

VOLUME III

NUMBER 13

*RESTRICTED*

**RESTRICTED**

*N*



*4470*

# AIRCRAFT RECOGNITION

THE INTER-SERVICES JOURNAL

0204219

Instructors Reading this Document

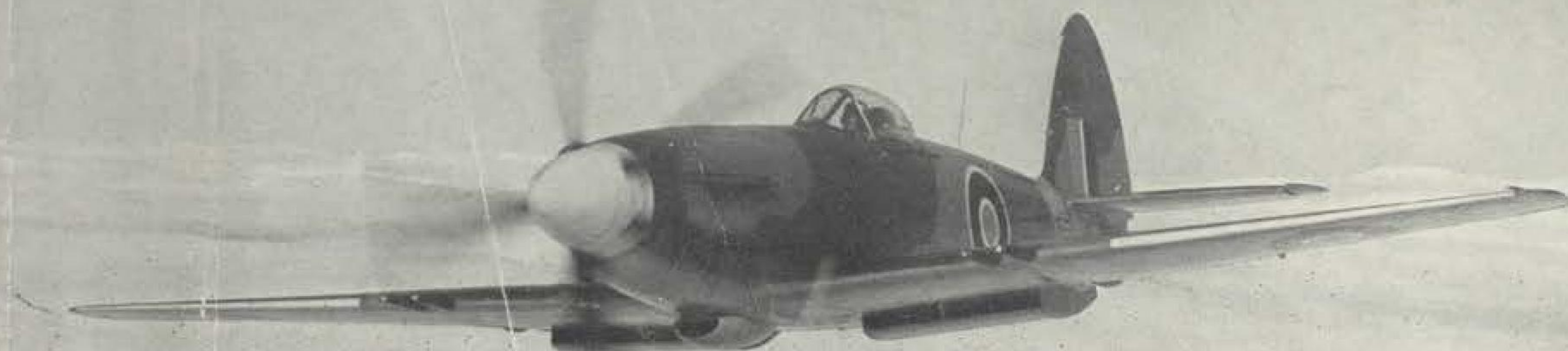
Sign Below

(File No. \_\_\_\_\_)

Name

*A. D. Smith*

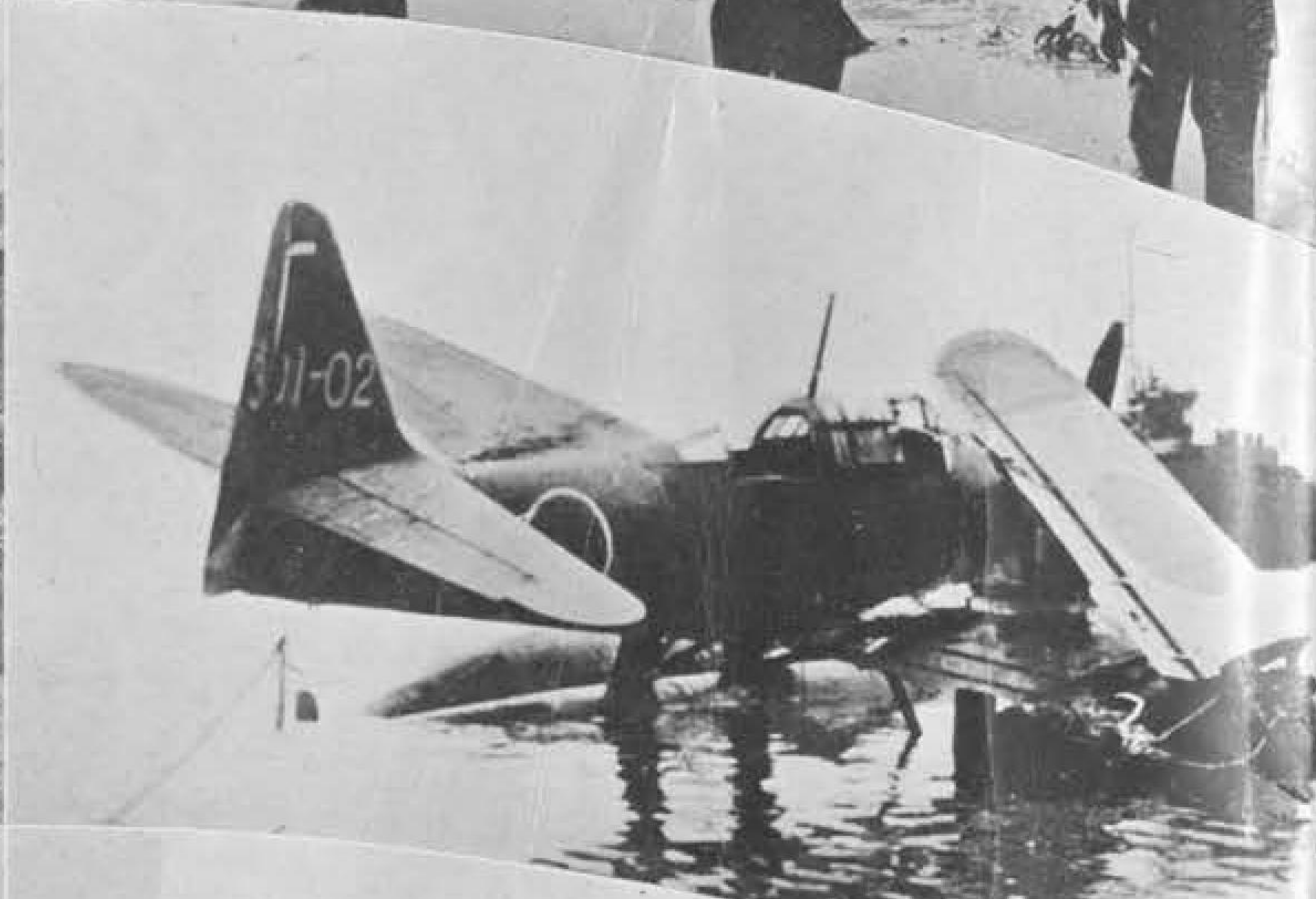
Date *16 OCT*



SEPTEMBER 1945

*6 OCT 1945*

*no P. O. Box*



# SUNSET





# AIRCRAFT RECOGNITION

THE INTER-SERVICES JOURNAL  
(RESTRICTED)

**T**HE WAR IS OVER. The Japanese Air Forces have been as completely defeated as were the Regia Aeronautica and the Luftwaffe.

There is no longer any necessity to study the outlines of enemy aircraft as in the past six years.

With the conclusion of hostilities this Journal must also come to an end. Since September, 1942, "Aircraft Recognition"—The Inter-Services Journal—has been a medium for bringing to the Services information, photographs and drawings of aircraft for Recognition training.

The object of the Journal was to make the subject as palatable and interesting as possible, and to supplement the previous somewhat dull material with photographs and articles. The fact was realised that stimulating interest in aeroplanes themselves automatically simplified the teaching of Aircraft Recognition.

Occasionally there have been criticisms that the Journal was giving too little information and information that was too late. But war conditions of printing and the strict security regulations necessary for a publication with such a wide distribution were unavoidable handicaps. Another factor that could not be overcome, but which added to the legitimate complaints of those overseas, was the distances which so many copies of each Journal had to travel before they reached their final destinations.

No effort has been spared in an endeavour to get available material to the Services at the earliest possible moment.

Because of the time taken in publication with war-time staffs, the bulk of this issue was prepared before there was any suggestion of the Japanese collapse. Hence the inclusion of some material which may be considered out of date. Some explanation is also needed for the page of photographs of the R.A.F. School of Aircraft Recognition. This shows the School as it was before the end of the War in Europe. Unfortunately, space had not been found to include the photographs at an earlier date. But they should still be useful to those planning Recognition Rooms.

In laying aside their task the Editorial Committee wish to express their thanks to those who have contributed articles, drawings and suggestions during the past three years.

To cater for the varying needs of all three Services, besides the Royal Observer Corps, and for most of the time the Spotters' Clubs, has not been altogether easy. But if a lasting interest in Aircraft Recognition has been created for even a few, and above all, if the Journal has been the means of saving even one life that otherwise might have been lost by some unfortunate error in identification—then the Committee consider that their efforts during the past three years have been well worth while.

The victorious end of the War does not mean that there is no further need for Recognition training. The War has shown, not only the necessity for Aircraft Recognition, but how long an organisation takes to develop—both for the production of material and for widespread instruction—starting from zero.

No Nation disarms entirely in peace-time. The World has not yet reached that Utopian state. But a reduction of armed forces and expenditure on armaments and training for war is essential. Although this Journal must be considered one of the more extravagant forms of training material, only justified by the uncompromising demands of actual War, some simpler form of Journal with photographs, tests, and latest information on new types will probably be available in the future.

A strong man armed is still the surest discouragement to any would-be aggressor. That Aircraft Recognition is inseparable from gunnery has been learned. Obviously it is one of the first weapons of defence.

Until such time as visual recognition can be superseded by other means, or until aircraft as weapons of war become obsolete, training should be maintained at a high level. It should be obligatory for all the defence services.

Let us not forget the lessons we have learned during the past six years. "Forewarned is forearmed." Good luck to you all.

# "LINE"

COMPARE the de Havilland Hornet with the Grumman Tigercat. Compare the Supermarine Spiteful with the German Heinkel He 162. Compare the Boeing B-29 Superfortress with the Avro Lincoln. Compare the Aichi "Grace" with the Grumman Avenger.

One thing is obvious from all these comparisons. It is the extreme difference in line. The first of each of these comparisons are smoothly streamlined, fast, sleek aeroplanes which "look right"—and are right, aerodynamically speaking. The second of each of these comparisons are angular and even ugly. All are useful. But they are hardly beauties.

Two opposite lines of thought in aeronautical outlines can be seen in these examples—to streamline or not to streamline. Take the Spiteful and the He 162, for example—the one with beauty of line, an aeroplane of breeding—the other an aesthetic atrocity. Yet the Heinkel He 162 is the faster of the two.

The fact is that war has forced on designers functional requirements which have had to be satisfied in a minimum of man-hours in design and production, even at some sacrifice in purity of form.

Thus, the Hornet, the Spiteful and the Superfortress—all beautiful aeroplanes—are all the direct descendants of a line of aeroplanes dating back to more peaceful times, when time and trial could be lavished on design to produce the most satisfying product—Comet, Mosquito, Spitfire and Fortress. Indeed, breeding tells.

In contrast, the He 162 and, to a lesser extent, the Lincoln



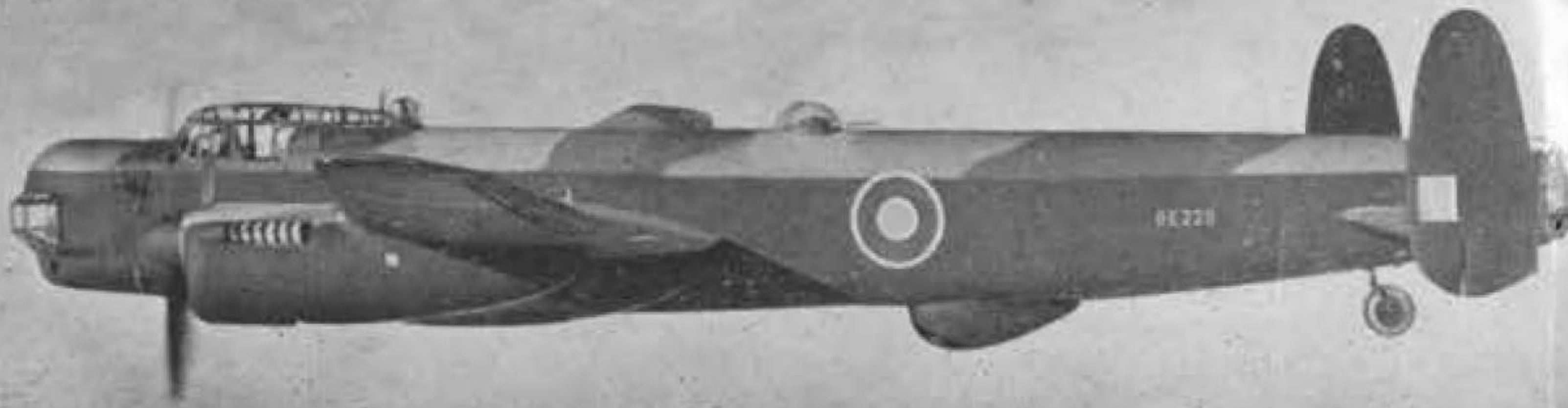
MOSQUITO XVI



MITCHELL III



GRACE



LINCOLN I



AVENGER



B-29, SUPERFORTRESS

and the Tigercat, have been rushed out under duress of war, while other types, such as the Fairchild C-82 Packet, have sacrificed form for function and have been planned to provide the maximum performance in loading or in fighting rather than in flying. The Constellation makes an interesting contrast with the C-82. The Lockheed designers evidently had an eye for peace-time operations—as well as for military transport duties—where both performance and payload count and every possible advantage from purity of form must be gained to keep running costs down to a minimum. The Packet, although it may also be used for commercial operations, need not stress performance in outline because its function is mainly that of weight-lifter over shorter ranges.

All this is an example of the evil influence which war has on the best forms of development in war. Performance is gained by brute force rather than by purity of outline. Furthermore, the aeroplane which "looks right" usually is right, from a flying point of view, whereas the ugly sister is often a brute to fly. The Mosquito is one of the best flying machines—from the pilot's point of view, as others—that has yet been built.

A notable exception to the spate of ugly aeroplanes which have appeared during the past year, has been the Japanese policy. Apart from such unedifying specialities as the "Baka" suicide rocket-jet bomb, they have turned out some efficient and good-looking types, such as the Nakajima "Frank" and "Irving" and the Mitsubishi "Dinah."

One reason for the Japanese policy may be because not until recently have the Japanese had engines as powerful as those of the Allies. Thus they had to produce aeroplanes of better aerodynamic design than those of their opponents if they were to meet them on comparatively equal terms.

As a result of their concentration on form the Japanese have been able to achieve high speeds and high rates of climb for the expenditure of moderate powers. They carry one-third of the equipment considered necessary on Allied types, so have to concern themselves less with design for etceteras once the basic lay-out is decided.

That types whose main function is to carry great loads should sacrifice form for function is understandable, but even fighters, for which speed is the first essential, have been subject to this utility urge. The Grumman Hellcat and Bearcat and the Ryan Fireball are examples of this disregard of line.

Why deck-landing types should have been particularly subject to uglification is difficult to say. One reason is probably that a high maximum speed may not be considered so essential as a number of other attributes.

Allied torpedo-bombers especially offend the aerodynamic eye—witness the Avenger, Seawolf and Barracuda. That the unsightly bellies of the first two are unnecessary is suggested by the fact that the Yokosuka "Frances," which carries a torpedo internally, also has a streamlined form. Again, "Norm" shows that Floatplane is not necessarily synonymous with Drag.

The angularity of a number of American service aircraft has led to a revival in some quarters recently of the old error of trying to teach Recognition by National Characteristics. But that the Japanese have not a monopoly of good line is shown by such types as the Mosquito, B-29, P-80 and a number of others. Nor are the Japanese guiltless of aeronautical gaucherie, as they have shown, for example, with "George" and "Liz."

So many considerations have to be taken into account that there can be no definite opinion laid down on which policy is right—streamline and achieve maximum performance at a cost in production and equipment, or design first and foremost for the function to be performed and let aerodynamic performance come as it may.

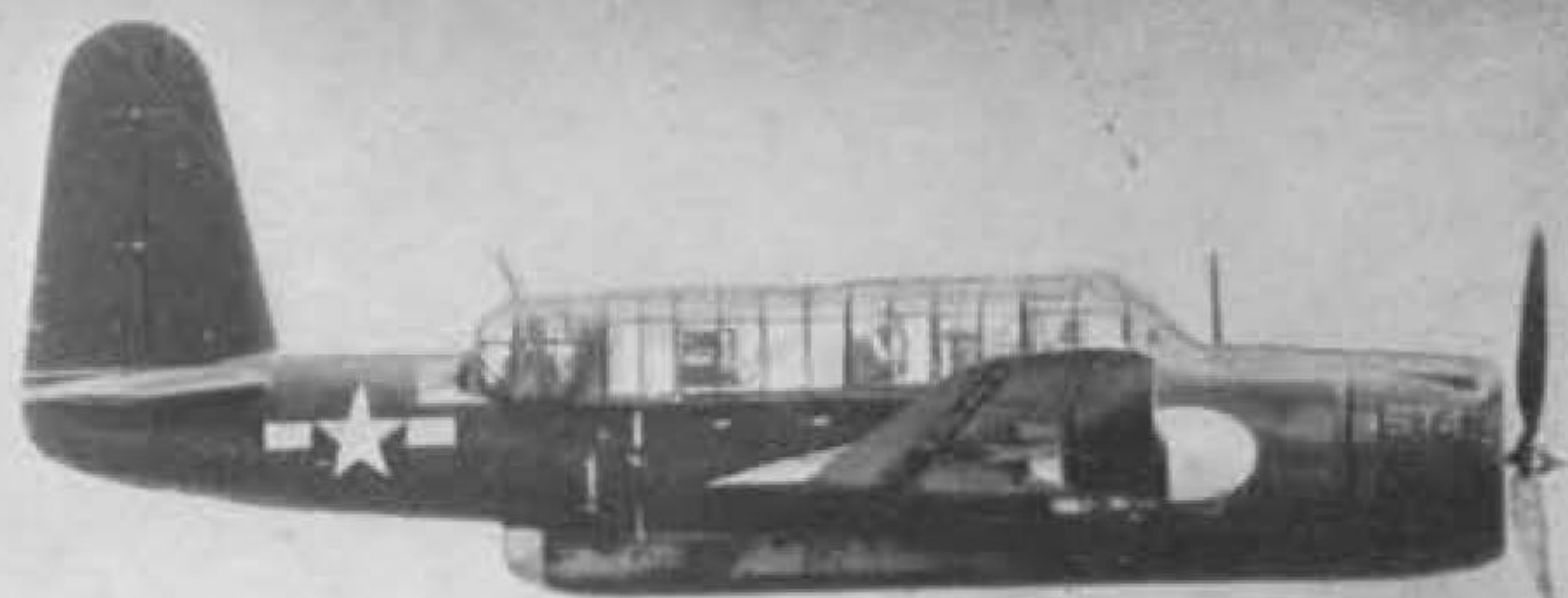
One thing is certain. Now that super-sonic speeds are being approached we are about to see some very different aerodynamic outlines from those to which we have been accustomed so far. Pointed noses, knife-edged wings, the thinnest of sections, will all be essential. To-day's aeroplanes, beautiful or ugly, will be as remote a few years hence as are the biplanes of yesteryear.



"DINAH" I



"NORM"



TBY, SEAWOLF



SC-1, SEAHAWK

# R.A.F. SCHOOL OF RECOGNITION





# The SORRY TALE of HERBERT TREE

'RECLESS' or RECOGNITION  
by  
L/SEAMAN GOSLING



Hear the tale of Herbert Tree  
Who qualified as A.A.3,  
But paid scant heed to his tuition  
Concerning Aircraft Recognition.

He qualified, then while on leave  
(With badge a-gleaming on his sleeve)  
Imbided, and was extremely vocal  
To patrons of his village "Local."

He told his listeners how he'd hit  
A Junkers and a Messerschmitt.  
They felt at times inclined to cheer,  
But found that hard—on war-time beer.

But though his tales were very strong,  
His facts were weak and very wrong.  
He talked of Ju 323s  
And called them fighters, if you please !

Of Me 190s and (pewh !)  
Of bomber Ju 52,  
Of Dornier 88s and (heavens !)  
Of single-seat 177s.

When leave expired he got a draft  
To "Crazy" Class destroyer *Daft*.  
Where, alas, young Herbert Tree  
Was something of a prodigy.

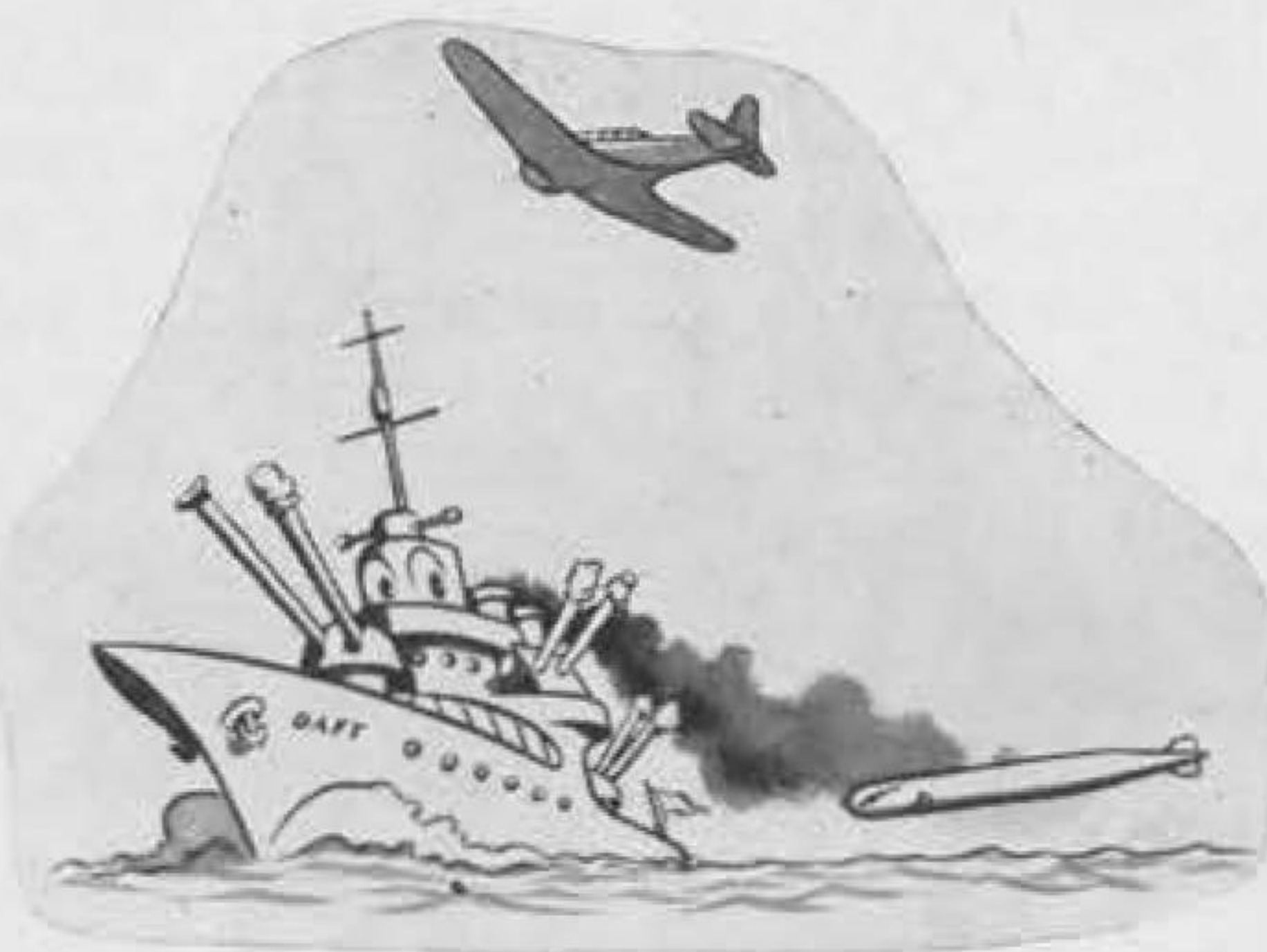
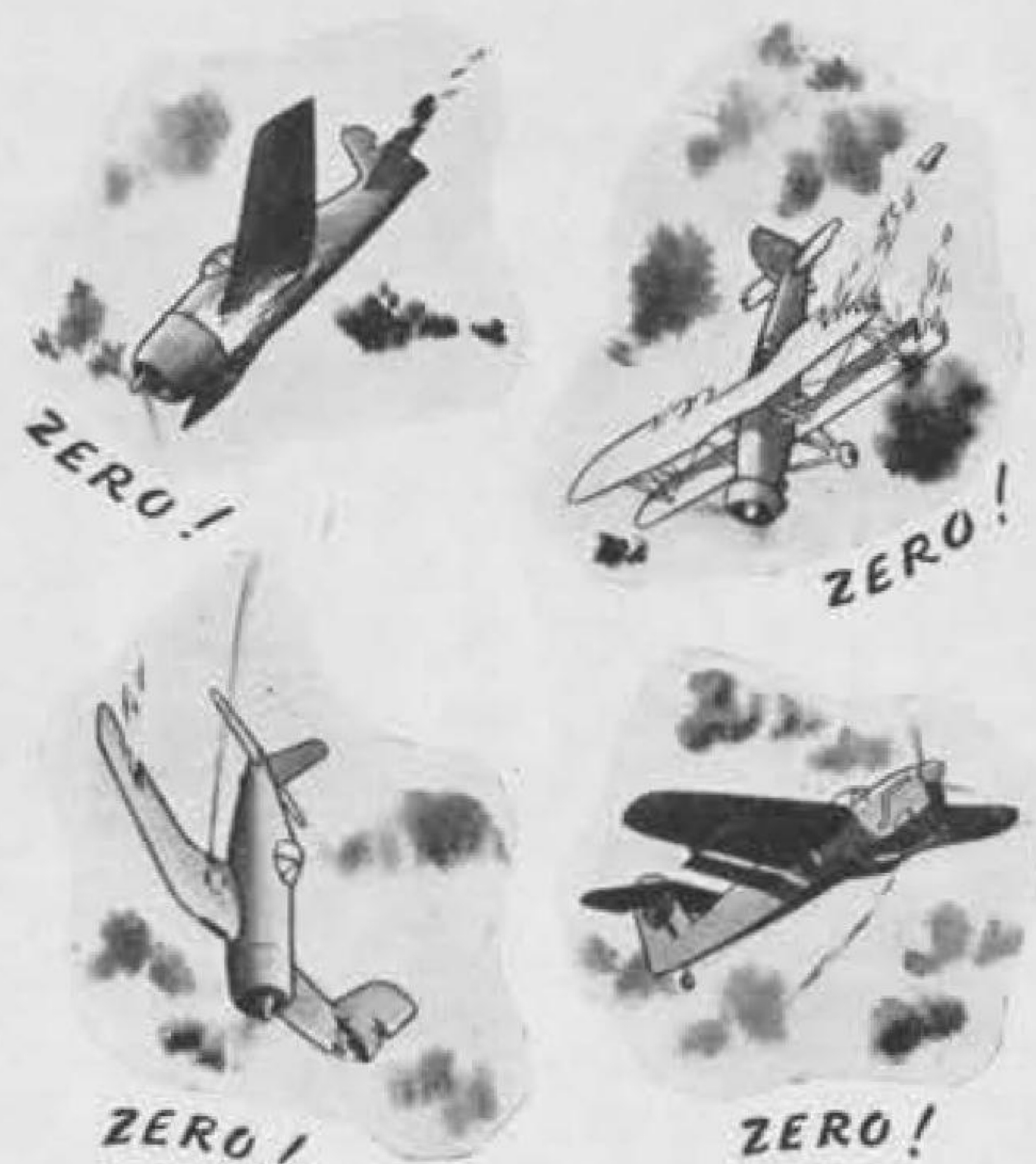
For among the whole ship's crew  
There was not a person who  
Could even start to recognise  
The craft that whiz across the skies.

So our Herbert, full of pride,  
Put on an awful lot of side.  
Until one day in '42,  
When something hurtled from the blue.

"Don't duck," said Bert. "We're right  
as rain.  
"It's just a blinking Hurricane!"  
But to his sorrow and dismay  
It dropped a bomb and got away.

This rattled everyone a lot,  
So from that time they had a shot  
At every aircraft passing by,  
At anything that dared to fly !

These tactics paid (so thought the Huns)  
For *Daft's* perpetually firing guns  
Not only downed a Messerschmitt,  
But a Tiffy, Hurri and a Spit.



They added to this tale of woe  
By shooting down a friendly Beau,  
And, to show they were not skimpy,  
They badly mauled a lonely Wimpey.

In fact the *Daft* was known as "Death"  
To pilots of the R.A.F.  
Who were relieved, to say the least,  
To learn that she'd been sent out East.

If scarce their knowledge of the Hun,  
Of Japs they knew exactly one.  
According to young Bert, our hero,  
Every plane became a "Zero."

They started well by opening fire  
Upon a Yank (which climbed up higher)  
And, 'cos it couldn't travel faster  
They brought a Swordfish to disaster.

Two Corsairs, spinning down in flame,  
Were due to their unerring aim.  
Nothing flying could elude her,  
*Daft* even wrecked a Barracuda !

Hellcats, Wildcats—every craft,  
Received a shot from H.M. *Daft*,  
Until an irate C-in-C.  
Addressed them energetically.

So then they tried the other boot  
And rigidly declined to shoot.  
Result, one evening rather late  
They failed to stop a lonely "Kate."

Which, skimming low, no hesitation,  
Attacked with grim determination,  
And dropping "fish" into the brine,  
Caught *Daft* below the waterline.

And so the sorry crew of *Daft*  
Betook to cutter, whaler, raft,  
And cursed with deep profanity  
The disillusioned Herbert Tree.

And all made then a solemn oath  
To strive and do their "uttermoth" \*\*  
To master Aircraft Recognition  
And so avoid a repetition.

\*(Because of long immersion in the water  
they all had colds !)



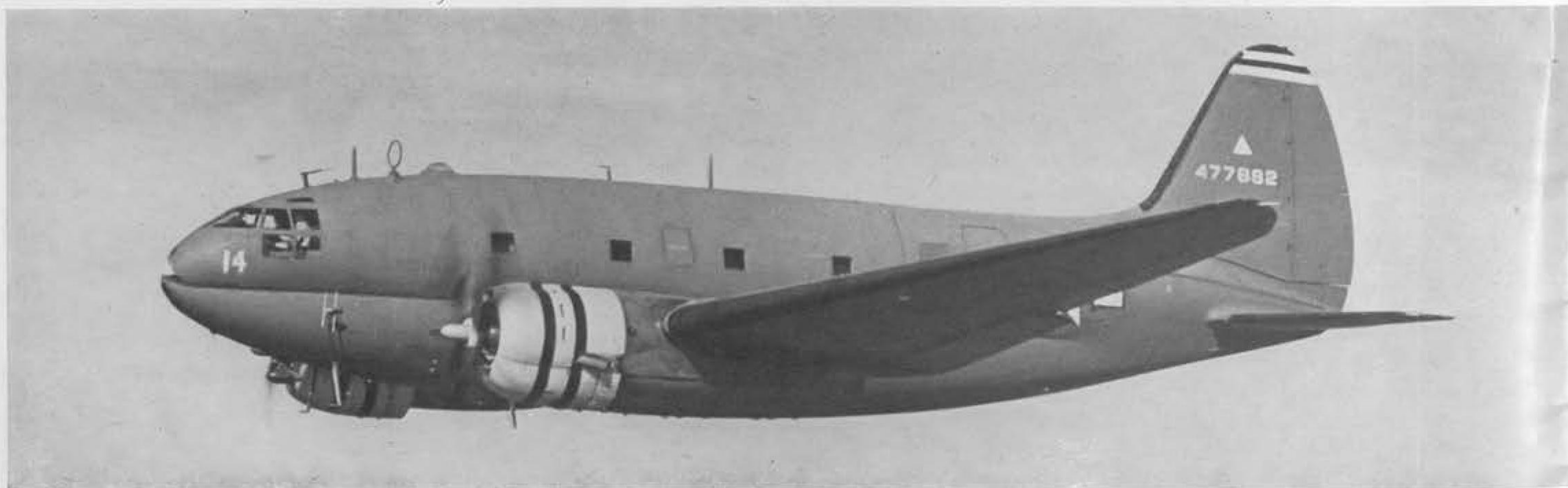
**L**IKE all military transports in service to date in the U.S. forces, the Commando was originally designed and built as a civil passenger-carrier. The basic design, known as the Curtiss-Wright CW-20, was drawn up in 1936, the aim of the designers being to evolve a large twin-engine aircraft capable of moving the greatest possible load at the lowest possible ton-mile or man-hour cost; in other words, an aeroplane which would ensure the operator the biggest return for his money.

The prototype CW-20 flew for the first time on March 26, 1940. With two 1,700 h.p. Wright Cyclone R-2600 engines, a capacity for 36 passengers and on a designed loaded weight of 38,000 lb., the CW-20 attained a maximum speed of 262 m.p.h. During the C.A.A. flight tests the U.S. Army showed an interest in the aeroplane and, after certain modifications had been made to meet military requirements, the prototype was given the U.S. Army designation C-55. After further testing it was reconverted to a civil type, fitted with

extra tanks and flown across the Atlantic to Great Britain in 9 hrs. 40 mins. Here it was handed over to British Airways, named "St. Louis" as a compliment to its birthplace, and was operated for a time on the shuttle service linking Great Britain with the trans-Atlantic flying-boat terminal at Foynes in Eire.

In the meantime, the design of the CW-20 was being modified for large-scale production as a military transport under the designation C-46. The interior of the fuselage was stripped of all traces of civil comfort, the floor was strengthened, larger doors provided and cargo tie-down fittings, stretcher supports, folding benches, etc., were installed. A single-strut landing-gear replaced the dual-leg type of the prototype and two 2,000 h.p. Pratt & Whitney R-2800 engines were installed.

One of the most unusual features of the C-46 is the fuselage cross-section, which resembles that of an inverted figure eight and is formed of two intersecting circles with



the common chord of intersection forming the cabin floor line. A circular section is ideal for pressurisation but a completely circular fuselage for an aeroplane of the size of the Commando would have presented excessive frontal area and would have resulted in reduced aerodynamic efficiency. Consequently the double circle was adopted, the common chord line serving the dual purpose of tying the circles together and providing the floor structure.

In the prototype CW-20 the two-circle structure was not apparent as the kink between the outside diameters was faired to give the fuselage an elliptical cross-section. This fairing was added not only for appearance but on the assumption that it was aerodynamically more efficient. As a military aeroplane, however, the problem of weight became all-important and so the fairing, which weighed about 275 lb., was discarded in the C-46 without any ill-effects.

Because of its large carrying capacity, the Commando was first used in numbers in the India-China theatre and since May, 1943, Commandos comprised three-quarters of the fleet with which Air Transport Command maintained its lifeline of supplies over the Himalayan "Hump," a task that has been eased since the reopening of the Burma road early this year. Nearly all the petrol needed by the 14th Air Force and by the B-29s which began the bombing of Japan from China was carried by Commandos. On outward journeys supplies of tungsten, tin and other essential materials, as well as Army personnel, sick and wounded, etc., were brought back to India.

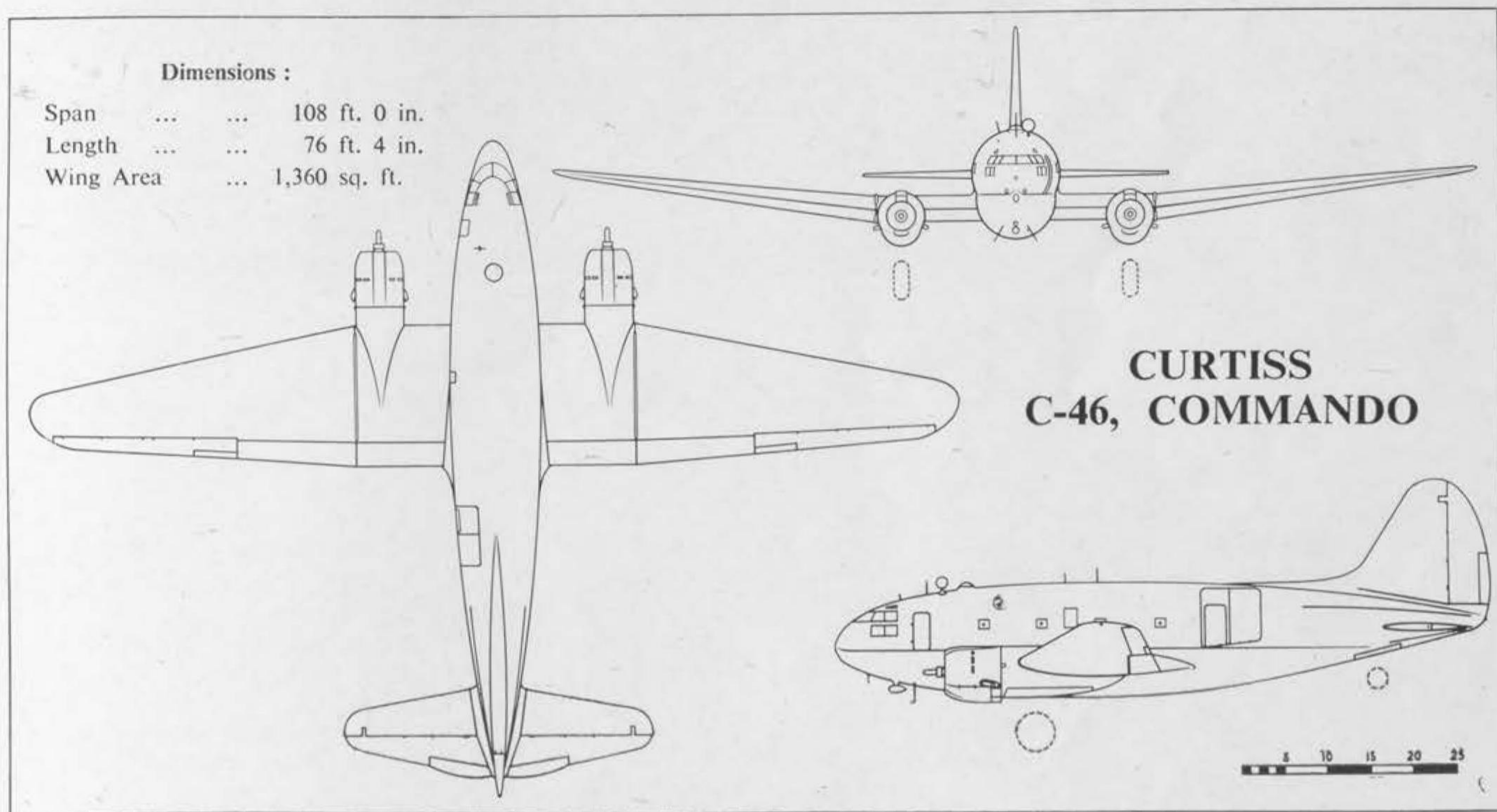
In service with the U.S. Marine Corps as the R5C-1, the Commando has taken part in the Pacific campaigns at Midway, the Gilbert Islands, Tarawa, Saipan, the Philippines, etc., taking in supplies and bringing out wounded. In February last one Commando actually took off from a boulevard in Manila, while fighting for the city was still in progress, with 80 persons on board, including 66 nurses who had been imprisoned there since the fall of Bataan and Corregidor.

The Commando first went into action in the European



Theatre of Operations in the airborne crossing of the Rhine on March 24 last. This was a paratroop operation and the aircraft used in this action were fitted for the first time with doors on both sides of the fuselage to enable the paratroops to drop in double "sticks" from each aircraft in half the time normally taken and to land in a tighter pattern.

As a combat aircraft serving with Troop Carrier Command the Commando carries a crew of five and 36-40 paratroops, or it can carry jeeps, light field guns, ammunition, or 33 stretcher cases. It can also tow two gliders. As a transport the variety of cargo it can carry is only limited by the size of its large freight-loading doors. Compared with the designed all-up weight of 38,000 lb. of the prototype CW-20, the Commando is now taking off at a loaded weight of anything up to 50,000 lb. and with a freight or combat load of 10,000 lb.





P-51H, MUSTANG



"TOJO"



P-51H, MUSTANG



B-29, SUPERFORTRESS



C-54, SKYMASTER

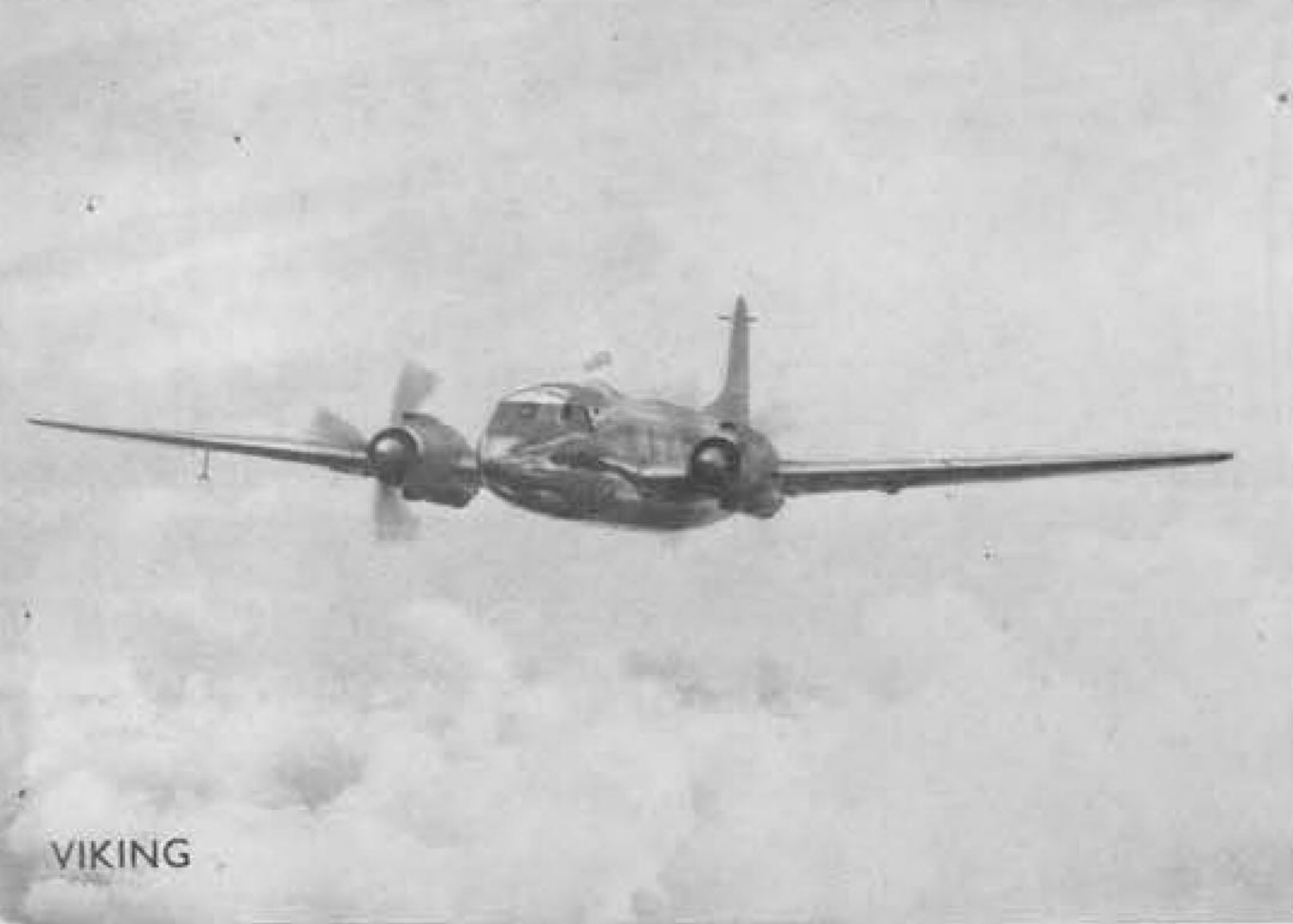
# Aircraft in

The latest version of the North American MUSTANG (*top left*) long-range fighter—the P-51H—incorporates more than 50 aerodynamic and structural changes. The two views illustrated above show the main points of difference in the new model—the increase in the size of the fin and rudder and tailplane, the almost complete elimination of the dorsal fin, the deeper intake for the radiator and the drooping nose.

The Boeing B-29 SUPERFORTRESS (*lower left*) which was able to carry greater bomb loads to Japan from bases nearer the main Japanese islands shortly before the end of the War, was also the first aeroplane to drop the "atom" bomb—on Hiroshima on August 8,

The banking view of "TOJO" (*top right*), the Nakajima fighter, shows well the broken straight taper on the trailing-edge of the wing which gave rise to the original misapprehension that the wing was elliptical.

The Douglas C-54, SKYMASTER (*lower right*), has proved one of the outstanding transports of the day and has seen service in all parts of the World and to all the battle areas. Not so long ago a flight from New York to Paris was a World-shaking event, but now it is a matter of ordinary routine for the Skymaster which is shown above flying past the Eiffel Tower. From war loads the Skymaster turns to peace-time operations,



VIKING



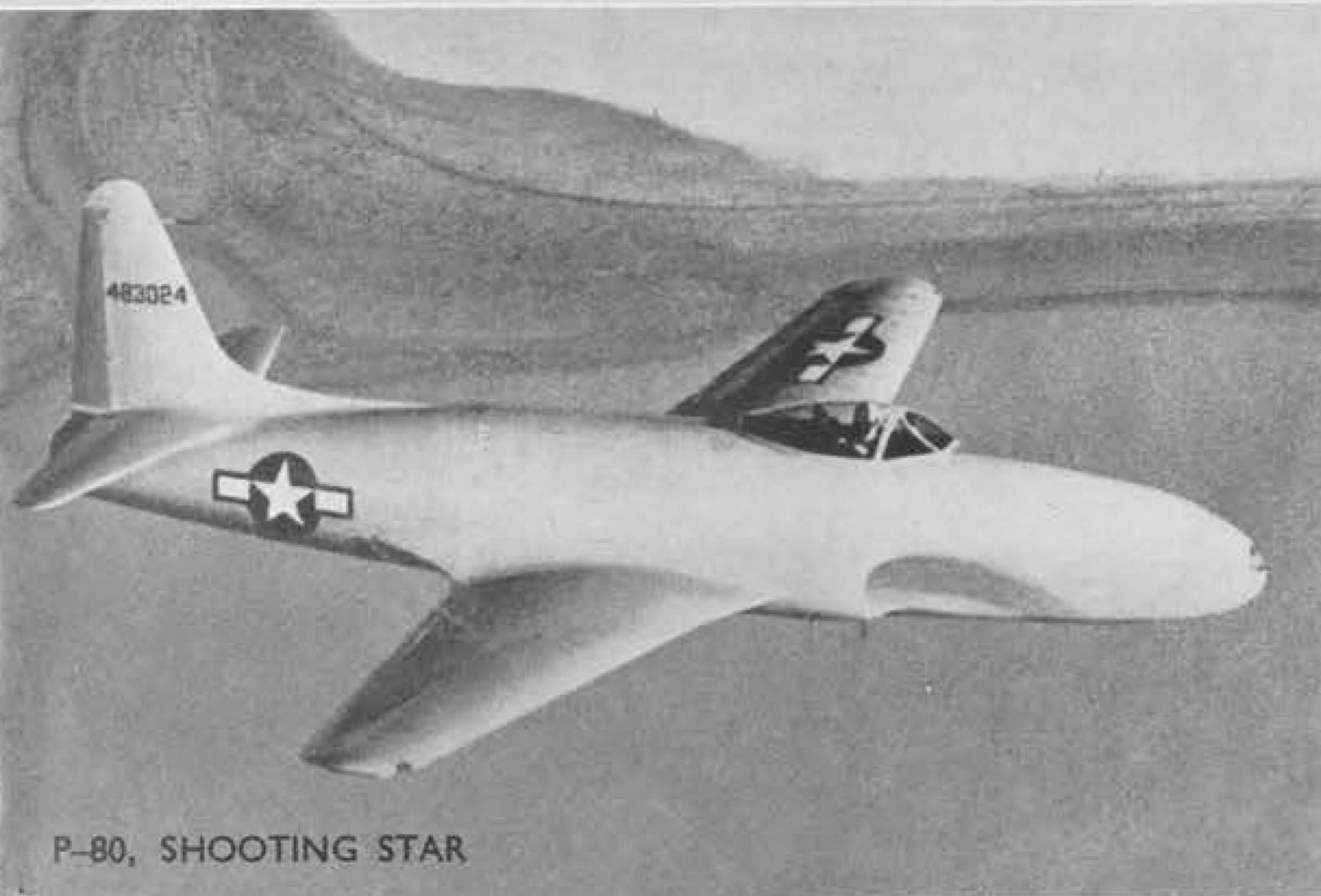
P-47N, THUNDERBOLT



MONITOR



P-47N, THUNDERBOLT



P-80, SHOOTING STAR



SB2C, HELLDIVER

# the News

The Vickers VIKING (*top left*), one of Britain's first post-war civil airliners, shows in this view its relationship with its famous military ancestor, the Wellington.

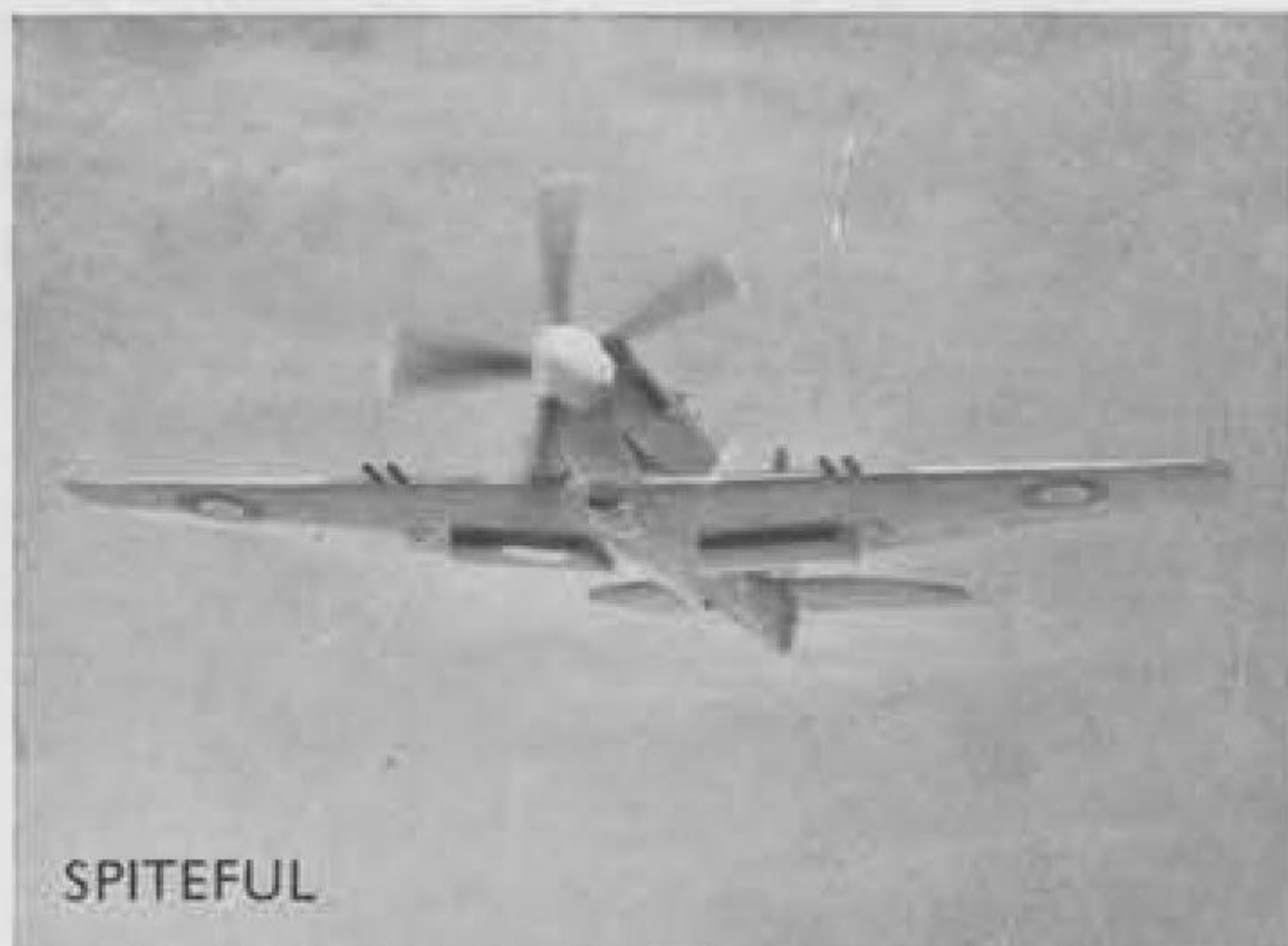
The Miles MONITOR (*middle left*) is designed to tow targets for the Royal Navy at a speed suitable for training the modern anti-aircraft gunner.

Lockheed P-80, SHOOTING STAR (*lower left*), too late to be used on operations in the War, gives every promise of becoming a first-class combat type, in spite of scepticism because of irresponsible claims which have had the opposite effect from that intended.

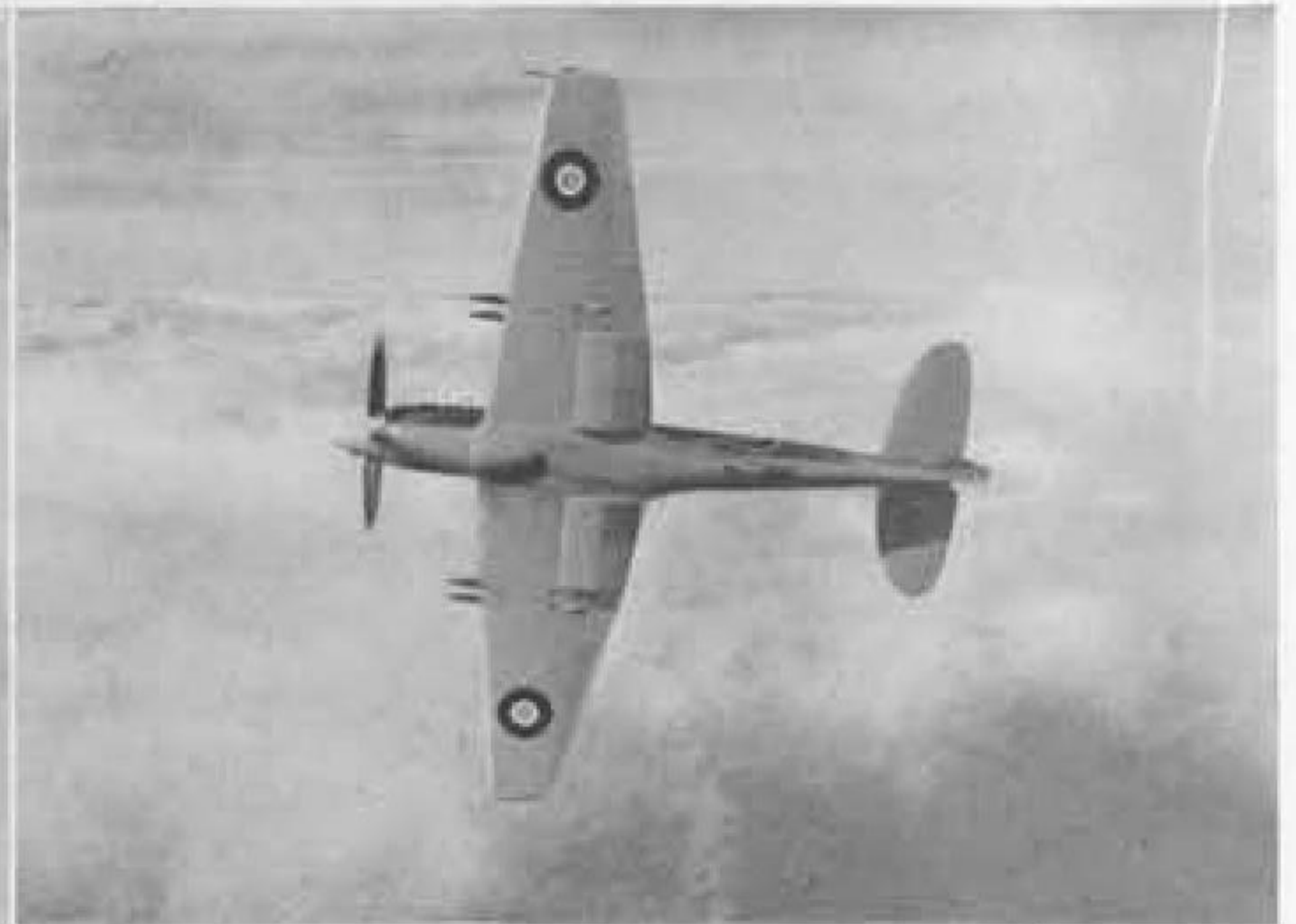
The two views of the Republic P-47N, THUNDERBOLT (*top right*) long-range fighter, show well the comparatively new dorsal fin and the increase in the wing span of this version. The P-47N was intended specifically for escort work with the Superfortress bombers in the Pacific theatre and with the P-51H was giving excellent service against Japan before the end of the War.

Curtiss SB2C, HELLDIVERS, have been one of the mainstays of the United States Navy in the War against Japan since they first went into service in November 1943. Operating from U.S. carriers they played an important part in the rapid American advance North towards Japan.

**PHOTOGRAPHIC ANGLES**



SPITEFUL



FR-1, FIREBALL



TBY, SEAWOLF



F8F, BEARCAT



**SPITEFUL**—Although the Supermarine Spitfire (Rolls-Royce Griffon) is a direct descendent of the Spitfire, it has several distinctive features such as the large tail unit, angular wing and a fuselage even more streamlined than that of the Spitfire. Top speed over 460 m.p.h. (389 knots). Span, 35 ft. 6 in. Length, 32 ft. 4 in.

**FR-1, FIREBALL**—The Ryan FR-1, Fireball, is the first aeroplane to combine a reciprocating engine (Wright Cyclone) for normal operations, with a jet unit to boost speed for combat. The intakes for the jet, set in the centre section of the wing, project forward of the leading-edge. Span, 40 ft. 0 in. Length, 32 ft. 4 in.

**TBY, SEAWOLF**—Originally designed by Vought and now built by Consolidated-Vultee, the TBY Seawolf torpedo-bomber is practically the same as it was in its original XBTU form. The Seawolf, intended to supplement the Grumman Avenger, is unlikely to be of great importance. Span, 56 ft. 11 in. Length, 32 ft. 4 in.

**F8F, BEARCAT**—The Grumman F8F, Bearcat (Pratt & Whitney Double Wasp) carrier-based fighter is a smaller, faster and more manoeuvrable version of its elder brother the Hellcat, which it will probably replace eventually. It has the fashionable dorsal fin of most new models. Span, 35 ft. 6 in. Length, 28 ft. 6 in.



**SILLOGRAPHS**

# Meet the Family

# - Grumman



TBF, AVENGER



J2F, DUCK



J4F, WIDGEON



F4F, WILDCAT



JRF, GOOSE



F8F, BEARCAT

**E**IGHT members of the Grumman family are serving with the U.S. Navy in the Pacific. They are the Wildcat, Hellcat, Tigercat, Bearcat, Avenger, Widgeon, Goose and Duck.

The first five are combat types and the Wildcat, Hellcat and Avenger are also in service with the Royal Navy. The Widgeon, and Goose have been adapted for various duties and, although they are not first-class aircraft perhaps, they are all serving in operational areas.

The J2F, Duck, is an amphibian and is used as a scout, for air-sea rescue duties and for target-towing. The current production version is the J2F-6. The JRF, Goose, is a military version of the civil transport of 1937 and is used as a Naval utility transport. The J4F, Widgeon, is in service with the U.S. Coast Guards as a light transport.

The angular lines that are typical of most Grumman types first appeared in the F4F, Wildcat, which was the main ship-based fighter of the U.S. Navy from 1941 until September, 1943. The Wildcat is still built by the Eastern Aircraft Division of the General Motors Corporation with the designation FM.

The F6F, Hellcat, first went into action in September, 1943. It is a bigger, faster version of the Wildcat and incorporates modifications built in the light of combat experience. More recently, reversing the procedure of "bigger and better," a smaller, faster version—the F8F, Bearcat—has joined the U.S. Navy. This latest addition to the family seems destined to become the best-yet of U.S. carrier-borne fighters. With a remarkably short take-off run, high rate of climb, outstanding speed and ability to manoeuvre, it can carry an astonishing load for its size. In fact, in spite of its smaller size, the Bearcat can do everything the Hellcat did before it—and a great deal more.

The TBF, Avenger, has been the standard carrier-based torpedo-bomber of the U.S. Navy since the Battle of Midway in 1942. It is also built by the General Motors Corporation with the designation TBM.

The F7F, Tigercat, is the first twin-engine fighter to go into service with the U.S. Navy. It is a day and night fighter and, although not typically Grumman in appearance, has the characteristic square-cut wings.



F7F, TIGERCAT

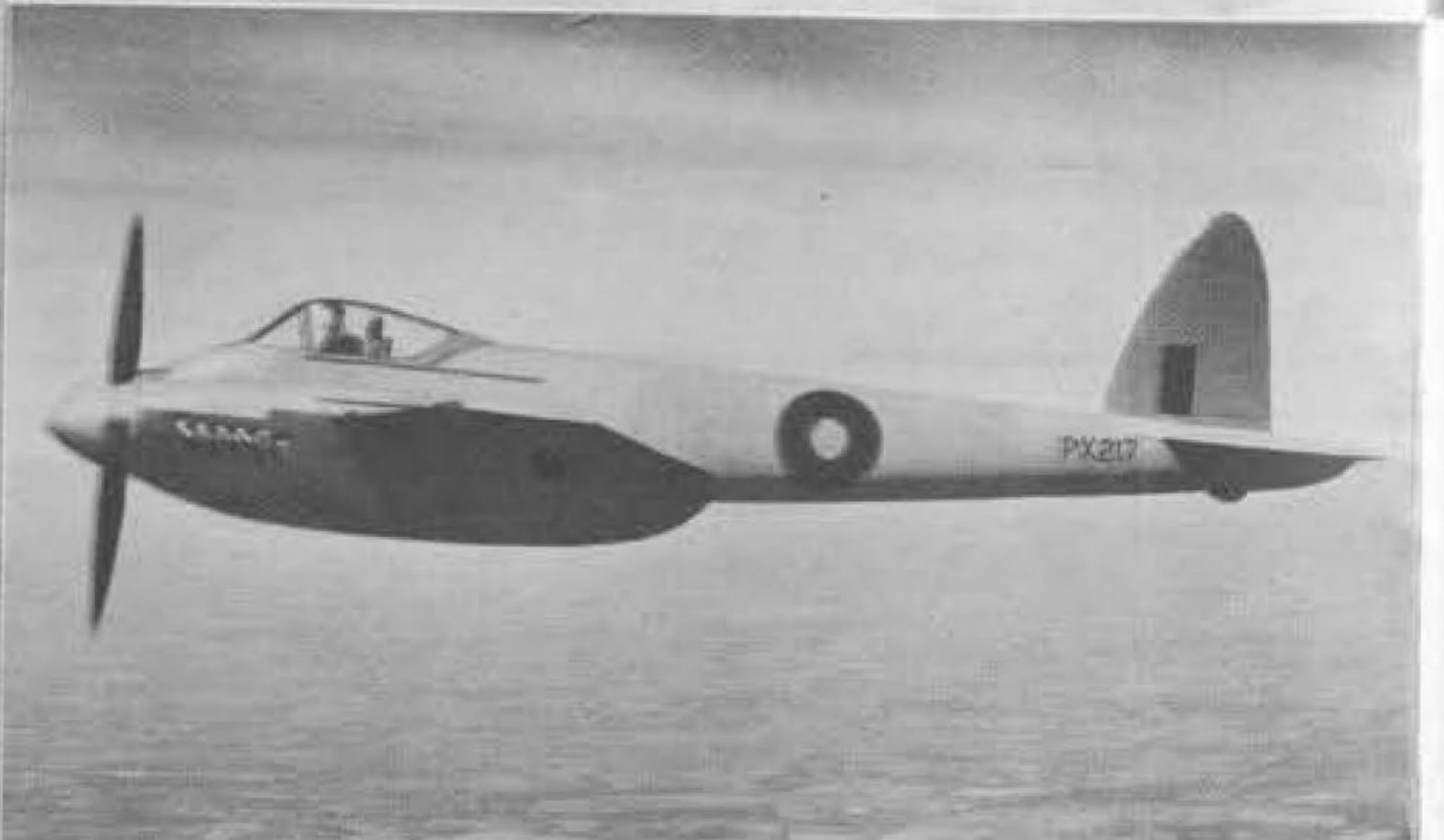


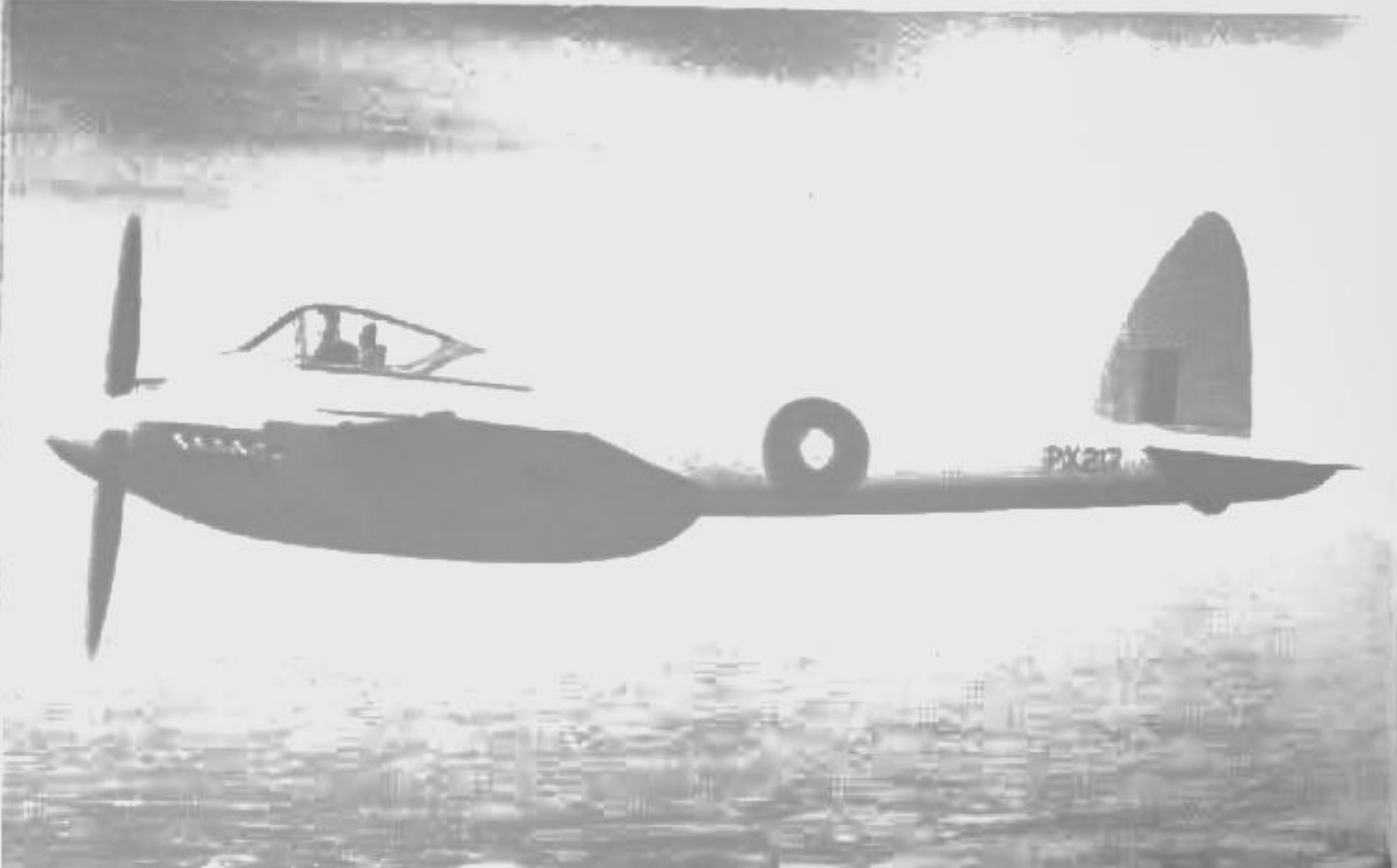
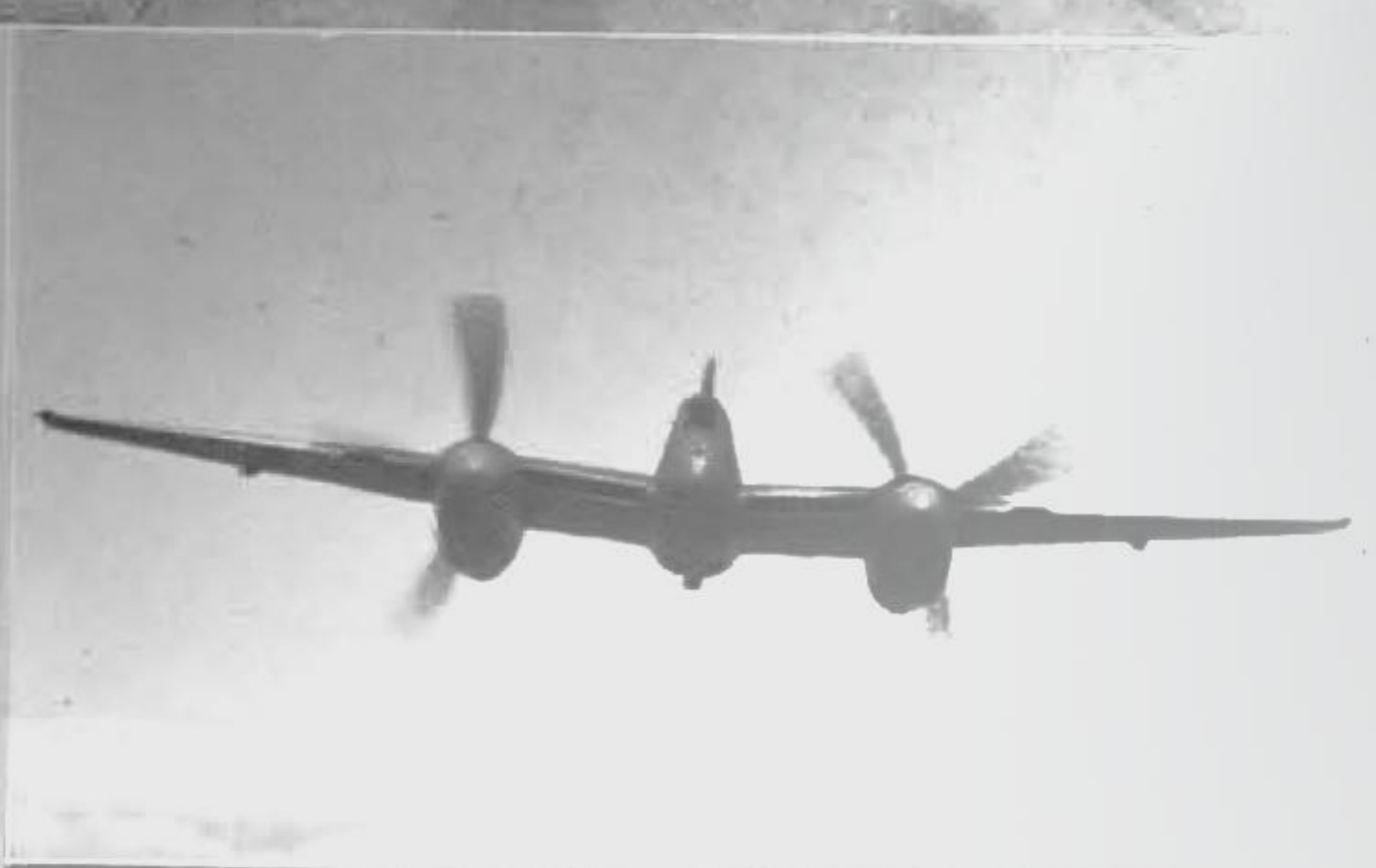
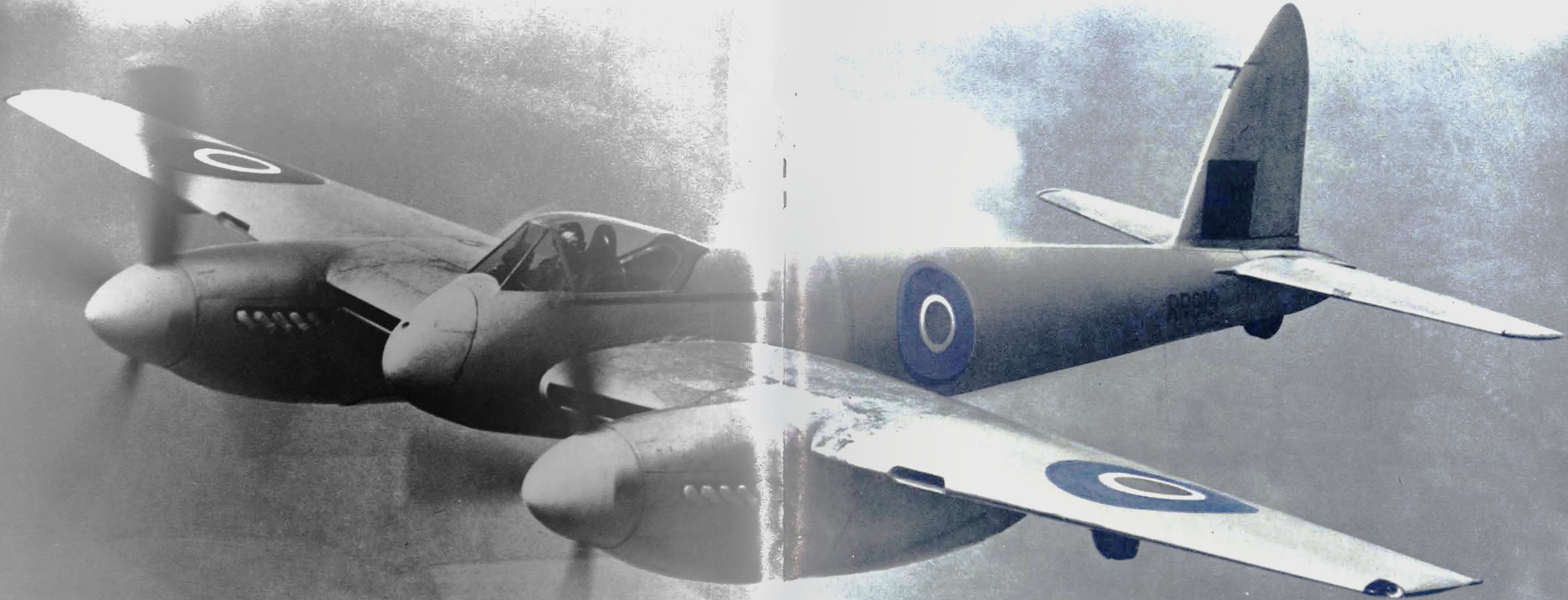
F6F, HELLCAT



**CHINESE PUZZLE**

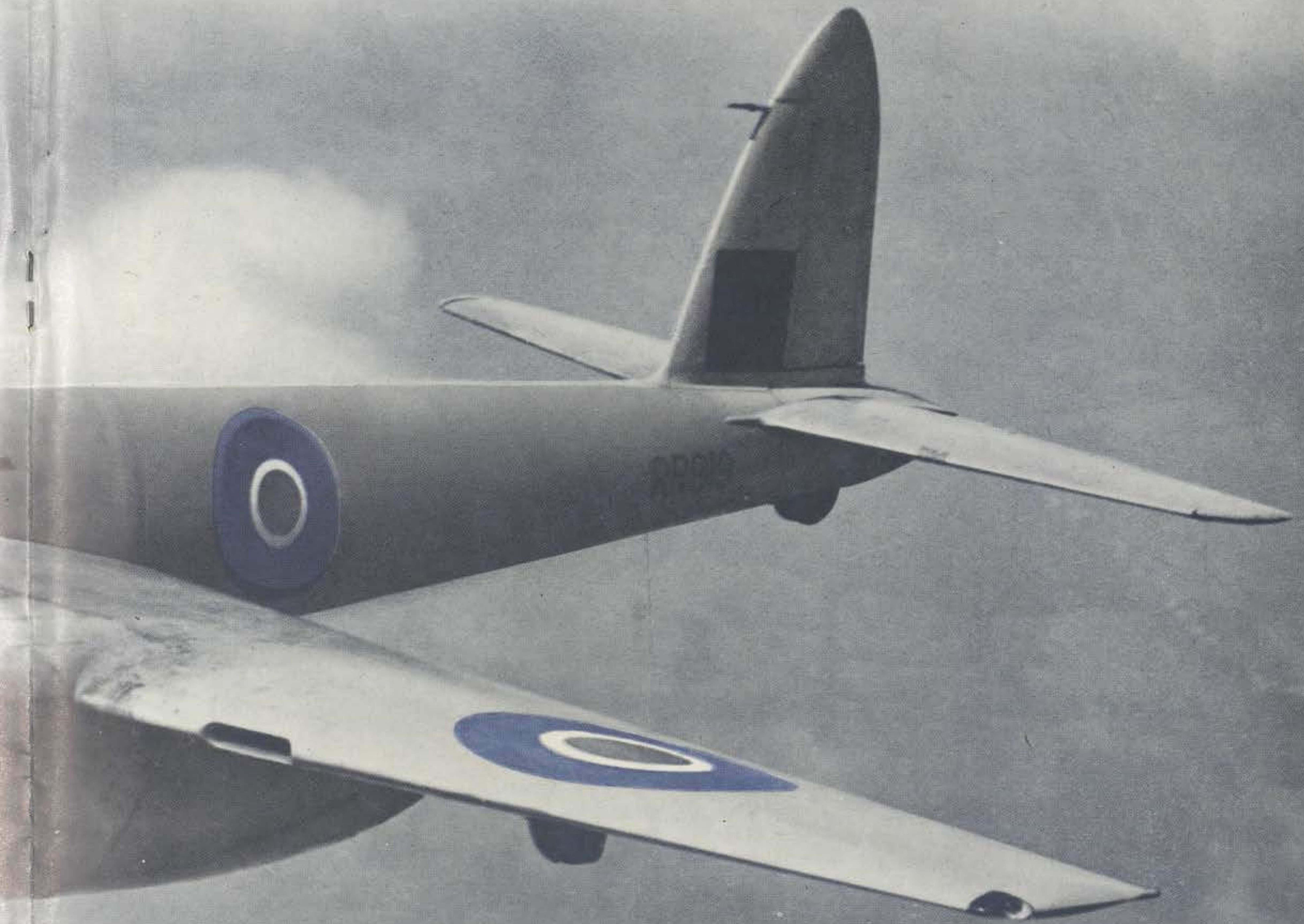
Silhouettes of 21 aeroplanes are hidden in this drawing. Can you find and name them?





DE HAVILLAND

*Hornet*



DE HAVILLAND

*Hornet*



# T A I L

**M**ORE individuality and art and less science and convention is shown in the design of the tail surfaces of an aeroplane than in any other portion of its external form.

Tails have become at once a designer's signature and evidence of character in different aeroplanes. Compare, for instance, the de Havilland line—Tiger Moth, Dominie, Dove, Mosquito, Hornet. The fins and rudders—and equally the tailplanes—of all these aeroplanes are characteristically “D.H.”, and yet each is stamped with its own recognisable personal features. Similarly, Lockheed, Mitsubishi and Bristol—to name but a few—exhibit similar peculiarities.

The fact that each designer can select his own hall-mark and reveal it in his tail designs shows how much latitude there can be in the aerodynamics of these surfaces. To realise how this can be, one must consider their function.

Tail surfaces—like the feathers of an arrow—are first and foremost designed to give directional stability to the whole machine. The total area of these surfaces, both vertical and horizontal, must be sufficient to counteract the effective area of the forebody of the aeroplane in front of the wing. Thus aeroplanes such as the Sunderland or the York, which have large body areas forward, have to have large tail surfaces. Otherwise, when the nose yawed the machine would become unstable and the yaw increase instead of being damped down.

As well as stability, the tail surfaces give directional and pitching control. There again, the lever arm provided by the length of the fuselage aft of the wings decides the areas required. A short aeroplane—such as the Thunderbolt—needs larger control surfaces at the tail than a long aeroplane—such as the Spitfire.

Indeed, an aeroplane which requires much fin and tail-plane area for stability may require only small areas for control—and *vice versa*.

Thus far science can lay down fairly exact rules for tail design. How those necessary areas shall be laid out is less precisely defined. High or low aspect ratio, straight edges or curves, the relationship of tailplane to fin and so on, can be settled more nearly to the whim of the designer.

Even so, personal flair or whim and calculated areas are not the whole story. Air flow does curious things by the time it has traversed a plump fuselage and eddied over stubby wing roots filleted on to fuselages—high, mid or low. And so a wind-tunnel may reveal that some portions of a fin or rudder, tailplane or elevator, is “blanketed” by one of the other surfaces so as to be useless.

This is particularly true of spinning trials in a vertical wind-tunnel. As the fuselage flails round in a spin the tailplane may hide the rudder from the air stream completely—thus preventing recovery. Or the fin in a certain position may stall, just like a wing at high angles of attack. Alterations must then be made.

Most of this may be revealed during model tests in the wind-tunnel. But unfortunately there are other complications. A tail form which is entirely satisfactory at 200 m.p.h. may be almost useless at 400 m.p.h. The opposite may also be true.

As speeds approach that of sound—approximately 770 m.p.h. at sea level, falling to 660 m.p.h. at 36,000 ft., above which it is constant—the airflow begins to do even more peculiar things. Even at an aircraft speed of 500 m.p.h. the airflow over a rounded section may be speeded up to about

the speed of sound at which the air becomes compressible. The result is that a tail area which is quite sufficient at the lower speeds may be too small for stability or control at maximum diving speeds.

Thus, although designers can estimate and calculate the performance of any aeroplane in the design stage, and although the size and angle of the tail are settled in the design stage, there is never any certainty as to how the tail will behave until after the first test flights.

All this has been reflected in newer types of aeroplane recently—and in newer versions of older types. Such aeroplanes as the North American Mustang, Republic Thunderbolt and Grumman Tigercat have all had their tail areas increased in their newer and faster versions—P-51H, P-47N, F7F-2. Even the Beaufighter is now resplendent with extra dorsal fin area.

In one other major particular vertical tail surfaces vary—single fins and rudders or multi fins and rudders. When the biplane tail unit went out of fashion in the early 1930s it was succeeded by the aerodynamically clean single fin and rudder on most types of aeroplane—although in those days the single fins were usually wire-braced to the tailplane.

Then, in the mid-1930s the Lockheed 10 Electra set a new fashion in twin fins and rudders fashioned as fully cantilever structures. The idea was to put the vertical control surfaces in the slipstream behind the twin engines, thus affording good directional control when taxiing and for take-off. At the same time the large areas required could be divided into two

# DESIGN

conveniently small sets of surfaces. Another advantage of the multi fin and rudder arrangement was that the fins were less high and so a lower hangar door was possible.

All these factors influenced design. But when speeds began to mount above the 300 m.p.h. mark, the extra aerodynamic cleanness of the single fin and rudder has brought about a revival of the large single surface. In particular, the tricycle undercarriage has made steering on the ground more positive and exact than was ever possible with the conventional undercarriage and surfaces in the slipstream.

The number of aeroplanes during the War which had modifications to the tail unit is interesting—and in almost every case there was an increase of fin area. The list includes the Avenger, Beaufighter, Boston, Catalina, Fortress, Halifax, Helldiver, Marauder, Spitfire and Wildcat.

The accompanying illustrations show some examples of the many varieties of tails—the fat twin fins and rudders of the B-24, Liberator, the tall and slender fins of the Lincoln, the single tail of the Mosquito, the much-increased fin area of the Beaufighter X, and the outstandingly large single fin of the B-32, Dominator.

An interesting point is that a number of recent new designs have much larger tail surfaces than would have been considered normal a few years ago. For example, the Privateer, the B-29, B-32, the Spiteful and the P-51H.

Tail design, therefore, is influenced by many different—and sometimes opposing—considerations; everything from air compressibility at high speeds down to the height of hangar doors. The result is that all tail surfaces are a compromise of varying requirements—and into that compromise most designers manage to weave a note of personality. All of which is a boon to students of Aircraft Recognition.



B-24J, LIBERATOR



MOSQUITO XVI



BEAUFIGHTER X



LINCOLN I



B-32, DOMINATOR

# It's the Exception...

THE time that is wasted over Recognition training when it could all be so simple! But it is a hard job breaking down the resistance of the die-hard type who has been "all through the mill."

Only the other day I was trying to convince one of them that the whole subject became perfectly simple with this great discovery of National Characteristics. He made a rude remark that if I called that a discovery I might go ahead and discover America and gunpowder, and a few other things that had also been discovered before away back in the past.

I explained that this was different; that you couldn't expect aeroplanes made by two Teutonic races to be very different so it wouldn't work with British and German types. But when dealing with Japs everything was different.

Anyone could see at once that the Japanese thought differently from the people of the West. I mean, they start reading books at the end and that sort of thing. So naturally they make their aircraft different. You could show me a dozen designs of new types I hadn't seen before and I would tell right away which were Japanese.

He said: "Well, how would you set about drawing a typical Jap aeroplane?" I said: "For example: a twin-engine aeroplane with slim lines, short nose, single fin and rudder and no dihedral to the tailplane would have solidly Japanese characteristics."

He drew this and asked me if that was what I meant.



Of course, I told him that was the exception that proved the rule. That in any case most British aircraft, particularly single-engine types, had in-line engines and that was a gift as the Japs all had radials.

I could see he was trying to be nasty when he drew

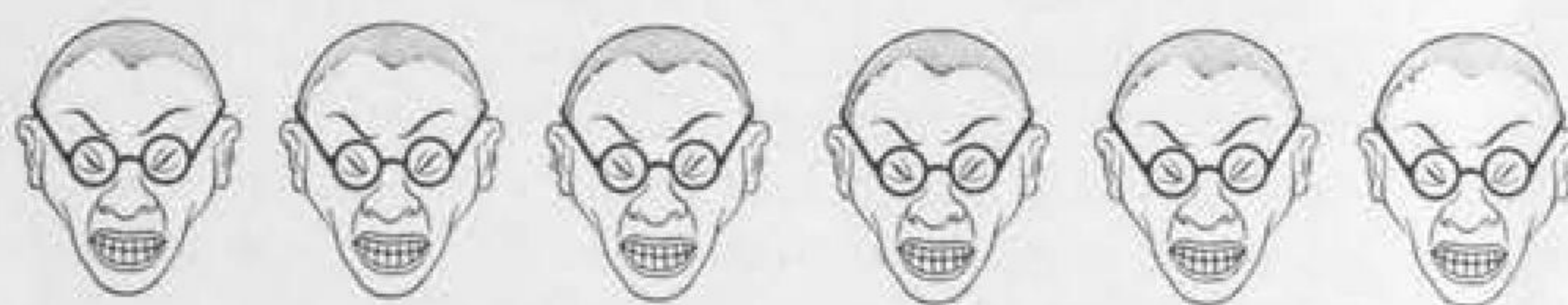


this and I said that, apart from obsolescent "Judys," that was the only Jap aeroplane with a pointed nose although it still conformed with that typical Jap feature of dihedral from roots.

The d.-h. was still scribbling away and I saw he had drawn this.



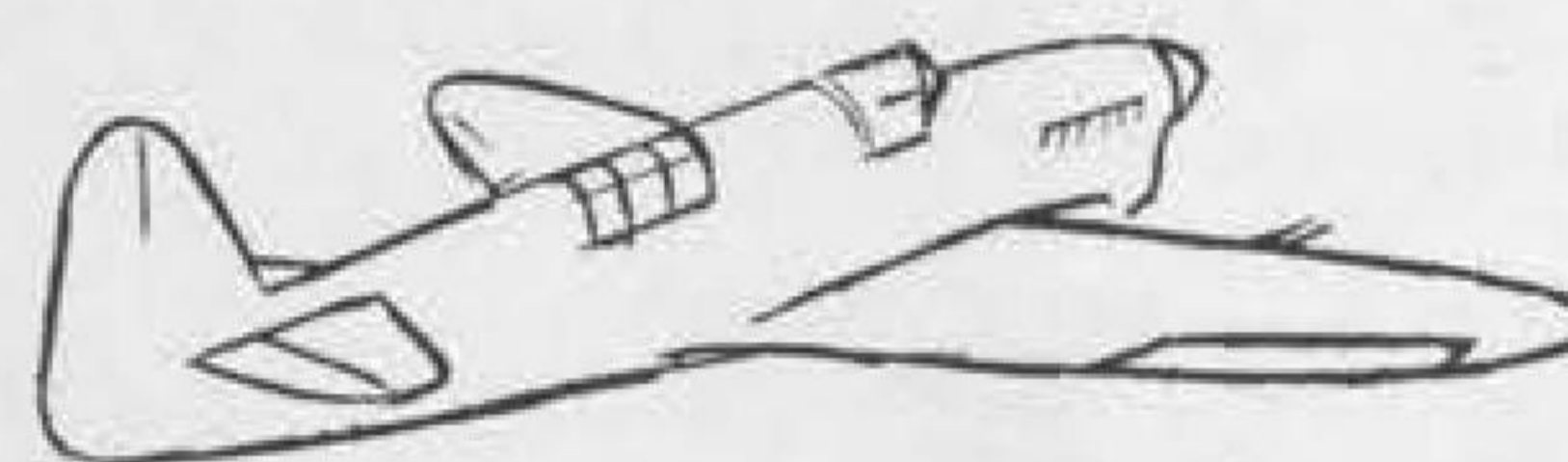
I couldn't help being annoyed at his persistence and stupidity. "You ought to know that that's the only radial engine fighter with dihedral from the roots that the Allies are using," I said. Anyway there was the



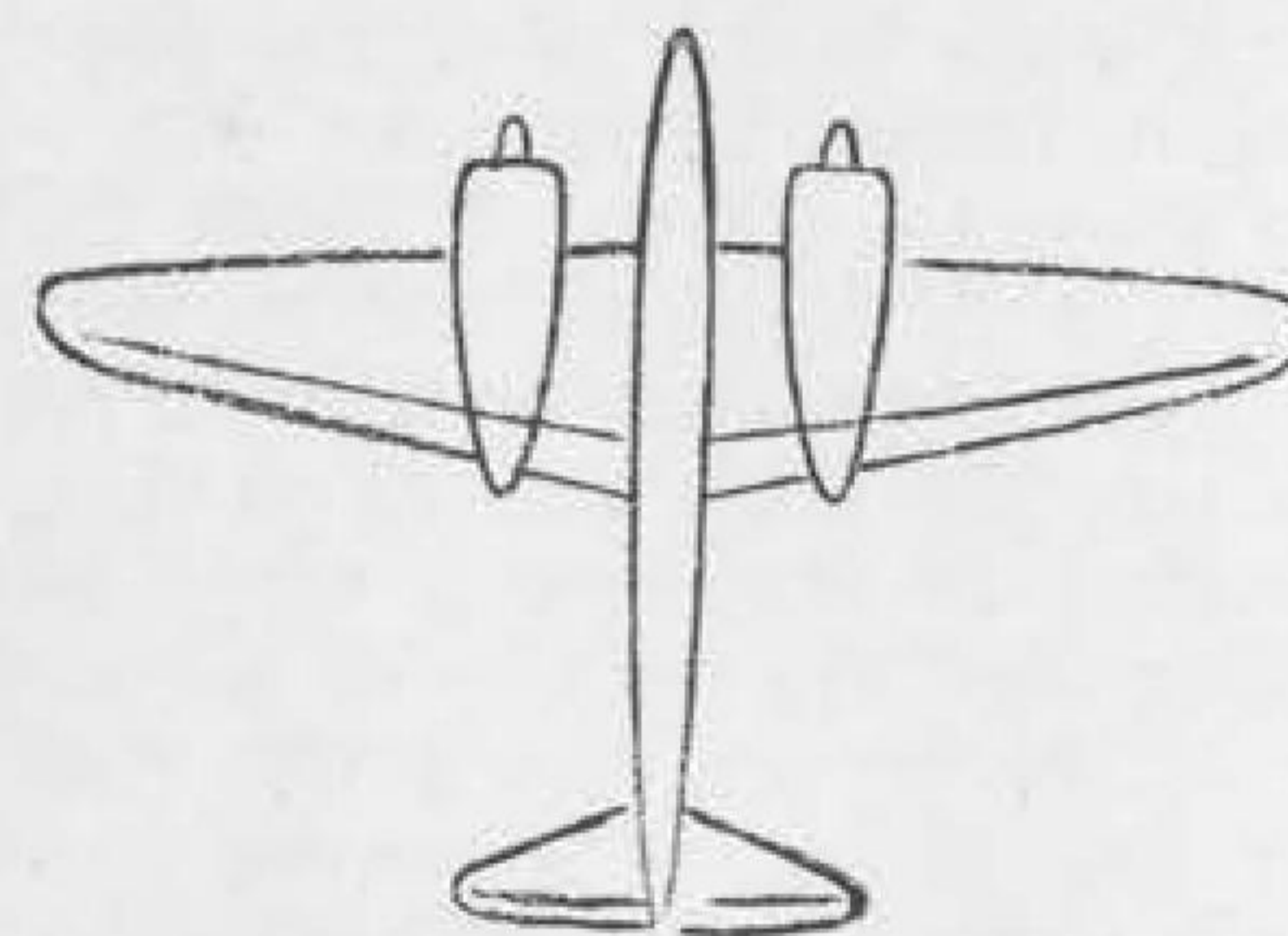
certain guide to nationality in Allied single-engine types by their having a mid wing.



I might have guessed he would go for one of only two Jap aircraft that happened to be exceptional in this wing position. I ignored it and told him that even combinations of taper were strongly national in Japanese types. "Zeke's" tail unit could be characterised as typically Japanese with a triangular fin and rudder and tailplane set forward.



I began to wish I hadn't gone on to this tack when he drew the Firefly and I astutely got off the one about engine nacelles breaking the trailing-edge of the wing identifying a friend.



I didn't recognise the sketch he drew this time but he told me it was a recently identified Ki 102—code-name "Randy"—obviously just another oddment.

I was launching into even tapers and elevator cut-outs when he gave me quite a shock, I must admit, by saying: "Well I'm afraid I'll have to agree that you're right." Frankly, I hadn't thought I had made much headway at all, so I asked him what it was that had convinced him.

He said: "Well you said it's the exception that proves the rule. I always thought that an assinine remark but it seems to be generally believed and so I suppose I must accept it. That being so, your case has been proved over and over again." I didn't feel quite happy about that answer.

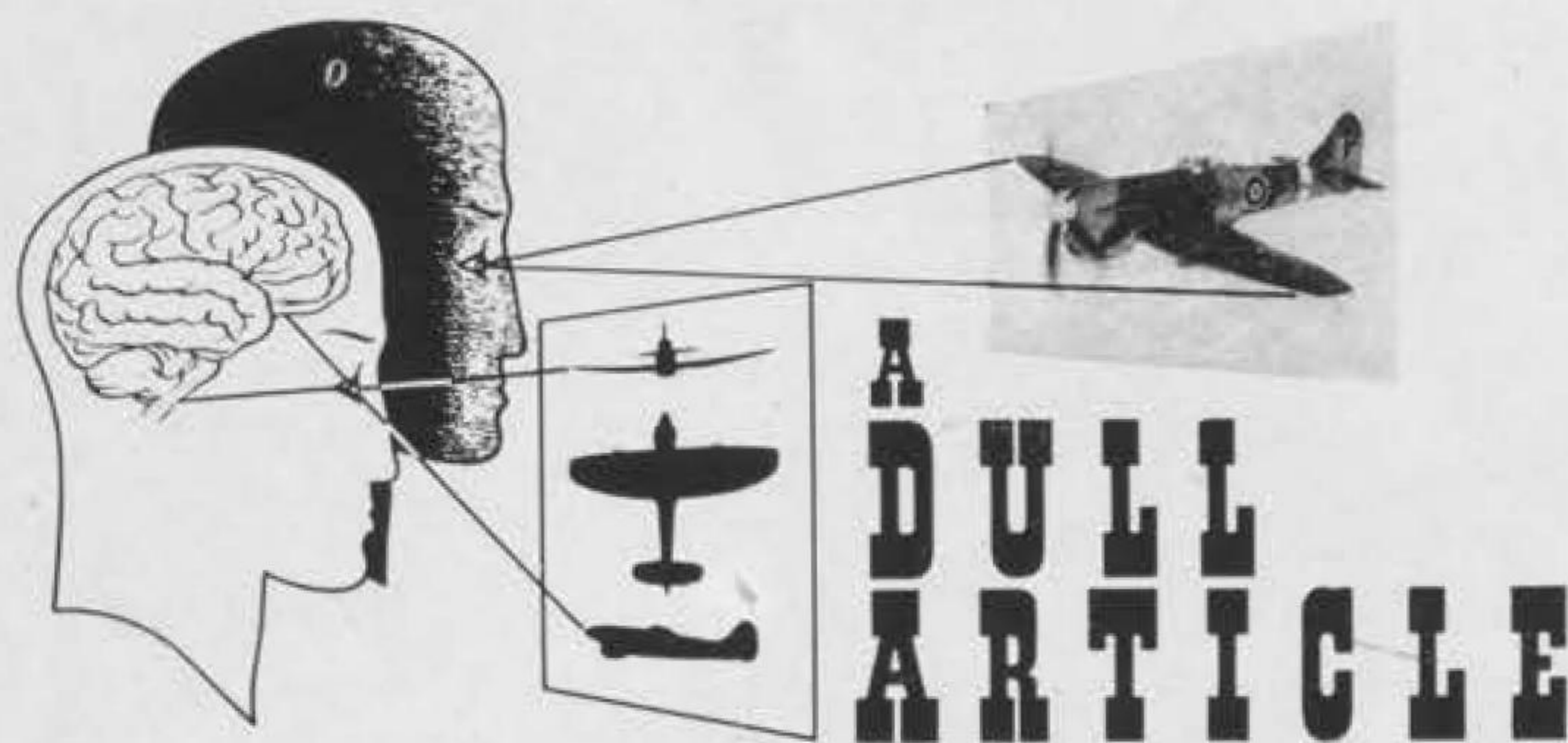
He then said, quite irrelevantly: "Do you remember that old riddle 'Why is Bernard Shaw like Shirley Temple?'" I said, "I didn't," and he said the answer was "Because they both had beards—except Shirley Temple."

Of course, you can't argue with lunatics.



**FLYING PHOTOGRAPHS**

Recognition Test No. 132



By C. H. GIBBS-SMITH

**T**HIS is a dull article—very dull. It deals with principles and generalities, and aims at outlining certain basic facts for use in teaching Recognition. Of the many and excellent varieties of actual instructional method nothing will be said, except to pray for the abolition of all pin-up-short-cut-carrot-dangling-sugar-coating schools of thought.

The difference between learning to distinguish vehicles of war and learning to recognise anything else, is chiefly one of speed—speed of learning their appearance and (quite another problem) speed of recognising the object once it is seen. Add to this another difficulty. We recognise most easily those things in which we have interest.

The interest which most students of war-time Recognition have in the subject is dictated by the desire for bodily survival, with perhaps a few stimulated by the wish to attack. Only a very few like aeroplanes. For them it will be easier. Therefore interest must be created or increased, and experience seems to show that success is closely bound up with the personality of the instructor. He must be left to his own devices with little guidance but his own flair.

One step further on and we can start thinking of essential principles which, if absorbed by the instructor and imparted to the student, can bring about the desired end—speed. But here the short-cut maniac would lure away the unwary by trying to abolish the solid basic ideas in favour of shortening (note the word) the process, not speeding it. You can gain time only by concentrating on essentials. It is the whole difference between building a broad-based pyramid which rises quicker and quicker as it nears the summit, and rushing to rear up a column of single bricks, one on top of another, until it totters and crashes.

**Analysis.** Whatever the method of teaching, there is little doubt that a process of breaking down an object into its basic shapes is essential. An aircraft is outstanding as a compound shape, the component shapes being variations on the constant themes of wing, engine, fuselage, and so on. These parts are so important that they should be isolated and studied at the earliest stage to enable the mind to build up the final “idea” of Lancaster or Spitfire.

One must work from the detail to the whole, otherwise the fundamental structure will get confused later on with other structures. Memory of individual shapes can be greatly strengthened—and recollection accelerated—by constant association with the common shapes of everyday life. “What does it remind you of?” is a very potent force and goes to make a mental cement for the retention of forms.

**Synthesis.** After, and only after, the component shapes have been stamped in the memory can you give attention to the whole aircraft. For it is total outline that must ultimately be sought. In the whole aeroplane, also, the component shapes will be seen, not only in their true linear

form, but in the constantly foreshortened and changing aspects of the three-dimensional machine as it moves through the air.

When learning from flying aircraft, models or photographs, details should be looked at within the changing framework of the total shape. This is not so difficult as it sounds. The trick is to make the mind do two things at the same time, by watching the total outline shape and by simultaneously keeping the tail of the eye on the individual shapes you know, as they go to form the whole co-ordinated aeroplane. An easy way to start acquiring the knack of seeing parts and whole together is to let the eye play over the machine and flash back and forth between individual features and general outline. You will soon find that separate optical efforts are not necessary and that you are contemplating all in one and one in all.

**Total Vision.** Total vision, the apprehension of the whole compound object as one, can be properly acquired only on a foundation of intimate acquaintance with the parts. As Koffka and Kohler showed in their Gestalt psychology, the total vision of an object in actual fact involves more than the sum of its parts. An overriding element emerges which, no matter how often the object changes its position, dominates it throughout. It is character—immediately recognisable in its full individuality, although composed of many subsidiary elements and seen from many angles.

**Speed of Recognition.** It is in speeding up the recognition of an object already known, the shortening of the gap between the time the object comes into view and the time when its identity is established, that total vision (peripheral vision, as it used to be called) comes into its own in another teaching sphere. This is the constant showing of known objects to the eye for shorter and shorter spaces of time.

It cannot be said too often that this drill only applies to aircraft which have been “analysed” and “synthesized”; in fact, properly learnt. This total vision exercise can never supersede the learning, that is to say, the intellectual thought process. It is essentially an automatic sharpening of the mind’s eye—a “post graduate” job.

By this exercise the psycho-optical reflexes are mechanically speeded up and it is comparatively simple to get a person to recognise a previously well-learnt aircraft at one fiftieth of a second, no matter what views turn up, provided a reasonably clear image is presented.

**Touch.** Last among the general principles is the important one of reinforcing the optical messages going to the brain by sending another stream of images through the sense of touch. Feeling aircraft models builds up a powerful supplement to visual recognition, as well as providing an excellent testing device.

**Size.** Subsidiary to the points made above is the question of the size of the photographs and silhouettes used in initial teaching. If the eye is allowed to play over large-shape images, the mind will absorb those shapes much more quickly and securely than if they were presented small. Learnt large, the shape character is more indelibly printed and no matter how small the image of an aeroplane seen thereafter, it links with speed and certainty.

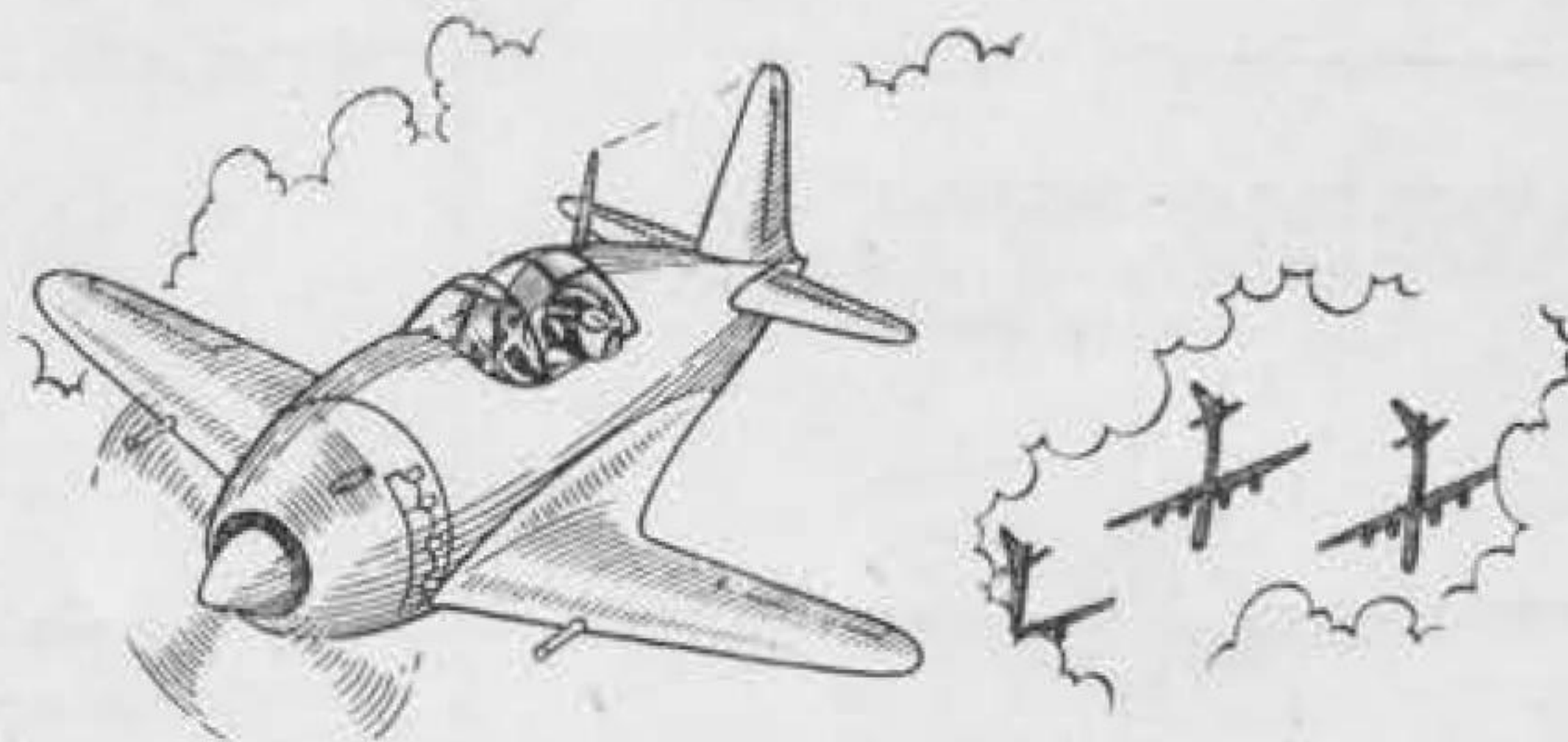
Lastly, a so-called controversial item about which there should really be no argument at all. Is it better to learn a few aircraft thoroughly, or a lot sketchily?

However small the number of certainties, that number can always be augmented. With half-knowledge of many aircraft go doubts about many, and doubts therefore are being stimulated and constantly shaking the whole structure.

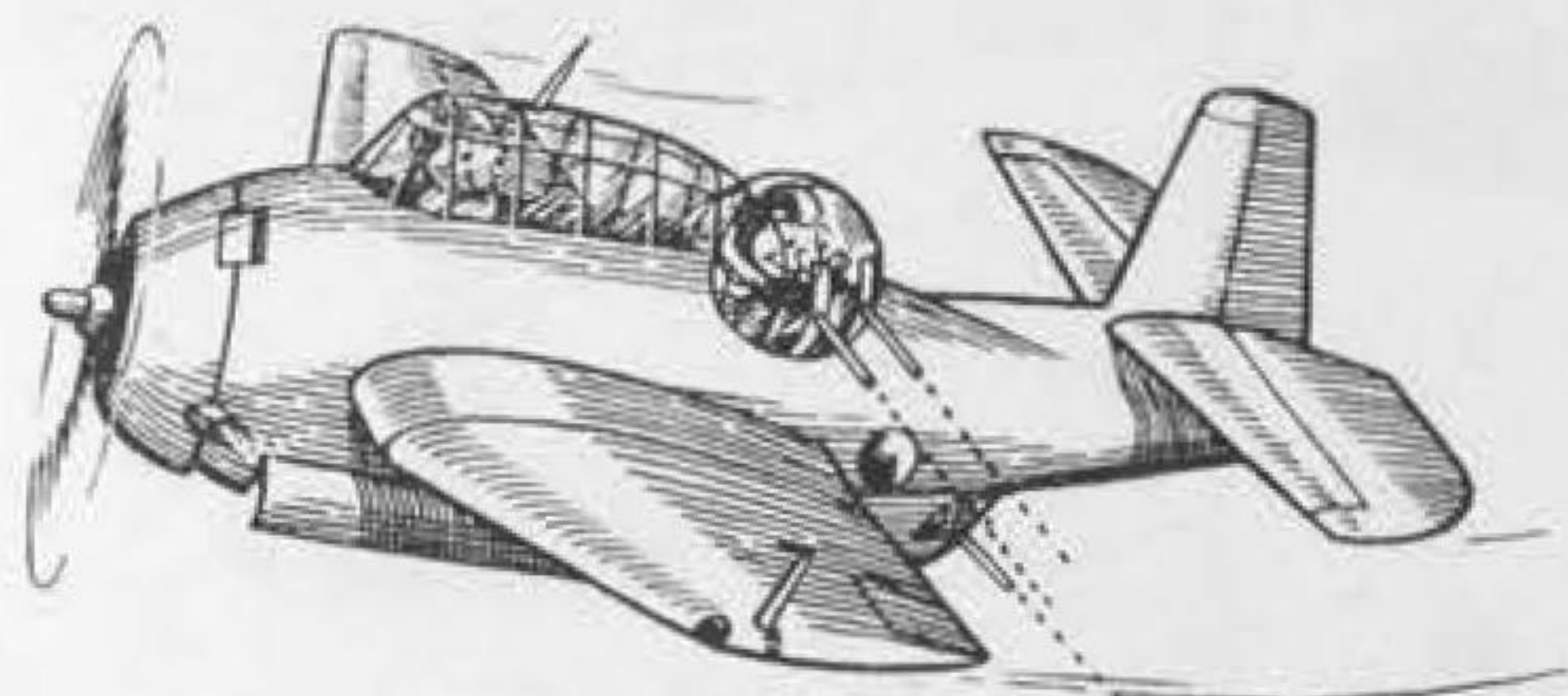
# MULTUM IN PARVO



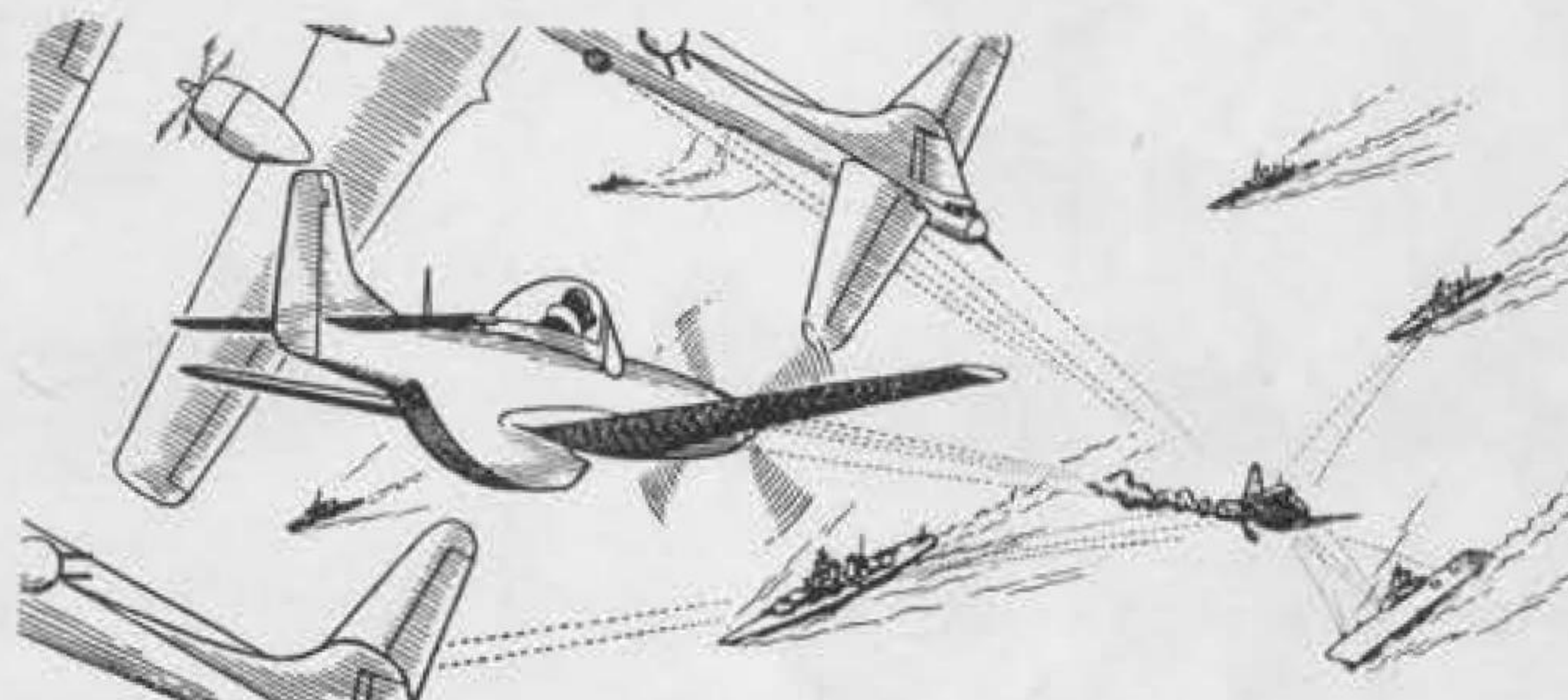
This is a ship the Japs built.



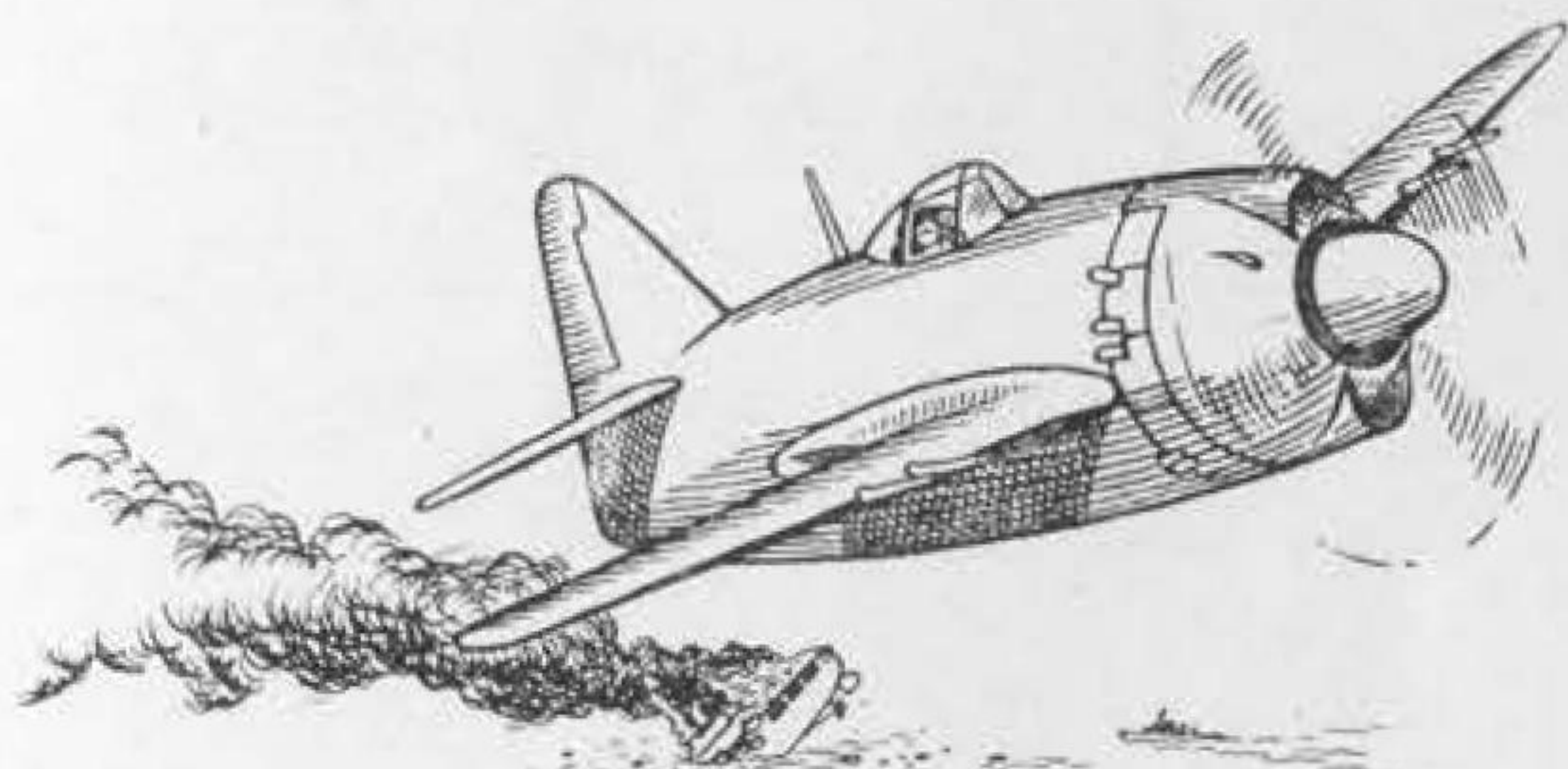
This is the yellow son of the sun  
That cast his slanting evil eye  
On the super bombers high in the sky  
That watched the fighter  
That tackled the blighter  
That took the air  
Intending to scare the impudent Yank  
That strafed the Nip  
And shattered the ship the Japs built.



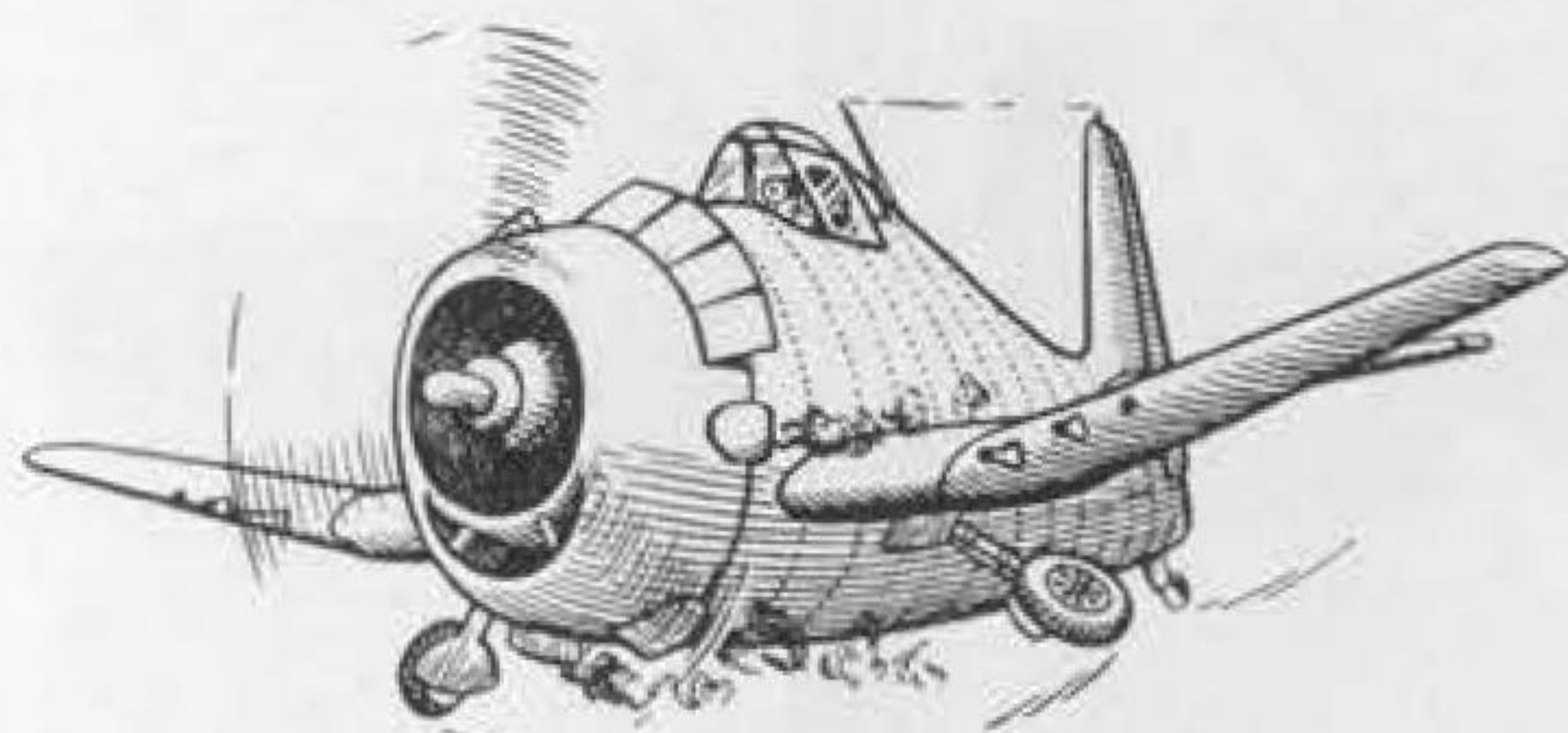
This is a Yank that strafed the Nip  
And shattered the ship the Japs built.



This is the escort that made the kill  
Because of his skill  
In firing his gun  
At the treacherous yellow son of the sun  
That cast his slanting evil eye  
On the super bombers high in the sky  
That watched the fighter  
That tackled the blighter  
That took the air  
Intending to scare the impudent Yank  
That strafed the Nip  
And shattered the ship the Japs built.



This is a blighter that took the air  
Intending to scare the impudent Yank  
That strafed the Nip  
And shattered the ship the Japs built.



This is the fighter that tackled the blighter  
That took the air,  
Intending to scare the impudent Yank  
That strafed the Nip  
And shattered the ship the Japs built.



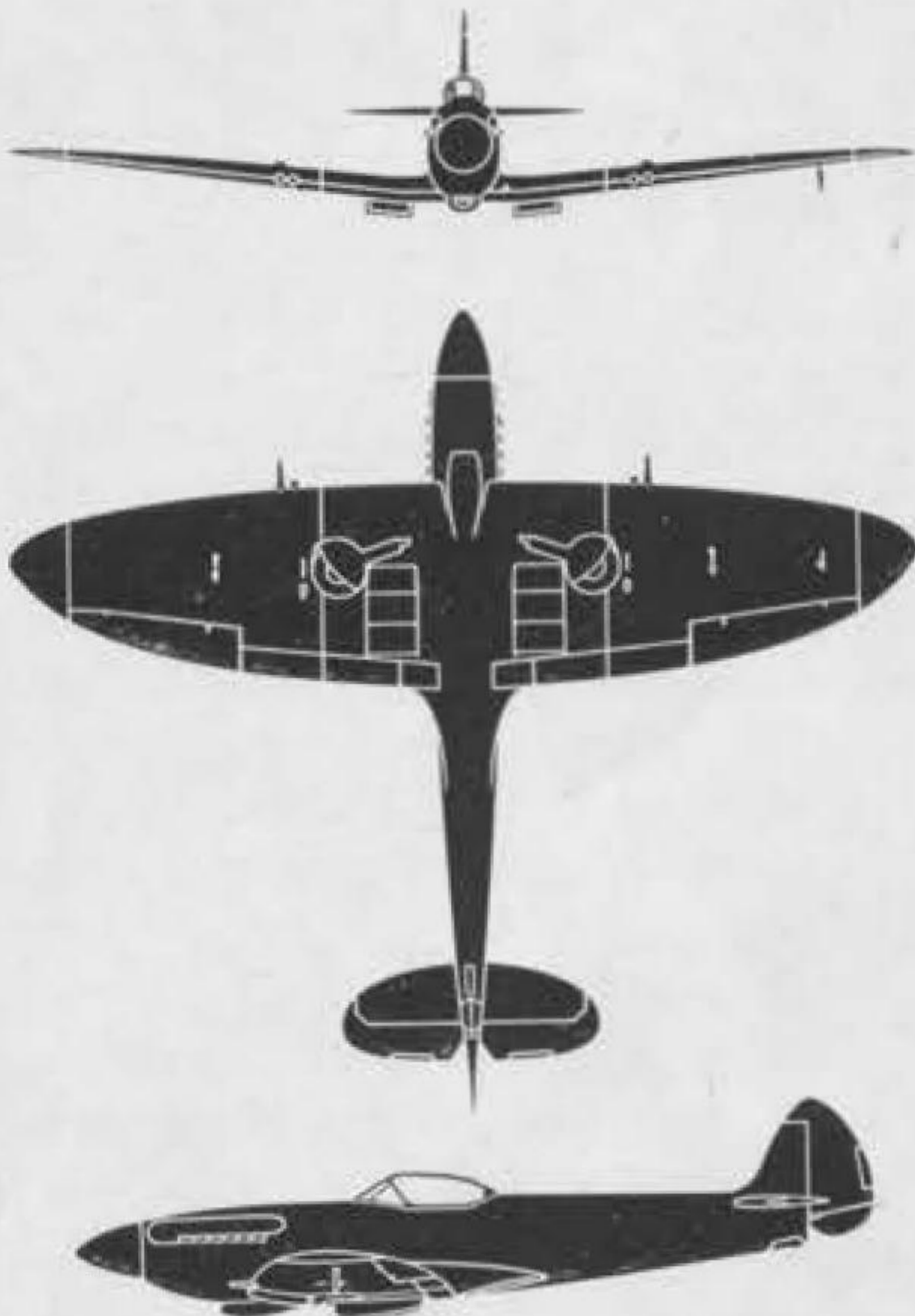
These are the gunners that put in claims  
For shooting a bandit down in flames  
As well as the escort that made the kill  
Because of his skill  
In firing his gun  
At the treacherous yellow son of the sun  
That cast his slanting evil eye  
On the super bombers high in the sky  
That watched the fighter  
That tackled the blighter  
That took the air  
Intending to scare the impudent Yank  
That strafed the Nip  
And shattered the ship the Japs built.



These are the bombers high in the sky  
That watched the fighter  
That tackled the blighter  
That took the air  
Intending to scare the impudent Yank  
That strafed the Nip  
And shattered the ship the Japs built.

# NEW AND REVISED

**VICKERS-ARMSTRONGS  
SUPERMARINE SEAFIRE XVII**  
(Rolls-Royce Griffon)



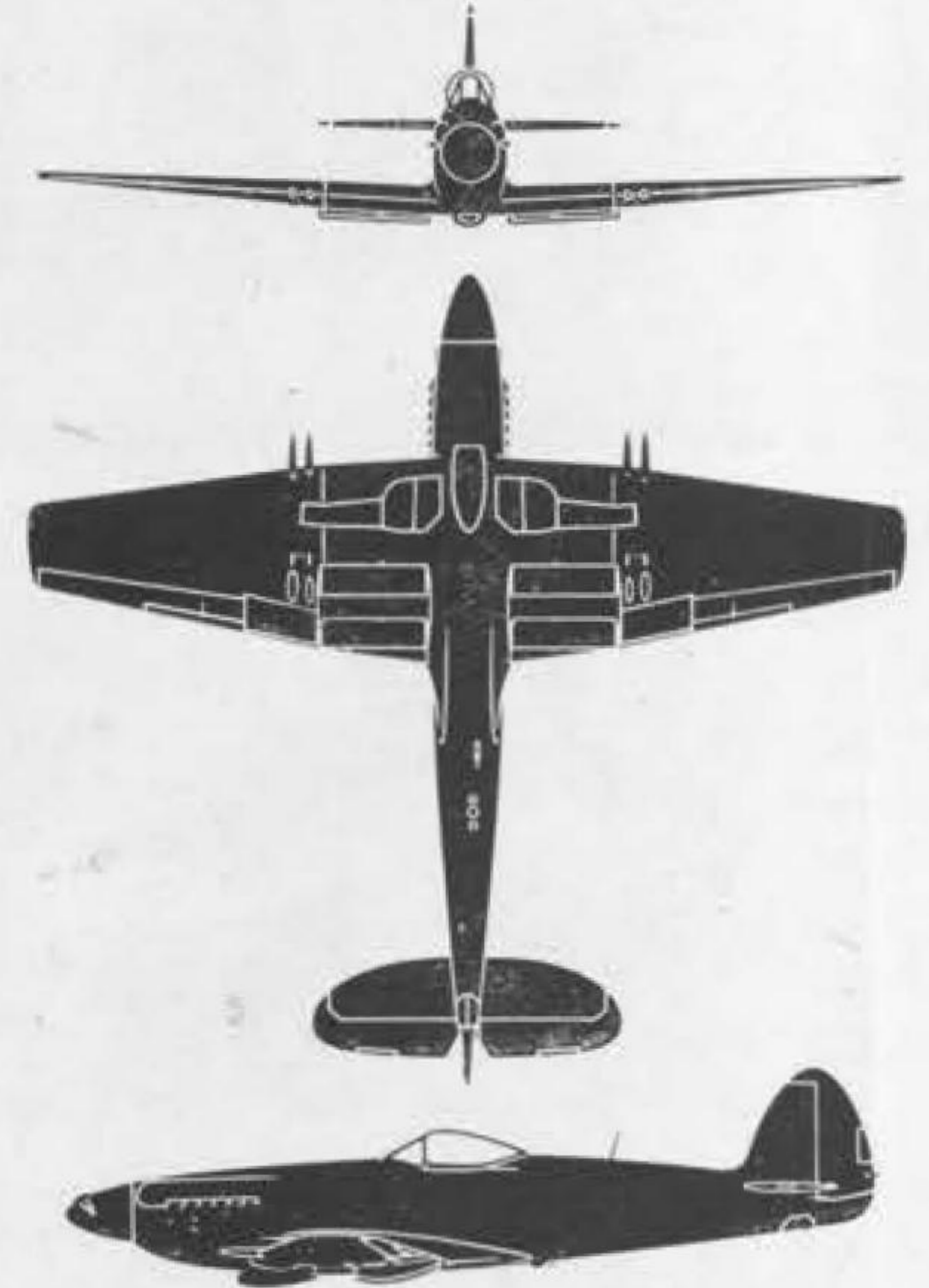
British Navy Fighter  
Span 36 ft. 10 in. Length 32 ft. 1 in.

**LOCKHEED P-80A,  
SHOOTING STAR**  
(General Electric I-40)



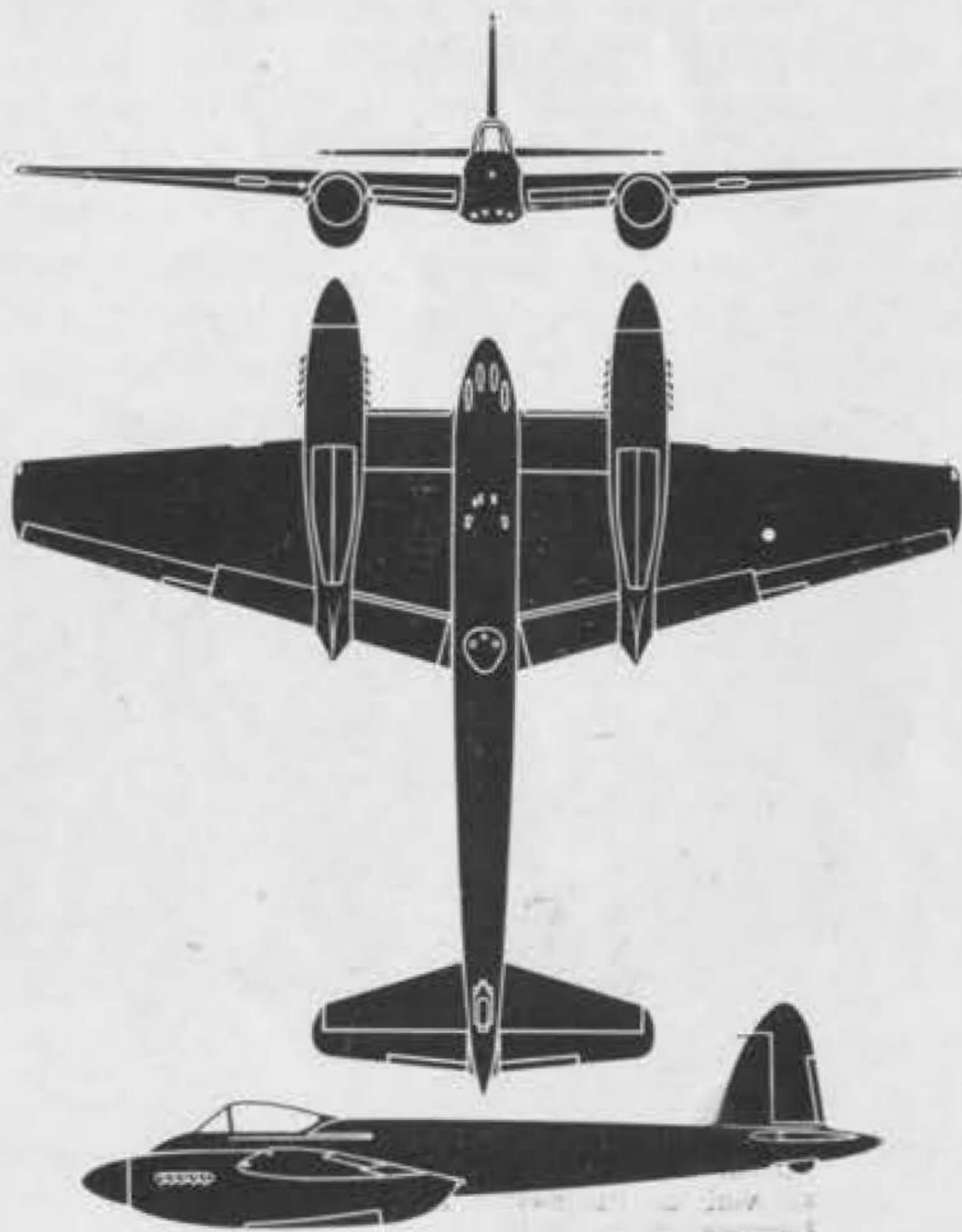
American Fighter  
Span 38 ft. 11 in. Length 34 ft. 6 in.

**VICKERS-ARMSTRONGS  
SUPERMARINE SPITEFUL XIV**  
(Rolls-Royce Griffon)



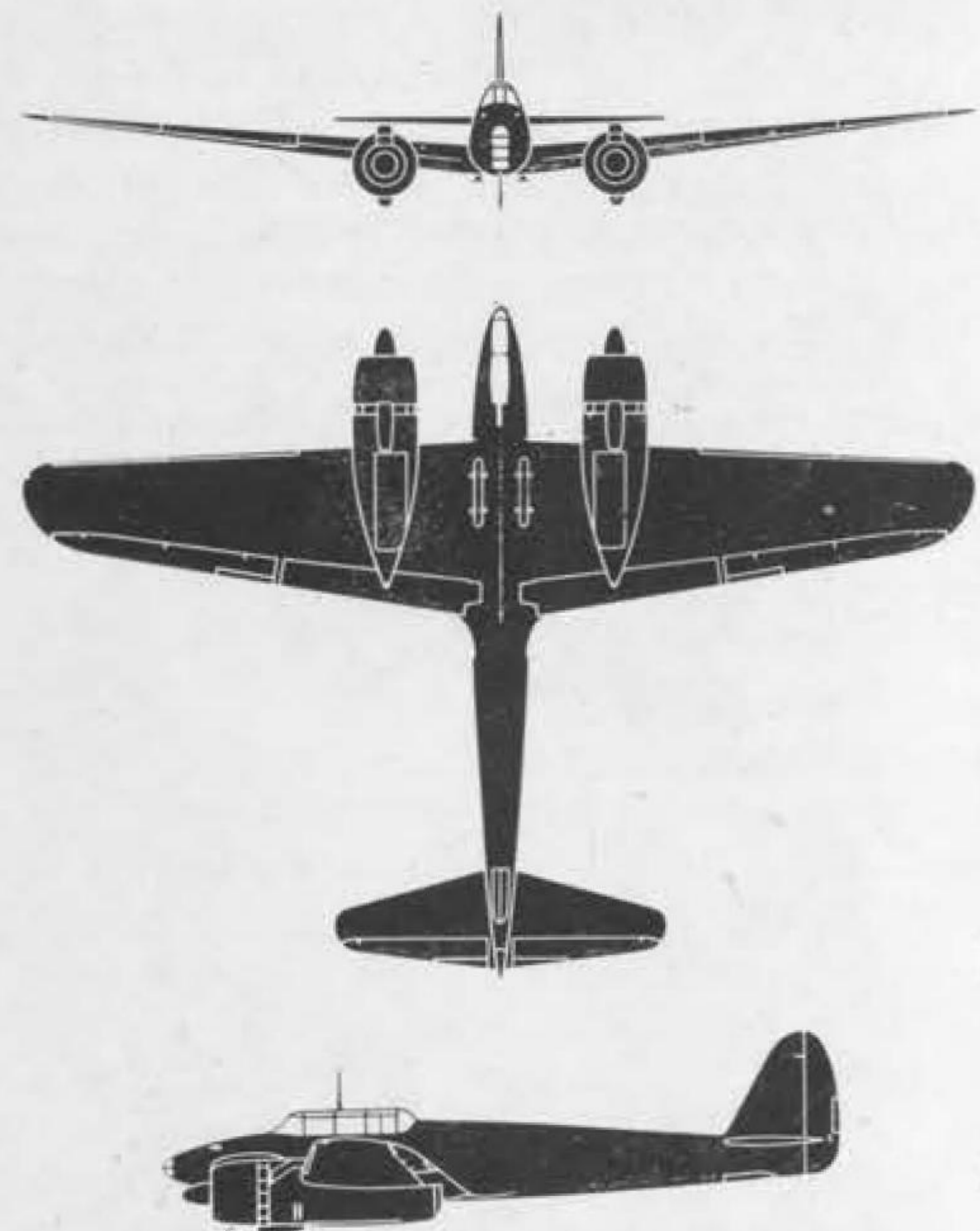
British Fighter  
Span 35 ft. 6 in. Length 32 ft. 4 in.

**DE HAVILLAND HORNET I**  
(Two Rolls-Royce Merlin)



British Fighter  
Span 45 ft. 0 in. Length 38 ft. 6 in.

**NAKAJIMA "IRVING" 21**  
(Gekko—Moon Light)  
(Two Nakajima Sakae 21)

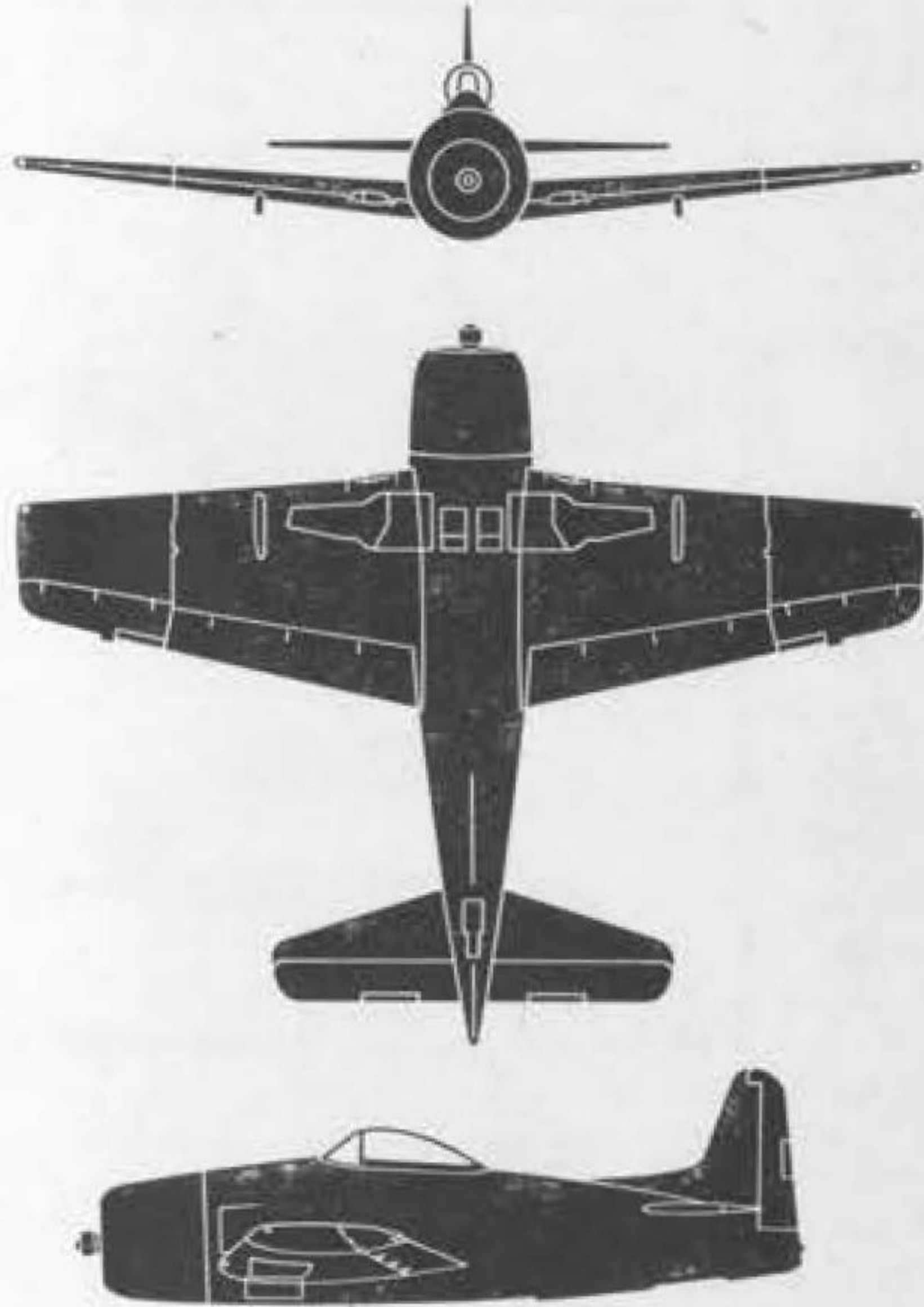


Japanese Navy Night Fighter  
Span 55 ft. 9 in. Length 39 ft. 11 in.

The model number of "Irving" with a single cockpit enclosure is uncertain and is only assumed to be 21.

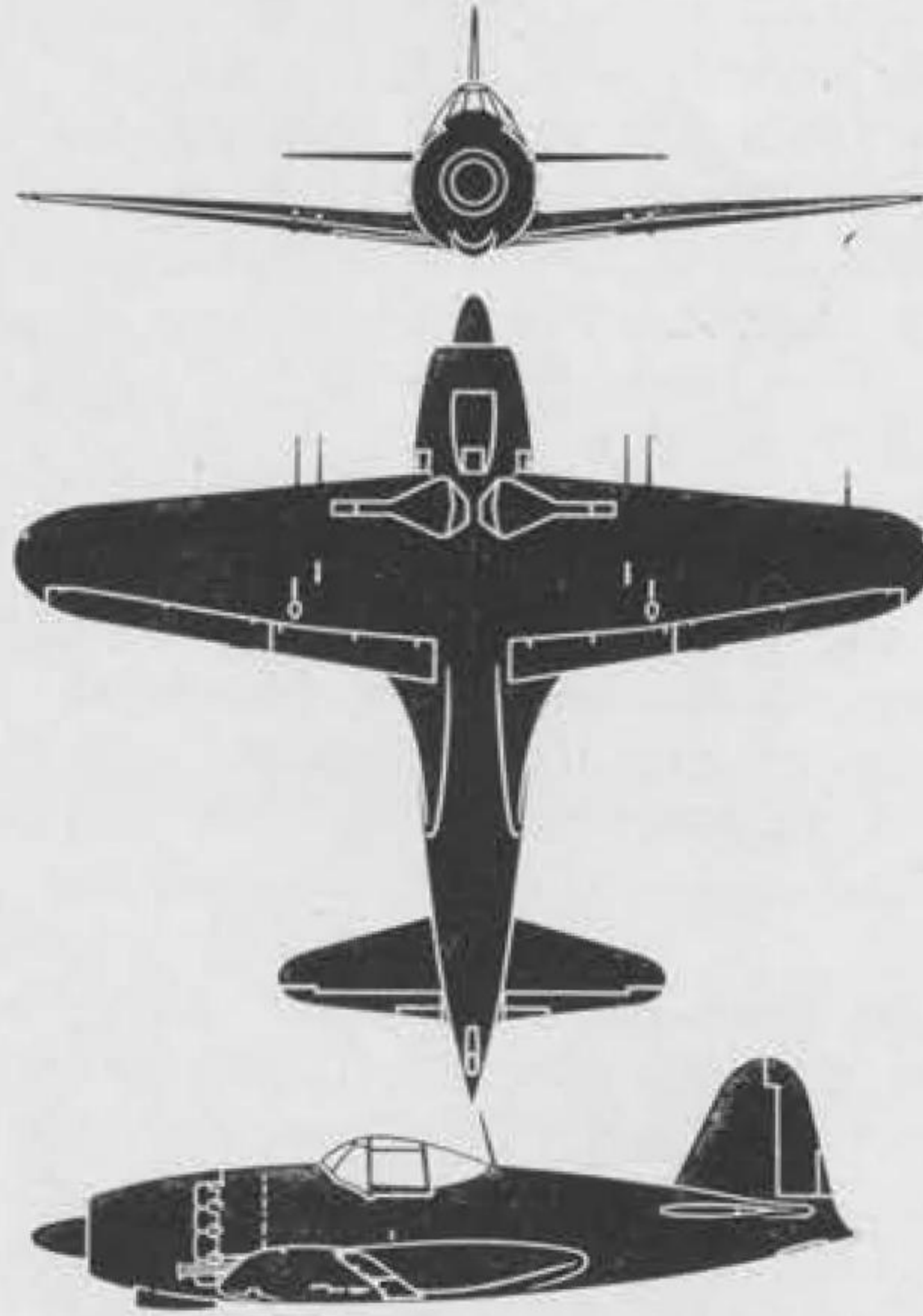
# SILHOUETTES

**GRUMMAN F8F, BEARCAT**  
(Pratt & Whitney Double Wasp)



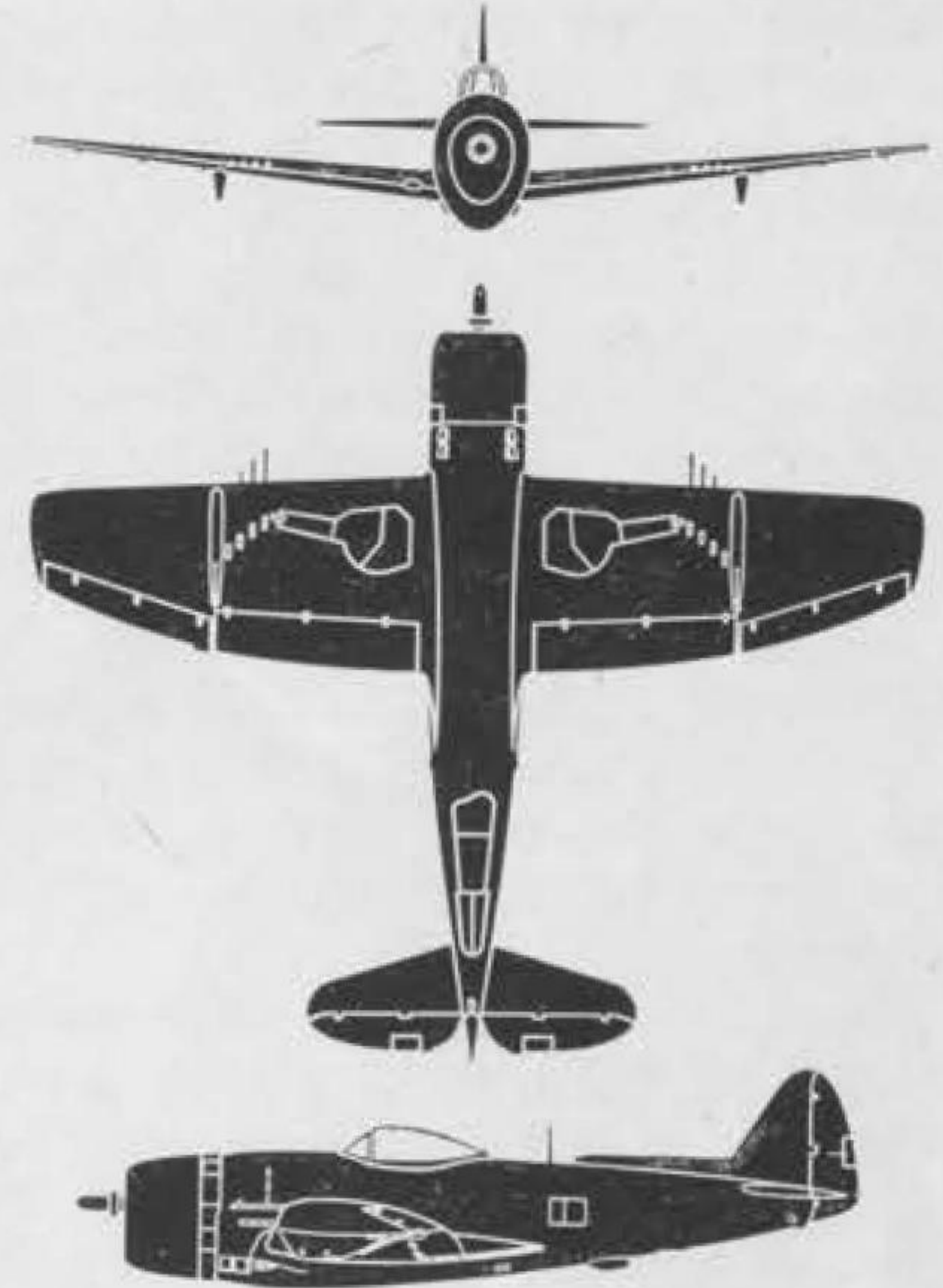
American Navy Fighter  
Span 35 ft. 6 in. Length 28 ft. 6 in.

**MITSUBISHI "JACK" 31**  
(Raiden—Thunderbolt)  
(Mitsubishi Kasei 23)



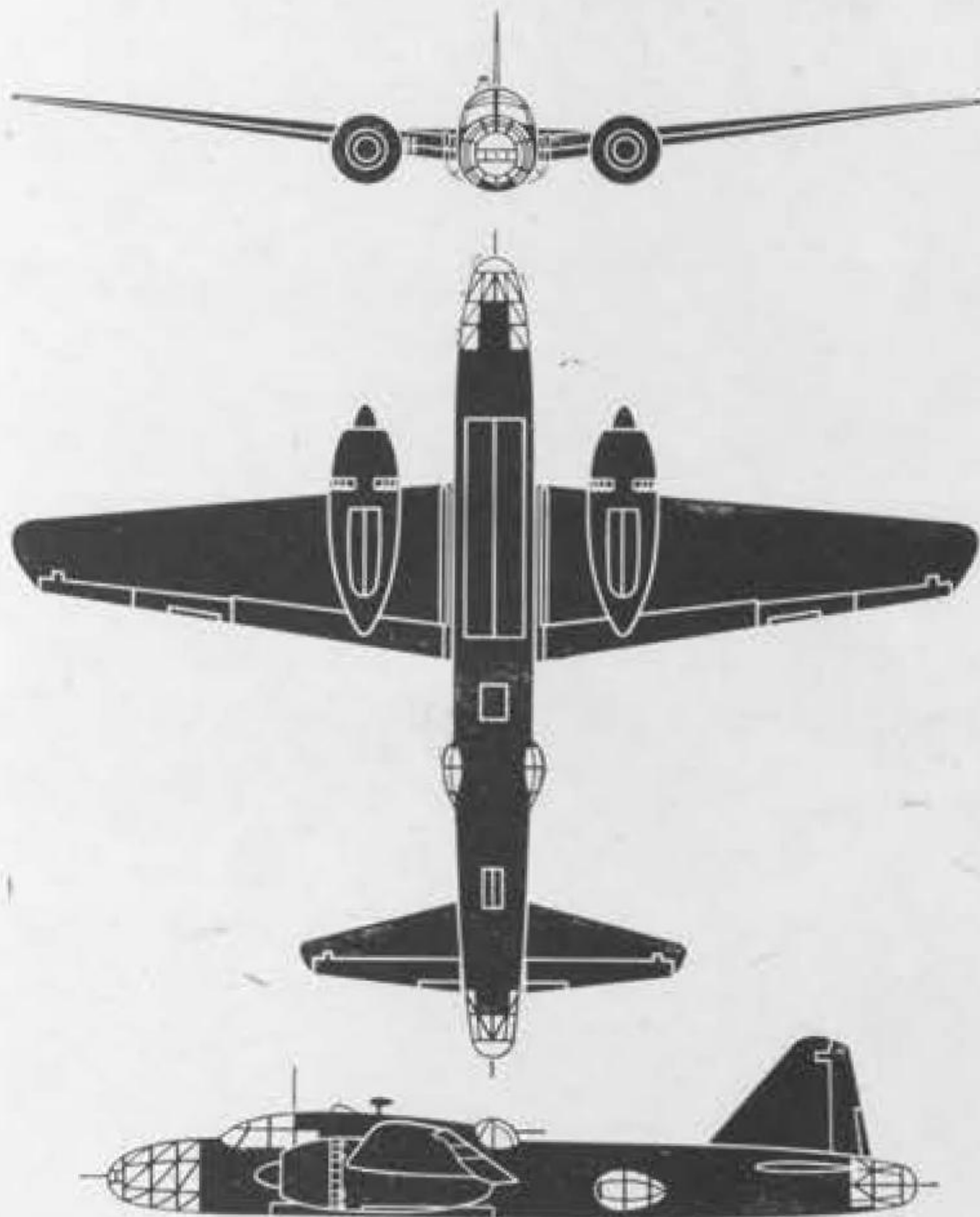
Japanese Navy Fighter  
Span 35 ft. 5 in. Length 31 ft. 10 in.

**REPUBLIC P-47N THUNDERBOLT**  
(Pratt & Whitney Double Wasp)



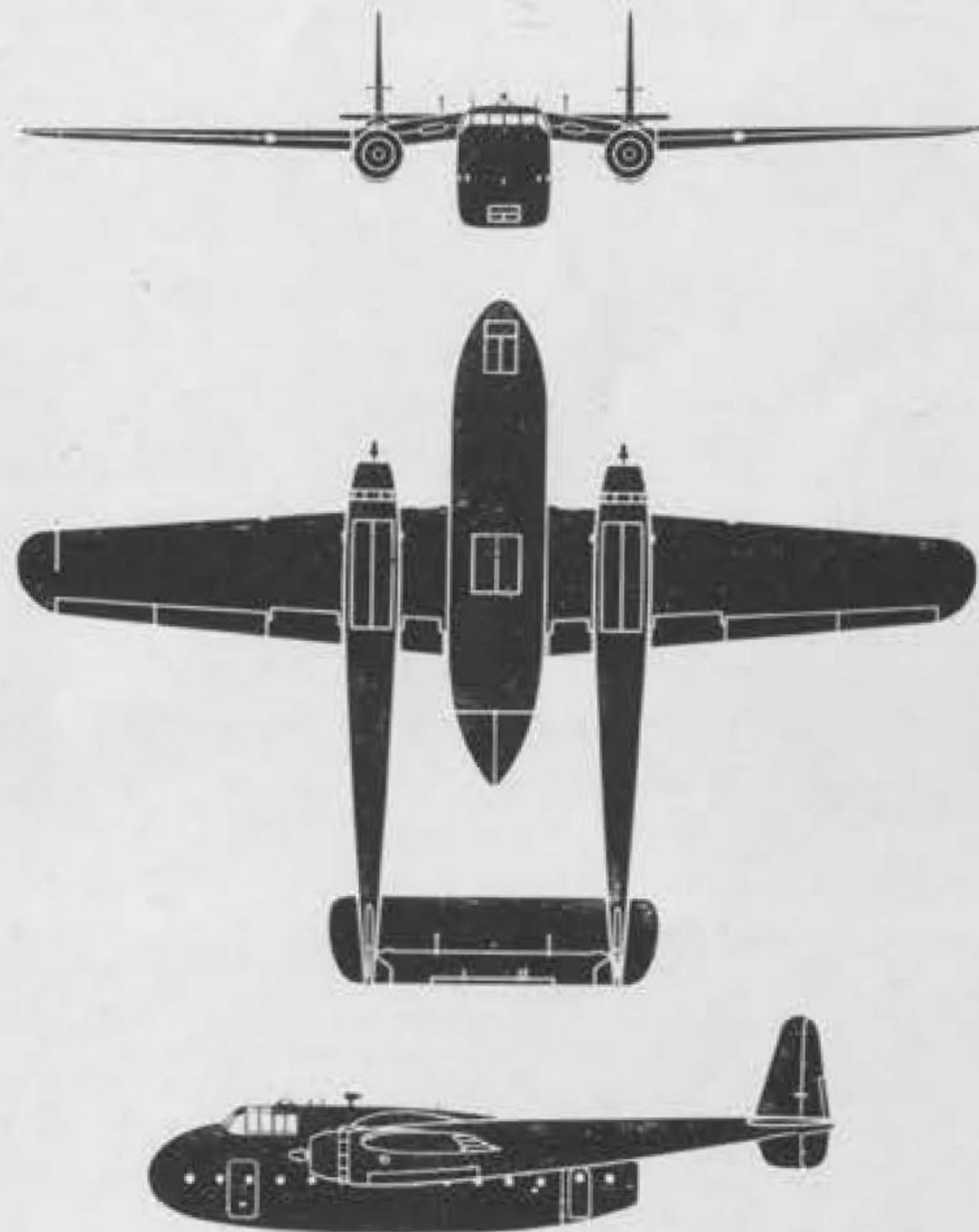
American Fighter  
Span 42 ft. 7 in. Length 36 ft. 2 in.

**MITSUBISHI "PEGGY"**  
(Two Mitsubishi Ha 104)



Japanese Army Bomber  
Span 73 ft. 8 in. Length 61 ft. 3 in.

**FAIRCHILD C-82, PACKET**  
(Two Pratt & Whitney Double Wasp)



American Transport  
Span 106 ft. 0 in. Length 76 ft. 0 in.

The silhouette of the P-47N shows the added dorsal fin and the drawing of "Peggy" is corrected in various details.

# Ab Initio

SO FAR in this series the basic ideas upon which Recognition Training should be built have been explained. The adaptation of the same method to learning each new type must be left to the student.

In the first two articles we were concerned mainly with outstanding features and the more obvious differences between one type of aeroplane and another. But how do we stand when, instead of being obviously different at first glance, aeroplanes appear to be similar and a close scrutiny is needed to detect variations of outline?

The process is really exactly the same but more care is needed. It is more important to know exact details of outline. In the long run there is no escape from the necessity of learning the whole silhouette. Even then, types that to-day have strong individual characteristics, to-morrow may be almost identical with new types, hostile or friendly.

Learn the silhouette until you are able to recognise even a wing tip and then you will have a really sound and lasting foundation.

Some of the Jap aircraft when made by the same manufacturer are much alike—there is a family resemblance. But even if it were safe to assume from general characteristics that an aeroplane was, for example, one of the Nakajima fighters, to know exactly which is still necessary if you are to take advantage of its blind spots, known weakness of structure or manœuvrability, and so on. You must never become slipshod in Recognition—you, or one of your friends, may have to pay dearly for any mistake.

Several of the twin-engine Japs have that sleek look that characterises the Mosquito and at first glance have the same general mass, but details give the clue in any position.

Look at the Mosquito silhouette. In head-on view notice particularly the shoulder-high position of the wing and its

span in relation to engines and fuselage. In plan view the important features are the extreme sweep forward of the trailing-edge of the wing and the sharp wing tips, the engine nacelles projecting well behind the wing, and the

large elliptical tailplane.

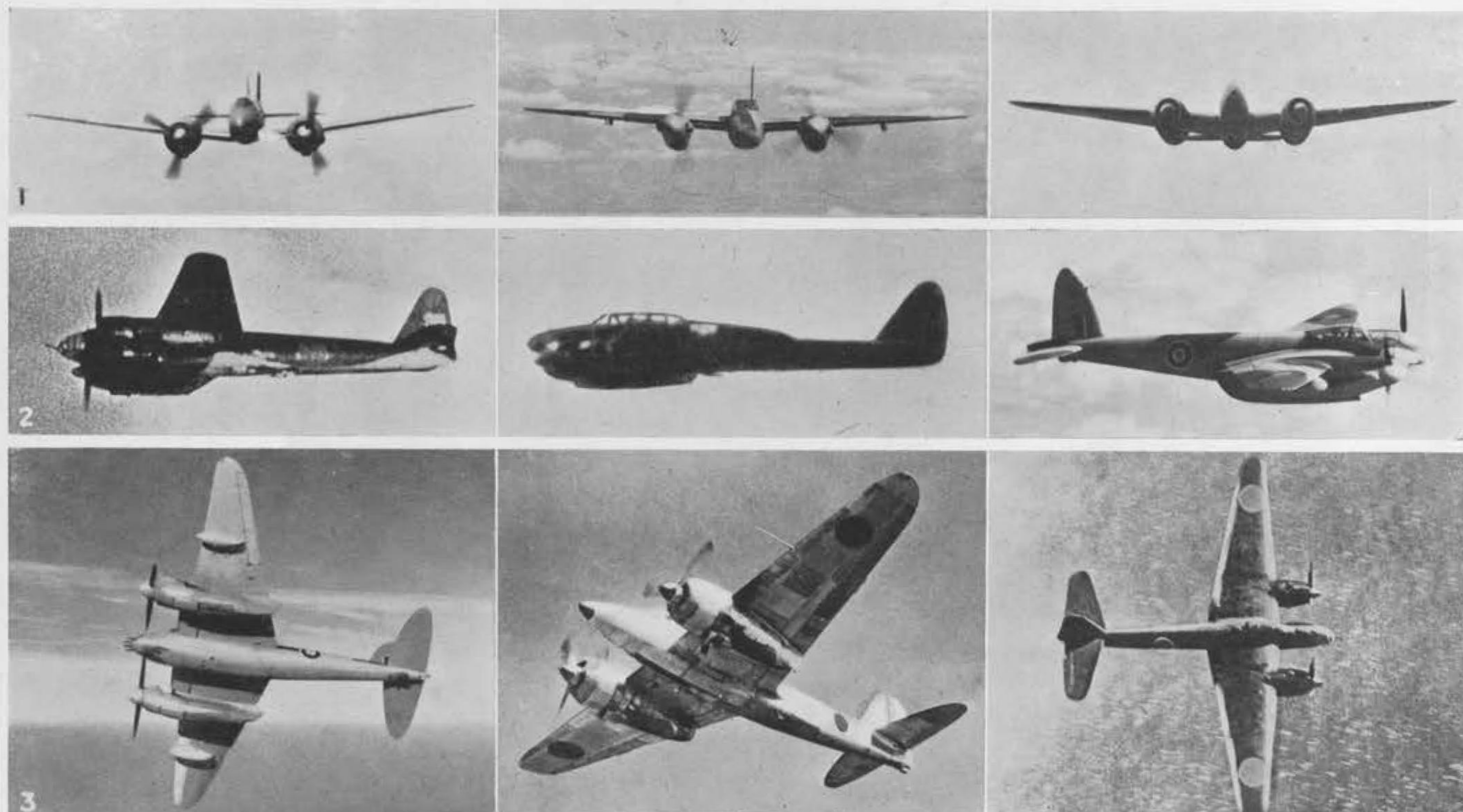
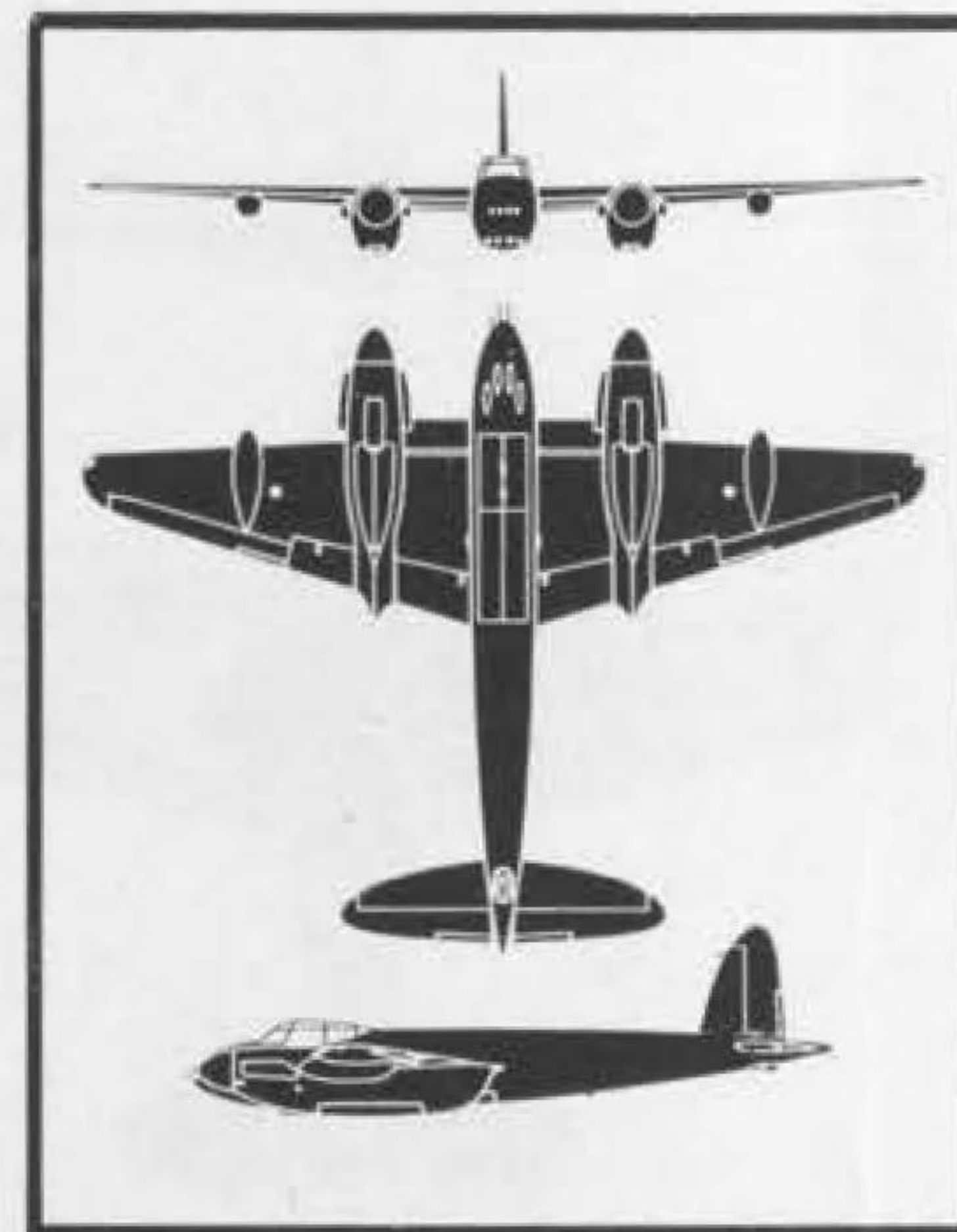
In side view the deep engine nacelles, the tall curved fin and rudder with pointed top that is set forward of the tail, are notable. Knowing these details the Mosquito should be found easily in the first three rows below.

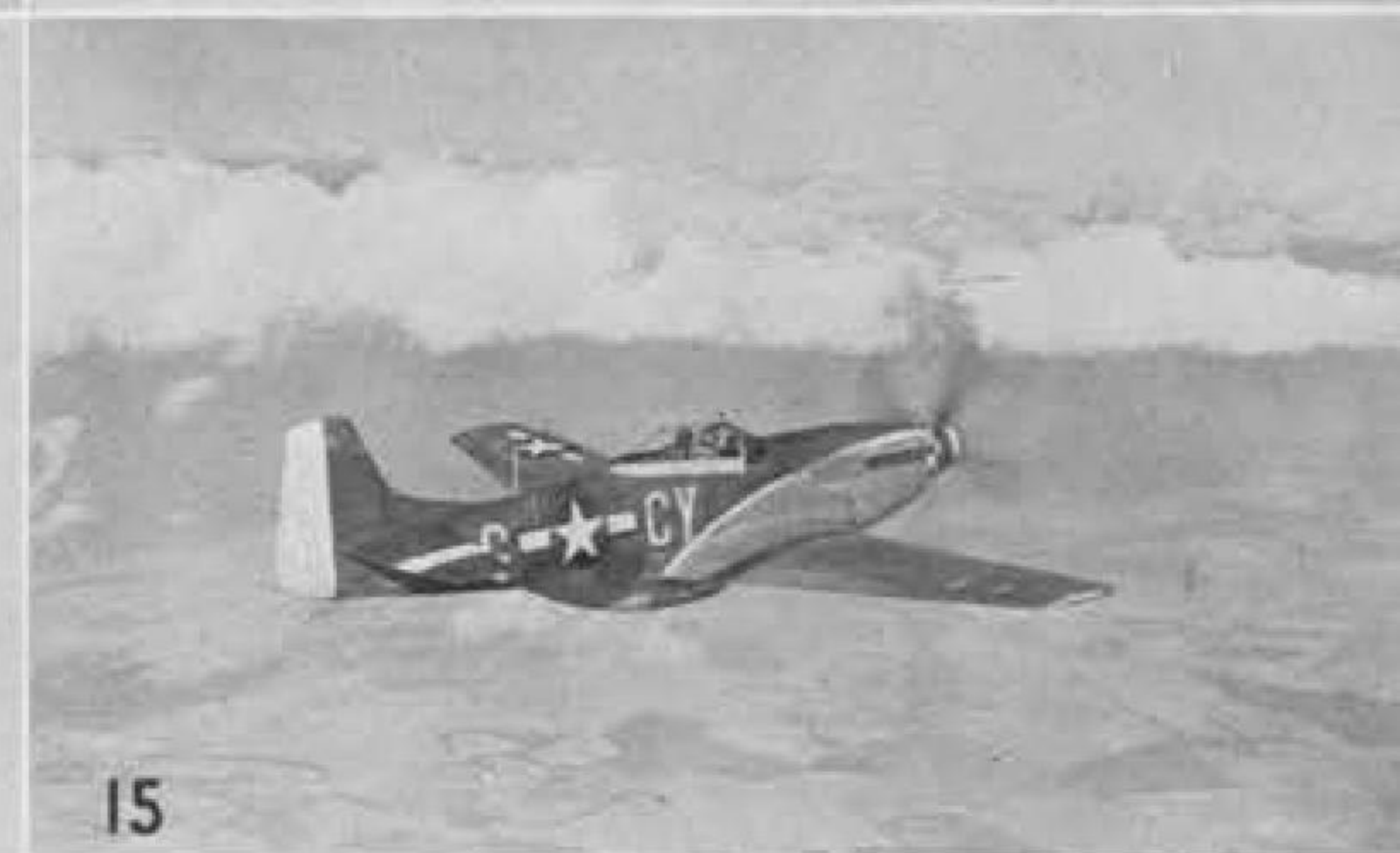
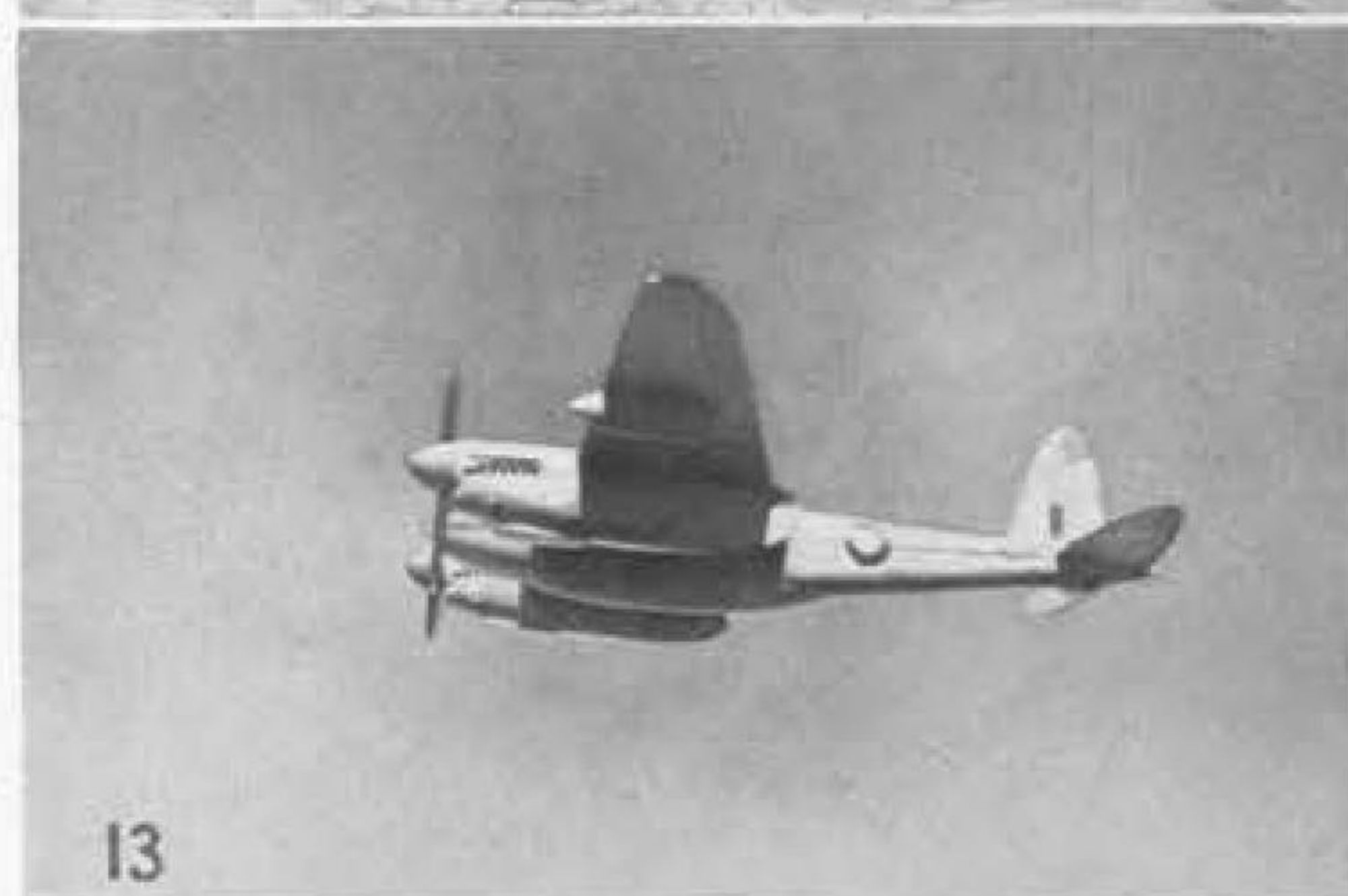
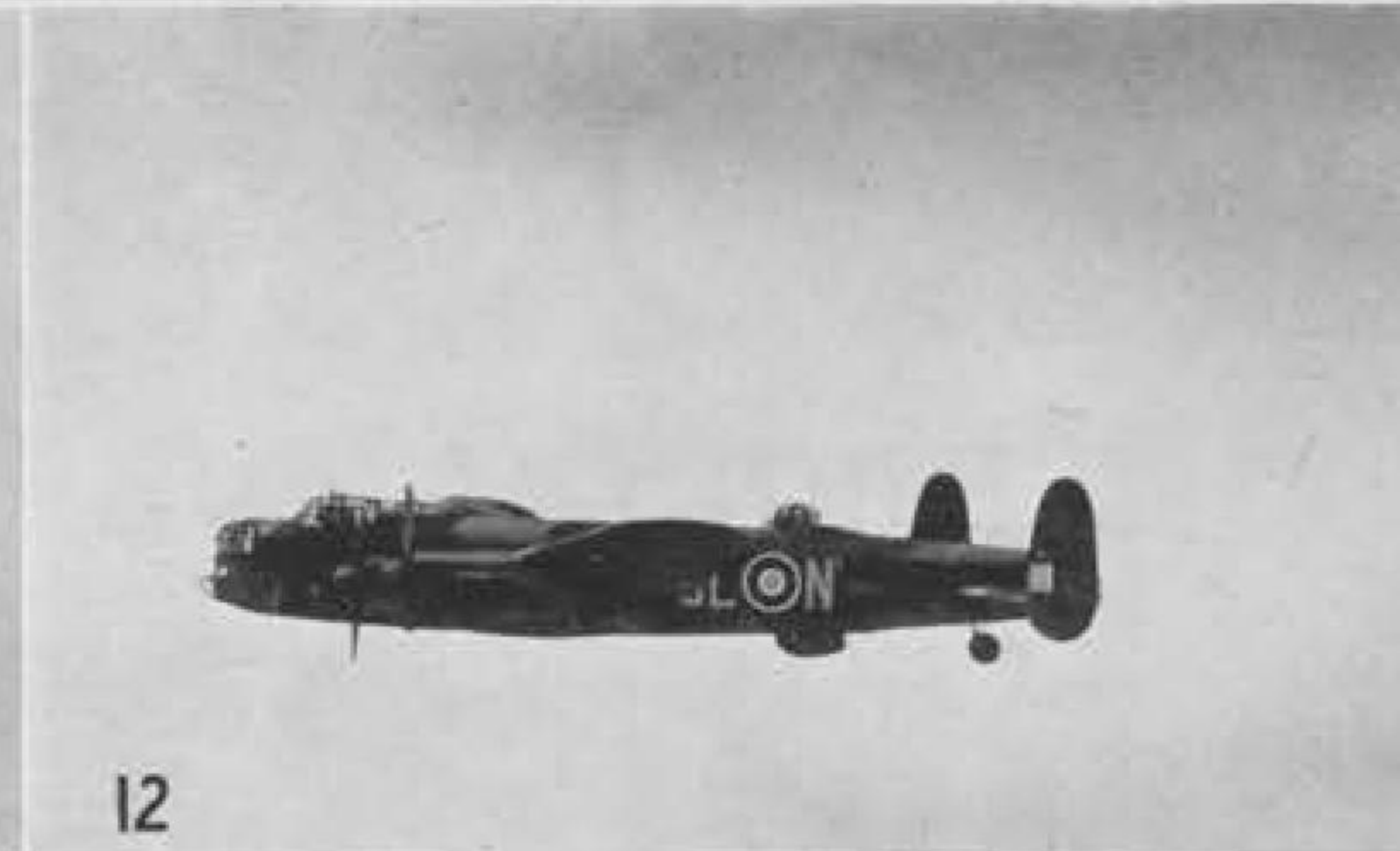
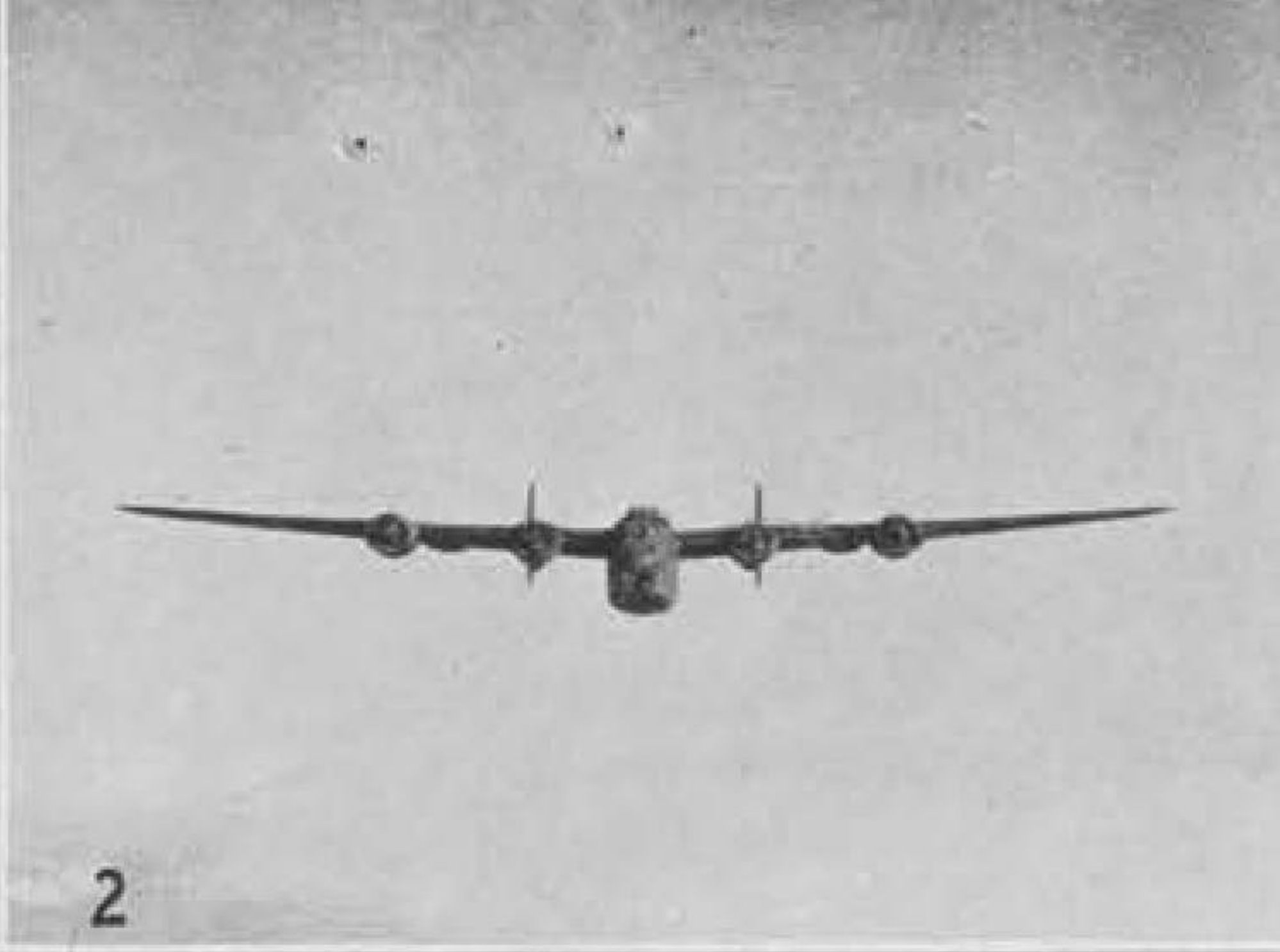
- (1) Centre.
- (2) Right.
- (3) Left.

See if you can pick out the Mosquito in the test pictures opposite — and don't be caught out by those pictures put there especially to trip you up. Other aeroplanes are included that you should know as well. The answers are on the back page.

If you have followed carefully what you have been taught, even if you were a real beginner, you should now realise, first, that after all it is possible to learn to tell which aeroplane is which. Secondly, this Recognition is interesting and that what you imagined must be drudgery can be fun. Thirdly, you will have experienced the satisfaction that comes from knowing more than the other chap.

Above all, if your job requires knowledge of aircraft, names will begin to bring a clear image before your mind and images will automatically mean a name to you. You will be becoming efficient.







159



160



161



162



163



164



165



166



167



168



169



170

## THROUGH THE RING SIGHT

Recognition Test No. 133

When the page is held at a distance of 20 in. from the eye, the ring superimposed on the photographs represents a 50 m.p.h. sight or a fixed sight. No attempt has been made to illustrate the correct aiming allowance. When you have recognised the aeroplanes, assess their approximate ranges in both sights. Solution at foot of page.

### SOLUTIONS TO RECOGNITION TESTS IN THIS ISSUE

#### FRONT COVER: SPITEFUL

#### SUNSET.

The aeroplanes shown, reading from left to right, top to bottom, are:—"Nick," "Emily," "Tony," "Paul," "Judy" 11, "Jill," "Peggy."

#### No. 130 (SILLOGRAPHS):

- |                   |                  |                  |
|-------------------|------------------|------------------|
| 134. Hornet       | 142. "Oscar"     | 151. "Grace"     |
| 135. Liberator IX | 143. "George"    | 152. "Judy" 33   |
| 136. "Frank"      | 144. "Jack"      | 153. "Peggy"     |
| 137. Goose        | 145. Seawolf     | 154. Spitfire 22 |
| 138. Expeditor    | 146. "Jake"      | 155. Harpoon     |
| 139. C-46         | 147. Firebrand   | 156. Fireball    |
| 140. Lincoln      | 148. Beaufighter | 157. Firefly     |
| 141. "Zeke" 52    | 149. "Dinah"     | 158. Corsair     |
|                   | 150. "Nick"      |                  |

#### No. 131 (CHINESE PUZZLE):

- |   |  |
|---|--|
| 1. Bathing beach ... Invader                | 13. Small dark tree ... Firefly                      |
| 2. Pleasure barge ... Lightning             | 14. Stag's antlers ... "Lily"                        |
| 3. River bank nearest fish—<br>"Emily"      | 15. Small left-hand dragon—<br>Invader (plan view)   |
| 4. Fishing rod ... Mosquito                 | 16. Large left-hand dragon—<br>Lightning (side view) |
| 5. Man fishing ... Black Widow              | 17. Large left-hand dragon—Havoc                     |
| 6. Whip ... "Irving"                        | 18. Lady's sedan ... "Frances"                       |
| 7. Willow tree ... "Helen"                  | 19. Small right-hand dragon—<br>Dakota               |
| 8. Willow tree ... Ventura                  | 20. Large right-hand dragon—<br>Dominator            |
| 9. Bank with otter's lair—<br>"Peggy"       | 21. Large right-hand dragon—<br>"Jack"               |
| 10. Largest building ... "Val"              |  |
| 11. Lady in porch ... Tempest II            |  |
| 12. Large tree behind building—<br>Fortress |  |

#### No. 132 (FLYING PHOTOGRAPHS):

- |                    |                     |                          |
|--------------------|---------------------|--------------------------|
| 85. "Tojo"         | 94. Barracuda       | 104. B-29, Superfortress |
| 86. Spiteful       | 95. "Jack"          | 105. F6F, Hellcat        |
| 87. Hornet         | 96. "Zeke" 52       | 106. Helldiver           |
| 88. Halifax VIII   | 97. Tempest II      | 107. P-47N, Thunderbolt  |
| 89. "Tony"         | 98. Warwick         | 108. "Baka"              |
| 90. FR-1, Fireball | 99. F8F, Bearcat    | 109. Warwick V           |
| 91. "Dinah" 3      | 100. B-25, Mitchell | 110. Beaufighter         |
| 92. "Frank"        | 101. PV-1, Ventura  | 111. Corsair             |
| 93. "Nick"         | 102. "Betty"        | 112. "Betty" with "Baka" |
|                    | 103. "Judy" 33      |                          |

#### AB INITIO:

- |                 |               |                    |
|-----------------|---------------|--------------------|
| 1. MOSQUITO     | 7. MOSQUITO   | 13. MOSQUITO       |
| 2. Liberator    | 8. SPITFIRE   | 14. "Frances"      |
| 3. "Dinah"      | 9. "Irving"   | 15. P-51D, Mustang |
| 4. F8F, Bearcat | 10. Halifax   | 16. Hellcat        |
| 5. LANCASTER    | 11. "Tony"    | 17. "ZEKE"         |
| 6. "ZEKE"       | 12. LANCASTER | 18. SPITFIRE       |

#### No. 133 (THROUGH THE RING SIGHT):

- |                                      |                                  |                                   |
|--------------------------------------|----------------------------------|-----------------------------------|
| 170. Beaufighter<br>450 and 300 yds. | 166. "Tony"<br>300 and 200 yds.  | 162. Spiteful<br>575 and 375 yds. |
| 169. Bearcat<br>550 and 375 yds.     | 165. Meteor<br>300 and 200 yds.  | 161. Mustang<br>350 and 225 yds.  |
| 168. Spitfire 22<br>350 and 225 yds. | 164. Auster<br>450 and 300 yds.  | 160. "Dinah"<br>350 and 225 yds.  |
| 167. Hornet<br>350 and 225 yds.      | 163. Firefly<br>225 and 150 yds. | 159. Tigercat                     |

Ranges, first through 50 m.p.h. sight, and second through the fixed sight:

# INDEX TO VOLUME III

## GENERAL

Ab Initio, 232, 256, 314  
 Airborne Infantry, The, 66  
 Aircraft in the News, 22, 42, 65, 79, 112, 140, 152, 177, 199, 218, 243, 266, 298  
 "And then there was one" (Drg.), 48  
 Are You Class Conscious? 222  
 Attack, The, 78  
 Attention to Detail, 38

Be Prepared! 44  
 Big Bombers, The, 4

Carrier Based, 76  
 Chinese Puzzle (Drg.), 303  
 Combat Reports, Extracts from Fighter Command, 63  
 Consolidated—Meet the Family, 260

Defence of Japan, 182  
 Ditching, 92  
 Do you Know . . . . , 114  
 Drop Tanks, 244  
 Dull Article, A, 310

Eastern Targets, (Centre Spread), 252-253  
 Enemy's Plans, *Illustrations*, 170  
 Escort, 196

Fighter Command, Extracts from Combat Reports, 187  
 Fleet Air Arm, 104  
 Floatplanes, 210  
 "Flying Buttresses Aren't They?" (Drg.), 144  
 Flying Photographs, 23, 40, 70, 118, 136, 161, 185, 212, 234, 263, 288, 309  
 Fundamentals of Flying, 33, 69, 87, 117, 176

G-Box, 99  
 German Aeronautical Terms, Some, 45  
 German Composite Aircraft, New, 22  
 German Jets, 52, 75  
 German Oddities, 198  
*Illustrations*, 215  
 German Transports, (Centre Spread), 84-85  
 Goodbye To All That, 250  
 Grumman—Meet the Family, 302

Heads and Tails, *Illustrations*, 174  
 Heredity, 206  
 Homare 21, 51

It's the Exception, 308

Japan, Defence of, 154  
 Japanese Aeroplanes, Names for, 107  
 Japanese Air Power, 12  
 Japanese Losses, 199  
 Japanese Nomenclature, 89  
 Japs of All Trades, *Illustrations*, 54-55  
 Jet Propulsion, 130  
*Cartoon*, 187

Liaison Aircraft, 41  
 Line, 293

Magic, 166  
 Meet the Family:—  
 Consolidated, 260  
 Grumman, 302  
 Lockheed, 224  
 Moving East, 100  
 Multi-Purpose, 220  
 Multum in Parvo, 311  
 Muzzle Puzzle, 184

Nakajima Fighters, 230  
 Navy's Way, *Illustrations*, 132-133  
 New Types, *Illustrations*, 228-229  
 New and Revised Silhouettes, 47, 71, 94, 95, 119, 143, 162, 191, 200, 238, 239, 262, 312  
 Night Bombers' View, *Illustrations*, 164  
 Night Fighter's View, *Illustrations*, 98  
 Night Sights, 135  
 Night Views, *Illustrations*, 225  
 Know Your Friend, Hellcat, 261

Opposite Numbers, 201  
 Oriental Pattern, 150

Pacific, Aircraft in Use, 243  
 Pacific Map, 146  
 Pacific Other Types, 258  
 Pacific Payload, 148  
 Pacific War, 147  
 Pacific War, R.A.F. and F.A.A. in Action, 152  
 Photographic Angles:—  
 B-29, 58  
 Bearcat, 300  
 "Betty" 22, 214  
 Black Widow, 58  
 DB-3F, 34  
 Dominator, 248  
 "Emily," 165  
 Fireball, 300  
 Firefly, 129  
 "Frances," 113  
 He 177A-5, 86  
 Helldiver, 189  
 IL-2, 34  
 Invader, 189  
 "Irving," 165  
 "Jake," 214  
 "Jill," 113  
 "Judy," 113  
 Ju 88R, 86  
 Kingcobra, 58  
 L-5 Sentinel, 189  
 Lancastrian, 248  
 Lincoln, 223  
 Me 109G, 86  
 Me 410, 86  
 Meteor III, 223  
 "Myrt," 165  
 "Nick," 214

Photographic Angles (continued)—:  
 "Paul," 214  
 PE-2, 34  
 Piper L-4, 189  
 Seahawk, 223  
 Seawolf, 300  
 Spiteful 300  
 Spitfire XIV, 58  
 Spitfire XIV, 129  
 Spifire 22, 300  
 TB-7, 34  
 Tempest, 129  
 Tempest, II, 223  
 Tigercat, 248  
 "Tony," 113  
 Warwick, 129  
 "Zeke" 52, 165

'Planes for Ships, 22  
 Progress—or Research and Development, (Drg.), 27

R.A.F. School of Recognition, *Illustrations*, 294  
 Rear Views, 2  
 Reconnaissance, 172  
 Recognito, (Drg.), 78  
 "Restricted" Journal, Editorial, 195  
 Rockets, 226  
 Royal Observer Corps, The, 82  
 Royal Observer Corps' Master Test, The, 144, 168

Salient Characteristics: "Frances," 106  
 He 177, 59  
 "Helen," 83  
 "Jack," 138  
 Me 410, 35

Short Cuts, 259  
 Sidelines on the: Beaufighter, 110  
 Halifax, 153  
 Lancaster, 139  
 Mosquito, 186  
 Typhoon, 209

Sillographs, 46, 64, 74, 107, 134, 164, 188, 208, 236, 249, 301  
 Silver Fleet, *Illustrations*, 36-37  
 Sorry Tale of Herbert Tree, The, 295  
 Speed in the Air, 124  
 Strangers (Drg.), 151. More Strangers (Drg.), 235  
 Suicide Attacks, 246

Tail Design, 306  
 "Tallboy" 12,000-lb. Bomb, 99  
 Test Films, 175  
 Theory and Practice: "Dinah," 237  
 "Jill," 213  
 "Judy," 160  
 "Tojo," 190  
 "Tony," 128

Through the Binoculars, 135, 142  
 Through the Gun Sights, 111, 198  
 Through the Ring Sight, 316

Variations—From Italy, 183

Whole Picture, The, 137

Ye Spotting Test 62,

## AIRCRAFT

### BRITISH AND AMERICAN

A-20, see Havoc  
 A-26, see Invader  
 A-30, see Baltimore  
 A-35, see Vengeance  
 Airacobra, *Illustrations*, 6 (Silh.), 47 (N. & R.), 117  
 Airacomet, *Illustration*, 65  
 Albacore, *Illustration*, 161  
 Albemarle, *Illustrations*, 2, 8 (Silh.), 40, 67, 88  
 Anson, *Illustrations*, 2, 8 (Silh.), 70, 136  
 Anson II (AT-20), 107, 144  
 Anson X, *Illustration*, 171  
 Anson XII, *Illustration*, 258  
 Argus, *Illustrations*, 6 (Silh.), 41, 79  
 AT-6, see Texan  
 AT-19, see Reliant  
 Auster IV, *Illustrations*, 6 (Silh.), 41  
 Avenger, 152  
*Illustrations*, 3, 6 (Silh.), 27, 77, 88, 105, 114, 134, 136, 152, 163, 188, 200 (N. & R.), 201, 208, 212, 249, 302

B-17, see Fortress  
 B-24, see Liberator  
 B-25, see Mitchell  
 B-26, see Marauder  
 B-29, see Superfortress  
 B-32, see Dominator  
 Baltimore, 64  
*Illustration*, 8 (Silh.)  
 Barracuda, *Illustrations*, 6 (Silh.), 74, 77, 99, 104, 115, 136, 167, 201, 242, 288, 309  
 Bearcat, 267, 308  
*Illustrations*, 266, 300, 302, 308 (Drg.), 309, 313 (N. & R.), 315  
 Beaufighter, 110 (Article)  
*Illustrations*, 9 (Silh.), 23, 46, 88, 98, 110, 118, 161, 164, 188, 208, 225, 226, 301, 309  
 Beaufighter X, *Illustrations*, 101, 162 (N. & R.), 201, 221, 243, 288, 307  
 Beaufort, *Illustrations*, 2, 23

Black Widow, 42  
*Illustrations*, 2, 10 (Silh.), 32, 58, 70, 74, 98, 118, 163, 164, 177, 208, 225

Boston, *Illustrations*, 23, 245  
 Boston IV, 107  
 Buckingham, 219  
*Illustrations*, 218, 234, 238 (N. & R.)

C-46, see Commando  
 C-47, see Dakota  
 C-54, see Skymaster  
 C-56, see Lodestar  
 C-69, see Constellation  
 C-82, see Packet  
 C-87, see Liberator  
 C-97, *Illustration*, 177  
 C-109, see Liberator

Catalina, PBN, 259  
*Illustrations*, 119 (N. & R.), 260  
 Catalina, PBY, 64, 260  
*Illustrations*, 11 (Silh.), 23, 70, 117, 212, 260

- Catalina, PBV-6A, *Illustration*, 288  
 CG-4A, see Hadrian  
 Commando, 149, 296 (Article)  
*Illustrations*, 9 (Silh.), 148, 152, 208, 225, 234, 249, 263, 296, 297 (Silh.)  
 "Commando," Liberator, 260  
*Illustration*, 22  
 Constellation, 224  
*Illustrations*, 224, 263  
 Coronado, *Illustration*, 11  
 Corsair, *Illustrations*, 2, 6 (Silh.), 40, 70, 77, 88, 105, 188, 208, 227, 236, 245, 263, 288, 301, 309  
 Crane, *Illustration*, 9 (Silh.)
- Dakota, *Illustrations*, 2, 9 (Silh.), 23, 40, 64, 74, 88, 98, 107, 117, 136, 141, 148, 163, 180-181, 185, 212, 301  
 Dauntless, *Illustrations*, 6 (Silh.), 107, 118, 212, 249, 259  
 Dominator, 99, 219, 260  
*Illustrations*, 218, 248, 260, 307  
 Duck, *Illustrations*, 258, 302
- Expedito, *Illustrations*, 40, 171, 258, 301
- F4F, see Wildcat  
 F4U, see Corsair  
 F6F, see Hellcat  
 F7F, see Tigercat  
 F-8, see Mosquito VI  
 F8F, see Bearcat  
 Fireball (FR-1), 267  
*Illustrations*, 266, 300, 301, 309  
 Firebrand III, 243  
*Illustrations*, 217, 238 (N. & R.), 242, 288, 301  
 Firefly, 243, 308  
*Illustrations*, 73, 79, 94 (N. & R.), 104, 107, 129, 134, 136, 143 (N. & R.), 161, 164, 185, 188, 208, 225, 243, 263, 301, 308 (Drg.)  
 FM-2, *Illustration*, 23  
 Fortress, *Illustrations*, 46, 88, 107, 141, 257  
 Fortress II, *Illustration*, 23  
 Fortress III, 107  
*Illustrations*, 5, 10 (Silh.), 24, 37, 74, 196, 256  
 Forwarder, see Argus  
 Fulmar, *Illustration*, 107
- Gloster E.28/39, *Illustration*, 65  
 Goose, *Illustrations*, 301, 302
- Hadrian, *Illustrations*, 14 (Silh.), 67, 118, 185, 263  
 Halifax, 153 (Article)  
*Illustrations*, 46, 67, 107, 118, 153, 163, 208, 315  
 Halifax III, *Illustrations*, 5, 11 (Silh.), 23, 98, 134  
 Halifax VII, 243  
*Illustrations*, 100, 161, 243  
 Halifax VIII, 243, 267  
*Illustrations*, 262 (N. & R.), 266, 309  
 Hamilcar, *Illustrations*, 14 (Silh.), 64, 66, 67, 74  
 Harpoon, 64, 219, 224  
*Illustrations*, 224, 229, 234, 238 (N. & R.), 249, 263, 288, 301  
 Havoc, 23, 42, 64, 245  
*Illustrations*, 2, 9 (Silh.), 32, 64, 74, 136, 161  
 Havoc (A-20J), *Illustration*, 88  
 Hellcat, 221, 261 (Know Your Friend)  
*Illustrations*, 6 (Silh.), 25, 40, 74, 77, 105, 114, 118, 135, 161, 164, 188, 201, 208, 212, 221, 225, 227, 259, 288, 302, 309, 315  
 Helldiver, 178 (Article), 299  
*Illustrations*, 7 (Silh.), 40, 74, 107, 123, 134, 135, 136, 163, 178, 179 (Silh.), 185, 188, 189, 194, 208, 288, 299, 309  
 Hornet I, 267  
*Illustrations*, 266, 301, 304-305, 309, 312 (N. & R.)  
 Horsa, *Illustrations*, 14 (Silh.), 67  
 Hudson, *Illustrations*, 9 (Silh.), 70, 136  
 Hudson III, *Illustration*, 43  
 Hurricane, 42, 244  
*Illustrations*, 7 (Silh.), 88, 244
- Invader, 202 (Article)  
*Illustrations*, 112, 119 (N. & R.), 134, 135, 136, 169, 189, 202 (Silh.), 203, 208, 212, 220, 234
- J2F, see Duck  
 J4F, see Widgeon
- Kingcobra, 22  
*Illustrations*, 47 (N. & R.), 58, 211  
 Kingfisher, *Illustrations*, 14 (Silh.), 70, 74, 208, 263  
 Kittyhawk, *Illustrations*, 7 (Silh.), 208
- L-1, see Vigilant  
 L-4, 41  
*Illustrations*, 2, 7 (Silh.), 177, 189  
 L-5, see Sentinel  
 Lancaster, 139 (Article)  
*Illustrations*, 5, 11 (Silh.), 43, 46, 70, 74, 88, 93, 98, 101, 134, 136, 139, 162 (N. & R.), 163, 212, 256, 315  
 Lancaster III, 243  
*Illustrations*, 232 (Silh.), 233, 242, 257  
 Lancastrian, *Illustrations*, 162 (N. & R.), 240, 248  
 Liberator, *Illustrations*, 11 (Silh.), 64, 74, 107, 117, 161, 234, 315  
 Liberator V (B-24D), 107  
 Liberator VI (B-24J), 112  
 Liberator, B-24H, *Illustrations*, 36, 88, 307  
 Liberator, B-24N, 219  
*Illustrations*, 218, 239 (N. & R.), 260  
 Liberator IX, *Illustration*, 301  
 Liberator, C-109, 177  
 Liberator, C-87 Express, 260  
*Illustrations*, 148, 216  
 Lightning, 126 (Article), 224, 245  
*Illustrations*, 10 (Silh.), 23, 36, 40, 74, 117, 118, 127 (Silh.), 201, 212, 224, 245  
 Lightning, P-38L, 197, 224, 245  
*Illustration*, 224  
 Lincoln, 219  
*Illustrations*, 223, 228, 234, 239 (N. & R.), 241, 263, 288, 301, 307  
 Lockheed, Meet the Family, 224  
 Lodestar, *Illustration*, 258
- Marauder, *Illustrations*, 9 (Silh.), 23, 36, 40, 118, 136, 188, 234  
 Marauder III (B-26F), *Illustration*, 112  
 Mariner, *Illustrations*, 14 (Silh.), 118, 258  
 Master, *Illustration*, 117  
 Messenger I, *Illustrations*, 234, 258  
 Meteor III, 199, 219  
*Illustrations*, 223, 228, 234, 239 (N. & R.), 263, 288, 291  
 Mitchell, *Illustrations*, 2, 23, 64, 88, 118, 135, 161, 185, 212, 225, 227, 288, 309  
 Mitchell III (B-25J), 42  
*Illustrations*, 9 (Silh.), 37, 70, 201, 221  
 Monitor, 299  
*Illustration*, 299  
 Mosquito, 186 (Article), 220, 308  
*Illustrations*, 46, 88, 98, 117, 135, 136, 156-157 (Centre Spread), 163, 164, 185, 188, 198, 212, 220, 225, 234, 288, 308 (Drg.), 315  
 Mosquito II, *Illustration*, 156  
 Mosquito IV, *Illustration*, 156  
 Mosquito VI, 140, 144  
*Illustrations*, 10 (Silh.), 23, 70, 116, 140, 156, 161, 201, 226, 242, 259, 314 (Silh.)  
 Mosquito IX, 152  
*Illustrations*, 157, 172  
 Mosquito XIII, 152  
*Illustration*, 197  
 Mosquito XVI, 152  
*Illustrations*, 100, 157, 162 (N. & R.), 249, 307  
 Mosquito XVIII, *Illustrations*, 112, 156, 263  
 Mustang, *Illustrations*, 70, 74, 118, 161, 185, 208, 212, 288  
 Mustang IV, P-51D, 197  
*Illustrations*, 2, 7 (Silh.), 22, 23, 32, 36, 65, 99, 125, 166, 177, 197, 201, 226, 249, 315  
 Mustang, P-51H, 298  
*Illustrations*, 291, 298
- Norseman, 144  
*Illustrations*, 41, 171, 258, 263
- OS2U, see Kingfisher  
 Oxford, *Illustrations*, 2, 23
- P-38, see Lightning  
 P-39, see Airacobra  
 P-40, see Kittyhawk  
 P-47, see Thunderbolt  
 P-51, see Mustang  
 P-59, see Airacomet  
 P-61, see Black Widow  
 P-63, see Kingcobra  
 P-80, see Shooting Star  
 Packet, *Illustration*, 313 (N. & R.)  
 PB2Y, see Coronado  
 PB4Y-2, see Privateer  
 PBM, see Mariner  
 PBN, see Catalina  
 PBY, see Catalina  
 Privateer, 152, 173, 260  
*Illustrations*, 145, 152, 162 (N. & R.), 173, 175, 185, 188, 234, 260  
 PT-24, see Tiger Moth  
 PV-1, see Ventura  
 PV-2, see Harpoon
- Reliant, *Illustrations*, 41, 105  
 RY-3, Liberator, *Illustrations*, 260, 263
- SB2C, see Helldiver  
 SBD, see Dauntless  
 SC-1, see Seahawk  
 Sea Otter I, 42  
*Illustrations*, 43, 71 (N. & R.), 105, 163  
 Seafire III, 42  
*Illustrations*, 43, 77, 104, 201  
 Seafire XVII, 219  
*Illustrations*, 228, 312 (N. & R.)  
 Seahawk, 219  
*Illustrations*, 223, 229, 234, 249, 263  
 Seawolf, *Illustrations*, 300, 301  
 Sentinel, *Illustrations*, 2, 7 (Silh.), 41, 118, 185, 189, 288  
 Shooting Star, 224, 299  
*Illustrations*, 249, 312 (N. & R.)  
 Skymaster, 149, 298  
*Illustrations*, 10 (Silh.), 149, 234, 298  
 SOC-3, 211  
*Illustrations*, 210, 211  
 Spiteful XIV, 267  
*Illustrations*, 266, 289, 300, 309, 312 (N. & R.)  
 Spitfire, 245  
*Illustrations*, 2, 60-61 (Centre Spread), 88, 117, 185, 188, 212, 232 (Silh.), 244, 315  
 Spitfire I, *Illustration*, 60  
 Spitfire V, *Illustrations*, 7 (Silh.), 60  
 Spitfire VIII, *Illustrations*, 7 (Silh.), 23, 60, 70  
 Spitfire IX, 22  
*Illustrations*, 8 (Silh.), 32, 60, 70  
 Spitfire XI, 173  
*Illustration*, 173  
 Spitfire XII, *Illustrations*, 61, 74  
 Spitfire XIV, 42  
*Illustrations*, 32, 40, 43, 58, 61, 71 (N. & R.), 97, 99, 100, 129, 136, 161, 163, 197, 233  
 Spitfire XVI, 199  
 Spitfire 21, *Illustrations*, 228, 234  
 Spitfire 22, 219  
*Illustrations*, 238 (N. & R.), 242, 248, 249, 263, 288, 301  
 Stirling, *Illustrations*, 11 (Silh.), 66  
 Stirling V, *Illustration*, 243  
 Sunderland, 81 (Article)  
*Illustrations*, 23, 81, 136, 163, 185, 263  
 Sunderland III, *Illustrations*, 1, 14 (Silh.), 80 (Silh.), 81, 101, 167  
 Superfortress, 30 (Article), 221, 298  
*Illustrations*, 4, 11 (Silh.), 30, 31, 58, 65, 74, 95 (N. & R.), 99, 118, 161, 168, 185, 193, 199, 221, 234, 263, 288, 298, 306, 309
- TBF, TBM, see Avenger  
 TBY, see Seawolf  
 Tempest II, 219, 254 (Article)  
*Illustrations*, 223, 229, 234, 238 (N. & R.), 255, 263, 309  
 Tempest V, *Illustrations*, 49, 71 (N. & R.), 74, 75, 99, 101, 107, 108-109 (Centre Spread), 118, 120, 123, 129, 135, 136, 161, 163, 185, 188, 198, 201, 208, 212, 249, 254  
 Tempest VI, 243  
*Illustrations*, 242, 254 (Silh.), 255, 263, 288  
 Texan, *Illustration*, 258  
 Thunderbolt, 42, 56 (Article), 245  
*Illustration*, 32, 40, 46, 56, 57, 64, 68, 70, 118, 125, 161, 185, 245, 263, 288  
 Thunderbolt, P-47C, 196  
 Thunderbolt, P-47D, 152, 197  
*Illustrations*, 8 (Silh.), 23, 36, 43, 56, 57 (Silh.), 114, 259

Thunderbolt, P-47N, 197, 244, 267, 299  
*Illustrations*, 197, 199, 226, 249, 266, 299, 309, 313 (N. & R.)  
 Tigercat, 64, 219  
*Illustrations*, 225, 228, 234, 239 (N. & R.), 248, 249, 263, 288, 302  
 Tiger Moth, 144  
 Typhoon, 209 (Article)  
*Illustrations*, 8 (Silh.), 22, 40, 64, 88, 99, 107, 125, 136, 185, 220, 227

UC-45, see Expeditor  
 UC-61, see Argus  
 UC-64, see Norseman  
 UC-78, see Crane

Vengeance, *Illustration*, 8 (Silh.)  
 Ventura, 224  
*Illustrations*, 10 (Silh.), 40, 161, 224, 288, 309  
 Vigilant, *Illustration*, 41  
 Viking, 299  
*Illustration*, 299

Warhawk, see Kittyhawk  
 Warwick, *Illustrations*, 10 (Silh.), 65 (A/S Rescue), 95 (N. & R.), 101, 118, 121, 129, 185, 208, 234, 309  
 Warwick V, 219  
*Illustrations*, 228, 263, 309  
 Wellington, *Illustrations*, 2, 22, 40, 98, 185  
 Wellington XIII, 107  
 Wellington XIV, 107  
*Illustration*, 112  
 Whitley, *Illustration*, 118  
 Widgeon, *Illustrations*, 258, 302  
 Wildcat, 117  
*Illustrations*, 8 (Silh.), 105, 117, 185, 302  
 Wildcat VI (FM-2), *Illustration*, 23

York, 148  
*Illustrations* 11 (Silh.), 64, 100, 149

**FRENCH**

D.520, *Illustration*, 26  
 Goeland, *Illustration*, 188  
 LeO 45, 26.

**GERMAN**

Arado 196, *Illustration*, 18 (Silh.)  
 Arado 232A, 198  
*Illustration*, 215  
 Arado 232B, 198  
*Illustrations*, 85, 95 (N. & R.)  
 Arado 234, 152, 251  
*Illustration*, 191 (N. & R.)  
 Arado 240, 198  
*Illustration*, 215  
 Arado 432, 250  
 Blohm & Voss 138, *Illustration*, 40  
 Blohm & Voss 138b, *Illustration*, 18 (Silh.)  
 Blohm & Voss 139, *Illustration*, 84  
 Blohm & Voss 144, 250  
 Blohm & Voss 222, 177  
*Illustrations*, 18 (Silh.), 84  
 Blohm & Voss 238, 250

D.F.S. 230, *Illustration*, 26  
 Dornier 17z, *Illustration*, 26  
 Dornier 24, 63  
 Dornier 217, *Illustration*, 46  
 Dornier 217E, *Illustration*, 64  
 Dornier 217K1, *Illustration*, 107  
 Dornier 217K2, *Illustration*, 23  
 Dornier 217M, *Illustration*, 16 (Silh.)  
 Dornier 217N, *Illustration*, 79  
 Dornier 335, 251  
*Illustration*, 200 (N. & R.)  
 Dornier 435, 250  
 Dornier 635, 250

Fieseler 156 Storch, *Illustrations*, 15 (Silh.), 41, 141  
 Focke-Wulf 190, *Illustrations*, 15 (Silh.), 23, 27, 32, 40, 46, 70, 74, 111, 117, 164, 170, 185, 188, 212  
 Focke-Wulf 190D, 141  
*Illustrations*, 141, 143 (N. & R.), 163, 188, 191 (N. & R.)  
 Focke-Wulf 191, 250  
 Focke-Wulf 200c, *Illustrations*, 18 (Silh.), 26, 74, 84, 136  
 FZG-76, Flying Bomb, 28 (Article)  
*Illustrations*, 28, 29, 99

Gotha 242, 198  
*Illustration*, 215  
 Gotha 244, 198  
*Illustrations*, 16 (Silh.), 84, 215

Heinkel 111, *Illustrations*, 16 (Silh.), 26, 85, 152, 216  
 Heinkel 162, 151  
*Illustration*, 240  
 Heinkel 177, 42  
*Illustrations*, 16 (Silh.), 26, 46, 59, 74, 98, 107, 118, 161, 163  
 Heinkel 177A-5, *Illustrations*, 86, 95 (N. & R.)  
 Heinkel 219, *Illustrations*, 17 (Silh.), 26, 79, 119 (N. & R.), 136  
 Heinkel 274, 250  
 Heinkel 280, 52  
 Henschel 126, *Illustration*, 41  
 Horten 9, 250

Junkers 52, *Illustrations*, 17 (Silh.), 40, 74, 85, 88, 118  
 Junkers 86P, 198  
*Illustration*, 215  
 Junkers 87D, *Illustration*, 16 (Silh.)  
 Junkers 88, *Illustrations*, 2, 23, 27, 32, 40, 46, 70, 88, 98, 107, 111, 135, 161, 164, 170, 208  
 Junkers 88A, *Illustration*, 17 (Silh.)  
 Junkers 88G, *Illustrations*, 17 (Silh.), 23, 197, 199  
 Junkers 88R, *Illustrations*, 48, 86  
 Junkers 88S, *Illustration*, 65  
 Junkers 90, *Illustration*, 85  
 Junkers 188, 42, 63  
*Illustrations*, 17 (Silh.), 22, 23, 40, 46, 198  
 Junkers 252, 198  
*Illustration*, 215  
 Junkers, 287, 250  
 Junkers 288, 250  
 Junkers 290, *Illustrations*, 18 (Silh.), 74, 84, 290  
 Junkers 352, *Illustrations*, 22, 47 (N. & R.), 84, 143 (N. & R.)  
 Junkers 388, 251  
*Illustration*, 200 (N. & R.)  
 Junkers 390, 251  
 Junkers 488, 251

Messerschmitt 109, *Illustrations*, 2, 32, 40, 88, 111, 118, 163, 170, 188  
 Messerschmitt 109F, *Illustrations*, 46, 212  
 Messerschmitt 109G, *Illustrations*, 16 (Silh.), 43, 47 (N. & R.), 70, 86  
 Messerschmitt 110, 244  
*Illustrations*, 2, 17 (Silh.), 26, 32, 46, 74, 244  
 Messerschmitt 163, 22, 53, 63  
*Illustrations*, 27, 53 (Silh. & Drg.), 188, 250  
 Messerschmitt 163B, 251  
*Illustration*, 125  
 Messerschmitt 209, 251  
 Messerschmitt 262, 22, 52, 251  
*Illustrations*, 53 (Silh. & Drg.), 119 (N. & R.), 124, 134, 135, 136, 161, 164, 185, 188, 192, 198  
 Messerschmitt 264, 251  
*Illustration*, 250  
 Messerschmitt 309, 251  
 Messerschmitt 328, 251  
 Messerschmitt 323, 198  
*Illustrations*, 18 (Silh.), 74, 85, 215  
 Messerschmitt 410, *Illustrations*, 17 (Silh.), 23, 35, 40, 46, 50 (page of illus.), 70, 74, 86, 88, 98, 107, 111, 116, 118, 164, 198, 212

Siebel 204, *Illustrations*, 26, 85

Ta 152, 251  
 Ta 154, 251  
*Illustration*, 250  
 Ta 183, 251  
 Ta 254, 251

**ITALIAN**

Caproni 313, *Illustration*, 188  
 Macchi 202, *Illustration*, 16 (Silh.)  
 Reggiane 2001, *Illustration*, 16 (Silh.)  
 Savoia-Marchetti 79, *Illustration*, 17 (Silh.)  
 Savoia-Marchetti 82, *Illustrations*, 18 (Silh.), 79

**JAPANESE**

"Baka," 264, 275  
*Illustrations*, 264, 275, 275 (Silh.), 309  
 "Betty" 11, 158 (Article), 279  
*Illustrations*, 20 (Silh.), 23, 32, 38, 40, 46, 54, 70, 88, 115, 118, 135, 136, 158, 161, 163, 183, 188, 207, 208, 212, 225, 246, 249, 252, 263, 279, 279 (Silh.), 288, 309  
 "Betty" 22, 159 (Article)  
*Illustrations*, 39, 94 (N. & R.), 159, 159 (Silh.), 214  
 "Dave," 64  
*Illustration*, 122  
 "Dinah," 280  
*Illustrations*, 20 (Silh.), 32, 40, 64, 88, 115, 122, 134, 135, 136, 170, 207, 237, 246, 249, 252, 262 (N. & R.), 263, 265, 280, 280 (Silh.), 288, 301, 309, 315  
 "Emily," 140, 165, 285  
*Illustrations*, 21 (Silh.), 40, 43, 51, 55, 64, 74, 88, 107, 118, 134, 140, 143 (N. & R.), 165, 167, 173, 185, 234, 249, 252, 285, 285 (Silh.), 288, 290  
 "Fran," 240  
 "Frances," 51, 282  
*Illustrations*, 51, 54, 96, 106, 107, 113, 114, 118, 136, 163, 183, 198, 199, 201, 208, 212, 225, 234, 236, 246, 249, 252, 259, 282, 282 (Silh.), 315  
 "Frank" 1, 141, 155, 219, 231 (Article), 273  
*Illustrations*, 191 (N. & R.), 201, 218, 230, 231 (Silh.), 234, 236, 252, 273, 273 (Silh.), 288, 301, 309  
 "Gander" (Ku 8), 219, 287  
*Illustrations*, 218, 287 (Silh.)  
 "George" 11, 154, 219, 269, 308  
*Illustrations*, 191 (N. & R.), 218, 249, 252, 259, 269, 269 (Silh.), 301, 308 (Drg.)  
 "Grace" 11, 141, 182, 286  
*Illustrations*, 143 (N. & R.), 262 (N. & R.), 286, 301  
 "Helen," 284  
*Illustrations*, 13, 20 (Silh.), 40, 74, 83, 107, 118, 152, 188, 208, 252, 263, 284, 284 (Silh.)  
 "Irving," 51, 102 (Article), 165, 281  
*Illustrations*, 20 (Silh.), 47 (N. & R.), 54, 79, 94 (N. & R.), 102 (Silh.), 103, 115, 155, 163, 164, 165, 170, 201, 208, 249, 263, 281, 281 (Silh.), 312, (N. & R.), 315  
 "Jack," 276  
*Illustrations*, 55, 71 (N. & R.), 114, 138, 249, 252, 276, 276 (Silh.), 288, 301, 309, 313 (N. & R.)  
 "Jake," 286  
*Illustrations*, 21 (Silh.), 54, 79, 107, 182, 185, 211, 212, 214, 286 (Silh.), 288, 301  
 "Jill," 277  
*Illustrations*, 13, 19 (Silh.), 54, 113, 115, 135, 161, 163, 170, 182, 201, 208, 212, 213, 225, 246, 249, 277, 277 (Silh.), 290  
 "Judy" 11, 64, 140  
*Illustrations*, 19 (Silh.), 54, 76, 107, 111, 113, 115, 136, 140, 160, 161, 170, 183, 185, 199, 200, 252, 290  
 Judy " 22, 271  
*Illustrations*, 167, 271, 271 (Silh.)  
 "Judy" 33, 219, 270  
*Illustrations*, 218, 246, 252, 259, 270, 270 (Silh.), 288, 301, 309

"Kate," *Illustrations*, 19 (Silh.), 136, 234, 236, 246

"Lily," 284  
*Illustrations*, 20 (Silh.), 39, 64, 115, 161, 170, 199, 206, 208, 212, 234, 249, 252, 284, 284 (Silh.)

"Liz," *Illustrations*, 13, 21 (Silh.)

"Lorna," 286  
*Illustration*, 286 (Silh.)

"Mavis," 64  
*Illustrations*, 21 (Silh.), 55, 149, 161

"Myrt," 51, 114, 165, 277  
*Illustrations*, 55, 94 (N. & R.), 115, 165, 183, 185, 188, 249, 277, 277 (Silh.)

"Nate," 230

"Nell," 64  
*Illustrations*, 20 (Silh.), 40, 70, 88

"Nick," 283  
*Illustrations*, 20 (Silh.), 46, 70, 134, 155, 163, 164, 170, 185, 206, 214, 225, 249, 252, 263, 283, 283 (Silh.), 290, 301, 309

"Norm," 11, 183, 211, 286  
*Illustrations*, 262 (N. & R.), 286

"Oscar," 230, 272  
*Illustrations*, 19 (Silh.), 64, 74, 107, 111, 118, 136, 163, 170, 188, 197, 198, 208, 212, 230, 234, 236, 246, 252, 272, 272 (Silh.), 301

"Paul," 11, 211, 286  
*Illustrations*, 54, 71 (N. & R.), 210, 212, 214, 262 (N. & R.), 286, 286 (Silh.), 290

"Peggy," 1, 219, 278  
*Illustrations*, 200 (N. & R.); 218, 249, 252, 278, 278 (Silh.), 290, 301, 313 (N. & R.)

"Pete," 211, 287  
*Illustrations*, 21 (Silh.), 287 (Silh.)

"Randy," 308  
*Illustration*, 308

"Rex," 211, 286  
*Illustrations*, 286 (Silh.)

"Rob," 155

"Rufe," 211  
*Illustrations*, 21 (Silh.), 88, 177, 211, 212, 263

"Sally," 287  
*Illustrations*, 21 (Silh.), 39, 40, 42, 70, 88, 287 (Silh.)

"Sally," 2, *Illustrations*, 185, 288

"Sonia," 287  
*Illustrations*, 19 (Silh.), 287 (Silh.)

"Tabby," *Illustration*, 148

"Tess," *Illustration*, 21 (Silh.)

"Thalia," 243

"Thelma," 243

"Tojo," 230, 276, 298  
*Illustrations*, 19 (Silh.), 38, 64, 68, 94 (N. & R.), 111, 155, 161, 163, 170, 185, 190, 231, 245, 249, 276, 276 (Silh.), 298, 309

"Tony," 274, 308  
*Illustrations*, 19 (Silh.), 32, 55, 74, 88, 113, 118, 128, 155, 161, 166, 170, 207, 208, 212, 234, 252, 274, 274 (Silh.), 290, 308 (Drg.), 309, 315

"Topsy," 149, 287  
*Illustrations*, 149, 191 (N. & R.), 234, 287 (Silh.)

"Val," 64, 287  
*Illustrations*, 13, 19 (Silh.), 32, 39, 64, 70, 170, 212, 287 (Silh.)

"Zeke," 51, 64, 245  
*Illustrations*, 20 (Silh.), 32, 40, 64, 74, 118, 170, 185, 188, 198, 201, 212, 232 (Silh.), 233, 245, 249, 252, 257, 263

"Zeke," 11, 64  
*Illustration*, 55

"Zeke," 32, 51, 64  
*Illustrations*, 18 (Silh.), 23, 32, 40, 64

"Zeke," 52, 64, 165, 268  
*Illustrations*, 55, 71 (N. & R.), 76, 111, 114, 134, 135, 136, 155, 161, 163, 164, 165, 204-205, 234, 246, 268, 268 (Silh.), 288, 301, 309, 315

RUMANIAN

Ikarus I.A.R.81, *Illustration*, 47 (N. & R.)

RUSSIAN

DB-3F (IL-4), *Illustrations*, 15 (Silh.), 34, 64, 70

IL-2, *Illustrations*, 14 (Silh.), 23, 34, 64, 70, 88, 136, 161, 163

LA-5, *Illustration*, 15 (Silh.)

LAGG-3, *Illustration*, 14 (Silh.)

MIG-3, *Illustration*, 70

PE-2, *Illustrations*, 15 (Silh.), 34, 64, 70

PE-3, *Illustration*, 140

SB-2, *Illustrations*, 15 (Silh.), 70

TB-7, *Illustrations*, 15 (Silh.), 34, 185

TU-2, *Illustration*, 112

YAK-9, *Illustration*, 15 (Silh.)



COMBINED ARMS RESEARCH LIBRARY  
FORT LEAVENWORTH, KS



3 1695 00538 2916

MAY 1996