KAWASAKI KI 61 TONY

A flight view of a Kawasaki Ki 61-I Tony that was captured by the Allies and tested after being repainted with non-standard coloring. The restored Japanese insignia was used for publicity purposes. Note the extremely clean design and radiator installation similar to the North American P-51.

THIS Kawasaki fighter, like other Japanese aircraft of WW II, is a source of confusion to Westerners because it has several designations. In the official sequential Kitai Army aircraft numbering system adopted in 1932, it's "Ki 61." It's also "Army Type 3 fighter" in the system where the number is the last digit of the Japanese dynastic Year 2603, (equivalent to 1940), the year in which the aircraft was designed. Further, the Allies, not knowing the true Japanese designations, assigned code names to all known Japanese airplanes. Believing that the Ki 61 was derived from an Italian design, they code-named it "Tony."

While most Japanese fighters used air-cooled radial engines prior to the war, the Ki 61 used a Japanese version of the 1,050hp German Daimler-Benz DB-601A that the Kawasaki Aircraft Engineering Co. built under license as the Ha 40. Kawasaki then built the Ki 61 to utilize this engine. This aircraft was a major departure from traditional Japanese design, and was the first to incorporate features found essential in the first year of European WW II operations—armor, self-sealing fuel tanks and heavier firepower. The prototype Ki 61 first flew in December 1941.

SPECIFICATIONS AND PERFORMANCE KI 61-1b

Wingspan	*39 ft., 4 7/16 in.*
Length	*28 ft., 8 1/2 in.*
Wing Area	*215.2 sq. ft.*
Empty Weight	*4,872 lbs.*
Gross Weight	*6,504 lbs. (7,165 lbs. with overload)*
High Speed	*368mph at 15,945 ft.*
Service Ceiling	*37,730 ft.*
Max Range	*684 miles*

Its initial armament was a pair of 12.7mm machine guns on the nose, and two 7.9mm guns in each wing on Ki 61-1a or one 12.7mm gun in each wing on Ki 61-Ib. These more than doubled the firepower of Japanese fighters then in service. Later versions adopted two and even four 20mm wing cannon. A few even had 30mm cannon.

The Tonys went into action in New Guinea in April 1943 and quickly became the principal Japanese Army fighter. Larger and heavier than the Japanese Navy's Mitsubishi Zeke, the Tony wasn't a dogfighter like the Zeke, but was better suited to the hit-and-run techniques that the Allies had developed to combat the Zeke. In any case, the Tony was superior to the principal land-based fighters that initially opposed it: the Bell P-39 and the Curtiss P-40.

Improved versions of the Tony were developed but didn't achieve true mass production. A slightly enlarged Ki 61-II had a 1,500hp development of the Ha 40, designated "Ha 140," but this engine was plagued with problems to the point where 275 of the Ki 61-IIs were completed as "Ki 100," with 1,500hp Mitsubishi Ha 112 radial engines. Peak production of the Tony (254 a month) was achieved in July 1944.

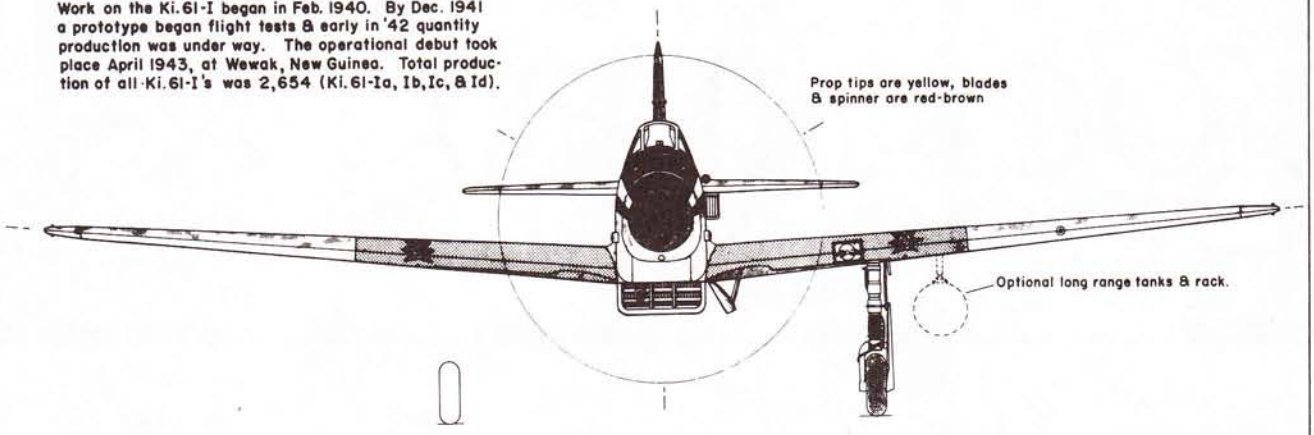
The final operations of the Tony were against Allied aircraft that were attacking the Japanese home islands. Only Ki 61-IIs with the altitude-rated Ha 140 engine could reach, and were effective against, the operating altitude of the B-29. Others did well against carrier-based fighters and were outclassed only by the U.S. Army P-51s operating from nearby Iwo Jima.

This ground view of a Ki 61-I shows the wide-track landing gear and basic natural-metal finish. Various camouflage patterns were often applied in the field.

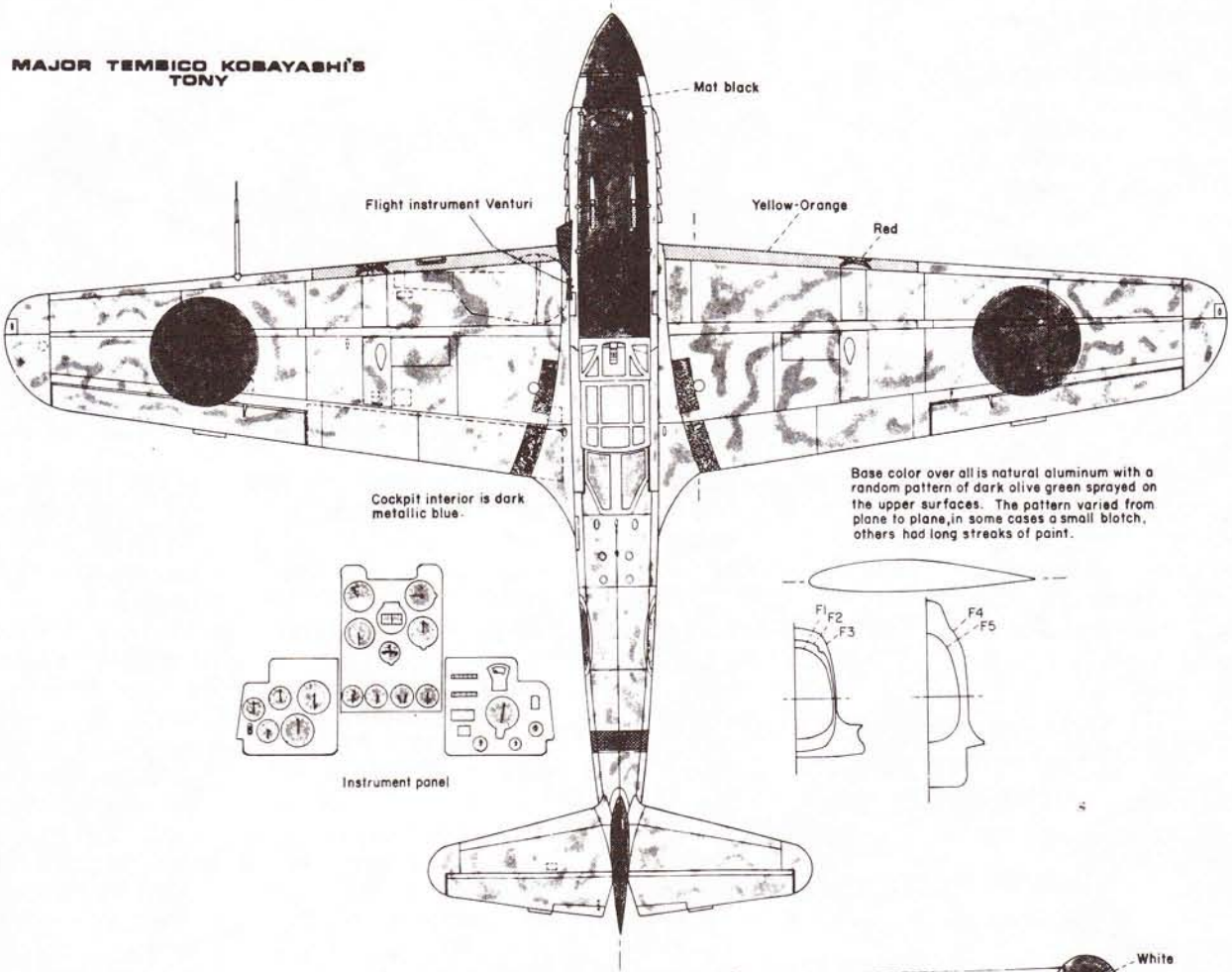
Production of the Tony ended in January 1945, owing to Allied bombing of the airframe and engine factories. Altogether, 3,078 Tonys were built: 2,654 Ki 61-Is (per the drawing), plus 12 prototype and pre-production Ki 61-Is and 412 Ki 61-IIs.

KAWASAKI KI 61 TONY

Work on the Ki.61-I began in Feb. 1940. By Dec. 1941 a prototype began flight tests & early in '42 quantity production was under way. The operational debut took place April 1943, at Wewak, New Guinea. Total production of all Ki.61-I's was 2,654 (Ki.61-Ia, Ib, Ic, & Id).

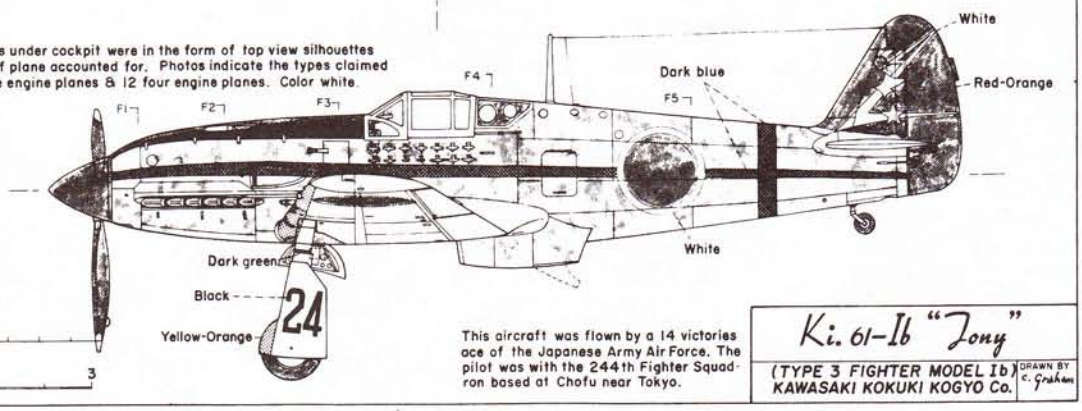


MAJOR TEMSICO KOBAYASHI'S TONY



Base color over all is natural aluminum with a random pattern of dark olive green sprayed on the upper surfaces. The pattern varied from plane to plane, in some cases a small blotch, others had long streaks of paint.

Victory marks under cockpit were in the form of top view silhouettes of the type of plane accounted for. Photos indicate the types claimed were 2 single engine planes & 12 four engine planes. Color white.



Scale

0 1 2 3 4 5 FEET

0 1 2 3 METERS

This aircraft was flown by a 14 victories ace of the Japanese Army Air Force. The pilot was with the 244th Fighter Squadron based at Chofu near Tokyo.

Ki. 61-Ib "Tony"

(TYPE 3 FIGHTER MODEL Ib)
KAWASAKI KOKUKI KOGYO Co.

DRAWN BY C. Graham

LOCKHEED HUDSON

THE Lockheed Hudson is an outstanding example of a successful transport plane—the 1937 14-passenger Lockheed Model 14—that became an even more successful bomber. The airliner was offered with a variety of radial engines in the 750-1,100hp range, and 112 were sold. Ironically, some planes, with a manufacturing license, were sold to Japan. During the war, the Allies code-named the Japanese versions "Thelma" and the imports "Toby."

In February 1938, aware of an upcoming visit by a British purchasing commission interested in obtaining American bombers, Lockheed rushed to produce a wooden mock-up of a Model 14 bomber fuselage. The British liked what they saw, but it didn't fully meet their needs. They wanted a reconnaissance bomber that would have a navigator as a key crew member. He needed to be close to the pilot and have an excellent field of view. Within 24 hours, Lockheed had modified the mock-up by increasing the number of windows in its nose.

Following two months of intensive discussion about aircraft details and equipment, the Air Ministry ordered 200 Lockheed B-14Ls under the British designation "Hudson I" (at a cost of $25,000,000), and as many more as could be delivered by December 1939.

A Lockheed Hudson I displays the early 1940 form of the British fin flash, which ran the full height of the fin.

SPECIFICATIONS AND PERFORMANCE LOCKHEED HUDSON

Wing Area	*551 sq. ft.*
Empty Weight	*11,630 lbs.*
Gross Weight	*17,500 lbs.*
Top Speed	*246mph at 6,500 ft.*
Cruising Speed	*170mph*
Ceiling	*25,000 ft.*
Range	*1,700 miles*

The Hudson's airframe was the same as the airliner's, and it marked the first military use of the new Fowler wing flap that had been introduced on the Model 14. It extended rearward and down, which increased wing area. An advanced feature, by U.S. military standards, was a British Boulton & Paul powered dorsal gun turret, which contained two British .303-caliber Vickers machine guns. Two fixed .303 guns were installed in the nose, and a bomb bay for up to 1,400 pounds of bombs or depth charges was located beneath the airliner floor. The powerplant for the Hudson I was the 1,100 takeoff hp Wright GR-1820-G302A Cyclone single-row engine.

The first flight of the Hudson was on December 10, 1938, and in February the first plane was shipped to England, where armament was installed. In the absence of a British turret in the U.S., the first Hudson was tested with a wooden mock-up of the turret.

The earliest Hudsons were shipped to England from California, or flown to New York and loaded aboard ships. Later Hudsons were sent to Canada for delivery to England by air, but because of U.S. neutrality at the time, they couldn't be flown across the Canadian border. They were flown by U.S. crews to airports right on the border, towed across the line, and flown on by Canadian crews.

Altogether, 2,940 Hudsons were built under six basic designations for British Commonwealth forces, two U.S. Army designations and one U.S. Navy designation, as follows:

BRITISH HUDSONS

Hudson I—The original 200 on the British direct-purchase order, plus an additional 150, all with Cyclone engines. Australia complicated the picture by ordering 50 Lockheed B-14Ss as "Hudson I" but specified the 1,100hp Pratt & Whitney R-1830-SC3G Twin Wasp, a twin-row engine. In recognition of the identity problem, a further 50 Australian Hudsons were ordered as "Hudson II," and the Australian Hudson Is were redesignated "Hudson IV."

Hudson II— Distinguishing

A Hudson V without a turret on a factory test flight in June 1941. Compare the cowling for the Pratt & Whitney engines with those of Wright-powered models in the drawing and other photos. Also note the rearward as well as the downward extension of the Fowler flaps.

external details of these twin-row engine Hudsons were deeper cowlings fitted with cooling flaps. The Australian Mark IIs differed from the Mark Is in that they had constant-speed propellers and a strengthened airframe.

Hudson III—The 428 Hudson IIIs had the airframe and propellers of the Mark II, upgraded 1,200 takeoff hp GR-1820-G205A engines, and three additional .303-caliber machine guns (one on each side of the rear fuselage and another in a ventral station).

Hudson IIIA—The 616 Mark IIIs obtained under the Lend-Lease program were sent to England.

Hudson IVA— 52 Mark IVs supplied to Australia under Lend-Lease with the U.S. Army designation "A-28." The engines were now R-1830-45.

Hudson V—The 408 Hudson Vs with Twin-Wasp engines were the last Hudsons procured on British direct-purchase contracts. They had the same equipment as the Mark IIIs.

Hudson VI—Improved Mark Vs with 1,200 takeoff hp R-1830-67 engines built by Chevrolet; 450 were procured through the U.S. Army as "A-28A."

This U.S. Navy PBO-1, formerly a Hudson IIIA, carries early 1942 Navy markings, is fitted with the British Boulton & Paul gun turret and retains its original British "Sand and Spinach" camouflage.

designated "Hudson IIIA" to reflect their closer conformity to U.S. Army specifications and equipment. Because they were procured with U.S. funds through U.S. Army channels, they were given U.S. Army designations (in this case, "A-29"). The civil Cyclone engines were redesignated as Army R-1820-87s.

Hudson IV—Redesignation of the original Australian Mark Is and Mark IIs as "Hudson IV." An additional 30 were

U.S. HUDSONS

Even before Lend-Lease and the assignment of U.S. designations to the Hudsons, the Army "drafted" some undelivered Hudsons from British contracts to meet its own increasing need for new aircraft. Most of these were used in unarmed transport and training roles. Because they didn't meet U.S. Army specifications at the time, they operated as "Lockheed Model 414" under their original British serial numbers, and they often used British insignia. Under Lend-Lease, new Army specifications were written to fit the existing airplanes so that they could be given the standard Army designations A-28 and A-29.

A-28—Lend-Lease designation for the Hudson IVA. Many were retained by the U.S. Army for use as bomber-trainers.

A-28A—Improved Mark Vs delivered as "Hudson VI."

A-29—Eight hundred Mark IIIAs built under Lend-Lease. Late in 1941, some were taken from the British order, armed and used to patrol the U.S. coastline. With no British turrets available, the armed A-29s were fitted with a single, hand-swung, .50-caliber machine gun in an open cockpit that replaced the turret.

A U.S. Army AT-18 gunnery trainer with a molded Plexiglas Martin gun turret. The rubber de-icer boots on the wings and tail are prominent on this unpainted airplane.

A-29A—The 184 A-29As were A-29s with cabins modified for alternative use as unarmed troop transports.

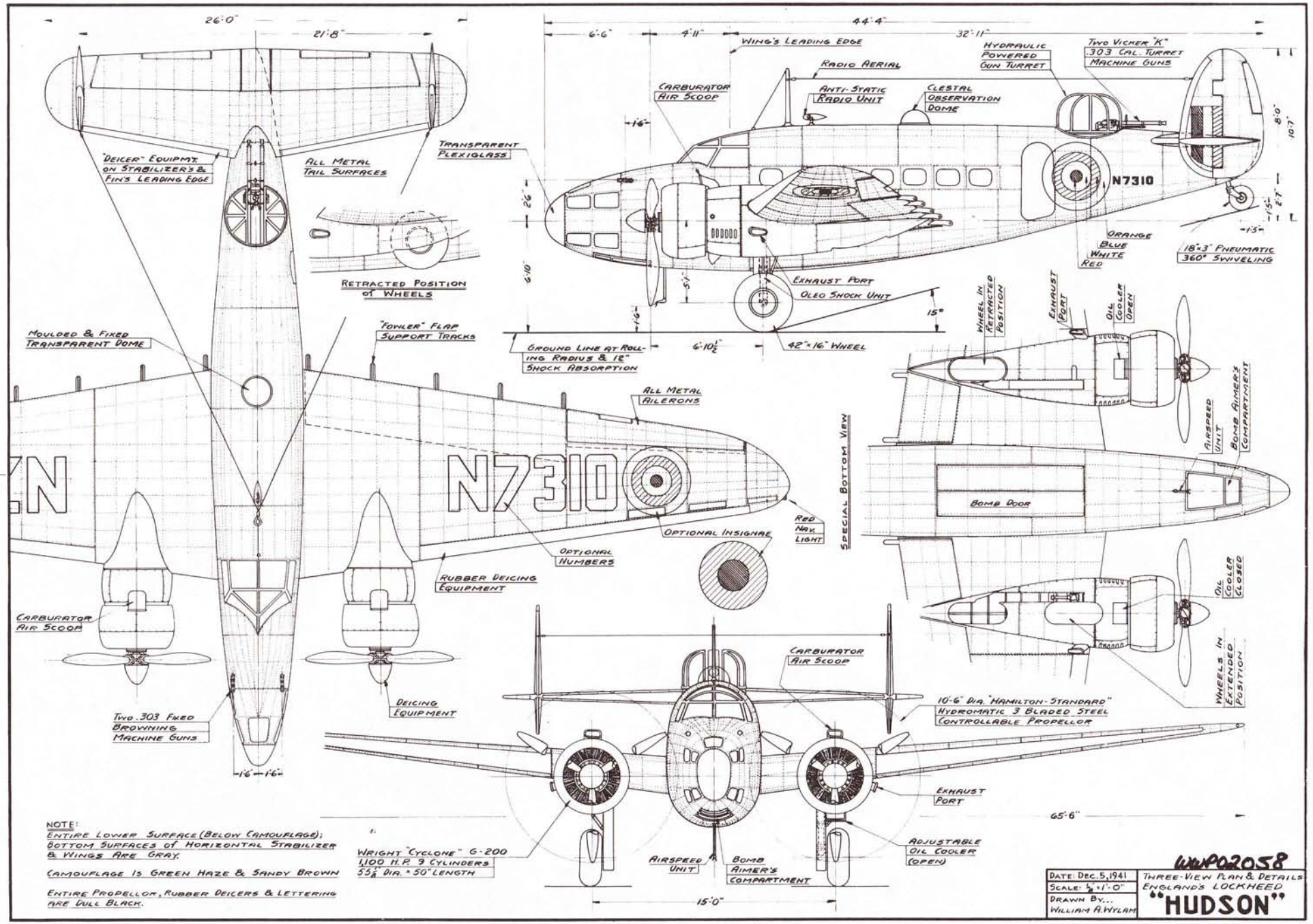
A-29B—Twenty-four A-29s that were modified for use as photo-survey planes.

AT-18—The only Hudsons built from scratch for the U.S. Army were the AT-18 Advanced Trainers. The 217 AT-18s were gunnery trainers fitted with American Martin turrets that used .50-caliber Browning machine guns. The engines were R-1820-87s.

AT-18A—The 83 unarmed AT-18As were navigation trainers (with the cabins arranged for trainee navigators and their instructors).

PBO-1—The U.S. Navy acquired 20 Hudson IIIAs with British turrets late in 1941 and designated them "PBO-1" ("PB" for "Patrol Bomber" and "O" for "Lockheed"). Engines were Navy (even dash number) R-1820-40s. Equipped with four 325-pound depth bombs, one PBO-1 sank a German U-boat on March 1, 1942, and another sank one on March 15. These were the first U.S. aircraft sinkings of U-boats.

Over the entire Hudson series, gross weight varied from 17,500 pounds (I) to 22,360 pounds (AT-18A); top speeds varied from 246 (I) to 261 (AT-18A).



NOTE:
ENTIRE LOWER SURFACE (BELOW CAMOUFLAGE); BOTTOM SURFACES OF HORIZONTAL STABILIZER & WINGS ARE GRAY.

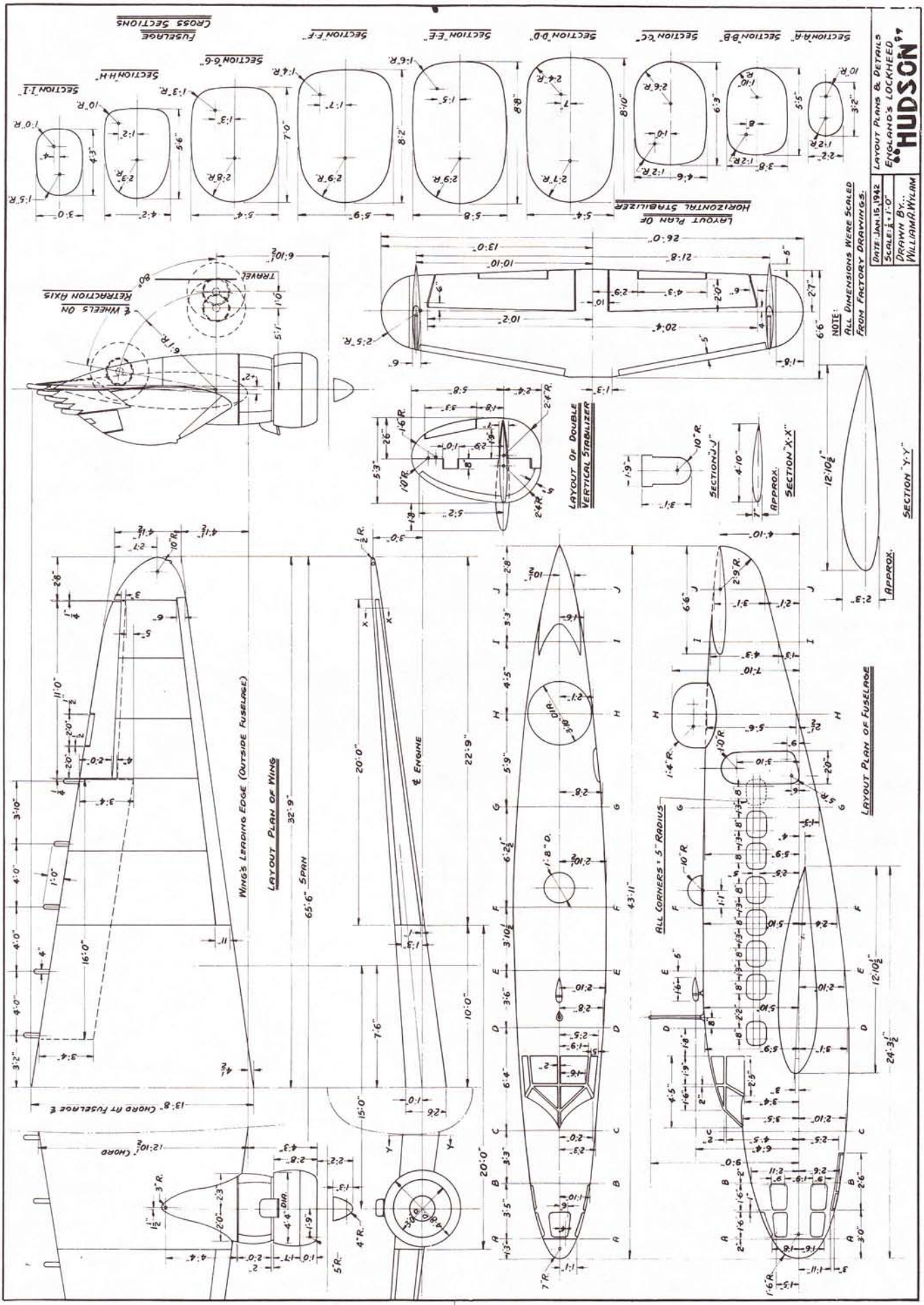
CAMOUFLAGE IS GREEN HAZE & SANDY BROWN

ENTIRE PROPELLOR, RUBBER DEICERS & LETTERING ARE DULL BLACK.

WWP02058

DATE: Dec. 5, 1941	THREE-VIEW PLAN & DETAILS ENGLAND'S LOCKHEED "HUDSON"
SCALE: ¼" = 1'-0"	
DRAWN BY... WILLIAM A. WYLAM	

LOCKHEED HUDSON

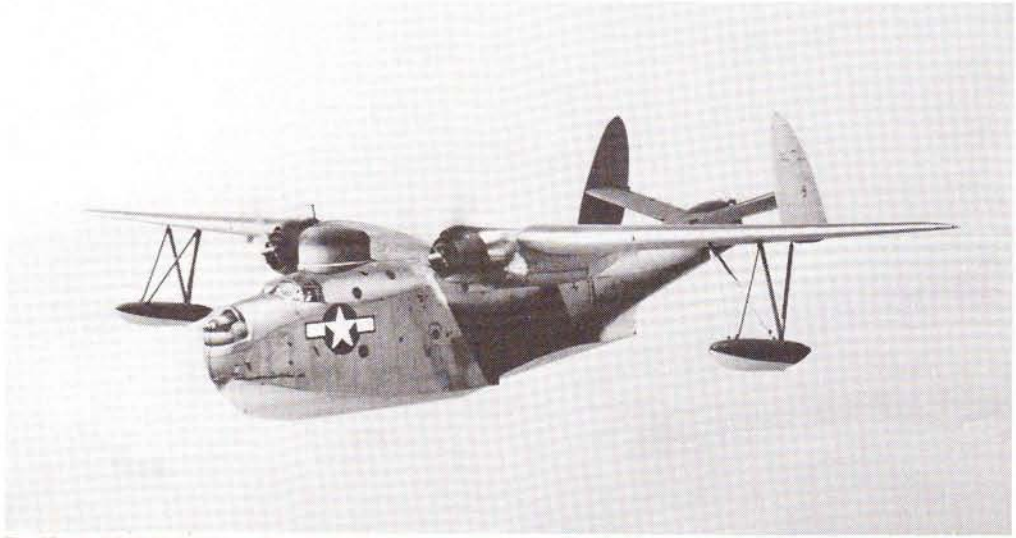


MARTIN PBM MARINER

FOUNDED in 1918, the Glenn L. Martin Company was one of the oldest American aircraft manufacturers. Martin was a major builder of flying boats, beginning in 1930 with the Navy-designed PM-1 and P3M-1 models built in its new plant in Baltimore, MD. The most famous Martin flying boat of original design was the four-engine "China Clipper" (Model 130), that opened trans-Pacific mail and passenger routes in 1935.

In June 1937, Martin was awarded a U.S. Navy contract for a single twin-engine flying boat: the Martin Model 162, designated "XPBM-1." It was intended as a follow-up and possible replacement for the Consolidated PBY model that was then in production. While the XPBM-1 had double the gross weight, and a wing that was only 14 feet longer than the PBY's, it had more powerful 1,600hp Wright R-2600-6 engines. In a very unusual move, Martin built a manned, quarter-scale flying model (Model 162A) for aerodynamic testing of the unique gull-wing design. The first flight of the XPBM-1 was on February 18, 1939.

The notable features of the XPBM-1 were its gulled wing; a powered nose turret with a single gun; a two-gun, powered dorsal turret just aft of the wing; a single gun in the tail cone; and single guns in hemispherical, hand-swung blister turrets on each side of the hull aft of the wing. Twin fins and rudders were at the ends of a straight, horizontal stabilizer, and the wing-tip floats retracted inward to lay flush against the underside of the wing. Up to 2,000 pounds of bombs or depth charges could be carried.



The Martin PBM-3D Mariner with late 1943 color and markings. Note the two-gun nose and tail turrets, the large radome on top of the hull and flush panels enclosing the side guns.

In a rare move of its own, the Navy ordered 20 production PBM-1s in December 1937, 14 months before the prototype flew. They were outwardly identical to the XPBM-1 except for the dihedral in the horizontal tail. An odd feature here was that the fins and rudders, instead of being vertical, were mounted perpendicular to the stabilizer. Wind-tunnel tests had revealed that there was less aerodynamic drag from a right-angle intersection between the fins and rudders and the stabilizer than when the fins were vertical to produce one acute and one obtuse angle of intersection.

The single XPBM-2, ordered at the same time, was similar to the PBM-1, except that it had increased fuel capacity and was stressed for catapult landing. Production PBM-1s began to reach the fleet in September 1940 and were given the name "Mariner" in October 1941.

PBM-3—True mass production of the Mariner began with the PBM-3, 379 of which were ordered in November 1940. They had 1,700hp R-2600-12 engines in lengthened nacelles that contained completely enclosed bomb bays. Armament was two .50-caliber guns in the nose turret and one each in the dorsal, tail and side positions. The side blister turrets of the PBM-1 were eliminated and the side guns then fired through flat panels that opened when required. The most notable outward change was the replacement of the retractable wing floats with the fixed type on five long struts.

PBM-3 Variants

PBM-3B—Six PBM-3B were supplied to the R.A.F. as "Mariner I," but they didn't measure up to British requirements and were returned to the U.S. Navy.

PBM-3C—The 274 PBM-3Cs had increased protective armor and could carry up to 4,000 pounds of bombs. Some were fitted with a large radome for search radar on top of the hull between the cockpit and the wing.

PBM-3D—Greater changes came with the 201 PBM-3Ds. They had 1,900hp R-2600-22 engines driving four-blade

This PBM-3 with prewar silver coloring was photographed in late 1942 or early 1943. Note the unpowered tail machine-gun turret and flush panels for side gun stations. The red bands on the wings and hull (later changed to green) identify an instrument trainer.

propellers; twin guns in the nose; dorsal and tail turrets; and single side guns. Bomb capacity was now 8,000 pounds, and some Ds had the large radome that was introduced on the PBM-3C.

PBM-3R—The 20 PBM-3Rs were unarmed transports with seating for 20 passengers and a reinforced cabin floor for heavy cargo.

PBM-3S—The 156 PBM-3Ss were specialized antisubmarine versions that carried four 325-pound depth bombs, extra fuel, and only four guns.

PBM-4—There were to have been 180 PBM-4s (essentially PBM-3s upgraded to use new, four-row 23,000hp Wright R-3350-8 engines). They weren't produced because the PBM-5 was built instead.

PBM-5—The 631 PBM-5s were outwardly similar to the PBM-3D, but they used 2,100hp Pratt & Whitney R-2800-22 or -34 engines. Six were converted to PBM-5A amphibians, and one was completed as the single-tail XP5M-1, of which 239 P5M-1 and -2 models were built after the war.

PBM-5 Variants

PBM-5E—PBM-5s fitted with search radar were technically designated "PBM-5E," but because the use of special-mission suffix letters was just beginning, the designation was seldom used in airplane paperwork or by the crews.

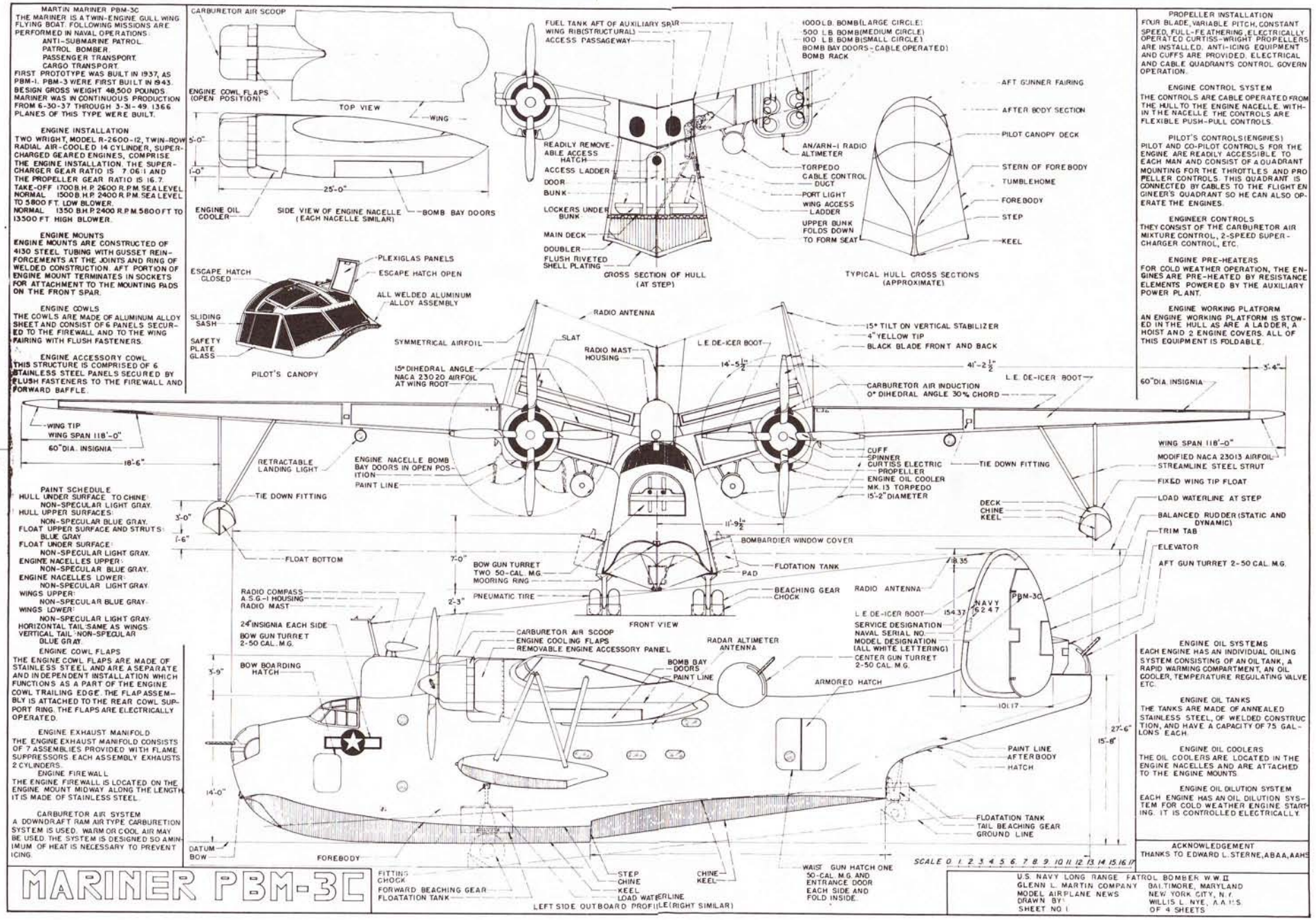
PBM-5G—During the war, several PBM-5s were transferred to the U.S. Coast Guard without a change of designation. After the war, these and other Navy transfers acquired the suffix letter "G" (as "PBM-5G"), which identified modifications made for specialized Coast Guard missions, most notably air-sea rescue.

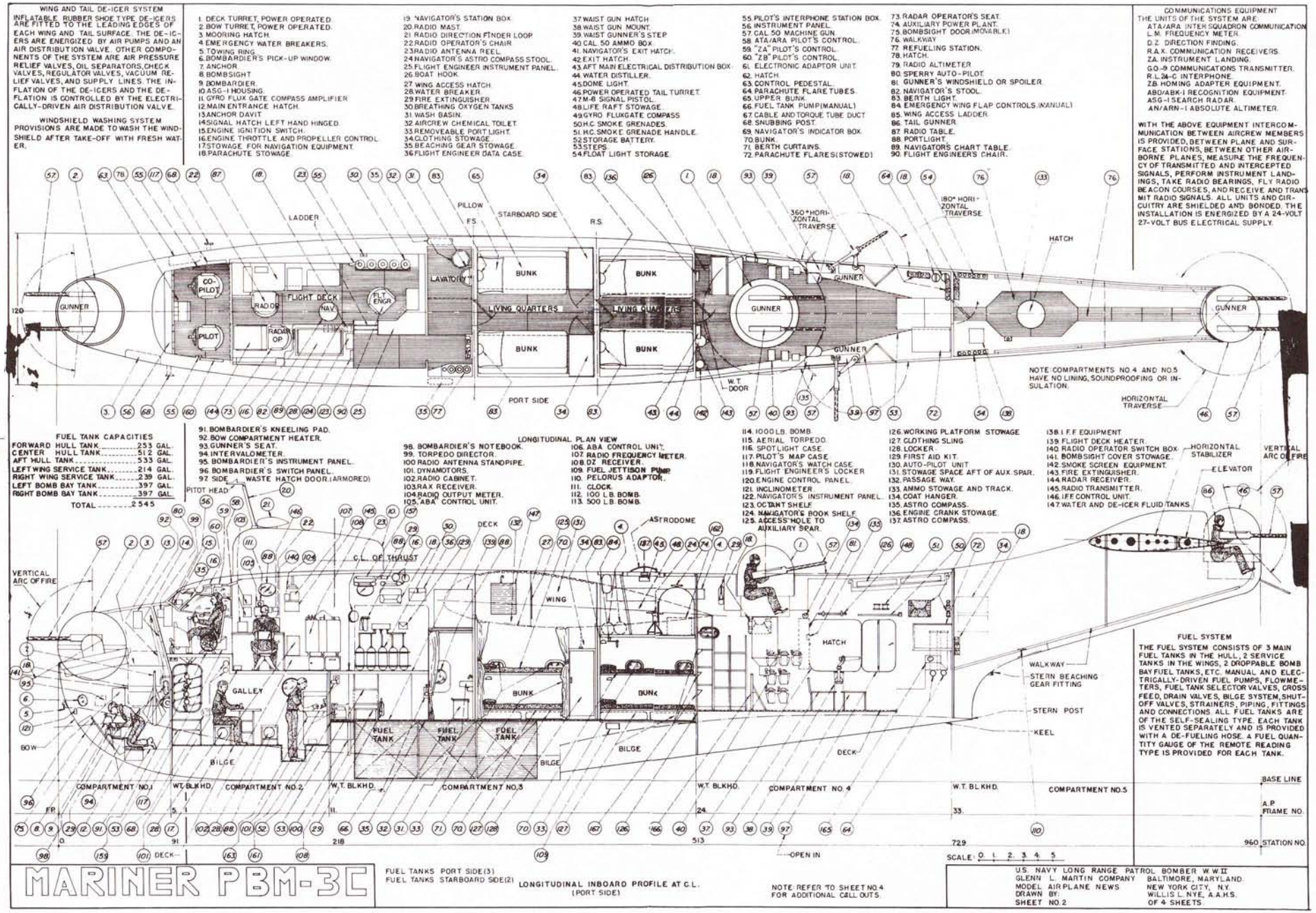
PBM-5A—The final production model of the Mariner was the PBM-5A amphibian, with 36 built to complete the production of 1,366 Mariners by March 1949. The last Mariners were withdrawn from squadron use in July 1956.

It's odd that the amphibious version of the Mariner appeared so late in its career. If the feature had been added earlier, it might have added greatly to the airplane's utility (as it had done with the PBY) and given the Mariner a greater role in WW II naval aviation.

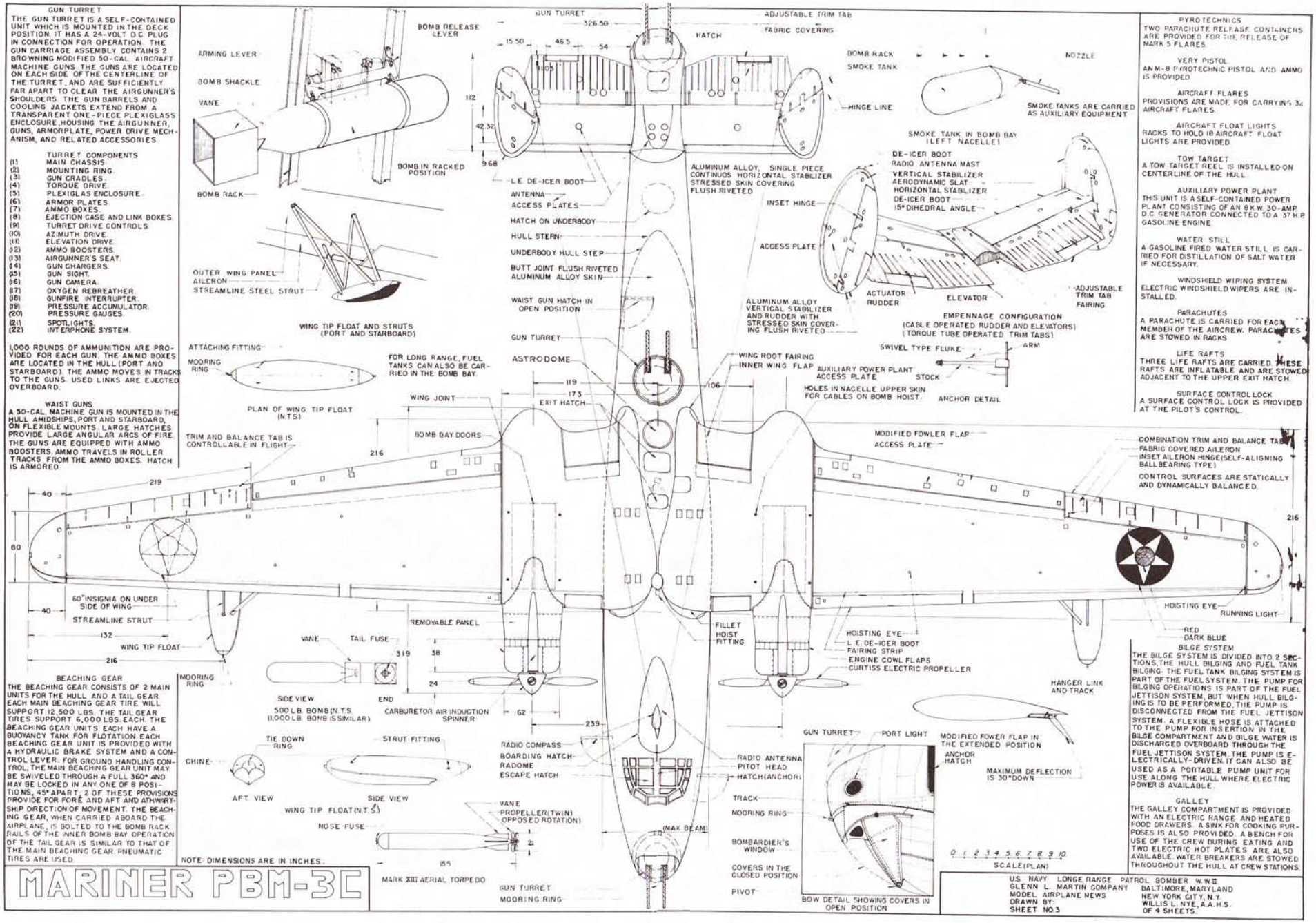
The first and the last: the XPBM-1 in its original form with a straight, horizontal tail and side gun blisters, and the PBM-5A amphibian that ended the Mariner line in 1949. The red bars were added to the insignia in January 1947.

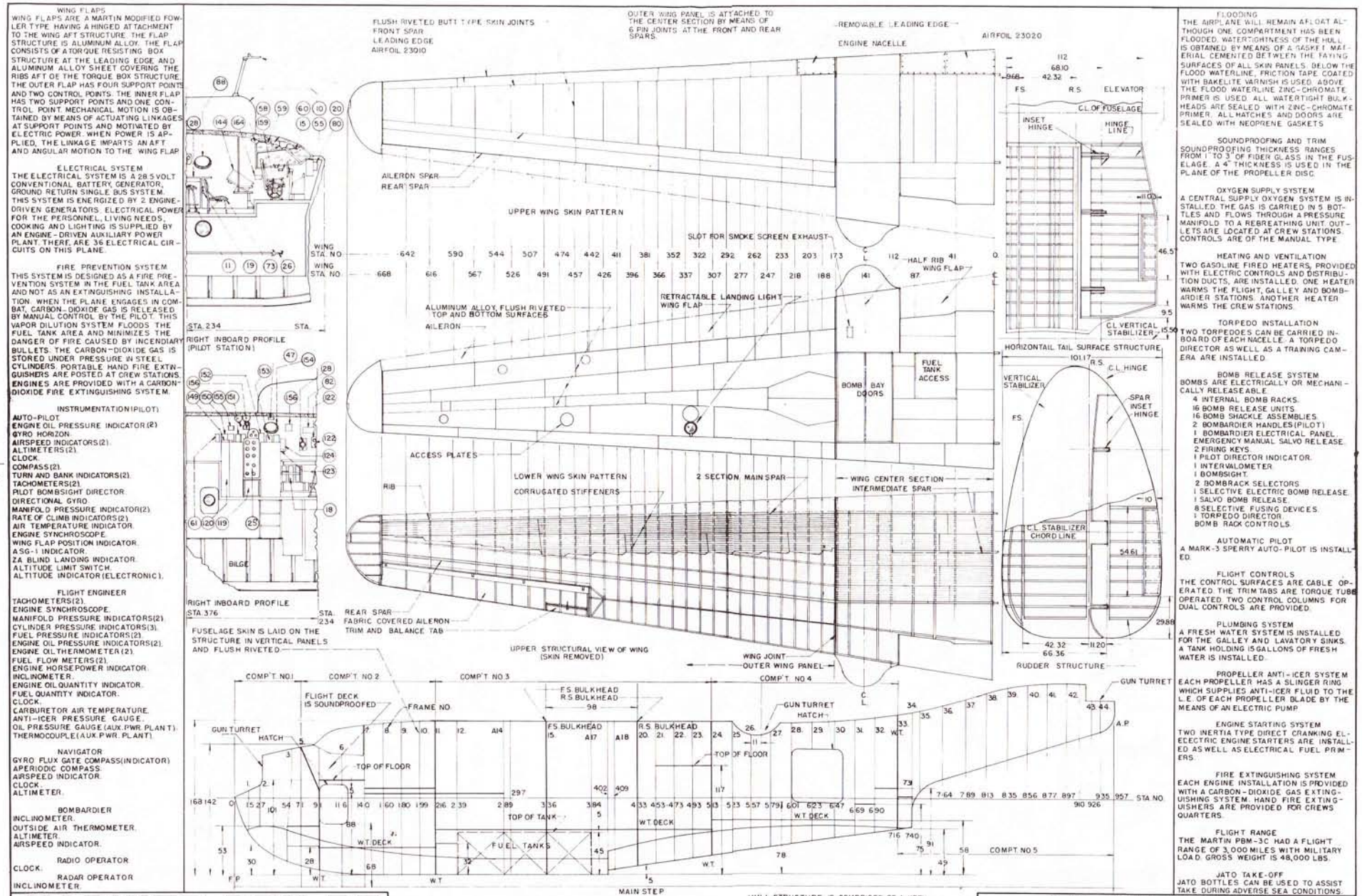
One of six PBM-3Bs sent to England as "Mariner I," painted in the British Coastal Command's white and gray color scheme. The Mariners didn't meet British requirements and were returned to the U.S. Navy.


MARTIN MARINER PBM-3C
THE MARINER IS A TWIN-ENGINE GULL WING FLYING BOAT. FOLLOWING MISSIONS ARE PERFORMED IN NAVAL OPERATIONS:
ANTI-SUBMARINE PATROL.
PATROL BOMBER.
PASSENGER TRANSPORT.
CARGO TRANSPORT.
FIRST PROTOTYPE WAS BUILT IN 1937, AS PBM-1. PBM-3 WERE FIRST BUILT IN 1943. DESIGN GROSS WEIGHT 48,500 POUNDS. MARINER WAS IN CONTINUOUS PRODUCTION FROM 6-30-37 THROUGH 3-31-49. 1366 PLANES OF THIS TYPE WERE BUILT.
ENGINE INSTALLATION
TWO WRIGHT, MODEL R-2600-12, TWIN-ROW RADIAL AIR-COOLED 14 CYLINDER, SUPER-CHARGED GEARED ENGINES, COMPRISE THE ENGINE INSTALLATION. THE SUPER-CHARGER GEAR RATIO IS 7.06:1 AND THE PROPELLER GEAR RATIO IS 16.7.
TAKE-OFF 1700 B.H.P. 2600 R.P.M. SEA LEVEL.
NORMAL 1500 B.H.P. 2400 R.P.M. SEA LEVEL TO 5800 FT. LOW BLOWER.
NORMAL 1350 B.H.P. 2400 R.P.M. 5800 FT TO 13500 FT. HIGH BLOWER.
ENGINE MOUNTS
ENGINE MOUNTS ARE CONSTRUCTED OF 4130 STEEL TUBING WITH GUSSET REINFORCEMENTS AT THE JOINTS AND RING OF WELDED CONSTRUCTION. AFT PORTION OF ENGINE MOUNT TERMINATES IN SOCKETS FOR ATTACHMENT TO THE MOUNTING PADS ON THE FRONT SPAR.
ENGINE COWLS
THE COWLS ARE MADE OF ALUMINUM ALLOY SHEET AND CONSIST OF 6 PANELS SECURED TO THE FIREWALL AND TO THE WING FAIRING WITH FLUSH FASTENERS.
ENGINE ACCESSORY COWL
THIS STRUCTURE IS COMPRISED OF 6 STAINLESS STEEL PANELS SECURED BY FLUSH FASTENERS TO THE FIREWALL AND FORWARD BAFFLE.
PAINT SCHEDULE
HULL UNDER SURFACE TO CHINE:
NON-SPECULAR LIGHT GRAY.
HULL UPPER SURFACES:
NON-SPECULAR BLUE GRAY.
FLOAT UPPER SURFACE AND STRUTS:
BLUE GRAY.
FLOAT UNDER SURFACE:
NON-SPECULAR LIGHT GRAY.
ENGINE NACELLES UPPER:
NON-SPECULAR BLUE GRAY.
ENGINE NACELLES LOWER:
NON-SPECULAR LIGHT GRAY.
WINGS UPPER:
NON-SPECULAR BLUE GRAY.
WINGS LOWER:
NON-SPECULAR LIGHT GRAY.
HORIZONTAL TAIL: SAME AS WINGS.
VERTICAL TAIL: NON-SPECULAR BLUE GRAY.
ENGINE COWL FLAPS
THE ENGINE COWL FLAPS ARE MADE OF STAINLESS STEEL AND ARE A SEPARATE AND INDEPENDENT INSTALLATION WHICH FUNCTIONS AS A PART OF THE ENGINE COWL TRAILING EDGE. THE FLAP ASSEMBLY IS ATTACHED TO THE REAR COWL SUPPORT RING. THE FLAPS ARE ELECTRICALLY OPERATED.
ENGINE EXHAUST MANIFOLD
THE ENGINE EXHAUST MANIFOLD CONSISTS OF 7 ASSEMBLIES PROVIDED WITH FLAME SUPPRESSORS. EACH ASSEMBLY EXHAUSTS 2 CYLINDERS.
ENGINE FIREWALL
THE ENGINE FIREWALL IS LOCATED ON THE ENGINE MOUNT MIDWAY ALONG THE LENGTH. IT IS MADE OF STAINLESS STEEL.
CARBURETOR AIR SYSTEM
A DOWNDRAFT RAM AIR TYPE CARBURETION SYSTEM IS USED. WARM OR COOL AIR MAY BE USED. THE SYSTEM IS DESIGNED SO A MINIMUM OF HEAT IS NECESSARY TO PREVENT ICING.
CARBURETOR AIR SCOOP
ENGINE COWL FLAPS (OPEN POSITION)
TOP VIEW
WING
5'-0"
1'-0"
25'-0"
ENGINE OIL COOLER
SIDE VIEW OF ENGINE NACELLE (EACH NACELLE SIMILAR)
BOMB BAY DOORS
ESCAPE HATCH CLOSED
PLEXIGLAS PANELS
ESCAPE HATCH OPEN
ALL WELDED ALUMINUM ALLOY ASSEMBLY
SLIDING SASH
SAFETY PLATE GLASS
PILOT'S CANOPY
FUEL TANK AFT OF AUXILIARY SPAR
WING RIB (STRUCTURAL)
ACCESS PASSAGEWAY
READILY REMOVEABLE ACCESS HATCH
ACCESS LADDER
DOOR
BUNK
LOCKERS UNDER BUNK
MAIN DECK
DOUBLER
FLUSH RIVETED SHELL PLATING
CROSS SECTION OF HULL (AT STEP)
1000 LB. BOMB (LARGE CIRCLE)
500 LB. BOMB (MEDIUM CIRCLE)
100 LB. BOMB (SMALL CIRCLE)
BOMB BAY DOORS - CABLE OPERATED)
BOMB RACK
AN/ARN-1 RADIO ALTIMETER
TORPEDO CABLE CONTROL DUCT
PORT LIGHT
WING ACCESS LADDER
UPPER BUNK FOLDS DOWN TO FORM SEAT
AFT GUNNER FAIRING
AFTER BODY SECTION
PILOT CANOPY DECK
STERN OF FOREBODY
TUMBLEHOME
FOREBODY
STEP
KEEL
TYPICAL HULL CROSS SECTIONS (APPROXIMATE)
PROPELLER INSTALLATION
FOUR BLADE, VARIABLE PITCH, CONSTANT SPEED, FULL-FEATHERING, ELECTRICALLY OPERATED CURTISS-WRIGHT PROPELLERS ARE INSTALLED. ANTI-ICING EQUIPMENT AND CUFFS ARE PROVIDED. ELECTRICAL AND CABLE QUADRANTS CONTROL GOVERN OPERATION.
ENGINE CONTROL SYSTEM
THE CONTROLS ARE CABLE OPERATED FROM THE HULL TO THE ENGINE NACELLE. WITHIN THE NACELLE THE CONTROLS ARE FLEXIBLE PUSH-PULL CONTROLS.
PILOT'S CONTROLS (ENGINES)
PILOT AND CO-PILOT CONTROLS FOR THE ENGINE ARE READILY ACCESSIBLE TO EACH MAN AND CONSIST OF A QUADRANT MOUNTING FOR THE THROTTLES AND PROPELLER CONTROLS. THIS QUADRANT IS CONNECTED BY CABLES TO THE FLIGHT ENGINEER'S QUADRANT SO HE CAN ALSO OPERATE THE ENGINES.
ENGINEER CONTROLS
THEY CONSIST OF THE CARBURETOR AIR MIXTURE CONTROL, 2-SPEED SUPERCHARGER CONTROL, ETC.
ENGINE PRE-HEATERS
FOR COLD WEATHER OPERATION, THE ENGINES ARE PRE-HEATED BY RESISTANCE ELEMENTS POWERED BY THE AUXILIARY POWER PLANT.
ENGINE WORKING PLATFORM
AN ENGINE WORKING PLATFORM IS STOWED IN THE HULL AS ARE A LADDER, A HOIST AND 2 ENGINE COVERS. ALL OF THIS EQUIPMENT IS FOLDABLE.
WING TIP
WING SPAN 118'-0"
60" DIA. INSIGNIA
18'-6"
RETRACTABLE LANDING LIGHT
ENGINE NACELLE BOMB BAY DOORS IN OPEN POSITION
PAINT LINE
TIE DOWN FITTING
3'-0"
1'-6"
FLOAT BOTTOM
RADIO ANTENNA
SLAT
SYMMETRICAL AIRFOIL
RADIO MAST HOUSING
L.E. DE-ICER BOOT
15° DIHEDRAL ANGLE
NACA 23020 AIRFOIL AT WING ROOT
14'-5½"
41'-2½"
15° TILT ON VERTICAL STABILIZER
4" YELLOW TIP
BLACK BLADE FRONT AND BACK
CARBURETOR AIR INDUCTION
0° DIHEDRAL ANGLE 30% CHORD
3'-4"
60" DIA. INSIGNIA
CUFF
SPINNER
CURTISS ELECTRIC PROPELLER
ENGINE OIL COOLER
MK. 13 TORPEDO
15'-2" DIAMETER
TIE DOWN FITTING
DECK
CHINE
KEEL
11'-9½"
BOMBARDIER WINDOW COVER
7'-0"
BOW GUN TURRET
TWO 50-CAL. M.G.
MOORING RING
FLOTATION TANK
PAD
PNEUMATIC TIRE
BEACHING GEAR CHOCK
2'-3"
FRONT VIEW
RADIO COMPASS
A.S.G.-1 HOUSING
RADIO MAST
24" INSIGNIA EACH SIDE
BOW GUN TURRET
2-50 CAL. M.G.
CARBURETOR AIR SCOOP
ENGINE COOLING FLAPS
REMOVABLE ENGINE ACCESSORY PANEL
RADAR ALTIMETER ANTENNA
BOMB BAY DOORS
PAINT LINE
BOW BOARDING HATCH
3'-9"
ARMORED HATCH
RADIO ANTENNA
L.E. DE-ICER BOOT
SERVICE DESIGNATION
NAVAL SERIAL NO.
MODEL DESIGNATION (ALL WHITE LETTERING)
CENTER GUN TURRET
2-50 CAL. M.G.
18.35
154.37
NAVY 5247
PBM-3C
101.17
27'-6"
15'-8"
14'-0"
DATUM
BOW
FOREBODY
FITTING
CHOCK
FORWARD BEACHING GEAR
FLOATATION TANK
STEP
CHINE
KEEL
LOAD WATERLINE
CHINE
KEEL
LEFT SIDE OUTBOARD PROFILE (RIGHT SIMILAR)
WAIST GUN HATCH ONE 50-CAL. M.G. AND ENTRANCE DOOR EACH SIDE AND FOLD INSIDE.
PAINT LINE AFTERBODY
HATCH
FLOATATION TANK
TAIL BEACHING GEAR
GROUND LINE
SCALE 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
WING SPAN 118'-0"
MODIFIED NACA 23013 AIRFOIL
STREAMLINE STEEL STRUT
FIXED WING TIP FLOAT
LOAD WATERLINE AT STEP
BALANCED RUDDER (STATIC AND DYNAMIC)
TRIM TAB
ELEVATOR
AFT GUN TURRET 2-50 CAL. M.G.
ENGINE OIL SYSTEMS
EACH ENGINE HAS AN INDIVIDUAL OILING SYSTEM CONSISTING OF AN OIL TANK, A RAPID WARMING COMPARTMENT, AN OIL COOLER, TEMPERATURE REGULATING VALVE ETC.
ENGINE OIL TANKS
THE TANKS ARE MADE OF ANNEALED STAINLESS STEEL, OF WELDED CONSTRUCTION, AND HAVE A CAPACITY OF 75 GALLONS EACH.
ENGINE OIL COOLERS
THE OIL COOLERS ARE LOCATED IN THE ENGINE NACELLES AND ARE ATTACHED TO THE ENGINE MOUNTS.
ENGINE OIL DILUTION SYSTEM
EACH ENGINE HAS AN OIL DILUTION SYSTEM FOR COLD WEATHER ENGINE STARTING. IT IS CONTROLLED ELECTRICALLY.
ACKNOWLEDGEMENT
THANKS TO EDWARD L. STERNE, ABAA, AAHS
MARINER PBM-3C
U.S. NAVY LONG RANGE PATROL BOMBER W.W.II
GLENN L. MARTIN COMPANY BALTIMORE, MARYLAND
MODEL AIRPLANE NEWS NEW YORK CITY, N.Y.
DRAWN BY: WILLIS L. NYE, A.A.H.S.
SHEET NO 1 OF 4 SHEETS



MARTIN PBM MARINER


GUN TURRET
THE GUN TURRET IS A SELF-CONTAINED UNIT WHICH IS MOUNTED IN THE DECK POSITION. IT HAS A 24-VOLT D.C. PLUG IN CONNECTION FOR OPERATION. THE GUN CARRIAGE ASSEMBLY CONTAINS 2 BROWNING MODIFIED 50-CAL. AIRCRAFT MACHINE GUNS. THE GUNS ARE LOCATED ON EACH SIDE OF THE CENTERLINE OF THE TURRET, AND ARE SUFFICIENTLY FAR APART TO CLEAR THE AIRGUNNER'S SHOULDERS. THE GUN BARRELS AND COOLING JACKETS EXTEND FROM A TRANSPARENT ONE-PIECE PLEXIGLASS ENCLOSURE HOUSING THE AIRGUNNER, GUNS, ARMORPLATE, POWER DRIVE MECHANISM, AND RELATED ACCESSORIES.
TURRET COMPONENTS
(1) MAIN CHASSIS.
(2) MOUNTING RING.
(3) GUN CRADLES.
(4) TORQUE DRIVE.
(5) PLEXIGLAS ENCLOSURE.
(6) ARMOR PLATES.
(7) AMMO BOXES.
(8) EJECTION CASE AND LINK BOXES.
(9) TURRET DRIVE CONTROLS.
(10) AZIMUTH DRIVE.
(11) ELEVATION DRIVE.
(12) AMMO BOOSTERS.
(13) AIRGUNNER'S SEAT.
(14) GUN CHARGERS.
(15) GUN SIGHT.
(16) GUN CAMERA.
(17) OXYGEN REBREATHER.
(18) GUNFIRE INTERRUPTER.
(19) PRESSURE ACCUMULATOR.
(20) PRESSURE GAUGES.
(21) SPOTLIGHTS.
(22) INTERPHONE SYSTEM.
1,000 ROUNDS OF AMMUNITION ARE PROVIDED FOR EACH GUN. THE AMMO BOXES ARE LOCATED IN THE HULL (PORT AND STARBOARD). THE AMMO MOVES IN TRACKS TO THE GUNS. USED LINKS ARE EJECTED OVERBOARD.
WAIST GUNS
A 50-CAL. MACHINE GUN IS MOUNTED IN THE HULL AMIDSHIPS, PORT AND STARBOARD, ON FLEXIBLE MOUNTS. LARGE HATCHES PROVIDE LARGE ANGULAR ARCS OF FIRE. THE GUNS ARE EQUIPPED WITH AMMO BOOSTERS. AMMO TRAVELS IN ROLLER TRACKS FROM THE AMMO BOXES. HATCH IS ARMORED.
BEACHING GEAR
THE BEACHING GEAR CONSISTS OF 2 MAIN UNITS FOR THE HULL AND A TAIL GEAR. EACH MAIN BEACHING GEAR TIRE WILL SUPPORT 12,500 LBS. THE TAIL GEAR TIRES SUPPORT 6,000 LBS. EACH. THE BEACHING GEAR UNITS EACH HAVE A BUOYANCY TANK FOR FLOTATION. EACH BEACHING GEAR UNIT IS PROVIDED WITH A HYDRAULIC BRAKE SYSTEM AND A CONTROL LEVER. FOR GROUND HANDLING CONTROL, THE MAIN BEACHING GEAR UNIT MAY BE SWIVELED THROUGH A FULL 360° AND MAY BE LOCKED IN ANY ONE OF 8 POSITIONS, 45° APART; 2 OF THESE PROVISIONS PROVIDE FOR FORE AND AFT AND ATHWARTSHIP DIRECTION OF MOVEMENT. THE BEACHING GEAR, WHEN CARRIED ABOARD THE AIRPLANE, IS BOLTED TO THE BOMB RACK RAILS OF THE INNER BOMB BAY. OPERATION OF THE TAIL GEAR IS SIMILAR TO THAT OF THE MAIN BEACHING GEAR. PNEUMATIC TIRES ARE USED.
NOTE: DIMENSIONS ARE IN INCHES.
MARINER PBM-3C
PYROTECHNICS
TWO PARACHUTE RELEASE CONTAINERS ARE PROVIDED FOR THE RELEASE OF MARK 5 FLARES.
VERY PISTOL
AN M-8 PYROTECHNIC PISTOL AND AMMO IS PROVIDED.
AIRCRAFT FLARES
PROVISIONS ARE MADE FOR CARRYING 36 AIRCRAFT FLARES.
AIRCRAFT FLOAT LIGHTS
RACKS TO HOLD 18 AIRCRAFT FLOAT LIGHTS ARE PROVIDED.
TOW TARGET
A TOW TARGET REEL IS INSTALLED ON CENTERLINE OF THE HULL.
AUXILIARY POWER PLANT
THIS UNIT IS A SELF-CONTAINED POWER PLANT CONSISTING OF AN 8 KW, 30-AMP D.C. GENERATOR CONNECTED TO A 37 H.P. GASOLINE ENGINE.
WATER STILL
A GASOLINE FIRED WATER STILL IS CARRIED FOR DISTILLATION OF SALT WATER IF NECESSARY.
WINDSHIELD WIPING SYSTEM
ELECTRIC WINDSHIELD WIPERS ARE INSTALLED.
PARACHUTES
A PARACHUTE IS CARRIED FOR EACH MEMBER OF THE AIRCREW. PARACHUTES ARE STOWED IN RACKS.
LIFE RAFTS
THREE LIFE RAFTS ARE CARRIED. THESE RAFTS ARE INFLATABLE AND ARE STOWED ADJACENT TO THE UPPER EXIT HATCH.
SURFACE CONTROL LOCK
A SURFACE CONTROL LOCK IS PROVIDED AT THE PILOT'S CONTROL.
COMBINATION TRIM AND BALANCE TAB
FABRIC COVERED AILERON
INSET AILERON HINGE (SELF-ALIGNING BALL BEARING TYPE)
CONTROL SURFACES ARE STATICALLY AND DYNAMICALLY BALANCED.
BILGE SYSTEM
THE BILGE SYSTEM IS DIVIDED INTO 2 SECTIONS, THE HULL BILGING AND FUEL TANK BILGING. THE FUEL TANK BILGING SYSTEM IS PART OF THE FUEL SYSTEM. THE PUMP FOR BILGING OPERATIONS IS PART OF THE FUEL JETTISON SYSTEM, BUT WHEN HULL BILGING IS TO BE PERFORMED, THE PUMP IS DISCONNECTED FROM THE FUEL JETTISON SYSTEM. A FLEXIBLE HOSE IS ATTACHED TO THE PUMP FOR INSERTION IN THE BILGE COMPARTMENT AND BILGE WATER IS DISCHARGED OVERBOARD THROUGH THE FUEL JETTISON SYSTEM. THE PUMP IS ELECTRICALLY-DRIVEN. IT CAN ALSO BE USED AS A PORTABLE PUMP UNIT FOR USE ALONG THE HULL WHERE ELECTRIC POWER IS AVAILABLE.
GALLEY
THE GALLEY COMPARTMENT IS PROVIDED WITH AN ELECTRIC RANGE AND HEATED FOOD DRAWERS. A SINK FOR COOKING PURPOSES IS ALSO PROVIDED. A BENCH FOR USE OF THE CREW DURING EATING AND TWO ELECTRIC HOT PLATES ARE ALSO AVAILABLE. WATER BREAKERS ARE STOWED THROUGHOUT THE HULL AT CREW STATIONS.
U.S. NAVY LONGE RANGE PATROL BOMBER W.W.II
GLENN L. MARTIN COMPANY BALTIMORE, MARYLAND
MODEL AIRPLANE NEWS NEW YORK CITY, N.Y.
DRAWN BY: WILLIS L. NYE, A.A.H.S.
SHEET NO.3 OF 4 SHEETS.
SCALE (PLAN)
0 1 2 3 4 5 6 7 8 9 10



WING FLAPS

WING FLAPS ARE A MARTIN MODIFIED FOWLER TYPE HAVING A HINGED ATTACHMENT TO THE WING AFT STRUCTURE. THE FLAP STRUCTURE IS ALUMINUM ALLOY. THE FLAP CONSISTS OF A TORQUE RESISTING BOX STRUCTURE AT THE LEADING EDGE AND ALUMINUM ALLOY SHEET COVERING THE RIBS AFT OF THE TORQUE BOX STRUCTURE. THE OUTER FLAP HAS FOUR SUPPORT POINTS AND TWO CONTROL POINTS. THE INNER FLAP HAS TWO SUPPORT POINTS AND ONE CONTROL POINT. MECHANICAL MOTION IS OBTAINED BY MEANS OF ACTUATING LINKAGES AT SUPPORT POINTS AND MOTIVATED BY ELECTRIC POWER. WHEN POWER IS APPLIED, THE LINKAGE IMPARTS AN AFT AND ANGULAR MOTION TO THE WING FLAP.

ELECTRICAL SYSTEM

THE ELECTRICAL SYSTEM IS A 28.5 VOLT CONVENTIONAL BATTERY, GENERATOR, GROUND RETURN SINGLE BUS SYSTEM. THIS SYSTEM IS ENERGIZED BY 2 ENGINE-DRIVEN GENERATORS. ELECTRICAL POWER FOR THE PERSONNEL, LIVING NEEDS, COOKING AND LIGHTING IS SUPPLIED BY AN ENGINE-DRIVEN AUXILIARY POWER PLANT. THERE ARE 36 ELECTRICAL CIRCUITS ON THIS PLANE.

FIRE PREVENTION SYSTEM

THIS SYSTEM IS DESIGNED AS A FIRE PREVENTION SYSTEM IN THE FUEL TANK AREA AND NOT AS AN EXTINGUISHING INSTALLATION. WHEN THE PLANE ENGAGES IN COMBAT, CARBON-DIOXIDE GAS IS RELEASED BY MANUAL CONTROL BY THE PILOT. THIS VAPOR DILUTION SYSTEM FLOODS THE FUEL TANK AREA AND MINIMIZES THE DANGER OF FIRE CAUSED BY INCENDIARY BULLETS. THE CARBON-DIOXIDE GAS IS STORED UNDER PRESSURE IN STEEL CYLINDERS. PORTABLE HAND FIRE EXTINGUISHERS ARE POSTED AT CREW STATIONS. ENGINES ARE PROVIDED WITH A CARBON-DIOXIDE FIRE EXTINGUISHING SYSTEM.

INSTRUMENTATION (PILOT)

AUTO-PILOT.
ENGINE OIL PRESSURE INDICATOR (2)
GYRO HORIZON.
AIRSPEED INDICATORS (2).
ALTIMETERS (2).
CLOCK.
COMPASS (2).
TURN AND BANK INDICATORS (2).
TACHOMETERS (2).
PILOT BOMBSIGHT DIRECTOR.
DIRECTIONAL GYRO.
MANIFOLD PRESSURE INDICATOR (2).
RATE OF CLIMB INDICATORS (2).
AIR TEMPERATURE INDICATOR.
ENGINE SYNCHROSCOPE.
WING FLAP POSITION INDICATOR.
ASG-1 INDICATOR.
ZA BLIND LANDING INDICATOR.
ALTITUDE LIMIT SWITCH.
ALTITUDE INDICATOR (ELECTRONIC).

FLIGHT ENGINEER

TACHOMETERS (2).
ENGINE SYNCHROSCOPE.
MANIFOLD PRESSURE INDICATORS (2).
CYLINDER PRESSURE INDICATORS (3).
FUEL PRESSURE INDICATORS (2).
ENGINE OIL PRESSURE INDICATORS (2).
ENGINE OIL THERMOMETER (2).
FUEL FLOW METERS (2).
ENGINE HORSEPOWER INDICATOR.
INCLINOMETER.
ENGINE OIL QUANTITY INDICATOR.
FUEL QUANTITY INDICATOR.
CLOCK.
CARBURETOR AIR TEMPERATURE.
ANTI-ICER PRESSURE GAUGE.
OIL PRESSURE GAUGE (AUX. PWR. PLANT).
THERMOCOUPLE (AUX. PWR. PLANT).

NAVIGATOR

GYRO FLUX GATE COMPASS (INDICATOR)
APERIODIC COMPASS.
AIRSPEED INDICATOR.
CLOCK.
ALTIMETER.

BOMBARDIER

INCLINOMETER.
OUTSIDE AIR THERMOMETER.
ALTIMETER.
AIRSPEED INDICATOR.

RADIO OPERATOR

CLOCK.

RADIO OPERATOR

INCLINOMETER.

FLOODING

THE AIRPLANE WILL REMAIN AFLOAT ALTHOUGH ONE COMPARTMENT HAS BEEN FLOODED. WATERTIGHTNESS OF THE HULL IS OBTAINED BY MEANS OF A GASKET MATERIAL CEMENTED BETWEEN THE FAYING SURFACES OF ALL SKIN PANELS. BELOW THE FLOOD WATERLINE, FRICTION TAPE COATED WITH BAKELITE VARNISH IS USED. ABOVE THE FLOOD WATERLINE ZINC-CHROMATE PRIMER IS USED. ALL WATERTIGHT BULKHEADS ARE SEALED WITH ZINC-CHROMATE PRIMER. ALL HATCHES AND DOORS ARE SEALED WITH NEOPRENE GASKETS.

SOUNDPROOFING AND TRIM

SOUNDPROOFING THICKNESS RANGES FROM 1" TO 3" OF FIBER GLASS IN THE FUSELAGE. A 4" THICKNESS IS USED IN THE PLANE OF THE PROPELLER DISC.

OXYGEN SUPPLY SYSTEM

A CENTRAL SUPPLY OXYGEN SYSTEM IS INSTALLED. THE GAS IS CARRIED IN 5 BOTTLES AND FLOWS THROUGH A PRESSURE MANIFOLD TO A REBREATHING UNIT. OUTLETS ARE LOCATED AT CREW STATIONS. CONTROLS ARE OF THE MANUAL TYPE.

HEATING AND VENTILATION

TWO GASOLINE FIRED HEATERS, PROVIDED WITH ELECTRIC CONTROLS AND DISTRIBUTION DUCTS, ARE INSTALLED. ONE HEATER WARMS THE FLIGHT, GALLEY AND BOMBARDIER STATIONS. ANOTHER HEATER WARMS THE CREW STATIONS.

TORPEDO INSTALLATION

TWO TORPEDOES CAN BE CARRIED INBOARD OF EACH NACELLE. A TORPEDO DIRECTOR AS WELL AS A TRAINING CAMERA ARE INSTALLED.

BOMB RELEASE SYSTEM

BOMBS ARE ELECTRICALLY OR MECHANICALLY RELEASEABLE.

4 INTERNAL BOMB RACKS.
16 BOMB RELEASE UNITS.
16 BOMB SHACKLE ASSEMBLIES.
2 BOMBARDIER HANDLES (PILOT)
1 BOMBARDIER ELECTRICAL PANEL, EMERGENCY MANUAL SALVO RELEASE.
2 FIRING KEYS.
1 PILOT DIRECTOR INDICATOR.
1 INTERVALOMETER.
1 BOMBSIGHT.
2 BOMBRACK SELECTORS.
1 SELECTIVE ELECTRIC BOMB RELEASE.
1 SALVO BOMB RELEASE.
8 SELECTIVE FUSING DEVICES.
1 TORPEDO DIRECTOR.
BOMB RACK CONTROLS.

AUTOMATIC PILOT

A MARK-3 SPERRY AUTO-PILOT IS INSTALLED.

FLIGHT CONTROLS

THE CONTROL SURFACES ARE CABLE OPERATED. THE TRIM TABS ARE TORQUE TUBE OPERATED. TWO CONTROL COLUMNS FOR DUAL CONTROLS ARE PROVIDED.

PLUMBING SYSTEM

A FRESH WATER SYSTEM IS INSTALLED FOR THE GALLEY AND LAVATORY SINKS. A TANK HOLDING 15 GALLONS OF FRESH WATER IS INSTALLED.

PROPELLER ANTI-ICER SYSTEM

EACH PROPELLER HAS A SLINGER RING WHICH SUPPLIES ANTI-ICER FLUID TO THE L.E. OF EACH PROPELLER BLADE BY THE MEANS OF AN ELECTRIC PUMP.

ENGINE STARTING SYSTEM

TWO INERTIA TYPE DIRECT CRANKING ELECTRIC ENGINE STARTERS ARE INSTALLED AS WELL AS ELECTRICAL FUEL PRIMERS.

FIRE EXTINGUISHING SYSTEM

EACH ENGINE INSTALLATION IS PROVIDED WITH A CARBON-DIOXIDE GAS EXTINGUISHING SYSTEM. HAND FIRE EXTINGUISHERS ARE PROVIDED FOR CREWS QUARTERS.

FLIGHT RANGE

THE MARTIN PBM-3C HAD A FLIGHT RANGE OF 3,000 MILES WITH MILITARY LOAD. GROSS WEIGHT IS 48,000 LBS.

JATO TAKE-OFF

JATO BOTTLES CAN BE USED TO ASSIST TAKE DURING ADVERSE SEA CONDITIONS.

MARINER PBM-3C

F.P. = FORE PEAK.
A.P. = AFT PEAK.
W.T. = WATERTIGHT BULKHEAD.

HULL STRUCTURAL DIMENSIONS (LONGITUDINAL PROFILE)

HULL STRUCTURE IS COMPRISED OF A KEEL STRUCTURE, WATERTIGHT BULKHEADS, CIRCUMFERENTIAL FRAMES AND LONGITUDINAL STRINGERS.

NOTE: DIMENSIONS IN INCHES

U.S. NAVY LONG RANGE PATROL BOMBER W W II.
GLENN L. MARTIN COMPANY — BALTIMORE, MARYLAND
MODEL AIRPLANE NEWS — NEW YORK CITY, N.Y.
DRAWN BY: WILLIS L. NYE, A.A.H.S.
SHEET NO. 4 — OF 4 SHEETS.

MARTIN PBM MARINER

W W II SCALE AIRCRAFT DRAWINGS

MARTIN B-26 MARAUDER

This early B-26 shows the initial installation of a .30-caliber tail machine gun. The photo was taken late in 1941, before the U.S. Army serial number was added to the vertical tail.

IN addition to its impressive record as a warplane, the Martin B-26 Marauder should be considered an historic U.S. Army design for another reason: it was the first warplane ever to be ordered into mass production "right off the drawing board" without having a prototype tested first. In January 1939, the U.S. Army, foreseeing an immediate need for new, high-performance airplanes, asked for proposals from the aircraft industry for a new medium bomber that would have an unprecedented high speed for the industry and carry five crew men, four .30-caliber machine guns and 2,000 pounds of bombs. By omitting requirements for low-speed handling characteristics, the Army implied that it was willing to accept a "hot" airplane to get the desired top-end performance. The Glenn L. Martin Co. submitted its paper Model 179 on July 5, 1939. After evaluating it against other proposals, the Army awarded Martin a contract for 201 production bombers and designated them "B-26."

B-26—First flown on November 25, 1940, the new B-26 was powered with 1,850hp Pratt & Whitney R-2800-5 engines. Its initial armament was a single flexible, .30-caliber machine gun in the nose and another in a manned tail position, and two .50-caliber guns in a powered, Martin-designed dorsal turret—the first such device to be installed in a U.S. bomber. The B-26 was also the first U.S. warplane to have been designed from the start with self-sealing fuel tanks. The bomb load was 4,800 pounds.

A wingspan of only 65 feet with an area of 602 square feet combined with the 32,000-pound gross weight to create the highest wing loading ever used on an Army airplane to that time. This horrified the pilots—and time was to justify their fears. The early models used for crew training soon earned the nickname "Widow Maker," and they almost lived up to the derisive reference "One a Day in Tampa Bay" at a Florida training center.

Later models had more span and area, but the wing loading didn't decrease, because the gross weight was increased. The early "Short Wing" B-26s were the fastest of all, with top speeds of 317mph at 15,000 feet.

B-26A—The B-26s were

★ ★ ★

followed by 139 B-26As with minor refinements and a fuselage that was lengthened by 2 feet, 3 inches. All four guns were now .50 caliber, and provision was made for carrying naval torpedoes and bombs.

B-26B—There were 1,883 B-26Bs, but a major change was made with the B-26B-10 that tamed it, and almost made it a different airplane. The wingspan was increased

Note: *While Bill Wylam's drawing is titled "B-26D," the airplane shown is actually representative of late B-26B models. Although detailed photos were released to the public during the war, accurate designations weren't given. For security reasons, all information relative to the B-26 was given under the designation "Marauder," without reference to the particular stage of model development. This was a major reason for the use of "popular" names for U.S. military airplanes. Mr. Wylam made as close a guess as he could for the designation based on the information that was available to him.*

A B-26F-1-MA in the natural metal finish adopted for most U.S. Army combat planes early in 1944. Note the external "package guns" on the lower fuselage.

by 6 feet to make it 71 feet; the wing area increased to 659 square feet; and the height of the vertical tail was increased. Other changes common to all B-26Bs were a 24-volt (rather than a 12-volt) electrical system, 2,000hp R-2800-41 engines and increased protective armor.

For defense, the single hand-swung tail gun was replaced with two .50 calibers in a ball turret, and two .50 calibers were mounted in the lower waist. The drawing shows these in socket fittings ahead of the "openable" panel, but they fire through the panels (as shown in the photo). For ground attack, a fixed, .50-caliber gun was installed inside the nose, and four others were added as "package guns" on the outside of the fuselage.

The normal gross weight of the B-26B increased to only 34,000 pounds, but the bomb load was reduced to 3,000 pounds. Overloads were common, however, and with a 5,200-pound bomb load, the gross weight rose to 36,500 pounds.

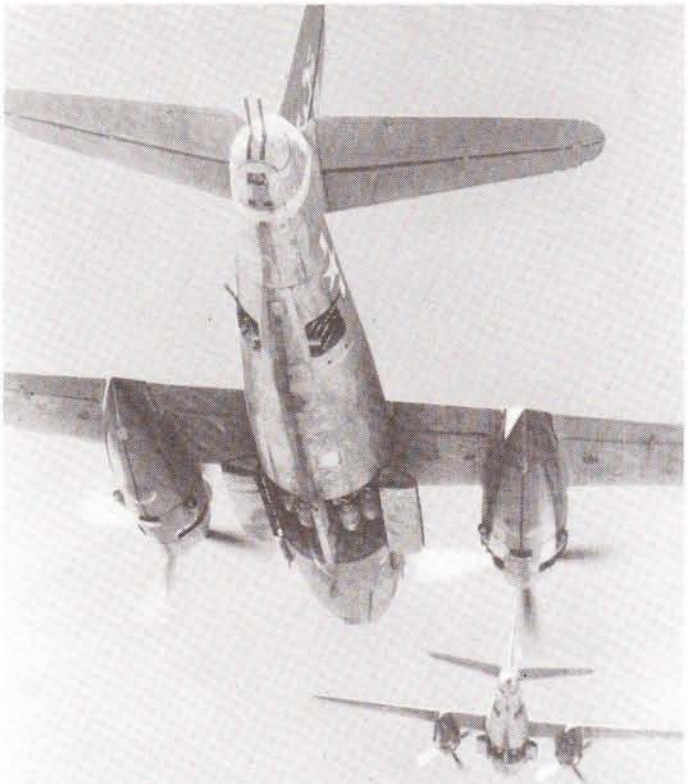
The tail number on the Wylam drawing is accurate for a B-26B-25-MA ("MA" identifies the main Martin plant in Baltimore).

B-26C—The 1,235 B-26Cs were similar to the B-26Bs except that they were built in a new Martin plant in Omaha, NE, where slightly different manufacturing methods were used. The designation became "B-26-MO." Gross weight increased to 38,200 pounds; the top speed dropped to 282mph.

B-26D and E—These two production B-26Bs were modified for experimental projects.

B-26F—The 300 B-26F-MAs were similar to the B and C models except that the angle of incidence of the wing was increased 3 1/2 degrees to further improve the takeoff and landing characteristics.

B-26G—The 893 B-26G-MAs were similar to the F model except that they had only 11 .50-caliber machine guns. A further 57 were built as unarmed crew trainers, and were designated "TB-26G."



This close-up flight view of the B-26B-30-MA shows the ball tail turret, waist gun ports with the guns extended, and the double-hinged doors of a bomb bay containing 500-pound bombs.

REDESIGNATED B-26s

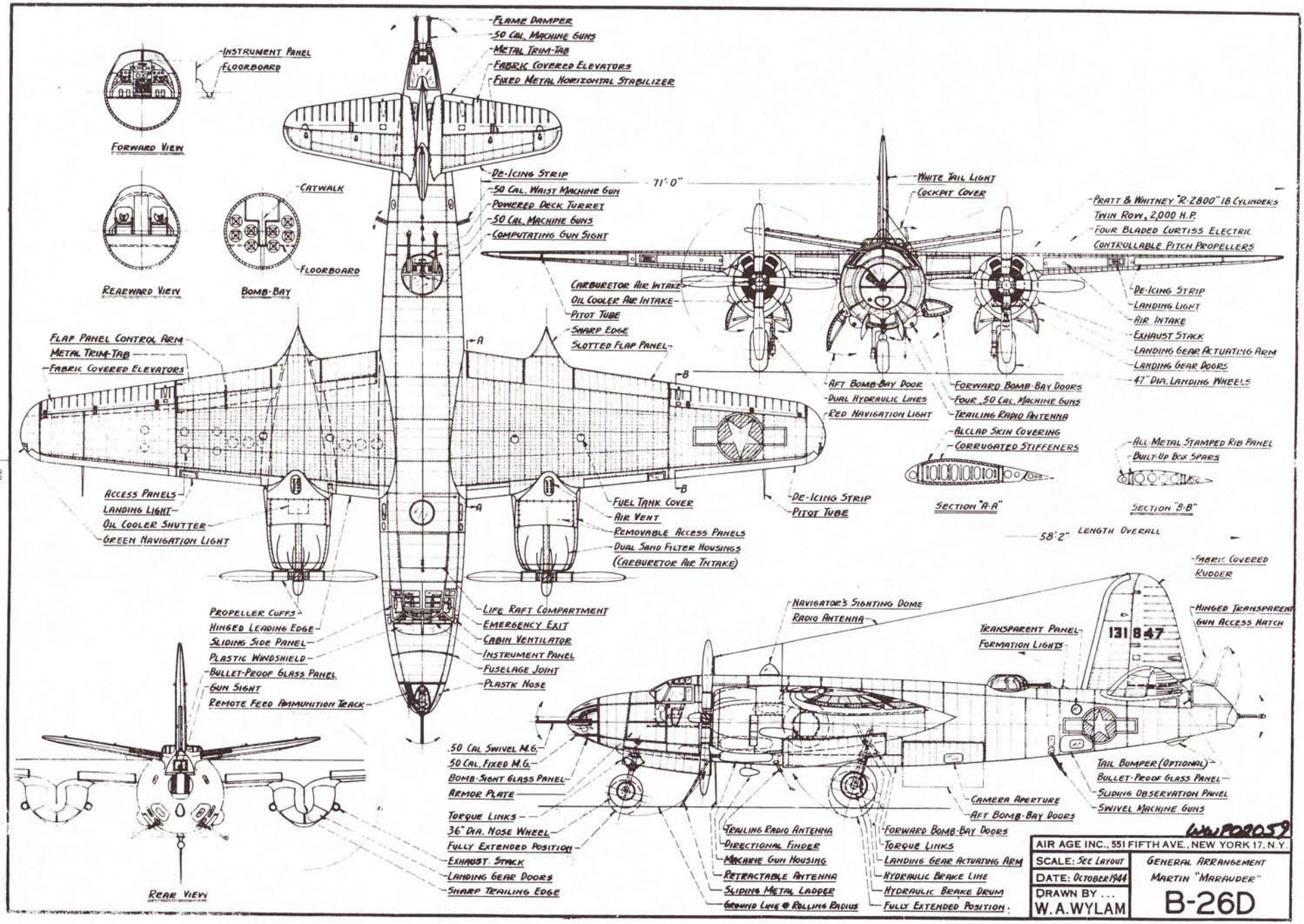
Some production Marauders were modified for use as crew trainers and redesignated: 208 former B-26Bs became "AT-23A Advanced Trainers," while 350 B-26Cs became "AT-23B." These were soon redesignated "TB-26B" and "C" after 203 of the AT-23Bs were transferred to the Navy as unarmed JM-1s ("J" for "Utility," "M" for "Martin"). The Navy also received 47 of the TB-26Gs as JM-2. The JMs were used primarily as tow-target tugs.

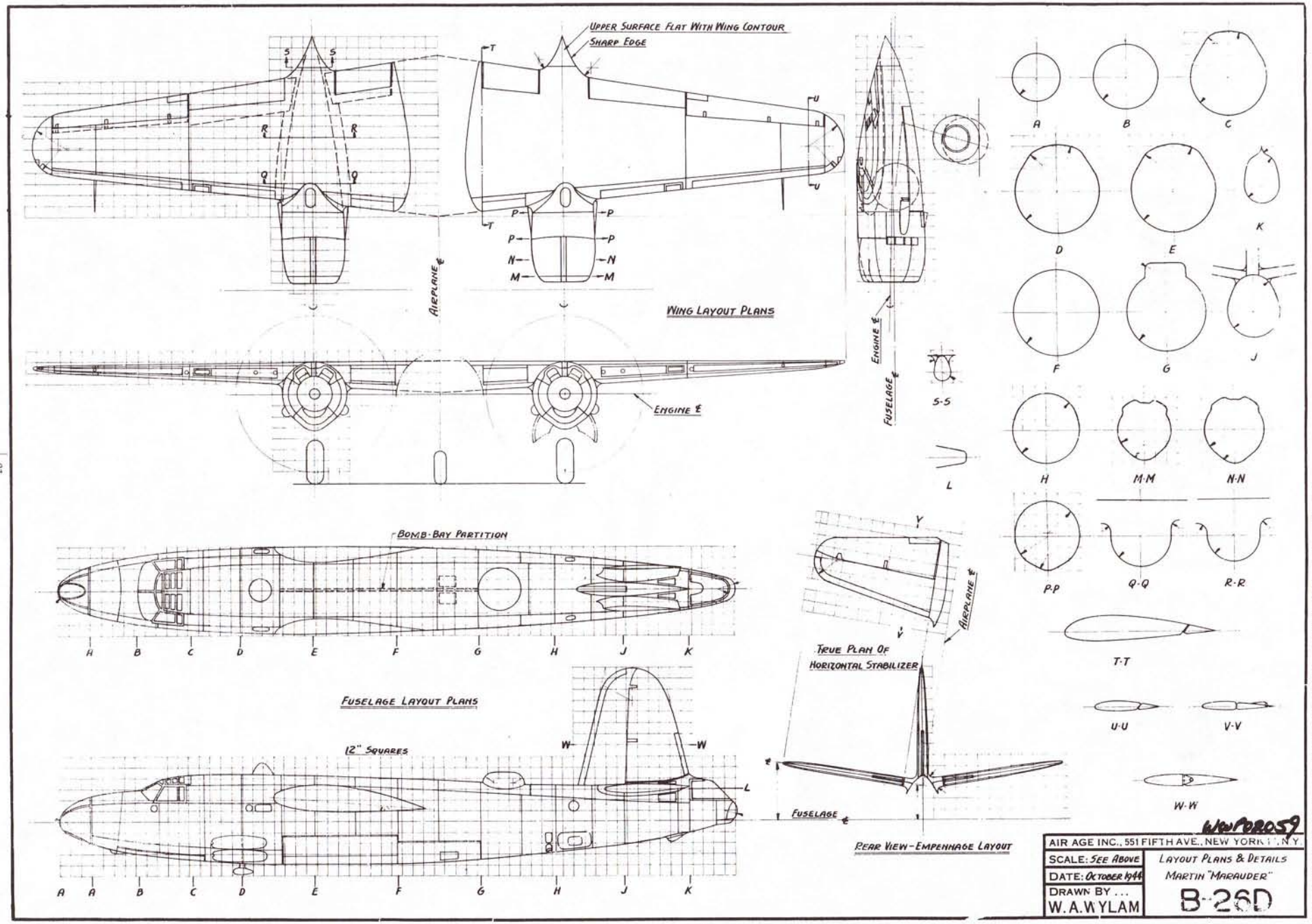
ROYAL AIR FORCE MARAUDERS

The R.A.F. received 544 B-26s under Lend-Lease as follows: 52 B-26As as Marauder I; a further 19 B-26As as Marauder IA; 123 B-26Cs as Marauder II; and a combination of 350 B-26Fs and Gs as Marauder III.

MARAUDERS IN ACTION

The first few B-26s were retained for testing, but the squadrons began to get B-26s in the spring of 1941. They served in every theater of U.S. Army Air Force operations, starting in New Guinea in April 1942, where the distance between targets and U.S. bases required a reduction of the bomb load because of the extra fuel tanks that were carried in the bomb bays. B-26As were used as torpedo planes in the Battle of Midway in June 1942.


FORWARD VIEW
INSTRUMENT PANEL
FLOORBOARD
REARWARD VIEW
BOMB-BAY
CATWALK
FLOORBOARD
FLAME DAMPER
50 CAL. MACHINE GUNS
METAL TRIM-TAB
FABRIC COVERED ELEVATORS
FIXED METAL HORIZONTAL STABILIZER
DE-ICING STRIP
50 CAL. WAIST MACHINE GUN
POWERED DECK TURRET
50 CAL. MACHINE GUNS
COMPUTATING GUN SIGHT
71'-0"
WHITE TAIL LIGHT
COCKPIT COVER
PRATT & WHITNEY "R-2800" 18 CYLINDERS TWIN ROW, 2,000 H.P.
FOUR BLADED CURTISS ELECTRIC CONTROLLABLE PITCH PROPELLERS
CARBURETOR AIR INTAKE
OIL COOLER AIR INTAKE
PITOT TUBE
SHARP EDGE
SLOTTED FLAP PANEL
DE-ICING STRIP
LANDING LIGHT
AIR INTAKE
EXHAUST STACK
LANDING GEAR ACTUATING ARM
LANDING GEAR DOORS
47" DIA. LANDING WHEELS
FLAP PANEL CONTROL ARM
METAL TRIM-TAB
FABRIC COVERED ELEVATORS
AFT BOMB-BAY DOOR
DUAL HYDRAULIC LINES
RED NAVIGATION LIGHT
FORWARD BOMB-BAY DOORS
FOUR .50 CAL. MACHINE GUNS
TRAILING RADIO ANTENNA
ALCLAD SKIN COVERING
CORRUGATED STIFFENERS
ALL METAL STAMPED RIB PANEL
BUILT-UP BOX SPARS
SECTION "A-A"
SECTION "B-B"
ACCESS PANELS
LANDING LIGHT
OIL COOLER SHUTTER
GREEN NAVIGATION LIGHT
FUEL TANK COVER
AIR VENT
REMOVABLE ACCESS PANELS
DUAL SAND FILTER HOUSINGS (CARBURETOR AIR INTAKE)
DE-ICING STRIP
PITOT TUBE
58'-2" LENGTH OVERALL
FABRIC COVERED RUDDER
HINGED TRANSPARENT GUN ACCESS HATCH
NAVIGATOR'S SIGHTING DOME
RADIO ANTENNA
TRANSPARENT PANEL
FORMATION LIGHTS
131847
PROPELLER CUFFS
HINGED LEADING EDGE
SLIDING SIDE PANEL
PLASTIC WINDSHIELD
BULLET-PROOF GLASS PANEL
GUN SIGHT
REMOTE FEED AMMUNITION TRACK
LIFE RAFT COMPARTMENT
EMERGENCY EXIT
CABIN VENTILATOR
INSTRUMENT PANEL
FUSELAGE JOINT
PLASTIK NOSE
TAIL BUMPER (OPTIONAL)
BULLET-PROOF GLASS PANEL
SLIDING OBSERVATION PANEL
SWIVEL MACHINE GUNS
.50 CAL SWIVEL M.G.
50 CAL. FIXED M.G.
BOMB-SIGHT GLASS PANEL
ARMOR PLATE
CAMERA APERTURE
AFT BOMB-BAY DOORS
TORQUE LINKS
36" DIA. NOSE WHEEL
FULLY EXTENDED POSITION
EXHAUST STACK
LANDING GEAR DOORS
SHARP TRAILING EDGE
REAR VIEW
TRAILING RADIO ANTENNA
DIRECTIONAL FINDER
MACHINE GUN HOUSING
RETRACTABLE ANTENNA
SLIDING METAL LADDER
GROUND LINE @ ROLLING RADIUS
FORWARD BOMB-BAY DOORS
TORQUE LINKS
LANDING GEAR ACTUATING ARM
HYDRAULIC BRAKE LINE
HYDRAULIC BRAKE DRUM
FULLY EXTENDED POSITION
AIR AGE INC., 551 FIFTH AVE., NEW YORK 17, N.Y.
SCALE: See Layout
DATE: October 1944
DRAWN BY ... W.A.WYLAM
GENERAL ARRANGEMENT
MARTIN "MARAUDER"
B-26D



MARTIN B-26 MARAUDER

MESSERSCHMITT ME 109

An Me 109B-2 in 1938 camouflage and markings. Note the white circle around the swastikas, the narrow white borders for all crosses, and the wing crosses close to the wing tips.

The Me 109 was one of the world's great fighter planes and it enjoyed the distinction of having been built in greater numbers than any other—some 33,000 were built. It was mass-produced in Germany from 1936 through 1945 and it was built in other countries after the war, serving in Spain until 1967.

The Me 109 was designed in 1934 in a four-way design competition for a modern fighter to be used by the brand-new Luftwaffe. Although it was designed to use the new 610hp Junkers Jumo inverted V-12 engine, the Me 109V-1 prototype had to use an upright 625hp British Rolls-Royce Kestrel engine when it flew in September 1935. While it differed little in outline from the new monoplane fighters that were being developed in other countries, the Me 109 was almost revolutionary in its use of a greatly simplified, all-metal structure for mass production and ease of maintenance in the field.

The design was also suitable for "stretch"—the use of higher power, heavier armament and other state-of-the-art changes that kept it competitive with later Allied fighters until the war's end. About the only serious deficiency of the Me 109 was the design of the landing gear. The gear was on a narrow track and the wheels weren't 90 degrees to the ground. This often gave the pilots serious problems when they landed.

Note: The "Me 109J" designation that's used on the Wylam drawing never officially existed. It was an in-house designation used by Messerschmitt for some Me 109G models that were being built for Spain late in the war. The drawing shows the configuration of the prewar Me 109B through D models fitted with the three-blade propeller of the Me 109E. The markings are for early Me 109Bs as seen in 1938. The "J" was just a guess on Mr. Wylam's part, as accurate designations for many German aircraft weren't readily available to the Allies in 1940, when the drawing was made.

Also, note that the abbreviations "Bf" and "Me" are both used in reference to the Messerschmitt airplanes. Although the planes were designed by Willi Messerschmitt and were referred to as such, they were the product of the Bayersche Flugzeug Werke (Bavarian Airplane Works) of Augsburg and were officially designated "Bf." The name of the firm was changed to Messerschmitt in July 1938, so "Me" became the official abbreviation, but "Bf" also remained in use almost until the war's end. Because "Me" is the most commonly used term today, it's used here even for the early, "true" Bf models.

PROTOTYPES

Three Me 109 prototypes were ordered in 1934 and designated "Me 109V-1" through "V-3" ("Versuchs," or "Experimental"). These were followed by 10 more prototypes mixed with pre-production Me 109B models. Designated V models continued to appear until late in the war (reaching V-55). Most of these were adapted from production models rather than built from scratch as experimental models.

Me 109B—This was the first production model because there was no Me 109A as such. It used the 635hp Jumo 210 engine and drove a fixed-pitch wooden propeller, which was later replaced by a two-blade metal controllable-pitch type. Its initial armament was a pair of 7.9mm machine guns that fired through the propeller, with a third gun that fired through the hollow propeller shaft. Early combat experience was gained by 45 109Bs that were sent to the German Condor Legion, which was fighting in the Spanish Civil War. The Me 109B's gross weight was 4,740 pounds and its top speed was 289mph at 13,120 feet (4,000 meters).

Me 109C—This model was outwardly similar to the B, but it had an improved Jumo 210C engine and two additional guns in the wings. Some Cs were used to test a 20mm cannon that fired through the propeller shaft, but this wasn't

An Me 109E-4/B, in 1940 coloring, carrying a 550-pound bomb. Note the wide white borders on the fuselage and the underwing crosses, and the wing crosses now located farther from the wing tip.

The major change in the appearance of the Me 109F resulted from the larger propeller spinner and round wing tips. Shown here is an early Me 109F-0.

The Me 109G was outwardly similar to the F model, except for the bulges for larger nose-gun ammunition drums located ahead of the cockpit (which started with the G-3). Shown here is an ME 109G-10/R1.

yet standard equipment.

Me 109D—The Me 109D, which kept the Jumo engine and two-blade propeller, was the first true mass-produced model, with several hundred built. Although it rapidly became obsolete, some D models saw action during the German invasion of Poland in September 1939. They were then "retired" to fighter-pilot schools.

Me 109E—A major change came with the Me 109E, which used the 960hp Daimler-Benz DB 600 engine, (an inverted V-12 like the Jumo) but had a three-blade propeller and a notably different radiator arrangement under the nose. Production Es with 1,100hp DB 600A engines entered service with the Luftwaffe early in 1939. A great variety of armament was incorporated in the E over its production life, and the nose-mounted cannon was standard equipment. Some other Es had cannon installed in the wings. Provision was also made for the installation of racks under the wings for bombs, and either a 300-liter drop tank or a 550-pound bomb could be carried under the fuselage.

In combat, the Me 109E was slightly superior to the British Hurricane I and far better than the Curtiss Kittyhawk. It was about even in performance with the early British Spitfires.

Me 109F—Major changes in appearance came in late 1940 with the Me 109F. Most notable were a greatly enlarged, nearly hemispherical propeller spinner, rounded (instead of squared) wing tips, and a horizontal cantilever tail that eliminated the bracing struts. From the F-3 model on, the engine used was the 1,350hp DB 601E. Its gross weight was 6,063 pounds and its high speed was 391mph at 19,680 feet (6,000 meters).

Me 109G—The Me 109G of 1942 was the most-produced model. Some featured cockpit pressurization (a new feature for fighters at the time), and from the G-3 on, the nose guns were 13mm. The larger ammunition drums required for these guns caused conspicuous bulges on each side of the fuselage ahead of the cockpit. Again, wing armament varied between cannons, extra machine guns and rockets. Its gross weight was 6,945 pounds; the high speed was 387mph at 22,967 feet (7,000 meters).

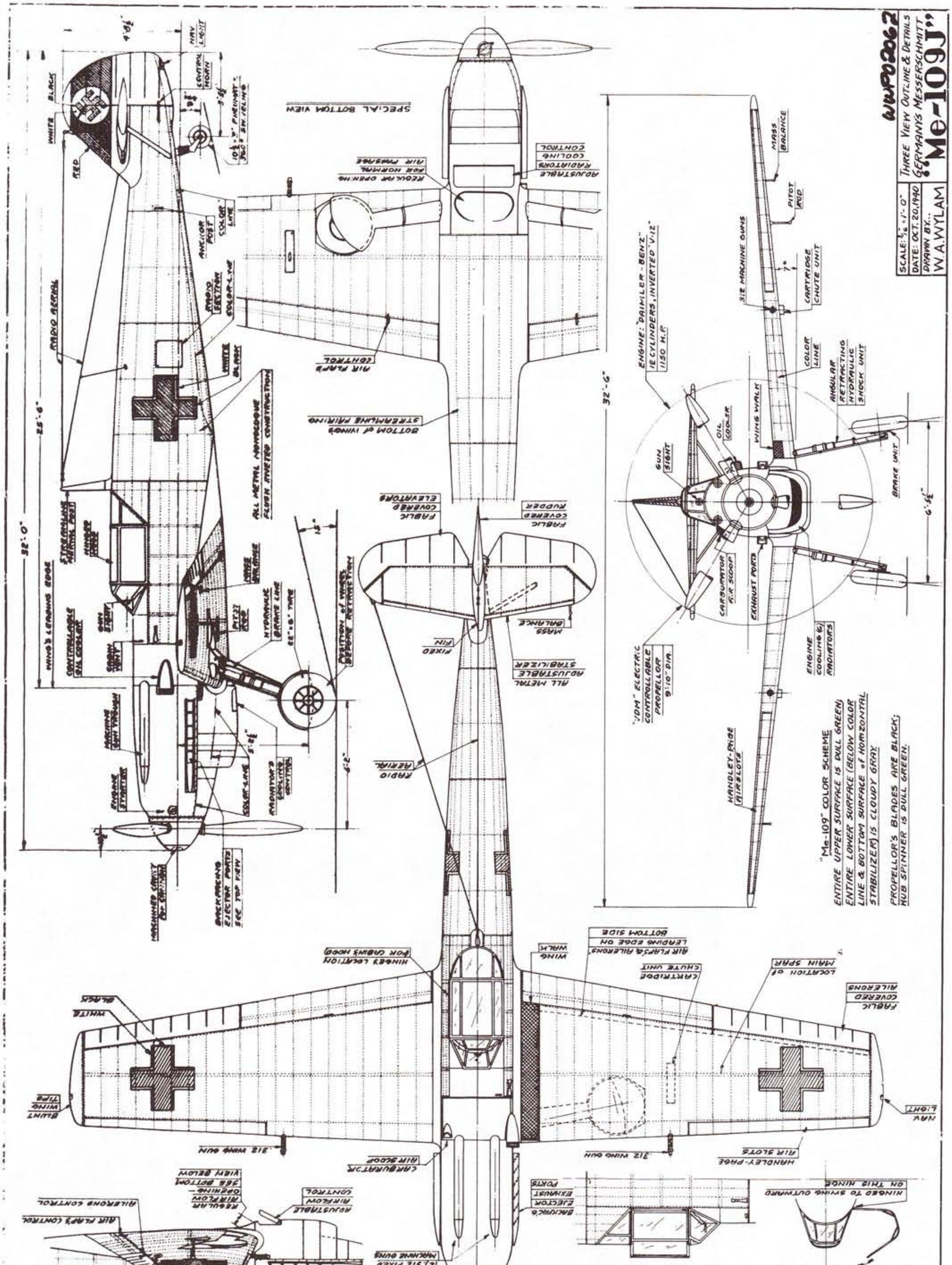
Me 109H, J—A small series of Me 109H prototypes (which were intended to be high-performance fighters) was started, using F-4 airframes for prototypes and G-5s for early production models. Only a few were delivered before the program was cancelled. The "J" designation was used by Messerschmitt as its own designation for 25 G airframes that were shipped to Spain without engines.

Me 109K—The final production model, which was similar to the late 109G, appeared late in 1944. The Me 109K used the 1,500hp DB 605L engine with a two-stage supercharger that could deliver up to 2,000hp for short dashes.

Its gross weight was 7,400 pounds, and its high speed was 452mph at 19,606 feet. These were figures that emphasized the ability of the 1934 design to grow and remain competitive with later fighter designs.

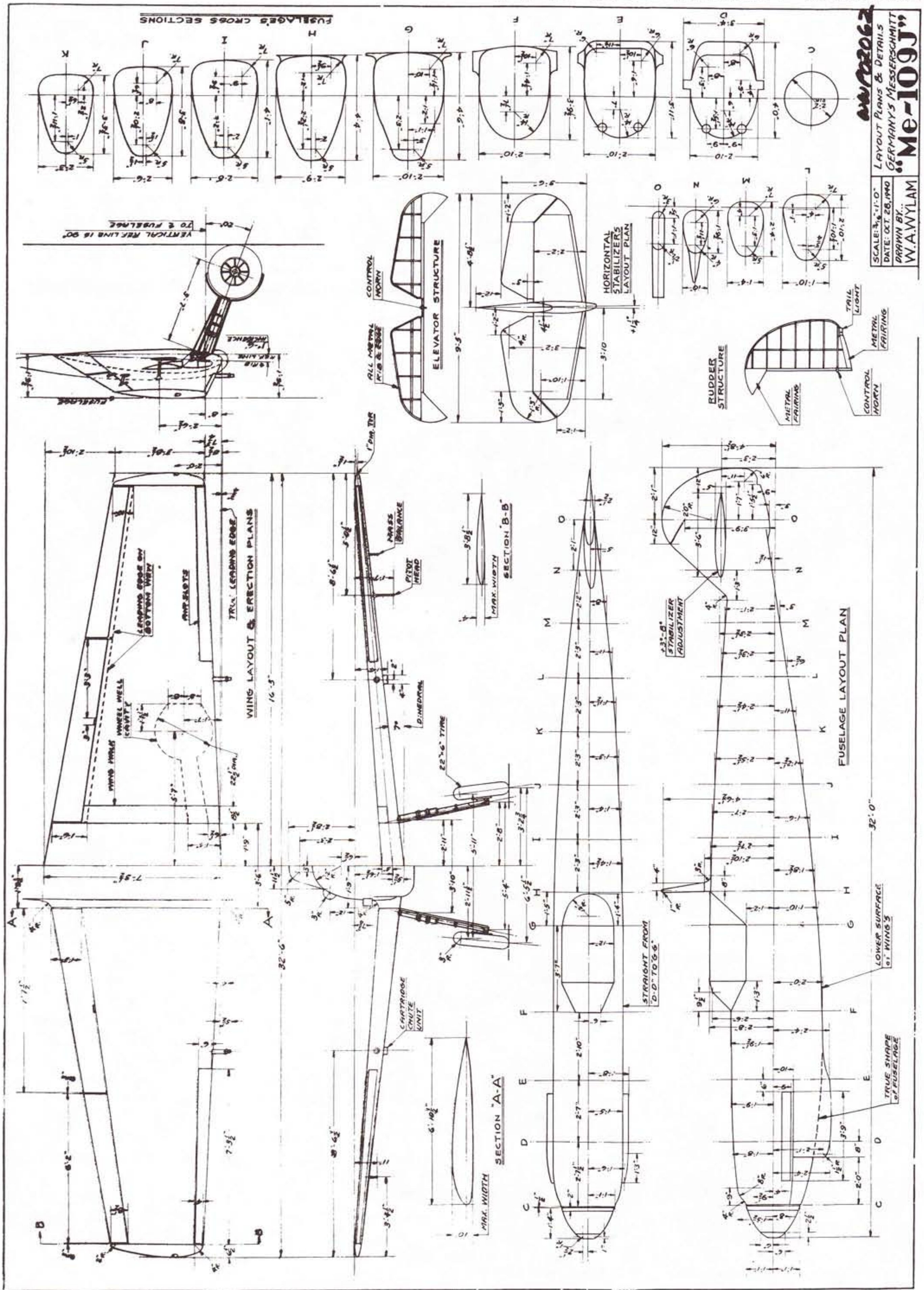
POSTWAR PRODUCTION

The Avia plant in Czechoslovakia had been building Me 109Gs, and after the war, it continued to build them for the new Czech Air Force, using both DB 605 and Jumo engines. Spain also built Me 109Gs after the war, using Hispano-Suiza engines, which were later replaced by British Rolls-Royce Merlins.



"Me-109J"
THREE VIEW OUTLINE & DETAILS
GERMANY'S MESSERSCHMITT
DATE: OCT. 20, 1940
DRAWN BY...
W. A. WYLAM
SPECIAL BOTTOM VIEW
SIDE VIEW IN FLYING POSITION
FRONT & SIDE VIEWS DETAILS of HINGED CABIN HOOD
ENGINE: "DAIMLER-BENZ" 12 CYLINDERS, INVERTED "V-12" 1150 H.P.
"Me-109" COLOR SCHEME
ENTIRE UPPER SURFACE IS DULL GREEN;
ENTIRE LOWER SURFACE (BELOW COLOR LINE & BOTTOM SURFACE of HORIZONTAL STABILIZER) IS CLOUDY GRAY.
PROPELLOR'S BLADES ARE BLACK; HUB SPINNER IS DULL GREEN.

MESSERSCHMITT ME 109



MESSERSCHMITT ME 262 SWALLOW

An Me 262A-1a tested in the U.S. after the war. The original German fuselage markings had been painted out, but erroneous crosses in WW I style were painted on later for publicity purposes.

THE German Messerschmitt Me 262 has the distinction of being the first turbojet airplane to see combat. It wasn't the first fighter without propellers to do so, however. That honor went to the Messerschmitt Me 162 Komet, which was powered by a liquid-fuel rocket engine and went into action on August 14, 1944. Although the Me 262 didn't go to war until October 3, 1944, its impact on aircraft design was great. Rocket propulsion wasn't adopted for subsequent fighters, but all of today's fighters are powered by turbojets.

It was fortunate for Allied air power that deployment of the Me 262 was held up, first by delays in jet-engine development and then by official indecision as to how it should be used. The initial planning for its use as a fighter was faulty, and then Adolph Hitler ordered that it be produced as a bomber rather than a fighter.

In 1938, the German Air Ministry encouraged the development of jet and rocket powerplants for military aircraft. As a result, the newly named Messerschmitt A.G. ("A.G." for "Aktien Geselleschaft," or Proprietary Company) was invited to design a jet-powered fighter. Messerschmitt's preliminary design study received the Ministry's Project No. P.1065, which appeared as a wooden mock-up in March 1940. Approval of this resulted in an order for three all-metal prototypes, designated "Me 262." The new fighter eventually received the name "Schwalbe" (Swallow).

Me 262A-1as in Germany. Note that the tail swastika is black with a white border, but that the fuselage cross consists only of a white outline over the fuselage camouflage pattern.

As a fighter airframe, the Me 262 was a relatively conventional design, but it featured a slightly swept-back wing to reduce compressibility at high speeds. Two axial-flow turbojet engines were installed in nacelles on the underside of the wing, outboard of the inward-retracting landing gear. A detail new to fighters at the time, but soon to be widely adopted, was the use of a cockpit canopy that was entirely above the fuselage, not faired into it as on the Me 109 and its contemporaries.

The first four Me 262s (Me 262V-1 through V-4) featured conventional tail-wheel landing gear. This was quickly changed to the tricycle type, and for good reason. The jet blast hit the pavement, damaging it, and also bounced upward to scorch the tail surfaces while further damaging them with blown-up debris. Significantly, all subsequent jet airplanes used tricycle landing gear with their jets parallel to the ground (notable exceptions are latter-day vertical takeoff types such as the British Harrier).

Airframe development got far ahead of jet-engine development, so the Me 262V-1 was hurriedly fitted with a

A two-seat Me 262B-1a/U1 night fighter tested in the U.S. after the war. Note the nose radar antennas and the auxiliary fuel tanks where bombs were carried on the bomber versions.

1,200hp Junkers Jumo piston engine in a modified nose. It made its first flight on April 18, 1941. Later attempts to fly it and other prototypes with early developmental jets failed because the engines weren't delivering sufficient thrust (1 pound of thrust equals 1hp at approximately 375mph; 1 pound of thrust equals more than 1hp above that speed and less below it).

Finally, powered by two 1,848-pound-thrust (static) Junkers 109-004A engines, the first all-jet Me 262 flight was made by the V-3 on July 18, 1941. Orders were then placed for production Me 262A-0 and -1 fighters, but for a while, it looked like they wouldn't be delivered as such. Hitler saw a demonstration flight of the Me 262V-6 in November 1943 and, impressed by its speed, decided that it was just the thing for hit-and-run bombing raids on England. He ordered that the new jets be built as bombers instead of fighters. A redesign program got under way, and the Me 262A-2 version could carry two 500kg (1,100-pound) bombs under the fuselage. The bomber version was named "Sturmvogel" (Storm Bird). Reason prevailed in the Air Ministry, however, and Hitler was persuaded to allow simultaneous production of both the Me 262 bomber and the fighter. The fighter was usually fitted with four 30mm cannon in the nose, but other armament arrangements were also used.

By April 1944, 12 prototypes and 10 Me-262A-0 preproduction models had been built. Initial production models went to fighter-pilot schools, not to the front, because considerable training was needed for experienced fighter pilots during their transition to the new jets. The first Me 262 combat mission against U.S. daylight bomber formations was on October 3, 1944.

The performance of the Me 262 handed the Allies a nasty surprise: it was more than 80mph faster than the best Allied fighters of the time. Its speed was an asset in hit-and-run attacks on the bomber streams and allowed it to avoid mixing with the defending fighters. The powered gun turrets of the bombers couldn't follow the Me 262's high-speed passes. Most of the Me 262s that were shot down were victims either of their own pilots' errors or of slowing down for more careful aim or for landing. Some Me 262s were designed with a single 50mm (2-inch) cannon in the nose to permit the Me 262s to attack the bombers while safely out of range of their .50-caliber guns. This version, however, was never produced.

The increasing need for night fighters resulted in the installation of specialized night-fighting radar into some single-seat Me-262A-1s, complete with an impressive array of antennas on the nose. Two-seat Me 262Bs were developed specifically as night fighters.

Altogether, 1,430 Me 262s were built out of thousands ordered, and then they were a classic example of too little, too late. Had they been available a year and half earlier (before long-range fighters began to accompany the bombers), the outcome of the Allied strategic bombing program might have been different.

★ ★ ★

Note: The designations "FE" and "T2" on the rear fuselages of German aircraft photographed in the U.S. during and after the war aren't original German markings. "FE" means "Foreign Equipment," and "T2" is the number of the particular Technical Intelligence office that tested the aircraft.

Me 262 nose details. At left, an Me 262A-2a with two 250kg (550-pound) bombs under the fuselage. At right, an Me 262A-1a fighter. Note the ports for the 30mm cannon in the upper nose.

THE MESSERSCHMITT ME-262A THE FIRST OPERATIONAL TURBO-JET FIGHTER DESIGNED AND BUILT BY MESSERSCHMITT A.G. 1433 PLANES OF THIS TYPE WERE MANUFACTURED AND 200 SAW ACTION IN WORLD WAR TWO. THE FOLLOWING IS A LIST OF THE VARIOUS MODELS:

- ME-262 V1 ..... PROTOTYPE.
- ME-262 V3 ..... PROTOTYPE.
- ME-262 V4
- ME-262 V5 ..... NOSE GEAR (FIXED)
- ME-262 V6 ..... RETR. NOSE GEAR.
- ME-262 V7 ..... PRESSURIZED.
- ME-262 V8 ..... ARMAMENT.
- ME-262 V9 ..... RADIO TEST.
- ME-262 V10 ..... STICK FORCE TEST.
- ME-262 A-0 ..... MASS PRODUCTION
- ME-262A-1a ..... SCHWALBE.
- ME-262A-1a/U1 ..... 4-30MM CANNON.
- ME-262A-1/U2 ..... TACTICAL FIGHTER.
- ME-262A-1b ..... FIGHTER
- ME-262A-2a ..... STORMVOGEL.
- ME-262A-2a/U1 ..... BOMB SIGHT.
- ME-262A-2a/U2 ..... BOMBER 2 PLACE
- ME-262A-3a
- ME-262A-5a ..... RECONNAISSANCE.
- ME-262B-1a ..... NIGHT FIGHTER.
- ME-262B-1a/U1 ..... NIGHT FIGHTER.
- ME-262B-2a
- ME-262C-1a ..... ROCKET ENGINE.
- ME-262C-2b
- ME-262C-3

THE GERMAN AIR FORCE USED THE ME-262 FOR TRAINING, INTERCEPTION, NIGHT FIGHTING, FIGHTER-BOMBER, FIGHTER RECONNAISSANCE, GROUND ATTACK ETC. THE CONTRACT FOR THE PROTOTYPE WAS AWARDED IN 1938. THE FIRST OPERATIONAL FLIGHT ON TURBO-JET POWER WAS MADE IN JULY, 1942. THE FIGHTER SERIES WAS CALLED THE SWALLOW AND THE BOMBER PLANES WERE CALLED THE STORMBIRDS.

PRODUCTION BREAKDOWN

THE FOLLOWING IS THE PRODUCTION ASSEMBLY BREAKDOWN:

WING TIP(2).
OUTER WING PANELS(2).
OUTER LEADING EDGE SLATS(2).
INNER LEADING EDGE SLATS(2).
AILERONS(2).
AILERON TRIM TABS(2).
OUTER WING FLAPS(2).
INNER WING FLAPS(2).
WING-FUSELAGE LANDING GEAR BOXES.
TURBO-JET ENGINE NACELLES(2).
MAIN LANDING GEAR(2).
NOSE GEAR.
NOSE GEAR DOOR.
NOSE CONE.
NOSE REMOVABLE PANELS(2).
FUSELAGE NOSE ASSEMBLY.
FUSELAGE MID-SECTION.
MAIN LANDING GEAR DOORS(2).
MAIN LANDING GEAR FAIRINGS.(2)
FUSELAGE FUEL CELLS.(4)
COCKPIT.
PILOT'S SEAT.
PILOT'S CANOPY.
WING-FUSELAGE FILLETS(2).
FUSELAGE AFT SECTION.
EMPENNAGE SECTION.
HORIZONTAL STABILIZER.
VERTICAL STABILIZER.
ELEVATORS(2).
ELEVATOR TRIM TABS(2).
RUDDER.
RUDDER TRIM TAB.
INSTRUMENT PANEL.
FLIGHT CONTROLS.
BOMB RACKS(2)
ARMAMENT.

DIMENSIONAL DATA

WING SPAN	40'-11.5"
OVERALL LENGTH	34'-9"
HEIGHT	12'-4"
WING AREA	270.00 SQ.FT.
CHORD(ROOT)	100"
CHORD(TIP)	31.75"
ASPECT RATIO	7.5
WING LOADING	44.5 LBS.
WEIGHT EMPTY	8,514 LBS.
USEFUL LOAD	7,106 LBS.
GROSS WEIGHT	15,620 LBS.
HIGH SPEED(RED LINE)	658 M.P.H.
DURATION 50-90 MINUTES AT 10,000 FT.	
MAX. AIRFOIL THICKNESS 35% CHORD.	
MAX. PERMISSIBLE C.G. 30% M.A.C.(AFT.).	
MAX. PERMISSIBLE C.G. 18.5% M.A.C.(FWD).	

LANDING AND TAKE-OFF

ME-262A FUELED WITH 475 GALLONS: CONCRETE RUNWAY 3750-4350 FEET.
WITH 578 GALLONS ABOARD:

	4350 TO 4950 FEET.
LANDING ROLL	4350 TO 4950 FEET.

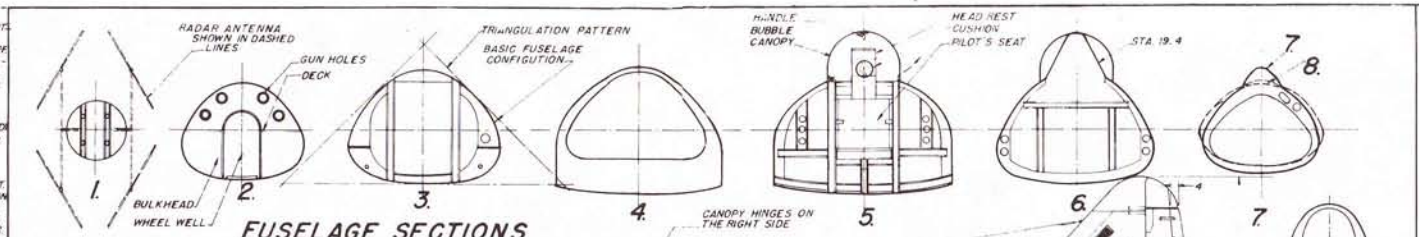
PERFORMANCE CLIMB

0 TO 13,000 FEET INDICATED, CLIMBING SPEED ..... 279 M.P.H.

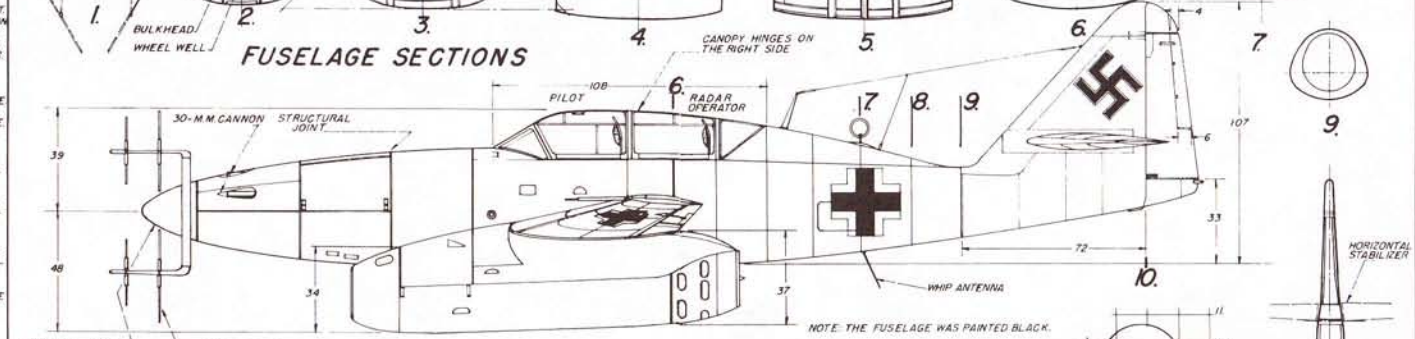
13,000-19,700 FEET	310 M.P.H.
19,700-26,200 FEET	342 M.P.H.
26,200-32,800 FEET	372 TO 403 M.P.H.

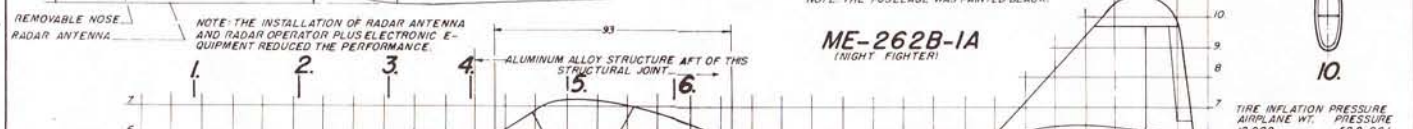
STALLING SPEED

LANDING GEAR AND WING FLAPS DOWN. 126 M.P.H.



FUSELAGE SECTIONS





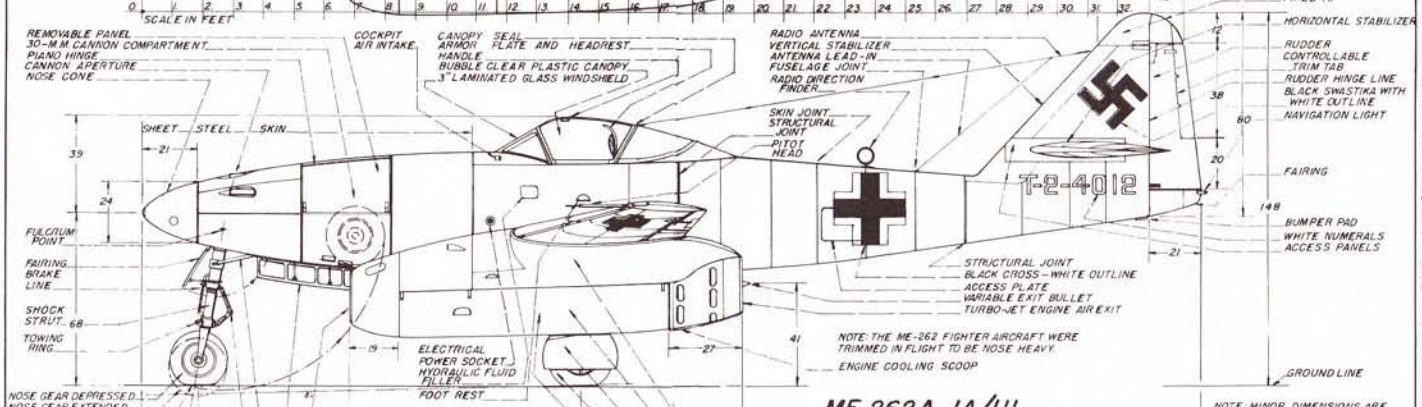
ME-262B-1A
(NIGHT FIGHTER)

PROFILE

TIRE INFLATION PRESSURE

AIRPLANE WT.	PRESSURE
12,000	58.8 P.S.I.
13,000	66.0 P.S.I.
14,000	70.0 P.S.I.

ALL TIRES ARE INFLATED TO THE SAME PRESSURE.



ME-262A-1A/U1
(INTERCEPTOR)

NOTE: MINOR DIMENSIONS ARE SCALED.

NOTE: THE MARKING SHOWN ON THE ME-262-1A/U2 ARE THOSE APPLIED BY HUGHES AIRCRAFT COMPANY FOR U.S.A.F. FLIGHT TEST PROGRAM. THE LUFTWAFFE USED A VARIETY OF CAMOUFLAGE COLORATION.

NOTE: THE MODEL ME-262-1A/U1 WAS CAPTURED IN WORLD WAR TWO BY U.S. ARMY GROUND FORCES AND GIVEN TO THE U.S. ARMY AIR FORCES FOR EVALUATION. IT WAS REBUILT BY HUGHES AIRCRAFT COMPANY, CULVER CITY, CALIF. IT WAS FLIGHT TESTED BY THE U.S. A.F.

SCALE

NOTE: ALL DIMENSIONS ARE IN INCHES.
SHEET NO.1

PERFORMANCE DATA

SEA LEVEL MAXIMUM SPEED ..... 500 M.P.H.
INITIAL RATE OF CLIMB ..... 3937 FEET/MIN
SERVICE CEILING ..... 37,565 FEET
RANGE AT SEA LEVEL ..... 298 MILES.
RANGE AT 19,684 FEET ..... 526 MILES.
RANGE AT 29,560 FEET ..... 652 MILES.
TAKE OFF RUN TO CLEAR 50FT. OBSTACLE ..... 3280 FEET.
TOUCH DOWN LANDING SPEED 108 M.P.H.

TURBO-JET ENGINES

THE TURBO-JET ENGINES WHICH POWERED THE ME-262A FIGHTER WERE DESIGNED AND BUILT BY JUNKERS FLUGZEUG UND MOTORENWERKE. THE ENGINES WHICH WERE INSTALLED IN THE FIGHTERS WERE MODEL JUMO 004. THE ENGINE IS 152" LONG AND A MAXIMUM DIAMETER OF 34".

GENERAL DATA

WEIGHT(WITHOUT THE COWL)	1669 LBS.
WEIGHT(WITH THE COWL)	1775 LBS.
SPECIFIC WEIGHT	.85 LBS.
THRUST	1,980 LBS.
PRESSURE RATIO	3:1
FUEL CONSUMPTION PER HOUR	2,745 LBS.
SPECIFIC FUEL CONSUMPTION	.139
MAXIMUM SPEED	8,700 R.P.M.
IDLING SPEED	3,080 R.P.M.
IDLING SPEED FUEL CONSUMPTION	614 LBS.
FRONTAL AREA	8.4 SQ.FT.

ENGINE ACCESSORIES

ENGINE OIL TANK, OIL PUMP ASSEMBLIES
FUEL PUMP, FUEL TANK
GOVERNOR, OIL PUMP, SPILL AND THROTTLE (VALVES)
TACHOMETER
AIR-OIL SEPARATOR
ORIFICE CONTROL SERVO MOTOR
ORIFICE CONTROL DRIVE SHAFT
FUEL FILTER
FUEL NON-RETURN FUEL VALVES
THROTTLE LINKAGE
PIPING AND ATTACHMENTS
ENGINE MOUNT BRACKETS
ENGINE IGNITER COILS
STARTER ENGINE (1 H.P. AT 6,000 R.P.M.)
FUEL TANK AND SUPPORTS
ELECTRICAL GENERATOR
HYDRAULIC FLUID PUMP
MISCELLANEOUS ENGINE COWLING

TWO KINDS OF FUEL ARE BURNED IN THIS JET ENGINE, AVIATION GASOLINE FOR STARTING AND KEROSENE FOR FLIGHT OPERATIONS. BOTH AIR AND LUBRICATING OIL ARE USED AS COOLING AGENTS. THERE ARE SIX COMBUSTION CHAMBERS. THREE CHAMBERS HAVE IGNITION PLUGS AND THREE HAVE INTERCONNECTORS. THE COMPRESSOR ROTOR IS COMPRISED OF EIGHT ROTOR DISKS. THE DIAMETER OF THE DISKS VARY FROM THE LOW TO HIGH PRESSURE ENDS. THE NUMBER OF BLADES ON THE ROTOR AND STATOR ALSO VARIES FROM THE LOW TO THE HIGH PRESSURE END. A VARIABLE EXHAUST CONE VARIES THE EXIT AREA. THIS CONE IS MECHANICALLY LINKED TO THE ENGINE THROTTLE.

THE JUMO-004 ENGINE HAD AN EIGHT STAGE AXIAL FLOW TURBO-JET AND SIX STRAIGHT THROUGH COMBUSTION CHAMBERS. THE SINGLE STAGE TURBINE DISCHARGED THE COMPRESSED AND HEATED AIR INTO THE VARIABLE EXIT ORIFICE. THE ENGINE WAS COOLED BY AIR BLED OFF FROM THE COMPRESSOR FLOWING PAST THE COMBUSTION CHAMBERS BY MEANS OF A DOUBLE SKIN DUCT. OTHER AIR WAS USED TO COOL THE TURBINE DISC AND ALSO TO COOL THE JET EFFLUX NOZZLE. AN INTERNAL COMBUSTION TYPE STARTING ENGINE IS MOUNTED IN THE INTAKE AIR DUCT. THE STARTING MOTOR HAS AN ELECTRIC STARTER. THE STARTING MOTOR IS 10 H.P. CAPACITY. THE STARTING MOTOR IMPARTS TORQUE TO THE ROTOR. PROVISION IS ALSO MADE FOR MANUAL STARTING.

PROVISION IS MADE TO LUBRICATE AND TO COOL THE ANNULAR BEARING ASSEMBLIES BY LUBRICATING OIL AS WELL AS THE ENGINE ACCESSORY DRIVE.

THE ENGINE IS CONSTRUCTED OF HIGH STRENGTH ALUMINUM ALLOYS AND ALLOYED SHEET STEEL. THE MAIN BODY OF THE ENGINE CONSISTS OF A MASSIVE FRONT ALUMINUM ALLOY CASTING WHICH SUPPORTS THE ENTIRE ENGINE. THIS CASTING ALSO CARRIES THE MOUNTING POINTS FOR THE ENGINE. EXTENSIVE WELDING IS ALSO USED IN THE ENGINE.

ACKNOWLEGEMENT

ROYAL FREY, U.S.A.F. AIR MUSEUM
JACK PIRELLA ..... A.A.H.S., I.P.M.S., C.B.C.
DON GARRETT ..... I.P.M.S.

ME-262A

GERMAN AIR FORCE, WORLD WAR TWO.
TWIN TURBO-JET ENGINE FIGHTER PLANE.

DRAWN BY ..... WILLIS L. NYE, A.A.H.S.
FOR ..... MODEL AIRPLANE NEWS
N.Y. NEW YORK CITY ..... NEW YORK.

WING STRUCTURE

THE WING STRUCTURE OF THE ME-262A IS CONSTRUCTED OF STEEL AND ALUMINUM ALLOY MATERIALS. IT HAS AN UNORTHODOX WING PLAN FORM. THE PRIMARY STRUCTURAL COMPONENT IS THE MAIN WING SPAR OF COMPOSITE CONSTRUCTION AND SWEPT BACK AT AN ANGLE OF 12° AT THE FUSELAGE. THE SPAR CONSISTS OF STEEL FLANGE ANGLES RIVETED TO AN ALUMINUM ALLOY WEB. THE ALUMINUM ALLOY WEB IS OF THE BUILT UP TYPE. THE WING SPAR TAPERS FROM 14.5" AT THE WING ROOT TO 3" AT THE WING TIP.

THE WING IS BUILT AROUND THE MAIN COMPOSITE "I" BEAM SPAR. THE SPAR BOOM CAPS ARE .75" THICK AT THE AIRPLANE CENTERLINE. THE UPPER CAP IS 4.25" WIDE AND THE LOWER IS 4.75". EACH WING PANEL IS AN INDIVIDUAL ASSEMBLY. THE MAIN SPAR IS SPLICED AT THE CENTERLINE. THE WEBS ARE FLANGED AND JOINED WITH BOLTS. STEEL SPLICE PLATES .75" THICK COVER THE TOP AND BOTTOM OF THE BOOM CAPS. THE PLATES ARE ATTACHED IN PLACE BY 6 THROUGH BOLTS, LOCATED ON EACH SIDE OF THE WEB. TAPERED WEDGES ARE PLACED BETWEEN THE SPLICE PLATES AND THE LOWER CAPS. THE WEB IN THIS AREA IS REINFORCED WITH STEEL HAT SECTION STIFFENERS. WHERE THE WING SWEEPBACK BEGINS, THE WEB IS REINFORCED WITH HAT SECTION ALUMINUM ALLOY STIFFENERS OUT TO THE WING TIP. THE WING SPAR IS LOCATED AT 35% OF THE M.A.C. HEAVY GAUGE ALUMINUM ALLOY NOSE RIBS VARY IN CONSTRUCTION IN DETAIL ALONGE OUTER WING SPAN. THE WING RIBS ARE FORMED AND FLANGED ALUMINUM ALLOY. THE COMPRESSION RIBS HAVE SHAPED STIFFENERS RIVETED TO THE WEB. TWO SPANWISE J-SECTION STRINGERS ARE LOCATED FORWARD OF THE MAIN SPAR. ANOTHER SIMILAR STRINGER IS LOCATED BETWEEN THE MAIN AND AUXILIARY SPARS.

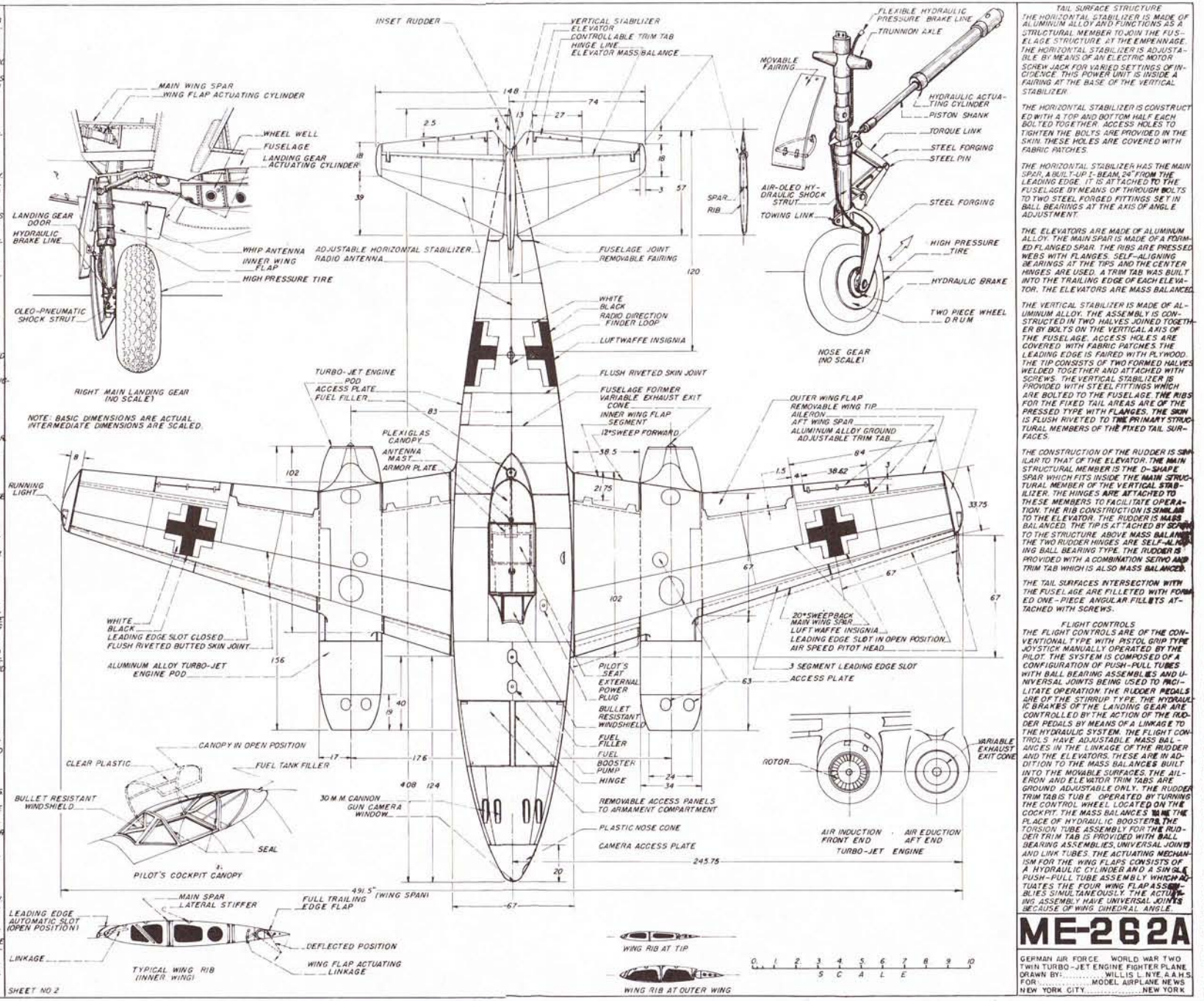
THE AUXILIARY SPAR EXTENDS OUT TO THE WING TIP AND CARRIES THE WING FLAPS AND THE AILERONS. THIS SPAR IS LOCATED 38.5" AFT OF THE MAIN SPAR. ITS WEB IS 12" DEEP. THE SPAR SECTION IS CHANNEL SHAPED. THE WEB IS STIFFENED BY MEANS OF HAT SHAPED MEMBERS RIVETED TO IT.

THE TOP SURFACE OF THE WING HAS A THICKNESS OF .083" AT THE LEADING EDGE AND VARIES TO .080 AT THE TRAILING EDGE. FLUSH RIVETING IS USED TO ATTACH THE SKIN TO THE STRUCTURE.

THE LEADING EDGE OF THE WING IS PROVIDED WITH A WING SLOT THAT OPENS AUTOMATICALLY IN A CLIMB AT 279 M.P.H. IN A GLIDE THE SLOT OPENS AT 186 M.P.H. THE SLOT AIRFOIL ASSEMBLY IS COVERED WITH .040 STEEL SKIN. THE FORMED AIRFOIL OF THE WING AFT OF THE SLOT IS MADE OF .010 SHEET STEEL. THE WING SLOT IS MADE IN 3 ASSEMBLIES, ONE BETWEEN THE FUSELAGE AND THE TURBO-JET ENGINE NACELLE AND BETWEEN THE NACELLE AND THE WING TIP. EACH WING FLAP ASSEMBLY IS ATTACHED TO TWO CURVED STEEL GUIDE TRACKS WHICH SLIDE OVER BALL BEARING ROLLERS ATTACHED TO THE WING NOSE RIBS. RANGE OF MOVEMENT IS 6" AT THE INBOARD PORTION AND 2.62 AT THE WING TIP. THE WING TIP ASSEMBLY IS FABRICATED IN 2 UPPER AND LOWER SUB-ASSEMBLY AND IS RIVETED TO THE OUTER WING STRUCTURE. THE SUB-ASSEMBLIES OF THE WING TIP ARE WELDED TOGETHER.

THE AILERONS ARE MADE OF ALUMINUM ALLOY. A CHANNEL SPAR, ROLLED SHEET ALUMINUM LEADING EDGE AND FORMED FLANGED RIBS. THE AILERONS ARE IN TWO SECTIONS OF 42" AND EACH SECTION IS INTERCONNECTED AT THE CENTER CONTROL BRACKET. SELF-ALIGNING BEARINGS ARE USED AT BRACKETS.

THE WING FLAP ASSEMBLIES ARE MADE IN TWO SECTIONS, THE INBOARD AND THE OUTER SECTION. THE WING FLAPS ARE MADE OF ALUMINUM ALLOY, SIMILAR TO THE AILERONS. IN OPERATION THE WING FLAPS MOVE AFT AND DOWN BY MEANS OF ROLLERS AND GUIDES WHICH SLANT DOWN. THE UPPER SKIN OF THE WING EXTENDS 1.5" OVER THE LEADING EDGE OF THE WING FLAP SO WHEN THE FLAP IS DEPRESSED THIS FUNCTIONS AS A SHROUD AND GUIDES THE AIRFLOW. THE FLAPS ARE ACTUATED BY HYDRAULIC ACTUATING CYLINDERS. THE WING FLAP POSITION INDICATOR IS MARKED AT 0, 10, 20, 30, 40 AND 50 DEGREES. THE WING FLAPS ARE INTERCONNECTED. THE WING FLAPS CANNOT BE OPERATED UNTIL THE LANDING GEAR HAS BEEN EXTENDED AND LOCKED IN POSITION. THE FLAP ACTUATING LINKAGES ARE A SYSTEM OF ALUMINUM ALLOY TUBES AND BELL-CRANKS.



TAIL SURFACE STRUCTURE

THE HORIZONTAL STABILIZER IS MADE OF ALUMINUM ALLOY AND FUNCTIONS AS A STRUCTURAL MEMBER TO JOIN THE FUSELAGE STRUCTURE AT THE EMPENNAGE. THE HORIZONTAL STABILIZER IS ADJUSTABLE BY MEANS OF AN ELECTRIC MOTOR SCREW JACK FOR VARIED SETTINGS OF INCIDENCE. THIS POWER UNIT IS INSIDE A FAIRING AT THE BASE OF THE VERTICAL STABILIZER.

THE HORIZONTAL STABILIZER IS CONSTRUCTED WITH A TOP AND BOTTOM HALF EACH BOLTED TOGETHER. ACCESS HOLES TO TIGHTEN THE BOLTS ARE PROVIDED IN THE SKIN. THESE HOLES ARE COVERED WITH FABRIC PATCHES.

THE HORIZONTAL STABILIZER HAS THE MAIN SPAR, A BUILT-UP I-BEAM, 24" FROM THE LEADING EDGE. IT IS ATTACHED TO THE FUSELAGE BY MEANS OF THROUGH BOLTS TO TWO STEEL FORGED FITTINGS SET IN BALL BEARINGS AT THE AXIS OF ANGLE ADJUSTMENT.

THE ELEVATORS ARE MADE OF ALUMINUM ALLOY. THE MAIN SPAR IS MADE OF A FORMED FLANGED SPAR. THE RIBS ARE PRESSED WEBS WITH FLANGES. SELF-ALIGNING BEARINGS AT THE TIPS AND THE CENTER HINGES ARE USED. A TRIM TAB IS BUILT INTO THE TRAILING EDGE OF EACH ELEVATOR. THE ELEVATORS ARE MASS BALANCED.

THE VERTICAL STABILIZER IS MADE OF ALUMINUM ALLOY. THE ASSEMBLY IS CONSTRUCTED IN TWO HALVES JOINED TOGETHER BY BOLTS ON THE VERTICAL AXIS OF THE FUSELAGE. ACCESS HOLES ARE COVERED WITH FABRIC PATCHES. THE LEADING EDGE IS FAIRED WITH PLYWOOD. THE TIP CONSISTS OF TWO FORMED HALVES WELDED TOGETHER AND ATTACHED WITH SCREWS. THE VERTICAL STABILIZER IS PROVIDED WITH STEEL FITTINGS WHICH ARE BOLTED TO THE FUSELAGE. THE RIBS FOR THE FIXED TAIL AREAS ARE OF THE PRESSED TYPE WITH FLANGES. THE SKIN IS FLUSH RIVETED TO THE PRIMARY STRUCTURAL MEMBERS OF THE FIXED TAIL SURFACES.

THE CONSTRUCTION OF THE RUDDER IS SIMILAR TO THAT OF THE ELEVATOR. THE MAIN STRUCTURAL MEMBER IS THE D-SHAPE SPAR WHICH FITS INSIDE THE MAIN STRUCTURAL MEMBER OF THE VERTICAL STABILIZER. THE HINGES ARE ATTACHED TO THESE MEMBERS TO FACILITATE OPERATION. THE RIB CONSTRUCTION IS SIMILAR TO THE ELEVATOR. THE RUDDER IS MASS BALANCED. THE TIP IS ATTACHED BY SCREWS TO THE STRUCTURE ABOVE MASS BALANCE. THE TWO RUDDER HINGES ARE SELF-ALIGNING BALL BEARING TYPE. THE RUDDER IS PROVIDED WITH A COMBINATION SERVO AND TRIM TAB WHICH IS ALSO MASS BALANCED.

THE TAIL SURFACES INTERSECTION WITH THE FUSELAGE ARE FILLETED WITH FORMED ONE-PIECE ANGULAR FILLETS ATTACHED WITH SCREWS.

FLIGHT CONTROLS

THE FLIGHT CONTROLS ARE OF THE CONVENTIONAL TYPE WITH PISTOL GRIP TYPE JOYSTICK MANUALLY OPERATED BY THE PILOT. THE SYSTEM IS COMPOSED OF A CONFIGURATION OF PUSH-PULL TUBES WITH BALL BEARING ASSEMBLIES AND UNIVERSAL JOINTS BEING USED TO FACILITATE OPERATION. THE RUDDER PEDALS ARE OF THE STIRRUP TYPE. THE HYDRAULIC BRAKES OF THE LANDING GEAR ARE CONTROLLED BY THE ACTION OF THE RUDDER PEDALS BY MEANS OF A LINKAGE TO THE HYDRAULIC SYSTEM. THE FLIGHT CONTROLS HAVE ADJUSTABLE MASS BALANCES IN THE LINKAGE OF THE RUDDER AND THE ELEVATORS. THESE ARE IN ADDITION TO THE MASS BALANCES BUILT INTO THE MOVABLE SURFACES. THE AILERON AND ELEVATOR TRIM TABS ARE GROUND ADJUSTABLE ONLY. THE RUDDER TRIM TAB IS TUBE OPERATED BY TURNING THE CONTROL WHEEL LOCATED ON THE COCKPIT. THE MASS BALANCES TAKE THE PLACE OF HYDRAULIC BOOSTERS. THE TORSION TUBE ASSEMBLY FOR THE RUDDER TRIM TAB IS PROVIDED WITH BALL BEARING ASSEMBLIES, UNIVERSAL JOINTS AND LINK TUBES. THE ACTUATING MECHANISM FOR THE WING FLAPS CONSISTS OF A HYDRAULIC CYLINDER AND A SINGLE PUSH-PULL TUBE ASSEMBLY WHICH ACTUATES THE FOUR WING FLAP ASSEMBLIES SIMULTANEOUSLY. THE ACTUATING ASSEMBLY HAS UNIVERSAL JOINTS BECAUSE OF WING DIHEDRAL ANGLE.

ME-262A

GERMAN AIR FORCE. WORLD WAR TWO TWIN TURBO-JET ENGINE FIGHTER PLANE.
DRAWN BY:..... WILLIS L. NYE, A.A.H.S.
FOR:..... MODEL AIRPLANE NEWS
NEW YORK CITY..... NEW YORK

MESSERSCHMITT ME 262 SWALLOW

LANDING GEAR

THE TRICYCLE LANDING GEAR IS FULLY RETRACTABLE BY MEANS OF HYDRAULIC ACTUATING CYLINDERS. THE MAIN LANDING GEAR ASSEMBLY IS HINGED TO A BUILT UP STEEL BOX STRUCTURE WHICH IS PART OF THE MAJOR WING ASSEMBLY. THE STEEL BOX STRUCTURE IS LOCATED BETWEEN THE MAIN AND AUXILIARY WING SPARS. THE MAIN WHEELS ROTATE UP AND INTO THE FUSELAGE BOTTOM. A VALVE IS ACTUATED AFTER THE WHEELS RETRACT WHICH CAUSES THE LANDING GEAR FAIRING DOORS TO CLOSE, FAIR THE WHEEL OPENING AND ALSO FUNCTION AS AN UP-LOCK. A SINGLE CANTILEVER SHOCK STRUT 26" LONG OF FORGED STEEL CARRIES EACH MAIN LANDING GEAR. A TORQUE LINK OF FORGED STEEL PERMITS 20° TRAVEL. A 1200 P.S.I. HYDRAULIC SYSTEM ACTUATES THE LANDING GEAR. THE ACTUATING CYLINDER IS BOLTED TO A HINGED FITTING TO THE ROOT RIB AT THE END OF THE FRONT SPAR OF THE LANDING GEAR TORQUE BOX. THE PISTON OF THE ACTUATING CYLINDER IS ATTACHED TO THE FRONT OF THE SHOCK STRUT.

THE NOSE GEAR RETRACTS AFT AND UP INTO A WHEEL WELL COMPARTMENT. A LINKAGE CLOSES THE NOSE GEAR DOORS. EITHER A TORQUE LINK OR A SHIMMY DAMPER WAS PROVIDED TO ELIMINATE SHIMMY ACTION.

HYDRAULIC SYSTEM

THE HYDRAULIC SYSTEM IS A MEDIUM PRESSURE TYPE, BEING 1200 P.S.I. FOR NORMAL OPERATION. THE SYSTEM SUPPLIES MOTIVE FORCE TO OPERATE THE RETRACTABLE LANDING GEAR AND WING FLAPS. AN ENGINE-DRIVEN HYDRAULIC PRESSURE PUMP SUPPLIES THE HYDRAULIC POWER. THE WING FLAPS AND LANDING GEAR ARE OPERATIVE BY MEANS OF MANUALLY OPERATED POSITION SELECTOR VALVES. THE SYSTEM ALSO OPERATED THE HYDRAULIC BRAKES FITTED TO THE LANDING GEAR. A MANUALLY OPERATED HYDRAULIC BRAKE WAS FITTED TO THE NOSE GEAR. THE HYDRAULIC BRAKES ON THE MAIN LANDING GEAR OPERATED BY THE PILOT'S TOE ACTION OF THE RUDDER PEDALS. THE BRAKES MAY ALL BE APPLIED SIMULTANEOUSLY OR INDIVIDUALLY. THE INNER MAIN WHEEL WELL DOORS ARE ALSO OPERATED OFF THE HYDRAULIC SYSTEM. THE PRESSURE PUMP IS DRIVEN BY THE LEFT TURBO-JET ENGINE. THE PRESSURE IS MAINTAINED BY AN ELECTRIC-MAGNETIC PRESSURE REGULATOR.

EMERGENCY SYSTEM

EMERGENCY EXTENSION OF THE LANDING GEAR AND WING FLAPS IS ACCOMPLISHED BY MEANS OF A PNEUMATIC SYSTEM. AIR UNDER PRESSURE FUNCTIONS TO ENERGIZE THE SYSTEM. THE OPERATION IS CONTROLLED BY A MAGNETIC SOLENOID VALVE.

AIR INDUCTION SYSTEM

THE INDUCTED AIR FLOWS INTO THE NOSE COWLING OF EACH TURBO-JET ENGINE AND THEN INTO THE COMPRESSOR.

AIR EDUCTION SYSTEM

THE COMBUSTED AIR EXHAUST FLOWS FROM THE COMBUSTION CHAMBER THROUGH THE TURBINE AND EDUCTS FROM THE TAIL PIPE.

TURBO-JET ENGINE CONTROLS

THE AMOUNT OF THRUST ENERGY DEVELOPED BY THE TURBO-JET ENGINE IS IN DIRECT PROPORTION TO THE FUEL WHICH IS SUPPLIED TO THE BURNERS. THE ENGINE THROTTLES ARE MOUNTED ON THE LEFT SIDE OF THE COCKPIT. THE THROTTLE MOVEMENT IS FORE AND AFT. THE AFT POSITION SHUTTING OFF THE FUEL.

TURBO-JET ENGINE MOUNT

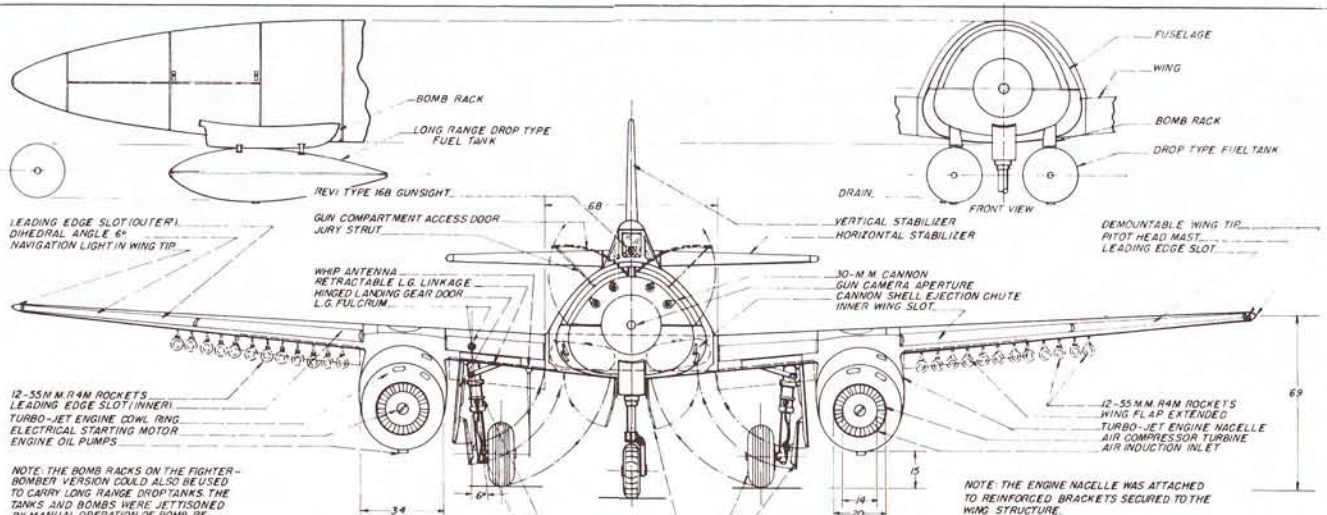
THE ENGINE IS MOUNTED ON THREE SHOCK ABSORBING FITTINGS. THE RIGHT AND LEFT FITTINGS ARE ATTACHED TO A STRUCTURAL HORIZONTAL MEMBER WHICH IN TURN IS ATTACHED TO STRUCTURAL NOSE RIBS IN THE LEADING EDGE OF THE WING. THE AFT MOUNTING IS ON THE FRONT WING SPAR.

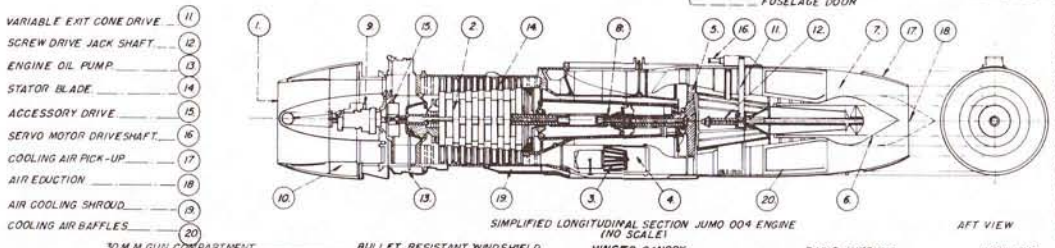
MAIN LANDING GEAR WHEELS

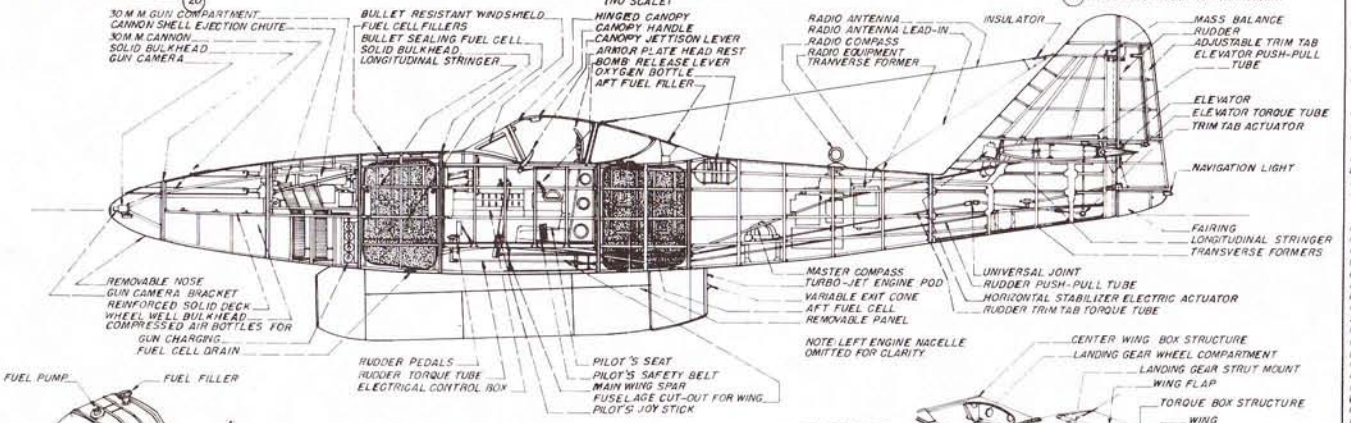
THE WHEEL ASSEMBLY CONSISTS OF AN 840 X 300 M.M. TIRE AND TUBE. THE WHEEL ASSEMBLY COMPRISES TWO PARTS WHICH ARE BOLTED TOGETHER TO FACILITATE QUICK TIRE CHANGING. THE BRAKES ARE AN EXPANDING BAND TYPE. THE WHEEL ASSEMBLY IS MOUNTED ON THE AXLE WITH A SET OF ROLLER BEARINGS ON EACH SIDE. THE TIRES ARE INFLATED TO 70 LBS. P.S.I. AND ARE A LOW PRESSURE TREADED CASING.

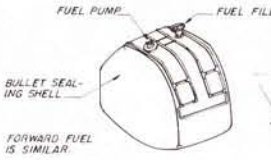
PARKING BRAKE

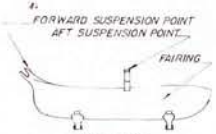
NO PARKING BRAKE OR TIE-DOWN FITTINGS ARE INSTALLED IN THIS AIRPLANE.

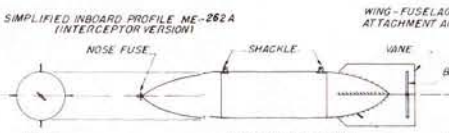


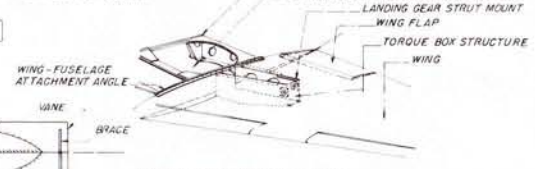












DETAILS OF 250 K.G. BOMB

SCALE: 0 1 2 3 4 5 6 7

SHEET NO 3

FUEL SYSTEM

THE FUEL SYSTEM CONSISTS OF THE FOLLOWING MAJOR COMPONENTS:

FRONT MAIN CELL 240 GALLONS
REAR MAIN CELL 204 "
FRONT AUX CELL 53 "
REAR AUX CELL 158 "
ELECTRICAL FUEL PUMPS.
FUEL LINES AND CHECK VALVES.
FUEL SELECTOR VALVES.
FUEL SHUT-OFF VALVE.
FUEL QUANTITY INDICATORS.
ELECTRICAL FUEL BOOSTER PUMPS.

THE FUEL CELLS ARE SELF-SEALING. THE OUTER SHELL WAS A FIRE RESITANT PLYWOOD. EACH FUEL CELL HAS TWO FUEL BOOSTER PUMPS. THE RESERVE FUEL CELL HAS ONE. BY MEANS OF THE FUEL SELECTOR VALVES, FUEL CAN BE PUMPED FROM ANY TANK TO EITHER ENGINE. FUEL CAN ALSO BE TRANSFERED FROM THE AFT CELLS TO THE FORWARD CELLS FOR PURPOSES OF LONGITUDINAL TRIM. ACCESS PANELS PERMIT THE FUEL CELLS TO BE MAINTAINED OR REPLACED. THE TWO FUEL VALVES CONTROLLING THE FUEL FLOW HAVE 3 SETTINGS ON A NOTCHED QUADRANT. TWO THROTTLE CONTROL ENGINE SPEED.

ENGINE OIL SYSTEM

AN ENGINE LUBRICATING OIL TANK OF 2.5 GALLON CAPACITY CARRIES THE OIL. TWO ENGINE-DRIVEN OIL PUMPS TRANSFER OIL TO THE COMPRESSOR BEARINGS, THE ACCESSORY DRIVE GEARS AND OTHER MOVING PARTS. A SEPARATE ELECTRICAL OIL PUMP SUPPLIED OIL TO THE AFT COMPRESSOR BEARINGS AND TURBINE BEARINGS.

INSTRUMENTATION

THE MAIN INSTRUMENT PANEL IS DIVIDED INTO TWO SECTIONS, THE FLIGHT INSTRUMENTS ARE LOCATED ON THE LEFT PANEL AND THE ENGINE INSTRUMENTS BEING LOCATED ON THE RIGHT PANEL.

FLIGHT INSTRUMENTS

ARTIFICIAL HORIZON.
BANK AND TURN INDICATOR.
AIR SPEED INDICATOR.
ALTIMETER.
RATE OF CLIMB INDICATOR.
REPEATER COMPASS.
BLIND APPROACH INDICATOR.
RADIO COMPASS.

ENGINE INSTRUMENTS

ENGINE TACHOMETERS (2).
TAIL PIPE GAS TEMPERATURE THERMOMETER.
FUEL INJECTION PRESSURE INDICATORS (2).
FUEL QUANTITY INDICATORS.
FUEL CONSUMPTION COUNTERS.
FREE AIR TEMPERATURE BULB SELECTOR.
FREE AIR TEMPERATURE THERMOMETER.
HYDRAULIC PRESSURE INDICATOR.

PILOT'S CONTROLS.

VENTILATION CONTROL.
BREATHING OXYGEN CONTROL VALVE.
BREATHING OXYGEN INDICATOR AND FLOWMETER.
FUEL SHUT-OFF AND SELECTOR VALVES.
ENGINE THROTTLES (2).
EMERGENCY LANDING GEAR CONTROL.
EMERGENCY WING FLAP CONTROL.
HORIZONTAL STABILIZER TRIM CONTROL.
RUDDER TRIM CONTROL.
CANOPY RELEASE CONTROL.
BOMB RELEASE.
NOSE WHEEL BRAKE AND WHEEL BRAKES.

POSITION INDICATORS.

HORIZONTAL STABILIZER TRIM.
LEFT MAIN LANDING GEAR.
RIGHT MAIN LANDING GEAR.
RUDDER TRIM TAB.

ELECTRICAL CONTROLS

FUEL TRANSFER PUMP (2).
RADIO - FU G-16.
RADIO - FU G-25A.
RECOGNITION LIGHTS.
PITOT HEATER.
HORIZONTAL STABILIZER TRIM.
INVERTER SWITCH.
RIGHT AND LEFT GENERATORS.
STORAGE BATTERY.
RIGHT AND LEFT FUEL MANIFOLD DRAINS.
RADIO CONTROL BOX.
RIGHT AND LEFT REIDEL STARTERS.
RIGHT AND LEFT TACHOMETER RANGE.
HEAD PHONE VOLUME CONTROL.
FLARE RELEASE.
WINDSHIELD HEATER SWITCH.
NAVIGATION LIGHTS.
DIRECTIONAL FINDER.
GUN CAMERA.
CANNON FIRING SWITCH.

THE MAIN ELECTRICAL SWITCH BOX WAS LOCATED ON LEFT SIDE OF THE PILOT'S COCKPIT.

ME-262A

GERMAN AIR FORCE WORLD WAR TWO TWIN TURBO-JET ENGINE FIGHTER PLANE
DRAWN BY.....WILLIS L. NYE A.A.H.S.
FOR.....MODEL AIRPLANE NEWS
NEW YORK CITY.....NEW YORK

MESSERSCHMITT ME 262 SWALLOW

COMMUNICATION EQUIPMENT

THE RADIO COMMUNICATION EQUIPMENT CONSISTED OF THE FOLLOWING:

VHF RADIO TRANSMITTER.
RADIO DIRECTION FINDER
I.F.F.
RETRANSMISSION EQUIPMENT GROUND CONTROL STATION
ANTENNA.
MICROPHONE.
RADIO RECEIVER.

ARMAMENT INSTALLATION

THE ARMAMENT CONSISTS OF FOUR MK-108 30-MILLIMETER CANNON MOUNTED HIGH IN THE NOSE OF THE FUSELAGE. THE CANNON IS 42" LONG MAKING A COMPACT INSTALLATION. THE CANNON BARRELS WERE FITTED WITH BLAST TUBES. ACCESS TO THE ARMAMENT INSTALLATION IS ATTAINED BY LATCHED HINGED DOORS. THE EJECTOR CHUTES FOR SPENT PROTILE CARTRIDGES DISCHARGES THESE AT THE LOWER SIDE OF THE FUSELAGE. THE AMMUNITION IS FED TO THE GUNS IN DRUMS. THE GUNS ARE SIGHTED TO CONVERGE 450 METERS AHEAD OF THE AIRPLANE. THE UPPER GUNS HAVE 100 ROUNDS AND THE GUNS HAVE 80 ROUNDS OF AMMUNITION. EACH GUN CAN FIRE 600 OR MORE ROUNDS OF AMMO PER MINUTE. THE GUNS ARE FIRED ELECTRICALLY. THE PILOT FIRES THE GUNS ELECTRICALLY BY MEANS OF A TRIGGER SWITCH MOUNTED ON THE JOY STICK. THE MUZZLE VELOCITY WAS 1570 F.P.S. AND EACH GUN WEIGHED 134 POUNDS.

GUN CHARGERS

THE GUN CHARGERS WERE OPERATED BY A PNEUMATIC SYSTEM USING COMPRESSED AIR. THE AIR IS CONTAINED IN 8 AIR FLASKS IN THE ARMAMENT COMPARTMENT.

BOMB RACKS

TWO JETTISONABLE TYPE BOMB RACKS WERE INSTALLED EACH CAPABLE OF CARRYING A 550 POUND BOMB. THE SELECTOR AND FUSING SWITCHES WERE LOCATED ON A CENTRAL PANEL BENEATH THE MAIN INSTRUMENT PANEL. THE BOMB RELEASE LEVER WAS LOCATED ON THE RIGHT SIDE OF THE COCKPIT. THIS LEVER ALSO RELEASES THE BOMB RACKS.

ROCKET PROJECTILES

PROVISION WAS ALSO MADE TO CARRY 12 R4M 5CM. ROCKETS UNDER EACH WING. THE ROCKETS WERE FIRED ELECTRICALLY. THE ROCKETS COULD BE FIRED SINGLY OR IN RIPPLE SALVO.

GUN CAMERA

THE GUN CAMERA WAS INSTALLED IN THE NOSE CONE. THE SHUTTER SPEED WAS SYNCHRONIZED WITH THE FIRING RATE OF THE CANNON. OPERATION OF THE FIRING SWITCH TURNED ON THE CAMERA.

GUN SIGHT

A REVI TYPE GUN SIGHT IS MOUNTED ABOVE MAIN INSTRUMENT PANEL. IT IS IN THE PILOT'S LINE OF VISION BUT IT IS SWUNG TO THE RIGHT SIDE DURING TAKE-OFF AND LANDING OPERATIONS.

JACK POINTS

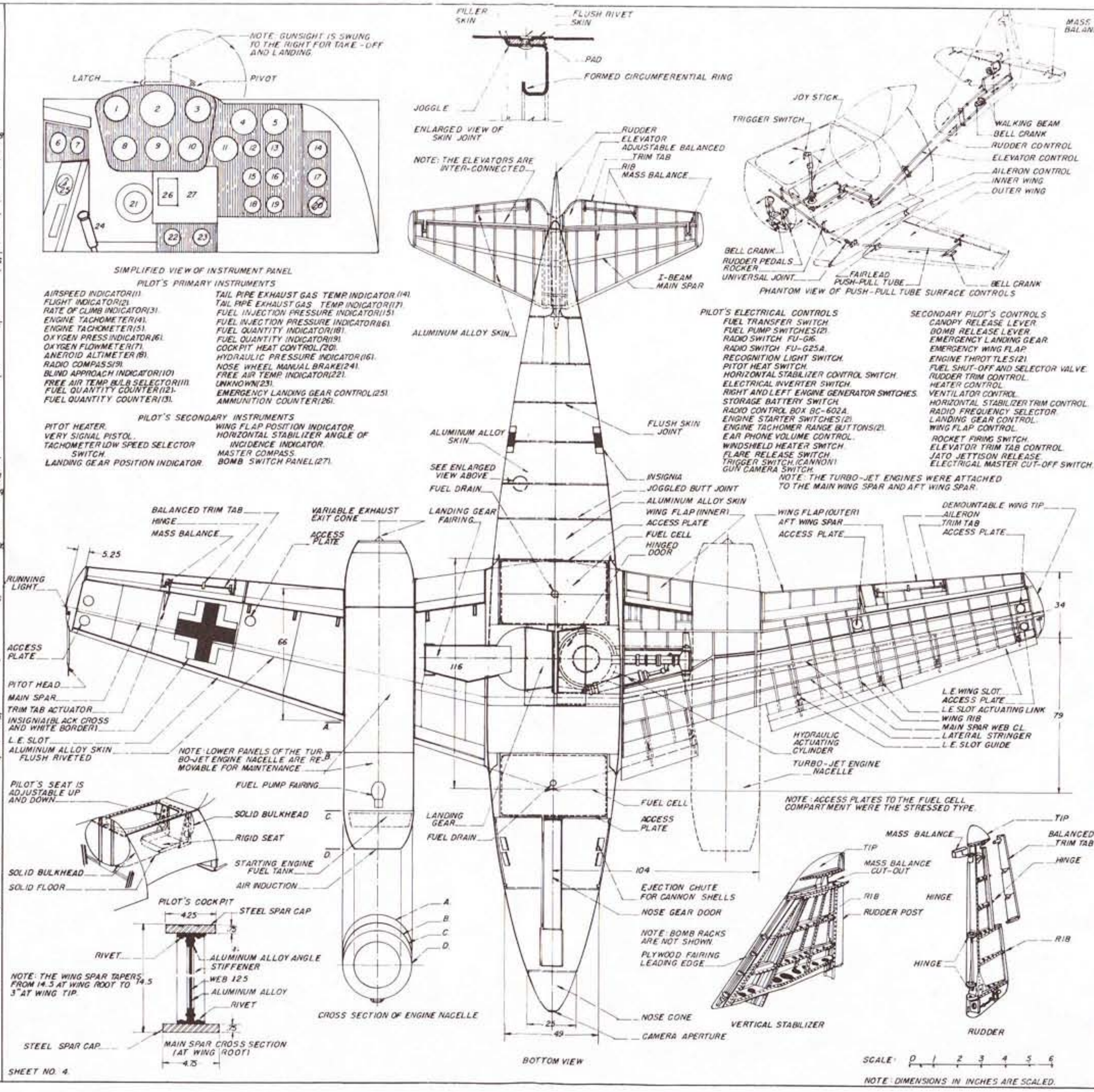
THE AIRPLANE IS JACKED AT FOUR PADS. TWO PADS ARE LOCATED ON THE UNDERSIDE OF EACH WING OUTBOARD OF THE ENGINE NACELLE. A PAD IS ALSO LOCATED ON THE UNDERSIDE OF THE FUSELAGE NEAR THE NOSE AND FORWARD OF THE LANDING GEAR AND AFT OF THE COCKPIT FORWARD OF THE TAIL SURFACE.

LANDING GEAR FAIRING

THE LANDING GEAR FAIRING FOR THE MAIN WHEELS AND STRUT ASSEMBLY IS BUILT IN TWO SECTIONS BOTH OF WHICH ARE DOUBLE-SKINNED FORMED GRID STRUCTURES. THE TOP ASSEMBLY IS HINGED TO THE WING TORQUE BOX STRUCTURE. THE LOWER FAIRING IS BOLTED TO A BRACKET WELDED TO THE OLEO PISTON ABOVE THE AXLE. THE FAIRING DOORS HINGED TO THE CENTERLINE OF FUSELAGE ARE ALSO A DOUBLE-SKIN GRID ASSEMBLY. THESE DOORS ARE ACTUATED BY HYDRAULIC POWER WHEN THE LANDING GEAR IS RETRACTED. THE FAIRING ON THE NOSE GEAR ASSEMBLY IS SIMILAR THOSE ON THE MAIN LANDING GEAR.

LANDING GEAR DOWNLOCKS

LANDING GEAR DOWNLOCKS ARE INCORPORATED IN THE HYDRAULIC ACTUATING CYLINDERS. PRESSURE ON THE PISTON HOLDS THE LANDING GEAR IN A FIXED POSITION. THE UP-LOCKS FUNCTION IN A SIMILAR MANNER. NO PARKING BRAKE IS PROVIDED. NO MEANS ARE PROVIDED TO THE PILOT FOR LOCKING THE CONTROL SURFACES. MANUALLY ATTACHED WOODEN CHOCKS ARE USED INSTEAD. NO TIE DOWN FITTINGS ARE PROVIDED.


LATCH
NOTE: GUNSIGHT IS SWUNG TO THE RIGHT FOR TAKE-OFF AND LANDING.
PIVOT
SIMPLIFIED VIEW OF INSTRUMENT PANEL
PILOT'S PRIMARY INSTRUMENTS
AIRSPEED INDICATOR(1).
FLIGHT INDICATOR(2).
RATE OF CLIMB INDICATOR(3).
ENGINE TACHOMETER(4).
ENGINE TACHOMETER(5).
OXYGEN PRESS.INDICATOR(6).
OXYGEN FLOWMETER(7).
ANEROID ALTIMETER (8).
RADIO COMPASS(9).
BLIND APPROACH INDICATOR(10).
FREE AIR TEMP. BULB SELECTOR(11).
FUEL QUANTITY COUNTER(12).
FUEL QUANTITY COUNTER(13).
TAIL PIPE EXHAUST GAS TEMP. INDICATOR (14).
TAIL PIPE EXHAUST GAS TEMP. INDICATOR(17).
FUEL INJECTION PRESSURE INDICATOR(15).
FUEL INJECTION PRESSURE INDICATOR(16).
FUEL QUANTITY INDICATOR(18).
FUEL QUANTITY INDICATOR(19).
COCKPIT HEAT CONTROL (20).
HYDRAULIC PRESSURE INDICATOR(16).
NOSE WHEEL MANUAL BRAKE(24).
FREE AIR TEMP. INDICATOR(22).
UNKNOWN(23).
EMERGENCY LANDING GEAR CONTROL(25).
AMMUNITION COUNTER(26).
PILOT'S SECONDARY INSTRUMENTS
PITOT HEATER.
VERY SIGNAL PISTOL.
TACHOMETER LOW SPEED SELECTOR SWITCH.
LANDING GEAR POSITION INDICATOR.
WING FLAP POSITION INDICATOR.
HORIZONTAL STABILIZER ANGLE OF INCIDENCE INDICATOR.
MASTER COMPASS.
BOMB SWITCH PANEL(27).
FILLER SKIN
FLUSH RIVET SKIN
PAD
FORMED CIRCUMFERENTIAL RING
JOGGLE
ENLARGED VIEW OF SKIN JOINT
NOTE: THE ELEVATORS ARE INTER-CONNECTED.
RUDDER
ELEVATOR
ADJUSTABLE BALANCED TRIM TAB
RIB
MASS BALANCE
I-BEAM MAIN SPAR
ALUMINUM ALLOY SKIN
JOY STICK
TRIGGER SWITCH
WALKING BEAM
BELL CRANK
RUDDER CONTROL
ELEVATOR CONTROL
AILERON CONTROL
INNER WING
OUTER WING
MASS BALANCE
BELL CRANK
RUDDER PEDALS
ROCKER
UNIVERSAL JOINT
FAIRLEAD
PUSH-PULL TUBE
BELL CRANK
PHANTOM VIEW OF PUSH-PULL TUBE SURFACE CONTROLS
PILOT'S ELECTRICAL CONTROLS
FUEL TRANSFER SWITCH.
FUEL PUMP SWITCHES(2).
RADIO SWITCH FU-G16.
RADIO SWITCH FU-G25A.
RECOGNITION LIGHT SWITCH.
PITOT HEAT SWITCH.
HORIZONTAL STABILIZER CONTROL SWITCH.
ELECTRICAL INVERTER SWITCH.
RIGHT AND LEFT ENGINE GENERATOR SWITCHES.
STORAGE BATTERY SWITCH.
RADIO CONTROL BOX BC-602A.
ENGINE STARTER SWITCHES(2).
ENGINE TACHOMER RANGE BUTTONS(2).
EAR PHONE VOLUME CONTROL.
WINDSHIELD HEATER SWITCH.
FLARE RELEASE SWITCH.
TRIGGER SWITCH(CANNON).
GUN CAMERA SWITCH.
SECONDARY PILOT'S CONTROLS
CANOPY RELEASE LEVER.
BOMB RELEASE LEVER.
EMERGENCY LANDING GEAR.
EMERGENCY WING FLAP.
ENGINE THROTTLES(2).
FUEL SHUT-OFF AND SELECTOR VALVE.
RUDDER TRIM CONTROL.
HEATER CONTROL.
VENTILATOR CONTROL.
HORIZONTAL STABILIZER TRIM CONTROL.
RADIO FREQUENCY SELECTOR.
LANDING GEAR CONTROL.
WING FLAP CONTROL.
ROCKET FIRING SWITCH.
ELEVATOR TRIM TAB CONTROL.
JATO JETTISON RELEASE.
ELECTRICAL MASTER CUT-OFF SWITCH.
NOTE: THE TURBO-JET ENGINES WERE ATTACHED TO THE MAIN WING SPAR AND AFT WING SPAR.
ALUMINUM ALLOY SKIN.
FLUSH SKIN JOINT
SEE ENLARGED VIEW ABOVE
FUEL DRAIN
INSIGNIA
JOGGLED BUTT JOINT
ALUMINUM ALLOY SKIN
WING FLAP (INNER)
ACCESS PLATE
FUEL CELL
HINGED DOOR
LANDING GEAR FAIRING
BALANCED TRIM TAB
HINGE
MASS BALANCE
VARIABLE EXHAUST EXIT CONE
ACCESS PLATE
WING FLAP (OUTER)
AFT WING SPAR
ACCESS PLATE
DEMOUNTABLE WING TIP
AILERON
TRIM TAB
ACCESS PLATE
5.25
RUNNING LIGHT
ACCESS PLATE
PITOT HEAD
MAIN SPAR
TRIM TAB ACTUATOR
INSIGNIA (BLACK CROSS AND WHITE BORDER)
L.E. SLOT
ALUMINUM ALLOY SKIN FLUSH RIVETED
66
116
34
79
L.E. WING SLOT
ACCESS PLATE
L.E. SLOT ACTUATING LINK
WING RIB
MAIN SPAR WEB CL.
LATERAL STRINGER
L.E. SLOT GUIDE
HYDRAULIC ACTUATING CYLINDER
TURBO-JET ENGINE NACELLE
NOTE: LOWER PANELS OF THE TURBO-JET ENGINE NACELLE ARE REMOVABLE FOR MAINTENANCE.
PILOT'S SEAT IS ADJUSTABLE UP AND DOWN.
FUEL PUMP FAIRING
SOLID BULKHEAD
RIGID SEAT
STARTING ENGINE FUEL TANK
AIR INDUCTION
SOLID BULKHEAD
SOLID FLOOR
PILOT'S COCKPIT
LANDING GEAR
FUEL DRAIN
FUEL CELL
ACCESS PLATE
NOTE: ACCESS PLATES TO THE FUEL CELL COMPARTMENT WERE THE STRESSED TYPE.
104
EJECTION CHUTE FOR CANNON SHELLS
NOSE GEAR DOOR
NOTE: BOMB RACKS ARE NOT SHOWN.
PLYWOOD FAIRING LEADING EDGE
NOSE CONE
CAMERA APERTURE
25
49
BOTTOM VIEW
A
B
C
D
CROSS SECTION OF ENGINE NACELLE
STEEL SPAR CAP
4.25
RIVET
ALUMINUM ALLOY ANGLE STIFFENER
WEB .125
ALUMINUM ALLOY
RIVET
14.5
NOTE: THE WING SPAR TAPERS FROM 14.5 AT WING ROOT TO 3" AT WING TIP.
STEEL SPAR CAP
MAIN SPAR CROSS SECTION (AT WING ROOT)
4.75
MASS BALANCE
TIP
MASS BALANCE CUT-OUT
RIB
RUDDER POST
HINGE
VERTICAL STABILIZER
TIP
BALANCED TRIM TAB
HINGE
RIB
HINGE
RUDDER
SCALE: 0 1 2 3 4 5 6
NOTE: DIMENSIONS IN INCHES ARE SCALED.
SHEET NO. 4

FUSELAGE STRUCTURE

THE FUSELAGE STRUCTURE WAS CONSTRUCTED OF ALUMINUM ALLOY. A SEMI-MONOCOQUE CONFIGURATION IS USED. THE STRUCTURAL CONFIGURATION CONSISTS OF BULKHEADS, HOOP FRAMES, LONGERONS AND STRINGERS. THE ENTIRE STRUCTURE COMPRISES FOUR MAJOR SUB-ASSEMBLIES ALL OF WHICH ARE BOLTED TOGETHER, I.E. THE NOSE SECTION, PILOT'S COCKPIT, AFT SECTION, AND THE EMPENNAGE. THE NOSE SECTION IS DETACHABLE SO VARIOUS TYPES OF WEAPONRY MAY BE USED. THE TAIL CONE IS ALSO REMOVABLE. ALTHOUGH THE COCKPIT WAS DESIGNED FOR PRESSURIZATION, NO PRESSURIZATION WAS USED. NO FORE AND AFT ADJUSTMENT WAS POSSIBLE FOR THE PILOT'S SEAT OR RUDDER PEDALS. THE PILOT'S WINDSHIELD CONSISTED OF LAMINATED PLATE GLASS 3.5" THICK. THE COCKPIT CANOPY IS MADE OF CLEAR PLASTIC MOUNTED IN A FRAME. IT PIVOTS ON A FRAME ON THE RIGHT SIDE TO PERMIT ENTRY OR EXIT. THE CANOPY IS LOCKED BY THE PILOT ON THE INSIDE. A SEAL IS PROVIDED. FOR EMERGENCY PILOT BAIL-OUT, THE CANOPY WAS JETTISONED. FORE AND AFT OF THE COCKPIT, A 238 GALLON FUEL CELL IS INSTALLED. ACCESS TO THESE FUEL CELLS IS POSSIBLE BY REMOVABLE ACCESS PLATES ON THE UNDERSIDE OF THE FUSELAGE.

THE FUSELAGE STRUCTURE HAS NO LONGERONS BUT LONGITUDINAL STRINGERS ARE USED TO STABILIZE THE SKIN STRUCTURE. THE TRANSVERSE FORMERS ARE AN INTEGRAL PART OF THE EXTERIOR SKIN SHEETS. THESE ARE JOGGLED TO THE THICKNESS OF METAL FOR LAP JOINT, THE FORMED INWARD TO MAKE A JAY OR CHANNEL SECTION. THE SKIN JOINTS AT THE JOGGLE WERE SMOOTHED WITH A FILLER MATERIAL. THE BULKHEADS WERE SHEET STEEL OR ALUMINUM ALLOY SHEET. SHEET STEEL SKIN .08" THICK WAS USED TO COVER THE ARMAMENT COMPARTMENT. THE FUSELAGE FUEL CELLS ARE ARMORED FORE AND AFT. THIS ARMOR ALSO FUNCTIONS TO PROTECT THE PILOT. THE COCKPIT WAS PROVIDED WITH A MANUALLY CONTROLLABLE FRESH AIR VENTILATOR.

CONTROL SURFACE MOVEMENT

THE CONTROL SURFACE MOVEMENTS ARE AS FOLLOWS:

AILERONS........20°
ELEVATORS........35°
ELEVATOR TRIM TAB........35°
RUDDER........30°
RUDDER TRIM TAB AT 30° DEFLECTION OF RUDDER........18°
RUDDER TRIM TAB AT 0° DEFLECTION OF RUDDER........20°
WING FLAPS........50° MAXIMUM.

OXYGEN EQUIPMENT

A LOW PRESSURE OXYGEN SYSTEM IS INSTALLED FOR USE OF THE PILOT.

MISCELLANEOUS EQUIPMENT

DATA CASE.
PILOT'S RELIEF TUBE.
VERY PISTOL AND CARTRIDGES.
SEAT TYPE PARACHUTE PACK.
SEAT BELT AND SHOULDER HARNESS.
MAP CASE.
HEADPHONES.
THROAT MICROPHONE.
OXYGEN MASK.

MISSLE ARMAMENT

THE MODEL ME-262A-1B WAS FITTED WITH 24 5CM TYPE R4M MISSLE. THE MISSLES WERE FIRED ELECTRICALLY. THE MISSLES HAD AN OPERATING RANGE GREATER THAN THE DEFENSIVE RANGE OF A 50 CALIBER MACHINE GUN ON B-17 AIRCRAFT. THE MISSILES WERE AIMED BY POINTING THE AIRPLANE AT THE TARGET. THE MISSILE WOULD EXPLODE ON CONTACT. THE MISSLES COULD BE FIRED IN PAIRS OR IN RIPPLE SALVO.

ROCKETS FOR TAKE-OFF

FOR SPECIALIZED MISSIONS, TWO 1100 POUND THRUST ROCKETS WERE FITTED TO ASSIST TAKE-OFF WITH A HEAVY BOMB LOAD.

FLIGHT CHARACTERISTICS

THE ME-262A WAS TRIMMED NOSE HEAVY IN FLIGHT. IT HAD GOOD STALL RECOVERY AND COULD BE SPUN AND RECOVERED HANDILY. THE PERFORMANCE IN HIGH SPEED TURNS WAS EXCELLENT. HOWEVER, IT SELDOM FOUGHT ABOVE 30,000 FEET BECAUSE THE POSSIBILITY OF ENGINE FLAMEOUT.

ME-262A

GERMAN AIR FORCE.....WORLD WAR TWO
TWIN TURBO-JET ENGINE FIGHTER PLANE
DRAWN BY:..........WILLIS L. NYE, A.A.H.S.
FOR:..........MODEL AIRPLANE NEWS
NEW YORK CITY..........NEW YORK

MITSUBISHI A6M ZERO

A restored Mitsubishi A6M-5C Zeke 52. Its markings are more accurate than on most restorations, but the rear fuselage doesn't match the drawing.

THE Mitsubishi A6M, called "Zero", "Zeke" and "Hamp" by the Allies, was one of the major technological surprises sprung by the Japanese in WW II. Because they had long been contemptuously regarded as being capable only of copying foreign airplane designs, their highly original, carrier-based fighter was startling.

The designation "Zero" came from the Japanese Navy practice of designating airplane types by the last two digits of the Japanese Dynastic calendar. The Japanese year 2600 matched our calendar year 1940, so "00," was shortened to "Type 0" for the A6M, which was named "Raiden." The naval model designation of "A6M" reflected the sixth A-model built by Mitsubishi (M). The sub-designation for the A6M-1 was Model 11, while the A6M-2 became Model 21, and the A6M-3 became Model 32, etc. The Allies also referred to it broadly as "The Zero," but when code names were applied to Japanese military aircraft, the standard models were called "Zeke," and the short-wing Model 32 was called "Hamp."

The prototype, which was powered by a 780hp Mitsubishi Zuisei engine, flew April 1, 1939, and was quickly ordered into production as Type 0 fighter Model 11. It entered combat in China in July 1940. Allied Intelligence reported on its capabilities, but the warnings were disregarded, which caused later regrets.

For two years, the Zero was superior to any plane it fought. It was fast and highly maneuverable and, thanks to its auxiliary fuel tanks, it had long range. Its shortcomings included a lack of armor protection for the pilot, a light structure and fuel tanks that weren't self-sealing. The Zero was also highly vulnerable to the .50-caliber guns of U.S. fighters—when they were able to hit it.

Its initial armament was two 7.7mm machine guns in the nose and two 20mm cannon in the wings. Armament varied during production to a maximum of a single 13.2mm gun in the nose, two more in the wings, plus the two cannon. Its bomb load ranged from two 132-pound bombs to a single 1,102-pounder, or up to eight 22-pounders. Late -6 and -8 versions could also be fitted with rockets.

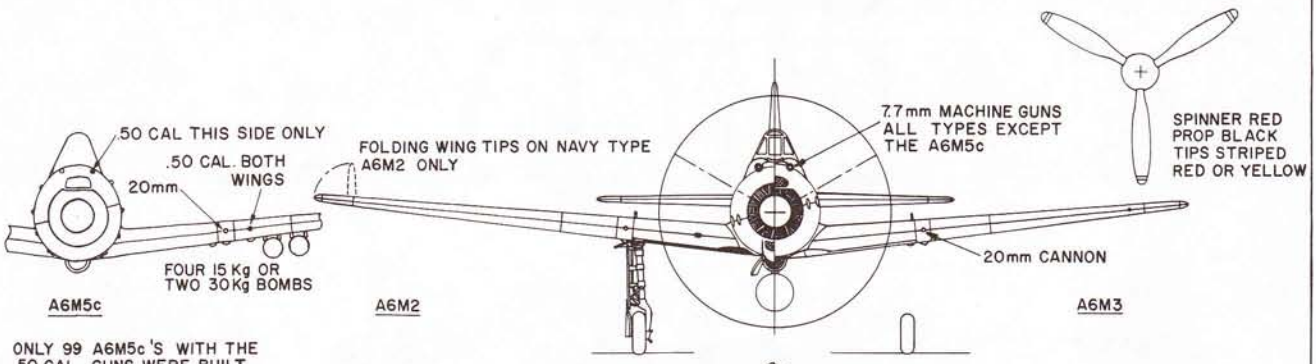
Although it was obsolete by mid-1943, when new Allied fighters opposed it, the Zero remained in production until the end of the war, with 3,879 built by Mitsubishi and 6,570 built under license by Nakajima, for a total of 10,449.

Most Zeroes—Models 11, 21, 52 and 64 (AM6-1, -2, -5 and -8)—had wingspans of 12 meters (39 feet, 4 inches), but Model 32 (A6M-3) had its span shortened by 1 meter to 36 feet. Other data for Zero Model 52 (A6M-5): powerplant: 1,130hp Nakajima Sakae 21; wing area: 229.27 square feet; empty weight: 4,136 pounds; gross weight: 6,025 pounds; high speed: 351mph at 19,685 feet.

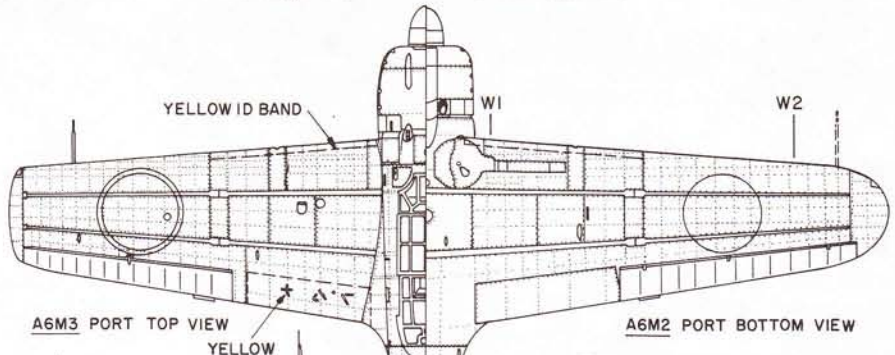
No, the Luftwaffe didn't use Zeroes. This A6M-2 Zeke 21, photographed in China just after the war, carries the green cross on a white marking used by some of the Japanese airplanes that were allowed to continue flying during the surrender negotiations. Note that a souvenir hunter has cut the unit marking off the rudder.

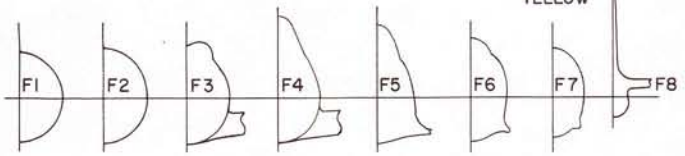
MITSUBISHI A6M ZERO

MODEL	ENGINE	H.P.	SPEED	AT ALTITUDE OF
A6M2	SAKAE 12 (Ha. 35/12)	925	317	16,400 FT.
A6M3	SAKAE 21 (Ha. 35/21)	1,130	341	20,500
A6M5	" "	"	358	22,000
A6M5c	" "	"	346	19,600

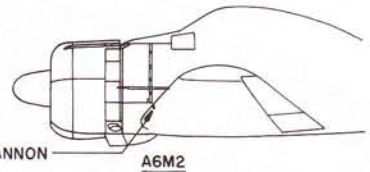


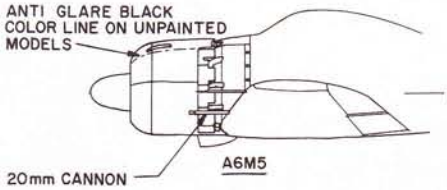
ONLY 99 A6M5c'S WITH THE .50 CAL. GUNS WERE BUILT SINCE THE ADDITIONAL WEIGHT AFFECTED THE PERFORMANCE SO BADLY.

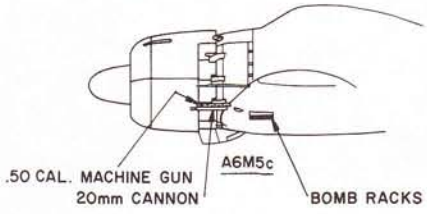


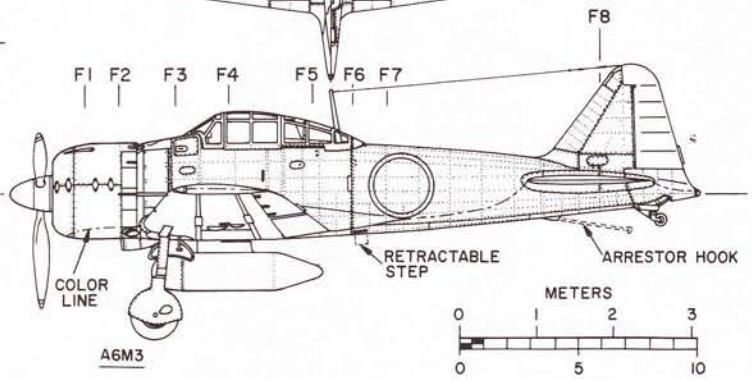


YELLOW OR WHITE BAND SOMETIMES OUTLINED IN RED









METERS
0 1 2 3
0 5 10
FEET

COLOR NOTE:

MOST WIDELY USED SCHEME, A BROWNISH OLIVE GREEN ON UPPER SURFACE WITH A WARM LIGHT GREY UNDERSIDE.

Mitsubishi Type Zero or "Zeke"

A6M2, A6M3 "HAMP", A6M5, and A6M5c

SCALE 1/8" = 1'

Drawn by C. Graham

MITSUBISHI G4M BETTY

This view of the Mitsubishi G4M-2 Betty bomber shows the powered upper turret and four-blade propellers added to this model. The color is dark green on the upper surfaces and silvery gray underneath.

THE Japanese Naval Air Arm was unusual in that it made extensive use of land-based bombers, and used them for long overland flights deep into enemy territory in what would usually be considered an Army-type operation.

The Mitsubishi G4M, code-named "Betty" by the Allies but not officially named in Japan, did acquire the unofficial nickname of "Hamaki," or "Cigar," in an obvious reference to the shape of its fuselage. The G4M prototype flew in September 1939, but its production was delayed in favor of the G6M-1, which had the same airframe but was equipped as a long-range escort fighter. This was necessary for raids deep into China, because Japan had no conventional fighters that were capable of escorting the bombers then in use for the full distance. The G6M-1 concept didn't work out, so the 30 planes that were built in 1940 were converted to trainers and transports.

Production Bettys, which were designated Navy Type 1 Attack Bomber Model 11 (G4M-1), were first delivered in April 1941. Its initial powerplants (contrary to the drawing) were 1,530hp Mitsubishi MK4A Kasei 11 engines; the bomb load was 1,764 pounds or one standard naval torpedo; defensive armament was four 7.7mm machine guns—one in the nose, one in a topside blister, one each in side blisters, and a 20mm cannon in the tail turret. The G4M-1's range was 3,256 nautical miles (3,749 statute miles), and its top speed was 266mph at 13,780 feet.

The G4M-1s enjoyed great success on raids into China as far inland as Chungking, and their lack of armor and heavy defensive armament wasn't a handicap when they faced the weak Chinese fighter resistance. It did, however, cause serious problems when they encountered even the second-rate but determined fighters that the U.S. and British defenses first put up against it.

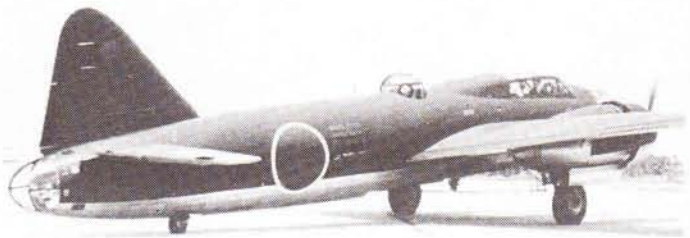
Improvements were made on the G4M-2 Model 22. The top blister was replaced with a powered turret that contained a 20mm cannon. The nose guns were doubled, the side blisters were removed and replaced with flat hatches (still containing 7.7mm guns), and a revised tail turret retained its 20mm cannon. Bomb load increased to 2,205 pounds, and power was increased to 1,800hp (takeoff), with Kasei 21 MK4P engines driving four-blade propellers (the G4M-1 had three-bladers). A new wing with laminar airfoil was used; gross weight increased to 27,588 pounds, but high speed increased to only 272mph at 15,090 feet. The final production version of the Betty was the G4M-3, which had a redesigned tail turret and dihedral in the horizontal tail.

Bettys were in production until the war's end, and they operated everywhere there were targets for land-based bombers (either land targets or ships at sea). An unusual conversion was made on the G4M-2e, which had its bomb bay modified to carry the MXY-7 Ohka ("Cherry Blossom," but called "Baka," or "Fool," by the Allies) single-seat suicide bomber. Carrying the Ohka greatly reduced the performance of the Betty, and made it an easy target for U.S. and British fighters. Sixteen were shot down during a single attack.

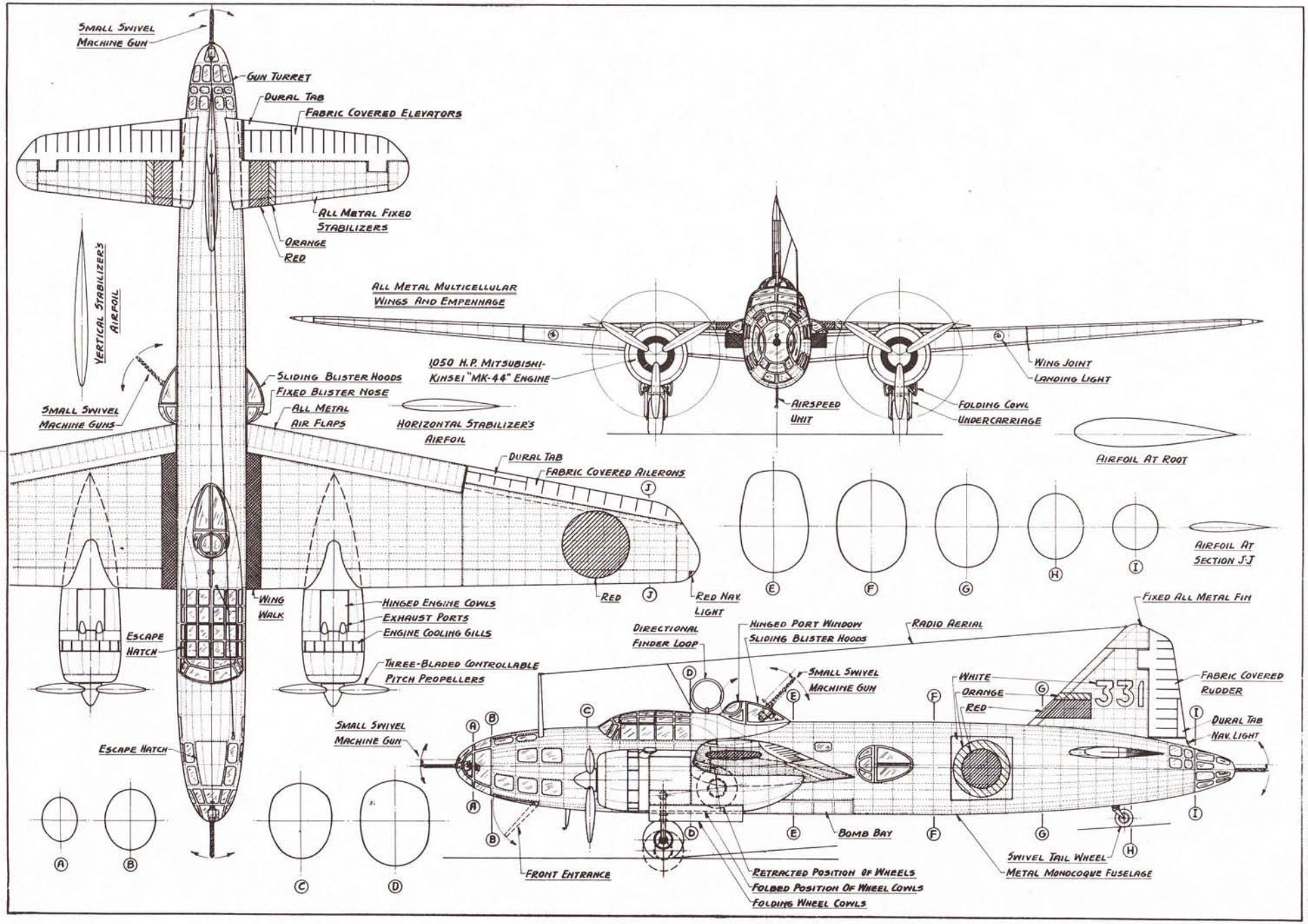
Altogether, 1,200 G4M-1s, 1,154 G4M-2s and 60 G4M-3s were built.

SPECIFICATIONS AND PERFORMANCE G4M-2

Wingspan	*82 ft., 1/4 in.*
Length	*65 ft., 7 in.*
Wing Area	*840.9 sq. ft.*
Empty Weight	*17,199 lbs.*
Gross Weight	*27,588 lbs.*
High Speed	*272mph at 15,090 ft.*
Range	*3,765 statute miles*



This view of the G4M-2 Betty bomber shows the flush hatches that replaced side machine gun blisters, and the tail turret redesigned with two vertically aligned transparent clam shells that opened to permit movement of the 20mm cannon.



MITSUBISHI G4M BETTY

NAKAJIMA KI-84 FRANK

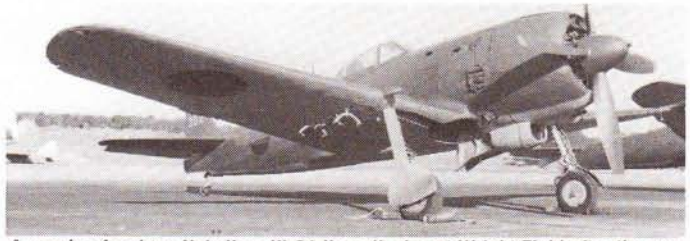
A Nakajima Ki-84 "Frank" of the 11th Sentai (group), captured in the Philippines. Note the lightning-flash Sentai marking on the tail and the plane's well-worn appearance. The numeral "46" on the rudder is an allied inventory number for captured airplanes.

THE best all-around Japanese fighter developed in response to the new U.S. models was the Nakajima Ki-84 Hayate ("Gale"). It was code named "Frank" by the Allies, but its official designation was Type 4 (for the Japanese year 2604) Model 1A Fighter. It was designed and built by the Nakajima Aeroplane Company, Ltd.; the prototype flew in April 1943.

The engine was a 1,800hp Nakajima Ha-45 Type 11, and the airplane's lines were similar to Nakajima's Ki-43 "Oscar" and Ki-44 "Tojo".

The prototype had provision for a single drop-tank under the fuselage, but the production models could carry two 44-gallon tanks, or up to two 550-pound bombs under the wings. Its initial armament was a pair of 12.7mm machine guns in the nose and two 20mm cannon in the wings. The Ki-84 was up-to-date in its use of heavy armor and protection for the fuel tanks, and it featured special "Butterfly Flaps" that could be lowered to improve maneuverability in combat.

The Ki-84 wasn't quite as fast as the latest U.S. P-51s and P-47s, but it could outmaneuver and out-climb them. "Franks" first went into combat against the U.S. 14th Air Force (the former Flying Tigers), in China in March 1944. Soon after, 10 three-squadron fighter groups that were equipped with Franks were stationed in the Philippines to resist the impending Allied invasion. The Franks didn't live up to their potential there, because they were badly outnumbered, and also because they suffered from fuel and hydraulic-system malfunctions and the failure of less-than-standard landing gear.



A wooden-fuselage Nakajima Ki-84-II on display at Wright Field after the war. The coloring is standard U.S. Army olive drab and gray. Unbordered and undersized Hinomaru markings have been re-applied for display purposes.

Improved versions of the Ki-84 quickly followed the Ki-84-Ia. The Ki-84-Ib eliminated the two machine guns and used four cannon. The few Ki-84-Ics (specialized bomber interceptors) had two 20mm cannon and two 30mm cannon.

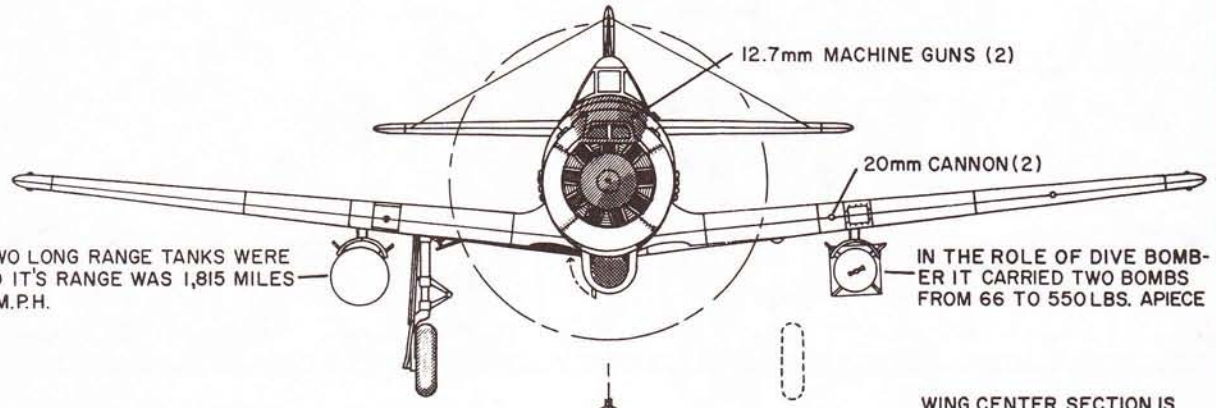
Because of the serious shortage of aluminum in Japan, wood was substituted for many parts of the Ki-84. The resulting composite model had a 1,990hp Ha-45 Type 23 engine and was designated the "Ki-84-II." Production was also seriously hampered by the B-29 raids on Japan, and an engine shortage after the engine factory was bombed. As in Germany, much of Nakajima's fighter production was forced into underground factories.

Altogether, 3,509 Ki-84s were built (contrary to the drawing)—127 prototypes, service test and pre-production models; and 3,382 production Ki-84-Is and -IIs by Nakajima and the Mansyu Aeroplane Manufacturing Co. in Manchuria. The drawing total includes derivative designs with other designations, such as the Ki-87 variant with a turbo-supercharger and the lightweight Ki-116.

SPECIFICATIONS AND PERFORMANCE KI-84-IA

Wingspan	*36 ft., 10 7/16 in.*
Length	*32 ft., 6 9/16 in.*
Wing Area	*226.04 sq. ft.*
Empty Weight	*5,864 lbs.*
Gross Weight	*7,955 lbs.*
Overload Weight	*8,576 lbs.*

NAKAJIMA KI-84 FRANK

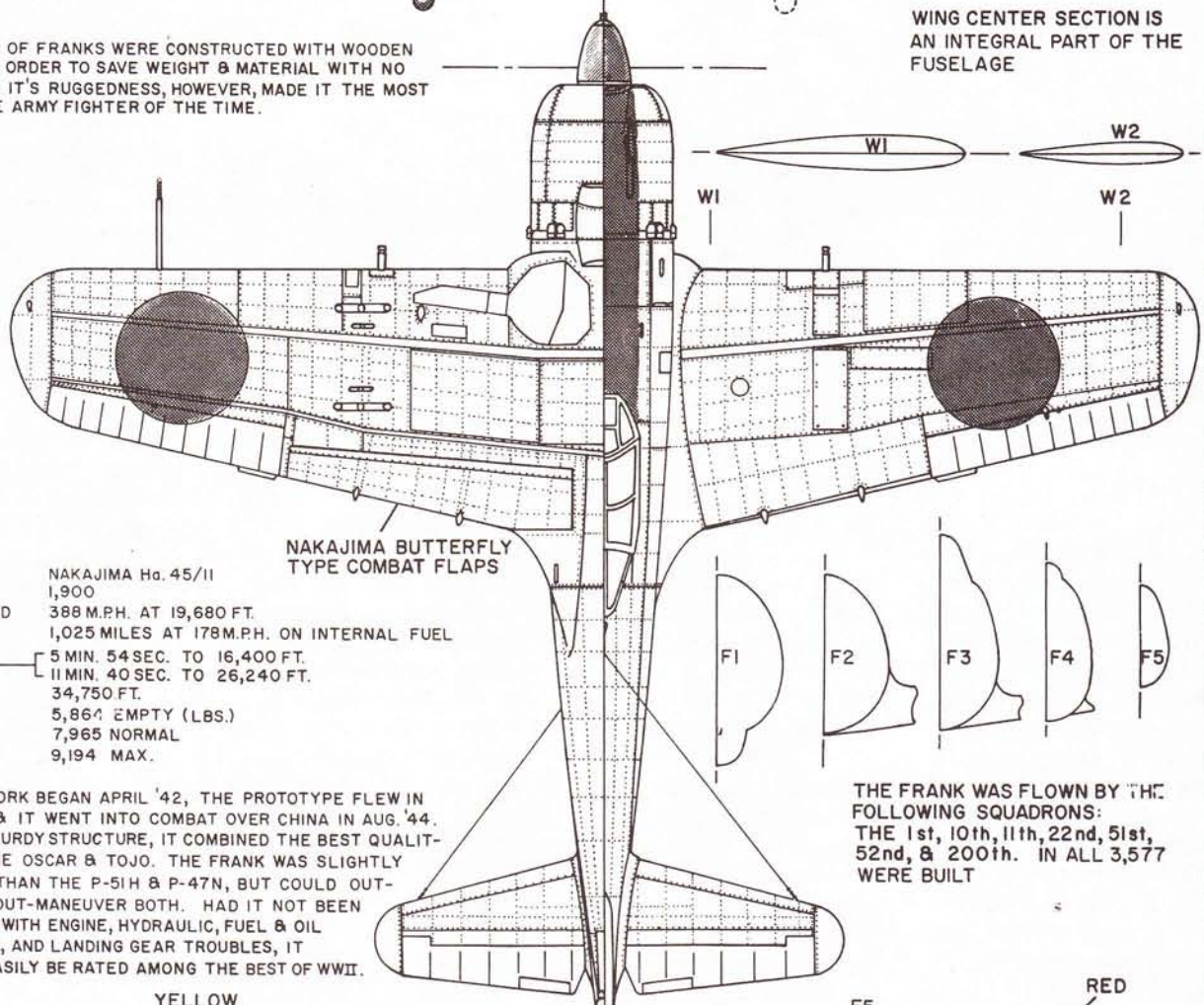


WHEN TWO LONG RANGE TANKS WERE CARRIED IT'S RANGE WAS 1,815 MILES AT 173 M.P.H.

IN THE ROLE OF DIVE BOMBER IT CARRIED TWO BOMBS FROM 66 TO 550 LBS. APIECE

A NUMBER OF FRANKS WERE CONSTRUCTED WITH WOODEN PANELS IN ORDER TO SAVE WEIGHT & MATERIAL WITH NO SUCCESS. IT'S RUGGEDNESS, HOWEVER, MADE IT THE MOST VERSATILE ARMY FIGHTER OF THE TIME.

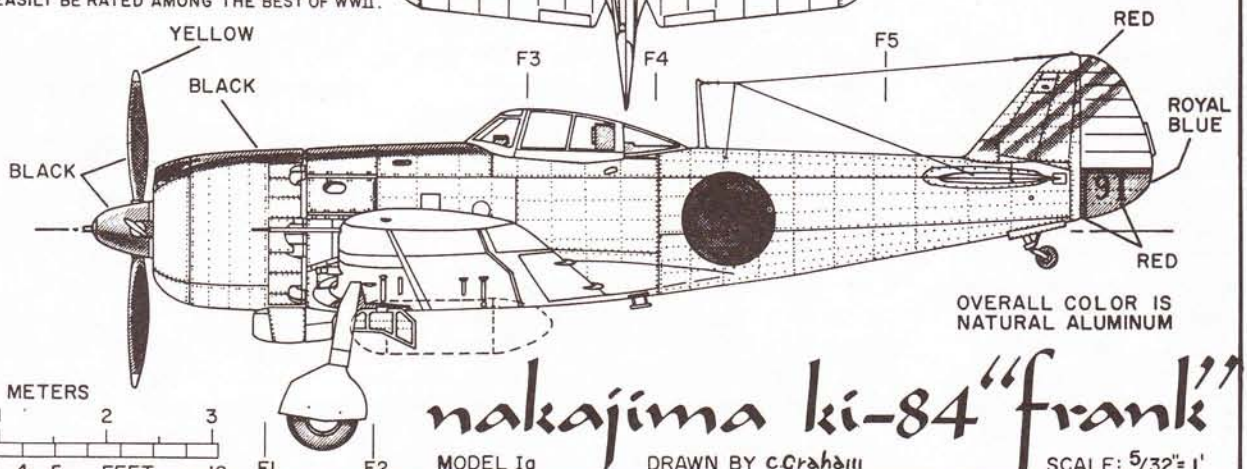
WING CENTER SECTION IS AN INTEGRAL PART OF THE FUSELAGE



ENGINE	NAKAJIMA Ha. 45/11
H.P.	1,900
MAX. SPEED	388 M.P.H. AT 19,680 FT.
RANGE	1,025 MILES AT 178 M.P.H. ON INTERNAL FUEL
RATE OF CLIMB	5 MIN. 54 SEC. TO 16,400 FT. 11 MIN. 40 SEC. TO 26,240 FT.
CEILING	34,750 FT.
WEIGHT	5,864 EMPTY (LBS.) 7,965 NORMAL 9,194 MAX.

DESIGN WORK BEGAN APRIL '42, THE PROTOTYPE FLEW IN FEB. '43, & IT WENT INTO COMBAT OVER CHINA IN AUG. '44. A VERY STURDY STRUCTURE, IT COMBINED THE BEST QUALITIES OF THE OSCAR & TOJO. THE FRANK WAS SLIGHTLY SLOWER THAN THE P-51H & P-47N, BUT COULD OUT-CLIMB & OUT-MANEUVER BOTH. HAD IT NOT BEEN PLAGUED WITH ENGINE, HYDRAULIC, FUEL & OIL PRESSURE, AND LANDING GEAR TROUBLES, IT WOULD EASILY BE RATED AMONG THE BEST OF WWII.

THE FRANK WAS FLOWN BY THE FOLLOWING SQUADRONS: THE 1st, 10th, 11th, 22nd, 51st, 52nd, & 200th. IN ALL 3,577 WERE BUILT



OVERALL COLOR IS NATURAL ALUMINUM

nakajima ki-84 "frank"

MODEL Ia DRAWN BY C. Graham SCALE: 5/32" = 1'

NORTH AMERICAN P-51B MUSTANG

A camouflaged P-51B-5-NA Mustang, photographed with the Ninth Air Force in England. The letters "AX" identify the 12th Squadron of the 67th Reconnaissance Group, identified by the letter "M."

IN 1940, the British Purchasing Commission (in the U.S.) wanted North American (NAA) of Inglewood, CA, to build the Curtiss P-40 under license. NAA engineers had been researching a new fighter design that would overcome some of the notorious deficiencies of the designs used early in the war. The design would also incorporate a new aerodynamic feature: the laminar-flow wing.

In 120 days, NAA built a prototype that used the same 1,100hp Allison V-1710-F3R engine then being used in the P-40. The first flight of the NA-73 (the company-funded prototype with civil registration NX19998) was made on October 25, 1940. Production models with British-specified armament of six .303-caliber guns were flying in May 1941. NAA had originally called it the "Apache," but this was soon changed to "Mustang." The initial British contract was for 320 Mustang Is, and this was soon increased by another 300. Some of these were acquired by the U.S. Army, but they weren't yet called P-51s.

The U.S. Army wasn't particularly interested in the new design, but it did direct that the fourth and tenth production Mustang Is be tested by the Army as "XP-51." Despite good maneuverability and high speed, the Army still wasn't interested in production. The 150 supplied to Britain as "Mustang IA" under Lend-Lease with four 20mm cannon were designated "P-51" though their armament and other details differed from the XP-51s. These carried both U.S. Army and British serial numbers.

The first Army order to NAA was for 500 examples of an odd type—a single-seat dive-bomber variant designated "A-36A." This had dive brakes, racks for two 500-pound bombs and an armament of six .50-caliber machine guns (four in the wings and two in the lower nose). The engine was the 1,325hp V-1710-87.

The A-36A first flew on September 21, 1942, and production models took part in the invasions of North Africa and Sicily. The dive-bombing tactic, however, was soon abandoned, and the dive brakes were wired shut.

The first Army fighter order was for 310 P-51As with 1,200hp V-1710-81 engines. Armament was four .50-caliber guns in the wings. Britain obtained 50 P-51As under Lend-Lease as "Mustang II." At this time, the Army didn't send P-51As overseas for combat.

The Mustang's only serious shortcoming was its lack of performance at altitude, which was attributable to the Allison engine. The British were sufficiently concerned about this to upgrade four Mustangs with Rolls-Royce Merlin engines. The performance gain was impressive, and the U.S. Army and NAA were encouraged to try Merlins in P-51s on their own. Two four-cannon P-51s were fitted with 1,380hp Packard-built V-1650-3 Merlins... and the rest is history.

Production orders followed for 1,998 P-51B-NAs at Inglewood and 1,750 similar P-51C-NTs from a new factory in Dallas, TX. Armament was the same as in the P-51A. The P-51Bs and Cs through B-10 and C-3 had 1,380hp V-1650-3 engines, while higher dash numbers of each had 1,490hp V-1650-7 engines.

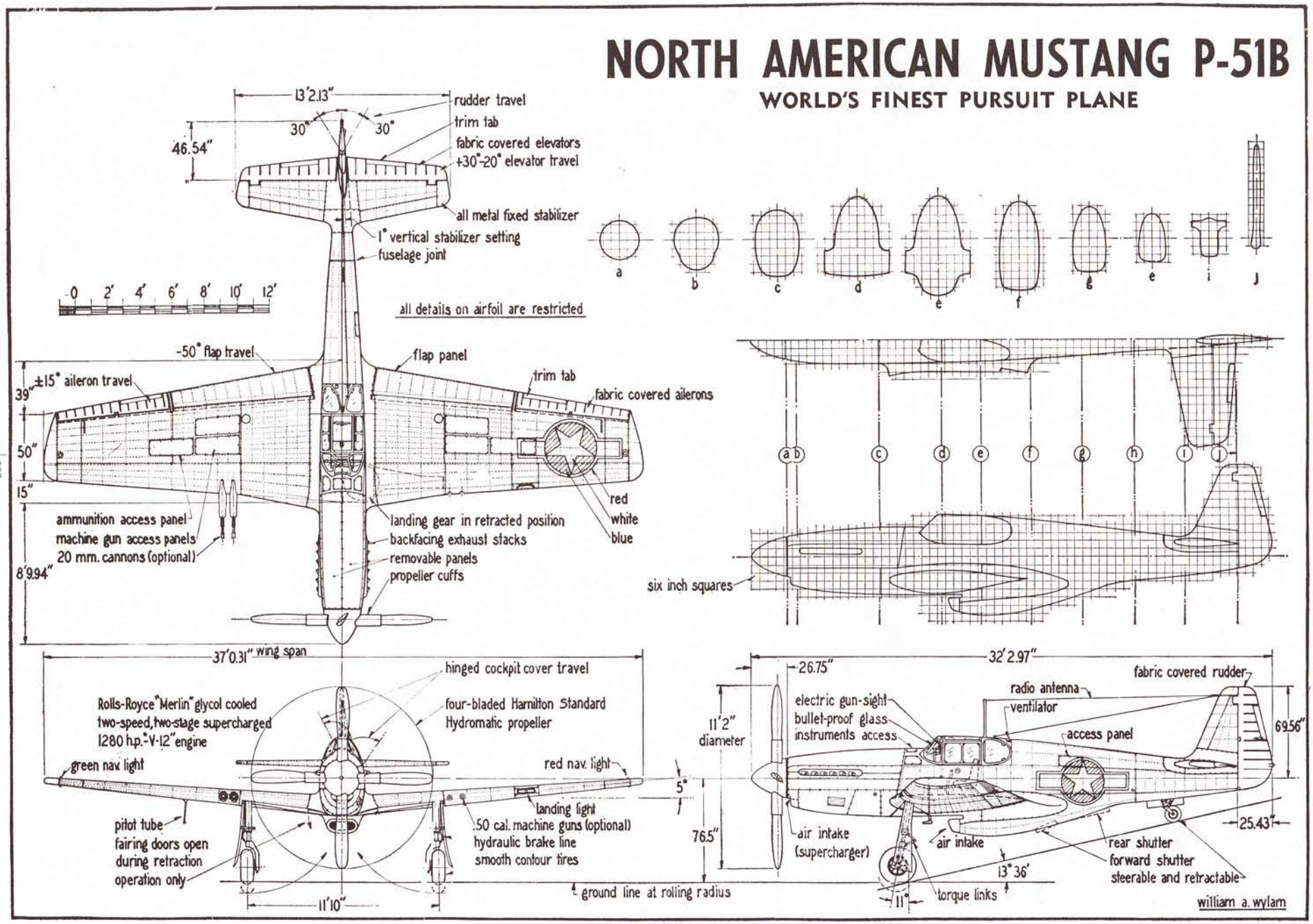
The British designated their 275 P-51Bs "Mustang III," but they made no distinction for 636 P-51Cs, which carried the same name.

There were also camera-carrying versions of the P-51. Such P-51s were designated "F-6A"; P-51As became "F-6B"; and both P-51Bs and Cs became "F-6C."

Because the Wylam drawing shows the P-51B with high turtle deck, the later bubble-canopy variants (P-51D through P-51K) won't be detailed here, but the British called them all "Mustang IV."

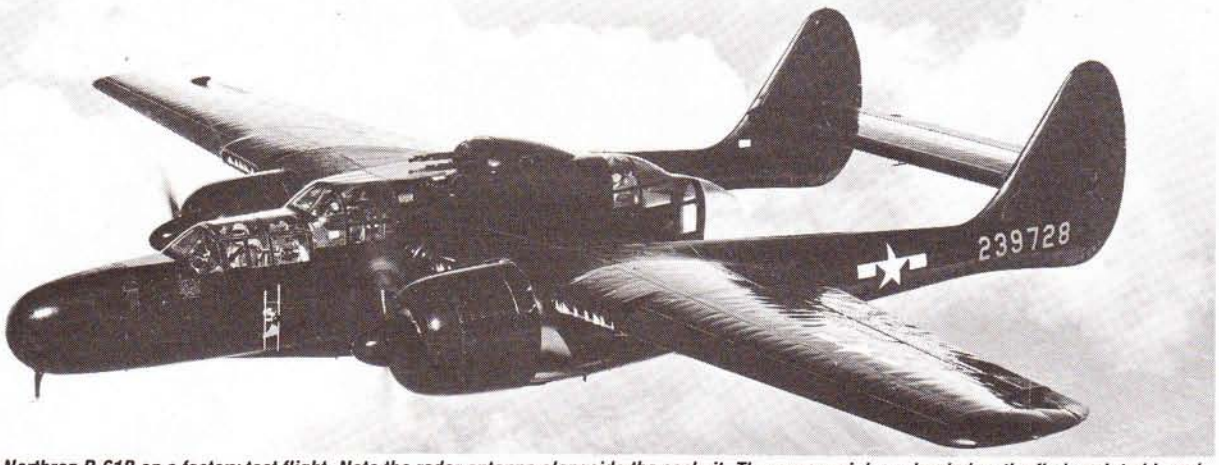
SPECIFICATIONS AND PERFORMANCE P-51 B

Wingspan	*37 ft.*
Length	*32 ft., 3 in.*
Wing Area	*237.7 sq. ft.*
Empty Weight	*17,199 lbs.*
Gross Weight	*11,000 lbs.*
High Speed	*440mph at 30,000 ft.*
Armament	*Four .50-caliber guns, plus two 1,000-lb. bombs*



NORTH AMERICAN P-51B MUSTANG

NORTHROP P-61 BLACK WIDOW



The glossy black Northrop P-61B on a factory test flight. Note the radar antenna alongside the cockpit. The army serial number below the fin is painted in red, which is standard for black night fighters.

MOST of the night fighters used in the war were adapted from existing designs for a specific mission. The only fighter that was specifically designed for night missions was the three-seat, twin-engine Northrop P-61. It was named "The Black Widow" because of its overall glossy black coloring.

The U.S. Army became interested in specialized night fighters as a result of British experience with German night raiders in 1940. Northrop Aircraft, Inc., of Hawthorne, CA, responded to an Army request and submitted a design with four fixed, forward-firing, 20mm cannon in the belly; British-designed radar in the nose to detect and track the enemy; and four .50-caliber machine guns in a powered turret for defense.

The engines were 2,000hp Pratt & Whitney R-2800-10s. The plane's most unusual feature was its twin-boom layout, with the crew in a short pod rather than in a full-length fuselage. The radar operator sat alongside the pilot. Two XP-61 prototypes were ordered, followed by 13 YP-61 service test models.

The first XP-61 had a matte-black finish and flew on May 26, 1942. Satisfactory tests resulted in an order for 200 production P-61As with glossy instead of dull paint, and deliveries began late in 1943. From the 38th aircraft on, the top turret was deleted in the belief that added speed was a better defense at night than manually aimed guns. The P-61As were sent to the Pacific and scored their first night victory on July 7, 1944. Others were sent to Europe and participated in the Normandy invasion.

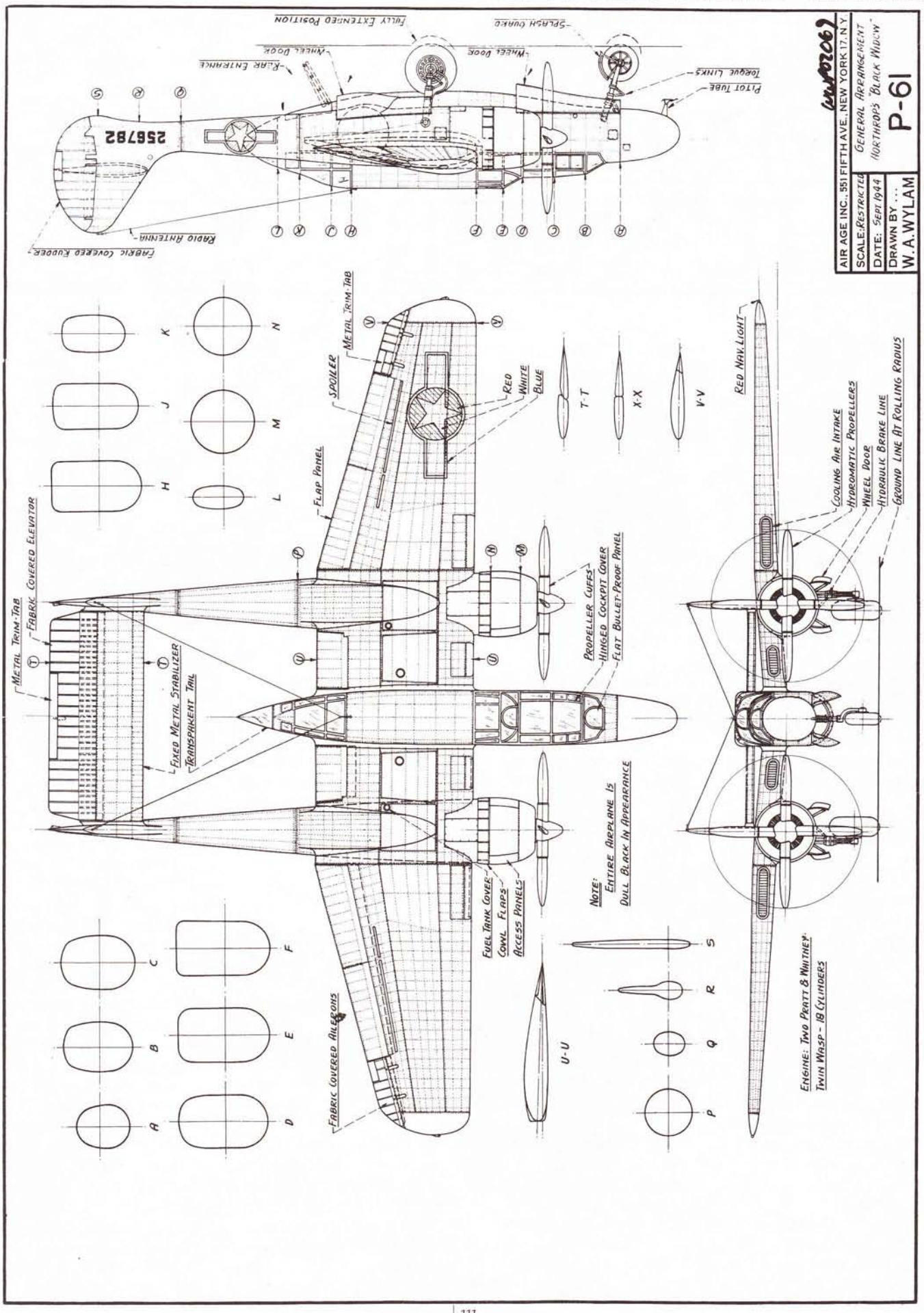
The P-61As were followed by 450 improved P-61Bs in July 1944. Most of these restored the top turret and could carry either four 1,600-pound bombs or two 300 gallon drop tanks under their wings. Final production versions of the Black Widow were 41 P-61Cs with 2,800hp R-2800-77 engines.

Subsequent P-61 designations were for conversions. Two XP-61Ds were former P-61As with R-2800-77 engines, and two XP-61Es were P-61Bs that were converted to day fighters with four cannons in the nose, no radar or top turret and the two-man crew seated in tandem under the longest one-piece bubble canopy built to that time. A P-61C conversion to XP-61F was cancelled. Sixteen P-61Bs were converted to unarmed P-61G Weather Reconnaissance planes. The first XP-61E was converted to the XF-15 "photo plane" with cameras in the nose, along with one P-61A that became the XF-15A. Thirty-six production F-15As followed, but they were out of service by 1952.

SPECIFICATIONS AND PERFORMANCE P-61 B

Wingspan	*66 ft.*
Length	*49 ft., 7 in.*
Wing Area	*664 sq. ft.*
Gross Weight	*29,700 lbs.*
High Speed	*366mph at 20,000 ft.*

P-61As (with black and white "Invasion Stripes") over Europe after the invasion of July 6, 1944. The wartime censor has left the serial numbers on the airplanes but has blacked out the radar antennas. Note the "Shark Face" painted on the nearest plane.


NORTHROP P-61 BLACK WIDOW
AIR AGE INC., 551 FIFTH AVE., NEW YORK 17, N.Y.
SCALE: RESTRICTED
DATE: SEPT 1944
DRAWN BY ... W.A.WYLAM
GENERAL ARRANGEMENT
NORTHROP'S "BLACK WIDOW"
P-61
FULLY EXTENDED POSITION
SPLASH GUARD
WHEEL DOOR
REAR ENTRANCE
PITOT TUBE
TORQUE LINKS
FABRIC COVERED RUDDER
RADIO ANTENNA
METAL TRIM TAB
FABRIC COVERED ELEVATOR
FIXED METAL STABILIZER
TRANSPARENT TAIL
SPOILER
FLAP PANEL
RED
WHITE
BLUE
PROPELLER CUFFS
HINGED COCKPIT COVER
FLAT BULLET-PROOF PANEL
FUEL TANK COVER
COWL FLAPS
ACCESS PANELS
FABRIC COVERED AILERONS
NOTE:
ENTIRE AIRPLANE IS
DULL BLACK IN APPEARANCE
T-T
X-X
V-V
U-U
RED NAV. LIGHT
COOLING AIR INTAKE
HYDROMATIC PROPELLERS
WHEEL DOOR
HYDRAULIC BRAKE LINE
GROUND LINE AT ROLLING RADIUS
ENGINE: TWO PRATT & WHITNEY
TWIN WASP - 18 CYLINDERS

REPUBLIC P-47 THUNDERBOLT

A Republic P-47D-25 in service with the Royal Air Force as "Thunderbolt II." The streamlined shape under the wing is a rack for either a drop tank or a 500- or 1,000-pound bomb. Note the absence of a dorsal fin.

THE Republic P-47 Thunderbolt, commonly called "The Jug," is an excellent example of a successful fighter that evolved through a series of designs from the same design team.

The Jug's distinctive configuration can be traced back to the 1933 appearance of the Seversky SEV-3 twin-float amphibian. The plane's distinctive features were its all-metal construction, its fuselage with a nearly circular cross-section, and its wing planform (straight sweepback on the leading edge and an elliptical trailing edge and wing tips). This trademark wing planform (shared with the Supermarine Spitfire) was retained for all subsequent Seversky and Republic fighters through the P-47 and some of its experimental derivatives.

Alexander Seversky, a former Imperial Russian Air Force pilot, didn't have a factory when he started business. His first airplane was built by Edo of College Point, NY, a famous builder of all-metal seaplane pontoons. Now, with a successful design to sell, Seversky established a factory in Farmingdale, Long Island, NY. The second Seversky airplane, which was similar to the first, was initially tested as a two-seat, land-plane fighter with fixed landing gear. It was soon modified (for a U.S. Army fly-off design competition) to a single-seater with an 850hp Pratt & Whitney R-1830 Twin Wasp engine and was fitted with a turbo-supercharger in the belly, and a new wing of the same span and area as the XP-41, but with a different center section and inward-retracting landing gear.

By that time, Seversky had been ousted, and the company was renamed "Republic." The new features of the XP-41 were incorporated into a new model, the P-43, which used the 1,200hp R-1830-35 engine and a standard armament of two .30-caliber and two .50-caliber machine guns. The fuselage had refined lines and was nearly 2 feet longer than the P-35/XP-41. There were 272 P-43s and P-43As built. Meanwhile, Republic had been selling export versions of the P-35. Of 120 ordered by Sweden, 60 were drafted by the U.S. after the Arms Embargo went into effect, and they were designated "P-35A." Most were shipped to the Philippines, where they soon fell victim to the Japanese Zero.

There was to have been a P-44—essentially the P-43 fitted with the new 1,850hp Pratt & Whitney R-2800 engine—but it was decided that the engine was too big for the existing airframe. A new Republic model that was then being designed (the light-

A P-47C shows off the sharp-topped fuselage structure behind the cockpit that earned models before the P-47D-25 the nickname "Razorback."

backward-retracting gear. Seversky won a production order for 77 P-35s with 950hp R-1830-9 engines, backward-retracting gear and an armament of one .30-caliber and one .50-caliber machine gun. Deliveries began in 1937, and the last production aircraft

This P-47D-30 with a dorsal fin and 150-gallon drop tanks has the dark blue stripes of the First Air Commando Group, which was based in Southeast Asia in 1944-45.

weight XP-47) was cancelled, and the designation "XP-47B" was given to an enlarged development of the P-43 that would use a big engine and eight .50-caliber machine guns (the heaviest armament then fitted to a single-seat fighter). The XP-47B, with a 2,000hp XR-2800-21 engine, flew on May 6, 1941, and it was followed by P-47 production models through P-47N (to a total of 15,683 planes), which are detailed here.

P-47B—This was the first production model, and 171 were built. Deliveries started late in 1942, and some went into action in Europe on April 8, 1943. In combat, the P-47B-RE had inadequate climb and maneuverability, but it had plenty of speed and firepower. It also had excellent diving ability, and its heavy structure could absorb terrific punishment. Its wingspan was 40 feet, 9 inches; area, 300 square feet; gross weight, 13,360 pounds; high speed, 429mph at 27,800 feet.

P-47C—The 602 P-47Cs were refined P-47Bs that had their noses lengthened 13 inches and were equipped to carry a 200-gallon drop tank under the fuselage. Although it wasn't quite as fast as the P-47B, its greater range enabled it to be used on long-range escort missions.

P-47D—This model was the major production version, and 6,315 were built. The initial improvement was a water-injected version of the 2,000hp R-2800-21 engine, which gave it a top speed of 433mph at 30,000 feet. Provision was made for two 150-gallon drop tanks under the wings or a 250- to 1,000-pound bomb on the same streamlined rack, plus a 500-pound bomb under the fuselage. A new Republic plant was built in Evansville, IN, and 2,350 P-47D-RAs were built there.

There were two notable external changes during P-47D production: a cut-down rear fuselage and a bubble canopy (as tested on the XP-47K) became standard on the P-47D-25 and on, and a long, shallow dorsal fin was added to the P-47D-27 and on. Because of the two different fuselage configurations, the P-47 models prior to D-25 became known as "Razorbacks."

The P-47D proved to be more effective as a fighter-bomber than as an escort fighter, and from P-47D-30 on, provision was made for carrying 10 rockets under the wings in addition to the bombs. England received 240 Razorback P-47Ds as "Thunderbolt I," and 590 P-47D-25s and on as "Thunderbolt II." The gross weight of the P-47D-25 was 19,400 pounds; its high speed was 428mph at 30,000 feet.

XP-47E—The last P-47B tested with a pressurized cockpit.

XP-47F—One P-47B tested with a laminar-flow wing.

P-47G—Duplicates of the P-47B built by Curtiss to compensate for the cancelled P-60A contract.

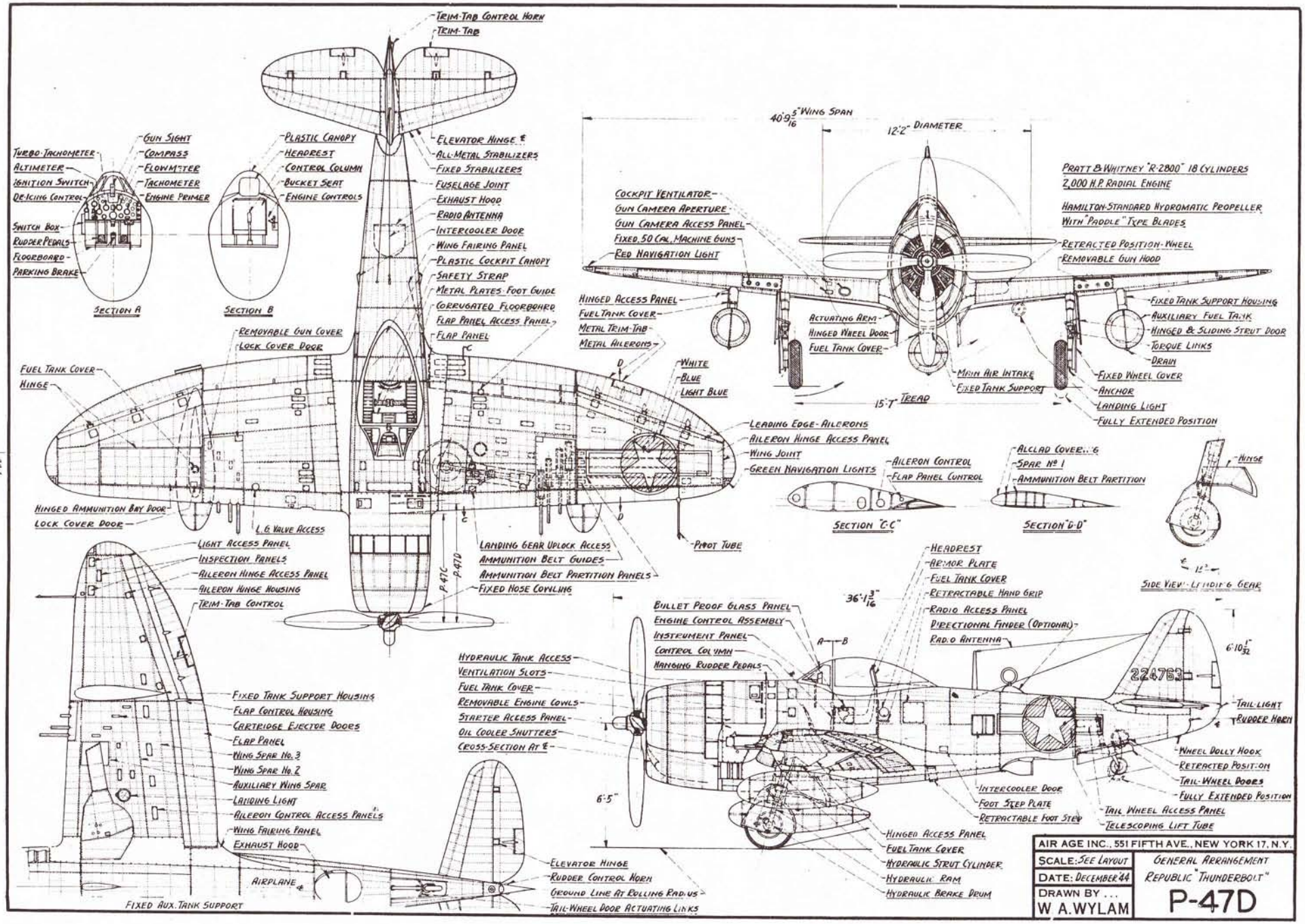
XP-47H, J, K and L—Experimental conversions which tested new features and equipment. The XP-47J tested a new, liquid-cooled, 2,300hp, 16-cylinder Chrysler XIV-2220-1 engine; the lightened XP-47J with a 2,100hp R-2800-61 engine became the first piston-engined plane to exceed 500mph; the XP-47K tested the bubble canopy; and the XP-47L had increased internal fuel capacity.

P-47M—A need for a fast, high-altitude fighter was met with the P-47M. Only 150 were built after three P-47Ds were modified as YP-47M prototypes. The bomb and rocket racks were deleted, and special 2,800hp R-2800-57 engines gave a top speed of 473mph at 32,500 feet. Most of the P-47Ms were in combat in Europe in the closing months of the war.

P-47N—The final production model, P-47, was produced solely for action in the Pacific. Its new wing had a span of 42 feet, 10 inches, an area of 322 square feet and squared-off wing tips. With additional internal fuel (as tested on the XP-47L), two 93-gallon drop tanks under the wings and a 100-gallon drop tank under the fuselage, the P-47N had a total fuel capacity of 1,266 gallons and a range of 2,350 miles, which was enough to enable it to escort B-29s to Japan in the last months of the war. With a 2,800hp R-2800-77 engine, the P-47N had a gross weight of 20,700 pounds and a high speed of 467mph at 32,500 feet.

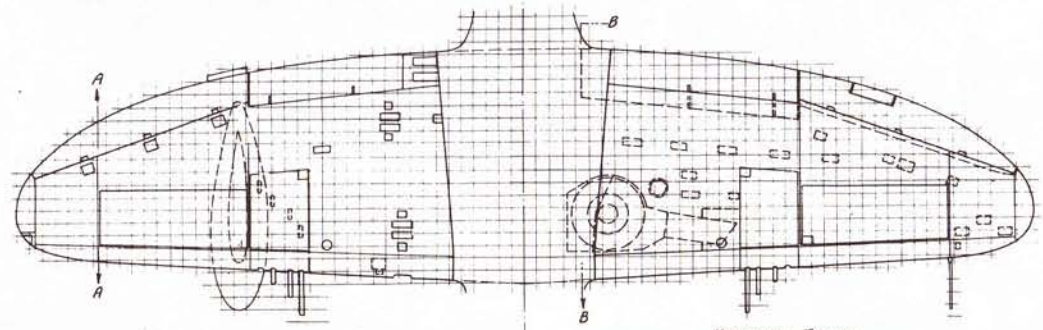
Republic built 1,667 P-47Ns in Farmingdale and 149 in Evansville. A further 5,934 planes were cancelled. The P-47 was retired as a first-line fighter right after the war, but bubble-canopy P-47Ds and P-47Ns stayed in the reserve training squadrons until 1955.

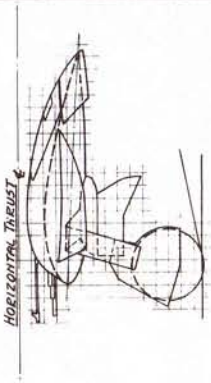
This is the final "Jug" model, the P-47N, with a lengthened and square-tipped wing. This plane is in fighter-bomber configuration, with two 1,000-pound bombs and 10 rockets.

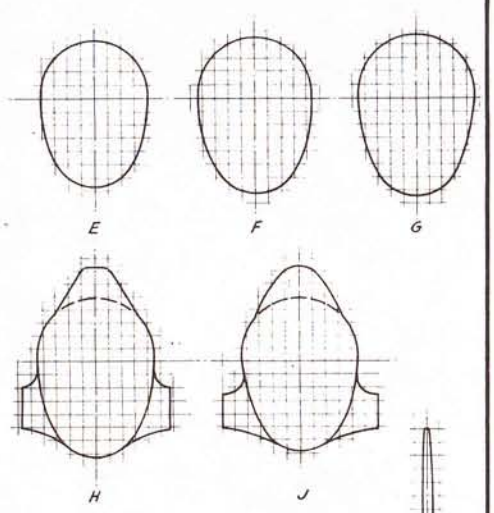


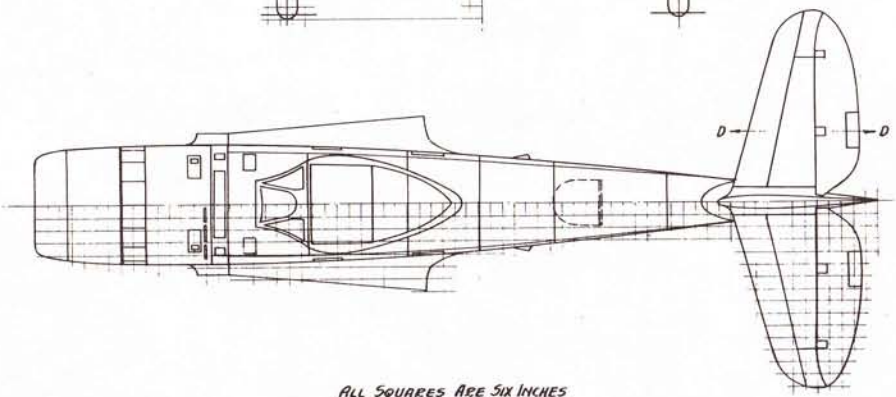
AIR AGE INC., 551 FIFTH AVE., NEW YORK 17, N.Y.

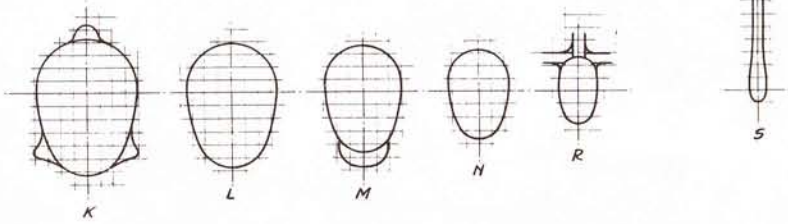
SCALE: See Layout	General Arrangement
DATE: December '44	Republic "Thunderbolt"
DRAWN BY ... W. A. WYLAM	**P-47D**



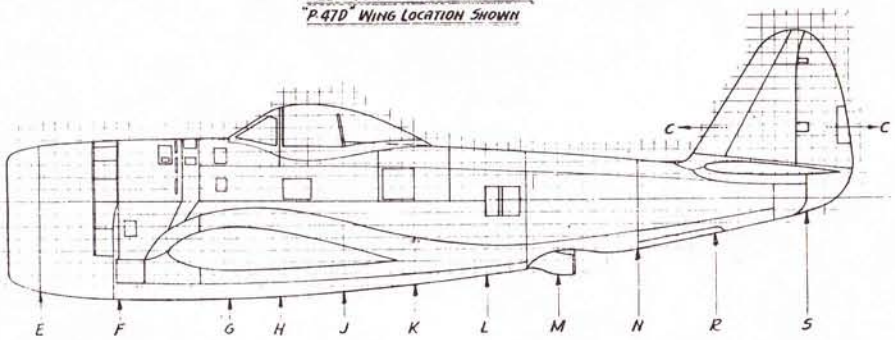


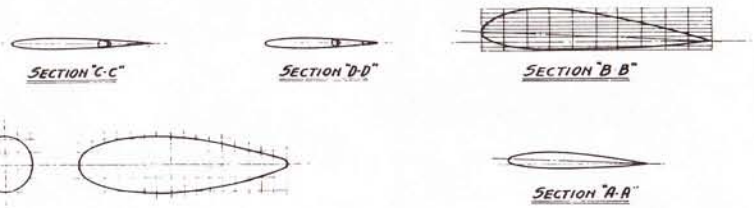




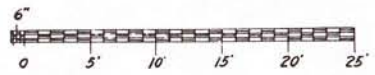


ALL SQUARES ARE SIX INCHES
"P-47D" WING LOCATION SHOWN





AUXILIARY FUEL TANK



ANGULAR MOVEMENTS

RUDDER	± 28°
RUDDER TRIM-TAB	± 12°
ELEVATOR	+30°-20°
ELEVATOR TRIM-TAB	+7°-8°

GENERAL DATA AND SPECIFICATIONS

WING INCIDENCE	+2½°	SPAN-WINGS	40'-9 5/16"
STABILIZER INCIDENCE	+2½°	SPAN-TAIL	16'-0 3/32"
FIN SETTING	0°	HEIGHT	13'-8 5/16"
MAX. CHORD-WINGS	9'-2"	TREAD	15'-7"
MAX. CHORD-HORIZON. STAB	5'-5 5/8"	LENGTH (P-47C)	35'-5 5/16"
MAX. CHORD VERT. STAB.	6'-5"	LENGTH (P-47D)	36'-1 3/16"
DIHEDRAL-WING	+6°	PROPELLER DIA.	12'-2"

AIR AGE INC., 551 FIFTH AVE., NEW YORK 17, N.Y.

SCALE: ABOVE	LAYOUTS & CROSS-SECTIONS
DATE: DECEMBER'44	REPUBLIC "THUNDERBOLT"
DRAWN BY ... W.A.WYLAM	P-47D

REPUBLIC P-47 THUNDERBOLT

STEARMAN KAYDET

THE Kaydet was the most used U.S. military primary trainer of WW II, but there's often confusion surrounding it because it had two builders' names—Stearman and Boeing. In 1934, after the breakup of the United Aircraft and Transport companies, the Stearman Aircraft Company of Wichita, KS became a wholly owned subsidiary of Boeing. It became Boeing's Stearman Division in 1938, and the Wichita Division of Boeing in 1941, when the airplanes officially became Boeings, even though the old Stearman model and serial numbers were continued. However, all those associated with the airplanes—builders and users alike—stubbornly continued to call the planes Stearmans, and today they're still referred to as such in the antique airplane movement.

In the case of the Stearman/Boeing Model 75, the use of the name "Kaydet" made it readily identifiable, even though there were eight manufacturers' sub-designations, four U.S. Army model designations and five U.S. Navy N2S series designations (see table).

The original Stearman Model 70 trainer, with a welded-steel tube fuselage and wooden-frame wings, flew late in 1933. The U.S. Navy bought 61 improved Model 73s in 1934 as NS-1 ("N" for trainer, "S" for Stearman) and had them fitted with 220hp Wright J-5 engines that had been out of production since 1929, but were still plentiful in Navy warehouses.

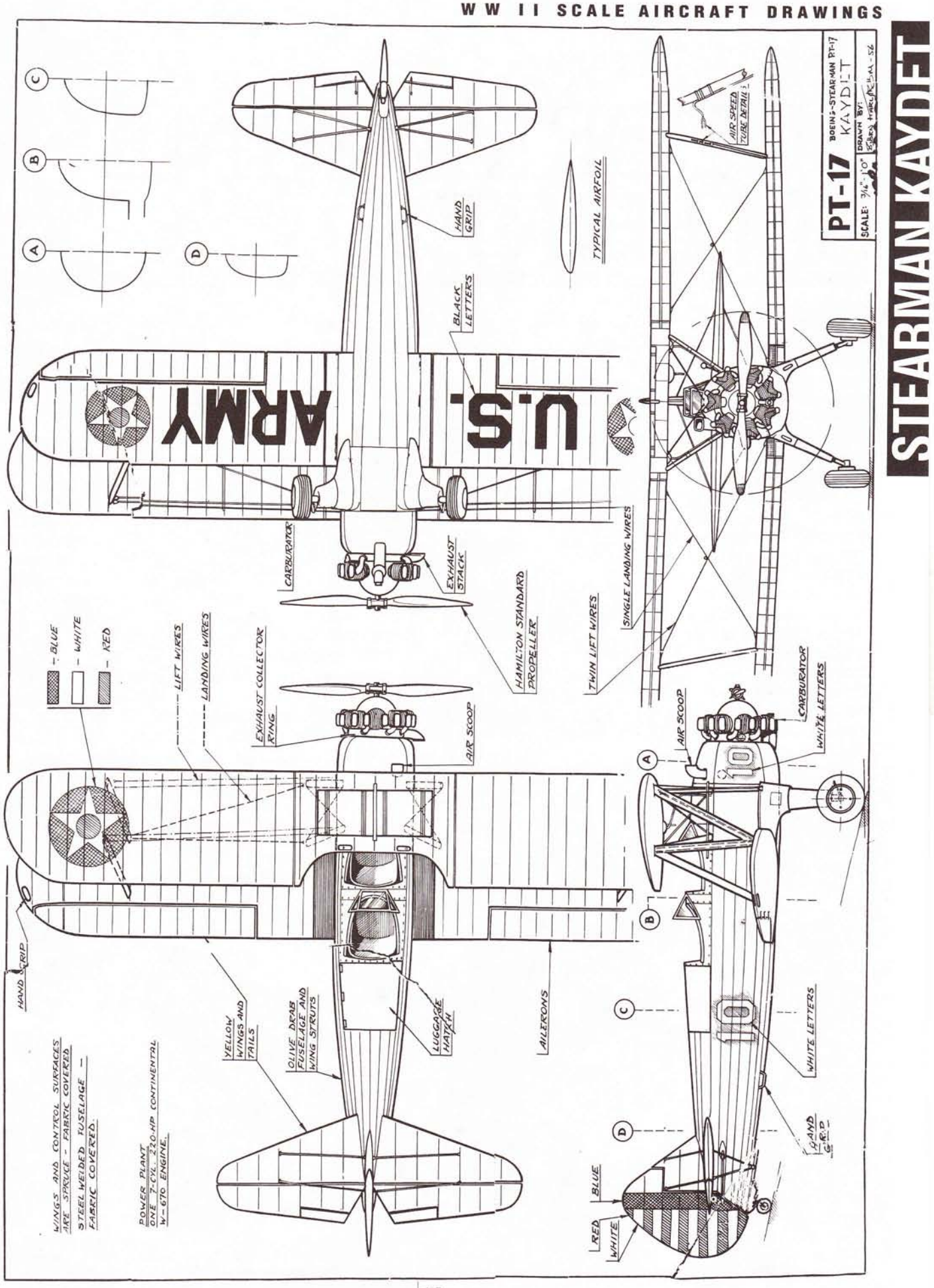
A Stearman PT-13A banked over to reveal the underside detail. The U.S. Army lettering is 24 inches high; the star insignia is 30 inches in diameter under the wing and 42 inches above.

Model 75, which was introduced in October, 1934, was similar to Model 73, but it used three different 220hp radial engines and won large orders from both the Army and the Navy. Altogether, 8,504 biplanes were built in the Model 70-76 series, with spare parts raising the widely publicized total to 10,346 (only the U.S. military Model 75s are shown in the table). Unit prices, less such government-furnished equipment (GFE) as engines and instruments, ranged from $7,713 to $10,412.

Until the spring of 1942, the Army Kaydets had colorful blue fuselages, chrome-yellow wing and tail surfaces, and the distinctive Army rudder stripes that had been used since 1926. Subsequent Army deliveries were all silver and without stripes. The winterized PT-27s supplied to Canada under Lend-Lease were all yellow, and some had cockpit canopies. Early Navy Kaydets were all yellow. Most of the later models were all silver, but a few were delivered all yellow.

Before inter-service standardization with the E-75 model, the Army and Navy frequently exchanged their Kaydets. Oddly, the different Navy dash numbers weren't equally significant; the difference between the N2S-1 and -2 was the same as between the Army PT-17 and PT-13, with entirely different engines, while the N2S-3, -3 and -4 differed only in the dash numbers of the same Continental R-670 engine.

Stearman Model	U.S. Army Designation	U.S. Navy Designation	Engine	No. Built
75	PT-13	-	Lycoming R-680	26
A75	PT-13A, B	-	Lycoming R-680	268
A75J-1	PT-18	-	Jacobs R-755	150
A75N-1	PT-17, 17A	N2S-1, -4	Continental R-670	3,769
B75	-	N2S-2	Lycoming R-680	125
B75N-1	-	N2S-3	Continental R-670	1,875
D75N-1	PT-27	-	Continental R-670	300
E75	PT-13D	N2S-5	Lycoming R-680	1,786


STEARMAN KAYDET
PT-17 BOEING-STEARMAN PT-17 KAYDET
SCALE: 3/16" = 1'0"
DRAWN BY:
U.S. ARMY
WINGS AND CONTROL SURFACES ARE SPRUCE - FABRIC COVERED
STEEL WELDED FUSELAGE - FABRIC COVERED.
POWER PLANT ONE 7-CYL. 220 HP CONTINENTAL W-670 ENGINE.
BLUE
WHITE
RED
LIFT WIRES
LANDING WIRES
EXHAUST COLLECTOR RING
AIR SCOOP
HAMILTON STANDARD PROPELLER
TWIN LIFT WIRES
SINGLE LANDING WIRES
CARBURATOR
EXHAUST STACK
HAND GRIP
BLACK LETTERS
TYPICAL AIRFOIL
AIR SPEED TUBE DETAIL
YELLOW WINGS AND TAILS
OLIVE DRAB FUSELAGE AND WING STRUTS
LUGGAGE HATCH
AILERONS
WHITE LETTERS
10

SUPERMARINE SPITFIRE

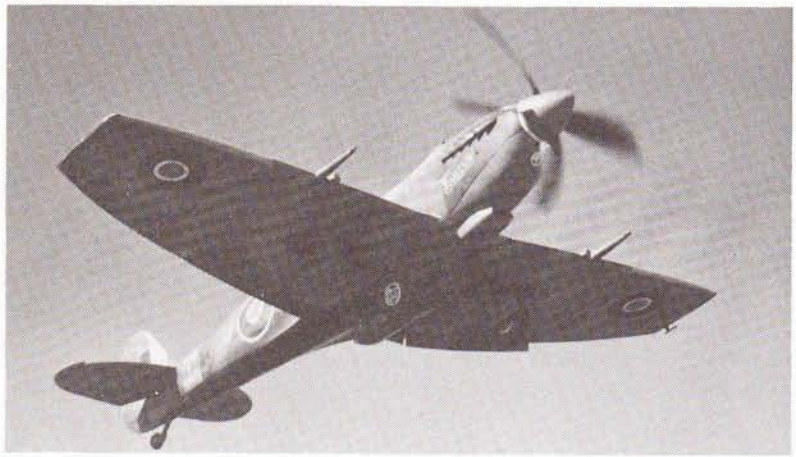
THE British Supermarine "Spitfire" was one of the greatest all-around fighters of the war. Its lines and performance, however, weren't the result of a long line of pedigreed fighters, in the way that the Hawker Hurricane evolved from Hawker and Sopwith fighters dating back to WW I. Rather, the Spitfire evolved from a line of monoplane seaplane racers that was started by designer Reginald J. Mitchell in 1925. His S-4 model changed the development of high-speed aircraft from biplanes to low-wing monoplanes. Later S-models set new speed records. The S-6B of 1931 retired the Schneider Trophy with a speed of 340.8mph around a triangular course, and it later set a new absolute speed record of 407.5mph.

An early Spitfire I with a fixed-pitch wooden propeller and a straight top canopy. Note the Type A roundel under the wing and the Type A.1 roundel on the fuselage.

Mitchell's racers were masterpieces in the way they fit the slimmest possible fuselage around a pilot and a liquid-cooled engine. This practice continued with the Spitfire, which was built in response to a 1934 Air Ministry request for an eight-gun fighter. The prototype used a 990hp Rolls-Royce Merlin C engine, and featured an elliptical wing planform for maximum aerodynamic efficiency, which was supposed to offset the handicap of added structural complexity. The narrow landing gear retracted outward into the wing, which, in its initial form, contained eight .303-caliber machine guns. The semi-monocoque metal fuselage was so narrow at the pilot's shoulder level that it was necessary to install a hinge-down door on the left side for access.

The prototype flew on March 5, 1936, and production orders soon followed. Spitfire Is with 1,030hp Merlins driving fixed-pitch, wooden two-blade propellers began to reach the squadrons

A Mk V Spitfire with a fin flash and an A.1 roundel on the fuselage, as used from December 1940 through June 1942. The Type B roundel was retained on the wings almost until the war's end. Note the rear-view mirror above the windshield and the tape over the gun muzzles.



A Spitfire H.F.VII with extended triangular wing tips (above) and a Spitfire VB with clipped wing tips (below).

in May 1938. Later articles featured three-blade, controllable-pitch metal propellers. Nine squadrons of Spitfires were in service by the start of the war, and 19 were in service when the Battle of Britain started in August 1940. Spitfires fought in all theaters where the R.A.F. operated.

The early Spitfires were slightly superior to the German Me 109E in speed and maneuverability, but the Me 109 could out-climb and out-dive them, and its guns had greater range. To meet the competition, the Spitfire was continually improved throughout the war years, using two different engines and a variety of wing planforms and structures to accommodate varying armament. It also used different fuselages and tail shapes.

In 1940, three of the famous Eagle Squadrons, manned by American volunteer pilots, flew Spitfires. Because of the shortage of American fighters in 1943, the British provided two U.S. Army Air Force fighter groups in England with Spitfires.

Altogether, the U.S. obtained 600 Spitfires under Reverse Lend-Lease out of the 21,767 built. These weren't given standard U.S. Army designations or serial numbers. Instead, they flew with British designations, serial numbers, equipment and coloring, with only the U.S. star insignia to identify them as being operated by the USAAF.

Although the accompanying drawings show the Spitfire V with the standard wing and fuselage, the following text and photos cover all of the variants through the postwar Spitfire 24, and identify the significant configuration changes. The higher Mark (Mk) numbers are out of sequence because the Spitfires with Merlin engines are grouped separately from those with Griffon engines. It should be noted that Spitfires through Mk XX were identified by Roman numerals, while later ones were identified with Arabic figures.

SEA-GOING SPITFIRES

It was inevitable that a successful land-based fighter would be considered for use on aircraft carriers. This was done with the Spitfire, which then became the "Seafire." (The basic Seafire and its variants are described following the Griffon Spitfire write-ups.)

SPITFIRE WINGS

The basic Spitfire wing had an elliptical planform, a span of 36 feet, 10 inches and an area of 242 square feet. It was built in three types: A, B and C. The A-Wing had provision for four or eight .303-caliber machine guns entirely enclosed within it. The B-Wing had provision for two 20mm cannon in place of two machine guns. The C-Wing was called the "Universal Wing," and it could carry two 20mm cannons and either two or four .303 guns. The final wing was the E-Wing, which had only 1 inch more span but 2 feet more area, because of its different root and tip shapes. This wing was fitted with four 20mm cannons.

A Spitfire Mk VB of the 309th Fighter Squadron, 31st Fighter Group, with U.S. insignia. Note the bulge on the wing over the cannon breech and the hinge-down door necessary for pilot access to the narrow cockpit.

SUPERMARINE SPITFIRE

A Spitfire F.Mk XIV with a Rolls-Royce Griffon engine, four-blade propeller, cut-down rear fuselage with bubble canopy, and an enlarged vertical tail.

In all cases, the structure of the A-, B- and C-wings allowed for planform variations. The wing-tip panels could be removed and the ends covered to produce a "clipped wing" with a 32-foot, 7-inch span. The span could also be increased to 40 feet, 2 inches by adding new triangular tips in place of the ellipticals. These span changes could be made within the various Spitfire Marks without affecting the Mark numbers. Some of the Spitfire Mark numbers mentioned below were assigned to Seafires.

MERLIN-POWERED SPITFIRES

Mark I—This was the initial production model, with a 1,030hp Merlin II engine and a non-retractable tail wheel. The early straight-top canopy changed to the bulged type to increase the pilot's headroom and visibility. There were four .303 guns in the Mk I because of a shortage; but there were eight in the Mk IA. It had no protective armor. The Mk 1B had a B-Wing.

Mark II—This was just like the Mk I but had a 1,050hp Merlin XII engine and 73 pounds of armor. The Mk IIB had two 20mm cannons and four .303 guns in the B-Wing. A few flew in the Battle of Britain, and some were later converted to Mk V with more armor and a Merlin 45 engine.

Mark III—This was a single prototype, strengthened to take the two-stage Merlin XX engine that delivered 1,280hp for takeoff and 1,480hp at 12,250 feet. It had additional armor, a strengthened structure, a retractable tail wheel and clipped wings. The 1,000 production versions ordered were completed as "Mks V" and "IX," and a further 120 were cancelled.

P.R. Mark III—Unrelated to the Mk III prototype, many Mks I and II were fitted with cameras in the fuselage and redesignated "P.R. Mk III" (for "Photoreconnaissance").

P.R. Mark IV—This unarmed photoreconnaissance variant appeared in September 1941. Extra range was obtained by building fuel tanks into the leading edge of the wing, thereby eliminating the guns. Various cameras were in the fuselage, as they were on the P.R. Mk III.

Mark V—A major advance, using the Merlin 45, 50, or 50A (1,470hp at 9,250 feet), or the -46 engine that delivered 1,415hp at 14,000 feet. Mks VB and VC could carry 115 or 175 Imperial gallon auxiliary tanks under the fuselage and either two 250- or one 500-pound bomb. The Mk VC introduced the C-Wing and entered service in March 1941. Some were modified for low-altitude work with 1,585hp Merlin 45M, 50M, or 55M engines, and were redesignated "L.F. Mk V" (for "Low-Altitude Fighter").

Mark VI—This high-altitude fighter with a pressurized cockpit and 1,415hp Merlin 47 engine was developed from the Mk VB. This model introduced the extended, pointed wing tips. Gross weight: 7,178 pounds; high speed: 364mph at 22,000 feet.

Mark VII—A designed-for-the-purpose high-altitude fighter with a two-stage, 1,710hp Merlin 64 engine, a C-Wing and a retractable tail wheel. It was delivered in April 1942. Gross weight: 7,875 pounds; high speed: 408mph at 25,000 feet.

F. Mark VIII—This was similar to the Mk VII, but didn't have the pressurization. The high-altitude version with an extended wing was designated "H.F. Mk VIII"; the low-altitude version with clipped wings was designated "L.F. Mk VIII." Several Mk VIIIs were used for experimental modifications, but retained their "Mk VIII" designation.

Mark IX—With the Mk V outclassed by later Me 109s and the new Focke-Wulf Fw 190, Mk V airframes were refitted with 1,720hp Merlin 66 engines and redesignated "Mk IX." There were three versions—standard F, H.F. and L.F.—all with the Mk V's fixed tail wheel. Deliveries began in July 1942. H.F. Mk IX gross weight: 7,500 pounds; high

The first Spitfire Mk 22, with a Griffon engine, five-blade propeller, bubble canopy and enlarged tail. Note the bulges in the nose to cover the cylinder banks of the larger engine.

The final variant of the Spitfire line: the Seafire Mk 46 with contra-rotating propellers. Note the extension of the rudder carried by the stinger-type arrester hook. The later Mk 47 was very similar, except for its greater fuel capacity and folding wings.

speed: 416mph at 27,500 feet.

P.R. Mark X—A pressurized photo-reconnaissance version of the Mk IX.

P.R. Mark XI—Just like the P.R. Mk X but without pressurization. It was delivered in 1942.

Mark XVI—Similar to the Mk IX; some had a C-Wing, and later versions had an E-Wing and an enlarged vertical tail. Others had a cut-down rear fuselage and a bubble canopy. It was delivered in 1944 with a low-altitude, American-built Packard Merlin engine.

GRIFFON-POWERED SPITFIRES

The need for greater performance resulted in the installation of the 1,735-2,050hp Rolls-Royce Griffon engine. This was larger than the Merlin (2,240-cubic-inch displacement vs. 1,650). The larger size resulted in prominent bulges in the longer nose to cover the cylinder banks. Four- and five-blade propellers were used, and some variants used two three-blade counter-rotating propellers. Altogether, 2,053 Spitfires were delivered with Griffon engines.

Mark IV—The Griffon prototype, with a 1,735hp engine, a four-blade propeller and an extensively reinforced structure. A mock-up wing was fitted with six 20mm cannon, but no six-cannon Spitfire was ever produced. To avoid confusion with the Merlin-powered P.R. Mk IV, the Mk IV prototype was redesignated "Mk XX."

Mark XII—Built in two versions: a strengthened Mk VC airframe for low-altitude fighting with a fixed tail wheel; and a Mk VIII airframe with retractable tail wheels. All entered service early in 1943 and had larger vertical tails and four-blade propellers. Gross weight: 7,400 pounds; high speed: 393mph at 18,000 feet.

Mark XIV— These had Mk VIII airframes with five-blade propellers. Some late articles had cut-down rear fuselages and bubble canopies. The F.R. Mk XIVE was a fighter-reconnaissance variant with fuselage cameras and a 2,050hp Griffon 65 engine. Gross weight: 8,500 pounds; high speed: 448mph at 26,000 feet.

Mark XVIII—Built from scratch in two versions: the F.Mk XVIII fighters and the F.R. Mk XVIII fighter-reconnaissance planes. Both versions had a reinforced fuselage and wing, and carried additional fuel. They were delivered too late to serve in the war.

P.R. Mark XIX—Unarmed Mk XIV airframes with a Mk VC wing. The first 20 weren't pressurized, but the final 225 were. They were operational in the closing months of the war.

Mark XX—The Mk IV prototype redesignated.

Mark 21—A major redesign with new E-Wing and fuselage structure but old-style cockpit canopy. Its powerplant was a 2,050hp Griffon 61 engine driving a five-blade propeller. It had four-cannon armament. This design was made too late for combat; only 122 of the 1,500 Mk 21s ordered were built. Gross weight: 9,200 pounds; high speed: 454mph at 26,000 feet.

Mark 22—This was similar to the Mk 22, except for its cut-down rear fuselage and bubble canopy. Some had contra-rotating propellers.

Mark 24—The last of 21,767 Spitfires and Seafires built was the Mk 24, which was similar to the Mk 22, but had increased fuel capacity. The last one was delivered to the R.A.F. in October 1947.

SEAFIRES

Mark IB—This was a conversion of A-Wing Mk VB Spitfires with A-frame arrester hooks (see "Hawker Sea Hurricane"). They were put into service in June 1942. Seafires participated in the invasion of North Africa in November 1942.

Mark IIC—These were built as new airframes similar to the Mk VC Spitfires with C-Wings. It came in two versions, the F. Mk IIC and the L.F. Mk IIC; the latter had a 1,645hp Merlin 32 engine and four-blade propeller. Some L.F. IICs were fitted with cameras and operated as "P.R. Mk IIC."

Mark III—A disadvantage of the early Seafires was their lack of folding wings for shipboard storage. On the designed-for-the-purpose Mk III, the outer wing panels folded upward near the root, and the tips folded downward to reduce the height and clear the ceiling of the below-deck hangars. Its armament was two 20mm cannon and four .303 guns. The fuselage was reinforced for catapult launching, and up to 500 pounds of bombs could be carried. Variants were the L.F. Mk III and F.R. Mk III. Engine: 1,470hp Merlin 55; gross weight: 7,100 pounds; high speed: 352mph at 12,250 feet.

Mark XV—This was essentially a sea-going variant of the Mk XII Spitfire, with a 1,850hp Griffon VI engine and a four-blade propeller. After the first 50, the arrester hook was changed from the A-frame type to a stinger type below the rudder which was fitted with a fairing that continued the rudder contour. Gross weight: 8,000 pounds; high speed: 383mph at 13,500 feet.

Mark XVII—Similar to the Mk XV except for the bubble canopy.

Mark 45—The postwar equivalent of the Spitfire Mk 22, with non-folding wings and a Griffon 61 engine with a five-blade propeller.

Mark 46—Similar to the Mk 45, except that it was powered by a Griffon 87 engine driving co-axial propellers. Also, it had the fuselage structure and bubble canopy of the Spitfire Mk 22.

Mark 47—Similar to the Mk 46, except that its wings folded upward outboard of the cannon, and it wasn't necessary to fold the wing tips.

GROUND TRANSPORT

THE SPITFIRE MK.V_B FIGHTER IS TRANSPORTABLE ON THE GROUND BY DISASSEMBLY INTO FOUR COMPONENTS:

COMPONENT NO.1.
- MAIN FUSELAGE.
- ENGINE MOUNT.
- ENGINE OIL TANK.
- FUEL TANKS.
- FLIGHT CONTROLS.
- PILOT'S EQUIPMENT.
- HYDRAULIC COMPONENTS.

COMPONENT NO.2.
- MAIN PLANE.
- LANDING GEAR.
- WING FLAPS.
- AILERON AND WING FLAP CONTROLS.
- LANDING LIGHTS.
- ARMAMENT.

COMPONENT NO.3.
- EMPENNAGE AND TAIL PLANE CONTROL COUNTER SHAFT.
- TAIL WHEEL.

COMPONENT NENT NO. 4.
- ENGINE AND ACCESSORIES.
- COOLANT HEADER TANK.
- FRONT COWLING RING.

ENGINE INSTALLATION

THIS PLANE CAN BE EQUIPPED WITH SEVERAL VERSIONS OF THE ROLLS ROYCE MERLIN 12-CYLINDER VEE TYPE ENGINES. THE ENGINES ARE LIQUID COOLED AND SUPERCHARGED. THE ENGINE DRIVES A THREE BLADE CONTROLLABLE PITCH PROPELLER.

TROPICAL USE

FOR TROPICAL USE, A HOT AND COLD AIR INDUCTION SYSTEM IS INSTALLED WHICH HAS AN AIR FILTER, A LARGER ENGINE OIL TANK, A LARGER RADIATOR, AND A LARGER ENGINE OIL COOLER OIL DUCT OUTLET.

ENGINE ACCESSORIES

AIR COMPRESSOR.
ENGINE-DRIVEN GENERATOR(12-VOLT).
PROPELLER CONSTANT SPEED UNIT.
VACUUM PUMP.
ENGINE OIL DILUTION VALVE.
HYDRAULIC FLUID PUMP.
ENGINE COOLANT PUMP.
ENGINE OIL PUMP.
MANUAL FUEL PRIMER AND ENGINE FUEL PUMP.
ENGINE STARTER (ELECTRIC TYPE).
CARBURETOR.
MAGNETOS.

ENGINE MOUNT

THE ENGINE MOUNT IS A RIVETED TUBULAR STEEL STRUCTURAL CONFIGURATION. IT IS ATTACHED BY MEANS OF TAPERED BOLTS PASSING THROUGH LUGS ATTACHED TO THE FUSELAGE FIREWALL. A BUILT-UP U-SHAPE MEMBER IS PART OF THE MOUNT AND HAS BLOCKS TO WHICH THE ENGINE MOUNTING LUGS ARE ATTACHED. BRACKETS AND CLIPS ARE RIVETED TO THE TUBULAR MEMBERS FOR SECURING SUPPLY PIPES, LINES, ACTUATING PUSH-PULL TUBES, HOSES, ETC.

ENGINE CONTROLS

THE THROTTLE AND FUEL MIXTURE CONTROLS ARE HOUSED IN A QUADRANT ON THE LEFT SIDE OF THE COCKPIT. POSITION OF EACH LEVER IS MAINTAINED BY FRICTION PLATES. A SLOT IS PROVIDED FOR EACH LEVER AND A GATE FOR THE THROTTLE IN THE TAKE-OFF POSITION. THE FUEL MIXTURE LEVER CAN ONLY BE SET IN THE WEAK AND RICH POSITIONS. AN AUXILIARY CONTROL IS PROVIDED TO OVER-RIDE THE ENGINE AUTOMATIC BOOST CONTROL IN AN EMERGENCY.

PROPELLER CONTROL

THIS CONTROL IS MOUNTED ON THE ENGINE CONTROL QUADRANT (MANUALLY OPERABLE).

LDG. GR. POSITION INDICATOR SWITCH

A SWITCH FOR THE LANDING GEAR POSITION INDICATOR IS MOUNTED ON THE AFT PORTION OF THE ENGINE CONTROL QUADRANT AND IS OPERATED BY A STRIKER ON THE THROTTLE LEVER.

SLOW RUNNING CUT-OUT CONTROL

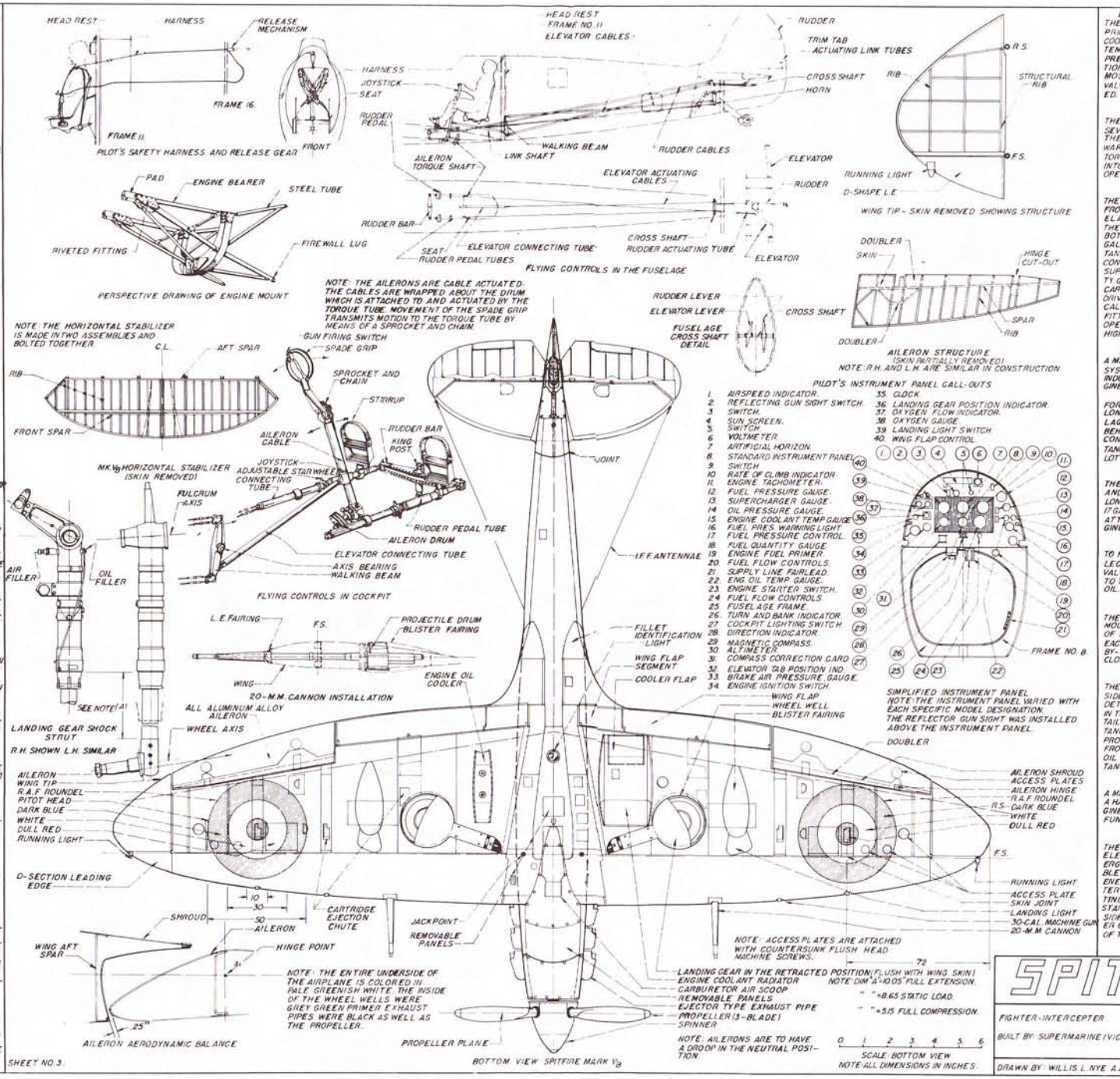
THE ENGINE IS EQUIPPED WITH A SLOW-RUNNING CUT-OUT CONTROL ON THE CARBURETOR WHEN STOPPING THE ENGINE. THIS CONTROL IS ACTUATED BY A PULL-RING ON THE INSTRUMENT PANEL.

ENGINE COOLANT RADIATOR

THE COOLANT RADIATOR IS MOUNTED UNDERSIDE OF THE RIGHT WING. IT IS ENCLOSED IN A FAIRING OPEN AT THE FRONT AND REAR. A COOLING FLAP IS PROVIDED TO REGULATE THE VOLUME OF AIR FLOWING THROUGH THE CORE AND THUS THE RATE OF COOLING. THE FLAP IS MANUALLY CONTROLLABLE.

ENGINE COOLANT

THE LIQUID COOLANT USED IN THE COOLANT SYSTEM IS A MIXTURE OF 70% DISTILLED WATER AND 30% ETHYLENE GLYCOL. THE ENGINE COOLANT TEMPERATURE IS CONTROLLED BY A THERMOSTAT.



ENGINE COOLANT HEADER TANK

THE LIQUID COOLANT HEADER TANK IS PRIMARILY AN EXPANSION SPACE FOR THE COOLANT AFTER IT REACHES OPERATING TEMPERATURE. IT IS PROVIDED WITH A PRESSURE RELIEF VALVE WHICH FUNCTIONS AT 2.5 P.S.I. ABOVE SEA LEVEL ATMOSPHERIC PRESSURE. THE PRESSURE VALVE IS THERMOSTATICALLY CONTROLLED.

GUN HEATERS

THE COOLING FLAP IS OPERABLE THROUGH SEVERAL SETTINGS. AT HIGH ALTITUDES THE FLAP CLOSED. IN THIS POSITION THE WARM AIR FLOWING THROUGH THE RADIATOR IS DIVERTED INTO WARM AIR DUCTS INTO THE GUN POSITIONS TO KEEP THE GUNS OPERATIVE.

FUEL SYSTEM

THE FUEL SYSTEM OBTAINS THE SUPPLY FROM TWO FUEL TANKS LOCATED IN THE FUSELAGE AFT OF THE FIREWALL BULKHEAD. THE 37 GALLON TANK IS MOUNTED IN THE BOTTOM OF THE FUSELAGE AND THE 48 GALLON TANK IS MOUNTED ABOVE IT. BOTH TANKS ARE INTERCONNECTED. A REMOTE CONTROL FUEL COCK CONTROLS THE FUEL SUPPLY. REMOTE INDICATING FUEL QUANTITY GAUGE IS INSTALLED. FUEL FLOW TO THE CARBURETOR IS PUMPED BY AN ENGINE-DRIVEN FUEL PUMP. AN IMMERSED ELECTRICALLY-DRIVEN FUEL BOOSTER PUMP IS FITTED IN THE LOWER TANK. THIS PUMP IS OPERATED BY SWITCH IN THE COCKPIT FOR HIGH ALTITUDE OPERATION.

FUEL INDUCTION PRIMING SYSTEM

A MANUALLY OPERATED FUEL PRIMING SYSTEM PUMP IS USED TO PRIME THE FUEL INDUCTION PIPES WHEN STARTING THE ENGINE.

LONG RANGE DROP TANKS

FOR LONG RANGE OPERATIONS, A 170 GALLON DROP TANK IS FITTED TO THE FUSELAGE. THE FUEL TANK IN THE FUSELAGE BEHIND THE PILOT'S COCKPIT IS USED IN CONJUNCTION WITH THE LONG RANGE TANK. A MANUAL RELEASE PERMITS THE PILOT TO JETTISON THE TANK IN FLIGHT.

ENGINE OIL SYSTEM

THE ENGINE OIL TANK HOLDS 8.5 GALLONS AND 2.6 GALLONS EXPANSION SPACE. FOR LONG RANGE OR TROPICAL OPERATIONS, A 17 GALLON OIL TANK IS FITTED. THE TANK IS ATTACHED TO THE UNDERSIDE OF THE ENGINE MOUNT.

ENGINE OIL DILUTION SYSTEM

TO FACILITATE FAST ENGINE STARTS, AN ELECTRICALLY OPERATED SOLENOID FUEL VALVE ALLOWS ENGINE FUEL TO FLOW INTO THE OIL TANK AND DILUTE THE ENGINE OIL. (OPERABLE BY THE PILOT).

ENGINE OIL COOLERS

THE TWO ENGINE OIL COOLERS ARE MOUNTED IN TANDEM ON THE UNDERSIDE OF LEFT WING AND SECURED IN A CRADLE. EACH COOLER HAS A DRAIN PLUG AND A BY-PASS VALVE. THE OIL COOLERS ARE ENCLOSED IN A FAIRING.

ENGINE OIL TANK

THE OIL TANK FILLER IS LOCATED LEFT SIDE OF THE FUSELAGE AND ITS POSITION DETERMINES THE CORRECT LEVEL OF OIL IN THE TANK WHEN THE PLANE IS IN THE TAIL DOWN POSITION. THE INTERIOR OF THE TANK IS FITTED WITH BAFFLES TO ASSURE PROPER MIXING OF HEATED RETURN OIL FROM THE ENGINE WITH THE REST OF THE OIL IN THE TANK. THE CONTOUR OF THE TANK CONFORMS TO THE FUSELAGE.

ENGINE HAND TURNING GEAR

A MANUAL STARTER IS NOT PROVIDED BUT A HANDLE IS PROVIDED TO TURN THE ENGINE CRANKSHAFT FOR MAINTENANCE FUNCTIONS.

ELECTRICAL ENGINE STARTER

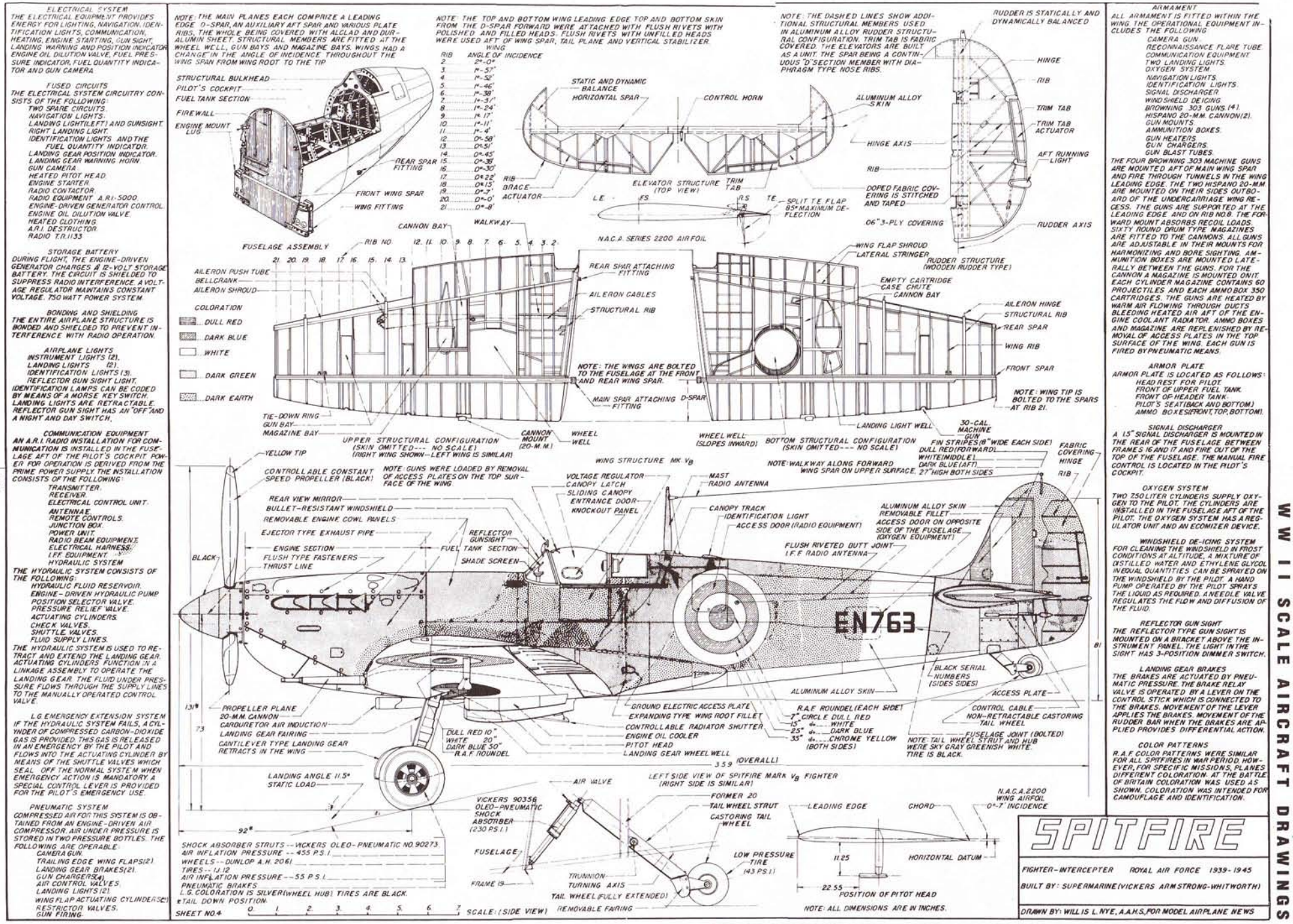
THE ENGINE IS STARTED BY MEANS OF AN ELECTRICAL ENGINE STARTER. IT IS ENERGIZED BY A STARTING SWITCH OPERABLE BY THE PILOT. 12-VOLT ELECTRICAL ENERGY IS SUPPLIED BY A STORAGE BATTERY. PROVISION IS ALSO MADE FOR STARTING BY MEANS OF EXTERNAL POWER. THE STARTER MOTOR IS FITTED TO THE RIGHT SIDE OF THE ENGINE. A STARTING BOOSTER COIL IS MOUNTED ON THE RIGHT SIDE OF THE ENGINE FIREWALL BULKHEAD.

SPITFIRE

FIGHTER-INTERCEPTER ROYAL AIR FORCE 1939-1945

BUILT BY: SUPERMARINE (VICKERS ARMSTRONG - WHITWORTH)

DRAWN BY: WILLIS L. NYE A.A.H.S. FOR MODEL AIRPLANE NEWS



SUPERMARINE SPITFIRE

SUPERMARINE SPITFIRE

THE SUPERMARINE SPITFIRE IS ONE OF THE GREAT AIRPLANES OF ALL TIME. A TOTAL OF 20,351 PLANES OF THIS TYPE WERE BUILT OF 18 DISTINCT MARKS AND HUNDREDS OF VARIANTS. SPITFIRES WERE BUILT BY THE SUPERMARINE, CASTLE BROMWICH AND WESTLAND FACTORIES. THESE FIGHTERS WERE FLOWN BY R.A.F., U.S.A.A.F. AND OTHER ALLIED NATIONS IN WORLD WAR II. NAVAL VERSIONS OF THE SPITFIRE WERE KNOWN AS THE SEAFIRE OF WHICH 2,408 WERE BUILT.

SPITFIRE PRODUCTION SUMMARY

MARK NO.	NO. OF PLANES
I	1,583
II	920
III	229
V	6,479
VI	100
VII	140
VIII	1,658
IX	5,665
X	16
XI	471
XII	100
XIV	957
XVI	1,054
XVIII	300
XIX	225
21	122
22	278
24	54

SEAFIRES

IB	372
II/III	30
III	1220
XV	340
XVII	232
45	50
46	24
47	90

LEADING PARTICULARS

NAME	SPITFIRE FVB
TYPE	FIGHTER SINGLE SEAT
WING SPAN	36'-10"
LENGTH	29'-11"
HEIGHT TO PROPELLER TIP	11'-5"
GROUND TO C.L. THRUST LINE	6'-1"
LANDING ANGLE	STATIC LOAD 11.5°
MEAN AERODYNAMIC CHORD	7'-1"
TAIL SURFACE SPAN	10'-6"
AIRFOIL	N.A.C.A. 2200
WING ANGLE OF INCIDENCE	2°
WING DIHEDRAL ANGLE	6°
WING AREA	242 SQ. FT.
AILERONS	18.9 SQ. FT.
WING FLAPS	15.6 SQ. FT.
TAIL PLANE ANGLE OF INCIDENCE	2°
TAIL PLANE AREA	31.46 SQ. FT.
ELEVATOR AREA	13.26 SQ. FT.
TRIM TABS	0.76 SQ. FT.
VERTICAL STABILIZER	4.61 SQ. FT.
RUDDER	8.23 SQ. FT.

CONTROL SURFACE MOVEMENT

AILERONS UP 26° ..... DOWN 19°
AILERON DROOP ..... 3/8 INCH.
ELEVATOR UP 28° ..... DOWN 23°
ELEVATOR TRIM TABS. UP 20° DOWN 7°
RUDDER 28° RIGHT OR LEFT
RUDDER TRIM TAB RIGHT 6° LEFT 18°
WING FLAPS ..... DOWN 85°

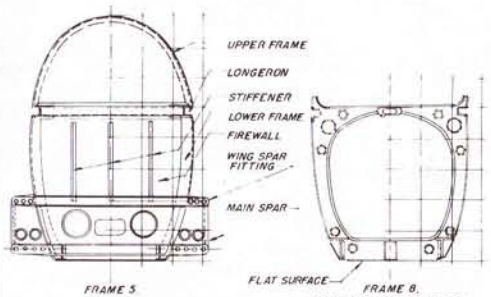
SPITFIRE MK. V

THE SPITFIRE MK. V TYPES VA, VB AND VC ARE SINGLE PLACE FIGHTERS, LOW WING MONOPLANES, POWERED BY ROLLS-ROYCE MERLIN ENGINES (45, 46, 50 AND 50A ON "F" VERSION PLANES). "F" VERSION PLANES ARE HIGH ALTITUDE FIGHTERS WHEREAS "LF" PLANES ARE POWERED WITH ROLLS-ROYCE MERLIN 45M, 50M OR 55M ENGINES. SPITFIRE IIA AND VB DIFFER ONLY IN ARMAMENT, THIS CHANGE BEING MADE BY USE OF DIFFERENT MAIN PLANES. THE VC TYPE COULD ACCOMMODATE ANY OF THE THE ARMAMENT INSTALLATIONS.

THE SPITFIRE FIGHTER WAS THE DESIGN CREATION OF R.J. MITCHELL, CHIEF ENGINEER OF THE SUPERMARINE WORKS OF VICKERS—ARMSTRONG IN RESPONSE TO THE AIR MINISTRY SPECIFICATION F.37/34 ISSUED IN 1935. THE FIRST PROTOTYPE K5054 FLEW AT R.A.F. PAGEANT AT HENDON IN 1936. THE FIRST PRODUCTION PLANE, K9787, WAS COMPLETED IN 1938. PLANE K9789 WAS THE FIRST PLANE TO ENTER SQUADRON SERVICE OF THE R.A.F. IN 1938.

R.A.F. SQUADRONS 71, 121 AND 133 WERE EAGLE SQUADRONS AND LATER WERE TRANSFERED TO 4TH FIGHTER GROUP OF U.S.A.A.F. 8TH AIR FORCE. 600 SPITFIRES WERE DIVERTED TO U.S.A.A.F. BY THE END OF 1943. THE 31ST FIGHTER GROUP OF THE U.S.A.A.F. THE FIRST AMERICAN AIR COMBAT UNIT IN EUROPE IN 1942, WAS EQUIPPED WITH SPITFIRES.

BRITAIN SUPPLIED 1331 SPITFIRES TO THE RUSSIAN AIR FORCE IN WORLD WAR II PLUS MANY OTHERS TO ALLIED NATIONS.

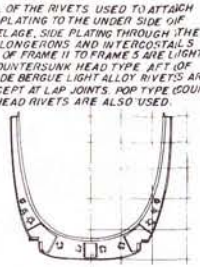


FRAME 5.

FRAME 8.

NOTE: FRAMES 6 TO 10 ARE SIMILAR IN DIMENSION AND GEOMETRICAL CONFIGURATION.

NOTE: ALL OF THE RIVETS USED TO ATTACH THE SKIN PLATING TO THE UNDER SIDE OF THE FUSELAGE, SIDE PLATING THROUGH THE FRAMES, LONGERONS AND INTERCOSTALS FORWARD OF FRAME 11 TO FRAME 5 ARE LIGHT ALLOY COUNTERSUNK HEAD TYPE. AFT OF FRAME 11, DE BERGUE LIGHT ALLOY RIVETS ARE USED EXCEPT AT LAP JOINTS. POP TYPE COUNTERSUNK HEAD RIVETS ARE ALSO USED.

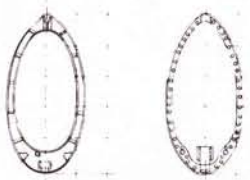


FRAME 10.

NOTE: LIGHTENING HOLES ARE BEADED AROUND THEIR EDGES FOR STRENGTH.

FRAMES 13 TO 18.

NOTE: FRAMES 13 TO 18 ARE SIMILAR EXCEPT IN GEOMETRICAL DIMENSIONS.

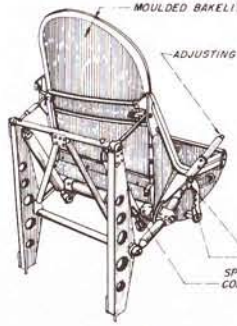


FRAME 19 (FORWARD). FRAME 19 (AFT).

NOTE: EACH HALF OF FRAME 19 IS BOLTED TOGETHER.

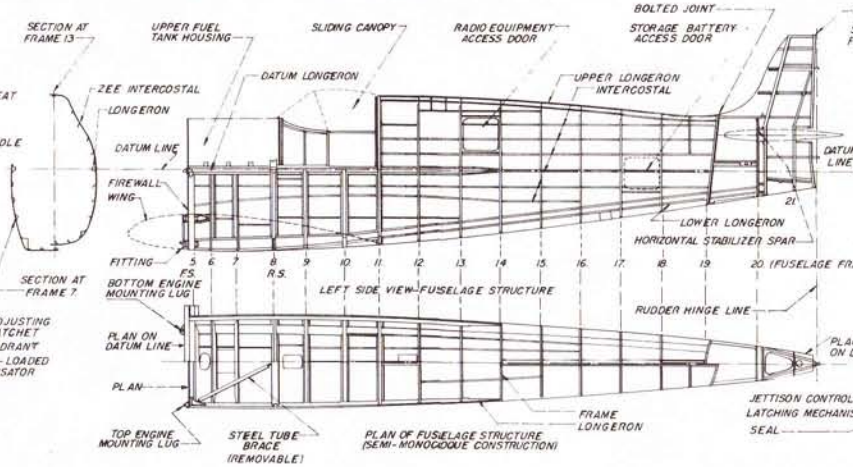
NOTE: EACH FUSELAGE FRAME IS OF CHANNEL SECTION.

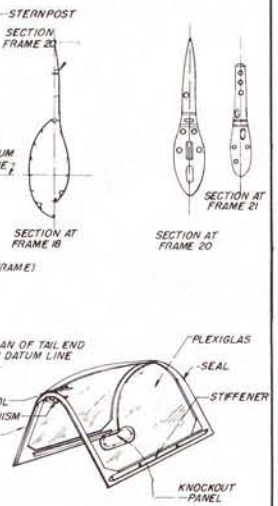
NOTE: THE WING PANELS ARE ATTACHED TO THE FUSELAGE AT THE MAIN SPAR BY MEANS OF THREADED BOLTS SECURED BY SAFETIED NUTS. CONTROL CABLES, SUPPLY LINES AND ELECTRIC WIRES HAVE DISCONNECT FITTINGS AT THE WING ROOTS.



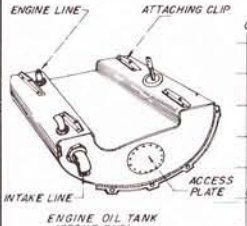
PILOT'S SEAT FRAME

NOTE: ARMOR PLATE IS ATTACHED TO THE BRACKETS AT THE BACK OF THE SEAT.

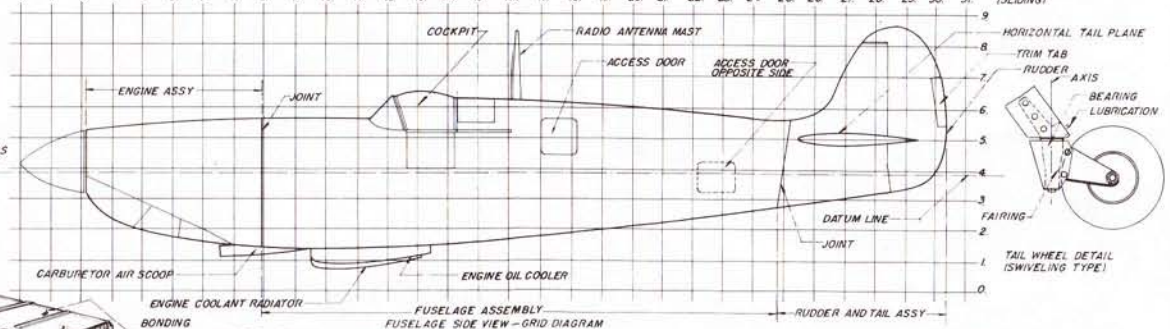




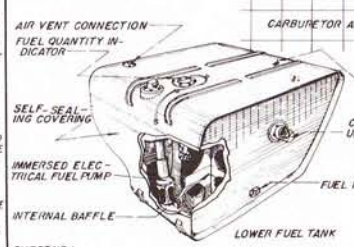
CANOPY DETAIL (SLIDING)

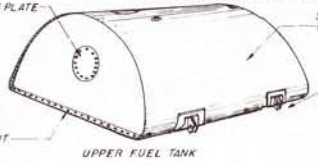


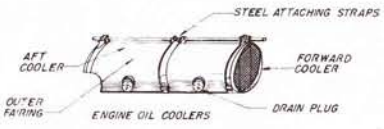
ENGINE OIL TANK (FRONT END)



TAIL WHEEL DETAIL (SWIVELING TYPE)







0 1 2 3 4 5 6 7 8 9
SCALE (SIDE VIEW)

SHEET NO.:

MAJOR ASSEMBLIES OF SPITFIRE

WING TIPS (RIGHT-LEFT).
AILERONS (RIGHT-LEFT).
MAIN PLANE (RIGHT-LEFT).
HEADER TANK.
ROLLS-ROYCE MERLIN ENGINE.
ENGINE EXHAUST MANIFOLDS (2).
ENGINE-DRIVEN GENERATOR.
UPPER FUEL TANK.
LOWER FUEL TANK.
ENGINE BRACE STRUTS.
FIREPROOF FUSELAGE BULKHEAD.
WINDSHIELD.
JETTISONABLE HOOD.
INSTRUMENT PANEL.
PILOT'S ACCESS DOOR.
RADIO COMPARTMENT ACCESS DOOR.
HORIZONTAL STABILIZER (RIGHT-LEFT).
ELEVATORS (RIGHT-LEFT).
VERTICAL STABILIZER.
RUDDER.
RUDDER TRIM TAB.
ELEVATOR TRIM TAB (RIGHT-LEFT).
TAIL WHEEL STRUT.
AFT PORTION WING-FUSELAGE FILLET.
MAIN PLANE AFT SPAR FITTING (2).
20M.M. GUN BAY (2).
AMMUNITION MAGAZINE DOOR (2).
MAIN LANDING GEAR (RIGHT-LEFT).
LANDING GEAR SHOCK STRUT (RIGHT-LEFT).
20 M.M. CANNON FAIRING (2).
20M.M. CANNON (2).
LANDING GEAR SHOCK STRUT FAIRING (2).
20M.M. CANNON ADJUSTING RING (2).
MAIN WING SPAR (2).
DROP TYPE FUEL TANK.
FRONT SPAR WING ROOT (2).
ENGINE MOUNT.
SUPPRESSOR.
ENGINE OIL TANK.
PROPELLER.
SPINNER.
FRONT COWLING RING.
MAIN FUSELAGE ASSEMBLY.
HYDRAULIC ACTUATING CYLINDERS.
PILOT'S SEAT.
WING FLAPS (RIGHT AND LEFT).
LANDING LIGHTS (2).
TAIL WHEEL.
MAIN LANDING WHEELS (2).
FLIGHT CONTROLS.
TAIL CONTROL COUNTERSHAFT.
ENGINE OIL TANK.
ARMAMENT, AMMO MAGAZINES.
RADIO EQUIPMENT.
MAIN PLANE FILLETS.
RADIATOR.
ENGINE OIL COOLERS (2).
BOMB CARRIER.
MAIN PLANE LEADING EDGE (2).

PILOT'S CONTROLS

FLIGHT CONTROLS.
FLIGHT CONTROLS LOCK.
ELEVATOR TRIM TAB.
RUDDER TRIM TAB.
LANDING GEAR OPERATION.
LANDING EMERGENCY EXTENSION.
WING FLAPS.
THROTTLE AND FUEL MIXTURE.
FUEL MANAGEMENT.
PROPELLER GOVERNOR.
RADIATOR SHUTTER.
ENGINE BOOST EMERGENCY CUT-OUT.
ENGINE IDLING CUT-OUT CONTROL.
ENGINE OIL DILUTION.
ENGINE FUEL PRIMER.
ENGINE STARTER.
CANOPY CONTROL.
PILOT'S SEAT ADJUSTMENT.
COCKPIT DOOR.
BRAKE CONTROL.
GUN CHARGERS.
GUN FIRING.
REFLECTOR GUN SIGHT.
LANDING LIGHTS.
COCKPIT LIGHTS.
NAVIGATION LIGHTS.
WINDSHIELD DE-ICER.
PITOT HEATER.
IDENTIFICATION LIGHTS.
SIGNAL DISCHARGER.
RADIO EQUIPMENT.
BOMB RELEASE.
PARACHUTE FLARE RELEASE.
BREATHING OXYGEN.
ENGINE IGNITION.

ACKNOWLEDGEMENT

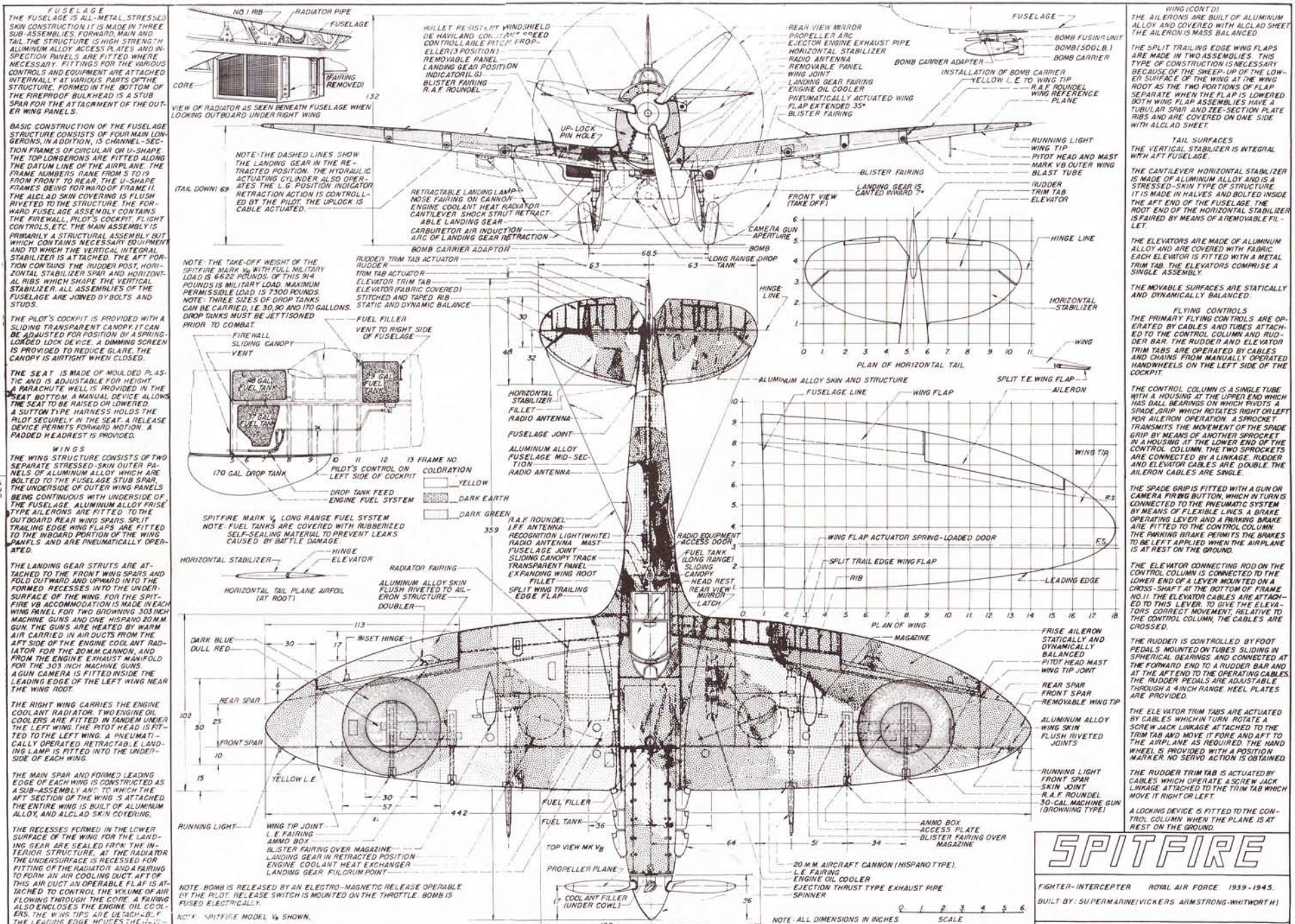
THANKS TO P.D. CAMPBELL OF KAPUSKASING, ONTARIO, CANADA WHO PROVIDED THE TECHNICAL DATA WHICH MADE THESE DRAWINGS POSSIBLE.

SPITFIRE

FIGHTER-INTERCEPTER ROYAL AIR FORCE 1939-1945

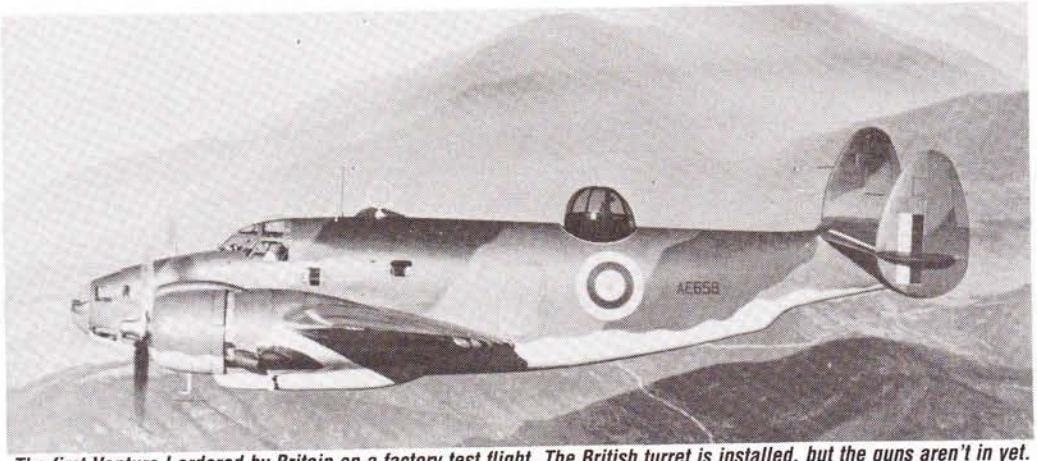
BUILT BY: SUPERMARINE (VICKERS ARMSTRONG-WHITWORTH)

DRAWN BY: WILLIS L. NYE A.A.H.S. FOR MODEL AIRPLANE NEWS



SUPERMARINE SPITFIRE

THE VEGA VENTURA



The first Ventura I ordered by Britain on a factory test flight. The British turret is installed, but the guns aren't in yet. Note the step-up forward of the tail for the ventral gunner's station.

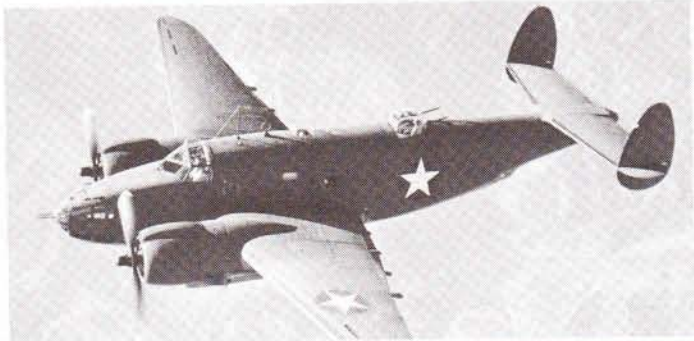
IN 1938, Lockheed introduced an improved version of its Model 14 airliner as the "Model 18 Lodestar." The British were pleased with the Hudson bomber conversion of the Model 14, and they asked Lockheed to do the same with the Model 18, but with more major changes.

The principal change was the use of the new 1,850hp Pratt & Whitney S1A4-G (R-2800) Double Wasp engine in place of the 875 to 1,200hp airliner powerplants. The R-2800s used wide-blade, or "paddle," propellers because the location of the engine nacelles on the Lodestar wing precluded larger diameters, and four-blade units weren't desirable. A bomber nose and a bomb bay similar to those on the Hudson were fitted, but the lower rear fuselage was modified to accommodate a ventral gunner's station, which resulted in a distinctive upward step toward the tail. A powered dorsal turret was installed farther forward than the one on the Hudson.

Lockheed gave the new bomber a new model number (37), and the British, after placing an initial order for 300 in May 1940, named it "Ventura." A further 375 were ordered later that year, and its first flight was on July 31, 1941.

The Venturas weren't built in Lockheed's Burbank plant, or even by Lockheed as such. Vega Aircraft Corp., a wholly-owned subsidiary with a factory adjacent to the Lockheed-owned Union Air Terminal in Burbank, was selected to build the Ventura, hence its identity as a Vega rather than a Lockheed product. On November 30, 1943, Vega was absorbed by Lockheed, and the factory, where 2,750 Boeing B-17s were also being produced, became "Lockheed Plant 1A." Some Ventura variants for the U.S. Army were built in the main Lockheed plant.

Ventura I—These had armament of two fixed and two flexible .303-caliber machine guns in the nose; two or four more in the dorsal turret; two in the waist positions; and two in the ventral station. The Ventura I could also carry 2,500 pounds of bombs. The first Mark Is were powered with 1,850hp civil engines. Deliveries began in September 1941, and Venturas were in service by November.



View from above of a U.S. Army Vega B-34, with two fixed .50-caliber machine guns and two flexible .30-caliber guns in the nose; .50-caliber guns are in the Martin powered turret and the ventral gun station.

Ventura II—The 487 Ventura IIs carried more fuel, 3,000 pounds of bombs and four guns in the turret, and they were powered with 2,000hp U.S. Army R-2800-31 engines.

Ventura IIA—These were 200 planes originally ordered for Britain under Lend-Lease that carried the U.S. Army designation "B-34." Only 25 were sent to the R.A.F.; others went to other Empire forces—20 to Australia, 25 to Canada with R.A.F. serial numbers, and 23 to New Zealand. The rest remained in the U.S. and were soon designated "RB-34," since they weren't considered suitable for combat missions. Most were used as trainers and for utility work.

Ventura III and IV—The Ventura III was to have been an R.A.F. version of the U.S. Army O-56 (later the B-37), but none of them were procured. No "Ventura IV" designation was assigned.

Ventura V—These were "navalized" versions of the Ventura supplied under Lend-Lease by the U.S. Navy from PV-1 orders. British forces acquired 388, and many were diverted to Australia, Canada, New Zealand and South Africa.

Long-range reconnaissance version of the U.S. Navy Vega PV-1 with 155-gallon drop tanks. Note the painted-over (once transparent) bomber nose, and the oddity of the star insignia on both the nose and the aft fuselage.

The prefix "G.R." was given to reconnaissance versions as in "G.R. Mark V."

American Venturas—The U.S. Army took over some of the British-contract Ventura Is, and then provided others to the R.A.F. and its own squadrons from later B-34 contracts. The Army, however, called its B-34s "Lexington" rather than "Ventura." The U.S. Navy became the major user of Venturas as "PV-1" and "PV-3," still using the British name.

Model 37—Because the drafted Ventura Is didn't meet U.S. Army specifications, they couldn't be given Army designations or serial numbers. Instead, the Army simply called them "Model 37." These became "R Model 37" in October 1942. This resulted in an interesting bit of confusion by some when they misunderstood the spoken letter "R" to mean "Our Model 37," as compared with the British Model 37.

B-34—The first 200 Lend-Lease Venturas were designated "B-34," and only 24 went to the U.S. Army. Major changes included an American Martin turret and American equipment and armament, including .50-caliber machine guns.

B-34A—A further 211 B-34s: 66 went to Britain and the others went to the U.S. Army as follows: 101 B-34A-2 bomber trainers, 28 B-34A-3 gunnery trainers and 16 B-34A-4 target tugs.

B-37—The Army ordered 550 armed reconnaissance/observation versions of the Ventura under the designation "O-56." Before they were completed, however, the Army discontinued the "O for Observation" category and redesignated the O-56s as bombers, since they fit that category and could still carry 2,000 pounds of bombs. The designation "B-34B" was to have been assigned, but because the planes had 1,700hp Wright R-2600-13 Double Cyclone engines instead of Pratt & Whitneys, they were given the new bomber designation "B-37." Production was in the main Lockheed plant, but because the space was needed for other projects, the contract was cut short. Only 18 B-37s were built, and they were used as trainers.

PV-1—The U.S. Navy, with 1,600 PV-1 variants ordered as "PV-1" ("P" for Patrol; "V" for Vega), was the major Ventura user. These carried additional internal fuel, plus two 155-gallon drop tanks and fittings for 10 5-inch rockets, and they could carry up to 3,000 pounds of bombs, depth charges, or a torpedo in the bomb bay. The Navy used its Venturas widely in the Pacific and in Alaska from early 1943 until the end of the war. Armament varied greatly according to the mission, including night fighters for the U.S. Marines with three-man crews, six fixed nose guns and British night-intercept radar. Some photographic conversions were designated "PV-1P."

PV-2—A greatly revised Ventura with longer wings, larger tail surfaces and extensive internal and armament changes was ordered in 1943. The revisions justified its new name, "Harpoon," and made this plane too different from the basic Ventura to be called such. Harpoons did see action late in the war.

PV-3—To get Venturas into its inventory before the PV-1s on order could be built, the U.S. Navy took the last 27 of the British Ventura IIs and designated them "PV-3" in October 1942.

Top photo: an unarmed U.S. Army Ventura I that had been drafted from the British order and redesignated "Lockheed Model 37." Above: one of the 18 U.S. Army Lexingtons that had been ordered as O-56 observation planes, but were delivered as B-37 bombers.

INSTRUMENTS

INSTRUMENTS FOR FLIGHT AND ENGINE OPERATION ARE PROVIDED FOR THE PILOT AND AIRCREW. THE INDICATING INSTRUMENTS ARE PNEUMATICALLY, HYDRAULICALLY OR ELECTRICALLY OPERATED. INSTRUMENTS ARE AS FOLLOWS

AIR AND ENGINE OIL TEMPERATURE INDICATORS.
ENGINE MANIFOLD PRESSURE INDICATORS.
AIR SPEED INDICATORS.
ENGINE REVOLUTION INDICATORS.
FUEL QUANTITY INDICATORS.
FUEL PRESSURE INDICATORS.
FUEL FLOW METERS.
HYDRAULIC PRESSURE INDICATORS.
DE-ICER AIR PRESSURE INDICATOR.
ALTIMETER.
MAGNETIC COMPASS.
DIRECTIONAL GYRO. GYRO HORIZON.
RATE OF CLIMB INDICATOR.
OXYGEN PRESSURE INDICATOR.
ANTI-ICER FLUID QUANTITY INDICATOR.
BATTERY AMMETERS.
AUTO-PILOT.
EMERGENCY BRAKE AIR PRESSURE INDICATOR
CLOCK.
WING FLAP POSITION INDICATOR.
LANDING GEAR POSITION INDICATOR.
TRIM TAB POSITION INDICATORS.
STEERING INDICATOR.
TURN AND BANK INDICATOR.
CARBURETOR AIR TEMPERATURE INDICATOR.
ENGINE OIL COOLER SHUTTER POSITION INDICATOR.
VACUUM INDICATOR

NAVIGATION INSTRUMENTS

CLOCK.
AIR SPEED INDICATOR.
ALTIMETER.
AIR TEMPERATURE INDICATOR.

BOMBARDMENT INSTRUMENTS

BOMB SIGHT PLUG.
CAMERA PLUG.
BOMB SELECTOR KEYS.
FUSING SWITCH.
BOMB APPROACH DIRECTOR SWITCH.
INTERVALOMETER SWITCH.
FLEXIBLE LIGHT RHEOSTAT.
FLIGHT INSTRUMENT RHEOSTAT.
DRIFT SIGHT RHEOSTAT.
BOMB RELAY RESET SWITCH.
INDICATOR LIGHTS.
BOMB RELEASE RELAY FUSE PANEL.

VENTILATION SYSTEM

FRESH AIR IS INDUCTED INTO THE FUSELAGE THROUGH 5 ADJUSTABLE AIR VENT INTAKE ASSEMBLIES. THE VOLUME OF INDUCTED AIR IS MANUALLY CONTROLLED. FOUL AIR IS EXHAUSTED FROM OUTLETS IN THE FUSELAGE SKIN.

LANDING GEAR

THE LANDING GEAR IS OF THE HYDRAULICALLY OPERATED, RETRACTABLE TYPE, AND RETRACTS COMPLETELY WITHIN THE ENGINE NACELLES. THE OPENINGS IN THE BOTTOM OF EACH NACELLE ARE PROVIDED WITH DOORS THAT OPEN AND CLOSE WITH THE OPERATION OF THE LANDING GEAR. WHEN THE LANDING GEAR IS EXTENDED, THE OLEO-PNEUMATIC SHOCK ABSORBER STRUTS ARE PERPENDICULAR TO THE THRUST LINE. THE PILOT OPERATES A CONTROL ON THE ENGINE CONTROL PEDESTAL TO RETRACT THE LANDING GEAR

PHOTOGRAPHIC EQUIPMENT

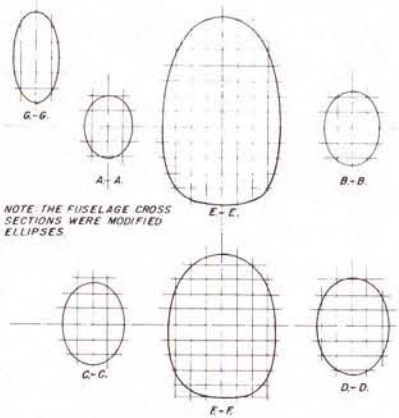
AN AERIAL CAMERA IS MOUNTED ON THE LEFT SIDE OF THE FUSELAGE ADJACENT TO THE ENTRANCE DOOR. THE CAMERA CAN BE USED FOR VERTICAL OR OBLIQUE PHOTOGRAPHY. THE CAMERA MAY BE OPERATED WITH AN 8, 10 OR 14" LENS. THE CAMERA IS ELECTRICALLY OPERATED AND CAN TAKE A TIMED SEQUENCE OF PHOTOS BY INCLUDING THE INTERVALOMETER INTO THE CAMERA CIRCUIT

AIRCREW SURVIVAL

EACH CREW MEMBER HAS A PERSONAL FLOTATION JACKET AND SURVIVAL KIT, FIRST-AID KIT.

STOWAGE ITEMS

THE FOLLOWING ITEMS ARE STOWED ABOARD FOR AIRCREW USE.
GROUND-TO-AIR SIGNAL CARD INDEX.
TWO POUND FIREMAN'S AXE.
BOMB HOIST MECHANISM.
RUBBER MAT TO COVER BOMBARDIER'S WINDOW
ADJUSTABLE AERIAL WINCH.
FLASHLIGHTS FOR AIRCREW.
TOOL KIT (AIRFRAME AND ENGINE)
FOUR ONE PINT VACUUM FLASKS.
PORTABLE FIRE EXTINGUISHERS.
WALK-AROUND OXYGEN BOTTLES.
MARINE DISTRESS SIGNALS.
DRAFTING MACHINE ON BOMBARDIER'S TABLE
FLOTATION TYPE SEAT CUSHIONS.
TO PUBLICATIONS.
WEIGHT AND BALANCE MANUAL.
PILOT'S CHECK-OFF CARD
CHEMICAL TOILET.
RUBBER FLOOR MAT AT CREW STATIONS.
PLANE FLIGHT RECORDS.
VERY PISTOL AND CARTRIDGES.
SPARE ELECTRICAL FUSES AND LAMPS.
SPARE ELECTRONIC TUBES.
SEA MARKERS.
FLOATING SURVIVAL CONTAINER
FLOAT LIGHTS.
GUN TURRET AND ASTRODOME COVERS.
CREW RATIONS.

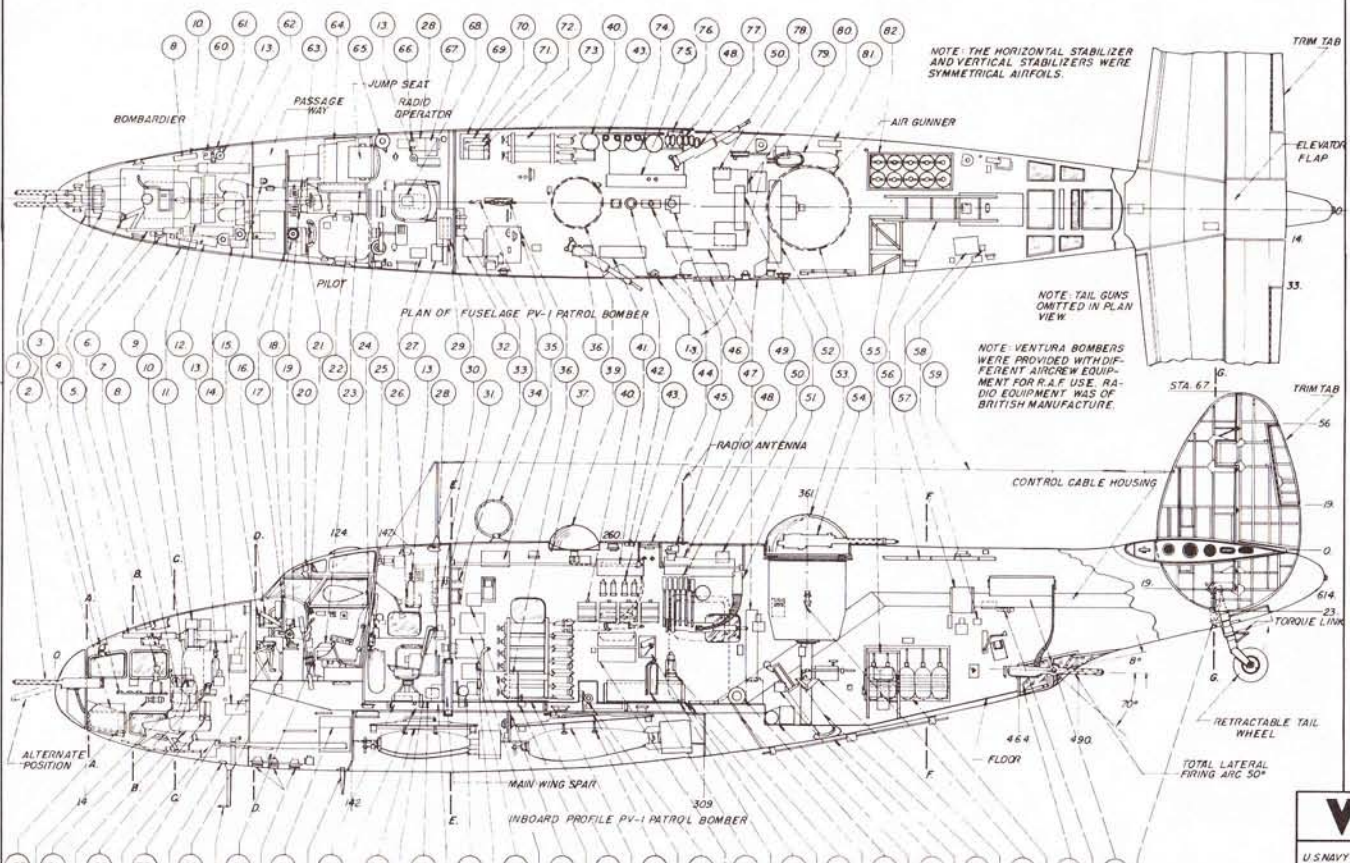


NOTE: THE FUSELAGE CROSS SECTIONS WERE MODIFIED ELLIPSES.

APPROXIMATE FUSELAGE CROSS SECTIONS PV-1

CALL-OUT NOMENCLATURE

1. NOSE GUNS.
2. NOSE GUNS AMMUNITION BOXES.
3. NAVIGATOR'S REMOTE INDICATING COMPASS.
4. VARD AIRCRAFT PLOTTER.
5. FIXED NOSE GUNS (NO LATERAL MOVEMENT)
6. ASTRO COMPASS.
7. ASTROGRAPH.
8. MN26C REMOTE COMPASS.
9. NAVIGATOR'S INSTRUMENT PANEL.
10. AZIMUTH INDICATOR.
11. FIXED NOSE GUNS AMMUNITION BOXES.
12. BOMBARDIER'S ELECTRIC SWITCH PANEL.
13. HAND FIRE EXTINGUISHER.
14. INTERVALOMETER.
15. FIRE EXTINGUISHER IMPACT ACTUATOR.
16. SPERRY AUTOMATIC PILOT.
17. PILOT'S INSTRUMENT PANEL.
18. 1826-1 PILOT'S COMPASS.
19. PROPELLER CONTROL BOX.
20. PILOT'S REMOTE INDICATING COMPASS.
21. CONTROL COLUMN.
22. AUXILIARY CONTROL COLUMN
23. MAIN ELECTRICAL CONTROL BOX
24. MAIN HYDRAULIC FLUID RESERVOIR.
25. AIRCREW FLASHLIGHTS.
26. AI/3-4 AMPLIFIER.
27. INTERPHONE AMPLIFIER.
28. BLIND LANDING APPROACH RECEIVER.
29. ONE GALLON THERMOS.
30. RADIO OPERATOR'S AND INTERPHONE EQUIPMENT.
31. RADIO ANTENNA TRANSFER RELAY.
32. DYNAMOTOR.
33. 2-VOLT BATTERY CONTAINERS.
34. RADIO LOOP ANTENNA.
35. RADIO COMPASS RECEIVER.
36. CHEMICAL TOILET.
37. EMERGENCY ESCAPE EXIT.
38. LEFT HAND SIDE GUN (30-CAL.)
39. ASTRO HATCH.
40. DRINKING WATER CANTEENS.
41. L.H. SIDE GUN AMMO BOX.
42. UPPER RECOGNITION LIGHT.
43. VACUUM THERMOS FLASKS.
44. VERY PISTOL SOCKET.
45. REMOTE INDICATING COMPASS TRANSMITTER.
46. FUSELAGE ENTRANCE DOOR WITH DINGHY.
47. PARACHUTE STOWAGE RACK.
48. MARINE DISTRESS FLARES.
49. EXTERNAL BATTERY CART PLUG.
50. FIRST AID KIT.
51. R.H. SIDE GUN AMMO BOX.
52. DINGHY RADIO TRANSMITTER AND ACCESSORY CASE.
53. GUN TURRET (MARTIN TYPE)
54. TWIN TURRET GUNS (50-CAL.)
55. CAMERA MOUNT.
56. LADDER STOWAGE.
57. RADIO REGEIVER.
58. IMPACT DESTRUCTOR.
59. RADIO ANTENNA.
60. BOMBARDIER'S WINDOW ANTI-ICER TANK.
61. DRIFT RECORDER.
62. BOMB SIGHT.
63. ENGINE CONTROL STAND.
64. BATTERY COMPARTMENT.
65. EMERGENCY LANDING GEAR EXTENSION UNIT.
66. BLIND APPROACH JUNCTION BOX.
67. BLIND APPROACH DYNAMOTOR.
68. AUTOMATIC SERVO UNIT.
69. RADIO RECEIVER.
70. RADIO TRANSMITTER.
71. RADIO JUNCTION BOX.
72. ANTENNA LOADING UNIT.
73. RECONNAISSANCE FLARES.
74. TOOL AND ACCESSORY STORAGE BOX
75. FLIGHT RATIONS CONTAINER.
76. INTER-AIRCRAFT CONTROL LAMP
77. RIGHT HAND SIDE GUN (30-CAL.)
78. TRAILING ANTENNA REEL.
79. EMERGENCY RATION CONTAINER.
80. FLARE CHUTE.
81. BLIND APPROACH RADIO RECEIVER.
82. OXYGEN FLASKS.
83. RUDDER PEDAL ASSEMBLY.
84. IMMERSION SWITCH.
85. PITOT MAST.
86. DOWNWARD IDENTIFICATION LIGHTS.
87. RADIO ANTENNA.
88. BOMB RACKS.
89. FUEL JETTISON VALVE.
90. WING FLAP POSITION INDICATOR TRANSMITTER.
91. BOMB BAY DOOR HYDRAULIC ACTUATING CYLINDER.
92. WING FLAP HYDRAULIC ACTUATING CYLINDER.
93. VERY PISTOL CARTRIDGE BOX.
94. VERY PISTOL.
95. DI-POLE RADIO ANTENNA.
96. TUNNEL GUNS (30-CAL.)
97. TUNNEL GUNS AMMO BOXES.
98. TAIL WHEEL POSITION INDICATOR TRANSMITTER.



NIGHT FIGHTER

THE PV-1 COULD BE CONVERTED TO THE ROLE OF A NIGHT FIGHTER BY MODIFICATION OF THE FORWARD NOSE GUNS AND BOMBARDIER'S COMPARTMENT. THE RADAR EQUIPMENT IS FITTED INTO THIS COMPARTMENT AND A PLASTIC NOSE FOR THE RADAR ANTENNA. THE PV-1 MADE ITS FIRST NIGHT FIGHTER KILL AT TOROKINA, SOLOMON ISLANDS, NOVEMBER, 1943. AN AIRCREW OF THREE WAS CARRIED ON NIGHT FIGHTING MISSIONS. PILOT CAN FIRE THE FORWARD 50-CAL. GUNS BY PRESSING BUTTON ON THE CONTROL COLUMN.

SURFACE CONTROLS

THE SURFACE CONTROLS ARE ACTUATED BY MEANS OF CABLES, PUSH-PULL TUBES, BELL CRANKS AND CABLE SECTORS. THEY ARE CONTROLLED FROM THE FLIGHT STATION BY THE CONTROL WHEEL, CONTROL COLUMN AND RUDDER PEDALS. STOPS ARE PROVIDED TO LIMIT MOVEMENT AND INTERFERENCE WITH THE ADJACENT STRUCTURE.

TRIM AND BALANCE TABS

COMBINATION TRIM AND BALANCE TABS ARE ATTACHED TO THE MOVABLE PORTIONS OF THE CONTROL SURFACES, WITH THE EXCEPTION OF THE RIGHT AILERON. THIS TAB FUNCTIONS AS A BALANCE TAB ONLY. THE AMOUNT OF TRIM REQUIRED IS MADE EVIDENT TO THE PILOT BY INDICATORS ON THE CONTROLS IN THE FLIGHT STATION.

LANDING GEAR SHOCK STRUTS

THE SHOCK STRUTS EMPLOY A COMBINATION HYDRAULIC AND PNEUMATIC ACTION TO ABSORB LANDING LOADS. IMPACT LOADS ARE ABSORBED BY HYDRAULIC ACTION. TAXYING LOADS ARE ABSORBED BY THE PNEUMATIC AIR CUSHION.

LANDING GEAR WHEELS

THESE WHEELS ARE CAST FROM MAGNESIUM ALLOY, 15 X 16 IN SIZE, AND ARE FITTED WITH TAPERED ROLLER BEARINGS. THE TAIL WHEEL IS ALSO MADE OF MAGNESIUM AND IS 18 INCH STREAMLINE TYPE. TIRES ARE 16.00 X 1600 HEAVY DUTY, 10-PLY, INNER TUBE TYPE. TAIL WHEEL TIRE IS 18-INCH STREAMLINE TYPE. TAIL WHEEL HAS A CABLE OPERATED CENTERING LOCK.

LANDING GEAR BRAKES

THE HYDRAULIC BRAKES ARE TOE OPERATED BY THE PILOT BY MEANS OF INDIVIDUAL BRAKE VALVES ACTING ON EACH RUDDER PEDAL. EACH BRAKE CAN BE INDIVIDUALLY CONTROLLED. MULTIPLE DISC TYPE BRAKES ARE USED. A PARKING BRAKE IS ALSO INSTALLED.

SAFETY DEVICES

THESE DEVICES CONSIST OF LANDING GEAR WARNING HORN, ELECTRICALLY OPERATED CONTROL LEVER LATCH, AN UPLOCK AND THE HYDRAULICALLY OPERATED DOWNLOCK.

L.G. EMERGENCY EXTENSION

THIS IS ACCOMPLISHED BY MEANS OF AN INDEPENDENT HYDRAULIC SYSTEM OPERATED BY THE PILOT AFTER RELEASE OF THE MECHANICAL UPLOCK.

HYDRAULIC SYSTEM

THE HYDRAULIC PRESSURE SYSTEM OPERATES THE FOLLOWING COMPONENTS:
LANDING GEAR.
TAIL WHEEL.
LANDING GEAR BRAKES.
BOMB BAY DOORS.
GUN CHARGERS.
FOWLER TYPE WING FLAPS.
HYDRAULIC PRESSURE IS SUPPLIED BY TWO ENGINE-DRIVEN PUMPS. NORMAL OPERATING PRESSURE IS 650-750 P.S.I. 2 OT GALLONS ARE CONTAINED IN THE FLUID RESERVOIR. AN AIR-BALLASTED PRESSURE ACCUMULATOR MAINTAINS PRESSURE IN THE SYSTEM UNDER LOAD IN CONJUNCTION WITH THE HYDRAULIC FLUID PRESSURE REGULATOR.

TAIL EMERGENCY EXTENSION

IF THE MAIN HYDRAULIC SYSTEM FAILS, THE TAIL WHEEL CAN BE EXTENDED BY MANUAL OPERATION BY MEANS OF A CABLE EXTENSION SYSTEM.

PLANE DEVELOPEMENT

THE PV-1, WHILE SIMILAR IN APPEARANCE TO THE LOCKHEED LODESTAR, WAS A COMPLETELY DIFFERENT PLANE. IT WAS ENGINEERED AROUND A BASIC LOCKHEED CONFIGURATION. THE WEIGHT WAS INCREASED, FLIGHT RANGE INCREASED, PERFORMANCE IMPROVED ETC. THE STRUCTURE WAS STRENGTHENED FOR MILITARY PERFORMANCE. BASIC DIMENSIONS REMAINED THE SAME EXCEPT THE WING CENTER SECTION WHICH WAS INCREASED IN SPAN.

VENTURA

U.S.NAVY PATROL BOMBER PV-1 WORLD WAR 1939-1945.
MFR'D: LOCKHEED AIRCRAFT CORPORATION AT BURBANK, CALIFORNIA
DRAWN BY: WILLIS L. NYE, A.A.H.S.
FOR
MODEL AIRPLANE NEWS NEW YORK CITY, N.Y.

SHEET NO. 3

ARMAMENT

THE NOSE GUNS ARE TWO-POSITION FIXED 30-CALIBER BROWNING M-2 TYPE. THEY ARE LOCKED TO FIRE STRAIGHT FORWARD OR CAN BE DEPRESSED 25° DOWNWARD. THE GUNS ARE MANUALLY CHARGED BY THE BOMBARDIER AND ELECTRICALLY FIRED BY THE PILOT. 375 ROUNDS OF AMMO ARE CARRIED. THE FIXED 50-CAL. FORWARD FUSELAGE GUNS ARE ARRANGED TO FIRE FORWARD AND ARE CHARGED HYDRAULICALLY. THE GUNS ARE FIRED ELECTRICALLY BY THE PILOT. 125 ROUNDS OF AMMO ARE CARRIED. THE SPENT CARTRIDGES ARE EJECTED INTO CANVAS BAGS ADJACENT TO THE NOSE GUNS AND FIXED FORWARD GUNS. PROVISION IS MADE TO CARRY EXTRA AMMO. TWO MACHINE GUNS ARE ALSO MOUNTED IN THE AFT VENTRAL POSITION. THE 30-CAL. TYPE M-2 GUNS ARE FLEXIBLE IN OPERATION. THE GUNS FIRE 8° UPWARD AND 70 DEGREES DOWNWARD. LATERAL TRAVERSE IS 25° EACH SIDE OF THE CENTERLINE OF THE AIRPLANE. 500 ROUNDS OF AMMO ARE CARRIED. AMMO IS SUPPLIED FROM FLEXIBLE CHUTES TO EACH GUN. 500 EXTRA ROUNDS PER GUN CAN BE CARRIED. LINKS AND SPENT CARTRIDGES ARE EJECTED OUTSIDE THE FUSELAGE. THE GUNS ARE FIRED AND CHARGED MANUALLY. SIDE 30-CAL. FLEXIBLE GUNS MAY BE MOUNTED IN THE WINDOWS OF THE FUSELAGE. BALL SOCKET MOUNTS ARE USED. GUNS ARE SUPPLIED WITH AMMO BY MEANS OF FLEXIBLE CARTRIDGE CHUTES. MANUAL CHARGING AND FIRING ARE USED. INTERRUPTERS PREVENT THE GUNS FROM FIRING INTO THE STRUCTURE.

ARMOR PLATE

ALL SEATS FOR THE AIRCREW ARE PROTECTED BY ARMOR PLATE EXCEPT THE RADIO OPERATOR'S SWIVEL SEAT. THE RECONNAISSANCE FLARES AND INSTRUMENT PANEL ARE ALSO PROTECTED BY ARMOR PLATE.

BOMBING COMPONENTS

ADAPTERS TO CARRY BOMBS IN A UNIVERSAL BOMB CARRIER.
BOMB RELEASE SWITCHES.
PILOT'S BOMB RELEASE AND BOMB BAY DOOR OPERATING SWITCH.
BOMB JETTISON RELEASE SWITCH.
BOMB ARMING SWITCH (PILOT AND BOMBARDIER)
MANUAL BOMB HOIST.
HYDRAULIC CONTROL VALVES.

BOMB LOAD

THE FOLLOWING BOMB LOAD CAN BE STOWED IN THE BOMB BAY:
6 300 LB. BOMBS OR 1 500 LB. BOMB
7 300 LB. BOMBS OR 6 350 LB. DEPTH CHARGES
1 2000 LB. TORPEDO AND TORPEDO RACK.

BOMB SIGHT

A TYPE D-8 BOMB SIGHT IS INSTALLED IN THE BOMBARDIER'S COMPARTMENT. THE BOMBARDIER'S WINDOW FOR AIMING THE BOMBS IS PROVIDED WITH AN ANTI-ICING PUMP, TANK AND SPRAY NOZZLE.

BOMB BAY ADAPTERS

BRACKETS ARE INSTALLED FOR HOLDING SEVEN BOMB ADAPTERS IN THE BOMB BAY. SWAY BRACES ARE PROVIDED TO PREVENT ROLLING OF THE BOMBS.

BOMB BAY DOORS

BOMB BAY DOORS CONSIST OF FOUR ASSEMBLIES DIVIDED LONGITUDINALLY AND ARRANGED IN GROUPS OF TWO PANELS HINGED TO EACH OTHER AND TO THE FUSELAGE BELOW THE FLOOR. THE BOMB BAY DOORS OPERATE SWITCHES TO ENERGIZE INDICATOR LIGHTS IN THE FLIGHT AND BOMBARDIER'S STATIONS, AND WHICH ALSO PREVENT RELEASE OF THE BOMBS UNLESS THE DOORS ARE OPEN.

BOMB LOADING

BOMBS ARE HOISTED TO THE ADAPTERS BY MEANS OF A GEARED MANUALLY OPERATED HOIST.

INTERVALOMETER

AN ELECTRICALLY OPERATED INTERVALOMETER DISTRIBUTES THE BOMBS AS TO TIMING THE RELEASE.

BOMB RELEASE SYSTEM

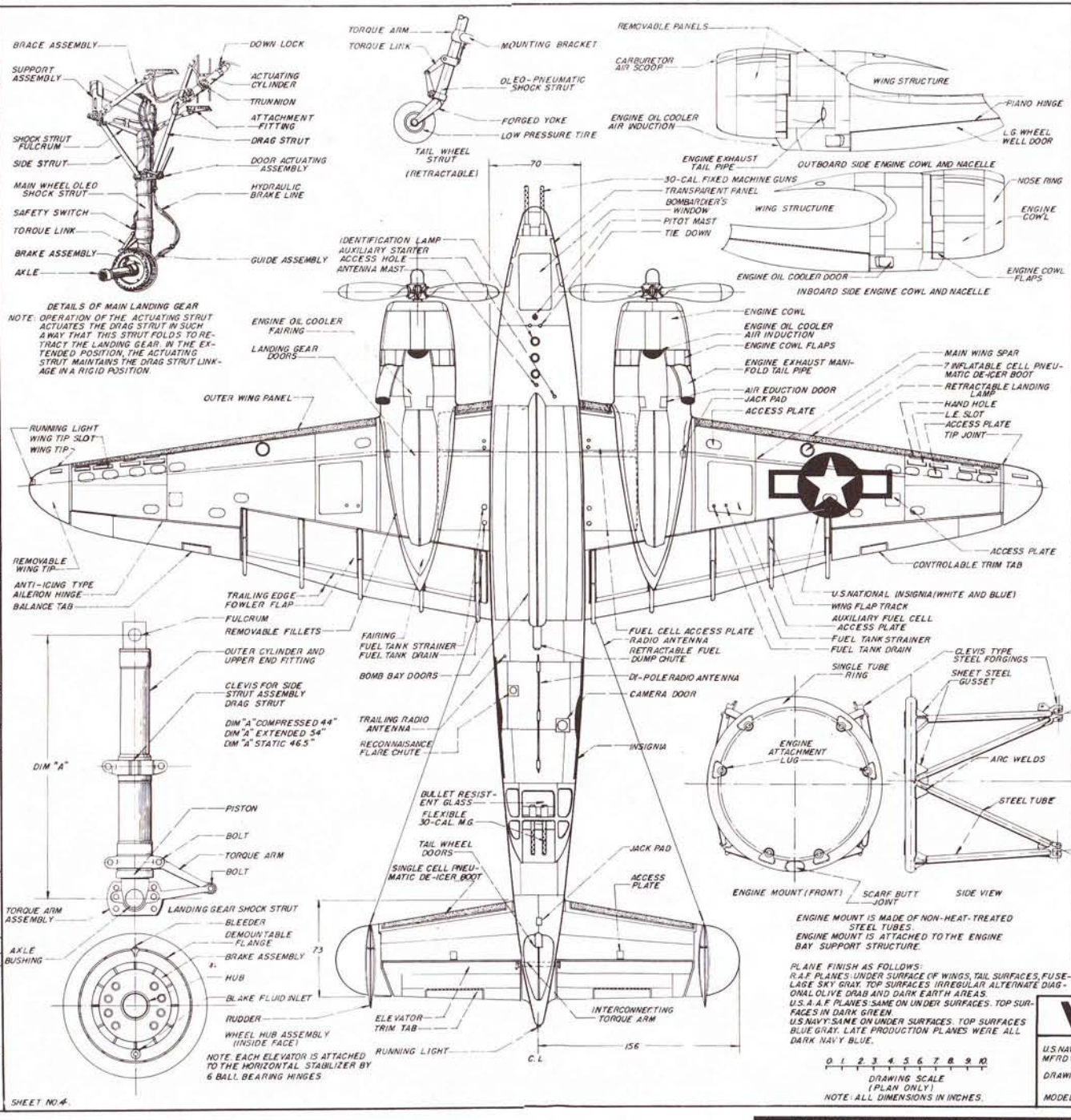
THE BOMB RELEASE SYSTEM IS OPERATIVE AFTER THE BOMB DOORS HAVE BEEN OPENED. THE BOMB RELEASE SYSTEM IS ELECTRICALLY CONTROLLED BY SWITCHES ON THE MAIN ELECTRICAL PANEL.

BOMBARDIER'S OPERATIONS

THE BOMBARDIER MAY SELECT ANY NUMBER OF BOMBS AND RELEASE THEM IN A UNIFORMLY SPACED SERIES AT A MINIMUM RATE OF 2 BOMBS PER SECOND AND A MAXIMUM RATE OF 20 BOMBS PER SECOND BY MEANS OF THE INTERVALOMETER. THE BOMBS MAY ALSO BE RELEASED SINGLY. THE ENTIRE BOMB LOAD MAY ALSO BE RELEASED SIMULTANEOUSLY. THE PILOT CAN ALSO RELEASE THE BOMBS.

PYROTECHNICS

A FLARE CHUTE IS LOCATED IN THE AFT RIGHT SIDE OF THE FUSELAGE. FLARES ARE MANUALLY LOADED AND RELEASABLE BY THE PILOT. MARINE DISTRESS SIGNALS ARE ALSO CARRIED IN A RACK. A VERY PISTOL IS PROVIDED TO FIRE THE SIGNALS. 12 DISTRESS SIGNALS ARE CARRIED.



POWER-DRIVEN GUN TURRET

A MARTIN TYPE GUN TURRET WITH 2 FLEXIBLE BROWNING M-2 MACHINE GUNS IS MOUNTED ON THE TOP SIDE OF THE FUSELAGE. A MOUNTING RING AND ATTACHMENT TO THE FUSELAGE ARE PROVIDED. THE TURRET IS SELF-CONTAINED WITH AMMO BOXES, GUNNER'S SEAT AND OTHER ACCESSORIES. THE GUN TURRET CARRIES 400 ROUNDS OF AMMO FOR EACH GUN. THE GUN TURRET IS ELECTRICALLY DRIVEN. GUNS MOVE THROUGH A VERTICAL ANGLE OF 75°. GUNS ARE ELECTRICALLY FIRED AND OPTICALLY SIGHTED.

FIXED GUN SIGHTS

FORWARD FIXED GUNS ARE AIMED BY MEANS OF FIXED RING AND BEAD SIGHTS.

AERIAL TORPEDO

THE NAVAL VERSION PV-1 AND PV-3 COULD BE EQUIPPED TO CARRY AERIAL TORPEDOES DEPENDING ON THE COMBAT MISSION. SPECIAL MOUNTING EQUIPMENT MUST BE MOUNTED IN THE BOMB BAY. SPECIAL ELECTRICAL CIRCUITRY, RANGE COMPUTING AND AIMING DEVICES MUST ALSO BE INSTALLED. THE TORPEDO IS ELECTRICALLY ENERGIZED AND RELEASED AFTER THE BOMB BAY DOORS HAVE BEEN OPENED. BOMB BAY DOORS REQUIRE MODIFICATION FOR USE WITH A TORPEDO.

ELECTRICAL SYSTEM

THE B-34 IS EQUIPPED WITH A 24-30 VOLT DIRECT CURRENT, SINGLE WIRE, SHIELDED AND BONDED ELECTRICAL SYSTEM. THE NEGATIVE TERMINAL OF THE STORAGE BATTERY AND THE NEGATIVE SIDE OF CIRCUIT IS GROUNDED TO THE AIRFRAME. CURRENT IS SUPPLIED BY TWO ENGINE-DRIVEN GENERATORS, RATED AT 200 AMPERES EACH AND A 24-VOLT STORAGE BATTERY. ALL WIRING IS CARRIED IN ALUMINUM CONDUIT. EXTERNAL GROUND POWER CAN BE SUPPLIED TO A RECEPTACLE IN THE FUSELAGE WHEN THE PLANE IS ON THE GROUND. ALL CIRCUITS ARE PROTECTED AGAINST OVERLOADS BY FUSES OR CIRCUIT BREAKERS.

ENGINE IGNITION

ENGINE IGNITION IS ENERGIZED BY DUAL MAGNETOS AND DUAL DISTRIBUTORS SEPARATELY MOUNTED ON THE FRONT OF EACH ENGINE. THE CONTROL SWITCH IS MOUNTED ON THE ENGINE CONTROL PEDESTAL.

STORAGE BATTERY

RESERVE ELECTRICAL POWER IS SUPPLIED BY A 12-CELL, 24-VOLT, STORAGE BATTERY WITH A 51-AMPERE HOUR CAPACITY. SURPLUS ELECTRICAL POWER GENERATED BY THE ENGINE-DRIVEN GENERATORS MAIN THE BATTERY IN A CHARGED CONDITION.

ELECTRICAL CIRCUITRY

THERE ARE 70 INDIVIDUAL ELECTRICAL CIRCUITS FOR THE OPERATION OF THE B-34. THESE CIRCUITS ENERGIZE THE ENGINE IGNITION, INSTRUMENTATION, ARMAMENT, COMMUNICATIONS, NAVIGATION, FLIGHT ACCESSORIES, FUEL AND OIL SYSTEMS, ETC. LIGHTING, ACCESSORY MOTORS, POSITION INDICATORS.

LONG RANGE FLIGHT

WHEN A LONG RANGE FLIGHT IS TO BE MADE IN ACCESS OF THE NORMAL RANGE, A 200 GALLON FUEL CELL IS INSTALLED IN THE FORWARD BOMB BAY, A 290 GALLON FUEL TANK IS INSTALLED IN THE AFT BOMB BAY, AND 2 277 GALLON FUEL TANKS ARE INSTALLED IN THE CABIN. AN OIL TANK IS ALSO STOWED IN THE CABIN. A SET OF TEMPORARY FLOORING IS INSTALLED IN THE CABIN AREA. CERTAIN MODIFICATIONS ARE MADE IN THE CABIN. IN ADDITION, SEA MARKERS ARE CARRIED, FLOAT LIGHTS AND A SURVIVAL KIT ETC.

ELECTRICAL LIGHTS

FOLLOWING LIGHTS ARE ON THIS PLANE:
RETRACTABLE LANDING LIGHTS.(2).
NAVIGATOR'S LIGHT.(1).
BOMB BAY LIGHTS.(2)
CABIN DOME LIGHT.(1)
CABIN NIGHT LIGHTS.
FUEL PRESSURE WARNING LIGHTS.(2)
RUNNING LIGHTS.(2)
FLIGHT INSTRUMENT LIGHTS.
RECOGNITION LIGHTS.(3)
RADIO OPERATOR'S LIGHT.(1).
TORPEDO SIGHT LIGHT.(1)
TAIL GUNNER'S DOME LIGHT.(1).
ASTRO DOME LIGHT.(1).
SWITCH PANEL EMERGENCY LIGHT.(1).
LIGHT INTENSITY IS CONTROLED BY RHEOSTATS.

ACKNOWLEDGEMENT

PUBLIC RELATIONS DEPARTMENT OF LOCKHEED AIRCRAFT CORPORATION FOR PHOTOGRAPHS.
GUNNERY SGT. FRITZ GEMEINHARDT U.S.M.C.

VENTURA

U.S. NAVY PATROL BOMBER PV-1 WORLD WAR 1939-1945.
MFRD: LOCKHEED AIRCRAFT CORPORATION AT BURBANK, CALIFORNIA

DRAWN BY: WILLIS L. NYE, A.A.H.S.
FOR
MODEL AIRPLANE NEWS NEW YORK CITY, N.Y

THE VEGA VENTURA

LOCKHEED U.S. NAVY PV-1

THE LOCKHEED U.S. NAVY PV-1 "VENTURA" IS A MODIFICATION OF THE LOCKHEED LODESTAR, WHICH IN TURN WAS DEVELOPED FROM THE AIR TRANSPORT MODEL 14, "SUPER ELECTRA," FIRST FLOWN IN JULY, 1937. THE FIRST TEST FLIGHT OF THE VENTURA (MEANING LUCKY STAR) WAS MADE IN JULY, 1940. ORIGINALLY, THE BRITISH AIR COMMISSION PLACED AN INITIAL CONTRACT FOR 375 PLANES AND A SECOND CONTRACT FOR AN ADDITIONAL 300 PLANES. AT THE OUTSET OF WAR IN 1941, ALL OF THESE PLANES WERE ACQUIRED BY THE U.S. GOVERNMENT. 200 BECAME B-34 AND 333 OTHERS WERE CONVERTED TO THE B-34A CONFIGURATION. VENTURAS SERVED IN THE R.A.F. AND R.C.A.F. THE PV SERIES WAS ASSIGNED TO THE U.S. NAVY BECAUSE OF ITS SPEED, MANEUVERABILITY, AND RANGE. IT HAS BEEN USED ON ANTI-SUBMARINE PATROLS, AS A BOMBER, PHOTO RECONNAISSANCE, AND TACTICAL MISSIONS. 2162 PV SERIES PLANES PROCURED. ALTHOUGH IT WAS USED BY THE U.S.A.A.F. IN THE U.S.A., IT WAS NOT USED IN COMBAT BY THEM. THE U.S. NAVY USED IT AS A LAND BASED COMBAT AIRPLANE. IT WAS EMPLOYED ON LOW ALTITUDE, MEDIUM RANGE MISSIONS.

PRODUCTION BREAKDOWN

1. ENGINE COWL COOLING FLAP RING (2).
2. ENGINE COWL WELL (2).
3. ENGINE MOUNT (2).
4. NACELLE FIREWALL (2).
5. ENGINE SUPPORT BAY STRUCTURE (2)
6. LANDING GEAR (2).
7. LANDING GEAR DOOR (2).
8. OUTER WING TIP (2).
9. AILERON (2).
10. AILERON TRIM TAB (2).
11. OUTER WING PANEL AFT SECTION (2).
12. WING FLAP (2).
13. WING FLAP TRAILING EDGE EXTENSION (2).
14. WING CENTER SECTION AFT SECTION (2).
15. WING CENTER SECTION CENTER SECTION.
16. WING CENTER SECTION FORWARD SECTION.
17. WING CENTER SECTION MAIN SPAR.
18. AFT FUSELAGE FLOOR.
19. FUSELAGE DOOR.
20. FUSELAGE MID SECTION.
21. FUSELAGE AFT SECTION.
22. TAIL WHEEL.
23. TAIL CONE.
24. HORIZONTAL STABILIZER CENTER SECTION.
25. HORIZONTAL STABILIZER LEADING EDGE.
26. VERTICAL STABILIZER LOWER ASSEMBLY (2).
27. RUDDER LOWER ASSEMBLY (2).
28. HORIZONTAL STABILIZER TIP (2).
29. HORIZONTAL STABILIZER OUTER PANEL (2).
30. ELEVATOR (2).
31. UPPER VERTICAL STABILIZER (2).
32. UPPER RUDDER ASSEMBLY (2).
33. RUDDER TRIM TAB (2).
34. ELEVATOR TRIM TAB (2).
35. ELEVATOR FLAP.
36. GUN TURRET FOUNDATION.
37. UPPER FUSELAGE ASSEMBLY.
38. CANOPY.
39. WING SECTION LEADING EDGE.
40. LOWER ENGINE NACELLE ASSEMBLY (2).
41. UPPER ENGINE NACELLE ASSEMBLY (2).
42. ENGINE COWL (2).
43. MAIN WING SPAR.
44. WING LEADING EDGE (2).
45. FUSELAGE NOSE.
46. FUSELAGE NOSE ASSEMBLY.
47. PILOT STATION.
48. FORWARD FUSELAGE FLOOR.
49. UPPER BOMB BAY DOOR ASSEMBLY (2).
50. LOWER BOMB BAY DOOR ASSEMBLY (2).

MODEL DESIGNATION

PV-1	U.S. NAVY (VEGA MODEL 37)	
PV-2	D*	(ENLARGED PV-1) HARPOON
PV-2C	D*	D* D*
PV-2D	D*	D* D*
PV-3	D*	D*
B-34	U.S. ARMY (2001) SAME AS PV-1	
B-34A	D*	(333)
B-34B	D*	(117)
B-37	D*	(18) FORMERLY O-56.

AERODYNAMIC AREAS

TOTAL WING AREA	551.00 SQ.FT.
AILERONS AREA	34.90
WING FLAPS	107.50
HORIZONTAL STABILIZER	88.33
ELEVATORS	40.60
ELEVATOR TRIM TABS	4.03
VERTICAL STABILIZERS	29.28
RUDDERS	34.83
RUDDER TRIM TABS	3.81
ELEVATOR FLAP	5.25

TANK CAPACITIES

CENTER SECTION FUEL TANKS	494 U.S. GALS.
AUXILIARY FUEL TANKS (2)	82 "
ENGINE OIL TANKS	32 "
HYDRAULIC FLUID RESERVOIR	2 "

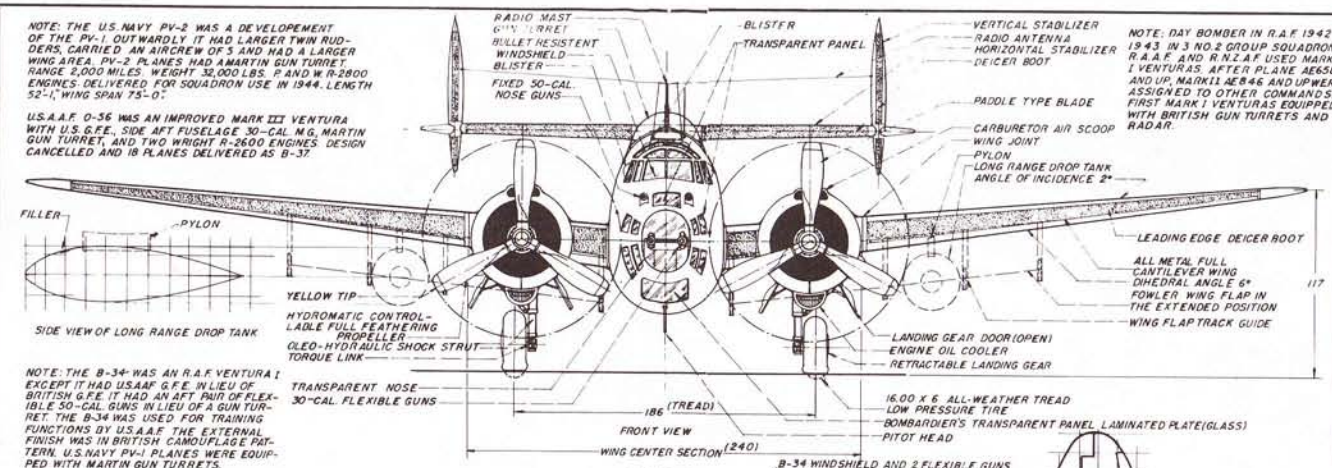
PROPELLERS

HAMILTON STANDARD HYDROMATIC
HUB NO. 23E50-287
BLADES (3) NO. 6477A-12.
QUICK FEATHERING CONSTANT SPEED
PITCH LIMITS 0° TO 88°
DIAMETER 126"

NOTE: THE U.S. NAVY PV-2 WAS A DEVELOPEMENT OF THE PV-1, OUTWARDLY IT HAD LARGER TWIN RUDDERS, CARRIED AN AIRCREW OF 5 AND HAD A LARGER WING AREA. PV-2 PLANES HAD A MARTIN GUN TURRET. RANGE 2,000 MILES. WEIGHT 32,000 LBS. P AND W R-2800 ENGINES. DELIVERED FOR SQUADRON USE IN 1944. LENGTH 52'-1", WING SPAN 75'-0".

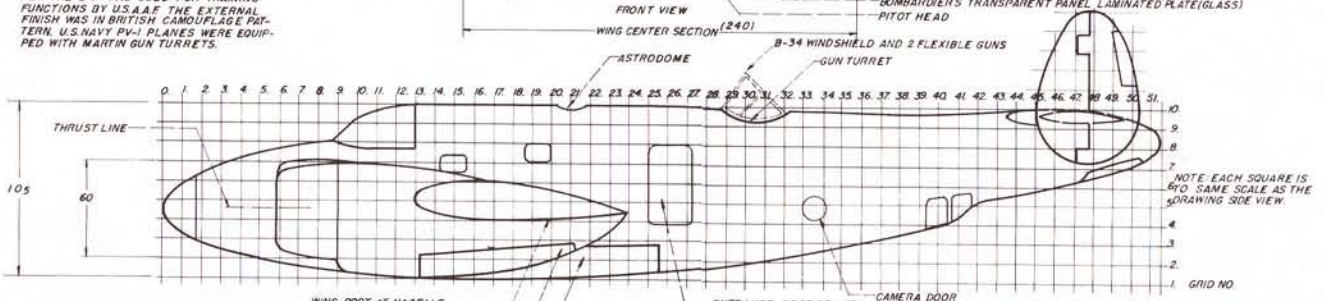
U.S.A.A.F. O-56 WAS AN IMPROVED MARK III VENTURA WITH U.S. G.F.E., SIDE AFT FUSELAGE 30-CAL. M.G., MARTIN GUN TURRET, AND TWO WRIGHT R-2600 ENGINES. DESIGN CANCELLED AND 18 PLANES DELIVERED AS B-37.

NOTE: THE B-34 WAS AN R.A.F. VENTURA I EXCEPT IT HAD U.S.A.A.F. G.F.E. IN LIEU OF BRITISH G.F.E. IT HAD AN AFT PAIR OF FLEXIBLE 50-CAL. GUNS IN LIEU OF A GUN TURRET. THE B-34 WAS USED FOR TRAINING FUNCTIONS BY U.S.A.A.F. THE EXTERNAL FINISH IN BRITISH CAMOUFLAGE PATTERN. U.S. NAVY PV-1 PLANES WERE EQUIPPED WITH MARTIN GUN TURRETS.



SIDE VIEW OF LONG RANGE DROP TANK

NOTE: DAY BOMBER IN R.A.F. 1942-1943. IN 3 NO. 2 GROUP SQUADRONS R.A.A.F. AND R.N.Z.A.F. USED MARK I VENTURAS. AFTER PLANE AE658 AND UP, MARK II AE846 AND UP WERE ASSIGNED TO OTHER COMMANDS. FIRST MARK I VENTURAS EQUIPPED WITH BRITISH GUN TURRETS AND RADAR.



NOTE: U.S.M.C. USED PV-1 MODIFIED FOR NIGHT FIGHTER OPERATIONS IN THE SOUTH PACIFIC IN 1943. VMF(N-531) RECORDED THE FIRST KILL AT TOROKINA POINT, SOLOMON ISLANDS, NOVEMBER, 1943.

LEFT SIDE VIEW OF PV-1 (RIGHT SIDE-SIMILAR)

NOTE: THIS DRAWING IS DEDICATED TO MARK CAMPBELL, PIONEER FLYER, MEMBER OF EARLY BIRDS, A.A.H.S., SILVER WINGS, C.A.P., ENGINEERING DEPARTMENT, LOCKHEED AIRCRAFT CORPORATION FOR 25 YEARS AND PIONEER PLANE BUILDER. THE AUTHOR WORKED WITH HIM AT LOCKHEED WHILE THE VENTURA WAS BEING DESIGNED.

0 1 2 3 4 5 6 7 8 9 10
DRAWING SCALE

NOTE: ALL DIMENSIONS IN INCHES.

SHEET NO. 1

TABLE OF WEIGHTS

WEIGHT EMPTY	18,523.00 LBS.
PILOT	200
BOMBARDIER	200
RADIO OPERATOR	200
TURRET GUNNER	200
GUNNER'S PARACHUTE	40
FRONT MAIN TANKS (228 GAL.)	1,368
REAR MAIN TANKS (266 GAL.)	1,596
AUX. WING TANKS (82 GAL.)	492
TRAPPED FUEL	14.5
ENGINE OIL TANKS (32 GAL.)	240
TRAPPED OIL	91.1
NOSE M.G.	47.3
AMMO (500 RDS.)	105
BOW M.G.	140.2
AMMO (500 RDS.)	155.6
SIDE M.G.	50.2
AMMO.	1,200
TURRET GUNS	130
AMMO (800 RDS.)	249
TUNNEL GUNS	65.5
AMMO.	140
BOMBSIGHT	14.4
3-500 LB. BOMBS	1,500
4-250 LB. BOMBS	1,000
MISC. BOMB CARRIERS	139.3
PYROTECHNICS	21
SIGNAL PISTOL AND AMMO	9.4
FLARES (RECCO)	28.5
FUSE CAPSULES	3.0
MISC. NAVIGATION EQUIPMENT	2.0
EMERGENCY EQUIPMENT	42.0
SURVIVAL EQUIPMENT	91.0
CAMERA AND CONTROLS	41.0
OXYGEN FLASKS	180.6

NOTE: THE ABOVE ITEMS ARE REMOVABLE LOAD AND VARY, DEPENDING ON THE MISSION.

WEIGHT EMPTY INCLUDES:	
GUN TURRET AND MOUNT	463 LBS.
M.G. MOUNTS	212.6
FIXED BOMB & FUSING GEAR	130
FIXED PYROTECHNIC EQUIPMENT	21.7
HYDRAULIC & ANTI-ICING FLUID	137.2
ARMOR PLATE	316.
BULLETPROOF GLASS	57.9
DESIGN GROSS LOAD	22,500 LBS.
DESIGN OVERLOAD	26,500 "

COMMUNICATION EQUIPMENT

BLIND LANDING APPROACH EQUIPMENT.
TRANSMITTERS. TA-12B.
CONTROL UNIT. MR-9B & 36/6B.
MORSE KEY MT-1B.
ANTENNA LOADING COIL MT-53B.
TRAILING ANTENNA REEL MT-5E.
FIXED ANTENNAE.
ELECTRICAL JUNCTION BOXES. 3507.
RECEIVERS. RA-10B.
AMPLIFIERS. 3611.
STATION BOXES. 3620.
AZIMUTH INDICATOR. MN-22A.
RELAY UNITS. MT-53B.
COMMAND EQUIPMENT.
D.C. DYNAMOTORS.
LOOP ANTENNA MN-20A.
MICROPHONES AND HEAD SETS.
INTERPHONE.

AUTOMATIC PILOT

A SPERRY TYPE A-3 AUTOMATIC PILOT IS INSTALLED TO MECHANICALLY CONTROL THE PLANE. IT IS CONTROLLED BY THE PILOT.

HEATING SYSTEM

FIVE STEWART WARNER ARE INSTALLED IN THE FUSELAGE TO SUPPLY WARM AIR TO THE AIRCREW. HEATERS ARE INDIVIDUALLY CONTROLLABLE. THE HEATERS ARE GASOLINE FIRED AND ELECTRICALLY IGNITED.

SURVIVAL EQUIPMENT

4 HALF GALLON WATER FLASKS.
4 RATION CONTAINERS.
4 EMERGENCY RATION CONTAINERS.
1 GALLON THERMOS BOTTLE.

SOUND INSULATION

SOUND DEADENING MATERIAL IS CEMENTED TO THE INSIDE OF THE FUSELAGE SKIN IN THE FLIGHT STATION, BOMBARDIER STATION AND THE RADIO OPERATOR'S STATION.

CENTER OF GRAVITY

THE LIMITS OF POSSIBLE C. OF G. TRAVEL ARE 182.92" TO 194.09 INCHES AFT OF THE AXIS OF REFERENCE (23.5% TO 33.1% OF THE MEAN CHORD. THE AXIS OF REFERENCE IS AT STRUCTURAL STATION "0". THE LEADING EDGE OF THE MEAN CHORD IS 155.75 INCHES AFT OF THE AXIS OF REFERENCE. LENGTH OF MEAN CHORD IS 115.84".

VENTURA

U.S. NAVY PATROL BOMBER PV-1 WORLD WAR 1939-1945
MFRD. LOCKHEED AIRCRAFT CORPORATION AT BURBANK, CALIFORNIA

DRAWN BY: WILLIS L. NYE A.A.H.S.
FOR
MODEL AIRPLANE NEWS NEW YORK CITY 10, N.Y.

ENGINES

THE PV-1 VENTURA IS POWERED BY TWO PRATT AND WHITNEY TWIN ROW, RADIAL, 18 CYLINDER, AIR-COOLED, R-2800-2 SBG, SUPERCHARGED, SINGLE STAGE TWO SPEED ENGINES: 12,000 H.P. RATING.

BORE	5.75"
STROKE	6.00"
CUBIC DISPLACEMENT	2804"
DRY WEIGHT	2305 LBS.
COMPRESSION RATIO	6.1 TO 1.00
LOW BLOWER RATIO	7.6 : 1
HIGH BLOWER RATIO	9.9 : 1
ENGINE OVERALL DIAMETER	52.5"

ENGINE ACCESSORIES

EACH ENGINE HAS A DIRECT CRANKING INERTIA ENGINE STARTER. PROVISION IS ALSO MADE FOR MANUAL STARTING BY MEANS OF A CRANK. PROPELLER GOVERNORS ARE MANUALLY CONTROLLABLE BY MEANS OF CABLES RUNNING FROM THE ENGINE CONTROL PEDESTAL. PROPELLER FEATHERING PUMPS OPERATE OFF 24-VOLT STORAGE BATTERY.
ENGINE-DRIVEN GENERATORS ARE 30-VOLT, 30-AMPERE 1500 WATT CAPACITY.
AUXILIARY FUEL PUMPS ARE ELECTRICALLY DRIVEN AND CONTROLLED BY THE PILOT.
ENGINE PRIMERS ARE ELECTRICALLY OPERATED.
CARBURETOR HEAT IS OBTAINED FROM A MUFF INSTALLED AROUND THE ENGINE EXHAUST MANIFOLD. HEAT FLOWS INTO THE CARBURETOR AIR INDUCTION SYSTEM BY MEANS OF A MANUALLY CONTROLLABLE HINGED DOOR.
PROPELLERS ARE AUTOMATIC IN PITCH AND BLADE ANGLE SETTING. GOVERNORS ARE ENGINE-DRIVEN.
EACH ENGINE IS BOLTED TO A WELDED STEEL TUBULAR TYPE ENGINE MOUNT THROUGH VIBRATION ABSORBING BUSHED MOUNTINGS.
THE ENGINE FIREWALL BULKHEAD IS CORROSION RESISTANT STEEL SHEET.
EACH ENGINE AND THE ACCESSORY COMPONENTS IS REMOVABLE AS A UNIT AT THE FIREWALL AND IS INTERCHANGEABLE.
ENGINE-DRIVEN VACUUM PUMPS ENERGIZE THE FLIGHT INSTRUMENTS AND THE DE-ICER BOOTS.
ENGINE-DRIVEN HYDRAULIC PUMPS ENERGIZE THE HYDRAULIC PRESSURE SYSTEM.
AN ENGINE-DRIVEN FUEL PUMP SUPPLIES FUEL UNDER PRESSURE TO THE FUEL SYSTEM.
AN ENGINE-DRIVEN OIL PUMP SUPPLIES LUBRICATING OIL TO THE ENGINE.
AN ENGINE-DRIVEN TACHOMETER GENERATOR ENERGIZES THE TACHOMETER.

ENGINE OIL SYSTEM

EACH ENGINE IS PROVIDED WITH AN OIL SYSTEM WHICH IS LOCATED IN EACH ENGINE NACELLE. MANUAL AND AUTOMATIC OIL PRESSURE CONTROLS ARE PROVIDED. EACH ENGINE OIL TANK HAS A 16 GALLON CAPACITY. OIL COOLERS PROVIDE TEMPERATURE REGULATION. EACH ENGINE HAS AN OIL DILUTION SYSTEM TO ASSIST IN STARTING THE ENGINE IN COLD WEATHER.

ENGINE CONTROL PEDESTAL

THE PEDESTAL, LOCATED IN THE FLIGHT COMPARTMENT, CONTAINS THE FOLLOWING CONTROLS:
RIGHT AND LEFT ENGINE THROTTLES.
D. D. D. D. FUEL MIXTURES.
D. D. D. PROPELLER GOVERNORS.
D. D. D. ENGINE SUPERCHARGERS.
D. D. D. CARBURETOR AIR TEMPERATURE.
BOMB BAY DOORS.
AUTOMATIC PILOT.
TAIL WHEEL CENTERING LOCK.
ALL OF THESE CONTROLS ARE CABLE ACTUATED.

ENGINE OIL COOLERS

THE FLOW OF OIL THROUGH THE COOLER IS CONTROLLED THERMOSTATICALLY. THE OIL TEMPERATURE IS REGULATED TO COMPENSATE FOR CHANGES IN AIR TEMPERATURE AND ENGINE OPERATING CONDITIONS. THIS IS DONE BY CONTROLLING THE VOLUME OF AIR FLOWING THROUGH THE COOLER. ELECTRICALLY OPERATED DOORS, CONTROLLED BY THE PILOT, REGULATE THE VOLUME OF AIR FLOWING THROUGH THE COOLING AIR DUCT.

ENGINE EXHAUST MANIFOLD

THE ENGINE EXHAUST MANIFOLD CONSISTS OF EIGHT TUBULAR SEGMENTS CLAMPED TOGETHER TO COMPRISE A MANIFOLD.

ENGINE SUPPORT STRUCTURE

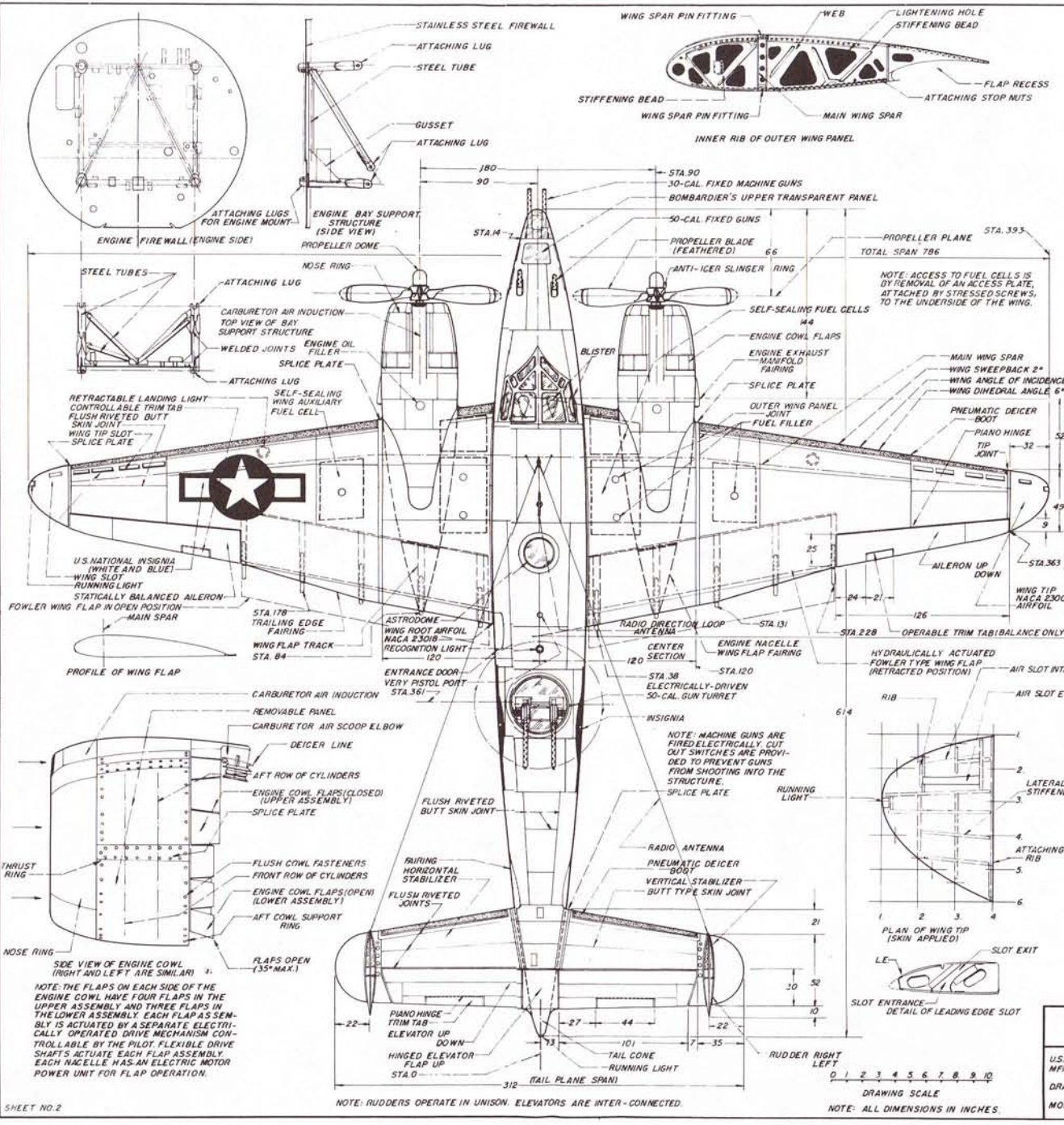
THE TUBULAR STEEL TRIANGULAR BRACED STRUCTURES ARE ATTACHED TO THE FRONT WING SPAR IN THE ENGINE NACELLE. THE ENGINE MOUNTS ARE ATTACHED TO THESE STRUCTURES.

ENGINE FUEL SPECIFICATION

100 OCTANE SPEC. AN-VV-F-781.

ENGINE FIRE EXTINGUISHER

THE ENGINE INSTALLATION IS PROTECTED BY A FIRE EXTINGUISHING SYSTEM WHICH USES CARBON-DIOXIDE UNDER PRESSURE. BOTH IMPACT AND THERMAL ACTUATORS AUTOMATICALLY ACTIVATE THE SYSTEM. MANUAL OPERATING CONTROLS ARE ALSO INSTALLED. THE SYSTEM IS OPERABLE ON THE GROUND OR IN FLIGHT. A TUBULAR MANIFOLD DISTRIBUTES THE CARBON-DIOXIDE UNDER PRESSURE TO THE ENGINE.



FUEL CELLS

FUEL CELLS ARE SELF-SEALING, AROMATIC RESISTANT, SYNTHETIC MATERIAL CONSTRUCTION. THE CELL MATERIAL IS COMPOSED OF SEVERAL LAMINATED SYNTHETIC RUBBER SHEETS AND LAMINATE RUBBER CEMENTED TOGETHER AND COVERED WITH PLIOFORM. THE SHEETS VARY IN COMPOSITION AND THICKNESS. ALL FITTINGS ARE BUILT AS AN INTEGRAL PART OF THE FUEL CELL. FOUR FUEL CELLS ARE LOCATED IN THE WING CENTER SECTION. THE FUEL CELLS ARE INTERCONNECTED. ON EACH SIDE OF THE FUSELAGE, AN AUXILIARY FUEL CELL IS LOCATED IN EACH OUTER WING PANEL.

FUEL JETTISON SYSTEM

THE FUEL OF THE FOUR FORWARD AND THE TWO AFT CELLS ARE EQUIPPED WITH JETTISON VALVES. THE CONTROL IS MANUALLY OPERABLE BY THE PILOT. THE CHUTE IN OPERATION EXTENDS BELOW THE FUSELAGE AFT OF THE BOMB BAY DOORS.

FUEL SYSTEM

A SEPARATE FUEL SYSTEM, LOCATED IN EACH NACELLE, FUNCTIONS FOR EACH ENGINE. A GROSS FEED FUEL VALVE, LOCATED IN THE FUSELAGE CONNECTS BOTH FUEL SYSTEMS IN AN EMERGENCY.

ENGINE-DRIVEN FUEL PUMP

THE ENGINE-DRIVEN FUEL PUMP IS USED IN NORMAL FLIGHT OPERATION. THE ELECTRICALLY-DRIVEN FUEL PUMP IS USED FOR GROUND FUELING OR IN AN EMERGENCY CONDITION.

FUEL TANK SELECTOR VALVES

EACH ENGINE NACELLE HOUSES TWO FOUR-WAY SELECTOR VALVES MANUALLY CONTROLLABLE BY CABLES AND A TORQUE SHAFT FROM THE PILOT'S COMPARTMENT.

PROPELLER OPERATION

EACH PROPELLER GOVERNOR IS OPERATED OFF THE ENGINE OIL SYSTEM FOR THE RESPECTIVE ENGINE. THE DESIRED PITCH SETTING IS MA... BY THE PILOT. THE FEATHERING PUMPS A... CONTROLLABLE BY MEANS SWITCHES OPER... BY THE PILOT. PROPELLERS ARE AUTOMATI... PITCH AND BLADE ANGLE SETTING. THE FE... ERING PUMP RUNS AN AUXILIARY HIGH PRE... SYTEM TO FEATHER THE BLADES.

ENGINE COWL

THE ENGINE CONSISTS OF A NOSE RING, IN... MEDIATE COWL PANELS AND COWL FLAPS. ... INTERMEDIATE COWL PANELS ARE REMOV... THE CARBURETOR AIR SCOOP CONSISTS OF ... NOSE, INTERMEDIATE AND ELBOW SECTION... THE COWL FLAPS EXTEND AROUND THE PE... PHERY OF EACH ENGINE. THE COWL FLAPS ... ELECTRICALLY OPERATED.

PNEUMATIC SYSTEM

EACH ENGINE DRIVES A ROTARY VANE TYP... PUMP WHICH TRANSFERS AIR FROM THE V... UUM LINES TO THE PRESSURE LINES OF TH... SYSTEM. THE PNEUMATIC SYSTEM OPERA... THE GYRO HORIZON, AUTOMATIC PILOT AND... AND BANK INDICATOR. THE DE-ICER BOOTS ... OPERATE OFF THE PNEUMATIC SYSTEM. T... OPERATION OF THE PNEUMATIC SYSTEM IS ... TROLED BY MANUAL OPERATION OF A VALVE.

OXYGEN SYSTEM

TEN CYLINDRICAL OXYGEN FLASKS, CHARGED TO LOW PRESSURE, AN OXYGEN FLOW REGULATOR, SIX FLOW METERS, SEVEN OUTLETS AND NECESSARY SUPPLY LINES COMPRISE THE SYSTEM. THE FLASKS ARE CHARGED TO 1800 P.S.I. WALK AROUND FLASKS AND FACE MASKS ARE ALSO PROVIDED FOR THE AIRCREW.

FUSELAGE ENTRANCE DOOR

THE ENTRANCE DOOR SWINGS ON SPECIAL RELEASE HINGES. WITHIN THE DOOR SHELL, AN INFLATABLE LIFE RAFT IS INSTALLED. THE LIFE RAFT IS AUTOMATICALLY INFLATABLE BY CO_2 UNDER PRESSURE IN A FLASK ATTACHED TO THE LIFE RAFT. THE DOOR HAS A QUICK RELEASE MECHANISM WHICH ALLOWS THE DOOR TO BE RELEASED WITH LIFE RAFT AND INFLATION CYLINDER. THE DOOR IS MADE AS WATERTIGHT AS IS PRACTICABLE.

MISCELLANEOUS EQUIPMENT

EACH SEAT HAS A SAFETY BELT. THE BOMBARDIER AND AFT GUNNER POSITIONS HAVE SPECIAL SAFETY BELTS. AN INTERIOR HAND RAIL IS ALSO INSTALLED. A BOMB HOIST IS ALSO STOWED IN THE FUSELAGE. AN ADJUSTABLE AERIAL WINCH IS ALSO STOWED IN THE FUSELAGE. FOUR VACUUM TYPE FLASKS ARE CARRIED. A TOOL KIT IS ALSO CARRIED. GROUND-TO-AIR SIGNAL INDEX CARD HOLDER IS ALSO CARRIED. A HAND AXE IS ALSO CARRIED.

VENTURA

U.S. NAVY PATROL BOMBER PV-1 WORLD WAR 1939-1945
MFRD: LOCKHEED AIRCRAFT CORPORATION AT BURBANK, CALIFORNIA

DRAWN BY: WILLIS L. NYE, A.A.H.S.
FOR
MODEL AIRPLANE NEWS NEW YORK CITY, N.Y.

THE VEGA VENTURA

VOUGHT SB2U CHESAPEAKE / VINDICATOR

An SB2U-3 in the overall light gray adopted for tactical U.S. Navy planes in February 1941. This is Airplane No. 16 of the Marine Scouting Squadron One (VMS-1).

★ ★ ★

STARTING in the early 1920s, the Chance Vought Corporation of Long Island City, NY (later of East Hartford, CT), was the major supplier of scouting and observation planes to the U.S. Navy. Until 1934, scouting, light bombing and observation were considered separate missions, and the airplanes used separate "S," "B" and "O" designations. In 1934, some missions and designations were combined; e.g., "SB" for Scout-Bombers and "OS" for Observation-Scouts.

Vought entered the dual-designation era with the SBU-1 biplane, which started as the XF3U-1 two-seat fighter. The 124 SBU-1s and -2s were Vought's last biplanes. Changing requirements and the Navy's final acceptance of monoplanes for use on aircraft carriers resulted in subsequent Navy monoplane designs .

Vought responded to a U.S. Navy requirement for a folding-wing monoplane scout-bomber, and they received a contract for one XSB2U-1 on October 11, 1934. Like the Hawker Hurricane, the SB2U (Vought's Model 156) carried traditional Vought tube-and-fabric structure into the monoplane age. The SBU fuselage construction and tail shape were adapted to a new, metal-frame, low-cantilever wing that contained retractable landing gear. The wing had a single spar, a closed aluminum D-tube from the spar forward for torsional strength, and it was fabric-covered aft of the spar. The wing folded upward outboard of the flat center section by means of a manually operated screw jack that was secured to fittings on the wing and fuselage.

Its armament was two .30- or .50-caliber machine guns in the wings, and a single, flexible, .30-caliber gun in the rear cockpit. A single 500- or 1,000-pound bomb was carried on an ejector rack under the belly. Because the SB2U was a vertical dive bomber, this device was necessary to swing the bomb clear of the propeller. Two 100-pound bombs could be carried on racks under the wing. The powerplant for the production SB2U-1s was the 825hp Pratt & Whitney R-1535-96, and 54 planes were ordered in October 1936. An odd feature (compared with previous scout models) was the great distance between the cockpits.

The SB2U-1s entered

The following figures compare the weight and performance of the SB2U-1 and the SB2U-3:

Empty Weight	*5,049/5,620 lbs.*
Gross Weight	*7,888/8,900 lbs.*
Rate of Climb	*1,220/1,051 ft./min.*
Service Ceiling	*26,400/22,000 ft.*
Fuel	*690/2,766 lbs.**
High Speed	*250/221mph (at 9,500 ft.)*
Range	*1,120/2,640 statute miles*

*Navy specification tables for 1941 give pounds instead of gallons.

A Vought V-156F of the French Navy. Note the red, white and blue stripes on the elevators and the rudder, and the dive brakes on the wing (a feature not used on the U.S. Navy/Marine SB2Us).

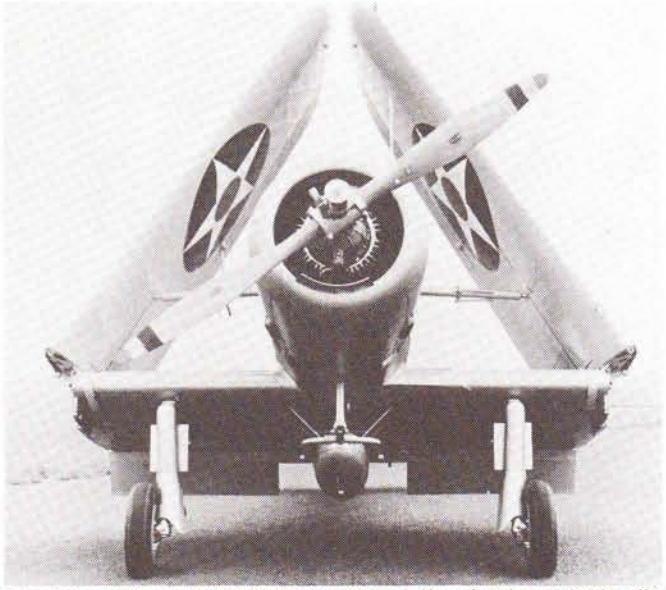
This underside view of the SB2U-3 1-S-16 shows the retracted landing gear and racks for 100-pound bombs. Note the star on the lower right wing.

service in December 1937, and they were followed by 58 improved SB2U-2s that were ordered in January 1938. The final order was for 57 SB2U-3s that were delivered to the U.S. Marine Corps late in 1940. The -3s were heavier because of their increased fuel and armor and their two additional wing guns.

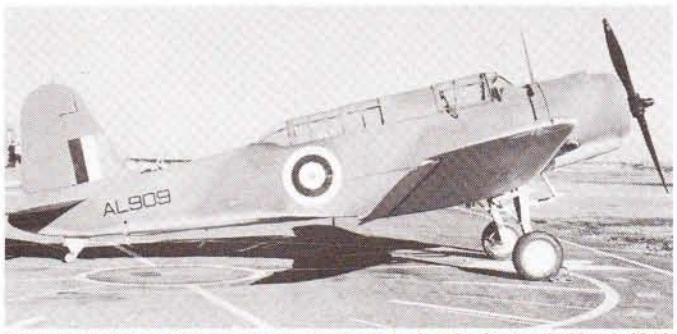
In 1938, the Navy allowed Vought to build 40 SB2U-2s for the French Navy as "V-156F" ("F" for France). These planes were equipped to French requirements, including the novel reverse-action French throttles that pulled back to increase power. French armament was installed in France. The V-156Fs served on French aircraft carriers and with shore-based squadrons, and they were the only SB2U types to go on the offensive (some made bombing raids from southern France into northern Italy in 1940). After the fall of France, England took over a second French contract for 50 V-156Fs, and named them "Chesapeake." Vought designated them "V-156B-1" ("B" for Britain).

The U.S. didn't adopt the British name, as it did with some other U.S. models in British service. When U.S. military planes were given "popular" names in October 1941, the SB2Us were named "Vindicator."

When the planes were re-equipped to British standards (including forward-open throttles and extra armor), the Chesapeakes were too heavy to operate from the small British carriers to which they had been assigned. As a result, they were reassigned to secondary shore duty and didn't see combat. It has been stated, but not verified, that the Germans used captured V-156Fs for scouting missions along the English coast.



A front view of the SB2U-2 with its wings folded. Note that the turning handles on the right-hand jack are extended, and that those on the left jack are folded.

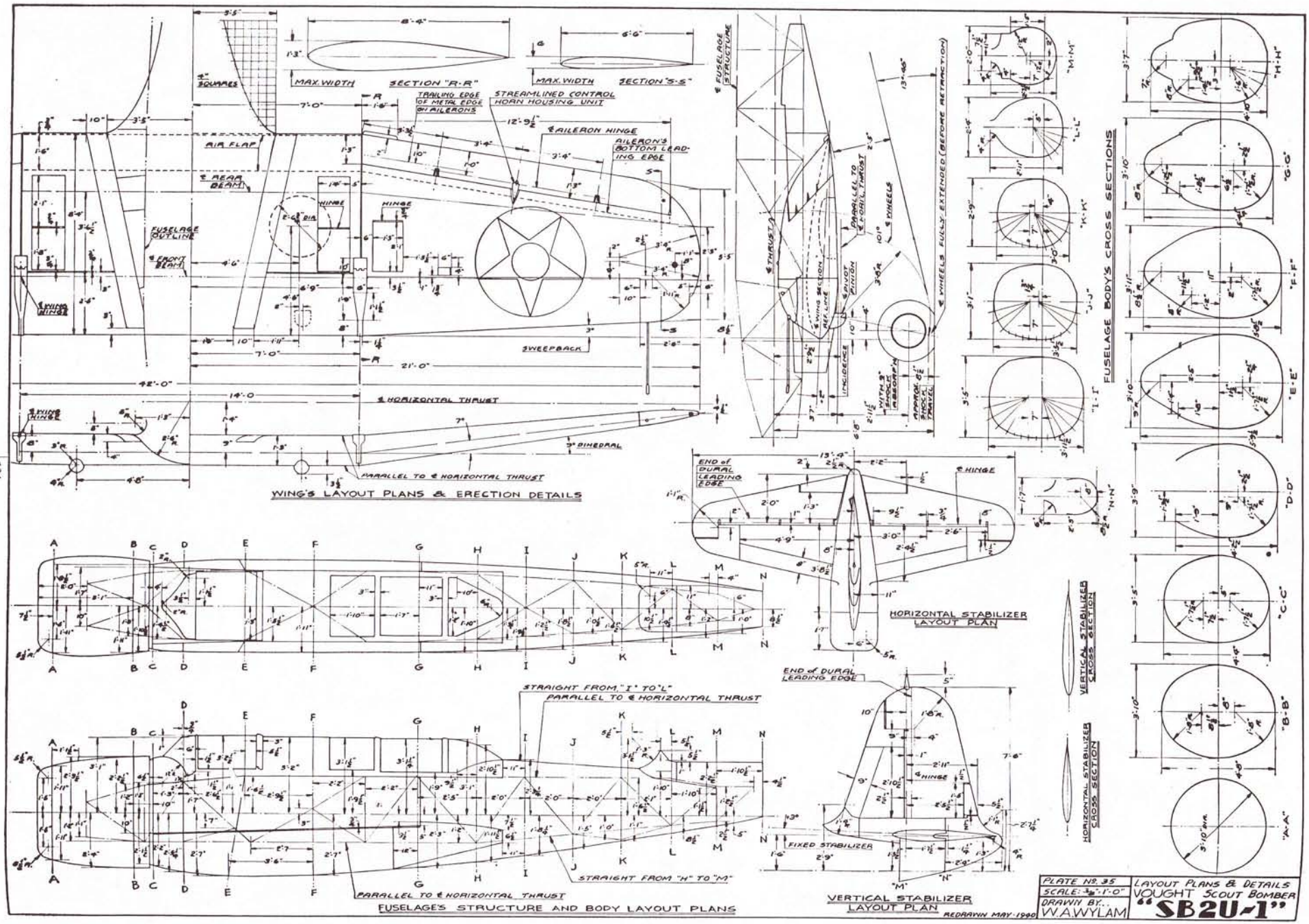


The British V-156B-1 Chesapeake, photographed at the factory in March 1941.

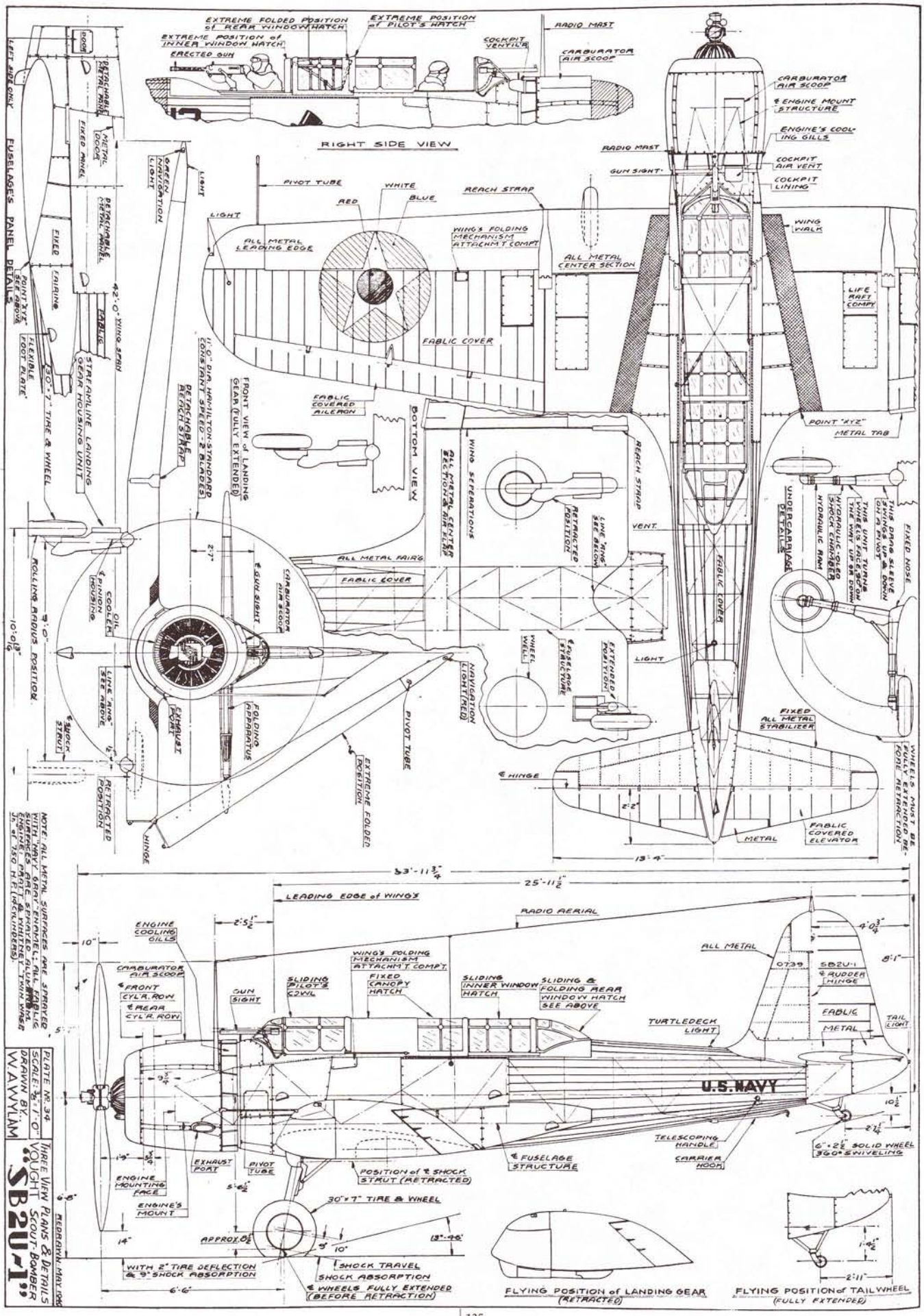
By the middle of 1940, SB2U-1s and -2s were flying with seven U.S. Navy squadrons from four of the Navy's six big carriers. By the end of 1941, there were only four squadrons aboard two carriers. The U.S. Marines had all of their SB2U-3s at shore bases. Some of the carrier-based SB2Us that were at Pearl Harbor on December 7, 1941, were destroyed on the ground by the Japanese. Later Marine SB2U-3s were ferried to Midway Island, where they attacked Japanese ships during the Battle of Midway in June 1942.

Four SB2U squadrons served on the carriers "Wasp" and "Ranger" in the Atlantic until the end of 1942. They finished their service as trainers.

In 1939, the United Aircraft Corporation, the parent firm of both Vought and Sikorsky, merged the two into a single entity: the Vought-Sikorsky Division of United. The Vought factory was moved from East Hartford into the Sikorsky plant in Stratford, CT. The SB2U-3s that were then being built technically became "Vought-Sikorskys" instead of "Chance Voughts."


WING'S LAYOUT PLANS & ERECTION DETAILS
FUSELAGE'S STRUCTURE AND BODY LAYOUT PLANS
HORIZONTAL STABILIZER LAYOUT PLAN
VERTICAL STABILIZER LAYOUT PLAN
FUSELAGE BODY'S CROSS SECTIONS
VERTICAL STABILIZER CROSS SECTION
HORIZONTAL STABILIZER CROSS SECTION
SECTION "R-R"
SECTION "S-S"
STRAIGHT FROM "I" TO "L" PARALLEL TO ℄ HORIZONTAL THRUST
STRAIGHT FROM "H" TO "M"
PARALLEL TO ℄ HORIZONTAL THRUST
REDRAWN MAY 1990
PLATE NO. 35
SCALE: 3/8" = 1'-0"
DRAWN BY.. W.A.WYLAM
LAYOUT PLANS & DETAILS
VOUGHT SCOUT BOMBER
"SB2U-1"

VOUGHT SB2U CHESAPEAKE/VINDICATOR



VOUGHT OS2U KINGFISHER

THE Vought OS2U Kingfisher was the most widely used U.S. Navy shipboard catapult plane of the war. On March 22, 1937, the Chance Vought Company (then of East Hartford, CT) received a contract for a single XOS2U-1, which was intended as a replacement for older Vought and Curtiss biplanes that were still serving the fleet. The prototype first flew on July 20, 1938, and an order for 54 production OS2U-1s followed. The first examples, which were mostly seaplanes, reached the fleet in August 1940, while others equipped with wheels were assigned to naval air stations and reserve training bases around the country.

As an airplane, the Kingfisher had little in common with previous Vought designs, other than the SBU-SB2U tail shape. It was an all-metal monoplane with a 450hp Pratt & Whitney R-985-48 Twin Wasp Jr. engine. The distance between the pilot and the observer/gunner was unusual, even when it was compared with the SB2U. A structural innovation for a production airplane was the spot-welding (rather than riveting) of sheet aluminum.

A Vought OS2U-3 Kingfisher seaplane, with 1943-44 dark blue-gray camouflage on the upper surfaces graduating to white undersides. The hook under the float was used to snag a retrieval net before the seaplane was hoisted aboard the mother ship.

The seaplane version used a single main float and wing-tip floats. Early floats were made by Vought, but the majority of them were built on a separate Navy contract by the Edo Corporation of College Point, Long Island, NY. The airplanes were flown from the new Vought-Sikorsky plant in Stratford, CT, to naval air stations, where the floats were installed in Navy shops.

SPECIFICATIONS AND PERFORMANCE OS2U-3

Powerplant	*Pratt & Whitney R-198-AN-2 or -8:450hp*
Wingspan	*35ft., 10 7/8 in.*
Wing Area	*262 sq. ft.*
Gross Weight	*6,000 lbs.*
High Speed	*165mph at 5,500 ft.*

The Navy was also involved in the manufacture of the Kingfisher. After Vought delivered 158 improved OS2U-2s with R-985-50 engines, and was working on 1,006 longer-range OS2U-3s, the U.S. Naval Aircraft factory in Philadelphia, PA, built 300 OS2U-3s as "OS2N-1" (the Navy had built a single XOSN-1 biplane of its own design there in 1938; hence the "OS2N-1" designation).

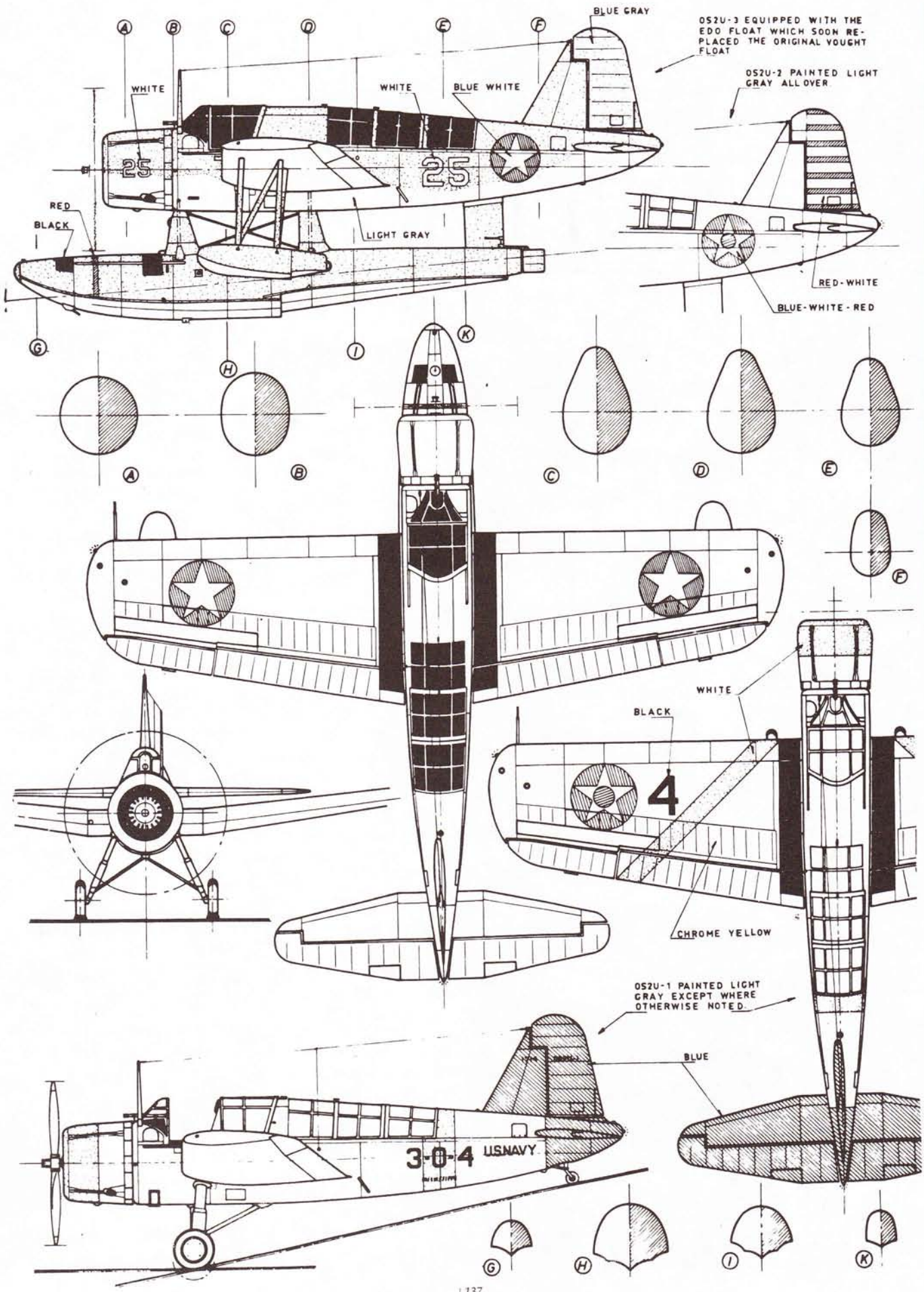
British forces received 100 OS2U-3s in 1942, and kept the name "Kingfisher." In the U.S., Kingfishers (on wheels and on floats) served with the Inshore Patrol Squadrons. In the fleet, they operated on wheels from aircraft carriers, and catapult seaplane versions served on battleships and cruisers until the end of the war.

Although they were usually low-performance scouts and observers that were lightly armed (two .30-caliber machine guns and two 325-pound depth charges), Kingfishers earned great fame for numerous rescue missions, where they picked up downed air crews from under the guns of Japanese shore batteries, and found lost personnel. The most famous of these missions was the successful 22-day search for Captain Eddie Rickenbacker, America's WWI Ace, who was forced down in the Pacific with a B-17 crew in November 1943.

★ ★ ★

An OS2U-3 ashore on its fixed landing gear. This is airplane no. 6 of Scouting Squadron Six, in the dark blue-gray top and side camouflage, and light gray underside camouflage, of 1942-43.

VOUGHT OS2U KINGFISHER



WESTLAND LYSANDER

A Westland Lysander II photographed at Kabrit, Egypt, in 1943. Note the lowered wing flaps and the very large pants (spats) over the wheels.

THE British Westland "Lysander" was developed in 1935 by Westland Aircraft, Ltd., of Yeovil, England. Westland applied latter-day technology to the traditional "Army Cooperation" airplane, which had been standardized by the major air powers as a large, versatile, open-cockpit biplane. Its mission was to work with the ground forces through observation and reconnaissance; photography; light bombing; and ground attack with machine guns. In pre-radio days, such planes could also pick up messages from ground points and drop them (and small quantities of supplies) to remote outposts.

The metal-framed Lysander retained all of the required Army Cooperation qualities, despite such major changes as a high monoplane wing, and a closed cabin in which the gunner/observer sat far to the rear, separated from the pilot by the fuel tank.

The single-wing design was much more than a simple deletion of the lower wing of a traditional biplane in the interest of improved crew visibility and streamlining. The odd planform (see photos and drawings) resulted in an overall aerodynamic forward sweep of the wing—an innovation that was many years ahead of its time. It also featured large trailing-edge flaps, and full-span, automatic, leading-edge slats that opened for slow-speed flight. Both features were relatively new to military aircraft, and they gave the Lysander unprecedented short takeoff and landing (STOL) performance.

Its initial powerplant was the 890hp Bristol Mercury XII radial engine; it had the unique Bristol-type cowling in which the leading edge of the cowling was also the collector ring for the engine exhaust. The single exhaust stack was at the lower right side. The Lysander's initial armament was a pair of forward-firing, .303-caliber machine guns in the wheel fairings outboard of the propeller arc, and a single WW I vintage, .303-caliber Lewis machine gun in the rear cockpit. Using both belly racks and racks on winglets, sixteen 20-pound bombs, four 216-pound bombs or two 250-pound bombs could be carried. Other stores, such as flares, smoke generators, supply cannisters and auxiliary fuel tanks, could also be

Lysander IIs with stub wings in place on the landing gear; the wheel covers have been removed. Note the far-aft location of the fuselage bomb racks and the early form of the narrow fin flash that was adopted in mid-1940.

SPECS AND PERFORMANCE LYSANDER III

Powerplant	*870hp Bristol Mercury XX or 30*
Empty Weight	*4,365 lbs.*
Gross Weight	*6,318 lbs.*
High Speed	*209mph at sea level; 196mph at 15,000 ft.*
Minimum Speed (at gross weight)	*56mph*
Takeoff Run (to clear 50-foot obstacle)	*930 ft.*
Landing Run (over 50-foot obstacle)	*1,020 ft.*

Side view of the Lysander II. Note how the rear portion of the cabin enclosure slides straight aft.

carried by the versatile Lysander.

Another innovative Lysander feature was the single-leg landing gear, which was designed for high-impact short and hard landings. It had large spats over the wheels, and it could be fitted with stub wings, called "winglets," that served as mounts for bomb racks, rescue equipment and miscellaneous supplies. Later, a large cylindrical cargo container or auxiliary fuel tank was fitted under the belly. The first flight of the prototype was on June 15, 1936.

Lysander I—Successful tests of two prototypes resulted in an order for 169 Lysander Is, and production was completed in 1939. Gross weight was 4,065 pounds.

Lysander II—This was similar to the Mk I, except for a change to a 905hp Bristol Perseus XII sleeve-valve engine. Because of size and detail differences, this wasn't interchangeable with the Mercury engine. Westland built 442 Mk IIs, and a further 75 were built in Canada. Gross weight was 6,015 pounds.

Lysander III—This plane "reverted" to an 870hp Mercury XX engine; 250 were built in Yeovil, and another 17 were built in a new Westland plant in Doncaster. The armament was increased to two flexible machine guns.

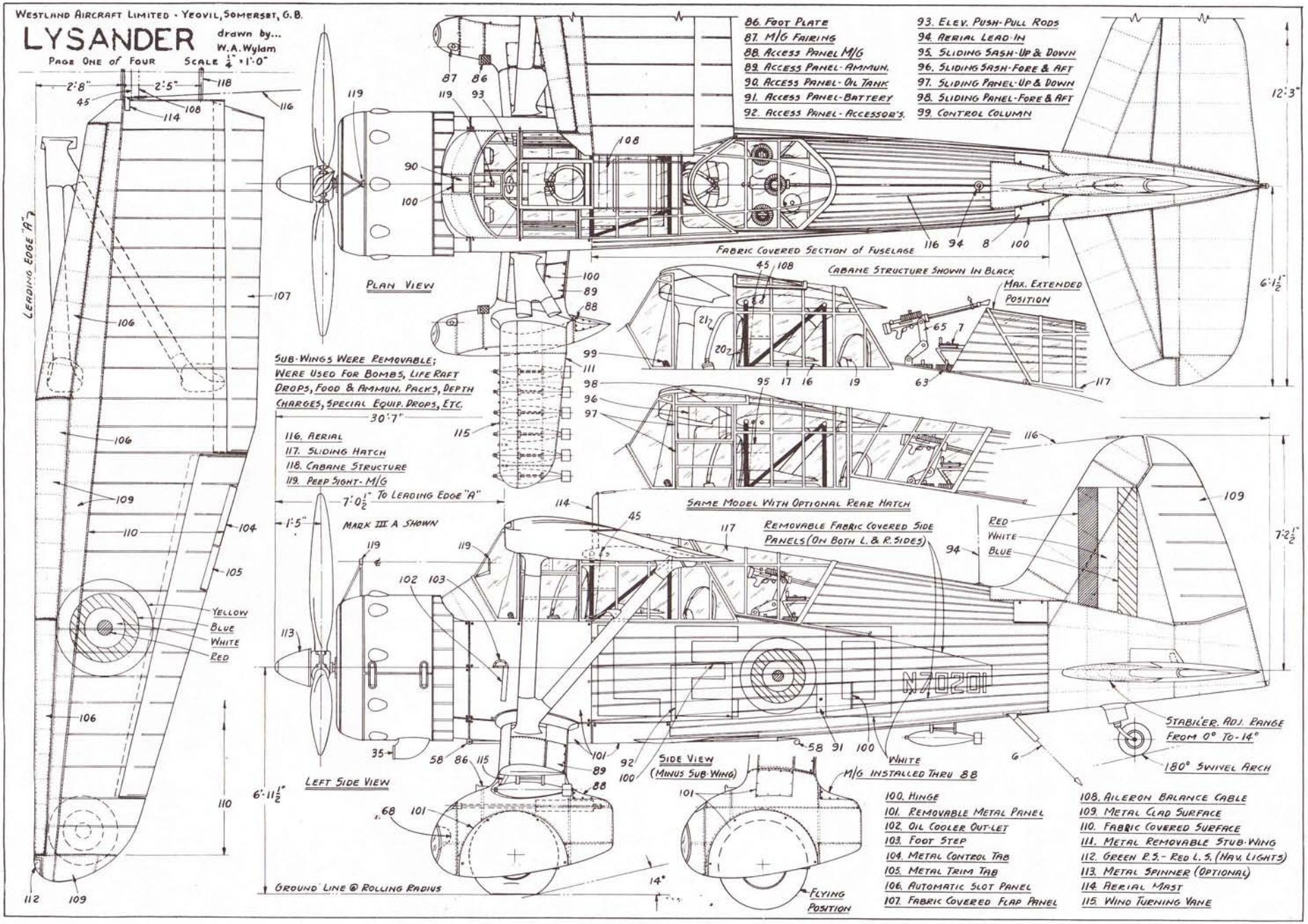
Lysander IIIA—These were improved Mk IIIs with 870hp Mercury 30 engines; 370 were built. A further 100 were completed as unarmed T.T. Mk III target tugs.

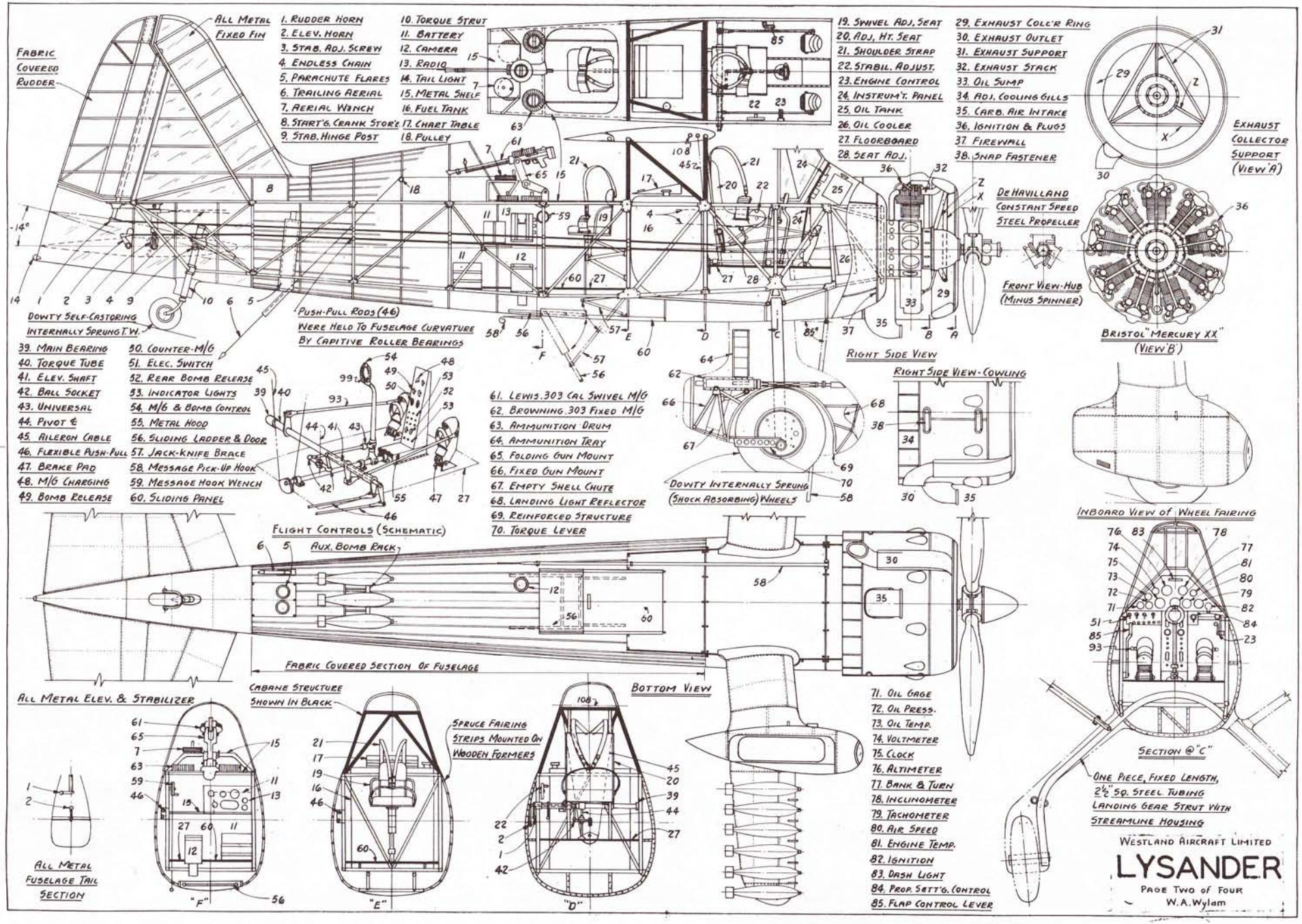
The R.A.F. had seven squadrons of Lysanders in service when the war started, and six were sent to France. Their role was traditional as long as the front remained stable in the "Sitzkrieg." When the "Blitzkrieg" began on May 10, 1940, the old Army Cooperation role was shattered; the Lysander and similar types were unable to operate in the old way. Their own troops were hard to follow in the rapidly changing scene; enemy armored columns were impervious to light machine-gun attacks and even to light bombs, and they possessed formidable firepower that was deadly to slow, low-flying aircraft. Further, the overwhelming German air power shot down many Lysanders, and destroyed others on their airfields. Of 174 Lysanders sent to France, only 50 were able to return to England—88 were lost in combat, and 36 were either destroyed on the ground or abandoned by their retreating squadrons.

Many British-based Lysanders were lost in the Battle of France, when they flew across the Channel to drop supplies to surrounded Allied troops and were hit by German ground fire.

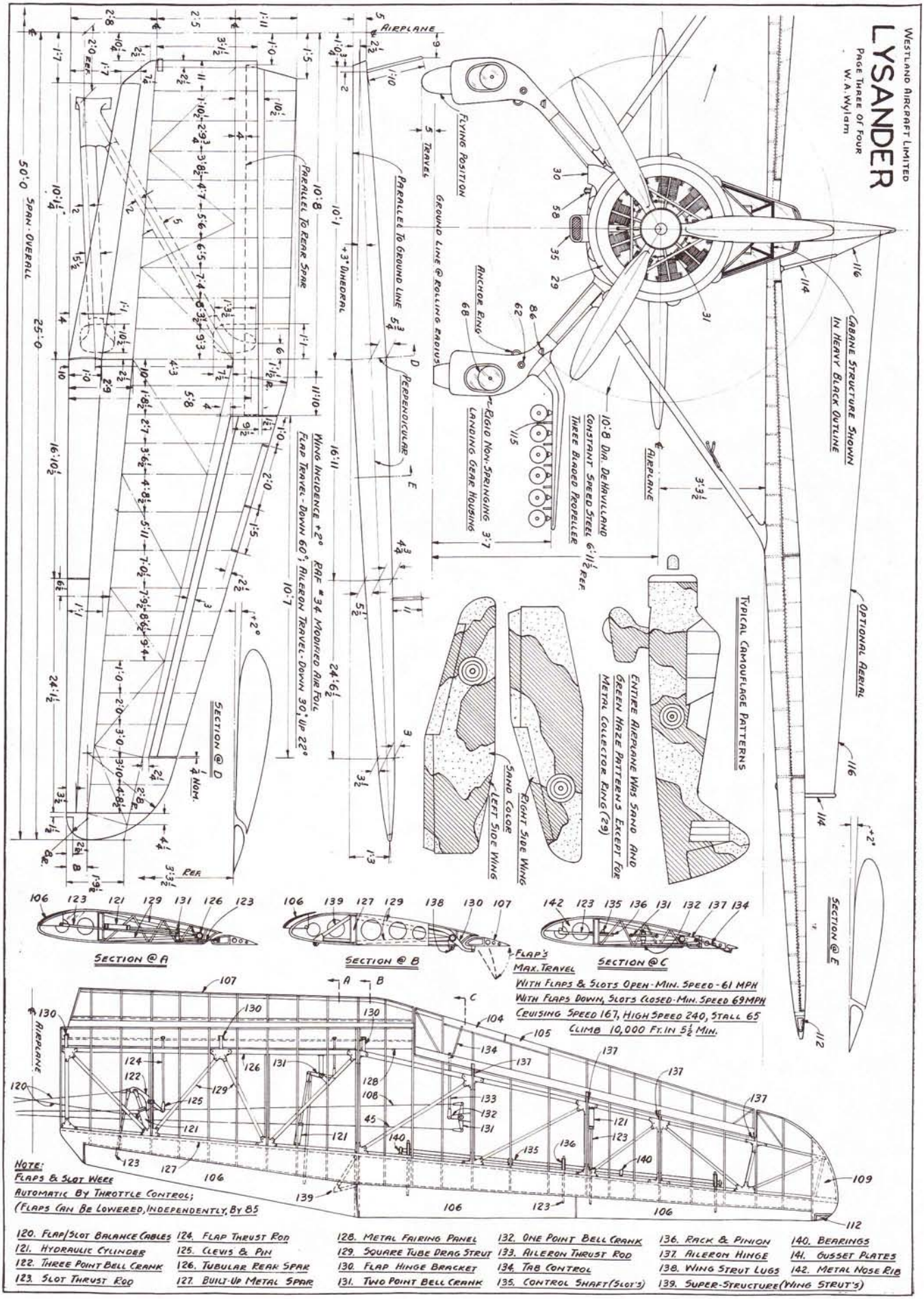
The Army Cooperation role continued in modified form in other theaters of the war—notably in North Africa, were Lysanders had been sent before the war. After the war began, Lysanders also served in Greece, Palestine and India. The Lysanders' most famous operation—and the one best suited to their STOL characteristics—was the nighttime shuttling of French Resistance and other agents (and supplies) into and out of occupied France. Between August 1941 and late 1944, some 400 such sorties were made, with nearly 300 people flown in and 500 brought out. For this clandestine work, the Lysanders were painted overall matte black.

This view of a Lysander III with a belly-mounted auxiliary fuel tank shows the full-span wing slats open during a landing approach.

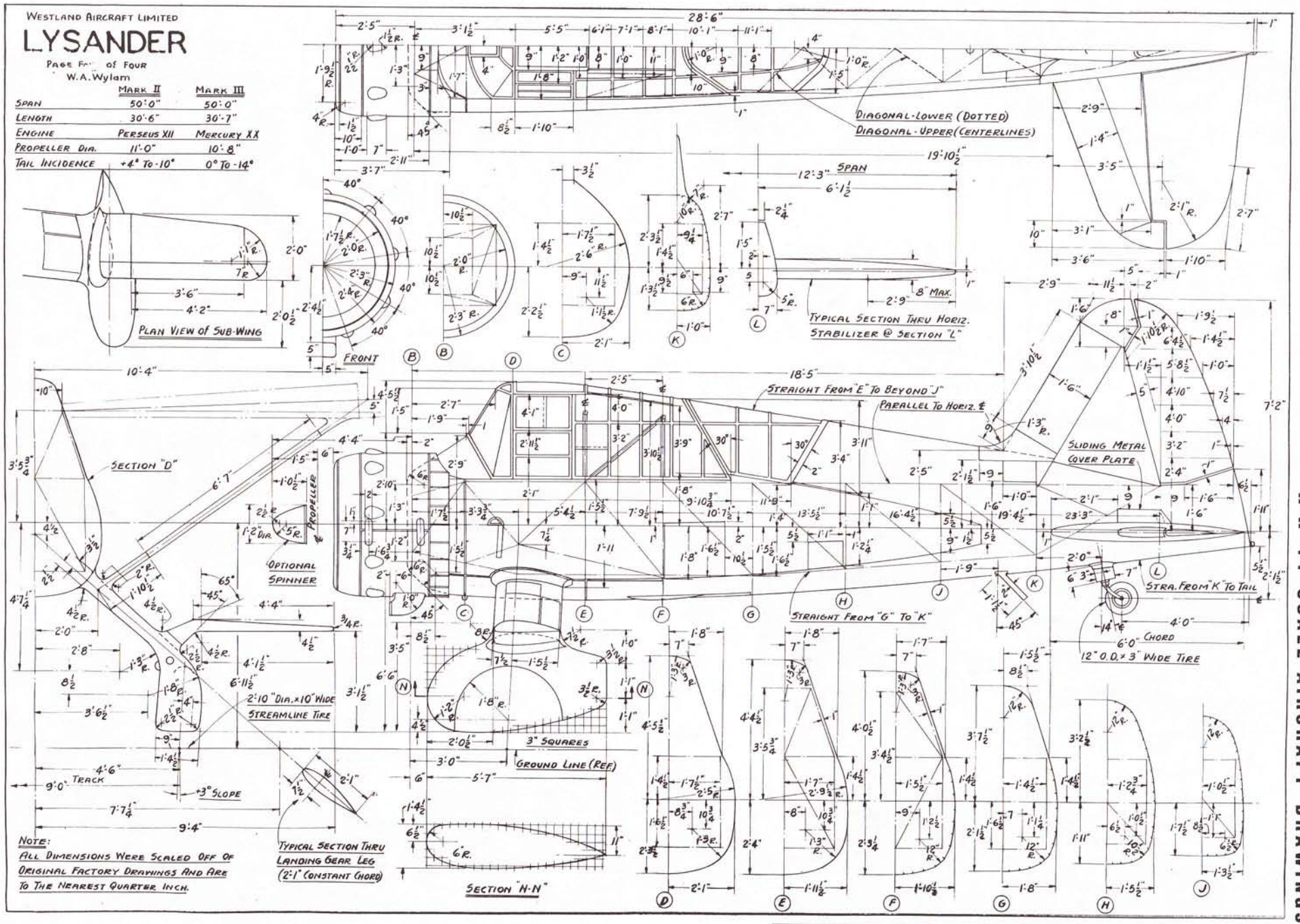

WESTLAND AIRCRAFT LIMITED - YEOVIL, SOMERSET, G.B.
LYSANDER
drawn by... W.A. Wylam
PAGE ONE of FOUR
SCALE 1/4" = 1'-0"
LEADING EDGE "A"
PLAN VIEW
FABRIC COVERED SECTION of FUSELAGE
CABANE STRUCTURE SHOWN IN BLACK
MAX. EXTENDED POSITION
SUB-WINGS WERE REMOVABLE; WERE USED FOR BOMBS, LIFE RAFT DROPS, FOOD & AMMUN. PACKS, DEPTH CHARGES, SPECIAL EQUIP. DROPS, ETC.
30'-7"
116. AERIAL
117. SLIDING HATCH
118. CABANE STRUCTURE
119. PEEP SIGHT - M/G
7'-0 1/2" TO LEADING EDGE "A"
MARK III A SHOWN
LEFT SIDE VIEW
GROUND LINE @ ROLLING RADIUS
SAME MODEL WITH OPTIONAL REAR HATCH
REMOVABLE FABRIC COVERED SIDE PANELS (ON BOTH L. & R. SIDES)
RED
WHITE
BLUE
SIDE VIEW (MINUS SUB-WING)
M/G INSTALLED THRU 88
FLYING POSITION
STABILIZER ADJ. RANGE FROM 0° TO -14°
180° SWIVEL ARCH
YELLOW
BLUE
WHITE
RED
N7020
12'-3"
6'-1 1/2"
7'-2 1/2"
6'-11 1/2"
86. FOOT PLATE
87. M/G FAIRING
88. ACCESS PANEL M/G
89. ACCESS PANEL - AMMUN.
90. ACCESS PANEL - OIL TANK
91. ACCESS PANEL - BATTERY
92. ACCESS PANEL - ACCESSOR'S.
93. ELEV. PUSH-PULL RODS
94. AERIAL LEAD-IN
95. SLIDING SASH - UP & DOWN
96. SLIDING SASH - FORE & AFT
97. SLIDING PANEL - UP & DOWN
98. SLIDING PANEL - FORE & AFT
99. CONTROL COLUMN
100. HINGE
101. REMOVABLE METAL PANEL
102. OIL COOLER OUT-LET
103. FOOT STEP
104. METAL CONTROL TAB
105. METAL TRIM TAB
106. AUTOMATIC SLOT PANEL
107. FABRIC COVERED FLAP PANEL
108. AILERON BALANCE CABLE
109. METAL CLAD SURFACE
110. FABRIC COVERED SURFACE
111. METAL REMOVABLE STUB-WING
112. GREEN P.S. - RED L.S. (NAV. LIGHTS)
113. METAL SPINNER (OPTIONAL)
114. AERIAL MAST
115. WIND TURNING VANE



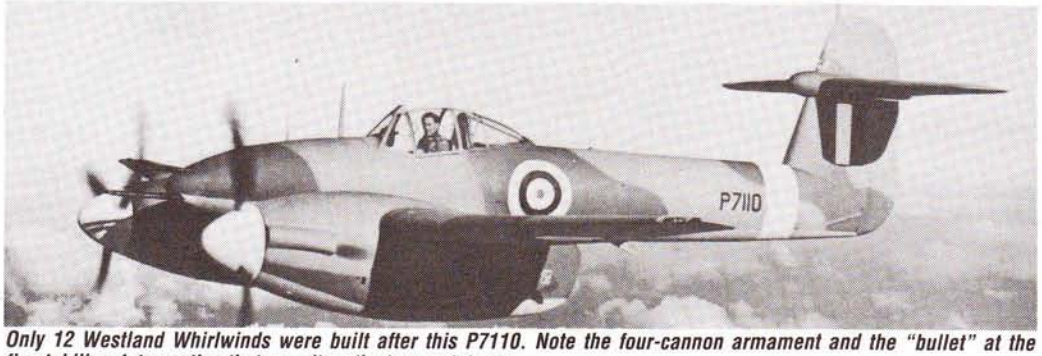
WESTLAND LYSANDER



120. FLAP/SLOT BALANCE CABLES
121. HYDRAULIC CYLINDER
122. THREE POINT BELL CRANK
123. SLOT THRUST ROD
124. FLAP THRUST ROD
125. CLEVIS & PIN
126. TUBULAR REAR SPAR
127. BUILT-UP METAL SPAR
128. METAL FAIRING PANEL
129. SQUARE TUBE DRAG STRUT
130. FLAP HINGE BRACKET
131. TWO POINT BELL CRANK
132. ONE POINT BELL CRANK
133. AILERON THRUST ROD
134. TAB CONTROL
135. CONTROL SHAFT (SLOT'S)
136. RACK & PINION
137. AILERON HINGE
138. WING STRUT LUGS
139. SUPER-STRUCTURE (WING STRUT'S)
140. BEARINGS
141. GUSSET PLATES
142. METAL NOSE RIB


WESTLAND AIRCRAFT LIMITED
LYSANDER
PAGE FOUR OF FOUR
W.A. Wylam
MARK II
MARK III
SPAN 50'0" 50'0"
LENGTH 30'6" 30'7"
ENGINE PERSEUS XII MERCURY XX
PROPELLER DIA. 11'0" 10'8"
TAIL INCIDENCE +4° TO -10° 0° TO -14°
DIAGONAL-LOWER (DOTTED)
DIAGONAL-UPPER (CENTERLINES)
PLAN VIEW OF SUB-WING
FRONT
12'3" SPAN
TYPICAL SECTION THRU HORIZ. STABILIZER @ SECTION "L"
STRAIGHT FROM "E" TO BEYOND "J"
PARALLEL TO HORIZ. ℄
SLIDING METAL COVER PLATE
SECTION "D"
PROPELLER
OPTIONAL SPINNER
STRAIGHT FROM "G" TO "K"
STRA. FROM "K" TO TAIL
6'0" CHORD
12" O.D. × 3" WIDE TIRE
2'10" DIA. × 10" WIDE STREAMLINE TIRE
3" SQUARES
GROUND LINE (REF)
TRACK
+3° SLOPE
TYPICAL SECTION THRU LANDING GEAR LEG (2'1" CONSTANT CHORD)
SECTION "N-N"
NOTE:
ALL DIMENSIONS WERE SCALED OFF OF ORIGINAL FACTORY DRAWINGS AND ARE TO THE NEAREST QUARTER INCH.

THE WESTLAND WHIRLWIND

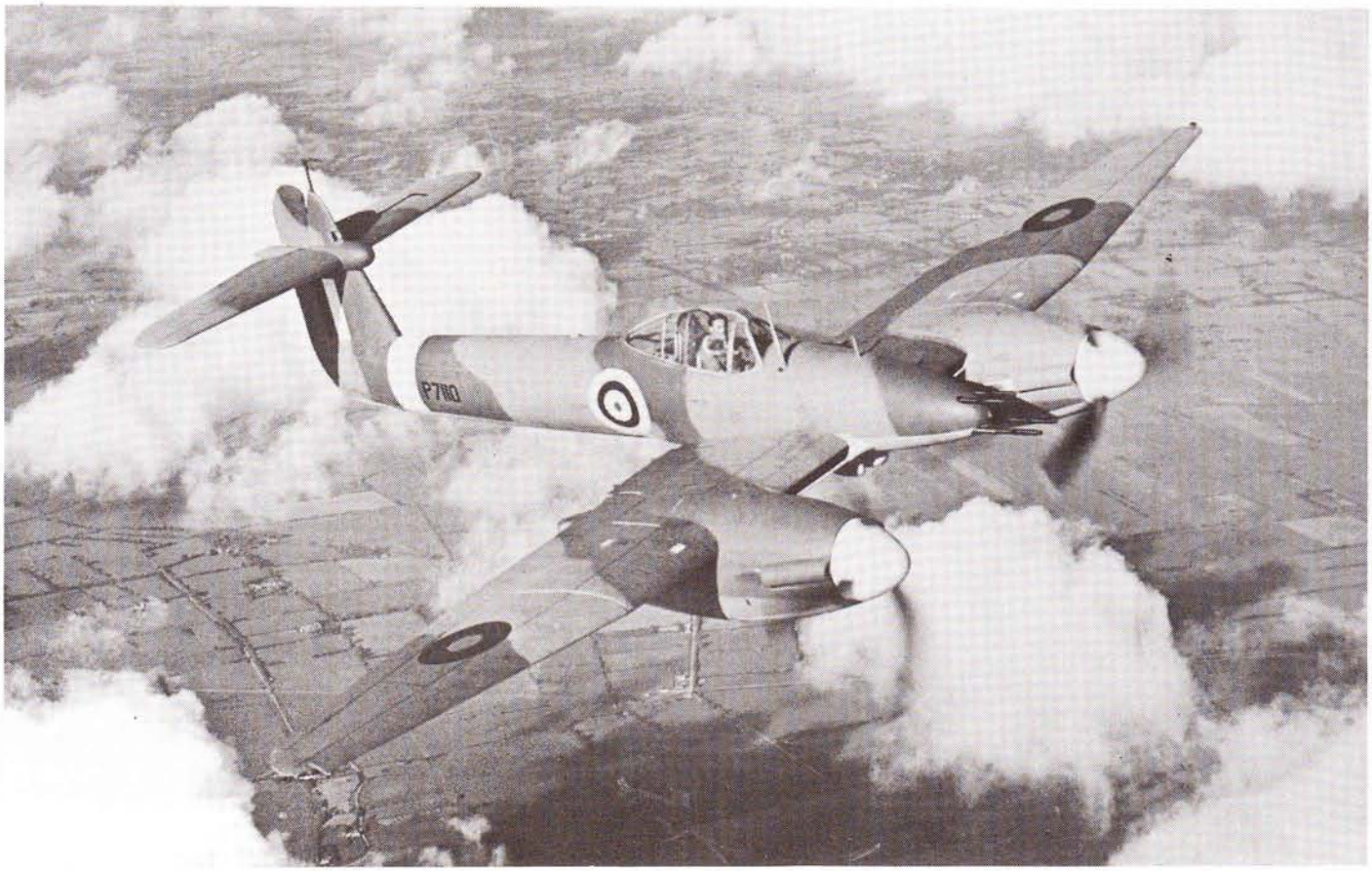


Only 12 Westland Whirlwinds were built after this P7110. Note the four-cannon armament and the "bullet" at the fin-stabilizer intersection that wasn't on the two prototypes.

THE British Westland Whirlwind was the world's first production twin-engine, single-seat fighter that was designed as such. The prototype flew on October 11, 1938, beating the American Lockheed XP-38 by three months. The Whirlwinds saw extensive action in Europe during the war, but they weren't built in great numbers. There were two prototypes, and only 144 production models that equipped two fighter squadrons.

Design of the Whirlwind began in 1936, in response to an Air Ministry request for a twin-engine, single-seat fighter. Westland beat proposals from Bristol and Hawker, and received a contract for two prototypes in February 1937. The Whirlwind airframe was, in effect, a scaling-down of conventional twin-engine transports and bombers; it had a shorter nose, engines in nacelles on the wing, and landing gear that retracted into the nacelles. This led to odd proportions, because the single-seat airframe was relatively small, but the nacelles,

This view from above shows engine and radiator air intakes, located in the leading edge of the wing, between the fuselage and the nacelles. Note the 1940 Sand and Spinach camouflage, the Type A.1 roundels on the fuselage and the Type B roundels on the upper wing surface.



SPECIFICATIONS AND PERFORMANCE: WHIRLWIND

Powerplant ..... Rolls-Royce Peregrine, 860hp at 2,850rpm at 13,500 ft.; 885hp at 3,000 rpm at 15,000 ft.

Wingspan ..... 45 ft.

Length ..... 32 ft., 3 in.

Wing Area ..... 250 sq. ft.

Empty Weight ..... 8,310 lbs.

Gross Weight ..... 10,356 lbs. (fighter); 11,388 lbs. (bomber with two 500-lb. bombs).

High Speed ..... 315mph at 5,000 ft.; 360mph at 15,000 ft.; 270mph at 15,000 ft. with two 500-lb. bombs.

with their standard-size engines, had to be as big as those on much larger aircraft.

The structure was all metal, including even the covering of the control surfaces. Its powerplants were 885hp Rolls-Royce Peregrines, which were developments of the earlier Rolls-Royce Kestrel that preceded the famous Merlin. The Whirlwind was the only airplane to use this engine, and troubles with the Peregrine hindered Whirlwind production and operations. Armament was the heaviest of any British fighter of the time; it had a battery of four 20mm cannons in the nose.

An initial order for 200 Whirlwinds was soon followed by an order for 200 more. Production began in Westland's Yeovil plant, but it suffered from the higher priority that was given to the Lysander program, and the first production Whirlwind didn't fly until May 1940. Two Whirlwinds, plus the second prototype, were assigned to No. 25 Fighter Squadron, but they were withdrawn when that unit was re-equipped with Bristol Beaufighters. The three, and other Whirlwinds, were then assigned to No. 253 Squadron, but because there were so few of them, they didn't participate in the Battle of Britain. Whirlwinds didn't engage the enemy until January 12, 1941, when two were sent up to intercept a lone German bomber over England. They scored a "probable"; and the first confirmed victory came on February 8, when a German Arado 196 seaplane was shot down.

The Whirlwind was kept secret from the public until February 1942. The Germans, however, knew of it much earlier; they had accurate silhouettes of the Whirlwind in their aircraft recognition manuals.

The short range of the Whirlwind precluded its use as an escort on long-distance bomb raids, but it did conduct escorts as far as Holland. Although it could hold its own against the Messerschmitt 109, the Whirlwind lacked high-altitude capability—a feature that wasn't considered important in a fighter when it was designed, but became very important after the war started. Whirlwinds equipped a second squadron (No. 137), and participated in low-altitude missions. They took part in attacks on German airfields and military installations in western France from their bases in England.

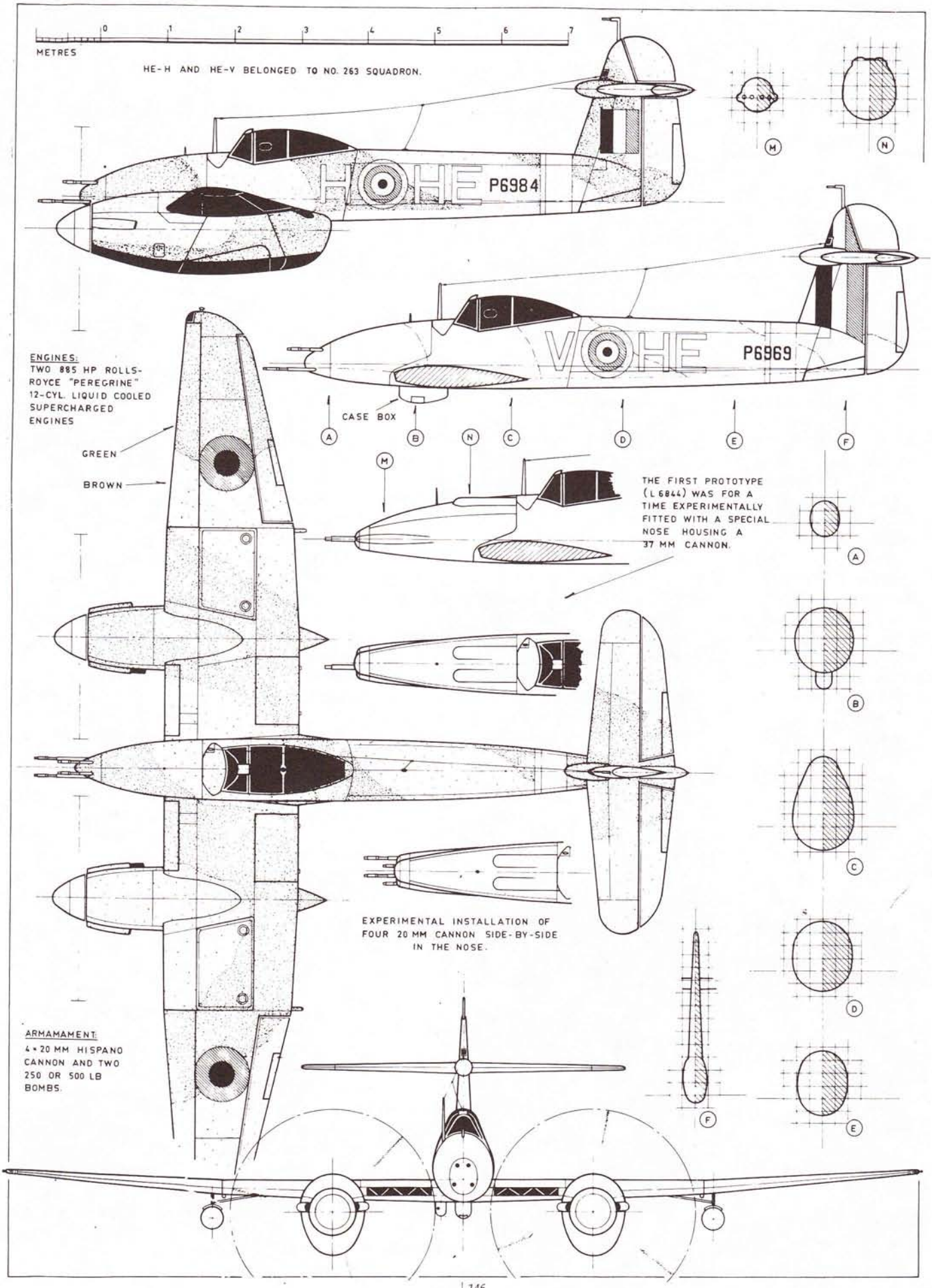
Bombing was added to the Whirlwind's activity in mid-1942, when racks for two 250-pound or two 500-pound bombs were added to the wings outboard of the nacelles. This version was named the "Whirlibomber."

The Whirlwind was already suffering from low priorities in its own factory, and production suffered further setbacks when the new Ministry of Aircraft Production decided to cancel Peregrine engine production in favor of increased Merlin production. As a result, the second order for 200 Whirlwinds was cancelled, and only 144 on the first order were completed. Westland then converted the Whirlwind production line to licensed production of Supermarine Spitfires.

The delivered airplanes were now "orphaned," with little support from the factory or the engine manufacturer; and the operational Whirlwinds were withdrawn from service. No. 263 Squadron was the last to use them, and 12 Whirlwinds made a spectacular attack on Cherbourg Harbor in France on October 22, 1943.

A variety of British colors and markings were used during the career of the Whirlwind. The first prototype was painted overall red with white letters and Type A roundels all over. The second prototype was all silver, again with Type A roundels. The odd arrangement of a black underside for the left wing, with a Type A.1 roundel matching a Type A roundel under the duck-egg blue right wing, is correct. This arrangement was also used by some other British fighters in 1940. Type C roundels were used on the fuselage and under the wings from July 1942 on.

This underside view of the Whirlwind shows the landing gear completely enclosed in nacelles, and Type A roundels under the wing.


METRES
0
1
2
3
4
5
6
7
HE-H AND HE-V BELONGED TO NO. 263 SQUADRON.
HOHE P6984
VOHE P6969
ENGINES:
TWO 885 HP ROLLS-ROYCE "PEREGRINE" 12-CYL. LIQUID COOLED SUPERCHARGED ENGINES
GREEN
BROWN
CASE BOX
A
B
N
C
D
E
F
M
THE FIRST PROTOTYPE (L 6844) WAS FOR A TIME EXPERIMENTALLY FITTED WITH A SPECIAL NOSE HOUSING A 37 MM CANNON.
EXPERIMENTAL INSTALLATION OF FOUR 20 MM CANNON SIDE-BY-SIDE IN THE NOSE.
ARMAMAMENT:
4 × 20 MM HISPANO CANNON AND TWO 250 OR 500 LB BOMBS.

THE WESTLAND WHIRLWIND

COLOUR SCHEME:
HE-H: DARK GREEN - DARK BROWN CAMOUFLAGE. UNDERSURFACES: DUCK-EGG BLUE (VERY PALE GREEN) EXCEPT FOR PORT WING & NACELLE, WHICH WERE BLACK. SPINNERS & FUSELAGE BAND: DUCK-EGG. MEDIUM GREY SQUADRON LETTERS. FUSELAGE ROUNDELS: RED-WHITE-BLUE-YELLOW (RED CENTER). WING ROUNDELS, UPPER: RED-BLUE, LOWER: RED-WHITE-BLUE WITH AN EXTRA YELLOW RING ON PORT WING. FIN FLASH: RED-WHITE-BLUE.
HE-V: AS HE-H BUT WITHOUT BLACK PORT WING AND WITH RED-WHITE-BLUE ROUNDEL UNDER BOTH WINGS.

0 4 8 1.2 1.6 2.0 2.4
FEET

"WHIRLIBOMBER" OF NO.137 SQUADRON CARRYING A 500 LB. BOMB UNDER EACH WING

GREY
GREEN
P6982 SF S

SF-S: CAMOUFLAGED DARK GREEN - DARK GREY (SAME PATTERN AS HE-H) WITH MEDIUM GREY UNDERSURFACES AND LETTERS. SPINNERS AND FUSELAGE BAND: DUCK EGG. MARKINGS: SAME COLOURS AS HE-V.

STARBOARD ENGINE AS SEEN FROM FUSELAGE. (COLOURS REVERSED ON PORT ENGINE).

UNDERSURFACE OF SF-S WING.

RETRACTABLE LANDING LIGHT

G H I K L

3-BLADE DE HAVILLAND CONSTANT SPEED PROPELLER. (BLACK WITH YELLOW TIPS)

CAMERA GUN

EMPTY CASE BOX

Westland "Whirlwind"

Tage

$17.95

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