

FLIGHT

and
AIRCRAFT ENGINEER

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The Outlook

Peace—and Scope for Plenty

HERE we are at the first peaceful Christmas since 1938 in a world simmering down after six years of war. Where do we find ourselves?

As each successive Christmas has come round we have, as we thought, scraped the bottom of the barrel for the last time and looked forward to a more generous portion in the future. There is to-day still a good scraping to be gained from the aeronautical barrel, and at long last there is just a little income and all is not continual outgoing.

The petrol allowance for private flying is infinitesimal but it is a start, and when Transport Command have finished carrying prisoners of war, leave parties and "demobbees" halfway across the globe there will doubtless be larger supplies available.

On the civil aircraft side the outlook is far from black. The Avro Tudor came out on time and promises to exceed expectations. The D.H. Dove is undergoing trials, and the prototype Bristol Freighter is flying. The unfortunate accident to the Handley Page Hermes came as a severe shock, but the second prototype, which is now being proceeded with, promises to retrieve the position.

From the aircraft engine shops of Britain come the finest aero engines of the world. This is true of both gas turbines and piston engines. The range of British engines—from the four-cylinder, air-cooled in-line to the turbo-jet which took the speed record at two-thirds

throttle—is without peer in workmanship or efficiency.

Britain is quite able to do any job of work she is called upon to do, and if the terms of the loan from America seem hard, let us take our coats off and do a job like that which we did at the time of Dunkirk.

For This Relief . . .

IT is in times such as this, when a victorious nation is almost as bankrupt as one which has suffered a defeat, that gratefulness should be felt even for the smallest reliefs. On that score, the announcement that charter concerns and clubs are to be allowed even a little aviation fuel is welcome.

The amount being permitted as a maximum for the operation of charter services may certainly be considered just adequate, since it will allow a utilisation figure of 700 hours a year—and few charter operators are likely to be able to exceed this figure during the first year. Even the clubs will not be too badly placed with a maximum allowance of 600 hours' flying for every aircraft each year.

But the amount offered to the private owner is plainly ludicrous and, if that was the best to be offered, we can see no reason why this unfortunate member of the public has even been mentioned. Nobody but an optimistic lunatic is going to buy an aircraft at vast expense if he is to be limited to a figure of less than 50 hours of flying a year. At the lowest possible estimate this will mean that his flying will cost him something like £10 an hour.

At the moment it seems quite

At this first Christmas of Peace, the Editor and Staff of "Flight" extend greetings to readers at Home and Overseas, and especially to those still serving abroad. Many kind wishes already received are warmly reciprocated.

impossible that any rationing system similar to that applied to surface vehicles can be practicable where aircraft are concerned. For a dozen reasons it is necessary that any aircraft, even one operated by a private owner, should be topped-up with fuel after every landing, and the need for maximum prospective endurance is specially obvious in the case of professionally conducted aircraft flying on serious business in possibly unfavourable weather conditions. In any case, how can allowances be made for occasions when a charter aircraft may be left to orbit an airfield at a set height for any period up to an hour while more important transports are permitted to land in controlled order during poor weather conditions? The mere promise of some more coupons will not be of great value to the pilot who is sitting in cloud, or who is at the other end of England during a charter trip. And what allowance has been made for necessary post-overhaul test flights and run-ups?

Civil R.A.T.O.?

NOW that the days have finally gone during which cost was the least considered item in the aviation balance sheet, some very vigorous attempts must be made to keep down the overheads in civil airline operation. And by far the greatest of these overheads is, and will continue to be, that concerned with the layout and maintenance of airfields. We have reached the point even now when runways of 4,000 yards are not considered to be unreasonable, and the figure will continue to rise unless some definite limiting international agreement can be reached on wing-loadings for civil aircraft.

In the meantime, efforts must still be made in aircraft design to reduce both the take-off run and the length of time-lapse between take-off and "safety speed," while

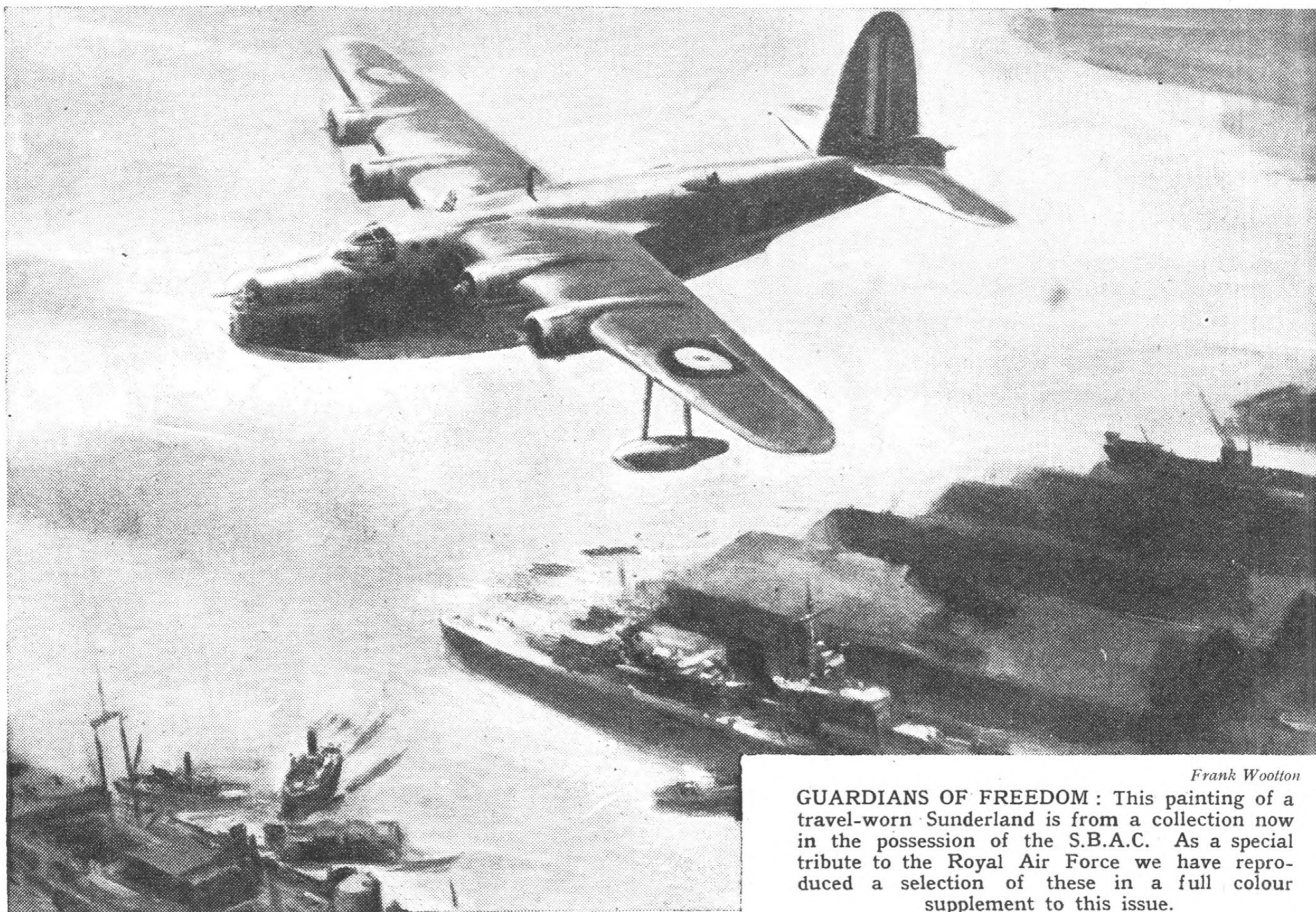
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still offering a high cruising speed and low operating costs on a distance-covered basis.

There are three immediately obvious ways of achieving this object. The first is to develop new high-lift devices; the second is to provide, as in the case of the Airspeed Ambassador, exceptional power-reserve coupled with good low-speed characteristics in the event of engine failure; and the third is to devise a form of rocket-assisted take-off system suitable for transport operation.

R.A.T.O. does not yet appear to have been seriously considered as a means of obtaining rapid acceleration between near take-off speed and safety speed, but we can see no reason why it should not be developed in a form which will be neither alarming nor uncomfortable for the passengers. Certainly the more knowledgeable occupants will be glad of any means by which the danger gap on take-off can be closed, while even the less expert passengers will be glad to feel height and speed being increased more rapidly.



Frank Woolton

GUARDIANS OF FREEDOM: This painting of a travel-worn Sunderland is from a collection now in the possession of the S.B.A.C. As a special tribute to the Royal Air Force we have reproduced a selection of these in a full colour supplement to this issue.

Since To-morrow

A Christmas Fantasy

By "INDICATOR"

HE was rather a sad young man with no outstanding characteristic except, perhaps, a tendency to look slowly over his shoulder at irregular intervals, as if he was expecting the wrong person to come up and slap him on the back. There was nothing actually furtive about the movement—just a slow uneasiness which is fairly common in these times.

It was early in the evening and the bar was as empty as we have learnt to understand the term nowadays. There was, in fact, room to move and seats on which to sit. I said something trite to him about London "not being the place we used to know," and added that it was a pleasure, for once, not to be playing a game of sardines with everybody else.

Like so many people who are feeling lonely after six years of communal life, he seemed to be glad to talk.

Apparently he'd just been released from the Service, so we had quite a lot in common. We inevitably found that we'd been at some of the same stations and had met many of the same characters. But at intervals his attention would drift away and he would listen quite perfunctorily to some probably pointless anecdote of mine while staring at something, so to speak, in his own mind. And he fiddled endlessly with half-smoked cigarettes, reducing them to rags.

Of course we talked about various flying experiences, and it was while I was describing my personal feelings during a minor adventure that I noticed in his face an expression which can occasionally be seen in that of a conductor when he is willing the strings to produce some exact shade of feeling.

Familiar Reality

I was telling him how, back in 1942 or thereabouts, the port engine of an aircraft had chosen to burst its blower impeller on me. I described the quite sudden and mysterious appearance of jagged holes, out of which fine jets of blue smoke streamed back from the cowling, and how the entire situation had all seemed ridiculously familiar. The sudden appearance of the holes, the failure of the throttle to prevent the revolutions and boost from falling away on the dials, my instinctive correction pressure on the starboard rudder, the way in which I was already working out a course to fly to the nearest airfield, the thought of my passengers, the two A.T.C. boys with parachute harnesses miles too big for them. . . . I described how it was all remorselessly familiar, just as if I had dreamt it a few hours, or days, or years before. I went on to wonder why all such unpleasant experiences seemed to be familiar, yet, at the same time, to be curiously unreal, and to remark how slowly the clock of life drags round while the sequence of events runs out like ticker tape to the end of the story.

Then he began. It was as if he had been awaiting just this moment and just this listener. My described feelings and ideas seemed to have come near enough to his own to break down some reserve or resistance. I won't attempt to give more than a few of his own words—merely his thoughts and theories and descriptions as they translated themselves through my own pictorial memory.

* * * * *

You've heard of *Experiment with Time*, he asked, Dunne's book? About dreaming the future. Dunne found himself doing just that, and because he was a scientifically

minded chap he couldn't bear to think he was a prophet or any nonsense of that kind, so he devised a theory of time-space to explain it. I don't necessarily believe in, or understand, his theory, but I *do* believe that he dreamed the future. I've been doing it myself on and off for two years. Not much of it; not enough to give me a line on things; but enough to make me wonder whether there is such a thing as reality and such a moment as "now."

It really began quite suddenly two years ago. Something happened to my mind, just as you describe. But for me it goes on happening. If you were interested I could easily give you the date when it began, because it was the

second night after I'd baled out of a troublesome aircraft during an evening test flight. The hydraulics had failed and I'd done everything I knew with the stupid emergency gear and had succeeded only in getting one leg locked down while the other was still flapping about in the slipstream. With about an eggcupful of fuel left and darkness falling I couldn't afford to wait around any longer, and I didn't feel like chancing a one-leg landing on that particular type. They burnt up too easily.

When I decided to get out, time seemed to stop. I wasn't frightened. It was just as you said—*familiar*. I'd done all this before. Under a purple-darkening sky the air was dead smooth and the Irish Sea stretched

endlessly away from the little fields of Cumberland like a dull silver carpet. It was all . . . static. Even the exhaust noise had become *wedged* in time—my time—and the rivets on the wing had been there since yesterday—or since to-morrow.

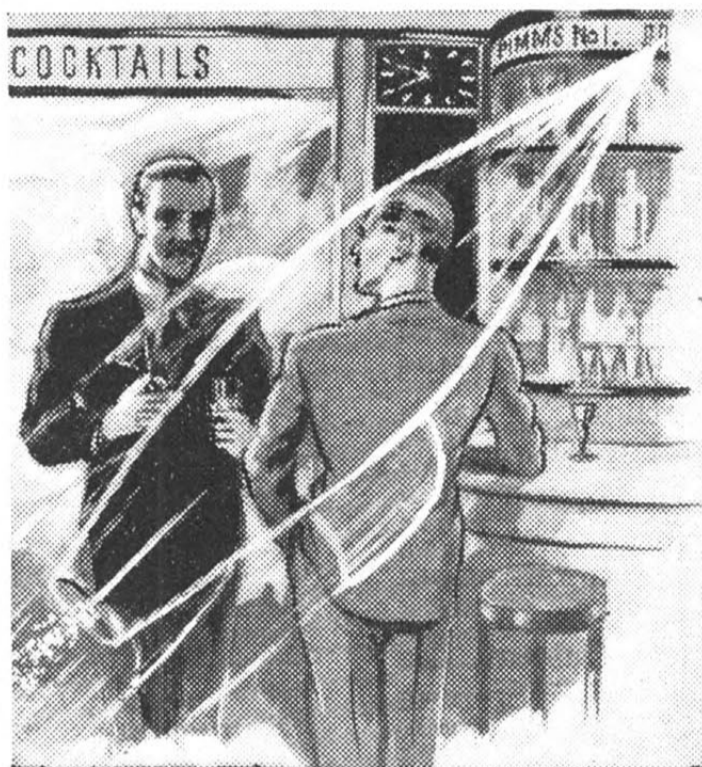
I turned the nasty old airship towards the sea, trimmed her back, opened the hood, undid my harness, stood up, and half fell out on to the wing before I was quite ready. Even when I found that I was spinning out along the wing instead of being blown straight off, there was nothing unexpected about it. I can still see the shape of the aileron shroud as well as I can see the shape of this glass. When I left the wing I was merely poised in space for another stretch of time while the kite drifted upwards and away like a dinghy left to its own devices by a swimmer. I was stationary, with the air clutching me like a thick, enveloping sea.

Too Coincidental

But I'm boring you. Lots of people have baled out and they all have their own story to tell. I got down all right. That was merely the beginning of it all. Nothing happened that night simply because, in the usual way, I gave myself too heavy a dose of alcohol to be anything but unconscious. Maybe the dreams began then, but my conscious mind was much too busy with a hang-over to attempt to remember them before they faded.

The dreams were about silly little things for a start—like remembering the cost of a car overhaul the night before I saw the bill. And I shan't forget the little smudge which made this bill, for a moment, look ten pounds more than it was—both in the dream and at the garage the following day.

It was the smudge and the queer-looking pence mark on that bill, so perfectly remembered, that finally lost for me the comforting feeling that the whole thing was really only a series of coincidences in rather poor taste. I started to take it all very seriously. I even went to the



SINCE TOMORROW

doc. and he passed me on to a psychiatrist who had'nt heard of Dunne—or who pretended not to have heard of him. The psycho boy, I know, thought the whole thing was a subconscious invention of mine, designed either to get myself off flying or to obtain some notoriety and a couple of extra rings: subconscioues are evidently not very well up in Air Force traditions and promotion systems!

A few weeks ago—and I only remember it so well now because I wrote it all down before I had time to forget it—I seem to have been involved, in an official capacity, in a future flying event of considerable importance. I wasn't on the ground; I was in some kind of machine poised at 20,000 metres. I'll tell you in a minute why I remember that figure. There were four or five of us, all looking through thick optically corrected windows in a pear-shaped shell which vibrated quietly but continuously.

Memory of a Memory

During the dream I knew exactly what it was and why I was there—and I felt no sense at all of the unusual. Now, with my conscious mind, I can only guess what it was about. All I have is the memory, so to speak, of the memory. I was excited but not frightened; I was jealous of the power and brains of one of the other occupants of the machine, who appeared to be a woman of considerable importance; I felt faintly superior about another occupant, who was talking noisily and excitedly into a microphone; and I felt a considerable and unqualified admiration for a third, who I remember as a radar expert—though the word "radar" is merely a translation of some understanding which I no longer possess.

Far below was an almost continuous carpet of cloud, the horizon was a clear black line, and the sky a deeper blue than I ever remember seeing in my lifetime flying. The temperature was absolutely constant and the sunlight through the windows could not be felt as heat. I remember the height figure because it was my job to see that it didn't vary, and also to follow, on a fluorescent screen, what appeared to be our own rate of drift relative to earthly configurations. This was somehow important because it had, I remember, eventually to be matched in some future calculations against the drift of another observation machine elsewhere. I've tried very hard to remember exactly how we were hung there, but I can't; all I know is that it was quite normal to me and that the power used was an accepted thing.

We were waiting quietly for radio information that a special projectile had left the ground and for knowledge of its E.T.A. relative to ourselves. I say "projectile" because I didn't think of it as an aircraft—that word appeared in my mind and was immediately dismissed rather as the words "flying machine" might to-day be dismissed and be replaced in the mind by "aircraft." It was a special device—but only, in some way, a variation of the one in which we ourselves were poised. Perhaps atomic power had arrived; that is the only thing I can imagine. Perhaps it was a speed record attempt being made at height and being timed by means of radar. If I had only given the matter some thought in my dream I'd be able to remember now. But I didn't; I'd done all the thinking before, and was merely waiting, with my mind a blank.

Preparations

On a bracket below my window were a pair of binoculars. Another of my jobs was to identify the projectile when it passed. Evidently there were going to be two of them. No, "binoculars" is the wrong word. I didn't think about them, but their function must have been to "foreshorten" time-space as well as to enlarge, giving a sort of slow-motion picture. Maybe their operation was much simpler. You know how, in sunlight, you can sometimes glimpse cannon shells leaving your guns? It was going to be like

that, and my idea of the "binoculars" now is that they were intended to ensure that I got just such a view with certainty, and not merely as an accident of lighting, eye focusing and eye movement.

When the moment came, I remember, I was very disappointed. It all seemed to be so normal and matter-of-fact. Of course, the radio message came only a second or two before the projectile was due to arrive, and it was almost past before I was ready. I remember the three-quarter rear view of something that looked rather like a finned shell. The nose was sharply pointed, the maximum thickness was two-thirds back, and the tail, from which emerged a fine stream of incandescent particles, was quite big in diameter. There were two prehensile wings rooted at about the centre of maximum fuselage thickness. In my dream it was as I expected, but I remembered that its shape had quite altered since I had seen it on the ground the day before. I can only imagine that the whole thing, perhaps, could be reshaped to suit different speed conditions. There were intense white vortices from one or two points, and I remember thinking that those vortices had not been expected and must have wasted a lot of power. Immediately after its passage there was a sharp shock. No sound—just a *jerk*, so to speak, in the sunlight.

And the whole experience was as real and as fixed in my consciousness as the memory of that summer evening when I baled out near the Solway. For both the memories there are wide gaps in the sequence, but I can't honestly say that these gaps were any greater for the dream than for the "real" experience that I remember. The difficulty with the dreams is that I can't always make my conscious mind remember why certain things happened, though I can remember quite clearly that the reason was obvious and accepted at the time.

Timeless Understanding

Something seems to go wrong during the transfer from unconscious to conscious—just as if the machinery for understanding, and even for remembering, is not capable of grasping facts that were quite easily grasped with the timeless part of my mind. There was nothing ridiculous, or extraordinary, or even particularly exciting about the circumstances of the dream I've just described—at the time. But it seems extraordinary and even ridiculous now. The situation would be the same, I suppose, if you took a man with the scientific knowledge and background of 1908, let him see the Herne Bay record runs of last month through the eyes and brain of a 1945 pilot, and then put him back in his 1908 brain to describe it all to one of his contemporaries.

The thing that really worries me is that I'm beginning to experience events that I don't understand at all and cannot grasp with my conscious mind—yet I always know that the circumstances were once, or will one day be, familiar. The effort of trying to remember and to translate is wearing me out.

Last night I lived for a while in a world which was, as I think about it now, a surrealist's nightmare of a universe in which something had slipped irrevocably. It wasn't our old familiar four-ale-bar time-space any more. Yet at the time I understood it perfectly, and accepted it, and was happy in a way that I never thought possible. Its only my damned conscious mind that is somehow unable to piece together the jig-saw. And it's driving me mad.

* * * * *

That was the gist of his rambling story. It carried us through several drinks, through dinner, and into a tube. I left him at South Kensington underground station with my telephone number and a promise to meet me three days later. He never turned up, and the Post Office tells me that the number he gave me hasn't had a subscriber since 1940, when the place was knocked down in the Blitz. Probably I wrote the wrong number down and he's lost mine. Perhaps he'll read this and drop me a line. I don't believe he was leg-pulling.

HERE AND THERE

R.A.F. Exhibition in Prague

MR. PHILIP B. B. NICHOLS, the British Ambassador, opened an exhibition organised by the R.A.F. in Prague last week.

On show are numerous photographs of aircraft, bombing operations in Germany, Britain and other war theatres, various items of equipment and apparatus for training pilots.

One section deals with the Czechoslovak Air Force in Britain.

New Guinea Pigs?

AUSTRALIAN troops stationed on Morotai, the northernmost island of the Molucca group in the Dutch East Indies, will be praying for the success of an experiment in aerial refrigeration (if they know about it, that is!) because a *Reuter* report says that 5,000 lb. of chilled beef—presumably their meat ration—is to be the subject of the experiment.

The meat is to be flown the 2,800 miles from Brisbane in a Dakota in order to "test whether meat can be kept fresh over long distances by the low temperatures prevailing at great heights."

If it can't, of course, there will be "bully" for dinner again!

Within a Decade

VARIOUS views have been expressed from time to time on how long it will be before the gas turbine jet engine finally ousts the piston type of power unit in aircraft.

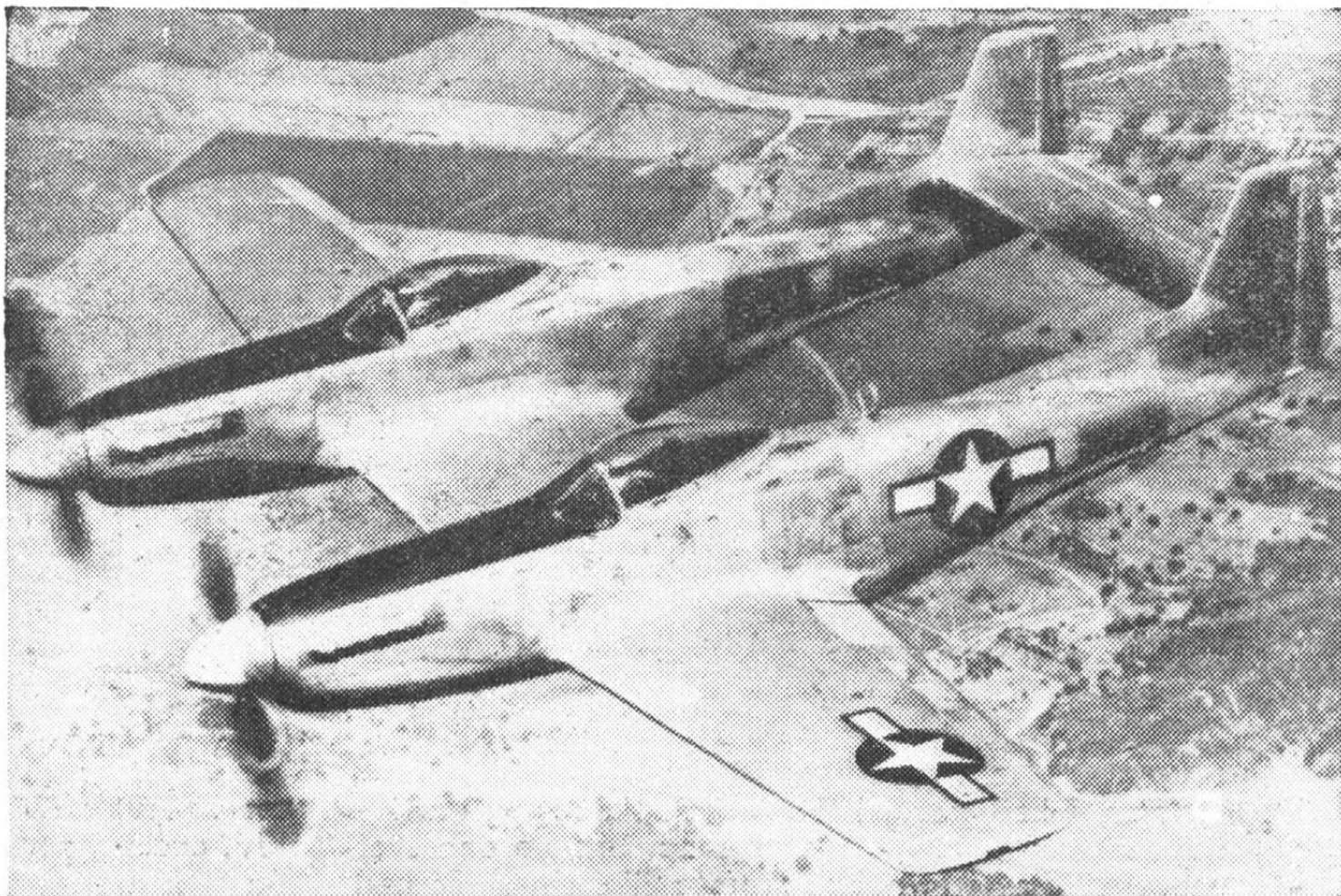
Air Comdre. Frank Whittle gave it from five to ten years when he addressed the Royal Institution in London last week, and said that they were only at the beginning of this field of engineering.

Absence of vibration and much reduced noise, he said, would add greatly to the comfort enjoyed by passengers in jet-propelled airliners, and he stressed the point that whereas it had been the practice to design piston engines quite independently of the airframes they subsequently powered, the jet-propelled aircraft of the future would be a "tailor-made" job throughout.

First of Its Kind

BELIEVED to be the only straight documentary film on the war history of a specific type of British aircraft, "The Mosquito," which was produced by Cecil Musk for the Film Producers' Guild, has now been re-edited for public exhibition and is being distributed by M.G.M. It made its debut as the second feature at The Empire, Leicester Square, last Friday.

Even in its original 45 min. length, this little film was packed with real in-



A WINNING DOUBLE: The recently introduced P-82 Twin Mustang (which thus "doubles up" on the British specification of America's best wartime fighter) has a top speed of over 475 m.p.h. and a combat range of more than 2,500 miles. It carries six guns, 25 rockets and four bombs, and two pilots to share long flights and thus avoid undue fatigue.

terest and was a distinct credit to the de Havilland cast no less than to its director, Capt. P. L. Cecil-Gurney. The re-edited public version runs for only 36½ min., and has gained in briskness without any factual loss, so adroitly has the cutting been done.

British prestige would greatly benefit by more films of this calibre (especially if shown abroad) and programmes would be vastly improved if they replaced some of the imported rubbish that now forms the bulk of "second feature" films in our cinemas.

Flying Racehorses

A NUMBER of enquiries from British and Irish racehorse breeders who want to fly bloodstock abroad have already been received by the Bristol Aeroplane Co. since it was made known that the new Bristol Freighter would provide facilities for the accommodation of a special horse-box to take two horses.

It is also expected that air transport between stables and courses in Britain will be sought by leading trainers, whose interest was aroused by the recent announcement of the Freighter's initial test flight.

Factory Allocations

AN area of more than 7,000,000 sq. ft. is represented by 28 additional "shadow" factories recently turned over by the Board of Trade to various firms for civilian production and export. Eventually they will employ about 35,000 persons.

Among the last 28, which brings the total allocations up to 170, are Brough to Blackburn Aircraft (aircraft engines), Barking to Henry Brown and Son (instruments), South Marston to Vickers-Armstrongs (aircraft), Stoke Orchard to Roy Fedden, Ltd. (aircraft engine research), Castle Bromwich to Dunlop (research), Sutton Coldfield to L. G. G. Charlesworth (plastic mouldings), and Bolton to de Havilland Aircraft (aircraft work, including jet engines).

News in Brief

Lord Henderson, son of the late Rt. Hon. Arthur Henderson, who joined Viscount Stansgate's personal staff early in November, has now been appointed an additional member of the Air Council.

Air Comdre. the Earl of Bandon has been appointed Commandant of the Royal Observer Corps in succession to Air Comdre. Finlay Crerar. He was formerly A.O.C. No. 224 Group, South-East Asia Command.

An east-west transcontinental record for Australia has been set up by a Sky-master of R.A.F. Transport Command captained by Flt. Lt. I. G. C. Hall, with a flight from Sydney to Perth in exactly nine hours—an average speed of 244 m.p.h. for the 2,200 miles. It was part of a routine flight on the Ceylon-Australia service.

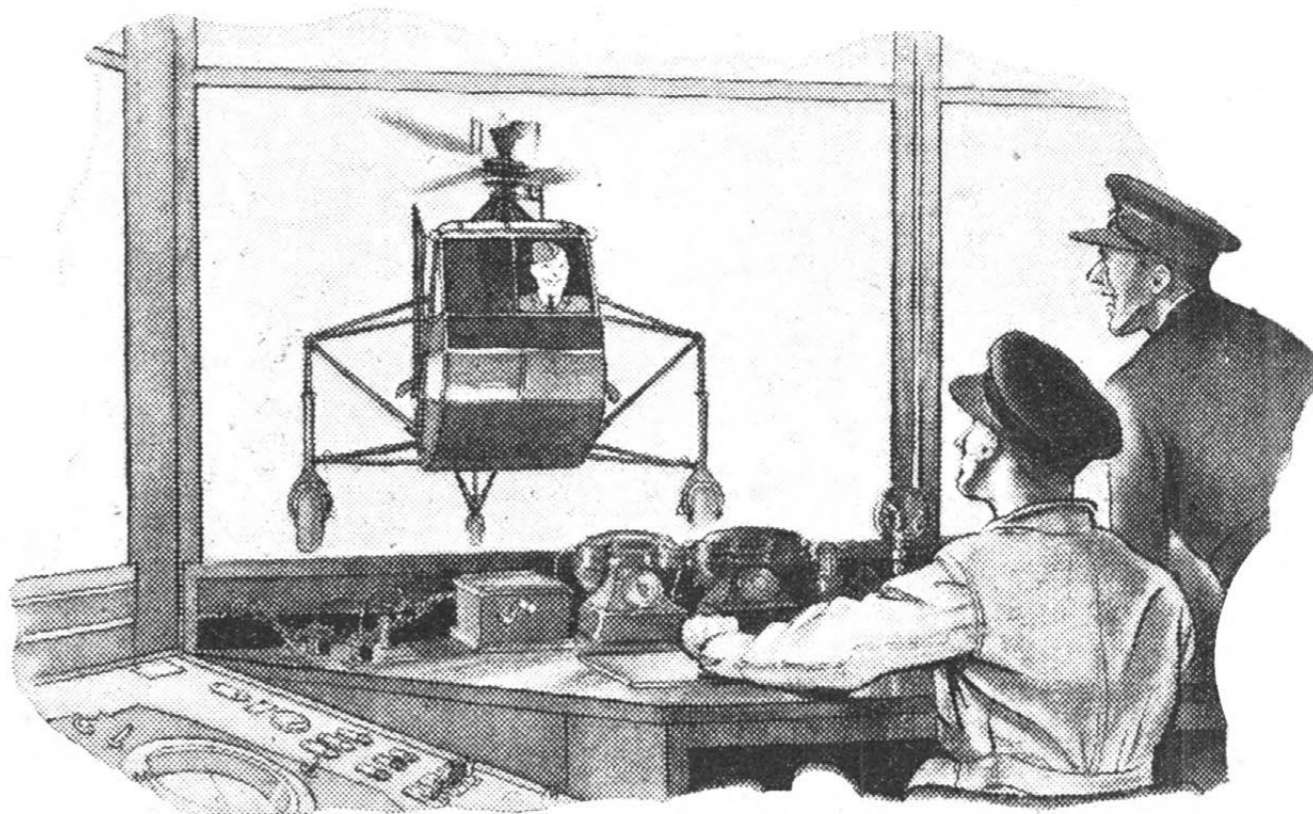
More than 800 students from the air forces of France, America, New Zealand, South Africa, Rhodesia, Egypt, Yugoslavia, Greece and Iraq have been trained at the Middle East Flying Control School since it opened at Heliopolis 18 months ago.

A lecture on "The Future of Electrics in Aircraft," by Messrs. J. B. Shearer and E. Robinson, of Rotax, Ltd., is to be given to the Society of Licensed Aircraft Engineers at Manson House, Portland Place, London, W.1, at 3.30 p.m., on Saturday, December 29th.

An exhibition of measuring and inspection equipment is to be held at the London offices of Alfred Herbert, Ltd., 70, Vauxhall Bridge Road, S.W.1, from January 7th to January 18th next, and will be open daily from 10 a.m. to 6 p.m. Some 14 or more different types of equipment will be included and the exhibition should appeal to all those interested in modern inspection methods.

STATE OF SUSPENSE

"... it stopped again and just hung there a few feet away, the face of its pilot one huge grin."



Of course, I had warned the A.C.O. that it was arriving at 09.00 hours to pick me up, but no one ever expected that it would be quite like this. It had approached normally enough, but, instead of doing an ordinary circuit, it came twirling along at about walking pace till it was smack over the control tower.

Then it stopped. Just like that. Next, sinking slowly (as if attached to an invisible parachute) till it was level with Control balcony, it stopped again and just hung there a few feet away, the face of its pilot one huge grin. Even he, who was presumably used to it, was enjoying the situation; so you can imagine what the effect was on us, who, with the exception of myself, had never set eyes on a helicopter before!

Of course, work on the Station pretty well stopped. ACHGDs abandoned their brooms and potato-peeling and rushed out. The Station Adj. forsook his "In" tray and even the Stationmaster could not resist the temptation to come out to see what was going forward or, rather, what was coming downward.

The creature had resumed its descent and was gingerly feeling for the ground with one wheel. Finding it, it gently lowered the other and then slowly inclined its whizzing tail downwards till its third wheel was safely earthed.

Two or three local wits were now shaking me by both hands and promising to arrange "full military honours." The Airfield Control Officer coined obituaries. I hadn't really had time to think till now, but as I climbed into that pulsating cabin I began to wonder if perhaps there wasn't something sinister behind these pleasantries after all.

But why, you ask, was I about to dice with death in this extraordinary contraption? Well, the fact was that one of the Station's aircraft had recently met with misfortune. It had come apart at ten thousand feet, and I was there to try to find a reason for this unorthodox occurrence. The pieces had fallen into cornfields, where they obstinately defied all attempts to find them; and until they were found my position was analogous to that of a coroner who has no body to sit on. So I had hit on the idea of borrowing this helicopter, and here it was. Here, furthermore, was I, sitting by the driver in some trepidation, waiting for something to happen.

I hadn't long to wait. The pilot twisted the handle of a large lever which protruded from between our seats, and a sort of muttering (which seemed to be originating from a point an inch or two from my spine) suddenly changed to a loud roar. The pilot's control column began a gentle circular oscillation, but nothing much else seemed to happen except that the control tower was sliding almost imperceptibly downwards past our cabin windows. I let go the breath I had drawn some five minutes previously and took a gander out of the open window. We were about

twelve feet off the deck, but we weren't moving perceptibly, except, perhaps, upwards. I decided that helicoptering was a piece of cake, and was idly wondering if my driver had ever been a lift boy when he moved his stick slightly. Without a word of warning the panting creature shot off backwards to a position about fifty feet above the middle of the airfield, where it suddenly stopped again. Fretfully I turned to the lift boy.

"If it's all the same to you, chum," I said, "you'd greatly oblige me by going forward next time; I'm more used to it that way."

He grinned. "O.K.," he said. "Now let's have a look at the map."

We hung there in the sky, motionless, while I indicated the scene of operations, our huge rotor churning the air over our heads.

"Right," said the lift boy. "Stand by to go about." He pressed a pedal, and the whole contrivance forthwith pivoted round through a hundred and eighty degrees till we faced the right direction. "Are we heading about right now?" I nodded, speechless.

He thereupon stuffed the nose down and urged our vehicle into a sort of loping canter towards the west.

There was an air-speed indicator in front of me, but I could see nothing on it except luminous paint. However, I guessed our speed to be about four miles an hour, and I couldn't have been far out at that, because it was just then that the cyclist overtook us in the country lane a few feet below. If I'd had a clothes-prop I could have knocked his hat off as he whizzed by. He must have been very deaf, because he only noticed us as he passed. Poor soul, he gave us one horrified glance, then, leaping from his machine, vaulted a farm gate and legged it into the countryside. I wished we'd had time to follow him, but we had work to do.

Finding the wreckage was just too easy. We spotted a large piece almost at once and we stopped immediately over it. Revs. 1,850, height three feet six, air speed nought m.p.h. I leaned out taking notes and photographs.

Whilst we quartered the cornfields at a height of about six feet, villagers turned out *en masse* and gaped at us, as well they might. Once we "settled" in a meadow, and an old farmer who came up declared that he "'adn't see'd nowt like it; leastways not since Varmer Burbidge's bull tossed my ole woman up into 'ay rick. But I see'd you two gennelmen go a mort 'igher'n what 'er did; aye, an' come down softer!"

The search was soon over, and we found ourselves over a large mansion where I had been hospitably treated the previous day, when I had called in my car, seeking eye-witnesses. I appraised the lift boy of this circumstance, and, as the prevailing weather conditions were conducive to thirst, he declared his intention to go visiting.

Accordingly we manoeuvred to the estimated position of

By

SQN. LDR. T. MAMMATT

STATE OF SUSPENSE

the front door, slowed down our rotor and sank slowly towards the gravel sweep in front of the house, pausing a moment on a level with the top windows, where we derived considerable amusement from the expressions on the faces of two young women engaged in making a bed.

The occupants of the mansion had by now come out, and, together with a large number of tenants and retainers, leavened with an assortment of dogs, had formed themselves into a reception committee. Amid enthusiastic demonstrations we got out and were entertained within for a pleasant half-hour with sherry and biscuits.

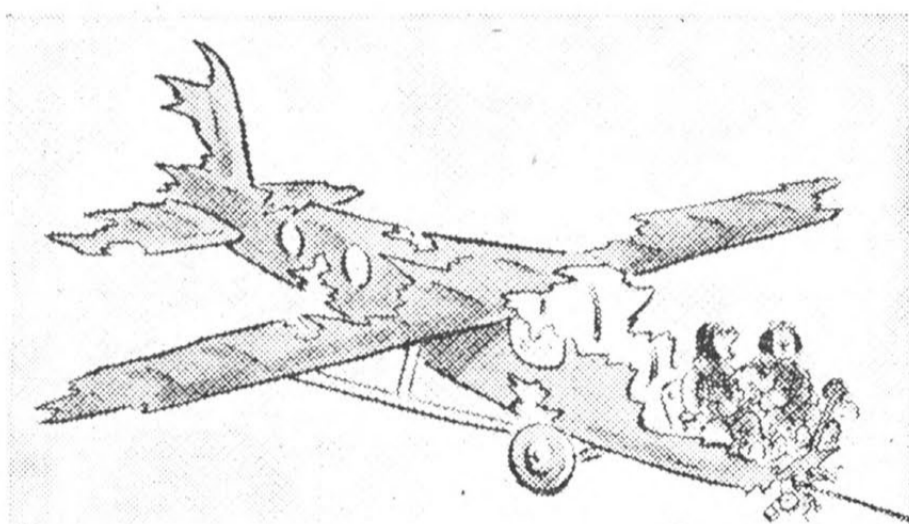
Then, thanking our hosts, we returned to our vehicle. Soon the Warner Super Scarab had roared into life, and our accelerating rotor blades were doing their utmost to decapitate a couple of Italian co-operators whose enthu-

siasm had outrun their discretion. Slowly we rose up past the windows, executed a steeply banked turn round the roof, then, stuffing the nose down, wallowed off on a course for my Station, where a "settling" was effected fifteen minutes later.

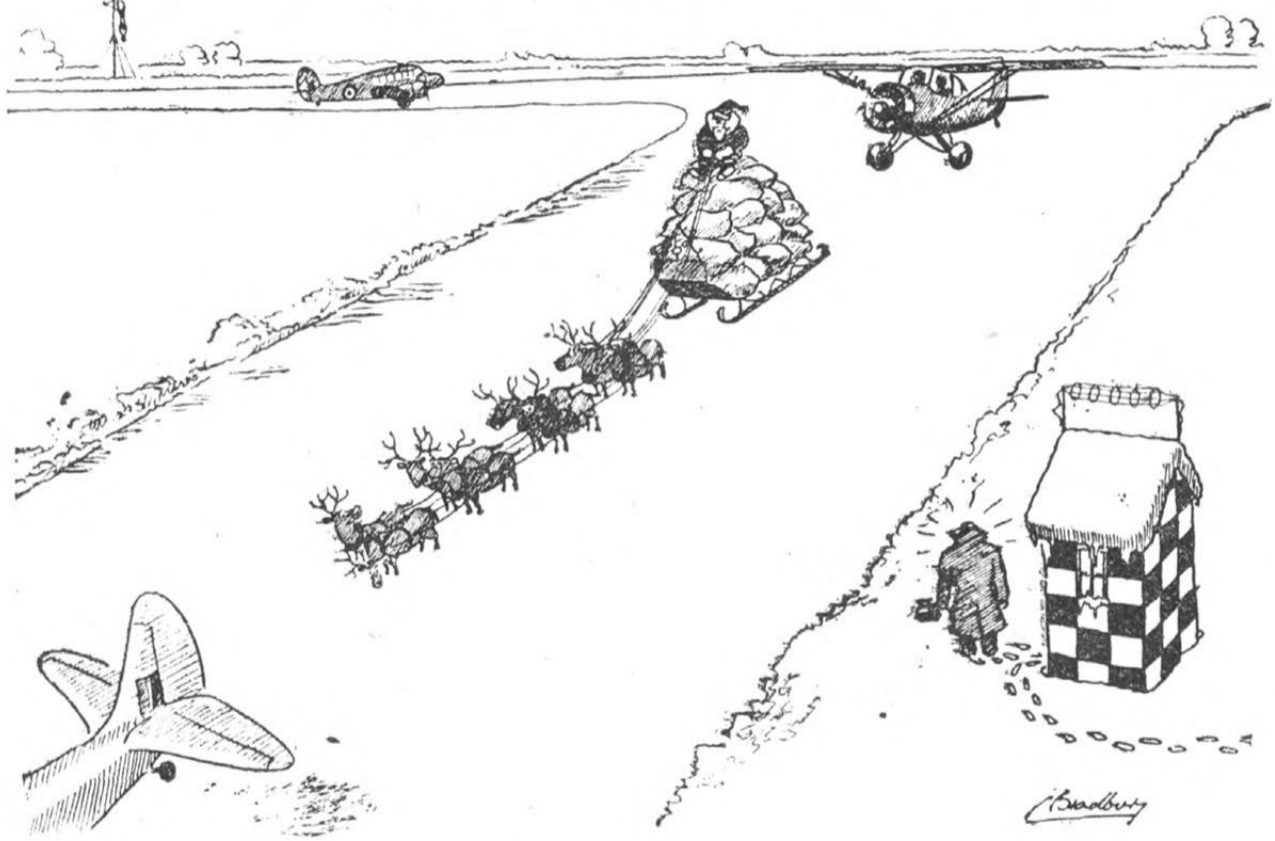
Regretfully I said good-bye to the lift boy. He had handled his flying merry-go-round in a masterly manner, and, I think, had enjoyed the trip almost as much as I had. Nostalgically I watched the evening sunlight flashing from the whirling rotor blades as he trundled his peculiar apparatus back to base.

"Long life to you, Mr. Sikorsky!" I murmured. "Your inventive genius has materially aided me in a difficult task. You have provided me with an experience which I shall never forget, and you have made me laugh!"

CHRISTMAS INTERLUDE



"It should be interesting when he releases" (Flying)



"Wait for the Green, Papa!"

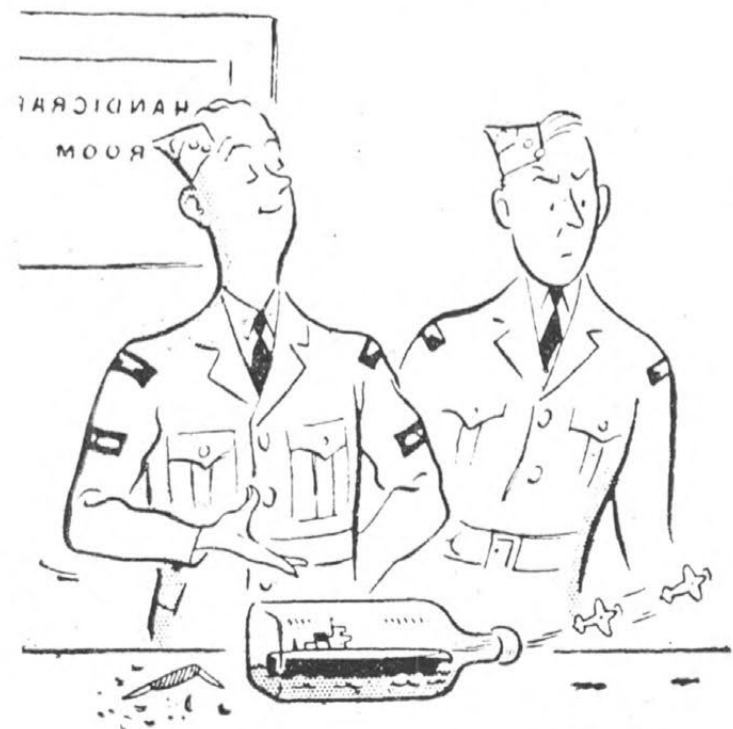


COLLINGRIDGE

"EX USAAF"



COLLINGRIDGE
'IT MAKES A NICE CHANGE COMING IN ON THE BEAM'



(Air Mail.)

British Aircraft Gas Turbines

Dr. Roxbee Cox Delivers the Wright Brothers Lecture to American Institute of the Aeronautical Sciences

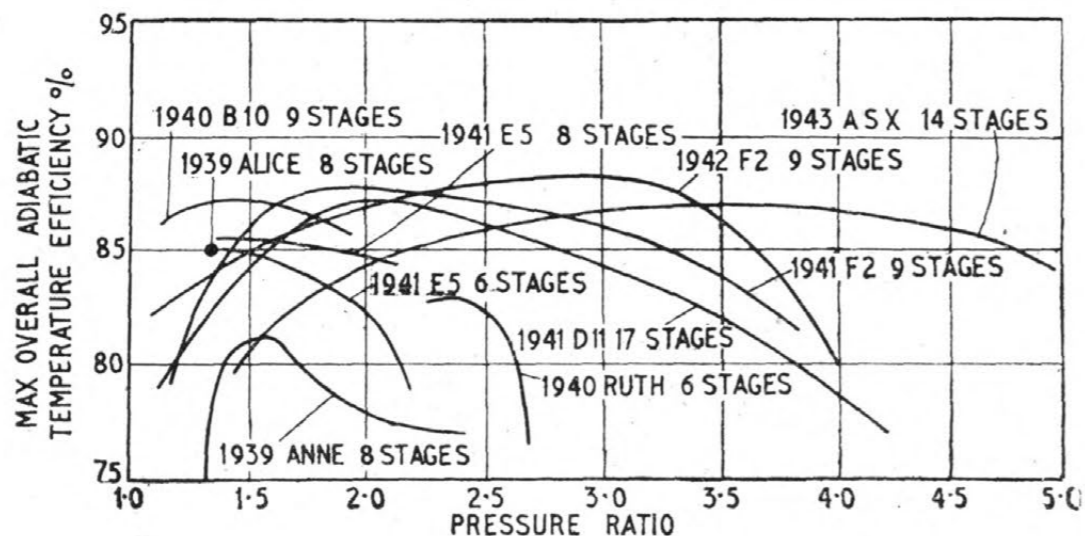
THIS year's Wright Brothers Lecture was delivered on December 17th to the Institute of the Aeronautical Sciences (the American equivalent to our Royal Aeronautical Society) by Dr. H. Roxbee Cox, chairman and managing director of Power Jets (Research and Development), Ltd. He introduced to his American audience the work done in Great Britain on aircraft gas turbines, beginning with the early investigations of Whittle, Griffith and Constant in difficult circumstances before the war, and tracing the two main lines of development associated with axial and centrifugal compressors.

The contributions made by various British firms were noted, and the collaboration between them was the subject of special comment. Some of the problems encountered were outlined, and facilities available for development described. A comparison was made between the characteristics of single and double-sided centrifugal compressors, the merits of axial and centrifugal compressors, of jet reaction, ducted fan and airscrew propulsion systems, and finally an examination of the influence of the gas turbine on airframe design.

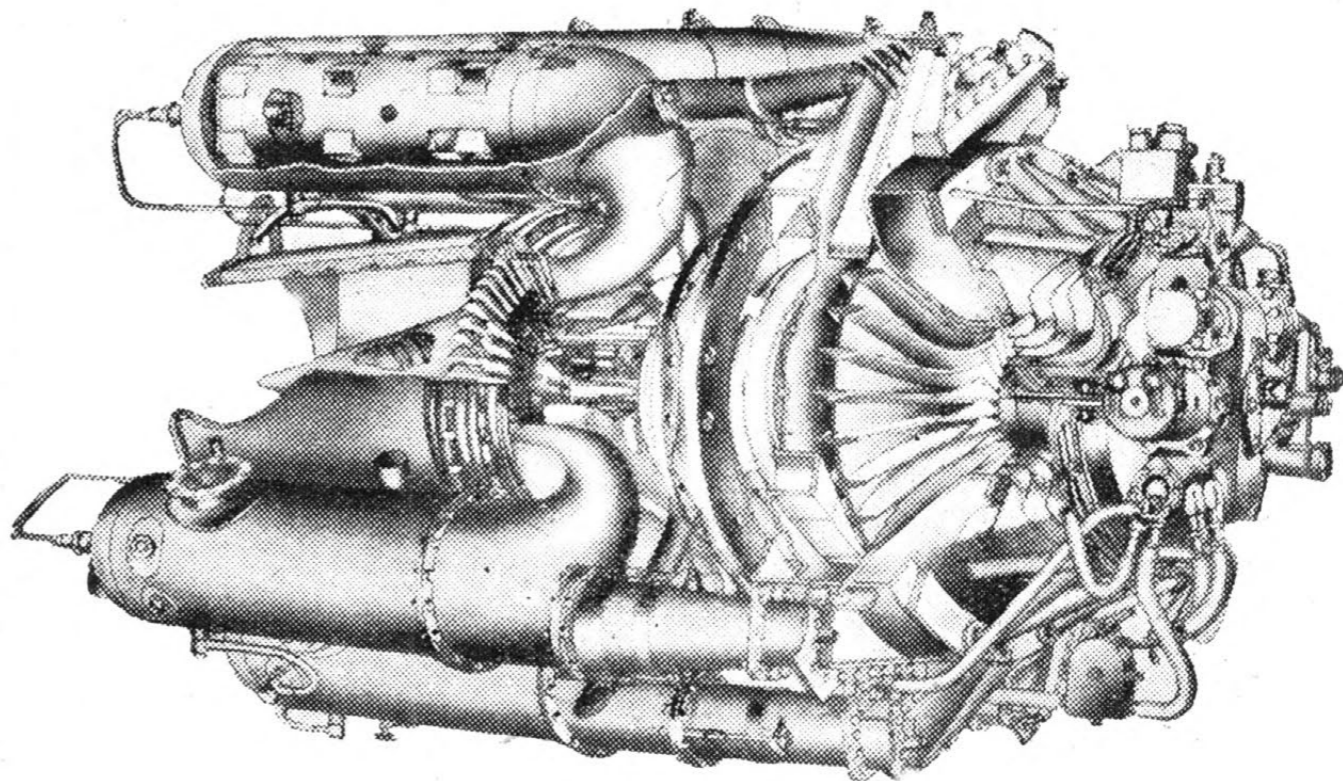
A good deal of Dr. Roxbee Cox's lecture was devoted to subjects with which our readers will already be familiar, either through the pages of *Flight* or from a study of "Gas Turbines and Jet Propulsion for Aircraft," by G. Geoffrey Smith, but much of the lecture dealt with aspects less familiar, or with details not hitherto disclosed.

Dr. Roxbee Cox caused some surprise by pointing out that the first gas turbine patent was granted in England to John Barber in 1791. The present flow of British gas turbine work springs from two distinct streams, one (axial compressors) owing its origin to Dr. A. A. Griffith, the other associated with the centrifugal compressor and Air Commodore Whittle's name. It was in 1926 that Dr. Griffith produced at

Sea level static performance of the de Havilland Goblin II production engine.

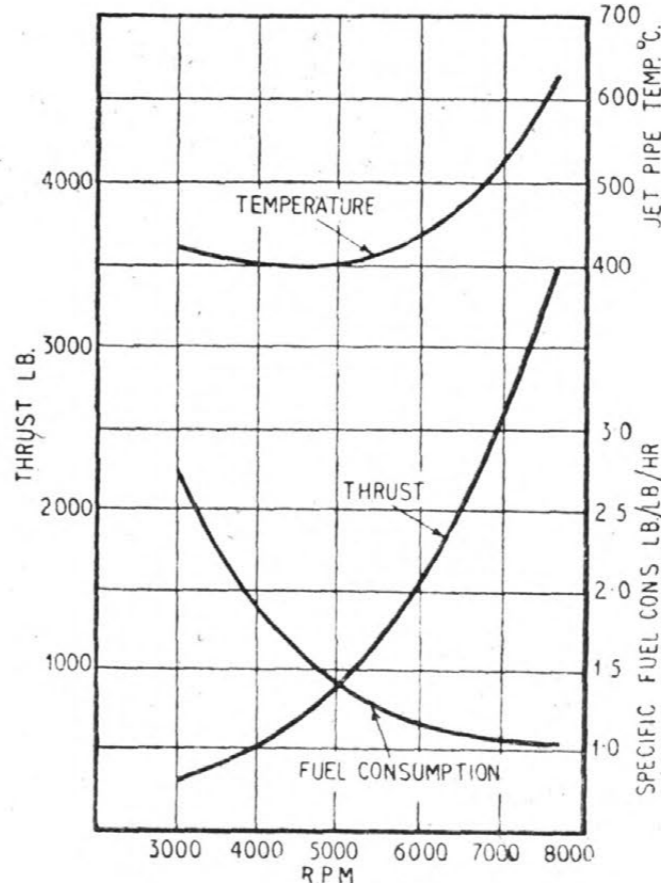


Some data on early axial compressor efficiencies.



Cut-away view of Power Jets W2/700 engine with second blower casing and improved diffuser system.

the R.A.E. an aerodynamic theory of turbine design, and in 1929 he discussed in an official paper the prospects of the internal combustion turbine driving an airscrew. In 1936 the R.A.E. obtained authority to build an axial-flow compressor. This was damaged by an enemy bomb in 1940, but in the meantime a more ambitious scheme had taken shape. In 1937 Mr. H. Constant of the R.A.E. put forward a paper and came to the conclusion that a turbine to drive an airscrew could be constructed which would compare in specific weight and fuel consumption with the piston engine. This proposal, as well as the Whittle jet propulsion scheme, was discussed by the Engine Sub-committee of the A.R.C. The results, so far as Whittle is concerned, are known to our readers, but a few words about the Constant scheme will not be out of place. The R.A.E. entered into collaboration with Metropolitan-Vickers and much design work was done, resulting in the B.10 with a nine-stage axial compressor driven by a four-stage turbine. This was followed by a series of schemes in which the air flowed without bends through a single compressor, an annular combustion chamber, the compressor turbine and a power turbine.



In the meantime, an experimental turbo-compressor very much like that suggested by Griffith was designed by the R.A.E. in 1938, manufactured by Armstrong-Siddeley in 1939 and tested in 1940.

Of the Whittle history much has already been published, and Dr. Roxbee Cox gave an account of the work,

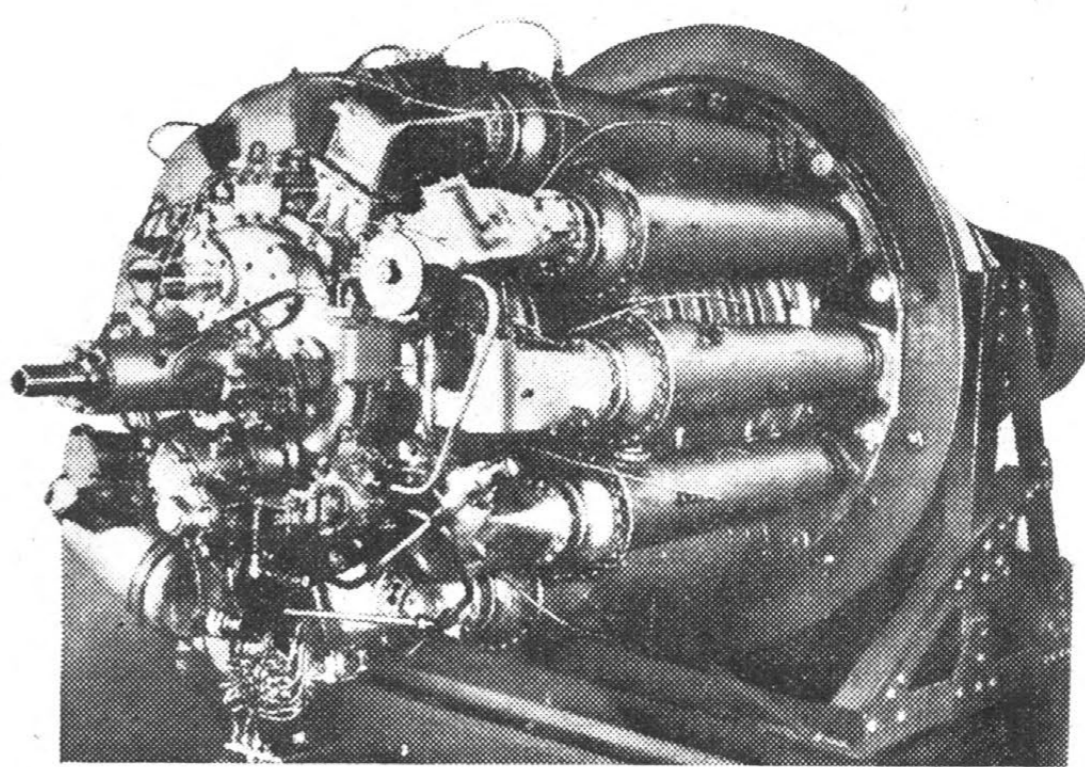
Sea level static performance of the Metropolitan-Vickers F.2 engine.

BRITISH AIRCRAFT GAS TURBINES

paying due tribute to all who were concerned in the co-operative work, such as B.T.H., Power Jets, the Rover company, Halford-de Havilland and Rolls-Royce. He particularly praised the Rover firm for their work in a difficult period, and for their courage in initiating the change-over to straight-through combustion. The change caused technical controversy, but he said he now thought that, under current conditions, the straight-through arrangement originally demonstrated on the Halford H.I has the advantage over the return-flow system of the classic Whittle engine.

Collaborationists

The different gas turbine engines dealt with in the lecture have been described in *Flight*, but the Armstrong-Siddeley engines are of interest. At the time this firm was given its first contract (November, 1942) there was, Dr. Roxbee Cox said, an overwhelming concentration on the centrifugal-compressor type of engine, Metropolitan-Vickers being the only exponents of the axial compressor. Armstrong-Siddeley sought to redress the balance and began work on the ASX, a fourteen-stage axial-flow compressor engine with a two-stage turbine. The ASX has eleven separate combustion chambers. Testing began in April, 1943, and the engine is now giving a maximum thrust of 2,800 lb. in the static condition at sea

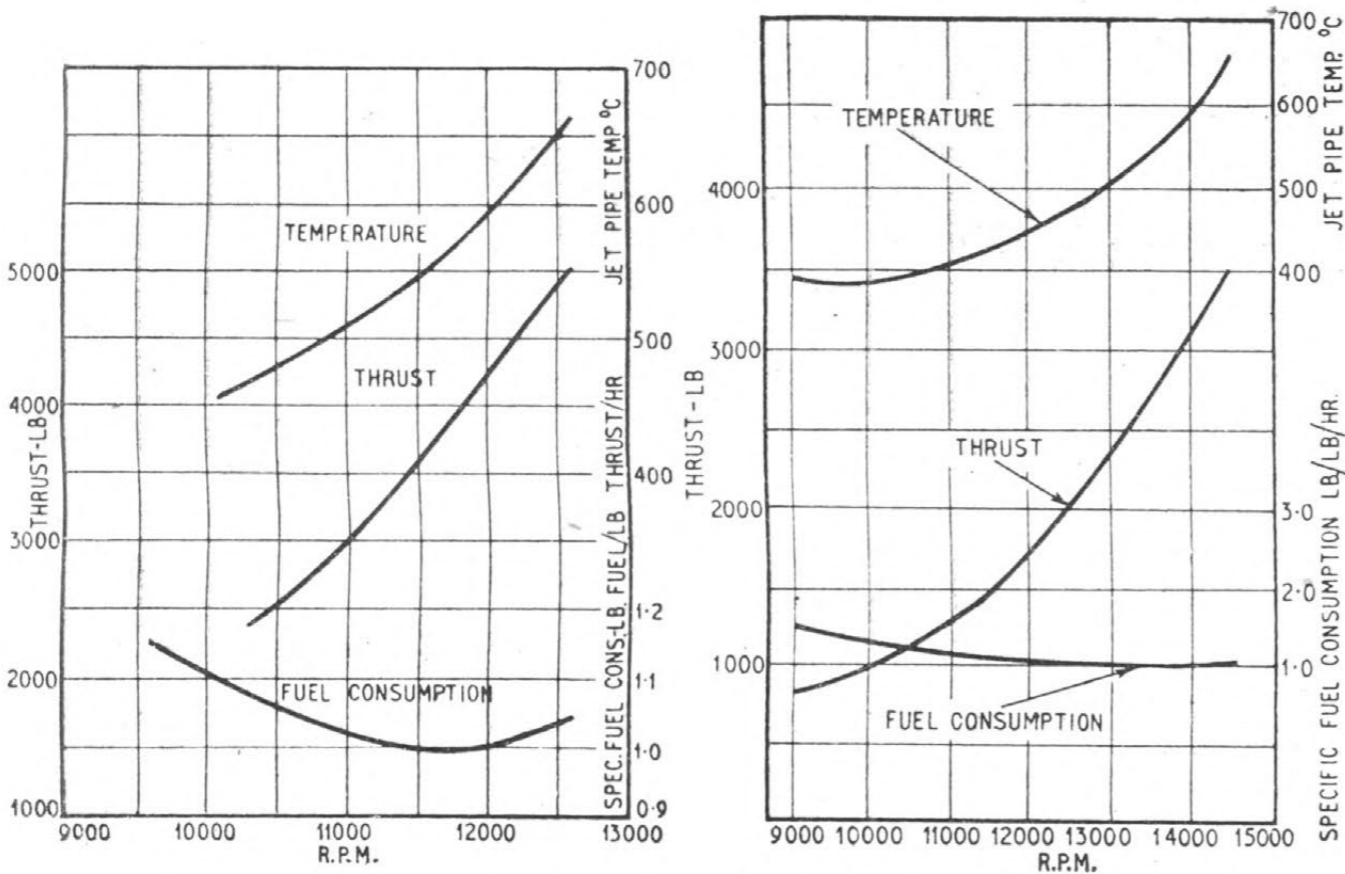


The Armstrong-Siddeley ASX engine.

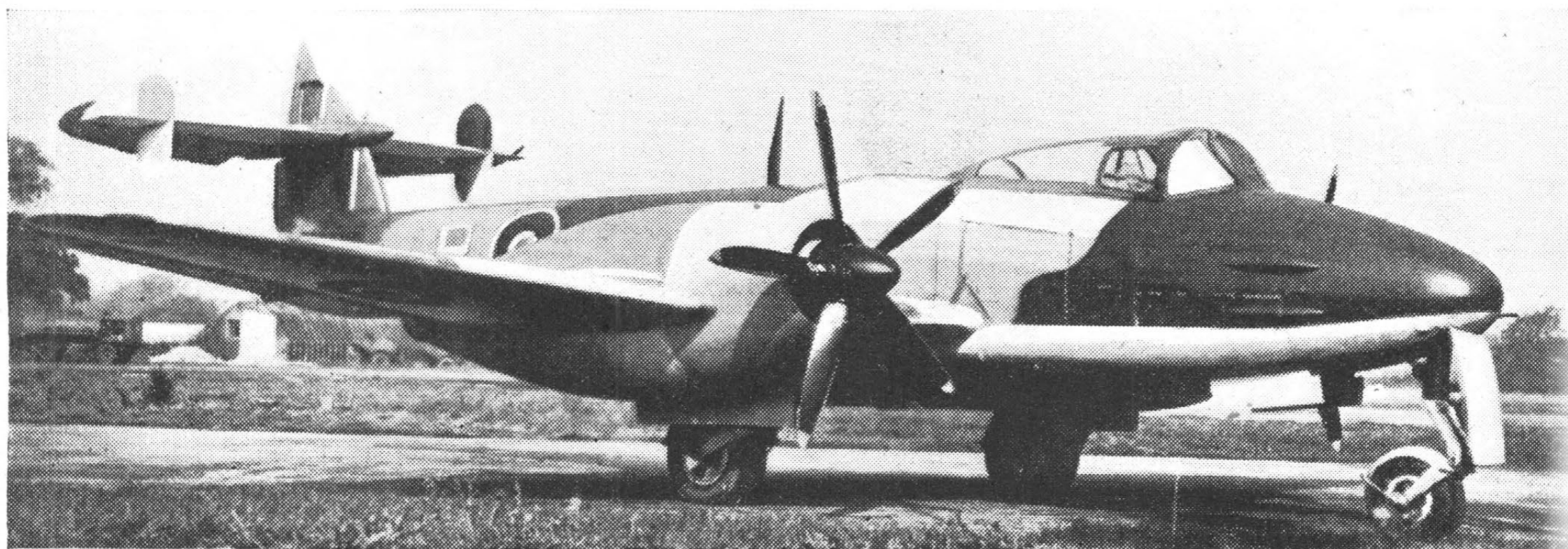
level. It is being tested in the Lancashire "Universal Test Bed." Tests of the compressor on the Northampton test plant established an adiabatic efficiency of 87 per cent.

One section of the lecture dealt with "The Gentle Art of Collaboration," and set out to show that this had been an unqualified success under the guidance of the Gas Turbine Collaboration Committee. Special appreciation of the work of research teams was expressed, notably Mond Nickel, Firth-Vickers, Jessops and the N.P.L. on high-temperature materials; Power Jets team on burners; Power Jets (Research and Development), Lucas and de Havilland teams on combustion technique, the work of the Asiatic Petroleum Company and the Combustion Panel on the physics of combustion, and the work of Mr. Constant's team at the R.A.E. on gas analysis, blade vibration and blading design.

Later parts of the lecture dealt with experimental facilities such as combustion test plant, component test plant, and flying test beds. Of the latter, we have already illustrated the Wellington bomber modified to take a W2B engine in the tail. A picture of the Lancaster is published here. Dr. Roxbee Cox explained that in the Lancaster the engine is mounted in what was previously the bomb bay instead of in the tail. The advantage was that in this



Sea level static performances of two Rolls-Royce engines, on the left the Nene and on the right the Derwent V.



A Gloster Meteor experimentally fitted with Rolls-Royce Trent airscrew turbine engines.

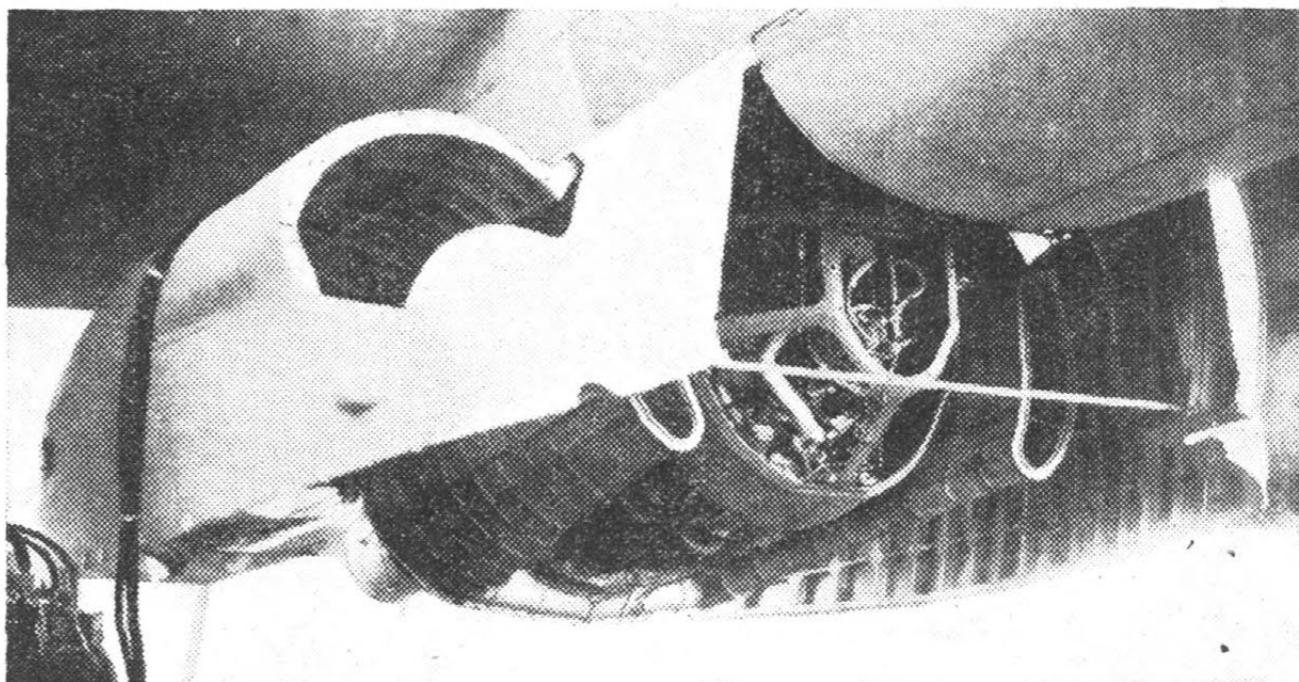
BRITISH AIRCRAFT GAS TURBINES

position a variety of engines of different form can be slung very conveniently. The first engine to be installed thus was the Armstrong-Siddeley ASX.

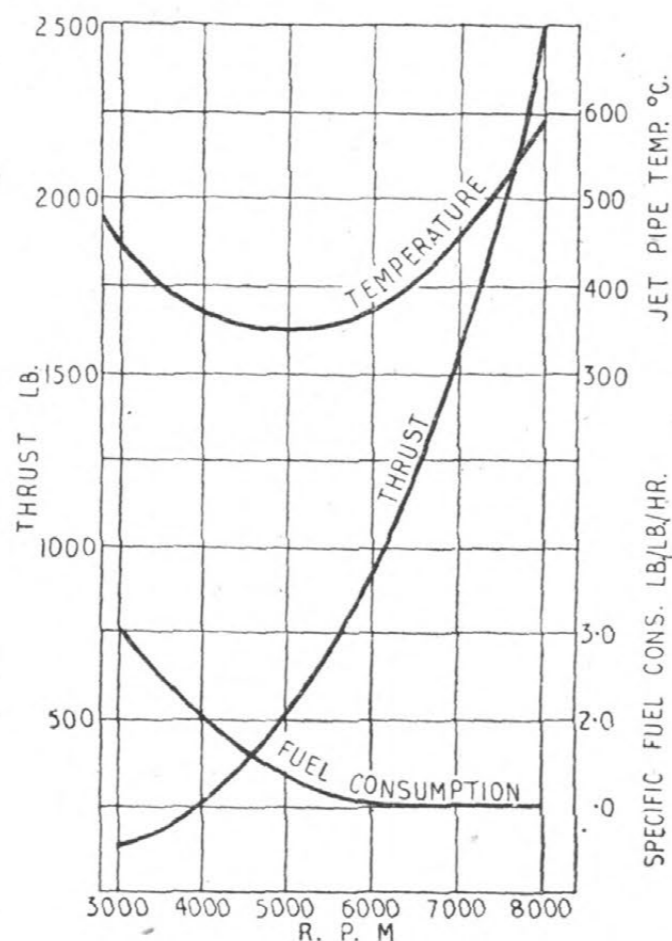
Since many people, even in this country, will not be very familiar with the general organisation of gas-turbine work, a summary of this section may be of interest. The centre of this organisation, the lecturer said, is the Ministry of Aircraft Production. Their overall policy is determined and implemented by contract. Grouped around the Ministry are the Government-owned Power Jets (Research and Development), Ltd., which conducts investigations in the general interest; and the Rolls-Royce, de Havilland, Bristol, Armstrong-Siddeley, Metropolitan-Vickers and British Thomson-Houston companies which develop engines along different lines. All these companies are doing gas-turbine work under Government contract.

He explained that the Power Jets company, with its 100 per cent. Government shareholding, does not compete commercially with the others; it constructs engines for experimental purposes, but does not go into production, which is the business of the other companies. The forum for intimate technical discussion and collaboration is the Gas Turbine Collaboration Committee.

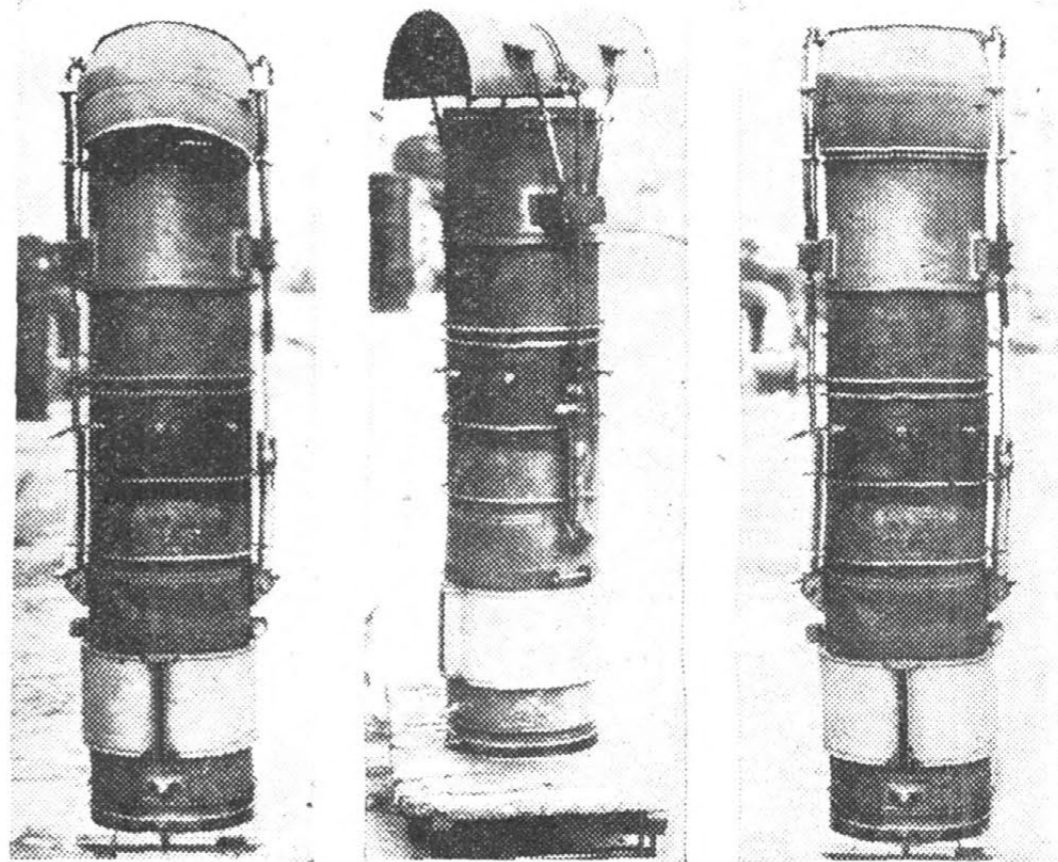
On the subject of the union of airframe and engine Dr. Roxbee Cox said that in the gas turbine, as distinct from the piston-engine, the three main thermodynamic processes take place in three different



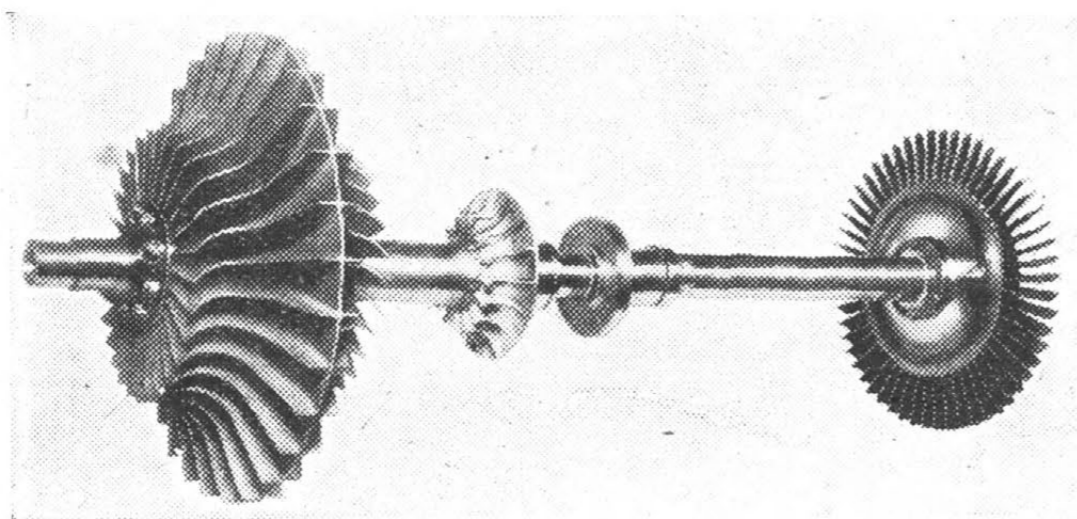
The "Universal Test Bed" Lancaster with ASX engine installed in the bomb bay (seen with doors open).



Sea level static performance of the Armstrong-Siddeley ASX engine.



Power Jets thrust spoiler which can give negative thrust for braking.



The rotor of a Derwent engine comprises a double-sided moeller at one end of the shaft, the turbine at the other and a fan for cooling the bearing in the centre.

components: the compressor, the combustion system, and the turbine. Not only are the shapes of these three susceptible to considerable variation, but their disposition in relation to each other can be varied too. The number of possible forms is legion, and with all these variations the aircraft designer has a wonderful opportunity for compromising between and inter-relating the structural and

power-plant parts of his machine. However, although considerable lip service has been paid to this point, Dr. Roxbee Cox said he was unaware of any aircraft in any country having been designed in a way consistent with such an ideal.

After outlining the advantages and disadvantages of turbine/airscrew combinations Dr. Roxbee Cox summed up by saying that for the longest ranges required the jet-propulsion gas turbine is beaten by the airscrew/turbine combination. In the long-range sphere the competition may be between the airscrew/turbine and the ducted-fan/turbine engines, but comparing the tractor-airscrew/turbine aircraft with the ducted-fan/turbine aircraft, the slipstream drag of the former may outweigh the better fuel consumption of its engines. If pusher airscrews are advanced to clinch the argument in favour of the airscrew version, then discussion becomes very complex, as mass balance of the aircraft, installation problems (e.g., jets fouling airscrews) and engine design (e.g., airscrew shaft and exhaust at the same end of the engine) are rapidly introduced; but whatever the result of this competition, it would be wrong to assume that either airscrew or ducted-fan/gas turbines are essentially long-range engines.

(In next week's issue of "Flight," certain aspects of Dr. Roxbee Cox's lecture will be dealt with in detail and various other jet units and components illustrated.)



The de Havilland Vampire I (D.H.100)

A "Conventionally Unconventional" Jet Fighter Described : Good View, Exceptional Handling Qualities and High Operational Maximum Speed

SO much has been said in recent months about speed in relation to handling qualities, and so many official and unofficial maximum figures have been given, that it is difficult to approach the case of any high-speed fighter aircraft without developing a tendency to become involved in "comparative" arguments and explanations. In describing the D.H.100, or, as it is better known, the D.H. Vampire, we shall simply state the facts, leaving those who are interested to draw the obvious inferences.

Here we have a fighter (the first of the de Havilland jet-propelled aircraft to go into production) which, with the 3,000 lb. thrust of a single Goblin II unit, and while carrying full operational equipment, has a maximum speed in level flight of 540 m.p.h. This figure has been exceeded by quite a handsome margin during development flying work, but it can be taken as the Vampire's normal, "guaranteed" maximum at 20,000ft.—neither the outcome of any special modifications and cleaning-up, nor the result of designing an aircraft merely for a high maximum speed at the cost of other considerations.

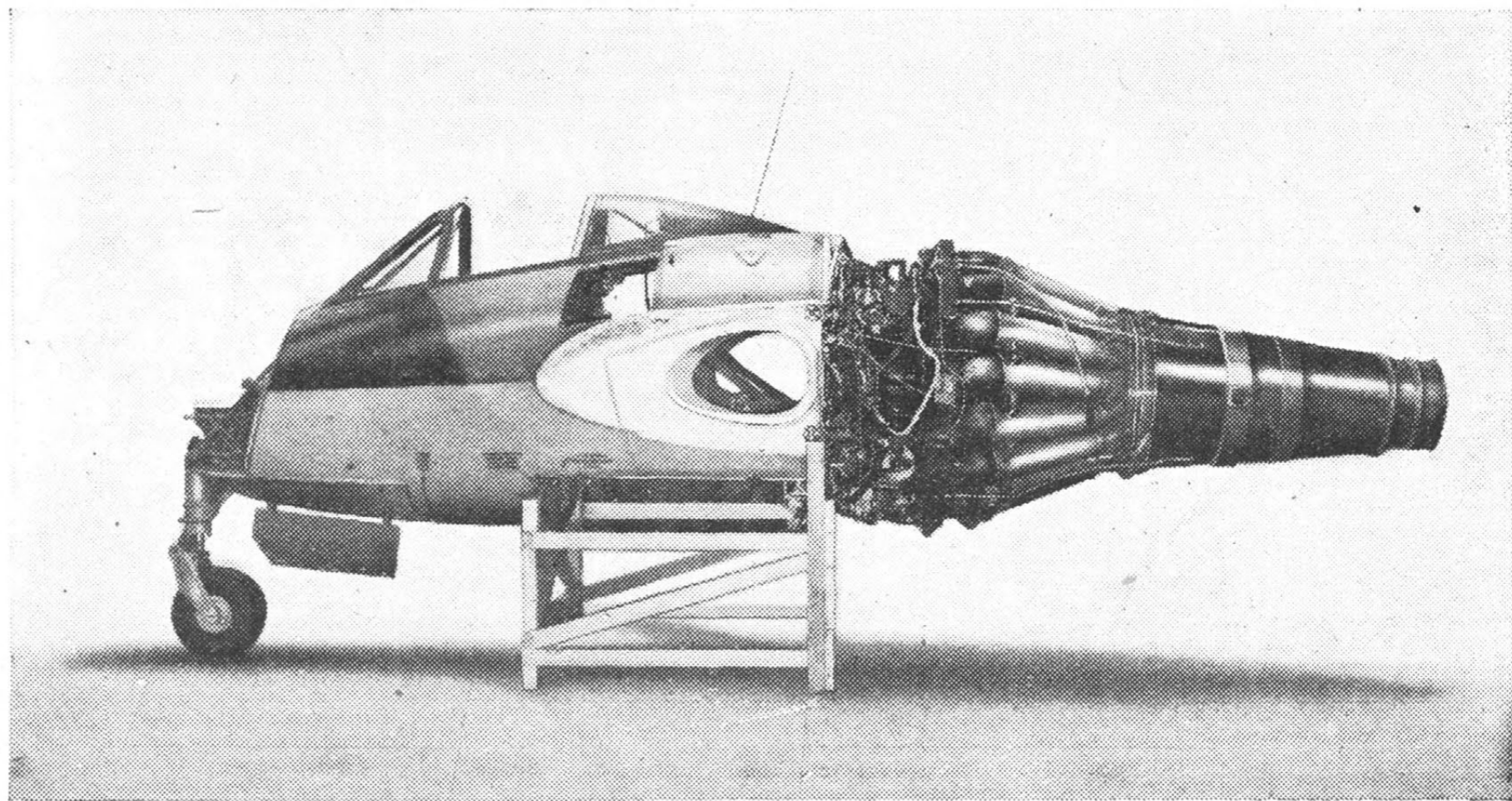
The Vampire's wing loading—32 lb./sq. ft. at normal operational weight—is very low for the class, and is, in fact, some 10 to 12 lb. less than that, for

instance, of the Mosquito and Hornet. The effects of this moderate loading, coupled with very good control response at all speeds, can be seen in the Vampire's demonstrably excellent manoeuvrability qualities and comparatively low safe-approach speed. The prototype Sea Vampire, on its recent carrier trials, was making powered approaches at an indicated air speed of 95 to 100 m.p.h., and all pilots who have flown the Vampire are enthusiastic about the handling qualities.

Unobstructed Outlook

In brief, a very successful attempt has been made to produce an extremely fast aircraft which is, at the same time, practical and safe as a fighting machine for the average pilot.

From the operational viewpoint the layout of this single-jet fighter has considerable advantages. The rear position of the unit gives the pilot something rather better than twin-engine view, even when arriving slowly under power,



The basis of the Vampire structure is well illustrated in this photograph of the stripped nacelle and its power plant. The large intake duct area is a crucial point in the design.

THE DE HAVILLAND VAMPIRE I (D.H.100)

and care has been taken to ensure that this advantage has not been partially lost by the installation of any large amount of equipment in the nose. The absence of an airscrew makes the nose wheel a practical proposition in a single-seat fighter, while "pusher" layout enables the four cannons to be mounted in the fuselage; they do not, therefore, need to be harmonised for a particular point of shell-strike concentration. Finally, the use of the jet power unit means that no time need be wasted in warming-up prior to take-off.

Without investigation, it might have been imagined that a "pusher" layout would have involved the designers in the solution of difficult c.g. problems, and, in fact, such a layout could hardly have been conveniently and compactly arranged with a normal piston engine and airscrew. However, the low weight of a jet unit, coupled with the fact that heavy items, such as the cannons, can be carried well forward of the c.g., has made the design not only practicable but even congenial. No particular structure-weight difficulties have been met in the design and manufacture of a twin-boom layout, and the total "fuselage" structure is certainly lighter than would have been any more conventional layout of a shape and size necessary to provide a jet outlet.

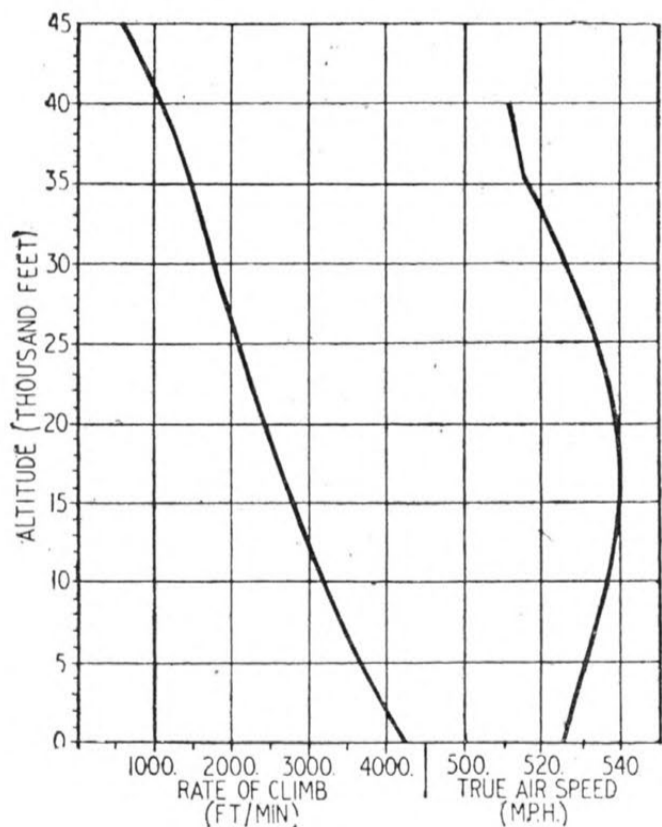
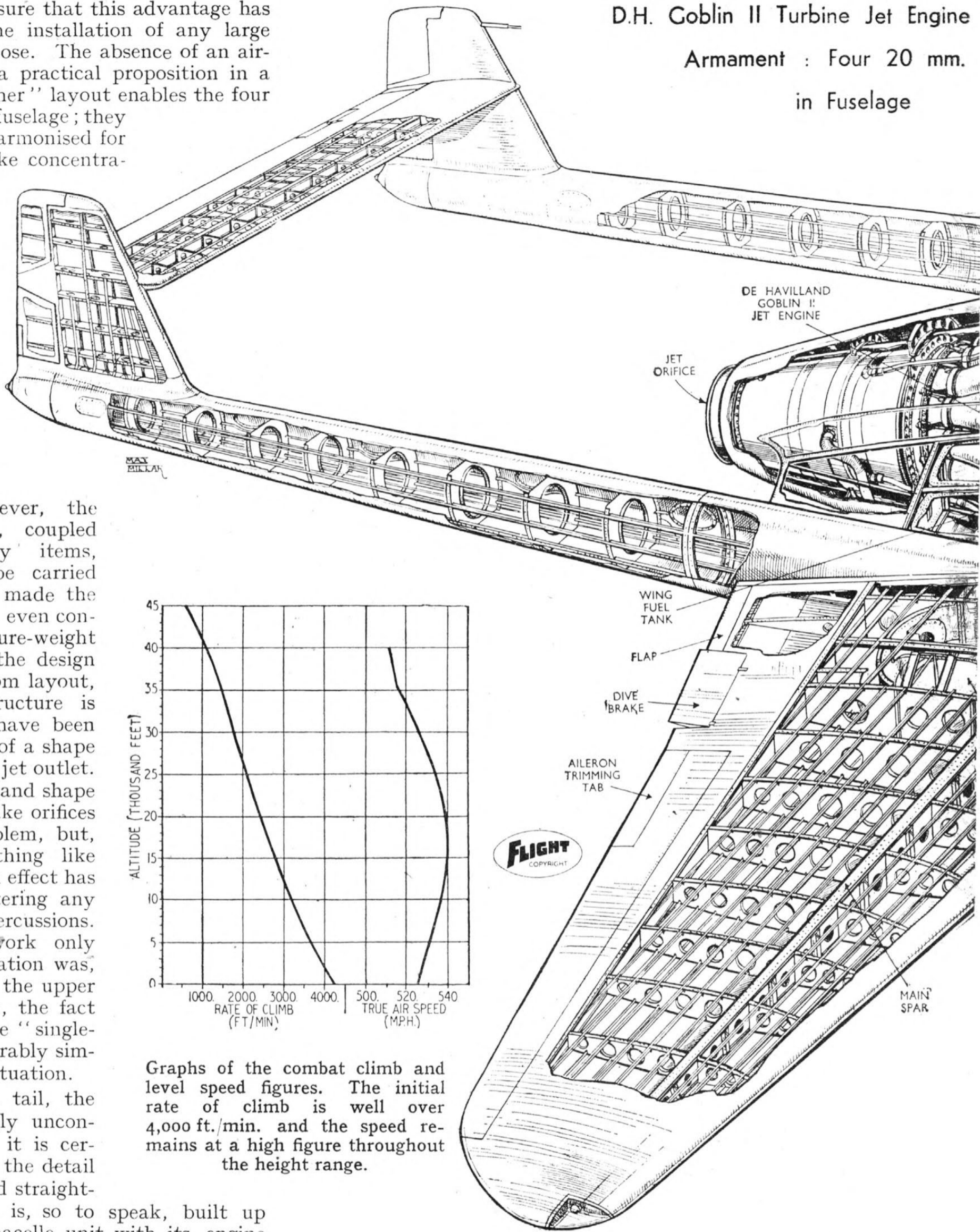
The planning of the location and shape of the necessarily large air intake orifices must have been no easy problem, but, with the layout used, something like 90-95 per cent. of available ram effect has been utilised without encountering any specially difficult airflow repercussions. During initial development work only one slight "sharpening" alteration was, we believe, found necessary to the upper lip of the intake. Here again, the fact that the Goblin blower is of the "single-sided" type must have considerably simplified the intake positioning situation.

Although, with its boomed tail, the Vampire may appear strikingly unconventional in appearance (and it is certainly ingenious in conception) the detail construction is quite simple and straightforward. The entire aircraft is, so to speak, built up around an extremely simple nacelle unit with its engine mounting and wing attachments and its intake duct system. The nacelle itself is constructed, on familiar Mosquito lines, of balsa wood sandwiched between plywood sheet, and is made in two half-shells with joints along the top and bottom centre lines. In this carapace unit are

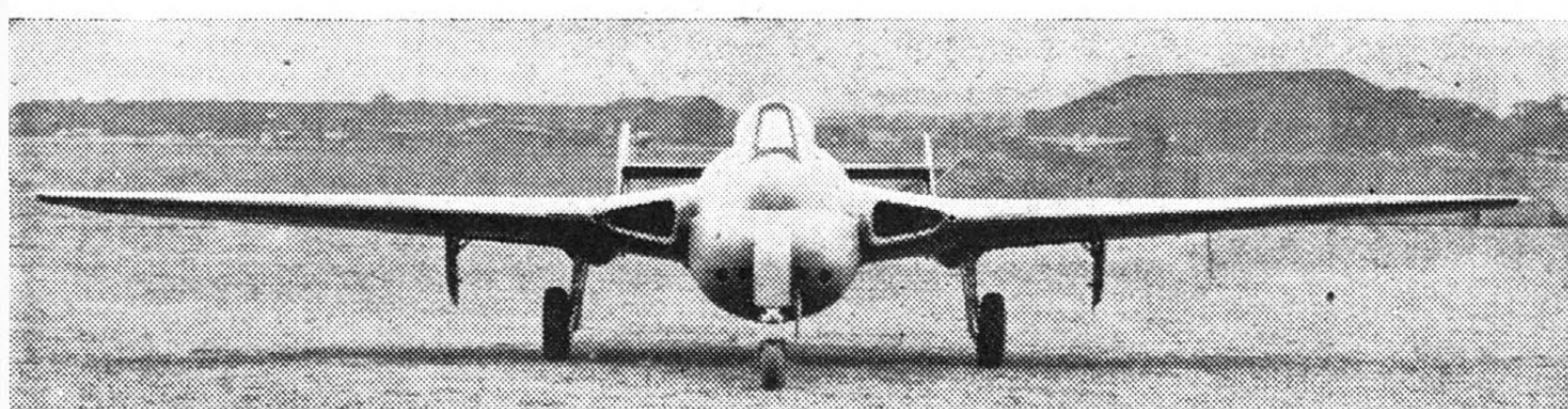
three primary bulkheads. That at the rear (No. 3), which is fireproofed, consists of the tubular engine mounting on the two crucial transverse members which take the main wing attachment bolts. Through this bulkhead pass

D.H. Goblin II Turbine Jet Engine

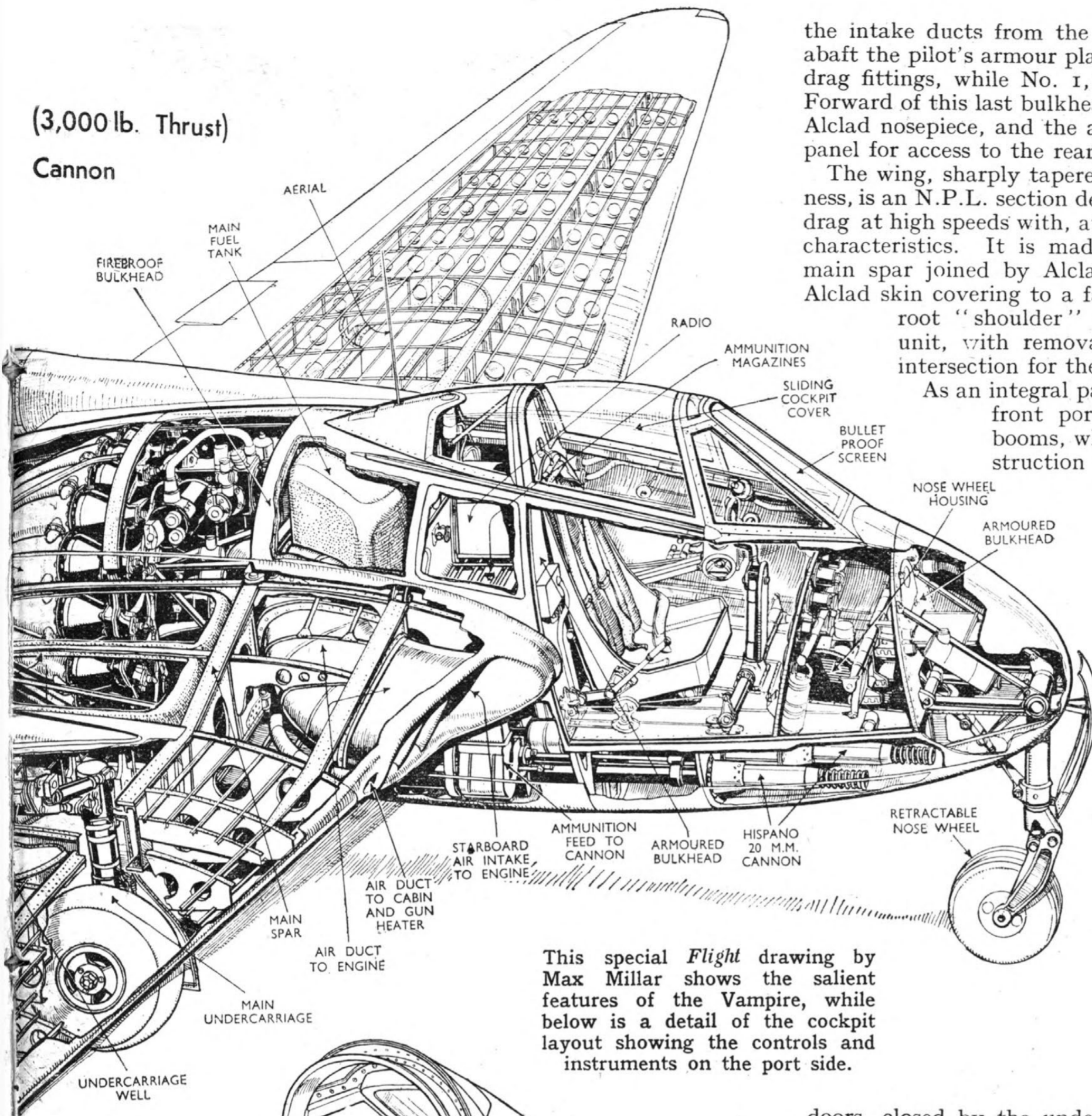
Armament : Four 20 mm. in Fuselage



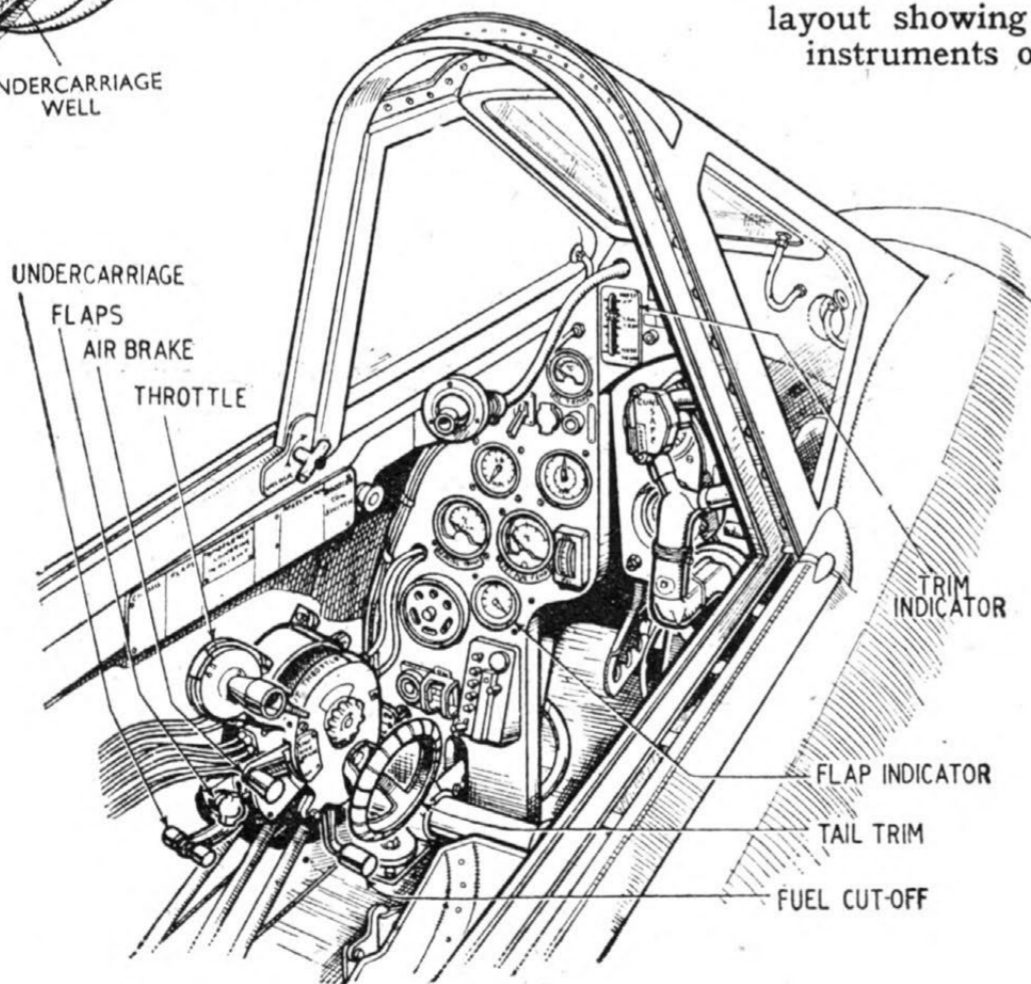
Graphs of the combat climb and level speed figures. The initial rate of climb is well over 4,000 ft./min. and the speed remains at a high figure throughout the height range.



(3,000 lb. Thrust)
Cannon



This special *Flight* drawing by Max Millar shows the salient features of the Vampire, while below is a detail of the cockpit layout showing the controls and instruments on the port side.



the intake ducts from the wing roots. Bulkhead No. 2, abaft the pilot's armour plate, carries the wing-attachment drag fittings, while No. 1, in the nose, is armour-plated. Forward of this last bulkhead there is a quickly detachable Alclad nosepiece, and the armour-plating has a removable panel for access to the rear of the pilot's dashboard.

The wing, sharply tapered both in plan form and thickness, is an N.P.L. section designed to give the least possible drag at high speeds with, at the same time, good low-speed characteristics. It is made up of a single "I" section main spar joined by Alclad ribs and a stringer-stiffened Alclad skin covering to a false rear spar. The intake and root "shoulder" section is made as a separate unit, with removable strips at the wing-nacelle intersection for the inspection of the attachments.

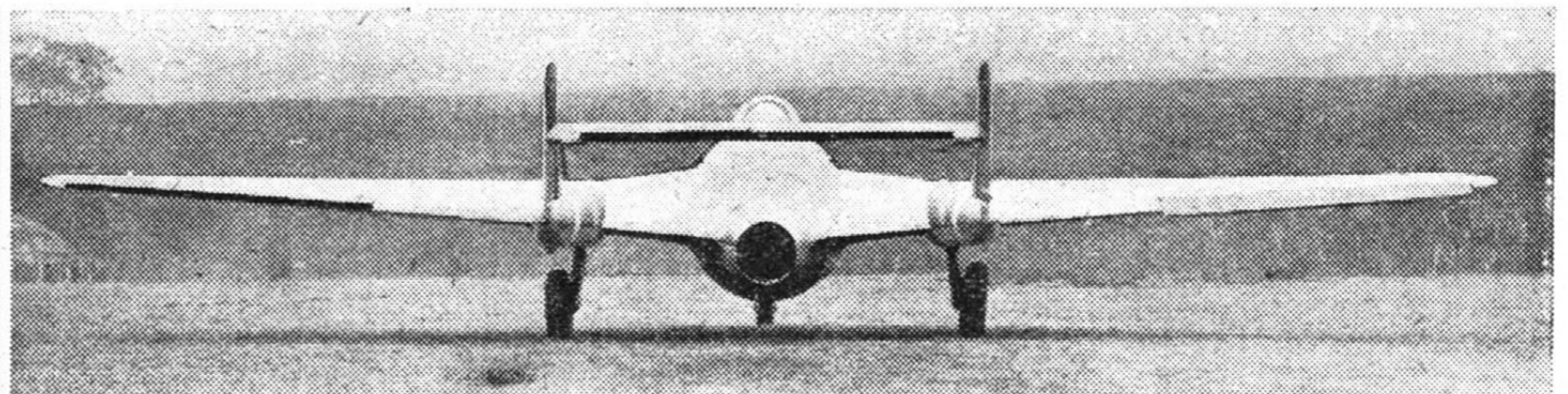
As an integral part of the wing structure are the front portions of the two oval-section booms, which are of semi-monocoque construction with heavy-gauge skin above and below and with stiffening diaphragms. The joint is a straightforward bolted flange. The tail assembly consists simply of a pair of metal-covered fins and rudders between which lie the tailplane and the one-piece elevator.

The centre-section, if so it can be described, is quite sharply deepened in thickness in order to accommodate the intake air ducts. Inboard of these intakes the root shoulder is indented, where the fairing skin meets the nacelle, in order to "separate" the two boundary layers and prevent "spilling" from the fuselage to wing and intake.

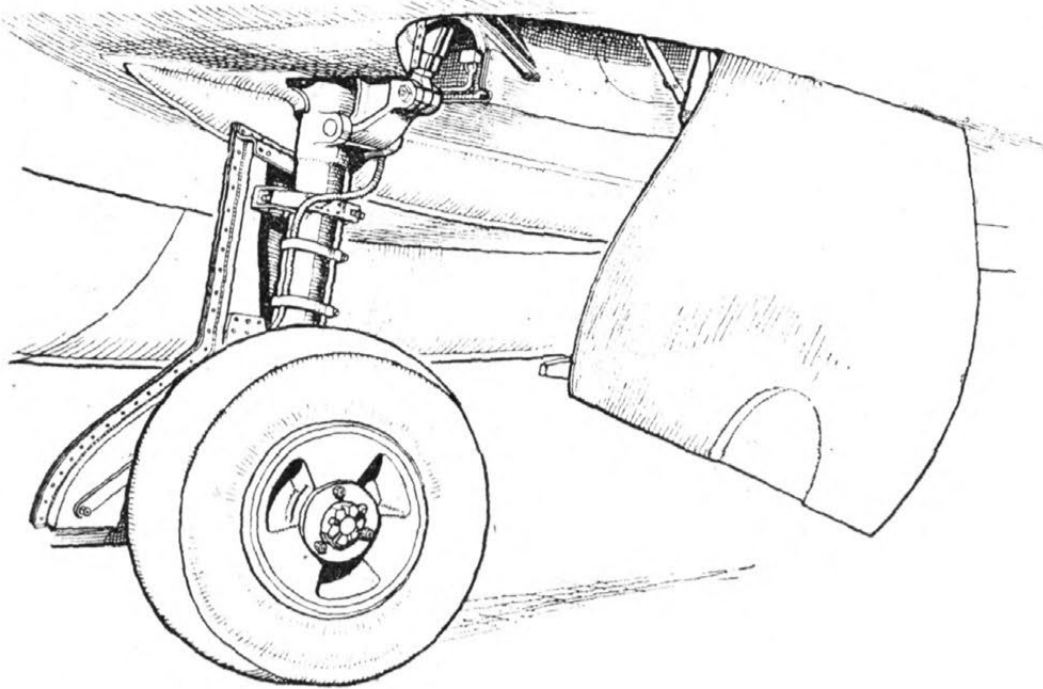
The undercarriage is conventional in design and operation. The main wheels retract inwards with half doors, closed by the undercarriage action and locked by Teleflex-operated pins, to cover the wells up to the point where the fixed undercarriage fairings take over. The nose wheel retracts rearwards, with a forward door hinging back to cover the oleo leg and a tyre-operated door closing sideways to cover the wheel housing. It is worth noting that this nose wheel, which is of the castoring and non-steerable type, has no shimmy damper, any tendencies in this direction being dealt with by the Marstrand tyre.

Lightweight Undercarriage

The hydraulic system for actuation of the undercarriage is also used to operate the split flaps and the air brakes, and works, through an accumulator, at a cut-out pressure of 2,600 lb./sq. in. There is one engine-driven pump, with an auxiliary hand-operated pump to the left of the pilot's seat. Since there is no airscrew, the undercarriage legs can, of course, be extremely short, and the weight of the three legs is only 3½ per cent. of the aircraft's total weight. The retraction, thanks partly to the low weight



THE DE HAVILLAND VAMPIRE I (D.H.100)



Jet propulsion permits the use of a very short and light undercarriage, one of the main legs of which, with fairing and door, is shown.

of the gear, is carried out in a matter of $2\frac{1}{2}$ seconds.

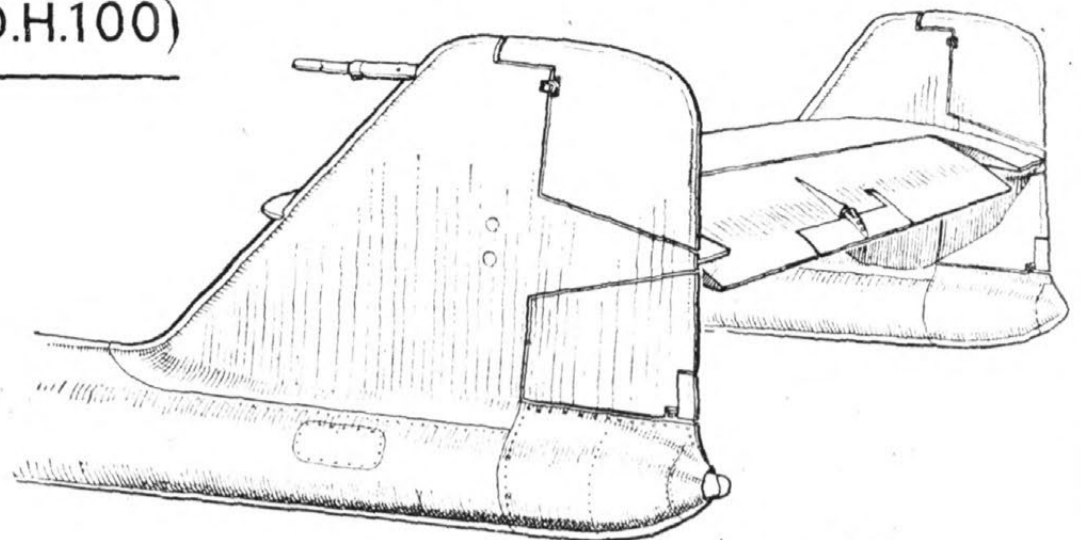
Unexpectedly enough, with such a high-speed type, there is nothing unusual about either the controls or the tab arrangements. A single-servo tab on the starboard side is used to balance the sealed-type round-nose ailerons; an adjustable servo tab is used for trimming and balancing the elevator; while, since there are no directional torque reaction effects, a small ground-adjustable non-servo tab only is fitted to each of the rudders. It may be remembered that, in the Vampire prototype, the rudders and fins were of a more recognisably "D.H." shape. It was found on initial tests that too much rudder surface had been provided, and these were consequently cut down to their present dimensions. The small rudder horns carry the necessary dynamic balances, while those for the elevator are exterior to the surface—something of an anachronism, however necessary in such a clean aircraft. All the controls are cable-operated through a system of pulleys.

Balanced Air Brakes

In four portions, the split flaps can be set at any angle up to 80 deg., while the air brakes, further outboard, can be applied at any speed up to 500 m.p.h. These brakes are interesting in that they are each formed by a single surface hinged centrally so that, while being operated, they are aerodynamically balanced. When retracted, the rear portion drops into a recess in the underside of the wing, leaving a flush surface. The deceleration provided by the brakes at high speed is of the order of $\frac{1}{3}$ G.

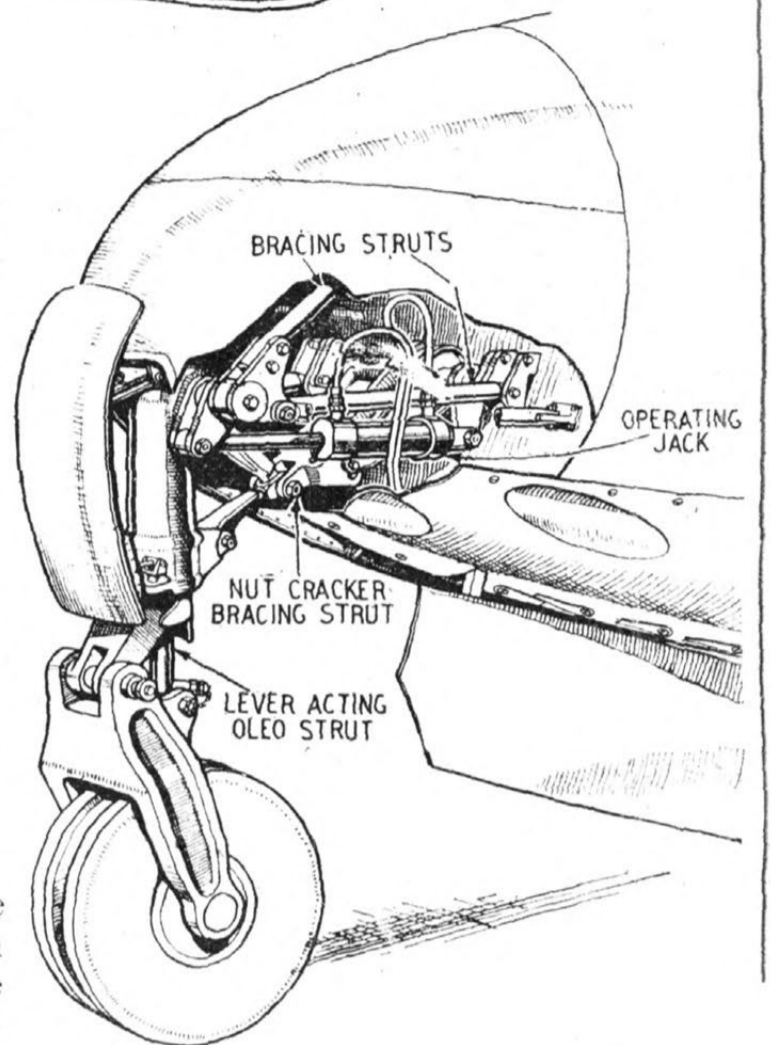
The power unit, placed as it is, and unencumbered by mounting side-members, can be easily reached for inspection purposes. It is held to its tubular steel mounting by only four bolts and a complete unit-change can be made, we are told, in a matter of forty minutes. The Goblin II jet unit has already been described in *Flight* (November 1st, 1945) and the only features which are of importance from the aircraft point of view are the fuel system and the cowlings.

Fuel, in the Mark I Vampire, is carried in three internal tanks—one in the nacelle between Nos. 1 and 2 bulkheads and one in each wing—and in two additional jettison tanks carried well inboard under the wing. These last can be either of the 50- or 100-gallon size and the fuel is transferred by means of pressure from the



Simple both in conception and construction is the tail unit (above). Notice the position of the pitot pressure head on the port fin.

The nose wheel of the Vampire (right) has no anti-shimmy damper, any tendencies to oscillate being damped out by the Marstrand tyre.



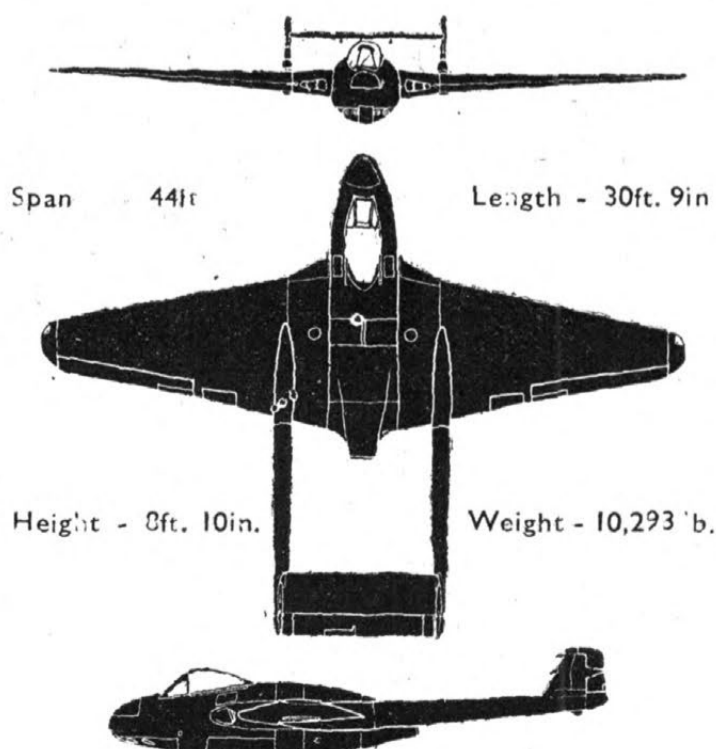
"reverse" side of the vacuum pump. These tanks are continuously pressurised and there

is no separate pressure control. The Mark II will have extra tankage provided by further wing tanks outboard of the undercarriage wells. All tanks feed into the collector-box below the fuselage tank, which also has a valved negative-G reservoir with a capacity of two gallons. Since all fuel is fed to the centre tank delivery there is need for only one "on-off" pressure cock in the cockpit, with an electric fuel booster pump in case of failure of the normal engine-driven pump. There is no oil tank as such since the small amount of lubricant required by the jet unit is carried in the latter's own sump.

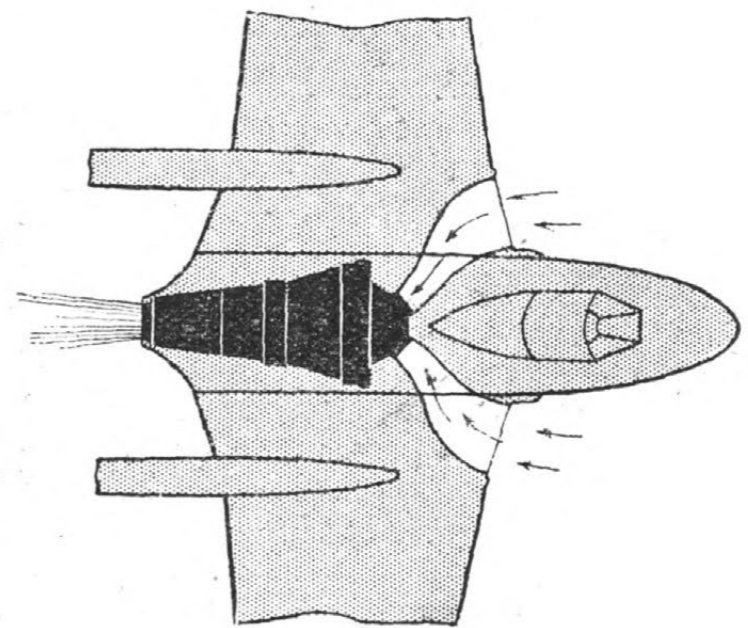
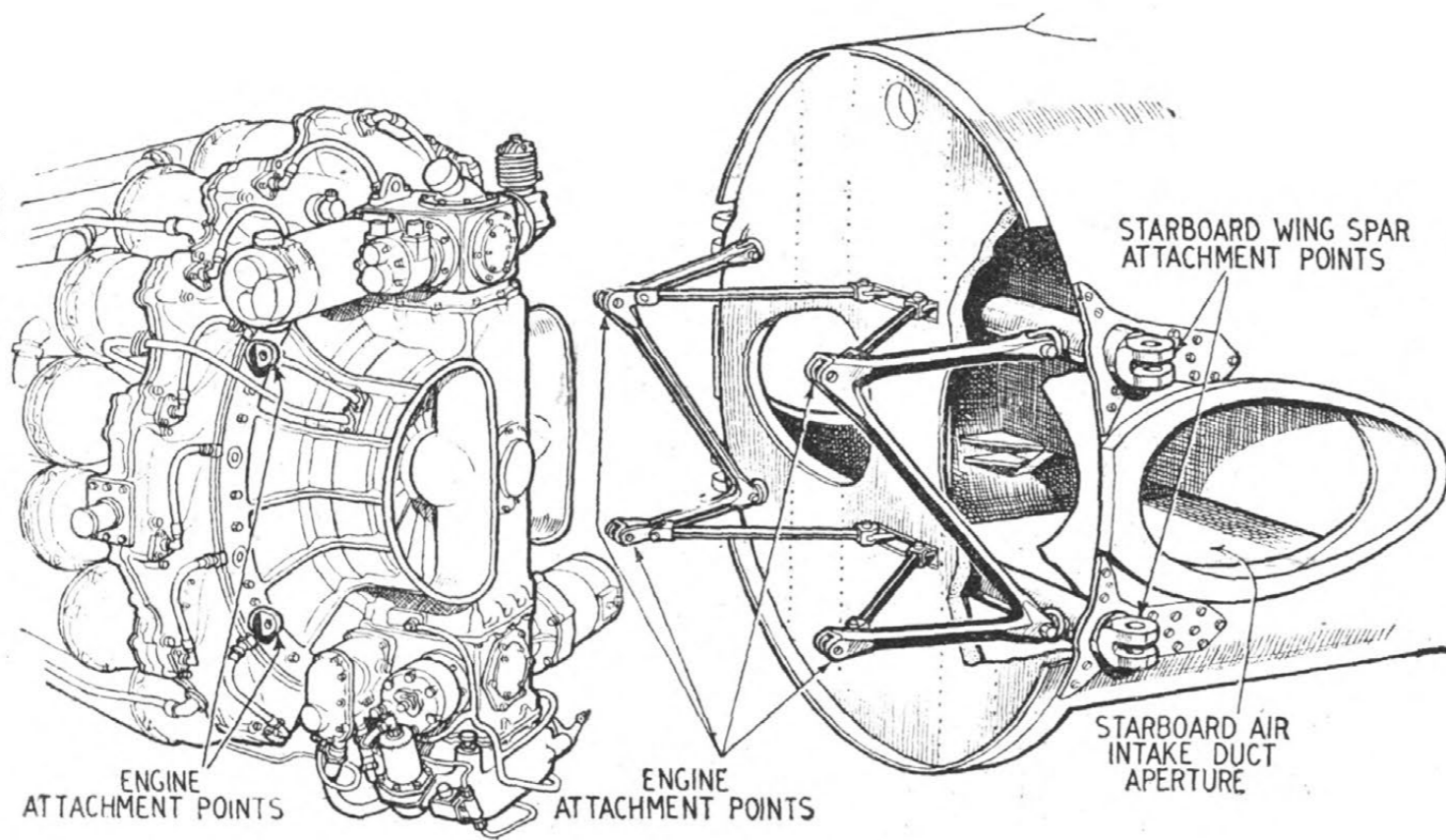
The engine cowlings, in effect, taper the oval-section fuselage back to the jet orifice. All are, of course, removable, but for normal inspection there are two quickly detachable cowlings, one above and one below the unit, and four hinged doors, two above and two below the accessory section of the unit. Quick-action toggle fasteners are used both for the removable and the hinged cowlings, and the latter have stowed supporting struts.

Built into the tail pipe shroud is a heater muff, air being fed to it from an intake outside the main starboard air intake, heated in the muff and fed, as required, to the cockpit and guns. When necessary the muff can, of course, be by-passed to provide cold-air ventilation only. At the jet orifice a venturi has been arranged to cause a depression and so pass air over the unit itself.

On and after the manufacture of the fiftieth aircraft at the English Electric Works, Preston, the Vampire will be produced in pressure-cabin form, a



THE DE HAVILLAND VAMPIRE (D.H.100)



An extremely simple four-point attachment power unit mounting (left) is a feature of the Vampire. The intake air duct arrangement to the unit is shown above diagrammatically.

D.H. 100 VAMPIRE
Goblin II Turbine Jet Engine

DIMENSIONS AND WEIGHTS :

Span	44ft.
Length	30ft. 9in.
Height	8ft. 10in.
Wheel track	11ft. 3in.
Structure weight	2,517 lb.
Tare weight	6,372 lb.
Combat weight	8,578 lb.
All-up weight	10,298 lb.

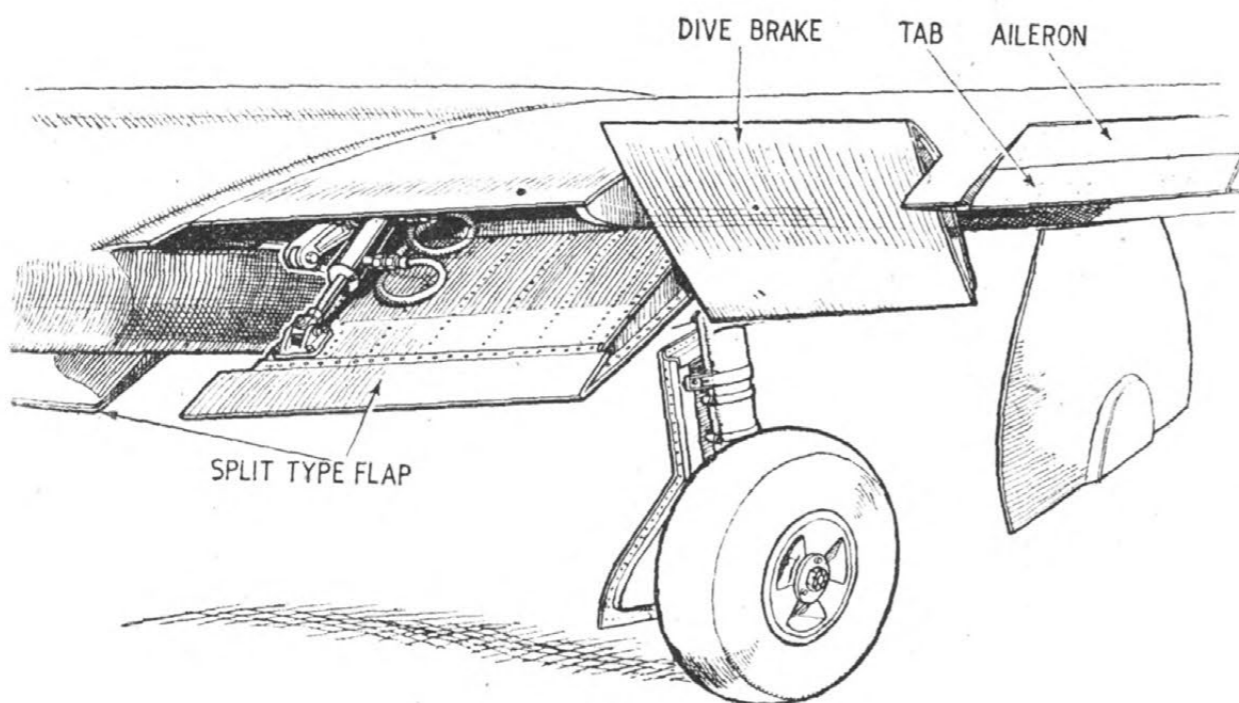
PERFORMANCE :

Maximum speed (20,000ft.)	540 m.p.h.
Initial rate of climb	4,200 ft./min.
Take-off distance to 50ft. at 10,298 lb.	850 yd.
Landing distance from 50ft. at 8,578 lb.	1,150 yd.

FUEL AND RANGE :

	Mark I	Mark II
Total fuel capacity	402 gall.	554 gall.
External drop fuel tank (included in above)	200 gall.	200 gall.
Patrol duration Sea Level	1.8 hours	2.6 hours
Patrol duration* Sea Level	1.8 hours	2.6 hours
	at 270 m.p.h.	270 m.p.h.
	2.25 hrs.	3.2 hrs.
	at 400 m.p.h.	400 m.p.h.
Still air range... .. Sea Level	500 miles	680 miles
	at 400 m.p.h.	400 m.p.h.
* With allowance for climb and 15 min. combat.	30,000ft. 1,050 miles	1,400 miles
	at 450 m.p.h.	450 m.p.h.

Marshall blower on the auxiliary gear box providing a relatively increased cockpit pressure of 2-2½ lb./sq. in. Air is fed from an intake in the port leading edge. At the same time the canopy is being redesigned in "bubble" form—an unusual arrangement for a pressurised aircraft, in which



For deceleration from high speed, simple aerodynamically balanced air brakes are used. These are outboard of the split flaps.

a good all-round view must usually be sacrificed for necessary air-tightness. The hood slides back in the usual way, but, when closed, the seal is complete to a point near the rear of the "bubble," where a semi-circular seal fits the shape of the canopy at that point.

The T.R.1464 radio, the gun breeches and the ammunition containers lie in the space between No. 2 bulkhead and the rear armour plate, and can be reached through doors on either side, while the I.F.F. set, the glycol tank for windscreen de-icing, and the ciné camera are carried forward of the instrument panel and of No. 1 armoured bulkhead. The batteries are carried below the fuselage tank.

The Sea Vampire

The Sea Vampire will, in its production form, be basically similar to the standard aircraft, the major differences being concerned with the increase of flap area and the installation of the necessary arrester hook. The last, with such a layout, presented new problems, particularly since there was so little available information about the handling of tricycle aircraft on carrier decks. In order that the arrester wire should pull approximately through the c.g., and not pitch the aircraft violently on to the nose wheel, it was necessary to hinge the hook arms to the end ribs of the wing. This necessitated the stowage of the hook in a fairing above the jet pipe and meant that, with its supporting arm, the hook falls through the jet stream. Though perhaps unconventional, the system has so far worked well.

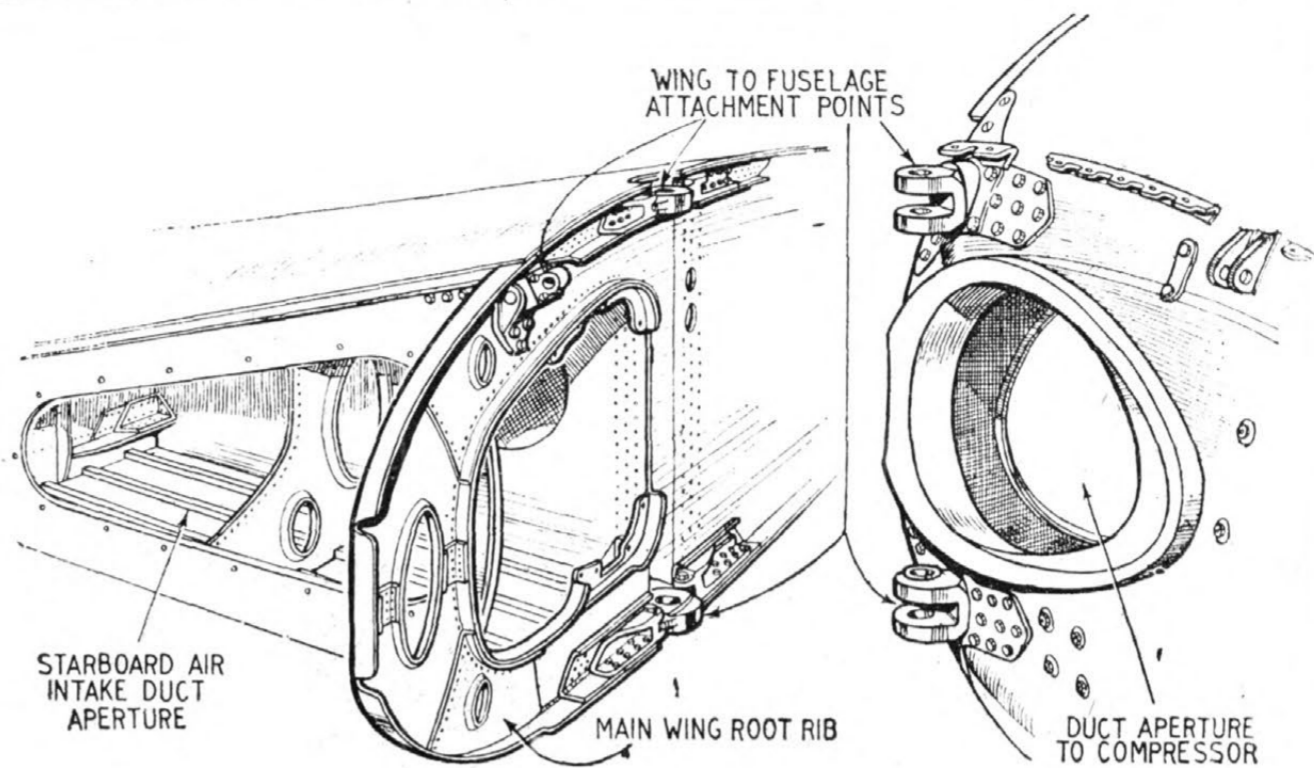
With a jet unit there is always some slight delay in power build-up from small throttle openings, and in order to permit high turbine revolutions and consequently quicker acceleration if suddenly needed during the approach, the flap area has been increased. This increase has been obtained by making the flap-line continuous in span through the points where the booms leave the wing, the two inner flap portions being so shaped that, when retracted, they fit snugly against the booms. By using full flap, with the additional drag provided by the air brakes, the pilot can make his approach at comparatively wide throttle openings and, in the event of a wave-off, is able to obtain full power quickly and, at the same time, to reduce drag immediately by retracting the air brakes. The result of air-brake retraction naturally results in a momentary loss of lift but, at the same time, produces a slight nose-up effect which effectively cancels out the loss. [Concluded on p. 66c

THE DE HAVILLAND VAMPIRE I (D.H.100)

Such a low-built tricycle aircraft as the Vampire should have considerable advantages for carrier operations. Not only does the nose-wheel arrangement prevent any swing on take-off and ballooning tendencies on landing, but it also makes the aircraft easier to manhandle, while the shortness of the undercarriage should permit simpler stowage.

As is customary in jet aircraft, the Vampire's control layout is extremely simple, and all the essential items are grouped around a box on the left side of the cockpit. The engine controls consist solely of a fuel cut-off cock at the base of the box, and a power control with its gyro-sight twist-grip handle. At the rear of the control box are the undercarriage, flap and air-brake control levers. The undercarriage control is, as a safety measure, held down by means of an electrically operated plunger when the weight is on the undercarriage, but, in case of overshoot emergency after landing, an over-ride switch is provided on the dash so that the solenoid plunger can be released. The only trimming control is that for the elevator tab, which is operated by a medium-sized handwheel mounted on the box. Since there are no appreciable torque reactions, no rudder trim is required.

The instrument panels carry six engine instruments—for oil pressure and temperature, turbine r.p.m., burner pressure, jet-pipe temperature and rear-bearing temperature—with a central blind-flying panel. The fuel contents gauges



There are only three wing attachments—two via the single spar and one to take drag stresses. This drawing shows how the structure allows for the intake-ducting in the wing root.

are on a panel immediately below the flying instruments. No normal compass is carried, but there is D.R. compass indicator on the right-hand panel working from a master compass mounted in the starboard wing.

The sliding hood is moved, through bevels and a shaft, by a control handle on the right-hand side, with peg-type stops to enable the canopy to be left in any desired position. When closed the cockpit is sealed by means of air supply from the pressure side of the vacuum pump. When the cabin is pressurised the sealing will then be completed from the system, with a control cock immediately beneath the hood handle.

NEW EMPIRE RADIO SCHOOL

AIR forces of the British Commonwealth are to have an Empire Radio School which is now being formed at R.A.F. Station, Debden, near Saffron Walden, Essex, under the control of the Air Ministry and R.A.F. Technical Training Command.

The school has been established with two main objects, first to ensure that radio instruction maintains progress, and secondly to train signals officers, signals and radar leaders and instructors.

Liaison will be maintained with all Commonwealth air force radio schools, with all commands, and with the Empire Air Armament School and the Empire Air Navigation School, as radio is becoming an essential part of much navigation and armament equipment. Through the Air Ministry, advice on all subjects concerning radio training will be available to Commonwealth air forces.

The school is to have its own training research and development section and a small writing section for producing training publications. The latest types of radio equipment and aircraft will be available for advanced and specialised study by pupils from all over the Empire.

R.A.F. POST-WAR ASSOCIATION

PLANS have now been made to form a Post-War Association of R.A.F. Officers who served in the Mediterranean or Middle East Commands during the war.

Named the "Headquarters R.A.F. Mediterranean Association," membership is open to all R.A.F. and W.A.A.F. officers, officers of the Dominion Air Forces, and Army Officers who were on the posted strength of Eastern Air Command, Mediterranean Air Command, North West African Air Force, Mediterranean Allied Air Forces, or Mediterranean-Middle East Command at any time up to October 15th this year.

Marshal of the Royal Air Force Sir Arthur Tedder, Air Marshal Sir John Slessor and Air Marshal Sir Guy Garrod, all intimately connected with the R.A.F. in the Mediterranean and Middle East during the war, have been invited to become patrons of the Association.

It is hoped to send a notice of the formation of the Association to all officers who have now left the theatre and were in any of the Commands mentioned. But application for membership can be made to Sqn. Ldr. M. R. E. Swanwick, Whit-

tington House, Old Whittington, Chesterfield, England. The nominal subscription of 5s., to provide for initial expenses, should be enclosed.

WHAT AMERICA THINKS TO-DAY

STATISTICS, it has been said, can be made to prove anything, yet they are extremely popular today in the form of "Gallup" polls on all sorts of subjects. A public poll, conducted by Benson and Benson, of Princeton, New Jersey, has recently been carried out for the U.S. Aircraft Industries Association and its findings published in a booklet.

These findings, which are "based on interviews with a carefully selected sample of 2,600 persons living throughout the United States" do not include any very surprising results.

We were by no means startled, for example, to read that 91 per cent. of the interviewees believed that the United States made the best aircraft, the other nine per cent. dividing their favours fairly evenly between Germany, England and Russia in that order. This, of course, is a great triumph for American Press publicity and just goes to prove that you can get most people to believe anything if you tell it to them often enough.

That 91 per cent. also thought that America should maintain a strong post-war air force was to be expected, but we notice that only 67 per cent. were prepared to pay a week's earnings in taxation in order to achieve this object. The highest degree of unanimity came in response to the question, "Has the aircraft industry done a good job in this war?" to which 92 per cent. replied in the affirmative; 6 per cent. said a grudging "Fair," and the odd 2 per cent. were frankly dissatisfied and answered "Poor."

Among a variety of other answers, 53 per cent. thought the makers of aircraft had saved enough money to tide them over hard times, and 25 per cent. went even further and thought that they had made too much profit out of the war. As much as 66 per cent. favoured the idea that surplus army and navy aircraft could be used for passengers and freight, and 66 per cent. said that more airports were needed.

As 69 per cent. thought that the U.S. Government should try to sell post-war surplus military planes, but only 50 per cent. agreed that this course would not hurt the manufacturers, it seems fairly safe to conclude that the other 19 per cent., at any rate, were not shareholders in the industry.

German Jet Developments

Heinkel-Hirth and Daimler-Benz Projects : Production Costs : Water-cooling Experiments

By SIR ROY FEDDEN, F.R.Ae.S., M.I.A.E.

THIS is the concluding instalment of Sir Roy Fedden's series of articles on German engine development as seen by his M.A.P. Mission. The first article (November 29th) discussed the future disposal of German experimental equipment, and was followed by a review of piston-engine progress (December 6th). Last week, Junkers and B.M.W. designs were dealt with, and further notes on jet progress now conclude the series. Previous articles on German aeronautical technical development (by G. Geoffrey Smith) appeared in "Flight" of September 27th and October 4th.

THE Heinkel-Hirth combine, under the direction of Herr Wolf, who may be remembered as coming here before the war for the Siemens interests, produced a few examples of the Heinkel-Hirth oil engine design by Herr Ohain. These were made shortly before the collapse, but a great deal of development work was still needed on this design. The compressor had three axial stages preceded by one stage which was partly axial and partly centrifugal. Various features are shown in the accompanying drawings.

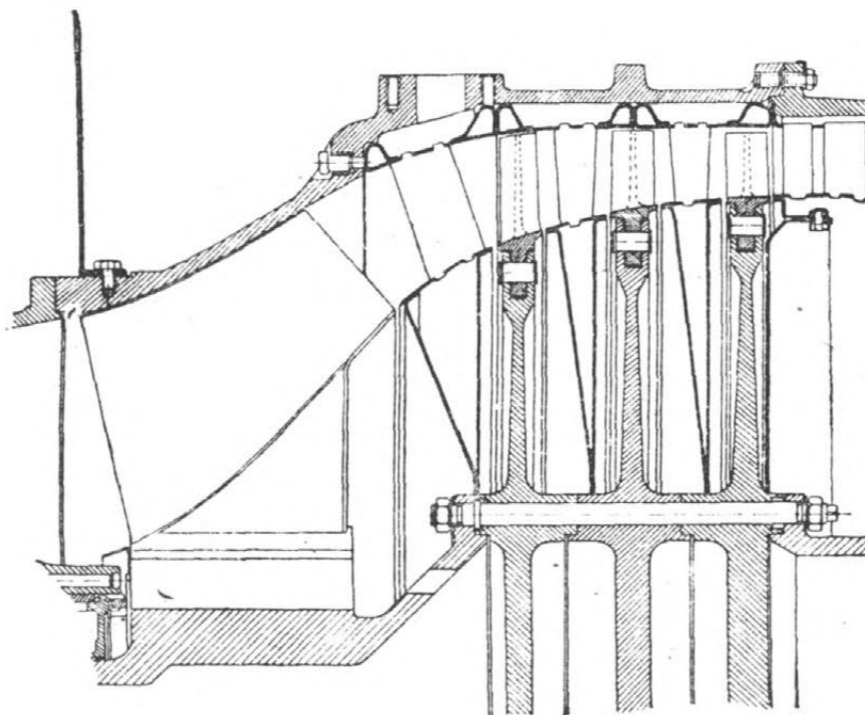
Daimler-Benz had also embarked on jet-engine development and had evolved a seventeen-stage, contra-rotating, axial-flow compressor in conjunction with a single-stage turbine, planned to produce a thrust of 2,650 lb. The design, however, was regarded as too heavy, and work on it was stopped by the German Air Ministry, the firm being instructed to devote their facilities to the Heinkel-Hirth project.

This by no means exhausts the total of German activity on turbine design and development; A.E.G. were hard at work on a project to drive contra-rotating airscrews by a compressor and two turbines with heat exchangers, whilst a similar project was in hand at Brown Boveri.

One could not help being impressed by the enthusiasm shown for jet propulsion by the production and commercial people of the German engine industry. The following tabulation of comparative costs, based on a production schedule of 1,000-1,500 engines a month, is compiled from information supplied by factory representatives, and adequately sums up the position:—

	Cost in marks
Junkers piston engine, Type 213	35,000
B.M.W. piston engine, Type 801	40,000
Junkers 2000 ESHP jet engine	10,000 (approx.)
B.M.W. 2000 ESHP jet engine	12,000 (approx.)

Generally speaking, there were no very special machining operations and expensive tooling required. The machining operations on German jet engines were for the most part carried out on ordinary machine-tool plant and the work was mainly straightforward turning. The sheet metal work was tooled on motor body plant, and I was given an interesting breakdown of production times for sheet-metal parts on the B.M.W.003 unit, as shown in the following table.



Section of the Heinkel-Hirth compressor.

B.M.W. FACTORY, EISENACH
Production Hours of Sheet-Metal Parts for B.M.W. 003 Turbine Jet Unit.

	hours
Turbine stator	14.50
Thrust nozzle	27.00
Combustion chamber	20.75
Intake cowl	21.50
Starter fairing	3.00
Compressor stators	36.50
Oil cooler inserts	1.75
Oil cooler complete	25.00
Total hours	150.00

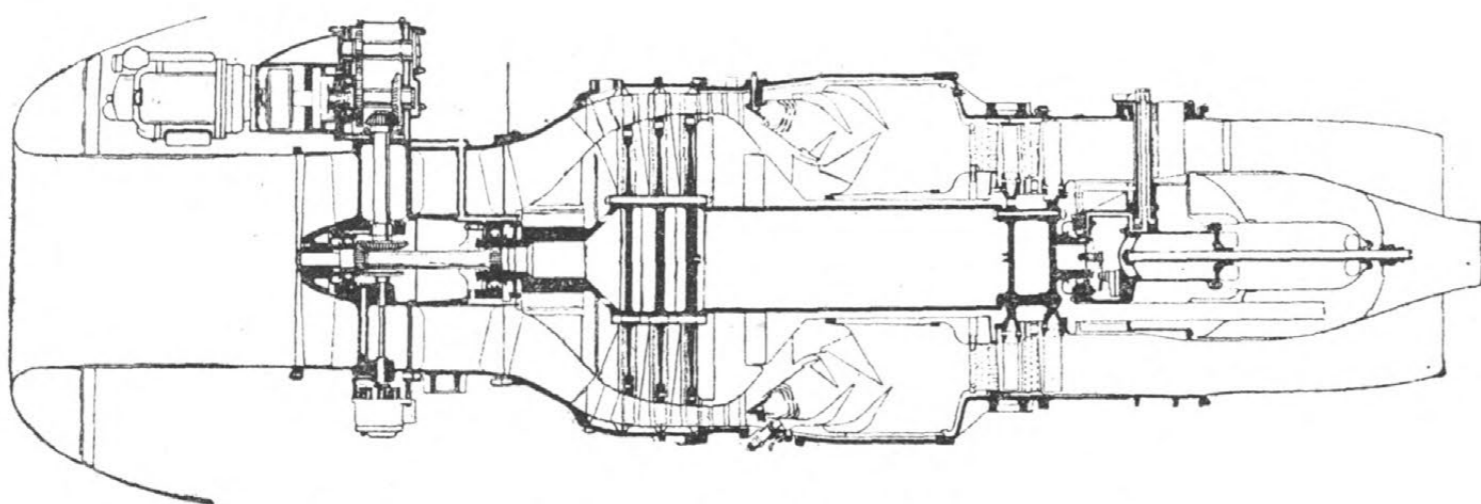
The methods adopted by the Germans to anchor their turbine blades are interesting and original. Certain of them seem to be simple and foolproof, and appear to allow for easier replacement of faulty turbine blades than the anchorage standardised on our own current production types.

Extemporising

The first B.M.W. turbines were based on their exhaust turbo-supercharger technique for piston engines, which was very advanced. The hollow blades were made up from forged halves welded together and machined. These blades had an endurance up to 200 hours, but in order to reduce the material consumed, and to cut production times, the designers were forced to adopt the method of fabricating the blades from sheet steel with a weld at the trailing edge as already illustrated. As a result, the life of a blade has been reduced to something like 50 hours. Apart from cracking at the weld the blades have tended to work loose due to stretching of the material, and conical wedges have had to be introduced.

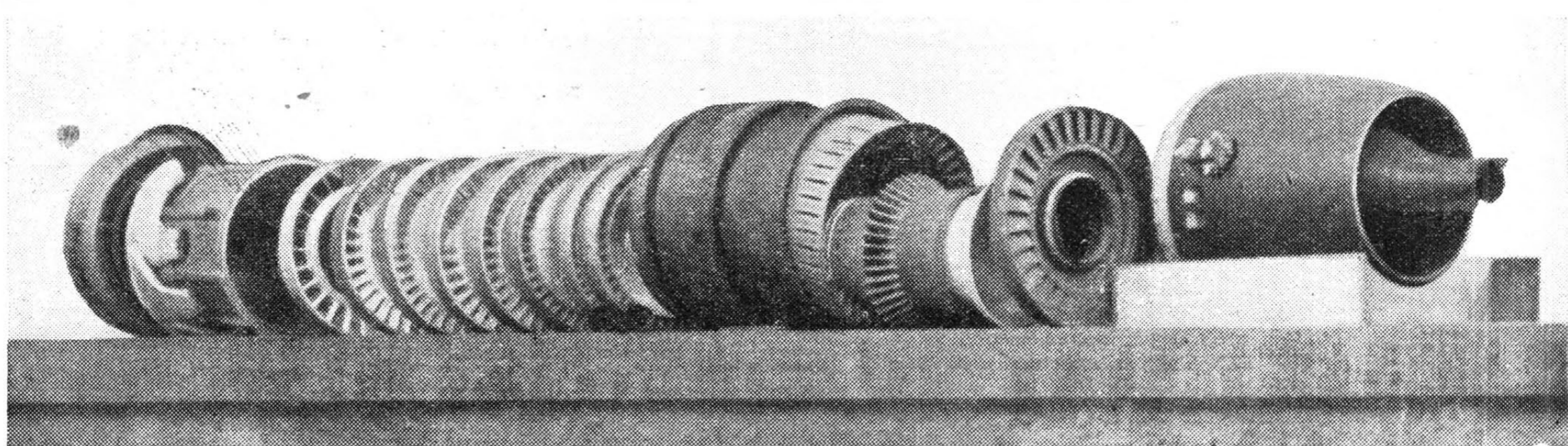
They are designed to tighten under centrifugal force and counteract this defect. The ultimate solution seems to be a hollow blade formed from a steel disc by a series of drawing operations. Such blades have already been fitted to some of the Junkers turbines.

Apart from the intensive development work at the engine works there



General arrangement of the Heinkel-Hirth unit.

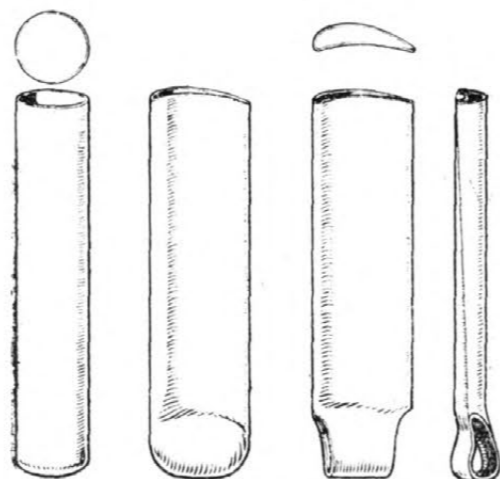
GERMAN JET DEVELOPMENTS



Sheet-metal parts of the B.M.W. 003 jet unit. Production hours for these parts are shown in the table on p. 661.

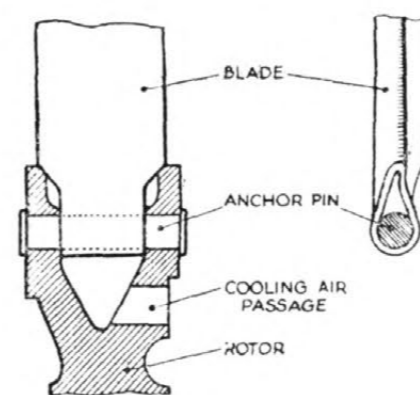
was a considerable programme of research in hand at the various technical institutes and laboratories such as Völkenrode, where Dr. Schmidt was working on water cooling for turbine blades. Initially the work was being concentrated on components for stationary engines, and we were shown a four-stage turbine wheel designed for 2,000 h.p. at 20,000 r.p.m. It was 12.6in. in diameter, and the blades were formed integrally with a hollow drum, inside which the cooling water was maintained at a constant level. Under operating conditions a constant flow of water is maintained through holes drilled in the blades from the root towards the tip. Under the pressure of centrifugal force, cool water flows up the middle of the blade passage towards the tip, while the less dense hot water is forced back to the drum. Under pressure of centrifugal force, the water does not boil inside the blades, but may boil inside the drum, and could be used to drive a steam turbine, which, they considered, might develop 10 per cent. of the power of the main turbine.

German production engineers realised that they had been



Stages in the manufacture of the Heinkel-Hirth hollow turbine blade.

committed to large production of jet engines before they were really ready, and there were many modifications to be expected in the midst of their attempt to achieve series production. When the war ended their jet engines were nothing like as reliable or as foolproof as their piston counterparts, but the men who could look back on the early days of the piston engine were most hopeful for the future; they believed that if they had the opportunity to develop without interruption for four or five years, they would have produced a prime mover at least as reliable as the piston engine, at one-third to one-quarter the price, and one-half of the weight. If they had had no restrictions on materials, they could have achieved these results more quickly.



Heinkel-Hirth turbine-blade fixing.

From the foregoing surveys it will be realised that the Germans were fully alive to the possibilities of jet engines for military aircraft, and had really lost interest in piston

engines. The approach to the new problem was bold and enterprising, but not realistic in view of their great wartime shortage of suitable materials and the enormous task of changing over to another form of prime mover at the most critical year of the war.

BOOK REVIEWS

"Wings," by Joan V. Ingram; illustrated by S. C. McManus; 2s., Hollis and Carter, Ltd., 25, Ashley Place, London, S.W.1.

SUB-TITLED "a new approach to reading," this little book is intended to assist parents and teachers in gaining the interest of children who, owing to illness or evacuation, have not learned to read as soon as they should. As its subject-matter is flying and aircraft, explained in simple words, it should also form an acceptable gift for small boys.

Astro Navigation Tables for the Common Tangent Method, by E. E. Benest, M.A., and E. M. Timberlake, B.Sc. W. Heffer and Sons, Ltd. 7s. 6d.

THE "position line" method of astronomical navigation is now generally accepted, but the well-known Marc St. Hilaire method entails the use of a series of rules to determine the azimuth and the plotting of this azimuth. This new series of tables permits the navigator to lay down a position line without the use of the azimuth and has the added advantage that it can be used in very high latitudes.

A system of plotting by the tangent method was outlined some years ago and shows an increase in accuracy over the more usual methods if the latitude is greater than 45 degrees. In the polar regions the use of Mercator charts is not practicable, and, since the common tangent method can be applied

to a Stereographic projection, a uniform system for plotting can be provided from the equator to the poles. The C.T. method, in specially developed form, is explained in the introduction to the tables. At the end of the book special tables are provided and a system is described by which the navigator is able to transfer position lines on polar charts.

"Allied Aircraft Illustrated"; edited by Leonard Taylor; Rolls House Publishing Co. for the Air League of the British Empire; 10s.

This is a collection of pictures taken from the wartime issues of *The A.T.C. Gazette*, with their captions suitably modified where necessary. As made clear in the foreword, the collection is in no sense a "directory of Allied aircraft," but is intended as a reflection of the war years from the aviation side. Some of them are in black and white and some tinted, and while the blues are very pleasing (especially when the picture embraces an expanse of sky) and the green and sepia shades restful, there are others which indulge in an overall violet that is not so happily chosen. Puce aircraft against an even pucer sky look somewhat weird.

The quality of the reproduction on glossy art paper is excellent, and the little volume suggests itself as a handy present for a nephew in the A.T.C.

Air Transport in Transition

Wartime Norwegian Civil Aviation Prepares for the Future : The Work of R.N.A.T.

By ALEC E. DAVIS

THE story of Norwegian wartime air transport began as long ago as 1941, when two Lockheed Lodestars were used on a service established between Sweden and the United Kingdom to bring over refugees who had made their way across the Norwegian-Swedish border. This service was operated by a small Norwegian unit under contract to B.O.A.C., and several thousand passengers were delivered safely despite the fact that part of the route lay over enemy-occupied territory.

Fully aware of the difficulties of road and rail transport in their mountainous country, the Norwegian Government in London early realised that air transport would be one of their most urgent needs when eventually they returned to Norway, and in November, 1943, a Royal decree was issued establishing a State institution to be known as the Royal Norwegian Air Transport (Norges Luftfartstyre), working under the Ministry of Defence, to prepare for the resumption of civil flying after the war. A later decree, in March, 1945, empowered R.N.A.T. to operate internal and external airways "until such time as Parliament could make a final decision regarding the organisation of civil air traffic."

This intention was put into effect almost immediately after the surrender of the Germans. The first of a batch of ten R.N.A.T. Dakotas touched down on the soil of liberated Norway on May 20 this year, and a regular service was then established between Leuchars (Fife) and Oslo. The terminus of this original R.N.A.T. North Sea Service was changed from Leuchars to Turnhouse, near Edinburgh, before the service eventually closed at the end of October.

Since then a number of other routes have been opened—or reopened—by R.N.A.T. Last June services were started between Oslo and Croydon, and Oslo and Stockholm, using Dakotas, and between Oslo and Copenhagen, using Lodestars. In October a run between Oslo and Amsterdam was started, using Dakotas, and flown twice weekly in each direction—a frequency which was due to be increased this month, with an alteration in timing to give connections at Amsterdam for Paris and Zurich.

The present fleet consists of seventeen Dakotas and Lodestars, though only five are fully equipped—by peacetime standards—for passenger-carrying. The aircrews are all members of the Royal Norwegian Air Force, including ex-R.A.F. Transport Command pilots with several years' experience on the Atlantic and India routes.

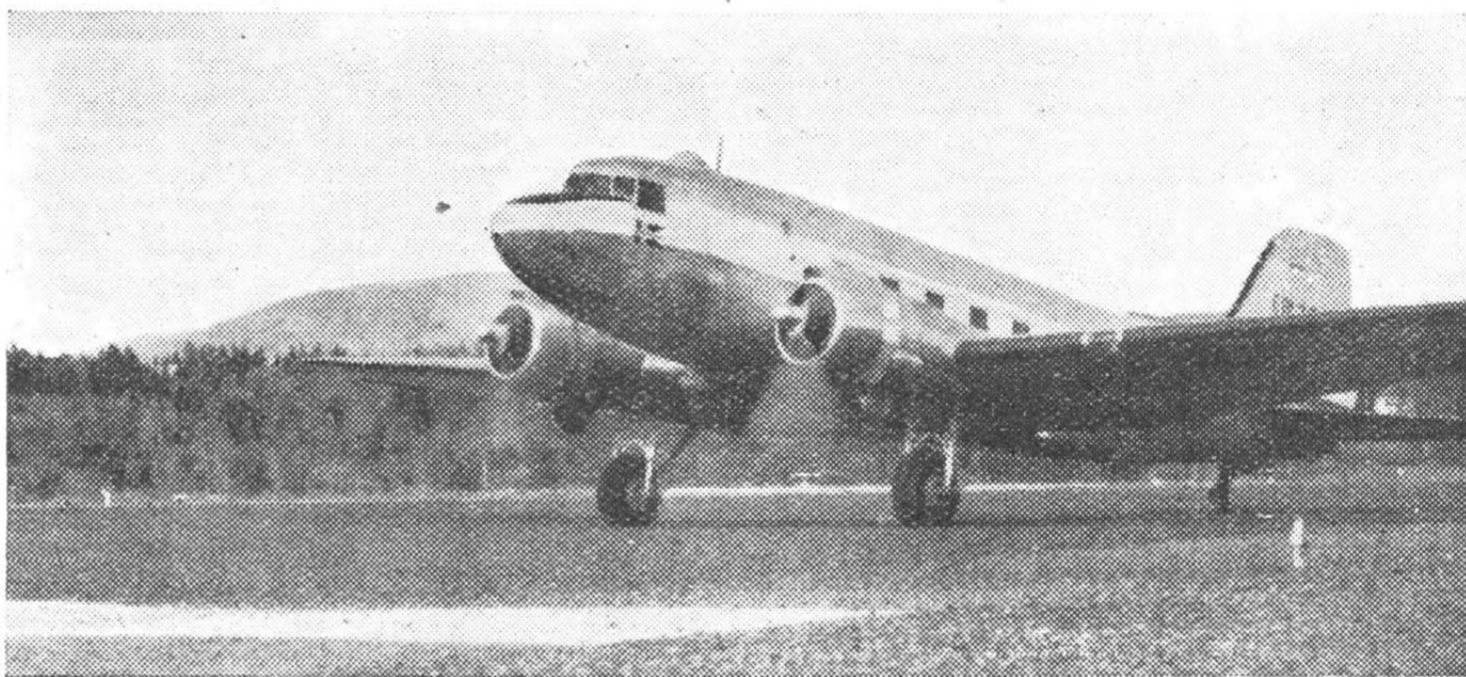
Internal Services

During last summer, a number of internal services were operated within Norway, but these have now been closed as their importance was not considered sufficient to justify the risks entailed in winter flying under present conditions. The most important internal route was Oslo-Trondheim, and a number of trips by Catalina between Oslo, Bodö and Tromsö were also made, with shorter services on the Oslo-Stavanger and Stavanger-Trondheim routes.

Proposals will shortly be placed before the Norwegian Parliament by the R.N.A.T. for its cessation and for the handing over of air transport to a monopoly company with commercially-subscribed capital. This would take over all

the aircraft and experienced personnel. Plans for the future include the acquisition of a fleet of Douglas DC-4 aircraft for main routes, the extension of the Oslo to Stockholm and Copenhagen services beyond their present termini, and the extension of the Amsterdam service as far south as Paris. A trans-Atlantic air service is also being considered. Internally, Oslo-Bergen is an obvious choice for early reopening, as it was once Norway's best-paying route.

As in many other capitals, there is much discussion in Oslo about the city's future air terminus. Fornebu was used before the war. This airfield is near the town and, moreover, it has an adjacent seaplane base on Oslo Fjord. The Germans extended the landing area during the war by



ONE MORE DAKOTA ; but this commercialised model has the Norwegian flag on its nose and the hills encircling Fornebu airfield in the background.

blasting away half a hillside. Even so, Fornebu, being almost surrounded by hills, is not a "good" airfield and it is considered too small by modern ideas. Increasing use is likely to be made of Gardermoen, a large airfield with 2,000-yard runways and long, flat approaches. It was developed as a bomber station by the Luftwaffe and has been used both by the R.A.F. and by the U.S. A.T.C. during the summer. But Gardermoen is 30 miles from the centre of Oslo and present communications are poor, though quite capable of improvement. At least, Gardermoen could be used for the long-distance services and as a "bad weather" alternative to Fornebu.

STILL MORE NORMAL

WITH the introduction of a new series of *Notices to Airmen* we seem to be returning even more quickly to normal times. The *Notices* will be printed on pink paper when dealing with navigational warnings and on white paper for less urgent information. As might be expected, the old *Air Pilot* has been cancelled, since it would have been impossible to amend it successfully. A new edition will be published in due course.

The first of a series of four *Notices to Airmen* includes one giving the dates for civil aircraft navigators' licensing examinations and another dealing with the arrangements which have been made for the resumption of "B" licence flying tests, which will, as before, be made from Croydon. For the benefit of those who have not a chance of seeing the *Notices* application for such tests should be made to the Ministry of Civil Aviation (Licensing Branch), Ariel House, London, W.C.2.

Pilots and other members of air crews who have no normal means of access to files of *Notices* should apply for individual issue to the Ministry of Civil Aviation (C.A.P.), London, W.C.2.

CIVIL AVIATION NEWS

FAR EASTERN LINK

PREVIOUS to the opening of the Chungking, Canton, Shanghai and Hong Kong service on November 22, China National Aviation Corporation had already started a service between Hanoi and Kunming. This is interesting, since the former is in French Indo-China and the latter is a capital of Yunnan province.

DECCA POSSIBILITIES

IT appears that the French radio authorities have arranged to organise a "grid" covering France and French colonies for operation with the Decca system of radio navigation which was described in *Flight* of September 13.

ATLANTIC COSTS

ALTHOUGH Pan-American Airways have been virtually forced to agree to the pre-war Atlantic fare of £93 15s., the company consider that the "cut" rate of approximately £69, to which they recently reduced their single fare, is an adequate commercial rate for such operations with modern types of landplanes. The standardised fare is that which has been considered adequate for a service using somewhat less economical flying boats. The P.A.A. attitude was explained in a recent statement from the company in which regrets were nicely expressed for "this competitive incident between two U.S. airlines serving the United Kingdom" which may have been a "source of embarrassment to the British Government."

AUSTRALIAN ITEMS

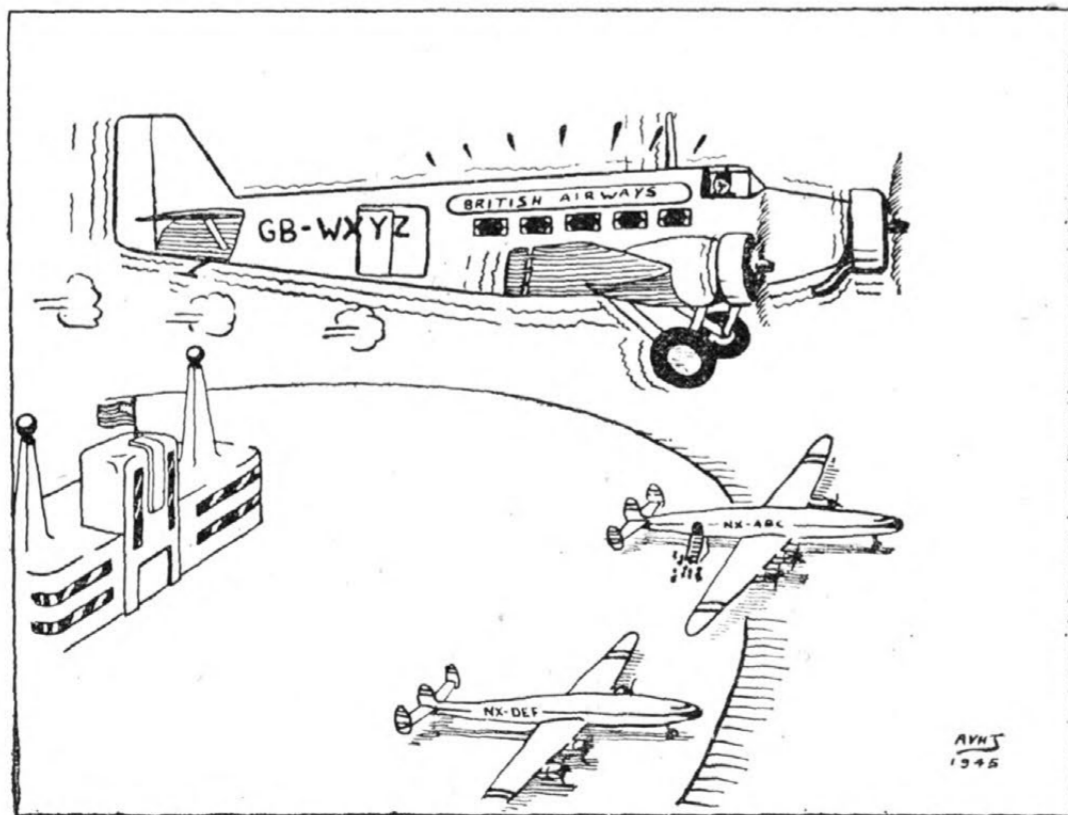
AMONGST the various purchasers of American aircraft is Australian National Airways, and the first of their DC-4 Skymasters is expected to arrive in January.

MacRobertson Millar Aviation have recently started a fortnightly "station" service in the form of a round trip to the various larger properties of West Australia which have the necessary landing strips. A doctor accompanies each aircraft from Broom to deal with the settlers' medical requirements.

There appears to be a good deal of support for the idea of making an entirely new land-sea airport for Sydney. The suggested area is that of Botany Bay.

The R.A.F. Transport Command service across the Pacific was discontinued, according to plan, on December 1. There were hopes that this service might be given a temporary lease of life on "emergency" grounds, but nothing came of the hopes. Liberators have been used exclusively for the service, which has, we learn, had a casualty-free record.

Canada's trans-Pacific air service is expected to follow a route from Vancouver to San Francisco, then on to Honolulu, Canton Island, Fiji and Sydney. One T.C.A. flight in four will make Auckland, New Zealand, its terminal. No date has been given for the opening of the service. The order



"WON'T IT LOOK GRAND"—with apologies to Titanic

(News item: "A plan to use captured Junkers 52/3m transport monoplanes to help re-equip British air lines is under consideration.")

of "urgency" for the Trans-Canada Airline services is: North Atlantic, West Indies-South America and Australia. It may be two years before this programme is fully implemented.

FOR GENERAL ASSISTANCE

A NEW concern, the purpose of which is primarily to act as a technical branch of British Aviation Insurance, has recently been formed. This is British Aviation Services and the name first appeared in connection with the delivery of the Dodero Sunderlands. This may be typical of the work which will be handled by the company. Capt. A. G. Lamplugh, principal surveyor and underwriter of B.A.I.C., is a director, while the managing director is Air Comdre. G. J. Powell, C.B.E., who is, of course, an ex-B.O.A.C. captain and a pioneer of the North Atlantic air route. During the war he has served as S.A.S.O. at 45 Group, Montreal, in connection with Atlantic ferry work.

SCANDINAVIAN PLANS

AT a recent conference in Copenhagen organised by the Danish company D.D.L., various prospects were outlined.

K.L.M. announced the opening of a daily service this month between Malmö and Amsterdam and that, with their ordered DC-4s, they would open services between Stockholm and Lisbon, and Stockholm and Geneva, each via Amsterdam.

Swedish A.B.A. hope to increase the frequencies on their services from Stockholm to Prague, Geneva and Paris, and also to operate certain of these services with DC-4s. D.D.L.'s present runs are those between Malmö and Copenhagen, Amsterdam and Paris, and between Copenhagen and Geneva.

CONTROL SIMPLIFICATION

AN American company has patented a system of aircraft control, known as the Elme, in which the rudder pedals have been discarded and the operations are concentrated in a column. The elevators and ailerons are moved by conventional column movements, while the rudder is operated by a wheel on this column. The idea is not designed so much to simplify flying, as to reduce costs and weights.

Presumably the firm knows all about the ingenious little Hordern-Richmond twin-engined light aircraft which was being experimentally flown in pre-war days with just such a control system. It presented some difficulties to the pilot already trained and practised in the operation of a normal system, but was soon mastered and might have proved to be rather more easy for the newcomer than the conventional layout.

"PROVING" ROUTES

WITH the idea of checking the safety of, and the ground organisation over, the various projected world air routes, the American Civil Aeronautics Administration has been planning a series of "proving" flights. Such are now under way across the Atlantic via the Azores, and have already been made across the North Atlantic, across the Pacific as far as Hawaii, to Alaska, and through Central and South America. In the near future the Pacific checks will be completed to Manila and Hong Kong and from Hawaii to New Zealand. In order to obtain accurate and experienced reports, the C.A.A. staff now includes more than a score of U.S. Army and Naval transport aircrew members.

VITAL FUEL

CHARTER flying concerns, schools, clubs and private owners will, after January 1, be in much the same position as the private and professional motorist as far as their fuel supply is concerned. The Ministry of Fuel and Power has authorised the release of limited quantities of aviation fuel for essential flying, and forms of application for this purpose may be obtained from Wing Comdre. E. Huntley, Air Ministry E.36, 19/29, Woburn Place, London, W.C.1, who has been in charge of the organisation of the aircraft rationing system.

Certain maximum limits have been stipulated, and the actual amount allowed will depend, of course, on the purposes and types of aircraft used. Charter operators will receive the equivalent fuel for a maximum of 60 hours' flying every month for each aircraft in service; clubs will be able to fly for a maximum of 50 hours every month for each aircraft; and, finally, the private owner, unless he can show that his aircraft will be used for business purposes, will receive the not very adequate allowance for an equivalent of four hours' flying a month.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

CAPTURED HELLCATS

Luftwaffe Used Them Against Allies

I HAVE a piece of information which, I think, may interest some of your readers. It is that on January 1st last, when the German Air Force attacked our airfields in Belgium, the force which attacked Ghent airfield consisted of two ME.262s which floated around independently, and a formation of about ten Fw 190s and two Hellcats with German markings on.

My qualifications for stating that they were Hellcats, not new type 190s, are as follows: (1) I have been an A/c rec. instructor; (2) they were only 50ft. up when they passed over us; (3) before I went over there I was on a station where there were some F.A.A. Hellcats; and (4) it was a beautifully clear day.

I think that completely covers that point.

What I would like to know is where they managed to get hold of them? Norway scarcely seems to provide a feasible answer. Another point is that all these aircraft were supposed to have been destroyed before they reached Germany; if so, why have we never heard anything of these two Hellcats?

W. L. G. NICOLL.

TWIN TRAINERS

R.A.F. and R.C.A.F. Methods Can Differ

"AYEONE" (*Flight*, November 29th) alleges that I ("Ulysses," *Flight*, November 15th) made several mis-statements which he went to great pains to correct. My views were based on my experience and observations over a period of years while "Ayeone" undoubtedly expresses the RAF instructor's viewpoint. I am not a member of the RAF and consequently our experience has not been identical, and the following comments on "Ayeone's" six points may clarify the situation.

(1) In Canada I spent two years at an RAF station instructing on Harvard aircraft. Whenever the various RCAF visiting flights came to the station there was a considerable divergence of opinion between the O.C. of the visiting flight and the CFI, especially with regard to cross-wind landings in a Harvard. Both sides put forth competent arguments to support their views. This shows that the RCAF and RAF did not always do everything the same way.

At the RCAF station where I was for a year it was the "common practice" to correct a swing on landing in a twin-engine aircraft by using the inside engine. At A.F.U.s in this country all the Canadian twin-engine instructors who were on course stated that engine was used to correct a swing in Canada, on the stations where they had been instructing.

(2) (a, b, c) I agree completely.

(3) Quite true, but unfortunately I have heard of some instructors who are lacking in self-respect.

(4) Again I agree. One course of pupils was soloed on Harvards without the use of flaps because of the high winds prevailing. Nevertheless, some instructors from other stations were very much surprised at this. I have heard of two S.F.T.S.s where pupils graduated without ever using anything but full flap all the time. This was probably before flapless landings became an obligatory part of the training at such stations.

(5) Unfortunately "Repat" Depots are not equipped with flying facilities so I am unable to offer "Ayeone" an opportunity of carrying out his very generous offer. It was with some hope that a volunteer would come forward to give a competent demonstration of how to fly an Oxford under all conditions that the letter was written.

(6) I am afraid that I was not concerned in this discussion with three-point landings in the early stages. On all present elementary trainers the reasons are obvious. However, in aircraft of the Oxford class, I repeat, a three-pointer is only necessary when (a) carrying out a precautionary landing, (b) landing on rough ground, and (c) landing on a small airfield. The insistence on three-point landings early in war resulted in Hudsons being three-pointed while T.C.A. did wheelers with their Lockheed 14's. Therefore, except as above mentioned, three-pointers are archaic.

"ULYSSES."

THE LONG-DISTANCE RECORD

Publicity for U.S. Achievements

I HAVE noticed with regret a tendency on the part of the Press in this country, and even in *Flight*, to make less of the breaking of the world's long-distance record by America than seemed to do justice to such a great achievement.

Perhaps it may have been (though this is mere conjecture on my part) that the American Press had not given a fair showing to the equally great achievement of the breaking of the world's speed record by a British aircraft. But even had that been the case, we ought to put ourselves above the level of "Sanctions" over publicity in matters of this sort.

During the war which has just ended, we have witnessed a magnificent combination of air strength in the operations of the Royal Air Force and of the U.S. Army Air Forces. The high-light of the R.A.F. was its fighter strength, so that it came as a fitting postscript to the great story of Fighter Command that we should publicly demonstrate, not only that we had built the most effective fighters for combat use, but that we had evolved the fastest fighter in the world.

In a similar manner, the high-light of the U.S. A.A.F. was the vast daylight bombing effort by those Forces, beginning with the Forts and Liberators in Europe, and reaching its climax in the long-range raids by the Superforts in the Pacific. To that splendid work, no better postscript could be found than the 8,198-mile flight of a Superfort from Guam to Washington.

I believe it is a fact that the Superfortress took off with a load of 9,250 Imperial gallons of fuel (equivalent to more than the contents of 7½ 6-wheeled bowsers), that that machine could not climb above 500ft. for the first two hours, and that the last 2,500 miles were flown on three engines. This information I have gleaned from various newspapers, but unfortunately there is no authoritative account of the record flight, such as I would have expected, in *Flight*; it is surely not too late for you to make good this omission.

Despite the several occasions on which we are bound to "nark" the Americans, and be equally narked in return, the need for Anglo-American co-operation remains paramount. To this end let us not be ungrudging in our praise when it has been so well merited.

JOHN GRIERSON.

[Mr. Grierson's suspicion that some dark and sinister motive prevented us from showing due appreciation of the world record flight of 8,198 miles made by a Superfortress is quite unfounded and rather amusing. Probably no other non-American journal has given, during the war years, so much publicity to American achievements as we have. That fact is, we believe, generally recognised by manufacturers in the United States. When we went to press only the barest facts of the American record were available, and even now little more firm, factual information has been released. When all the essential data enable a true assessment of the flight to be made, we shall deal with them.—ED.]

AIRSCREW TURBINES—

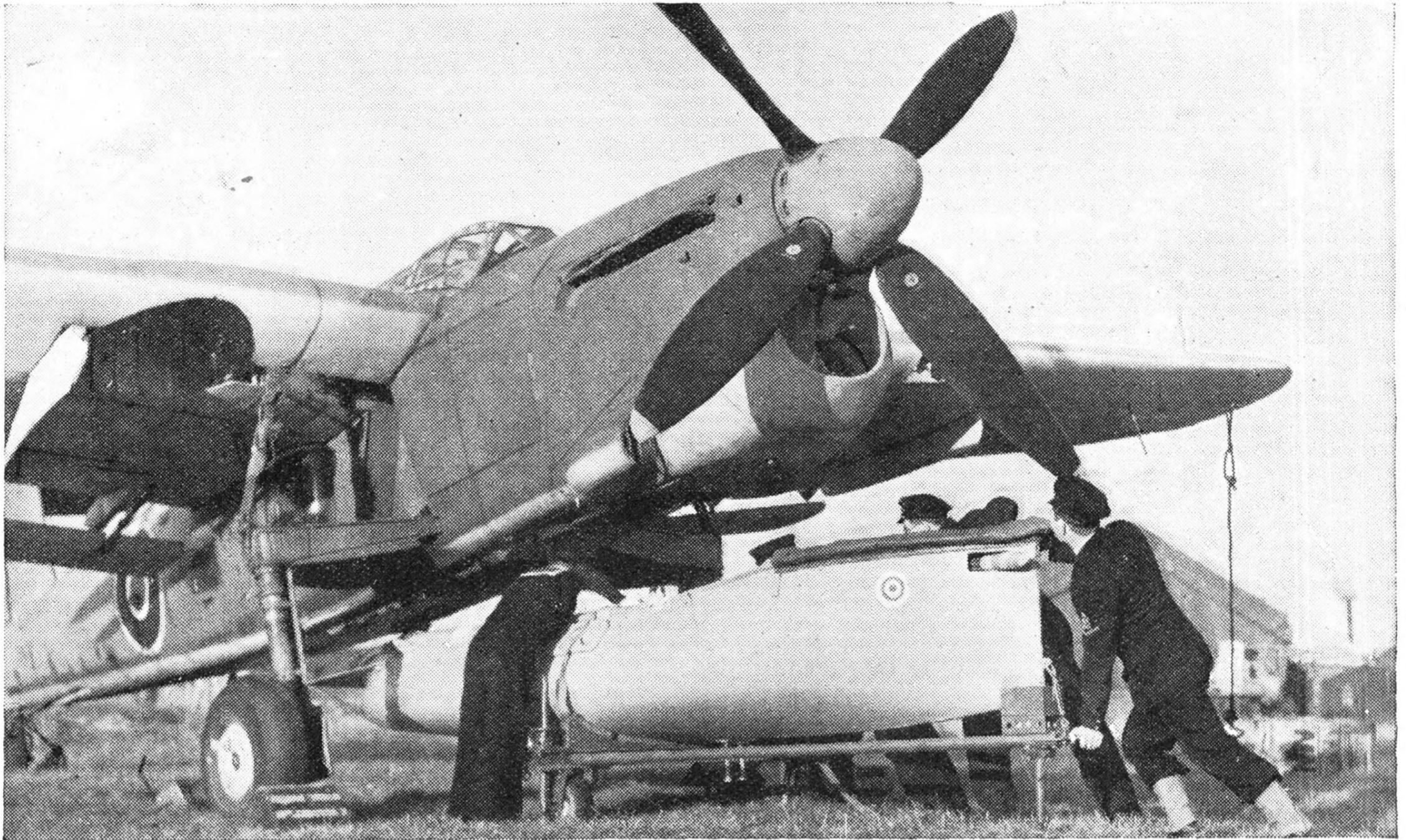
—Revive an Old Question in New Form

AT the risk of starting a controversy, I should like to raise a point which has been causing a certain amount of heated debate among some other non-technical types with whom I work. Briefly, your description of the Bristol Theseus I turbine/airscrew combination makes us wonder how much, if any, thrust is lost by virtue of the fact that the jet is operating in an airscrew slipstream.

I am aware that a rocket will operate as well in a vacuum as it will at sea level, presumably because the emerging gas does not "push against the surrounding air" (as might be supposed), but against its own inertia, which rapidly increases as the speed of the emerging stream falls off with the distance from the centre of combustion.

I cannot, however, see that the case of the turbine jet working in a slipstream is quite comparable. A/C.2.

[No thrust will be lost by reason of the compressor intake being behind the airscrew—in fact, a slight gain will result from the increase in ram effect. A rocket will operate in a vacuum because the fuel contains the oxygen necessary for combustion; this does not apply in the case of a jet-propulsion unit.—ED.]



SCHOOL FOR SAFETY: Valuable research and training work is carried out at the Naval Air Safety School at Eastleigh. The photograph shows an airborne lifeboat being attached to an N.A.A. Barracuda.



SERVICE AVIATION



Royal Air Force and Naval Air Arm News and Announcements

Awards Royal Air Force

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:—

Distinguished Service Order

Act. Wing Cdr. D. R. STUBBS, D.F.C., R.A.F.V.R.—This officer has participated in many successful operational sorties. During one attack on Munich he flew over the target at an altitude of 800 feet, despite enemy anti-aircraft fire, in order to complete his mission successfully. He also participated in the destruction of the Mitteland Canal at Gravenhorst in February, 1945, and in the attack on the Dortmund-Ems Canal at Ladbergen in March, 1945. Wing Cdr. Stubbs has also attacked synthetic oil plants at Merseburg, Pöhlitz, Leipzig-Bohlen, Rositz and Molbis. He has at all times displayed a high order of courage and devotion to duty.

Sqn. Ldr. H. C. KELSEY, D.F.C., R.A.F.V.R., No. 515 Sqn.—Since being awarded a Bar to the D.F.C., Sqn. Ldr. Kelsey has completed numerous high and low-level sorties by day and night, as well as fire-drawing missions over the Kiel and Dortmund-Ems canals and fire-raising attacks on many enemy airfields. He has destroyed at least another six enemy aircraft, bringing his total victories to at least 10 enemy aircraft destroyed. This officer has also inflicted considerable damage on the enemy's rolling stock. On many other occasions Sqn. Ldr. Kelsey has served in a particularly responsible role and has invariably accomplished his tasks in a masterly manner, often during adverse weather and in the face of concentrated anti-aircraft fire. He has, at all times, proved to be a skilful pilot and an inspiring leader.

Flt. Lt. A. R. MIDDLETON, D.F.C., R.A.F.V.R., No. 102 Sqn.—This officer has completed his third tour of operations. In April, 1945, he led the squadron in attacks on Heligoland and Nuremberg which proved to be highly successful. Flt. Lt. Middleton has been an outstanding leader both in the air and on the ground. His courage,

determination and ability while participating in most hazardous missions have contributed much to the success achieved by the squadron.

Flt. Lt. J. SPEDDING, D.F.C., R.A.F.V.R., No. 109 Sqn.—This officer has completed two tours of operational duty. For the majority of his sorties he was engaged on target marking duties in attacks directed against vital and strongly defended industrial targets in the Ruhr or in the Ludwigshaven and Gotha areas. He has a fine record of successes. Flt. Lt. Spedding has also been in command of a flight, and by his fearless leadership, determination and unswerving devotion to duty, he has set an inspiring example to all under his command.

Act. Flt. Lt. R. W. POWELL, D.F.C., R.A.F.V.R., No. 109 Sqn.—This officer has participated in three tours of operational duty. Since the award of the D.F.C. he has guided his aircraft in attacks against flying bomb sites, storage depots, tactical targets in support of the allied armies, and on strategic attacks against German oil and industrial centres. At all times Sqn. Ldr. Powell has set a magnificent example by his imperturbability under concentrated enemy anti-aircraft fire and by his outstanding navigational skill, which has inspired confidence in all with whom he has flown.

Act. Flt. Lt. J. WATT, D.F.C., R.A.F.V.R., No. 97 Sqn.—Flt. Lt. Watt commenced operational flying in November, 1940, and since then he has taken part in a large number of sorties, including numerous attacks against many of the major and most heavily defended industrial targets in Germany. More recently he has been navigator in a crew engaged on particularly responsible operational tasks. In April, 1945, this officer was detailed for an attack against the railway sidings at Cham in Czechoslovakia. The target was very small, and it was mainly owing to Flt. Lt. Watt's skilful navigation that the mission was successfully accomplished. This officer has proved to be an excellent leader, who by his skill and courage has inspired confidence in all the crews with whom he has flown.

Act. Flt. Lt. J. P. WHYMARK, D.F.C., R.A.F.V.R., No. 103 Sqn.—Since the award of the D.F.C. in June, 1944, this officer has been employed as gunnery leader of his squadron. In this capacity he has done excellent work both in the air and on the ground. On his first tour this officer participated in attacks on Benghazi, Taranto and Tripoli. During this time his aircraft was involved in two serious crashes whilst returning to base after being damaged by enemy action. Flt. Lt. Whymark has also operated in Western Europe. His missions have included attacks on Frankfurt, Stuttgart, Chemnitz, Munich, Berlin and Essen. Flt. Lt. Whymark



Badge of No. 790 Squadron, Naval Air Arm—*"In alto Societas"* (There's company aloft). On a blue field, upon clouds melting white, a cock proper.



Badge of No. 897 Squadron, Naval Air Arm—*"Quam possumus optime"* (The very best we can). On a blue field, upon a roseate tern proper.

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has at all times displayed skill and determination while on operations.

F/O. J. CASTAGNOLA, D.F.C., R.A.F.V.R., No. 617 Sqn.—F/O. Castagnola has taken part in a large number of operational sorties, many of which have been against major and heavily defended targets, including Berlin. He has throughout displayed exceptional ability and outstanding courage and determination. This officer participated in all three attacks which culminated in the destruction of the German battleship *Tirpitz*. In April, 1945, he was a member of the force which successfully attacked the battleship *Lutzow* and pressed home his attack in the face of very intense opposition. In the face of danger F/O. Castagnola's cool courage has inspired the members of his crew with confidence.

Act. Wing Cdr. M. G. COWAN, R.A.A.F., No. 460 (R.A.A.F.) Sqn.—During his first tour of operational duty this officer operated from the Netherlands East Indies. In this period his sorties were of the most difficult and hazardous nature, but he continued to display the utmost courage and devotion to duty. Wing Cdr. Cowan's missions in the European theatre of war have included attacks on Weisbaden, Ludwigshafen, Chemnitz and Hanover. On all these operations, intense anti-aircraft fire was encountered and frequent opposition from enemy fighters. As a squadron commander, Wing Cdr. Cowan has proved to be an excellent leader and has at all times shown a high standard of courage and devotion to duty.

Act. Sqn. Ldr. D. J. SULLIVAN, D.F.C., R.A.A.F., No. 463 (R.A.A.F.) Sqn.—Sqn. Ldr. Sullivan has participated in many hazardous sorties. His missions have included sorties to Berlin, Nuremberg, Hamburg, Stuttgart, Dortmund-Ems and Bremen. He took a very active part in the destruction of the Dortmund-Ems Canal, Sqn. Ldr. Sullivan has also attacked targets deep in the heart of German fighter zones with excellent results. Throughout, this officer has displayed keenness, determination and great ability.

Act. Wing Cdr. D. J. MCQUOID, D.F.C., R.C.A.F., No. 405 (R.C.A.F.) Sqn.—Since the award of a Bar to the D.F.C. this officer has participated in many operational sorties. He is an outstanding organiser and leader who, both in the air and on the ground, has set an inspiring example of skill, keenness and devotion to duty. On numerous occasions, when serving as master bomber or deputy master bomber, Wing Cdr. McQuoid, in adverse weather, has pressed home his attacks to a successful conclusion and by his determination and courage materially contributed to the success attained.

Second Bar to Distinguished Flying Cross

Sqn. Ldr. H. V. PETERSON, D.F.C., No. 429 (R.C.A.F.) Sqn.—This officer has served in both the African and European theatres of war. Since the award of a Bar to the D.F.C. he has attacked many of the most heavily defended targets in Germany. On several occasions his skill and fortitude were mainly responsible for the safe return of his aircraft and crew. Sqn. Ldr. Peterson is a flight commander of outstanding ability, whose fine leadership and organisation have been reflected in the high standard of operational efficiency maintained by his flight.

Bar to Distinguished Flying Cross

Act. Sqn. Ldr. E. L. PICKLES, D.F.C., R.A.A.F., No. 550 Sqn.
Act. Sqn. Ldr. C. C. GARDNER, D.F.C., R.A.A.F., No. 460 (R.A.A.F.) Sqn.
Sqn. Ldr. J. C. R. BROWN, D.F.C., R.C.A.F., No. 434 (R.C.A.F.) Sqn.
Sqn. Ldr. J. HUDSON, D.F.C., R.C.A.F., No. 434 (R.C.A.F.) Sqn.
Flt. Lt. T. A. ANGUS, D.F.C., R.C.A.F., No. 149 Sqn.
Flt. Lt. E. G. DUNDAS, D.F.C., R.C.A.F., No. 434 (R.C.A.F.) Sqn.
Act. Flt. Lt. J. P. DIXIE, D.F.C., R.C.A.F., No. 170 Sqn.
Flt. Lt. J. CASSIDY, D.F.C., R.A.A.F., No. 550 Sqn.
Flt. Lt. B. A. CONNOR, D.F.C., R.A.A.F., No. 162 Sqn.
Flt. Lt. O. A. S. PATTERSON, D.F.C., R.A.A.F., No. 460 (R.A.A.F.) Sqn.
Flt. Lt. T. V. WATTS, D.F.C., R.A.A.F., No. 460 (R.A.A.F.) Sqn.
Act. Flt. Lt. C. T. CROOK, D.F.C., R.A.A.F., No. 460 (R.A.A.F.) Sqn.
Act. Flt. Lt. F. E. HUGHES, D.F.C., R.A.A.F., No. 97 Sqn.
Act. Sqn. Ldr. J. C. PARKER, D.F.C., R.N.Z.A.F., No. 75 (N.Z.) Sqn.

Distinguished Flying Cross

Act. Sqn. Ldr. K. M. BOLES, R.N.Z.A.F., No. 109 Sqn.
Flt. Lt. C. E. BAXTER, R.N.Z.A.F., No. 186 Sqn.
Flt. Lt. G. C. HITCHCOCK, R.N.Z.A.F., No. 635 Sqn.
Flt. Lt. J. A. SCOTT, R.N.Z.A.F., No. 10 Sqn.
Flt. Lt. G. A. L. WEBBY, R.N.Z.A.F., No. 139 Sqn.
Flt. Lt. B. D. WILLIAMS, R.N.Z.A.F., No. 78 Sqn.
Act. Flt. Lt. R. S. BISHOP, R.N.Z.A.F., No. 635 Sqn.
Act. Flt. Lt. R. B. BOLT, R.N.Z.A.F., No. 35 Sqn.
Act. Flt. Lt. E. C. HARRIS, R.N.Z.A.F., No. 630 Sqn.
Act. Flt. Lt. D. A. INGHAM, R.N.Z.A.F., No. 214 Sqn.

Conspicuous Gallantry Medal (Flying)

W/O. S. C. HOPKINS, R.A.F., No. 214 Sqn.—W/O. Hopkins has a long record of operational

flying. He has completed two tours of duty with Coastal Command and one in which he has been employed on bomber support duties. During this last tour all his sorties were against heavily defended targets in the heart of Germany. By his cool courage, efficiency and determination in the face of the enemy this warrant officer has inspired the other members of his crew with confidence.

W/O. S. NUTTALL, D.F.M., R.A.F.V.R., No. 35 Sqn.—Since the award of the D.F.M. this warrant officer has flown on many more operational sorties, serving in a crew engaged on important marking duties. An air gunner of outstanding ability, his keen vigilance has, on many occasions, enabled his captain to take action to avoid enemy night fighters. Throughout a long period of operational flying, W/O. Nuttall has displayed gallantry and devotion to duty of a high order.

W/O. H. SCOTT, R.A.F., No. 223 Sqn.—This warrant officer has completed two tours of operational duty and has served with both Coastal and Bomber Commands. He is an air gunner, who,

throughout a long operational career, has consistently displayed outstanding gallantry and devotion to duty. By his courage, skill and determination in action he has set an inspiring example to all.

W/O. S. J. TREGUNNO, R.A.F.V.R., No. 51 Sqn.—Throughout two tours of operational duty, this warrant officer has displayed outstanding skill, courage and devotion to duty. As air gunner he has attacked most of the heavily defended targets in Germany. On his first mission in 1943, his aircraft was attacked by an enemy aircraft and so badly damaged it was forced down on to the sea. W/O. Tregunno and the other members of his crew were rescued by an airborne lifeboat. Despite this trying experience he resumed operational flying with undiminished enthusiasm and, later, shared in the destruction of two Junkers 88s. On another occasion this warrant officer was involved in an air combat with three enemy fighters, the engagement lasting 20 minutes before the hostile aircraft were driven off. At all times W/O. Tregunno has shown great courage and determination in the face of the enemy and his calm, confident bearing has been a valuable asset to his crew.

Flt. Sgt. S. J. H. ANDREW, D.F.M., R.A.F.V.R., No. 35 Sqn.—Since the award of the D.F.M. this airman has flown on a large number of opera-

R.A.F. WAR COMMANDERS

Air Vice-Marshal Sir Harry Broadhurst

Caricature portrait by Hayden

AIR VICE-MARSHAL SIR HARRY BROADHURST, K.B.E., C.B., D.S.O. and Bar, D.F.C. and Bar, A.F.C., who was born in 1905, is the youngest Air Vice-Marshal in the Royal Air Force. He will always be chiefly remembered as the leader of the Desert Air Force; but even if he had never held that position he would have many claims to a niche in history as a great pilot and a great air fighter.

He joined the R.A.F. in 1926, and soon went with No. 11 Bomber Squadron to India. He flew Wapitis on the N.W. Frontier, and received his first mention in despatches. Then he changed over to fighters, and served with No. 41 and No. 19 Fighter Squadrons. The last named was the first unit to get Gauntlets. His next job was as Chief Instructor at the F.T.S. at Abu Sueir, in Egypt. Then he passed through the R.A.F. Staff College at Andover. In 1939 Broadhurst became C.O. of No. 111 Fighter Squadron, the first unit to be equipped with Hurricanes. This squadron was also made responsible for the development of fighter tactics.

When war broke out Broadhurst went to France. In January, 1940, he was awarded his first D.F.C. Then he commanded a Hurricane wing, which he brought back to England when affairs in France got hopeless. His next activity was to command fighter sweeps over France, and while doing this work he was made a D.S.O. and later received a bar. His part in the Dieppe raid brought him a bar to his D.F.C.

Broadhurst was sent out to the Middle East just before Alamein, being then an Air Commodore, as S.A.S.O. to Sir Arthur Coningham, the A.O.C. Western Desert Air Force. Staff work during the hunting of Rommel into Tunisia must have been very exacting work, for the R.A.F. had to prevent the fast-flying Germans from ever getting clear. The work was brilliantly done. When the victors of Alamein were merged in Gen. Eisenhower's forces in Tunisia, Broadhurst was placed in command of the Desert Air Force (which retained its name, even when fighting in Italy) and

was promoted to Air Vice-Marshal. Had we unlimited space there is much more which might be recounted about Broadhurst. His first decoration was the Air Force Cross, which reminds us that he often performed at the Hendon Displays. Once he was one of three who performed aerobatics with their Gauntlets tied together. He was also a great air gunner, and won prizes for his marksmanship, as well as instructing others in the art of air firing. In his fighter sweeps over France he showed himself a fine pilot and a resolute fighter, and had many adventures which, unfortunately, cannot be described here.



SERVICE AVIATION

tional sorties. Many of these have been flown in the master bomber aircraft and all have been with a Pathfinder force. An air gunner of outstanding ability, Flt. Sgt. Andrew at all times has set a magnificent example by his courage, skill and steadfast devotion to duty.

Bar to Distinguished Flying Medal

Flt. Sgt. (now W/O.) S. HAMILTON, D.F.M., R.A.F.V.R., No. 10 Sqn.

Distinguished Flying Medal

Sgt. P. A. FAIRMAN, R.A.F.V.R., No. 576 Sqn.
Sgt. J. HILL, R.A.F.V.R., No. 102 Sqn.

Flt. Sgt. R. A. H. R. HUDSON, R.A.F.V.R., No. 158 Sqn.

Flt. Sgt. H. L. MACDONALD, R.A.F.V.R., No. 60 Sqn.

Flt. Sgt. A. C. NEWBY, R.A.F.V.R., No. 12 Sqn.

Flt. Sgt. (now P/O.) K. PARMENTER, R.A.F.V.R., No. 115 Sqn.

Flt. Sgt. (now W/O.) R. A. PHILLIPS, R.A.F.V.R., No. 214 Sqn.

Flt. Sgt. S. J. RADFORD, R.A.F.V.R., No. 157 Sqn.

Flt. Sgt. J. S. ROBERTS, R.A.F.V.R., No. 158 Sqn.

Roll of Honour

Casualty Communiqué No. 555.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list, 238 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Flt. Sgt. J. E. Fraser; F/O. T. G. Kingdon; W/O. E. C. O'Donnell.

MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—W/O. L. A. G. Carpenter; Flt. Sgt. D. V. Catterall; Sgt. J. G. H. Cox; Sgt. P. M. Myers; Sgt. R. S. Neale.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. G. P. Boyd; Sqn. Ldr. P. R. A. Ford, D.F.C.; P/O. G. Lister, D.F.M.; Sgt. K. Morrell; Flt. Sgt. R. A. Newham; Flt. Sgt. R. Phillips; Sgt. W. P. L. Purnell-Edwards; Sgt. G. I. Read.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. N. W. S. Abbott; Act. Flt. Lt. R. Adams, D.F.C.; Sgt. F. H. Aldridge; Sgt. J. B. Anderson; Flt. Sgt. F. R. Ashcroft; Sgt. E. Attenborough; Flt. Sgt. D. McF. F. Bell; P/O. D. G. Bradd; Sgt. D. Brooks; Flt. Sgt. E. J. A. Broomfield; Flt. Sgt. W. Brownlee; Sgt. N. Buckley; Cpl. J. E. M. Burgess; L.A./C. J. C. Burnett; Sgt. A. Campbell; Sgt. E. D. Carmichael; Flt. Sgt. L. C. Carter; Sgt. H. J. Chandler; Flt. Lt. P. Chinn; Sgt. T. S. Clay; Act. F/O. F. A. Clayden; Flt. Sgt. C. R. Clement; Sgt. W. Coates; F/O. D. C. Cooke; Act. Flt. Lt. N. J. Cornell; Act. F/O. C. W. Crawford; Sgt. A. H. Davies; Act. Sqn. Ldr. I. J. Davies, D.F.C.; F/O. L. G. Davis; Sgt. F. Dawson; Sgt. J. Divens; Sgt. R. E. Duck; F/O. H. W. J. Edwards; F/O. A. J. Enser; Flt. Sgt. E. V. Evans; Act. Sqn. Ldr. A. E. Foster, D.F.C.; F/O. P. J. Garlette; Sqn. Ldr. J. R. Grant; F/O. W. T. Grew; Sgt. A. D. Griffin; Sgt. C. L. Hagger; Sgt. T. A. Hall; Sgt. C. A. Hallett; Sgt. D. W. E. Hardy; Sgt. W. E. Hawkins; Sgt. E. W. Hayes; F/O. F. L. Hewish; Flt. Lt. J. R. Hill; Sgt. C. O. Holden; Flt. Sgt. D. A. Houben; Flt. Sgt. G. B. Hyndman; F/O. W. L. W. Jones; Act. W/O. D. R. Kelly; Sgt. H. G. Kember; F/O. K. H. King, D.F.C.; Sgt. G. Lamb; Sqn. Ldr. C. G. D. Lancaster, D.F.C.; Flt. Sgt. L. Lawrence; Air Chief Marshal Sir T. Leigh-Mallory, K.C.B., D.S.O.; Act. Flt. Lt. F. Lively; Flt. Sgt. R. A. F. Loretan; Flt. Sgt. F. J. May; Flt. Sgt. H. J. Middleditch; Sgt. H. L. Moore; Flt. Lt. K. A. Mooring; Flt. Sgt. G. Orr; Sgt. D. W. Palmer; Sgt. W. G. Parry; Sgt. I. A. Place; Sgt. M. J. L. Priest; Sgt. E. Ramsbottom; Flt. Sgt. D. Richardson; P/O. W. E. Rigby; Flt. Sgt. R. Rodger; Flt. Sgt. L. C. Roots; P/O. A. R. Ross; Sgt. R. H. Salmon; Flt. Sgt. J. P. Shaw; Sgt. R. Sleep; P/O. J. H. G. Smith; Sgt. C. Stapleton; Flt. Sgt. D. MacG. Steven; Flt. Sgt. D. E. J. Stevens; F/O. C. F. Stewart, D.F.M.; F/O. F. R. Stone; Sgt. J. R. Sunley; F/O. J. S. R. Swanson; Sgt. C. Sykes; Sgt. E. E. Tabner; Sgt. D. G. Tarbin; Sgt. A. F. Taylor; Flt. Sgt. A. G. Thomson; Sgt. R. Tomkinson; Sgt. D. G. Tustin; Sgt. R. Watson; Act. Flt. Lt. J. H. Wells; Sgt. T. B. Whewell; Act. Sqn. Ldr. A. L. Williams.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Act. Wing Cdr. W. I. Deas, D.F.C.; Sgt. W. D. Dixon; Act. Flt. Lt. G. G. H. Farara, D.F.C.; P/O. R. J. Locke; Sgt. L. A. A. Page; F/O. J. T. Taylor, D.F.C.; P/O. C. N. Wright.

WOUNDED OR INJURED IN ACTION.—Sgt. C. R. Austin; Flt. Sgt. S. Cooper; Flt. Sgt. H. Jaques; W/O. R. W. H. Narramore; Flt. Sgt. J. S. T. D. Ryder; W/O. H. M. Thomas; F/O. J. H. Wicken.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Sgt. A. J. Burling; Flt. Lt. B. Chapman; Flt. Sgt. T. H. Shirt; F/O. G. C. Smale.

MISSING, BELIEVED KILLED IN ACTION.—Sgt.



R.A.F. IN INDO-CHINA: R.A.F. officers check over the manufacturing details of a Japanese torpedo trainer, found on Thuda airfield, near Saigon in French Indo-China.

A. W. Brooks; F/O. W. H. Bull; Flt. Sgt. T. F. C. Clarke; Flt. Sgt. J. R. Fife-Miller; Flt. Lt. R. W. Robinson; Flt. Lt. R. C. J. Southey.

MISSING.—Flt. Lt. J. Bone; Flt. Sgt. H. D. Charles; Sgt. D. Crawford; F/O. W. L. Hindle; Sgt. J. Reilly; Flt. Sgt. F. Sutcliffe; F/O. D. B. P. Tylor.

KILLED ON ACTIVE SERVICE.—W/O. G. M. Bools; A/C.2 H. Bowley-Booth; Sqn. Ldr. R. P. Braun; Sgt. D. M. Buchanan; Flt. Lt. H. A. Buck; Sgt. J. Buckton; Sgt. A. C. W. Butler; A/C.2 T. W. Calderhead; W/O. G. H. Dixon; Sgt. P. Firth; P/O. T. Gould; Flt. Sgt. F. E. Hadden; Flt. Lt. E. F. Higham; Sgt. K. H. Humphries; Sgt. H. W. Jones; Flt. Lt. G. Knight; L.A./C. P. R. Lummis; A/C.2 A. E. Moule; L.A./C. J. A. Pettyfer; W/O. T. Price; W/O. D. L. B. Ross; Flt. Sgt. A. E. Sims; Flt. Sgt. W. G. Ward.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. R. A. Bloor; F/O. E. W. Hancock; Sgt. J. S. Newton.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED ON ACTIVE SERVICE.—F/O. G. Mamoutoff.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. C. L. Arnold; Sgt. R. F. Searle; L.A./C. W. H. Singleton; Flt. Lt. N. B. Worswick.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Cpl. E. G. East.

DIED ON ACTIVE SERVICE.—W/O. G. D. Barry; A/C.2 H. Corbin; L.A./C. J. Eldridge; L.A./C. G. W. C. Hoskins; A/C.1 W. H. H. Howe; Cpl. M. McKenzie; L.A./C. P. F. Mason; A/C.2 S. A. Munroe; L.A./C. S. Richardson; Sqn. Ldr. D. M. A. K. Roberts; L.A./C. A. J. Shotton; L.A./C. J. Stark; Flt. Sgt. R. J. Thomas; L.A./C. T. Williamson.

Women's Auxiliary Air Force

MISSING, BELIEVED KILLED IN ACTION.—L.A./CW. M. M. Walsh.

DIED ON ACTIVE SERVICE.—Cpl. V. Johnson.

Royal Australian Air Force

KILLED IN ACTION.—W/O. M. C. Keightley.
MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. C. G. Walker.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED KILLED IN ACTION.—W/O. R. Faria.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—F/O. A. A. Christie; P/O. J. T. N. Frost.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—F/O. R. A. Carter.

MISSING, BELIEVED KILLED IN ACTION.—F/O. W. J. Edwards; W/O. K. L. Hamilton.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. H. B. Montgomery.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. T. F. Berrigan; F/O. E. S. Isaacs.

DIED ON ACTIVE SERVICE.—P/O. E. Hurrell.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. J. J. R. Arcand.
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. W. J. Bentley; F/O. J. C. Holder; P/O. D. E. Jones; F/O. R. O. Moen; P/O. J. W. Savoie; Flt. Lt. C. R. Symons; Flt. Lt. A. R. Vance.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. H. A. Armstrong; P/O. J. P. Artyniuk; P/O. E. L. Bailey; Sgt. A. G. Balfour; Flt. Sgt. I. V. Bartlemay; Sgt. C. P. V. Biddlecombe; P/O. J. R. Bigham; P/O. L. Blanchard; F/O. W. S. Bonell; F/O. H. W. Bowker; Flt. Lt. F. T. S. Brice; P/O.

D. C. Brown; P/O. J. O. Burke; P/O. J. E. Byers; W/O. J. P. Clasper; Flt. Sgt. F. A. Coady; Flt. Sgt. D. M. Corbett; F/O. G. A. Costello; Sgt. A. T. Couch; P/O. E. E. Courtis; P/O. L. P. F. Crowther; P/O. J. A. Cunningham; P/O. A. J. Dickinson; P/O. E. D. Dubeau; P/O. C. V. Dymond; F/O. R. G. Ellis; P/O. C. C. Evans; F/O. J. R. Fichtner; F/O. C. H. Fisher; Flt. Sgt. C. C. Gilchrist; Flt. Sgt. C. C. Goble; F/O. F. E. Good; F/O. R. L. Green; Flt. Sgt. B. E. Greenhalgh; P/O. C. J. Hall; Flt. Lt. T. H. O. Hallihan; P/O. G. A. Henson; P/O. W. H. Herman; F/O. J. W. Hermiston; F/O. J. S. Hill; F/O. A. MacM. Hoar; F/O. J. Hong; P/O. F. W. Hood; Flt. Lt. S. B. Huppert; Sgt. W. V. Ireland; F/O. W. Jamieson; P/O. J. Kawucha; Act. Sqn. Ldr. J. B. Kerr; F/O. T. F. Kinsler; Sgt. R. C. Knight; P/O. W. C. Lawson; P/O. C. G. Leatherhead; P/O. R. L. Lochhead; P/O. N. H. Lynch; P/O. F. H. Lyne; F/O. T. B. McAneney; Flt. Sgt. E. J. McCloskey; P/O. D. F. McCorkle; P/O. R. J. J. McFadden; F/O. D. S. MacGregor; P/O. L. W. J. McKenna; Flt. Sgt. A. C. McLeod; Sgt. W. R. Meddick; Sgt. W. H. Moffat; Flt. Sgt. G. E. Moore; F/O. A. J. Morrison; F/O. H. A. Morrison; F/O. G. J. Mullin; P/O. J. K. Murray; F/O. J. A. Naiziger; F/O. A. N. Nelligan; Flt. Sgt. C. J. O'Connor; F/O. H. E. O'dan; F/O. F. G. Pater-son; W/O. M. H. Penhale; P/O. W. F. Pocock; P/O. A. L. Pollock; Flt. Lt. R. Powdrell; P/O. T. W. P. Price; F/O. F. S. Raftery; P/O. A. J. Retter; P/O. G. E. Robertson; F/O. W. J. H. Rushforth; F/O. E. A. Salomaa; P/O. A. M. Simmons; Flt. Sgt. E. R. Smith; P/O. J. O. Smith; F/O. J. Spector; F/O. R. D. Taylor; P/O. F. B. Thaine; Sgt. L. E. Toneri; Sgt. D. Urquhart; P/O. A. J. Venn; P/O. C. R. Verrier; Flt. Lt. D. Wallace; Flt. Sgt. H. P. Warll; F/O. E. F. Warren, D.F.M.; Sgt. J. F. G. Weedon; Flt. Lt. J. W. Weis; P/O. D. S. Whiting; F/O. H. Wright; P/O. J. Wright; F/O. J. F. Wyllie.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED KILLED IN ACTION.—W/O. R. W. Rideout.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—F/O. J. F. Armstrong; F/O. W. G. Baird; F/O. L. Gold; F/O. W. A. M. Hallett; P/O. T. C. Jenkins; Flt. Sgt. J. E. Leaman; P/O. R. T. W. Longley; F/O. E. A. Love; P/O. D. F. Wilson; P/O. W. H. Winder.

WOUNDED OR INJURED IN ACTION.—F/O. G. M. Horter; F/O. A. MacL. Nicol.

MISSING, BELIEVED KILLED IN ACTION.—P/O. J. L. Ives; Flt. Sgt. R. E. Reynolds.

KILLED ON ACTIVE SERVICE.—F/O. G. A. Aubrey, D.F.C.; Sgt. S. Berryman; Flt. Lt. W. G. Campbell; Sgt. V. E. Cline; Flt. Lt. N. W. Guy; Sgt. J. H. Kay; W/O. T. D. Lawley; F/O. B. D. McBride; F/O. R. K. Ourom; Flt. Sgt. F. J. Simpson; F/O. J. D. Travis; Flt. Sgt. J. L. Tweedy; Flt. Sgt. J. R. Williams; Flt. Sgt. D. R. Wilson; Flt. Sgt. E. J. Wright.

DIED ON ACTIVE SERVICE.—Flt. Lt. R. R. Law.

Royal New Zealand Air Force

KILLED IN ACTION.—W/O. R. S. G. Raynel.
MISSING, BELIEVED KILLED IN ACTION.—P/O. B. M. Natta.

South African Air Force

KILLED IN ACTION.—Lt. M. C. D. Breakey.
DIED ON ACTIVE SERVICE.—Act. Cpl. C. J. Botha.

Royal Indian Air Force

KILLED ON ACTIVE SERVICE.—A/C.1 Ghosh.
DIED ON ACTIVE SERVICE.—A/C.1 Joseph.