles were closed and brakes settled hard without fear of the tail lifting. **A**

■ See also *Salute To The Stirling* by D. Murray Peden, November and December 1977 *Aeroplane*

## A lesser-known role undertaken by Stirlings was flying Special Duties sorties deep into enemy territory – as JONATHAN FALCONER relates

**T**HE OPENING MONTHS OF 1944 saw four of Bomber Command's Stirling squadrons temporarily supporting the efforts of the two hard-pressed Special Duties squadrons based at RAF Tempsford in Bedfordshire by dropping personnel, weapons and equipment to Resistance groups in occupied Europe and Scandinavia. They were soon joined in this endeavour by No 38 Group's squadrons, operating the Stirling IV, who continued to fly in this role until the end of the war in addition to their primary tasking as paratroop and glider transports.

Flt Lt Bob Chappell and his 149 Squadron crew were typical of Bomber Command's contribution to Special Duties operations in 1944, which they flew in addition to minelaying and bombing sorties. Between September 1943 and September 1944 they completed 15 Special Operations Executive (SOE)



**SOE operations were performed in the dead of night, the aircraft often not returning home from these perilous missions until first light.**

"parachutages" trips to the French Resistance.

Pt Off David Mitchell was the navigator in Bob Chappell's crew, and he relates below something of their experiences on Special Operations:

"Our whole tour was fairly uneventful although we lost a lot of aircraft and friends on the squadron. So we flew with a constant feeling of wondering when our turn would come, a strain which was often diluted by plenty of beer and mad sing-song parties in the mess during stand-downs. But for the most part we had no trouble, apart from icing and some

hair-raising moments flying round mountain peaks in the Alps looking for our dropping sites.

"Supplying the Resistance was all low-level work, flying at 500ft across France, identifying our dropping site by a signal from a solitary figure in some remote field or plateau using a lamp or torch. Once codes were exchanged successfully three more lights would spring up in a line which identified the wind direction. We would make the drop from 150 to 200ft flying into the wind.

"We were fortunate enough to find all our reception parties and, having

exchanged correct signals, to drop our canisters and make our way safely home. Except once.

"It was the night of April 10, 1944. We had to fly with a substitute pilot, Fg Off Alan Bettles, and it had taken us a good four hours at 500ft to reach the dropping zone most of the way across France. Arriving bang on ETA, sure enough as always the reception was there. The three lights were already on, indicating the wind direction, but on this occasion they were signalling the wrong letter(s). There was mild panic while I hurriedly checked my charts, the chosen



## SOE OPERATIONS

pinpoint and DR run. Sure enough, I confirmed to the pilot that this was for certain our dropping site. We made several circuits at a cautious 300ft but we still did not get the pre-arranged signal code which would have allowed us to make the drop.

"The frustration was heightened when once again I became the focus of attention. Pilot to navigator: 'Are you really certain this is our spot?' At this point I was beginning to doubt myself, especially since we noticed several dropping zones on the way. Many would give you a preliminary flash, hopefully. So I hurriedly rechecked everything once again. Navigator to pilot: 'This is most definitely our dropping point. Time is getting on. If they don't give us the correct letters we're getting out of here!' This was a frustrating decision to take and reluctantly we started to climb and make our way home.

"They're doing it right now!' It was our rear gunner 'China' Town shouting into his mike — 'They're doing it right now, they're giving us the correct letters!' And he was right! So round we circled to make another approach. Bomb doors open. Wheels partly down and flaps partly down to reduce speed. We made our dropping approach. 200ft . . . 150ft . . . Suddenly all hell let loose. Two searchlights opened up straight on to us. We seemed to be under a lot of fire from at least three guns on the ground, at point-blank range.

"The bomb-aimer, George Mackie, was in his niche beside the bomb-sight. The flight engineer, a young, canny, over-conscientious Scot named Ian Harvie, was a little concerned about the amount of time we had spent in the target area, and was making a quick check of the fuel gauges. So, there was no one in the second pilot's seat and the pilot was screaming his head off to this no-one 'For Christ's sake give me more boost, more revs!' He was weaving as much as he could with both hands on the stick.

"It was Taffy Thomas, the WOp, who obliged. He rushed forward from his table, knocking everything flying and bruising himself black and blue on the way, and pushed the throttle levers forward — as he described it, 'pushing everything through the bloody gate'. The Hercules engines responded with a roar. For a moment we thought they had jumped the aircraft, like horses at the starting gate.

"During all this time 'China', the rear gunner, was taking care of the searchlights with a few accurate bursts from his guns. He said later he was reluctant to fire on the scurrying figures below who normally he knew to be our 'friendly' resistants.



**TOP** Stirlings of 149 Sqn formate over the Suffolk countryside.

**ABOVE** Flt Lt Bob Chappell (second left, back row) and crew.

**BELOW** Stirling IV LJ932 of 138 Sqn made a forced landing near Louth after being shot up by a Ju 88 on an SOE sortie in 1944.



"I'll say this for our pilot Bettles, he wasted no time. We were out of that danger zone like a flash. And so we made our way home, the first time we had not delivered the goods. To relieve our disappointment and frustrations we shot-up two trains and some road transport on the way home, much to the flight engineer's horror. He was still checking those fuel gauges. The total flight took 8hr

40min, so we didn't have a lot of juice left. When we landed none of us was the least bit tired."

Plt Off Den Hardwick and his crew joined 299 Squadron in No 38 Group on March 3, 1944, following a tour of bomber operations with 149 Squadron at Lakenheath. They were stationed at Keevil in Wiltshire and flew a number of SOE sorties deep into occupied France in the months

following D-Day. Den recalls in particular the night of September 15 when they took a team of 14 SAS paratroops to a drop zone close to Strasbourg on the River Rhine:

"The weather was good until we came to the Rhine valley, where visibility on the ground was nil due to dense fog. I called the stick leader, an SAS captain, up to the front and showed him the view from the cockpit. His only question was, 'How close to the DZ can you put us down?'. After discussion with Ted Webb, my navigator, we calculated that with a direct run from where we were, based on our last positive fix, the worst error would be 20 miles, to which came the reply, 'We can walk that tonight and they won't see us in the fog'. We made our run and away went the lads.

"Some few weeks later, after 299 had moved to Wethersfield, the crew went for a night out in Chelmsford. We walked into a pub and there, believe it or not, having a beer were the lads we had last seen jumping into the fog near Strasbourg. What a night that turned out to be!

"On the night of August 31 we set off on an SOE trip to southern France, somewhere north of the Pyrenees. We were flying in a virtually brand new Stirling IV, LJ971, and this was our third trip in her. Around the DZ we lost one engine; halfway across France on the return trip another engine started to overheat. By the time we reached northern France we were making very slow progress and gradually losing height, and it seemed there was no way we would make the Channel crossing. After D-Day the navigators used to draw a red line on the charts showing the latest information as to where the front line was. It was a bright moonlit night and



we spotted an airstrip which, according to the chart, was on our side of the front line. We managed a two-and-a-half-engine landing on a runway with no lights, which was quite hair-raising."

Tom White was the flight engineer in Den Hardwick's crew and he remembers the incident vividly:

"The sound of gunfire several miles away and the sight of all the mines that the Germans had left lying around, convinced us that this was no place for us to be. The Army took us to a tent and fed us on steak and boiled potatoes. We suspected there must have been a three-legged bullock in the vicinity."

"In the morning we found that another Stirling — from 196 Squadron — had also landed at B17 (Carpique airfield, west of Caen), and its skipper was Henry 'Chuck' Hoysted. His flight engineer and I decided that the engines of Hoysted's aircraft, ZO-D, were serviceable so they gave us a lift home to Keevil."

Another Keevil-based crew to fly SOE supply drops during the summer of 1944 was that of Fg Off Gib Goucher RCAF, also of 299 Squadron. One particular sortie caused them a few problems as Goucher's flight engineer, WO Leonard Brock, recalls:

"During August 1944 we carried out many night sorties over France but one was quite significant. On August 2 we took off in Stirling LJ919 on a night drop over France called *Horace 7* with 24 containers and one pannier. We met heavy flak over the DZ and returned to the UK, but we were diverted to Weston Zoyland in Somerset because our starboard elevator had been damaged by the flak. We made a successful landing and left the aircraft behind to be repaired by groundcrew, and flew back to Keevil."

"We returned to Weston Zoyland on August 4, by which time the aircraft had been repaired, and we found that all fuel tanks had been filled to capacity. We could take off all right but we could not land as we were above the all-up weight for landing. We asked permission to drop the containers but this was refused and we were told to fly over Salisbury Plain and jettison fuel from the main tanks. We dropped 1,170 gallons of 100 octane by opening valves inside the aircraft and the petrol went out in a thick black swirl. We managed to land back at Keevil and took the load back to France the following night and dropped it in the right position without opposition."



■ Jonathan Falconer is the author of *Stirling Wings* and *Stirling At War*, both published by Sutton



A Stirling of 1651 CU takes on fuel from a Zwicky refuelling truck at Waterbeach in 1943.



## The Electric Wonder

**REG BUTLER served in the wartime RAF as crew chief of "B" Flight, 218 Sqn, and well remembers the troublesome Stirling**

**O**N RECEIVING OUR FIRST Stirling it was brought into the hangar and attached to a massive jacking frame in order to carry out undercarriage retraction checks. This function was of an electrical nature and after the wondrous sight of watching all that undercarriage disappear into the nacelle, there was talk of micro-switches and over-runs of the motors. On the Mk I the emergency lowering gear was first brought into mesh by a lever known by Short as the "ucker gear". On the later marks, the electric motors were inboard and a modified system permitted a large handle to be fitted and the gear hand-wound down.

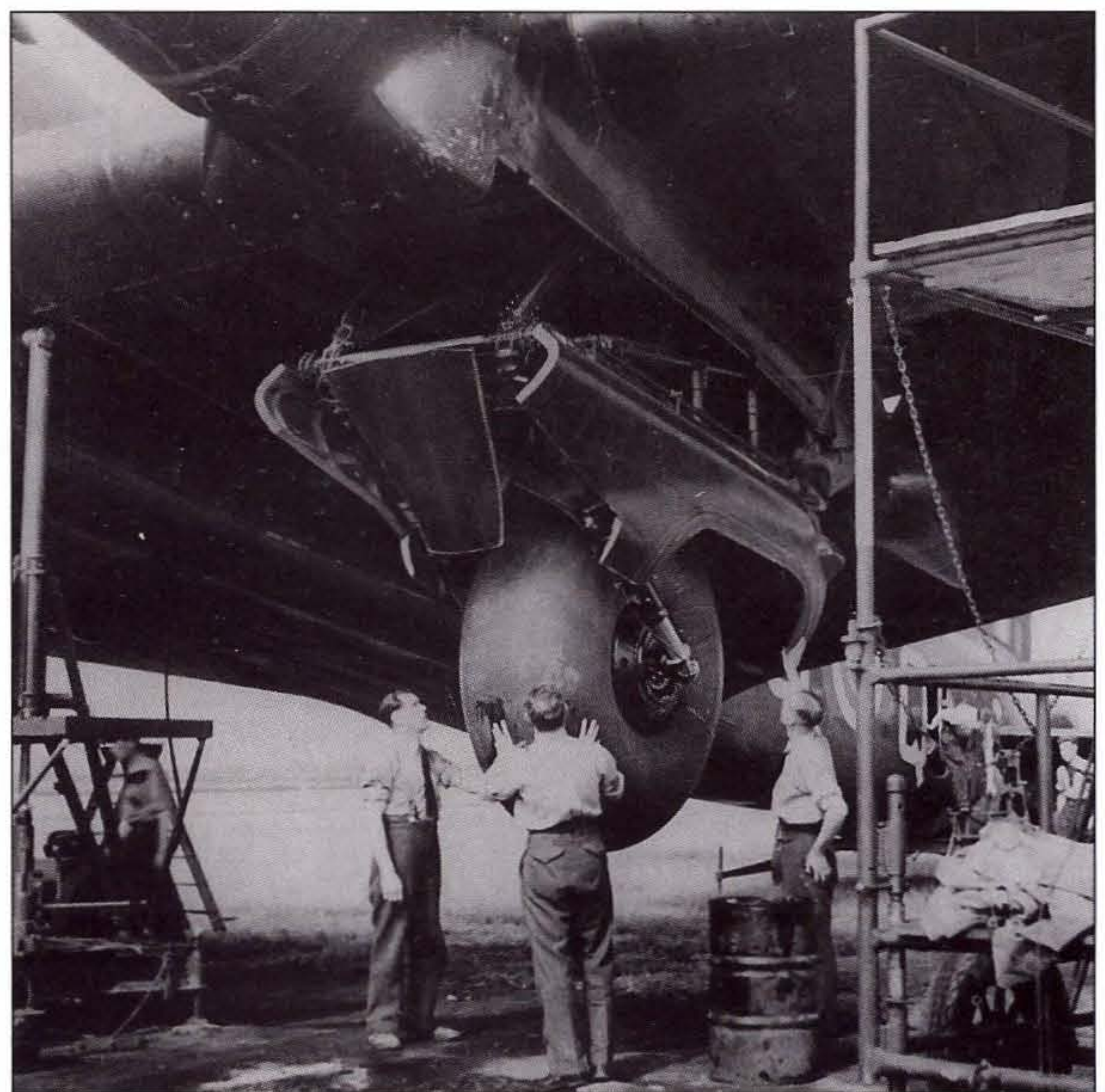
It was realised (by the technical staff at least) that the operation of an undercarriage, flaps, gill motors and other electrical equipment on 'circuits and bumps' would place a severe strain on the internal batteries. With this in mind, pilots were asked to limit the number of landings and then change the batteries.

A certain squadron leader ignored these requests and often had to manually lower the undercarriage. His comments were always the same — "Damn bad maintenance!"

The Stirling, having a single fin and rudder, was notorious for swinging on take-off. I saw many an undercart swiped off and often with a full bomb

load too! During the early days of our Stirlings, two aircraft landed within a few minutes of each other and on both occasions the port undercarriage collapsed and the dinghy became inflated and deployed. Great consternation! Everyone was looking for a scapegoat and eventually an expert from Short was called in. He diag-

nosed softness of the undercarriage up-lock hook, which became recessed through movement in flight and thus failed to release. The motor strived desperately to lower the gear but could not overcome the hook. The power was thus transmitted to the pylon struts which in turn were forced into the dinghy bay.



**ABOVE** The Stirling's Achilles' Heel, the electrically-operated undercarriage, needed regular checking by groundcrew.



If any inspection or rectification was required in the undercarriage bay, it was a simple thing to grab the struts and swing aloft like a monkey. Although this was a recognised procedure, it was quickly frowned upon when a flight sergeant was killed. Apparently a Stirling was on its dispersal point and seemed to have a damaged undercarriage. The poor chap did what anyone else would have done and lost his life. He swung himself into the undercarriage bay to have a closer look and was promptly trapped when the gear collapsed. A Coles crane was on its way to the bomb dump and was quickly commandeered. The only cable around was a towing bridle and unfortunately this snapped when used as lifting cable. You can imagine the orders that were issued after that episode.

Although some of my comments might suggest the Stirling's undercarriage was weak, I would like to quote an example of its strength.

One early morning we had a machine landing at Downham Market with the starboard outer engine on full throttle. The engine controls were of the Exactor type, and any malfunction would automatically give full throttle. For some unknown reason the pilot did not stop the engine and careered across the airfield into a very big ditch. The starboard wing was torn off complete with undercarriage and two engines. Miraculously, the crew were unhurt, but the pilot was killed on ops the next night while flying a borrowed aircraft.

Another event which is prominent in my mind occurred in early 1942, when I was in charge of "B" Flight, 218 Sqn, at Marham in Norfolk, before the hard runways had been laid. Early in the mornings it was not unusual for a mist to form which



**ABOVE** Either the most accurate belly-landing of all time, or more likely the result of an undercarriage collapse while running the engines at Digby in 1942.

**LEFT** A pair of "erks" stand beside the giant undercarriage. Swinging up monkey-style into the bays was forbidden on 218 Sqn after a gear collapse killed a flight sergeant.

would be a mere 6ft or so in depth, yet just sufficient to cause trouble for a tired pilot trying to land. Such was the luck of Sgt McCauley, who was a Canadian with a very bad stutter and who arrived over Marham on three engines. As he was patiently flying around awaiting his landing order, the one good engine on the starboard side began to lose power. McCauley called for priority landing and almost immediately struck a tree. The starboard tailplane and elevator became detached and stuck in the top of the tree. The Stirling meanwhile completed the circuit and made a wheels-up landing on the flarepath.

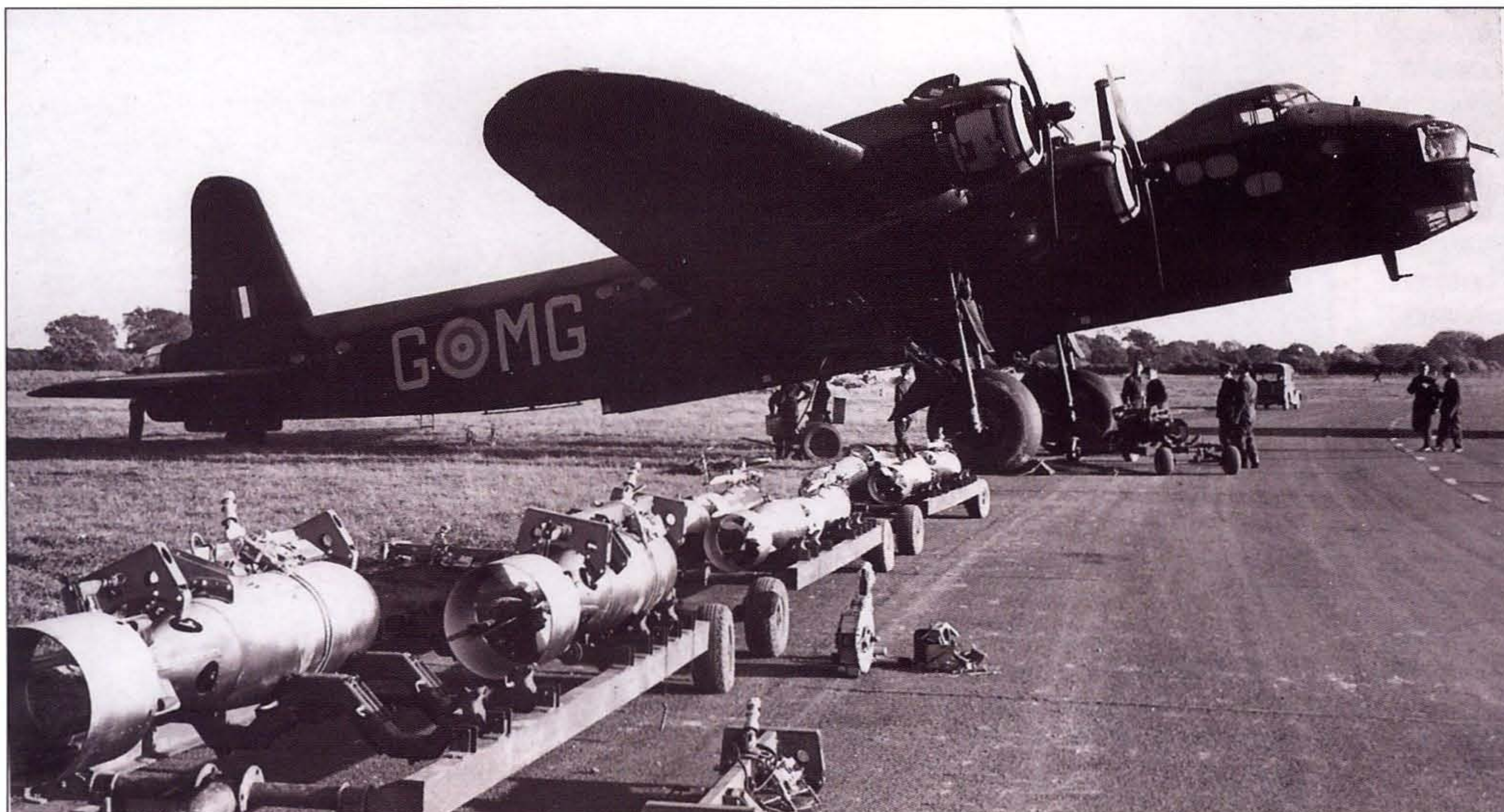
None of the crew was injured but the pilot, whose stutter was now even worse, remarked (when translated) that it was all right for the Group Captain who was safe in Control to advise him to keep calm!

The main systems on the Stirling were electrically operated and the long exposures to weather invariably produced electrical faults. The usual ones were the glowing of the warning lights which indicated that the current was running to earth. My cockney electrician would dash into my office and say "Sorry chief, I've got anuvver erf" and having sorted out several other "erfs" would exclaim; "It don't

give you no bleedin' 'eart, do it?"

At one time, however, we had a spate of starter-motor failures and I had one which occurred at a most awkward time. There were about 20 Stirlings all bombed up, refuelled and just waiting for the big op to start. Eventually the order was given to start up, and very soon all engines were running, except one — and that was one of my ten.

I dashed across to see what was wrong and the pilot shouted "Starter motor!" This was on the port outer engine, which was some 14ft above the ground. I had heard of the rope and starting bag, but had never seen one, and the idea seemed like a good one. There was a coil of rope in the back of our tender and I decided to have a go with a rope starter. We stopped the inner engine and put up the gantry to the outer engine and looped the rope as near as possible to the propeller blade tips. After instructing the pilot to press the starter button when I signalled I grabbed four lads and with one mighty heave and a signal to the pilot, the engine burst into life. I was very surprised indeed to see the engine running and the Wing Commander, who hated my guts, looked at me and gave what passed as a smile. Fortunately, the Stirlings were phased out and we carried on with Lancasters.



**LEFT** In spite of its problems, groundcrews were fond of the Stirling and found it had some advantages over the Wellington, the high props reducing injuries, and the "power egg" concept simplifying fitting and servicing.







# The ATA Angle

Former Air Transport Auxiliary pilot LETTICE CURTIS recalls ferrying the Stirling in wartime

IN DECEMBER 1941 a training unit was formed at Thruxton with the specific purpose of training Air Transport Auxiliary (ATA) pilots who would be required to ferry Stirlings to RAF squadrons the length and breadth of the country. This unit moved to Hullavington in May 1942, to Marham in August and to Stradishall in October. By 1943 the output of heavy bombers had risen to over 400 a month, and more ATA four-engine pilots were urgently needed to move them. In February 1943 an ATA Halifax training unit which had been opened at Pocklington broke down and in order to continue four-engined type training, ATA reverted temporarily to a previous arrangement: its pilots were to be given conversion courses with 1657 Conversion Unit (CU) at Stradishall. It was at this point that ATA's new chief flying instructor put in a bid for all his instructors to be trained to Class 5 (four-engined aircraft) standard — the dubious excuse being that when pilots came back to the ATA school for refresher courses which had now been introduced on single and twin-engined aircraft, instructors needed to be qualified to the same standard as their pupils. On the strength no doubt of the fact that I by now had been cleared for flying the Halifax, the AFTS CFI put forward the name



of Joan Hughes, who at the time was instructing on Oxfords, for the Stirling course. Thus it was that in March 1943 she was amongst those who were sent to Stradishall for four-engine conversion. As was usual on bomber stations, Joan had to stay with the WAAF Officers, some distance from the main Mess.

ATA pilots, like their RAF colleagues, were only allowed one detail a day, ATA tending to be given the 0730hr slot. RAF pilots who had come off Wellingtons were experiencing difficulty leading with the throttles, to keep the aircraft straight on the runway during take-off. Thus when on Joan's second take-off a tyre burst and the aircraft went off the

runway, it was exactly what the gathered observers had expected. A girl would never be able to control a large aircraft like the Stirling! But ATA pilots were accustomed to correcting for swing on aircraft with various types of engines and this was not a serious problem for them. As Joan progressed through the course the laughter faded and on the day she went solo, after some six hours' dual, the wing commander gave a party for her in the Ladies' Room of the Mess. By now Stirlings, which were only reaching at most 16,000ft with a bomb load, were suffering heavy losses and a number of the Stradishall instructors had been put on instruction as a rest from opera-

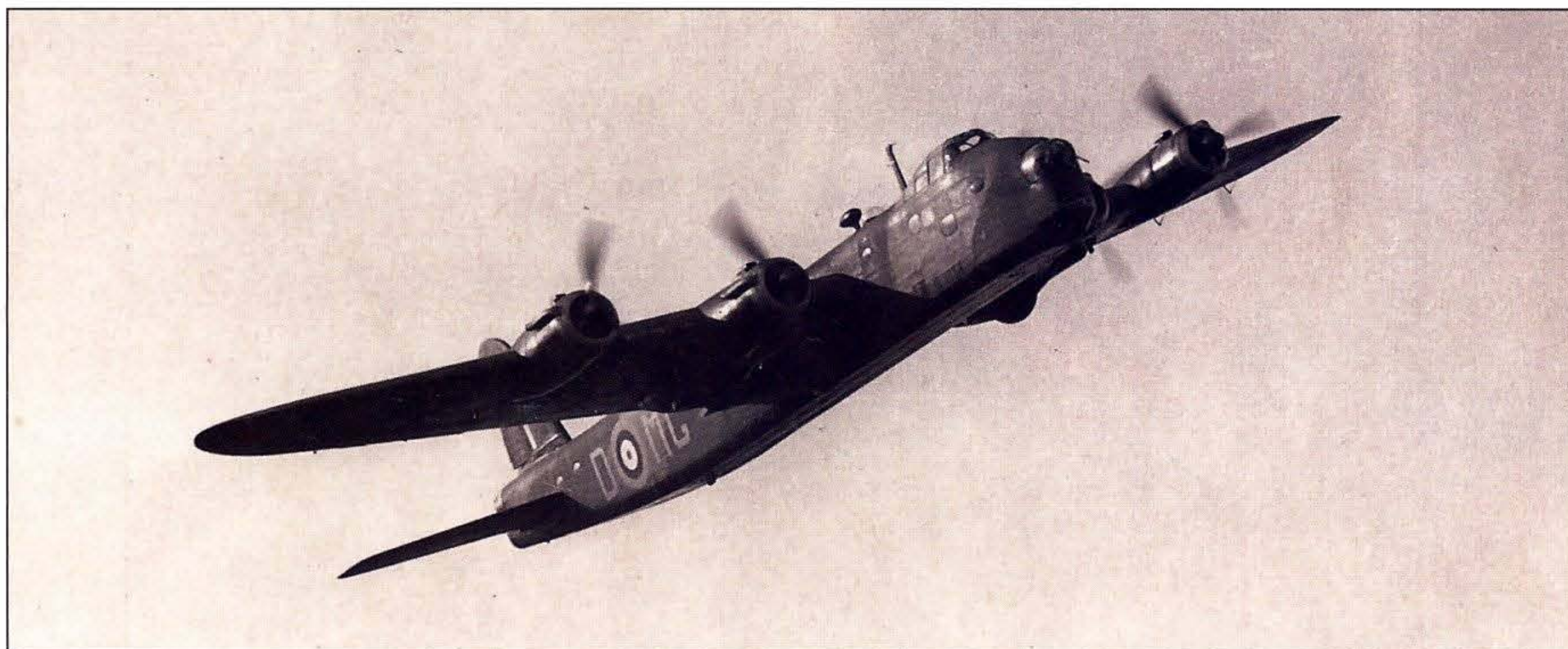
**ABOVE** Between 1940 and 1945 the Air Transport Auxiliary delivered 25,030 four-engined aircraft, including more than 3,500 Stirlings.

**LEFT** The author in the cockpit of one of the ATA's numerous Ansons in the early days of the war. The Anson was used extensively as a workhorse by the ATA.

tions. Many therefore were not experienced instructors. RAF pilots operating with heavy loads at night and in bad weather always made "wheel" landings, i.e. they touched down on the mainwheels with the tailwheel still off the ground. ATA pilots, however, who occasionally had to take aircraft into small grass fields, were encouraged by ATA to make three-point landings irrespective of aircraft type, as this shortened the landing run. Frustratingly, at Stradishall all pilots were required to land the RAF way. Harry Ellis, one of No 1 Ferry Pool's senior pilots, who was on the course and had considerable experience of flying large twins, was a man of strong convictions and when told to "wheel" his aircraft on, showed his disapproval. When asked by his instructor how he would do it Harry took over and demonstrated a perfect three-pointer. ATA training at Stradishall lasted for no more than a couple of months, by which time



**“My logbook lists 109 Stirling ferry trips. The Stirling was unique and had great character but it needed actually flying – exactly the reason why so many pilots enjoyed flying it”**



**LEFT** In 1944, one of the pioneers of the ATA, Commodore Gerard D'Erlanger, commented that every military aircraft in the sky “has been or will be flown by a pilot of the ATA”. N3641 MG-D was the second Stirling to be delivered to 7 Sqn at Oakington in 1940.

**BELOW** BK649 was the second production Mk III, and was used for various trials by the A&AEE at Boscombe Down. ATA pilots flew the type very lightly loaded, and found it agile and responsive.

No 1652 Heavy Conversion Unit (HCU) had been set up at Marston Moor. Here all subsequent ATA pilots and flight engineers in conjunction with 41 Group aircrew, were converted to four-engine flying on Halifaxes.

To go back to the Stirling, No 1 Ferry Pool at White Waltham was responsible for clearing aircraft from the Short factory at Rochester, and the majority of Stirlings from the South Marston factory at Swindon. It was here, through a complicated series of events which included an inspector going off to lunch in the middle of a pre-flight inspection, that test pilot Tom Brooke-Smith took off with crossed elevator controls. Halfway down the runway with the aircraft seemingly unwilling to unstick, a final heave on the control column brought the aircraft to rest on its nose with the fuselage at an angle of some 40° to the ground. I happened to be collecting a Spitfire from the airfield that day and was fascinated to see the aircraft at the end of the runway, in this unusual position. No 1 Pool also dealt with the majority of the output from 10 MU at



Hullavington and SEBRO at Bourn.

The Stirling's giant undercarriage, twin tailwheels, flaps and bomb doors, as well as smaller items like the cooling gills and windscreen wipers, were all electrically-operated, the twin-battery DC electrical system driving no fewer than 27 electric motors. Later variants, however, were fitted with four 40amp/hour batteries instead of just two. Another unique feature of early Stirlings was the use of hydraulic power-assisted Exactor controls to operate throttles,

propellers, fuel cocks and even the flying controls, the prevailing philosophy being that long mechanical linkages would be subject to too much friction. All these were eventually replaced by orthodox linkages but from time to time one came across aircraft with Exactor controls. The Exactor linkage consisted of an unpressurised column of fluid which sometimes suffered from cavitation, causing a delayed response. ATA pilots were therefore instructed to prime throttle, mixture and propeller controls before taking off and landing, by moving the levers two at a time through their full travel. Even so, boost and engine revolutions could wander in cruising flight and had to be corrected by moving their controls. By the time power settings had been adjusted, control levers on all four engines could be at different positions on the quadrant.

The giant Stirling undercarriage took a good minute to lower, after which the flight engineer had to trek down to the tail to check visually that the tailwheels were down. If the main undercarriage failed to lower, winding down by hand could take 8–9min per wheel. As the flight engineer was the only crew member in ATA, he had to carry out these tasks unaided.

Another notable feature of the Stirling was tailwheel shimmy, which sometimes developed during the latter stages of the landing run. This could build up until it felt as if the whole aircraft was about to disintegrate.

It was at Rochester that I lost one of my nine lives. It was a day of early morning mist, rising slowly into low stratus before dissolving to give a clear sunny day. At White Waltham we hung around calling for weather “actuals” and checking to see whether Shottesbrooke church spire, reckoned to show 2,000yd visibility, had come into view. My job for the day was a Stirling from Rochester to Hawarden and another one from Hawarden to Woburn. At around mid-day we eventually left for Rochester in a Fairchild Argus; visibility was rapidly improving but there was still a layer of cloud at around 800ft. Rochester airfield was in the heart of the London balloon barrage, extended at the time against V1 flying-bombs. It was approached through a balloon lane which was permanently open because the London balloons were fixtures. In theory pilots were required to go to Maps and Signals to check the position of balloons around any airfields they were visiting but in practice, because the position of the



**ABOVE** ATA staff pick up their jobs for the day at White Waltham in 1942. A common misconception is that most ATA pilots were women, but men outnumbered them ten to one.



London balloons rarely changed, I had not bothered. I approached the airfield from the north, crossing the Thames at Gravesend via a balloon lane I had used countless times before. Low cloud was still hiding the balloons.

At Rochester I lost no time signing up for the Stirling and obtaining clearance from Fighter Command to leave, and soon we were on our way, taking the route through the balloons I had used coming in. On the way north, low cloud and marginal weather caused us to land at Nuneaton before continuing to Hawarden where we collected our second Stirling; by the time we reached Woburn, it was a bright and sunny evening. The usual Fairchild was waiting to take us back to White Waltham where I was greeted by the operations officer with the news that the taxi pilot, returning from Rochester through what he thought was the lane I had used, had found himself face-to-face with a balloon cable complete with detonator.

Realising that something was seriously wrong, he circled the cable and landed undamaged in a field underneath. From there he rang the officer in charge of the balloon barrage. Would he, the pilot asked, please pull down some of his balloons so that the Fairchild could be flown out? The request brought forth a somewhat rude answer, the officer at first refusing to believe that an aircraft could have flown through his barrage. For the taxi pilot the truth came later when the clouds dissolved and the London balloons appeared in all their splendour, seemingly stretching to eternity in every direction. To me the sight of some 2,000 silver balloons, glinting on a clear day in the sunlight, remains one of the most memorable sights of the war. The Fairchild had to be taken to pieces and brought back to White Waltham by road.

I found out later that the site of the balloon lane had been changed the previous day, something I should have checked on before leaving White Waltham. The taxi pilot who thought he was following the route I had taken when coming in, was somewhat unfairly blamed for the incident. For me the thought that I had been through the cables not only in the Fairchild, but in the Stirling, was punishment enough. We had not seen a single cable and if we had, there was precious little I could have done about it. After all these years it is still a nightmare memory.

For an aircraft of its size the Stirling as ATA flew it was outstandingly manoeuvrable, answering to aileron like a Tiger Moth. It was not particularly easy to land, which made it all the more rewarding when a good three-point arrival was achieved. This

could sometimes take quite a bit of courage because of the large attitude change, but three-point landings were essential when aircraft had to be taken, as they often were, into grass fields where a minimum of ground run was available. Later in the war the Stirling played a major role with the airborne forces.

No 34 Satellite Landing Ground (SLG) in Woburn Park was a storage unit for No 8 MU at Little Rissington. Here aircraft were prepared for towing gliders for use in the invasion of France. Flights in and out of satellites were normally undertaken by MU pilots but in the run-up to D-Day, because of pressure of work, ATA's No 1 Ferry Pool at White Waltham was called on to help. The strip at Woburn to the west of the Abbey ran slightly uphill. There were at that time a number of trees alongside the strip under which aircraft were parked to make them less obvious from the air.

During 1944 at Woburn, Stirlings were fitted with yokes and release gear for towing gliders. Before D-Day some 200 Stirlings are said to have been stored there under trees, 25 on ½hr alert and another 50 on 1hr alert for delivery to operational squadrons. After D-Day many returned. Some were broken up on site, others were flown into No 12 SLG in the park of Beechwood House, an aircraft graveyard near Harpenden where the most notable feature was steeply rising ground which only became apparent on the last stage of the approach, calling for much last-minute pulling back of the control column.

In 1944, as the war reached its climax, vapour trails over southern England from the United States Eighth Air Force and their escorting fighters, gave way to waves of bombers from Yorkshire and Lincolnshire en route to their pre-invasion targets. Many of No 1 Ferry Pool's priority tasks now involved taking Stirlings to Keevil and Fairford where Horsa and Hamilcar gliders were already gathering. At Brize Norton, where we continued to take Spitfires, it was not unusual to find oneself landing over a glider parked on the lead-in to the runway. When flying over the Berkshire Downs it was essential before passing behind a transport aircraft to check that following it there was not a train of gliders.

ATA recorded 3,688 Stirling deliveries, most in support of D-Day. My logbook lists 109 Stirling ferry trips. The Stirling was unique and had great character but it needed actually flying — exactly the reason why so many pilots enjoyed flying it. **A**

■ See also *Anything to Anywhere*, Jan—April 1979 *Aeroplane*

## Joan Hughes

JOAN LILY AMELIA HUGHES was one of the "First Eight" women to be accepted into ATA service on January 1, 1940, and at 21 years old, the youngest. For the first 18 months the ATA women were tasked to fly Tiger Moths, Lysanders, Oxfords and Dominies, before Joan Hughes and three others were cleared in the summer of 1941 to fly Hurricanes and Spitfires, after much lobbying. Hughes was one of only 12 women who earned the Class 5 rating, which allowed her to fly four-engined "heavies", as well as 144 other types. After the war, Joan Hughes continued her passion for flight instructing, as well as flying demanding sequences in numerous films; *Those Magnificent Men In Their Flying Machines* (1965) and *The Blue Max* (1966) to name but two. She was awarded the MBE shortly after the war, and died aged 74 on August 16, 1993.

The Stirling occupied a special place in Hughes's heart, as may be seen in the correspondence which passed between herself and the late Alec Lumsden following his article on the type in the *Take A Card* series based on the ATA's Ferry Pilot's Notes, published in the March 1991 issue of *Aeroplane*:

"I will always have a soft spot for the Stirling, as I did my four-engine conversion on it at Stradishall in 1943. One or two things stand out in my memory:

1) It occasionally had tailwheel shimmy. It was like sitting in a huge jelly, and it fairly rattled your teeth.

2) If you did a very steep turn it pulled its nose down quite hard. The trimmer was in the roof, and if you were low in bad weather you had to re-trim, and as you rolled out, you had a lot of backward trim, and you had to get it off quick as you seemed about to stand on your tail.

3) It wasn't terribly nice in rain, as the windscreen was almost impossible to see through, and the bad weather panel was very small. You certainly needed a helmet on, as it gave you a great blast when you opened it.

"However, I was completely devoted to it, and have a lovely warm feeling whenever I see a picture of it. In some strange way I always felt like giving it a great hug. I can't think why but somehow it was a 'teddy bear' sort of aeroplane to ferry. We always flew it with very little weight (quite a different story to take on Ops I believe), but it was gorgeous in good weather with no weight. I always love thinking about that aeroplane."



**ABOVE** The diminutive Joan Hughes — she was 5ft 2in — accentuates even further the sheer size of the machine she thought of as "a teddy bear sort of aeroplane to ferry". Before joining the ATA, Hughes had been part of the Civil Air Guard, accumulating 600 flying hours on various types.