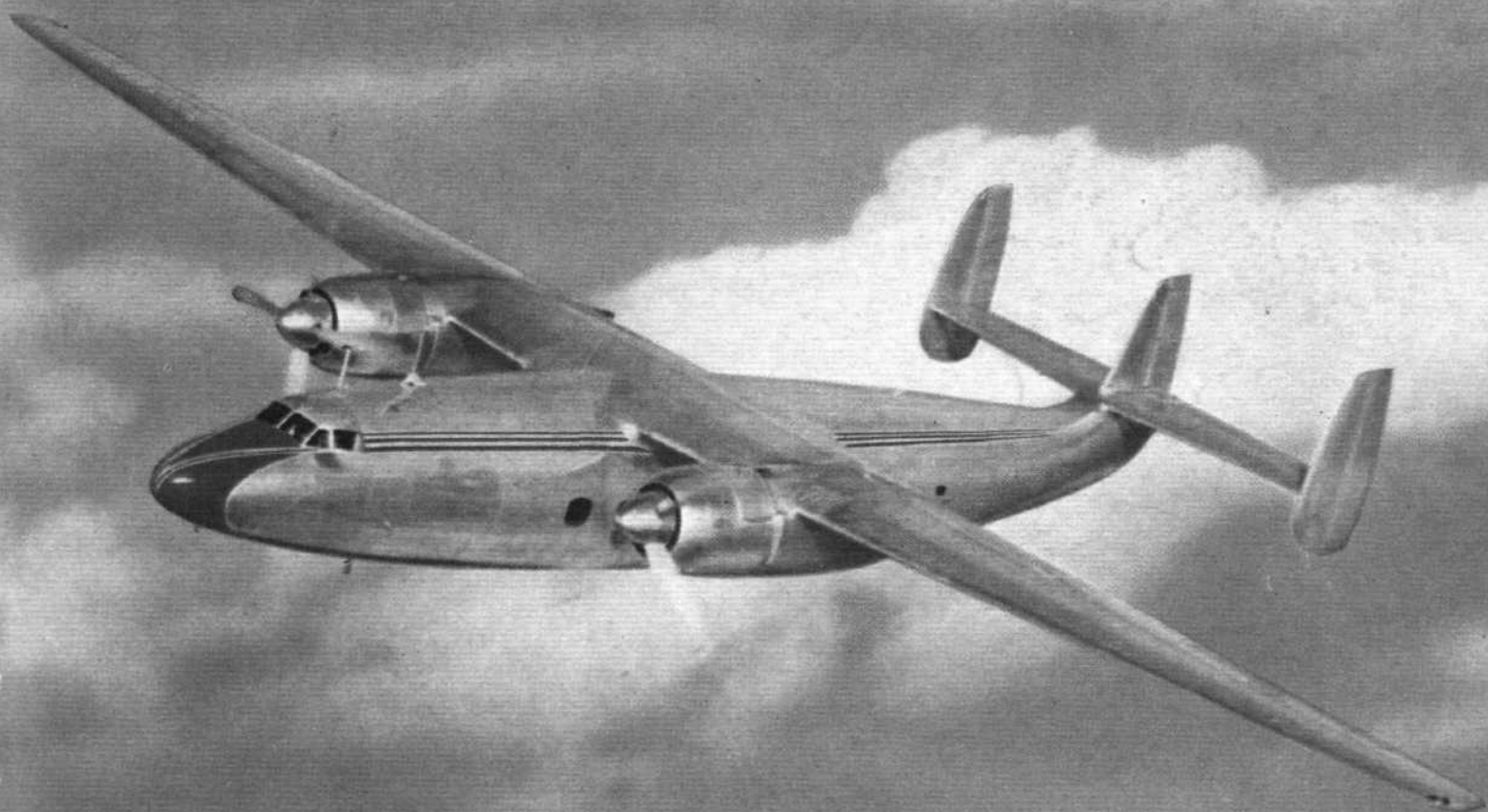


FLIGHT

and
AIRCRAFT ENGINEER

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

ONE SHILLING



AMBASSADOR

AIRSPEED LIMITED, CHRISTCHURCH AND PORTSMOUTH, ENGLAND

In association with the de Havilland Enterprise

Noral again!

Another British aircraft of outstanding design being constructed in Noral alloys. We have supplied all the aluminium alloy sheet and sections for the Saunders-Roe SR/45, together with some of the castings and forgings.

Northern Aluminium COMPANY LIMITED

MAKERS OF ALUMINIUM SHEET, STRIP, PLATE, SECTIONS, TUBING, WIRE, FORGINGS, CASTINGS, PASTE FOR PAINT
TECHNICAL DEVELOPMENT DIVISION: BANBURY, OXON. SALES OFFICES: LONDON, BIRMINGHAM, MANCHESTER, BRISTOL, NEWCASTLE-ON-TYNE, LEEDS



FLIGHT

and
AIRCRAFT ENGINEER

First Aeronautical Weekly in the World

Founded 1909

No. 2112. Vol. LV. THURSDAY, 16 JUNE, 1949

EDITORIAL DIRECTOR
G. GEOFFREY SMITH, M.B.E.

EDITOR
MAURICE A. SMITH, D.F.C.

ASSISTANT EDITOR
H. F. KING, M.B.E.

ART EDITOR
JOHN YOXALL

Editorial, Advertising and
Publishing Offices :

DORSET HOUSE,
STAMFORD STREET,
LONDON, S.E.1.

Telegrams : Flightpres, Sedist, London.
Telephone : Waterloo 3333 (60 lines).

Branch Offices :

COVENTRY
8-10, Corporation Street.
Telegrams : Autocor, Coventry.
Telephone : Coventry 5210.

BIRMINGHAM, 2.
King Edward House,
New Street.
Telegrams : Autopress, Birmingham.
Telephone : Midland 7191 (7 lines).

MANCHESTER, 3
260, Deansgate.
Telegrams : Iliffe, Manchester.
Telephone : Blackfriars 4412 (3 lines).
Deansgate 3595 (2 lines).

GLASGOW, C.2
26b, Renfield Street.
Telegrams : Iliffe, Glasgow.
Telephone : Central 4857.

SUBSCRIPTION RATES

Home : Twelve months, £3 1s. 0d.
Six months, £1 10s. 6d.
Overseas : Twelve months, £2 18s. 6d.

BY AIR : To any country in Europe
(except Poland). Twelve months,
£5 1s. 0d. Six months, £2 10s. 6d.
Canada and U.S.A. Six months, \$16.

In this issue:

Anniversary Display - -	694
South Pacific Traffic - -	705
Deck Landing - - - -	710
Portrait of a Pioneer - -	713
Joint Conférence - - -	714
Revolutionary Refuelling	718

Air Displays and the Public

IT is our belief that a strong and vigorous private flying movement and a keen and active public interest in flying are essential to the well-being of the aircraft industry and British aviation as a whole. Indeed, the future prosperity of our airlines is entirely dependent on increased public awareness and acceptance of air transportation. That abstract quality which for want of a better term is called air-mindedness is one acquired readily by British people; yet it is surprising (and a cause for some concern) that those of the public who wish to associate themselves actively with flying are still comparatively few, even when the cost factor is kept in mind.

It is heartening to read the long list of air displays, "at homes" and competitions which have been arranged for this year. The season has already got off to a good start, and not a week-end will pass by until the autumn without at least one section of the country being treated to an air show. The aviation movement is indebted to those people whose enterprise and hard work make these events possible, but here we must sound a warning note. The planning and organization of flying displays is not a job for the merely enthusiastic. Too much is at stake, and aircraft misused can become lethal machines. Everyone knows that it is easy for an inexperienced pilot to get carried away by the excitement of the occasion and attempt a little more, or cut things a little finer, than is wise. One mishap at a public flying meeting (and the inevitable newspaper publicity) can make a more lasting bad impression and do more harm to the cause than ten well-conducted affairs could rectify.

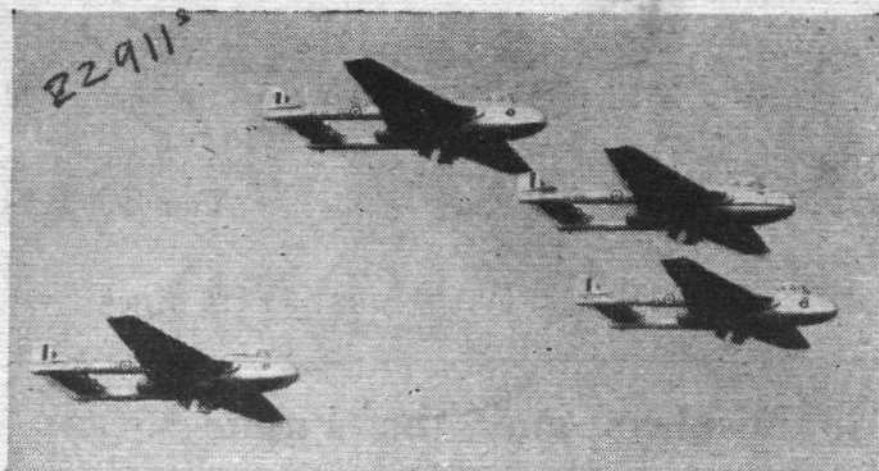
During the last season or two we have seen more than one "shaky do" which should never have occurred. We have in mind, for example, amateur pilots with insufficient skill and in unsuitable aircraft attempting a loop in formation; machines making joy-riding flights around an airfield while an aerobatic display is in progress; and aircraft taking-off and landing towards a marquee or public enclosure.

In addition to these considerations of safety the fact that the public have now learned to expect a high quality of entertainment and a high standard of organization should not be overlooked. They are quick to sense a lack of skill, even if they do not appreciate the finer points, and a long drawn-out programme of flying can be as boring as a sale of work. Competing for this interest are films, dog-, horse- and speedway-racing, professional sports and the radio. It is no longer a simple matter to obtain the support of the R.A.F. or the aircraft manufacturers, who are now seldom permitted to send large or high-speed aircraft for demonstrations. Nor is there such a variety of light aircraft as might be desired. Clubs and other organizers of meetings would do well to concentrate on precise timing, intelligent arrangement of turns, an informative commentary and proper attention to the comfort not only of members and guests but in particular of the paying spectators.

Evere—a Symbol

THERE was something about the international military flying display at Brussels/Evere, reported overleaf, which recalled medieval tournaments. Gallant young warriors (their comments on such a description of them would be entertaining to hear) were met together, primarily to honour the Belgian Air Force on its 35th anniversary, but also, if truth be told, to vie with each other in what amounted to military sports.

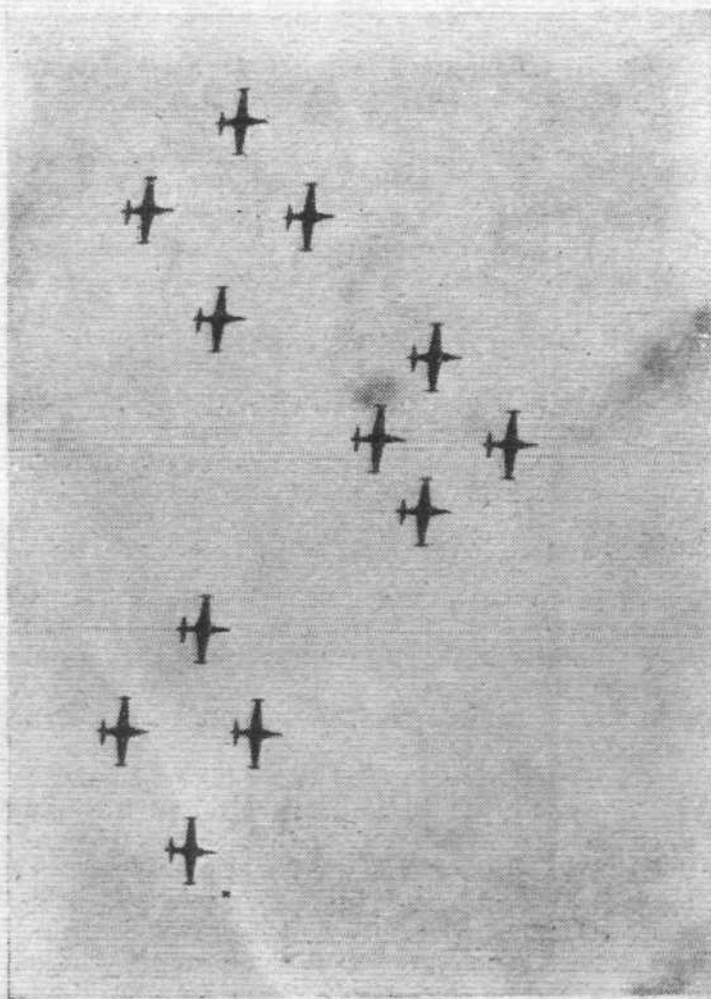
That this signalled a return to chivalry in modern warfare would, of course, be an unjustified conclusion; what it did signify, however, was the robust friendship of like-minded and ever-strengthening nations and their ability to work together. Not only Great Britain, but the U.S.A., France and the Netherlands had their champions in Brussels. Briefing in three languages by a Belgian major (a holder of the D.F.C.) and the good-humoured attention of all present greatly impressed our observer and promises well for the success of the forthcoming exercises in which the U.S.A. and Holland will take part, and to which Belgium and France will send observers. Facilitated by the standardization of British equipment, the knitting together of Europe's defences is evidently well in hand.



Pilots of No. 16 Sqn., B.A.F.O., take full advantage of the D.H. Vampire 5's low-speed tractability. S/L L. H. Lambert, the C.O., is in the lead.

THE citizens of Brussels sat in the cafés last Saturday evening appraising the bearing and uniforms of five military air Services. From their own *Force Aérienne*, the R.A.F., France's *Armée de l'Air*, the U.S.A.F., and the Netherlands Army Air Force, parties of officers were in the city to play their part on the following day at the Evere meeting. This unique event would celebrate the 35th anniversary of the Belgian Air Force. Some hours previously the visitors had been received, and wished good luck, by M. Van de Meulebroeck, the Burgomaster of Brussels.

On the Sunday morning these same officers were packed into the briefing room at Evere to hear every detail of the flying programme explained to them in admirable English, French and Flemish by Major Van Lierde, D.F.C. All visiting aircraft were to operate from the nearby civil airfield of Melsbroeck. In the course of the display some



Smart drill by the Lockheed Shooting Stars of the 53rd Fighter Squadron, U.S.A.F. Like the Vampires, these came from Germany.

ANNIVERSARY

Belgian Air Force, Supported by its 35th Year

dozen DC-4s, Convairs and Dakotas would be landing or taking off, so the strictest flying discipline was imperative. Major Van Lierde warned of obstructions and, "for the benefit of those seeking promotion," pointed out the tribunes built for the Chiefs of Staff and Ambassadors.

Arranged before the new hangars at Melsbroeck we found the visiting contingents—Vampires and Shooting Stars from Germany,

Mustangs and Thunderbolts from France, and more Meteors from Holland. The promised French Vampires had met last-minute snags and were forced to scratch.

By midday the surrounding roads were choked with excursionists—tens of thousands of them—doggedly converging on Evere. With this inexorable efflux from Brussels it was necessary to contend before attaining the airfield, barely in time for the overture to the meeting—a formation fly-over by five Tiger Moths (drawn from the *Ecole de Chasse*, under Major Dieu), trailing the five national flags.

How to Demonstrate Trainers

The programme, reading "Vols de formation: nine S.V.4 and nine Harvard," did not stir the emotions, but the realization of this item most certainly did. Under Majors Pauwels and Truyers, the eighteen pilots gave an object lesson in how to make the best of common instructional machines. Biplane and monoplane formations were synchronized with exemplary precision, converging by flights five times over, in a most spectacular manner. Loops in line astern and vic filled the sky with beautifully disciplined aircraft and the busy noise of little engines. Imaginatively conceived and beautifully executed, this event made a deep impression. Major Arend very divertingly filled in such gaps as there were. A number of Belgian pilots—the Major among them—are exceptionally gifted aerobatic performers, and the little Belgian S.V. is their ideal vehicle.



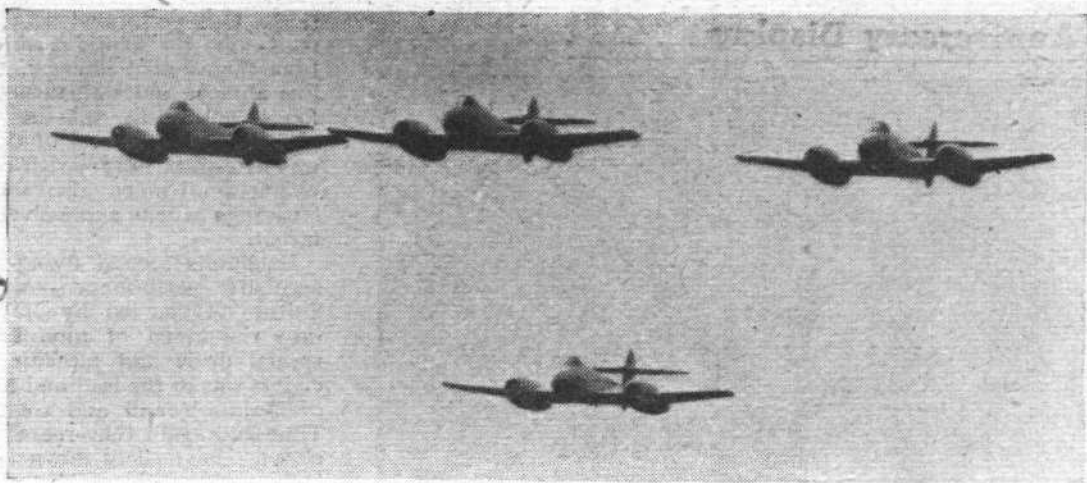
The performers take lunch, as the guests of the Belgian Air Force, at Melsbroeck, before their afternoon performance at Evere.

DISPLAY

our Nations, Celebrates ervice

"Flight" Photographs

A run by Gloster Meteors of No. 245/266 (Northern Rhodesia) Squadron, led by F/L. "Bob" Windle and including the C.O., S/L. E. W. Wootten.



The air now being cleared, there was a mass gasp as an F-80 Shooting Star materialized at high Mach and low level from behind a local chimney. This performer heralded a formation of twelve Shooting Stars of the 53rd Fighter Squadron, U.S.A.F., based at Furstenfeldbruck, and led by Lt. Col. R. Hunziker. All carried wing-tip tanks, but these did not prohibit very high speeds and dashing manoeuvres. Deck-level strafes and a series of extremely smart peel-offs were specially memorable. The F-80s gave way to nine Superfortresses—the only heavies in the show—which boomed over at some 500ft and caused the Belgians, who have no big bombers of their own, to enthuse.

A massed formation of twenty-four Spitfire XIVs (Capt. de Bueger) and six Mosquito night fighters (Major Vandensplassche) proved that piloting skill in the Belgian Air Force is not confined to a few masters. Line-abreasts were especially well maintained. A single Spitfire (Lt. Laloux) performed individually while the British-equipped armada was "in the wings." In smoothness of execution and niceness of positioning Lt. Laloux's demonstration recalled a similar performance by Major Arend in 1947. The "Spit" curtsied charmingly to the tribunes before making its exit.

Next came the turn of the Dutch pilots, under Major Flinterman, to show their proficiency on their newly acquired Gloster Meteors, four of which took the stage—rather circumspectly we thought—but in tidy formation. A roll in line abreast looked promising, but finished somewhat untidily. Three Dutch Harvards later had better success with this manoeuvre. As the Meteor pilots got into their stride, however, it was evident that they aspire to

laurels for Meteor flying, securely held for the present by the R.A.F. The succeeding Harvard flight rang the changes between various very tight formations, in full view of all.

The R.A.F. now took over. Some performers had been favoured with intermittent patches of blue sky, but the Meteor formation from No. 245/266 (Northern Rhodesia) Squadron had to contend with cloud. Through this the "quads" from Norfolk (S/L. Wootten, F/L. Stephen and Plt. II Bradley, led by F/L. Windle) gouged great tracks on their loops; nor did they allow it to bar their upward rolls. Less handicapped was the individualist—F/L. Scannell—who, having coaxed every last knot out of his Meteor on the steepest jet dives and lowest pull-outs of the day, ambled past, flaps down, just on the stall. Flaps raised and Derwents again wide open, Scannell built up some 600 m.p.h. for a final vapour-shrouded sequence of vertical rolls. He may be said to have shaken our Belgian friends to their very solid foundations.

The "Vamps."

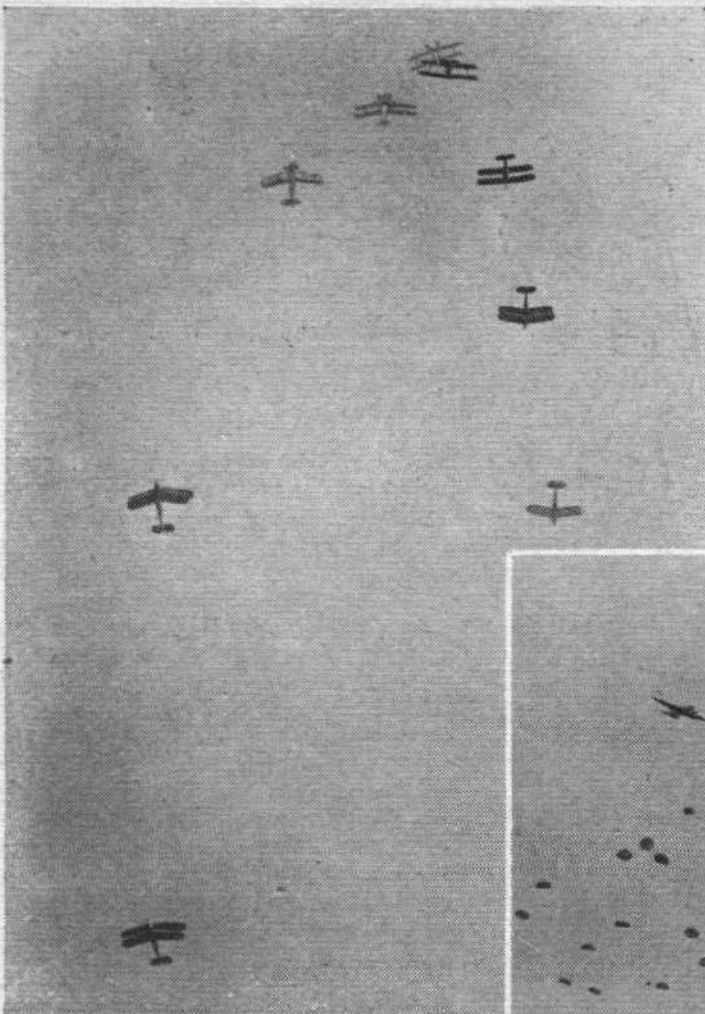
S/L. Lambert and his team of 16-Squadron Vampire Vs (F/L. Wilson, Plt. II Moorhouse, Plt. III Forrester and Plt. III Cosgrove) now presented themselves, with the individualist—P/O. Shaw—as part of the introductory formation. The Vampires, too, had bad luck with cloud. On the top of their loops the aerobatic formation of four could be seen just shaving the edges of the grey layer. Something rather out of the ordinary was a low-speed formation fly-past with wheels and flaps down.

P/O. Shaw was performing when the cloud was at its



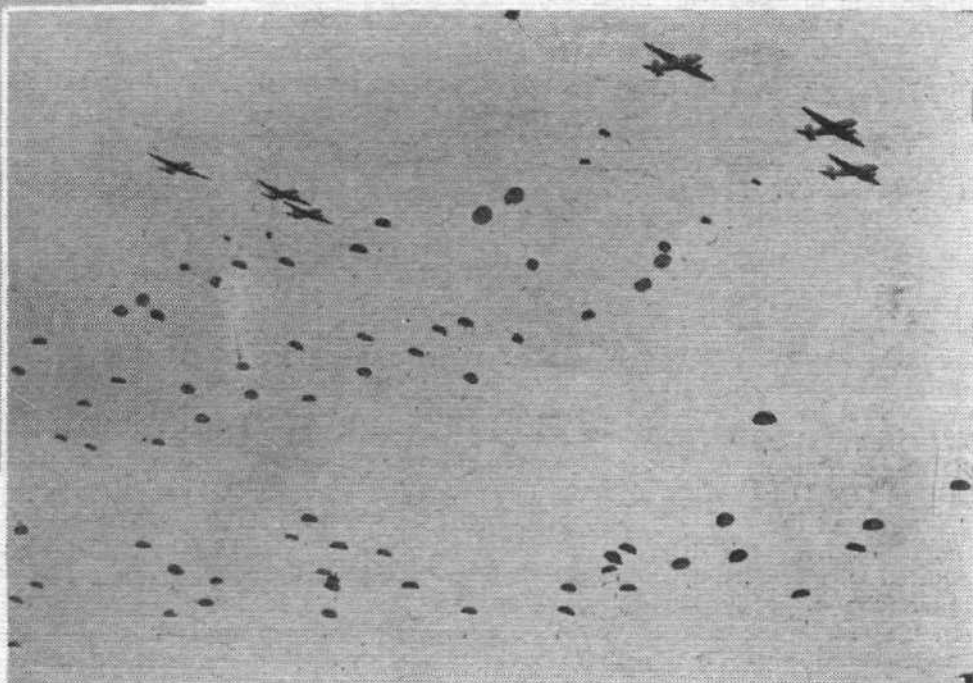
An example of real showmanship—the S.V.4 biplanes and Harvards, respectively from the Ecole de Pilotage Elementaire, and Ecole de Pilotage Avancée, of the Belgian Air Force during their cross-over act.

Anniversary Display



(Above) S.V.4s, of the Belgian Air Force's Elementary Flying School perform "le looping" in line astern. Nine Harvards behaved similarly, to everyone's delight.

(Right) Parachute troops of the Brigade Aéro-portée in the final event. A number touched down among the crowd.



darkest; he was, not inappropriately, introduced by the Belgian commentator as P/O. Shower. Far from damping enthusiasm, however, he commanded the undivided attention of spectators who had one eye on shelter.

Four S.V.4s of the 1st *Patrouille Acrobatique* of the French Air Force, led by Capt. Perrier, introduced France's contribu-

GLIMPSE OF AN ACHIEVEMENT

FREE distribution of an 11-minute documentary film on the Berlin Air Lift to some 3,500 British cinemas began on June 13th. Produced for German audiences by the Information Services Division of the Control Commission, the film originally occupied three reels, but has been cut to one reel, and re-edited, by British Movietone News on behalf of the Central Office of Information.

Photography is first-class—the shots of Sunderlands in operation are especially impressive—but one felt that the average cinema-goer, while retaining a mental image of the scene at the Air Lift terminals, will acquire but a scanty grasp of the story behind that scene. Eleven minutes is, of course, far too short a period in which to recount the full story of this enormous undertaking—a year-old story, which, as yet, has no ending. The commentary, spoken by Mr. Leslie Mitchell, is good as far as it goes, but would have been better if it had extended full credit to the planning and control staffs—largely British—responsible for shaping and administering the intricate traffic patterns, and to the crews of the American Sky-masters which carried a majority share of Berlin's supplies.

Incidentally, another Air Lift film—that made by Mr. William Courtenay in colour, and shown during the past few months to a number of aviation gatherings—goes to the opposite extreme, and is so detailed that it would be confusing to

tion. One performed solo; the others as a team. Whatever manoeuvre the soloist performed the trio repeated in formation. Like three ballet dancers, the S.V.4s repeatedly pulled up in line abreast and stall-turned in perfect unison. Their outside loops and rolls off—in fact all their manoeuvres—were obviously the product of tireless striving for perfection. Here was French artistry—with Belgian tools, be it said—at its most exquisite. France also sent three Thunderbolts and three Mustangs which successively simulated attacks on a ground target.

Belgium's second flying sequence led off with a first-rate aerobatic performance—much of it at low level—by three Spitfire XIVs, led by Major de Patoul. The sudden entry into the arena of nine Belgian Meteors obviously aroused special pride and pleasure in Belgian breasts. Major Mullenders was in the lead and two additional Meteors, in the hands of Majors Arend and Geerts, gave individual performances. Time and again they roared over inverted for every one of the eleven seconds laid down as the permissible maximum in the Meteor Handbook. The nine aircraft of the main formation finally dispersed and bore down individually on the field in a thunderous all-out attack. Evidently the Belgian pilots have taken kindly to their new British equipment.

To put the seal on an afternoon of brilliant flying, some 120 paratroops from the *Brigade Aéro-portée* stepped out of nine closely spaced Dakotas. Enthusiasm reached a tremendous pitch, especially when a dozen or so of the troops were seen to be carried into a section of the crowd. Scrambles and gasps ensued but no injury was reported.

H. F. K.

a lay audience; for those with background knowledge, however, it is extremely informative. Mr. Courtenay has recently added an up-to-date "epilogue," and the complete film was seen last week by an audience of R.A.F. and U.S.A.F. officers and others at the Simpson Services Club in London. Lord Douglas of Kirtleside was among those present, and thanked Mr. Courtenay for the lecture which he gave concurrently.

SPICER ESSAY SUBJECT REVISED

THE sub-committee of the Society of Licensed Aircraft concerned with the organization of the Dorothy Spicer Memorial Prize Essay Contest has decided that, in view of the small number of entries received, and the fact that none was considered of sufficient merit to qualify for the 1949 award, the title of the set subject should be changed and the entry date extended to August 31st, 1949.

Originally, the subject was "Flying Controls on Large Transport Aircraft." The new subject should have a more general appeal, for its title is "Servicing and Maintenance of Aircraft." Entrants may deal with any aspect of airframe or power-plant maintenance or with both.

Detailed conditions of entry, and entry forms, are obtainable on application to the General Secretary, Society of Licensed Ground Engineers, Finsbury Circus House, Blomfield Street, London, E.C.2.

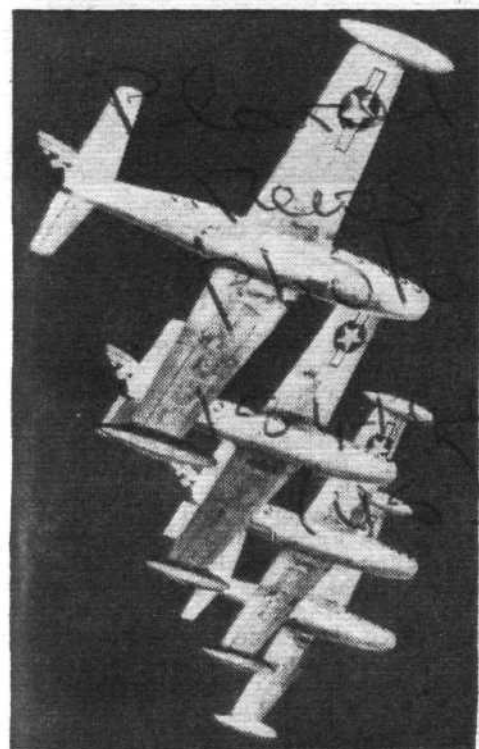
HERE AND THERE

Rare Ranks

FOR the first time since the end of the war, *The Air Force List* (published by H.M. Stationery Office at 12s 6d) is available to the public. In the first issue, dated April, 1949, one page, out of nearly 600, is sufficient for the names of master aircrew serving in the R.A.F.: Master Gunner G. B. Holland has the distinction of being the sole representative of his rank listed. In the remaining aircrew categories there are five master navigators, 11 master engineers, 24 master pilots and 41 master signallers.

Jet Precedent

THE honour of being the first passenger in a transatlantic jet aircraft has been claimed by a U.S.A.F. public relations officer, Lt. Col. C. Newlon. He landed at Manston on June 9th in a Lockheed TF-80 Shooting Star trainer, flown by Lt. Col. "Dave" Schilling, who last summer led the first American jet crossing of the Atlantic. This second flight consisted of 15 Shooting Stars—four of them two-seaters—which made the crossing in 15 days, via Labrador, Greenland, Iceland and Scotland. From Manston they flew on to Germany.



JET-TO-JET: Their dazzling airframes bold against a dark sky, four Republic F-84 Thunderjets make one of the most striking fighter formation pictures yet seen. The machines belong to the 14th Fighter Group, U.S.A.F., based at Dow Field, Maine, and the photographer was a fifth Thunderjet pilot, Capt. J. T. Nelson.



FRENCH TEST-BED: The Languedoc 161, a regular caller (in Air France colours) at London Airport, takes on an unfamiliar, overpowered air as a test aircraft for the Arsenal 24H engine. Two of these units, driving five-bladed airscrews, replace the Languedoc's inboard Pratt and Whitney Twin Wasps. The 24H is rated at over 4,000 h.p.

Ahead With Helicopters

WITH the claim that the company is now the world's largest manufacturer of commercial rotary-wing aircraft, United Helicopters, Inc., of Palo Alto, California, announce that deliveries of the three-seat Hiller 360 now total three aircraft per week.

Russian Engines

THE Soviet AS-90 eighteen-cylinder radial engine, of the type used in Lavochkin fighters and the Tu-70 (developed from the Superfortress), is rated at 2,100 h.p. for take-off. Another recent engine—the M-120—delivers 1,800 h.p., and the M-300 is reported to have a 3,000 h.p. rating.

French Air Budget Complaint

DURING a debate on the French military budget last week, it was announced that of the £385,000,000 total, 18.7 per cent would be allotted to the Air Force. Some deputies were critical of this proportion, and demanded that it should be larger. The National Assembly also learnt that the Air Minister, M. Moreau, had expressed the intention of ordering 100 Dassault 450 Ouragon jet fighters.

An Annual Opportunity

WITH the object of assisting a suitable candidate to undertake advanced work or study in aeronautics, the Royal Aeronautical Society has instituted a "Charter Scholarship." Normally, the scholarship will run for a year, but should the Council of the R.Ae.S. decide that the work and the student would benefit from an extension, such an extension would be granted. Although not essential, some higher degree or post-graduate diploma should result from the studies undertaken. Candidates for this year's scholarships should apply to the Society, at 4, Hamilton Place, Park Lane, London, W.1, not later than June 30th. The closing date in subsequent years will be June 1st.

Address on Air Power

PAST and present developments and the future prospects of aviation were discussed in an address on "The Economic Consequences of Air Power," delivered by J. Carlton Ward, jun., before the Library of Congress and the National Air Council of America on March 7th. Speaking of the guided missile for bomber interception, Mr. Ward, who is the chairman of the Fairchild Aircraft Corporation, expressed the opinion that, in an emergency, this weapon could be quickly perfected. Copies of the lecture, and others in the series, may be obtained free on application to the Publications Section, the Library of Congress, Washington, D.C.

News in Brief

LOCKHEED'S new penetration fighter, the XF-90, which was illustrated in *Flight* of May 26th, made a successful first flight on June 4th.

North America's latest fighter project, the XF-93, is reported to differ from the record-breaking F-86 Sabre mainly in air intake arrangements. It has flush fuselage inlets and a pointed nose in place of its predecessor's "straight-through" nose intake.

Formerly a flight lieutenant in the R.A.A.F., Mr. Frank J. Shaw has been appointed Australian representative for the aviation technical sales department of Smiths Aircraft Instruments, Ltd. He will be attached to S. Smith and Sons (Australia) Pty., Ltd., the recently formed subsidiary of the British Smiths Group.

Southsea Common was, on June 9th, the scene of the first helicopter arrival on a parade ground by an admiral, when the C-in-C., Portsmouth, Admiral of the Fleet Sir Algernon Willis, flew to the King's birthday ceremony in a Hoverfly 1. To-morrow, June 17th, Admiral A. E. Smith is due to visit the Mayor of Portsmouth from his flagship, the *Missouri*, also by helicopter.

H.M.S. "GAMECOCK" ENTERTAINS

Navy Day at Royal Naval Air Station, Bramcote

Illustrated with "Flight" Photographs

COMBINING serious aerial display with diversionary entertainment for the less air-minded, H.M.S. *Gamecock*, the Royal Naval Air Station at Bramcote, was turned last Saturday into a good old-fashioned fair-ground. The Bramcote event appears to have established itself as an annual in the Naval calendar. An excellent opportunity was provided for the ship's company to spend a day with their friends "at home" and to show off their Naval air goods in their own shop window. Such an exhibition must also assist recruiting, for the enthusiasm of potential "winged matelots" was particularly noticeable among the static exhibits. In the two large hangars the showpieces included several complete aircraft, sectioned engines and torpedoes, aircraft and ship models, frogmen, armament, and all those items of equipment at which the public never ceases to wonder.

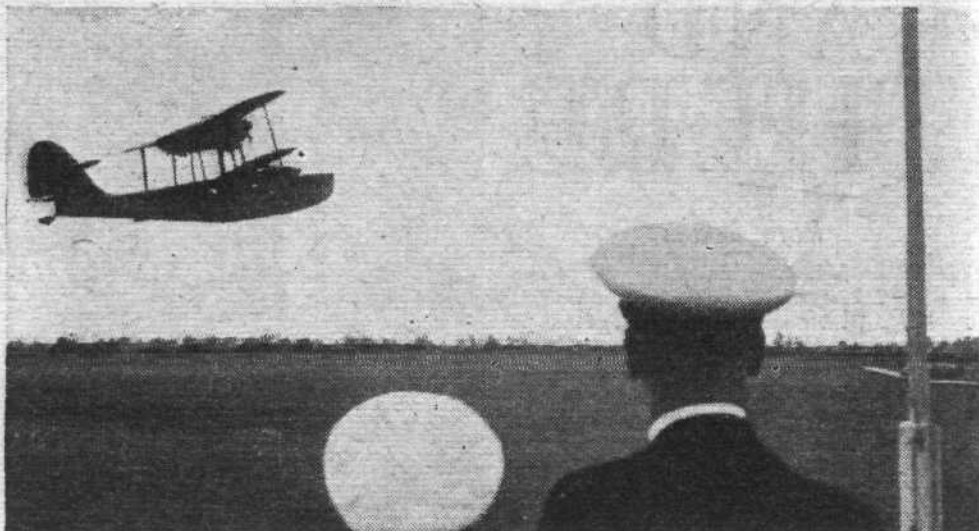
The fun-fair section inevitably occupied the attention of some of the visitors, and towards the end of the programme even a Vampire overhead attracted only a casual glance. No charge was made for entrance to the Station and no count of numbers was kept, but an attendance of some 15,000 visitors was estimated.

Events started with a ceremonial review in honour of the King's Birthday, at which the salute was taken by Vice-Admiral Sir George E. Creasy, K.C.B., C.B.E., D.S.O., M.V.O., Fifth Sea Lord, Deputy Chief of Naval Staff (Air). The roof of offices attached to one of the hangars made an excellent natural stage for physical training displays, sailors' hornpipes, dances by trainees, and country dancing by a bevy of attractive Wrens, all to the accompaniment of appropriate music played by the band of the Royal Marines.

During these performances Seafires were taking off to form up for the first flying event, which was timed to start at 1500 hr. The first formation in echelon was led by a flight of the Bramcote R.N.V.R. Squadron No. 1833 with a flight of 1831 Sqdn. and 1832 Sqdn. from Stretton and Culham respectively, astern and stepped-up. They then changed into "finger" (which might be described as an unbalanced Vic). The station-keeping was very good indeed and, when the aircraft broke off to land-on, the intervals were kept down to a commendably short time. The break-off interval on the downwind leg averaged 17 sec while the average landing-on was 22 sec. The commentator did his best to give some idea of the batsman's control over the landing aircraft, but it was unlikely that more than a few understood what was going on, since the batsman was lost in a hollow in the centre of the airfield and only occasionally could the bats be seen.

There followed a smooth aerobatic performance in a Seafire by Lt. Woodhead, a member of No. 1833 R.N.V.R. Squadron. An unusual but nevertheless worthy performer was a Sea Otter, which made several determined low-level ramblings towards the enclosure. Formation flying by three Sea Hornets of No. 809 Squadron was disappointing, but in landing-on their interval was well timed and short.

During this display Lt. Cdr. Sproule, recognized as the Navy's sailplaning expert, was towed-off in his Olympia. There was a fresh wind blowing which allowed him to hover almost without ground speed over the airfield. His



With some dignity, though with considerable noise, a Naval Sea Otter was demonstrated.



Sea Hornets of No. 809 Squadron fold their wings as they taxi-in past the public enclosures.

superb performance finished with a perfectly judged landing in front of the Admiral's party.

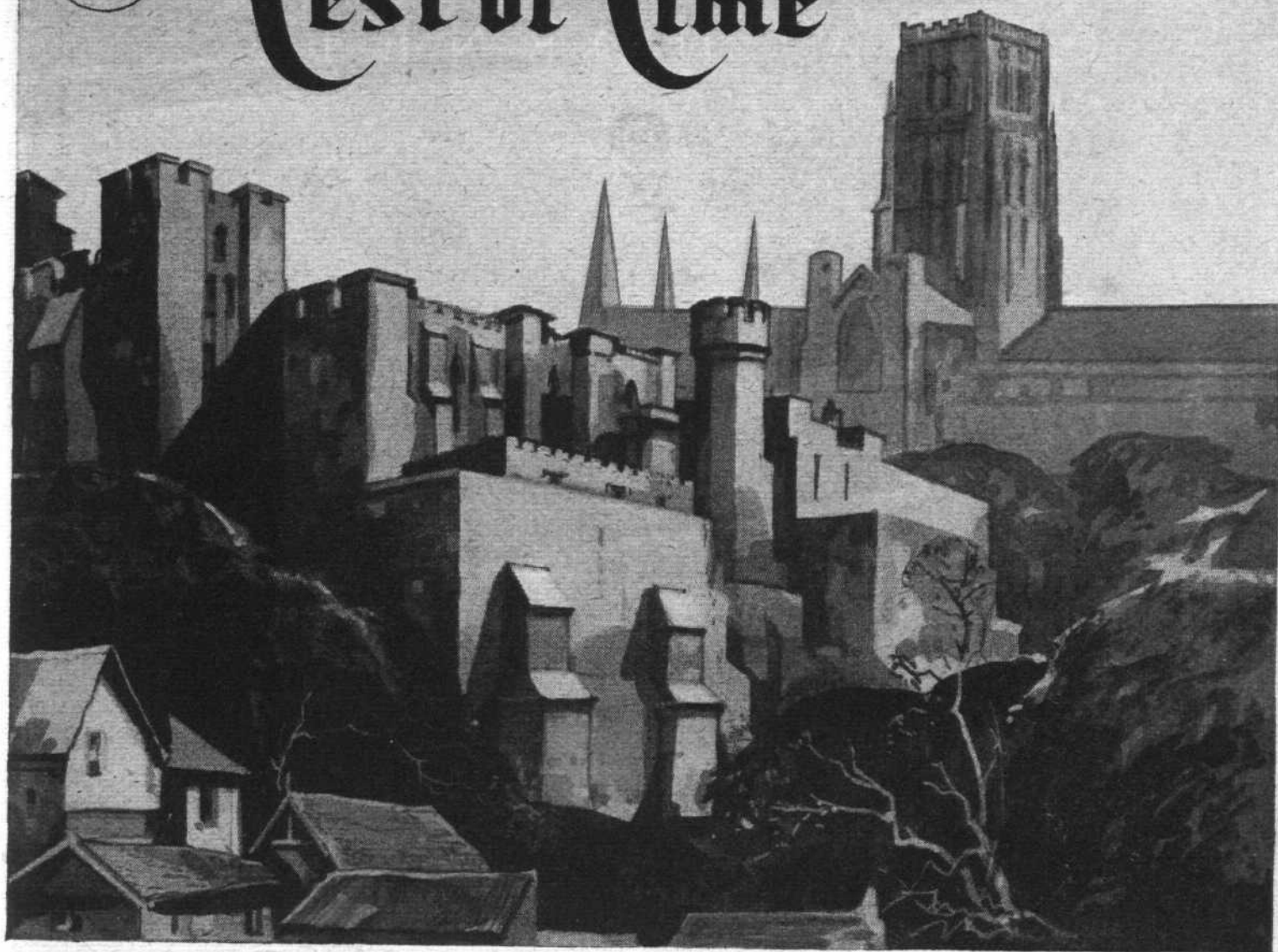
Impressive individual aerobatic displays were given in a Sea Hornet, a Seafire, a Sea Fury and a Vampire. The Firefly, flown by Lt. Malpas de Findlay, a maintenance pilot from the 15th Training Air Group, was made to slow roll unusually slowly. Slow rolling with the starboard airscrew feathered was skilfully demonstrated by Lt. Black (West Raynham) in a Sea Hornet.

Lt. "Jock" Elliott, from Farnborough, won the admiration of all by his handling of a Sea Fury. He flew an extremely accurate eight-point hesitation roll, which he performed a second time as if to prove that the precision of his first was no exception. The Fury was then turned through 360 deg. at fairly high speed, easily within the boundaries of the airfield; and finally, after a shallow dive, the pilot climbed away in the inverted position until it seemed that the aircraft would fall out of the sky.

Lt. Lindsay, in a Sea Vampire, approached the airfield in a steeply banked turn to the left, which, by completing three-quarters of the roll to the left, he turned into a steeply banked turn to the right—a most effective manoeuvre which is seldom practised. Seafires and Harvards of No. 1833 Squadron made a single strafing and dive-bombing attack, through a barrage of smoke-puffs, on a target on the airfield. It could not be said, however, that the attack was pressed home. On the parade ground at 1830 hr the end of the day was marked by Ceremonial Sunset and Beating the Retreat.

R. P.

The Test of Time



DURHAM CASTLE & CATHEDRAL

*"Half Church of God, half Castle 'gainst the Scot."
This great group of buildings crowning the lofty
hill above the River Wear.. The stronghold of
the Bishops Palatine from the Norman Conquest
to the end of the Scottish wars. The Cathedral
nave vault is said to be the earliest in England.*

**PERFECT DESIGN — FINEST
MATERIALS AND UNEQUALLED
WORKMANSHIP — all are
proved by the TEST OF TIME.**



Symbol of Endurance /



RANSOME & MARLES BEARING CO. LTD., NEWARK-ON-TRENT, ENGLAND

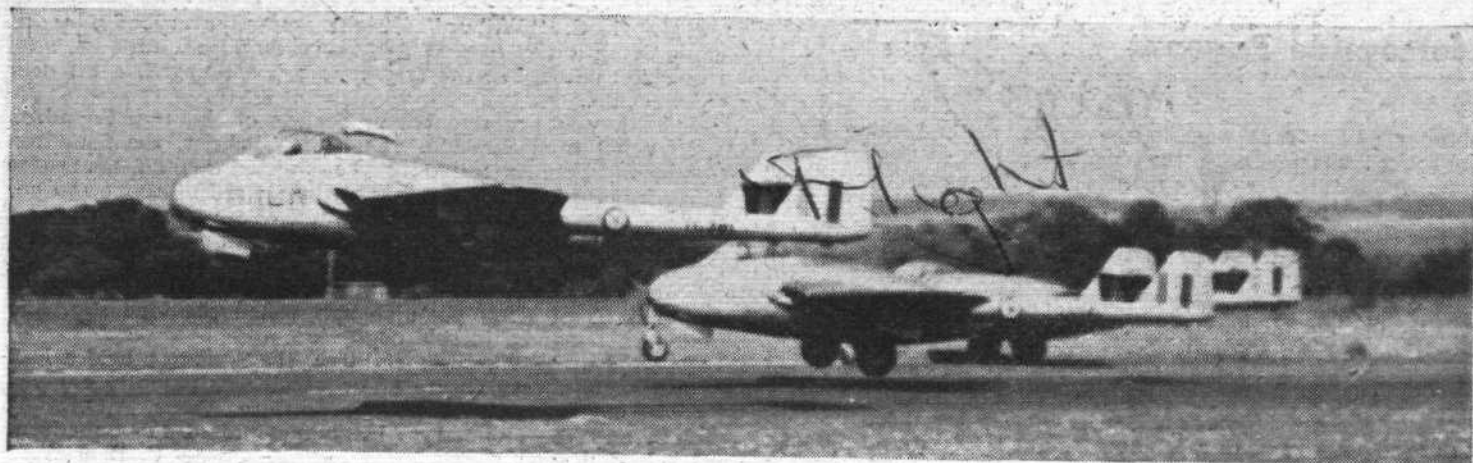
SEA HORNET



A fully developed naval version of the world's fastest propeller-driven operational aircraft, allowing an unequalled combination of striking power, speed, range and manoeuvrability, and having a degree of all-round cockpit visibility invaluable for night-fighting, reconnaissance, and day and night deck operation.

DE HAVILLAND
NAVAL AIRCRAFT





In the normal take-off formation of echelon starboard, the 605 Squadron Vampires get airborne for their high-speed demonstration.

MERSEYSIDE PAGEANT

Pleasant Afternoon on the Wirral Peninsular

IN fortunate contrast to the weather which prevailed when it was held in 1948, the Cheshire Air Pageant at Hooton Park, Wirral, was staged last Saturday in ideal conditions. Ideal, that is, in terms of sunshine, visibility and beauty of sky and setting, although the gustiness of a fresh breeze made some of the formation flying, particularly by the Tigers, somewhat tricky.

Lt.-Col. Neild, M.P. for Chester, having performed the opening ceremony, the first event was a fly-past and exhibition of formation work by Mk 22 Spitfires of the home Squadron—No. 610 (County of Chester)—supplemented by similar types from No. 611 (West Lancashire) Squadron and No. 613 (City of Manchester) Squadron. One of the best features of the day was the broadcast of the air-to-air and air-to-ground intercomm. over the public address system and, unusually, the quality of reception was high.

Perhaps the toughest flying job of the afternoon was the formation exhibition by three Tiger Moths of Manchester University Air Squadron (led by S/L. Howell, the C.O.), tied together with parachute cord. The Tigers took off and did their fly-pasts in vic, line-abreast and echelon and then landed,

still linked. The very bumpy conditions made throttle pumping and coarse aileron work plainly apparent and altogether this event was quite a highlight of the Pageant.

F/L. Bamberger, D.F.C., and F/O. Mercer then gave a display of individual aerobatics in Spitfire 22s, but "fog" in Mercer's VHF gave a Horace Hemsley flavour to their broadcast backchat. The Mk 22 is not the best Spitfire for aerobatic display, and in order to get some precision of manoeuvre, both pilots had to fly at a higher speed than was altogether desirable and thus used up rather a lot of sky.

Vampires from 605 (County of Warwick) Squadron at Honiley got airborne after a little delay due to unserviceability and did some high-speed formation fly-pasts. Station-keeping was very good, but the instructions given by the flight leader (F/L. J. Timmis) were far too laconic for the majority of the 5,000 spectators to have the slightest idea of what was being said. F/L. Dale did an excellent job as compère and his generally interesting and simple explanatory commentary helped a good deal.

As the 605 Vampires landed, Mr. J. A. Hanslip, the de Havilland test pilot, arrived in a Vampire 6 (Goblin 3) from Broughton. Numbered V. 0011, this aircraft was the first to have been built in Cheshire and, in fact, was so new that, in order to give it a presentable finish for the Pageant, it had been sprayed the previous evening with a coat of filler. The



(above) F/L. Bamberger, D.F.C., pulls his Spitfire 22 up into a rocket loop above the Squadron's target-towing Martinet.

(right) Tied in adversity: the three M.U.A.S. Tigers put up a first-class show in spite of bumpy conditions.



Merseyside Pageant

sulphur yellow coat was, in the event, no bad thing for it contrasted sharply with the deep blue of the sky and one could follow Mr. Hanslip's manoeuvres with ease.

After tea, the aircraft which had formed the static display in the aircraft park taxied out and took off one by one to give individual fly-pasts before returning to No. 48 M.U. at Harwarden. Respectively a Hastings, Lincoln, Wellington T. 10, Devon and Harvard, their departure was coincident with the Auster-tugging of an Olympia sailplane. Mr. W. Creece handled the Olympia with a nice combination of delicacy and dash, one of his more unusual manoeuvres being a very flat falling leaf, losing absurdly little height; then, after five loops and a series of S turns, he made a final low-level, downwind beat-up before turning back to a landing from a level kiting approach about three feet above the grass.

S/L. G. C. "Wilbur" Wright amused everybody by his crazy-flying antics in a Wright Aviation Tiger, although stall turns at 150ft above the crowd were, we thought, a bit near the knuckle.

The Navy was represented by Seafires of No. 1831 Squadron (R.N.V.R.) from Stretton. Lt. Cdr. Gilchrist, the Squadron Commander, demonstrated a rocket-assisted take-off, his Seafire fairly leaping into the air after an initial roll of about 150 yd. After a pleasant beat-up fly-past, the Wavy Navy set course for home, and the Pageant was brought to a close, as it had opened, by a demonstration by Hooton's own No. 610 Squadron Spitfires. With the cessation of the day's noisy endeavour, a thin mantle of strato-cumulus half veiled the blue sky, and a skylark remained in sole possession.

To wind up a very successful day, the Squadron held a Ball in the Mess, a very cheery affair which was patently enjoyed by everybody present, including A. Cdre. Vasse, A.O.C., 63 Group, and the Honorary Air Commodore of the Squadron, G/C. I. R. Parker. C. B. B-W.

French Naval Fighters

TWO single-seat Naval fighter prototypes—the Arsenal VG 90, originating from the Arsenal de l'Aéronautique, and the NC 1080, designed by the S.N.C.A. du Centre—will soon be flying in France. The VG 90 has been developed from the VG 70 high-speed research aircraft, which has been flying for some time past and is similar in general configuration. The most noticeable change is to be seen in the positioning of the air intakes: whereas the VG 70 employs a novel, but inefficient, form of scoop beneath the fuselage, the VG 90 has more orthodox intakes built into the sides of the fuselage under the wing leading edge.

A cantilever shoulder-wing monoplane with nose-wheel undercarriage, and powered by a single Hispano-built Rolls-Royce Nene, the VG 90 is intended for carrier operation. The built-in armament is three cannon, each with 200 rounds of ammunition, and rockets or bombs can be slung under the wings. Leading particulars are: Span, 39ft 6½in; length, 42ft 9½in; height, 9ft 7½in; wing area, 323.274 sq ft; weight loaded, 17,835 lb; weight empty, 11,433 lb; max. speed at 19,865ft, 596 m.p.h.; max. speed at sea level, 562 m.p.h.; max. range, 1,491 miles; climb at sea level, 4,370 ft/min; climb to 32,808ft, 12 min 30 sec.

The NC 1080 bears a strong resemblance to the Supermarine 510 and is intended for similar duties, and has the same power plant and armament as the VG 90. Leading particulars follow: Span, 36ft; length 40ft 4in; height, 11ft 3in; wing area,



The Nene-powered VG 90 nearing completion

290.95 sq ft; weight loaded, 15,740 lb; weight empty, 10,661 lb; max. speed at 16,404ft, 609 m.p.h.; max. speed at 29,527ft, 578 m.p.h.; range, 807 miles at 590 m.p.h.; climb at sea level, 5,500 ft/min; climb to 29,530ft in 11 min 20 sec.

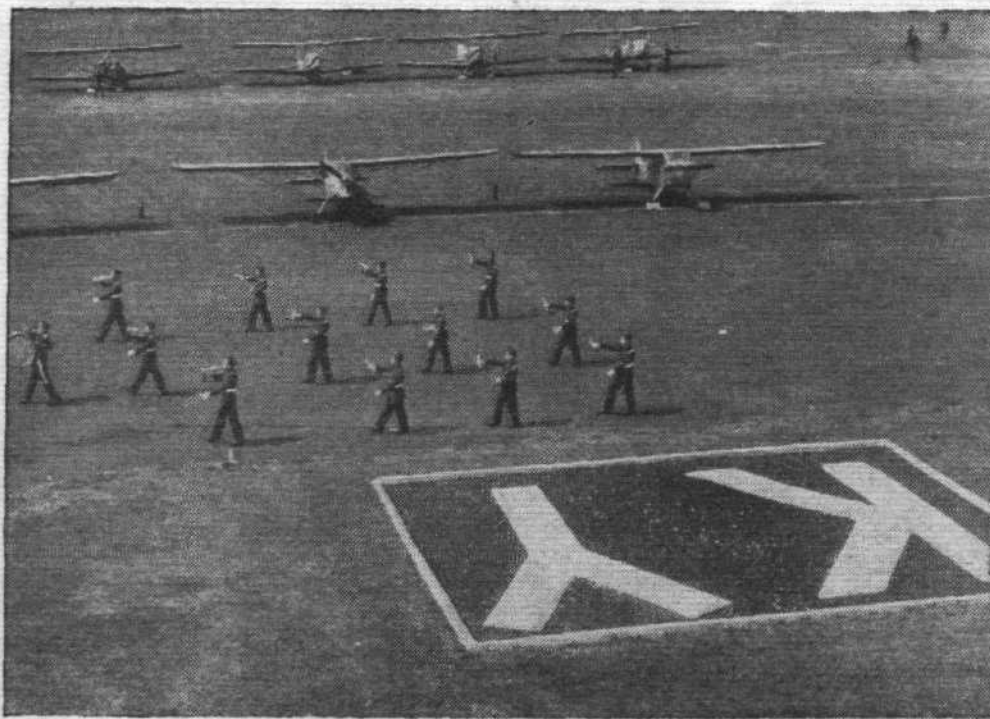
Surrey Reservists Rally

THOSE who have the opportunity to fly, or indulge in kindred activities, only in off-duty moments were well represented at the Surrey Rally, held last Sunday afternoon at R.A.F. Station Kenley. Primarily an A.T.C. occasion—

there were over 1,000 cadets present—the Rally also served as an "At Home" for Kenley, and gave to some 10,000 visitors a useful insight into the workings of the "week-end" forces.

On a scorching June afternoon, the A.T.C. uniform, with its close-fitting "dog-collar," is not, perhaps, the coolest of apparel. Nevertheless, 29 squadrons of the Surrey A.T.C. wing, smartly paraded before A. Cdre. T. N. McEvoy, C.B.E., the Air Officer Commanding No. 61 (Eastern Reserve) Group, drew well-earned praise from the inspecting officer. Before marching past A. Cdre. McEvoy, with the support of martial music from the W.R.A.F. Central Band, the cadets took part in a short drum-head service, conducted by the Rev. L. M. Wheeler.

First in the air were four Tiger Moth pilots of No. 24 Reserve Flying School (Rochester), to compete against fellow-reservists, similarly mounted, from Cambridge (No. 22 R.F.S.). Both teams had to cope with unsuitable conditions for such an event, but succeeded in giving very neat performances. Rochester "coped" well enough to repeat its recent victory over Cambridge at Shoreham. The interval between



"Flight" photograph from the control tower at Kenley—a march-past by band members of the Surrey Wing, A.T.C. Aligned on the perimeter track are V.R. Tiger Moths and Austers of No. 661 (A.O.P.) Squadron, R.Aux.A.F.

The Birthday Honours

Recognition for Personalities in Service and Civil Aviation

IN the list of honours issued in connection with the official celebration of His Majesty's birthday last Thursday appear the names of many persons holding both senior and junior posts in various spheres of British aviation, military and civil. The list includes the following:—

KNIGHTS BACHELOR

David Brunt, Professor of Meteorology, Imperial College of Science and Technology, London University; John Green, director, Thos. Firth and John Brown, Ltd.

ORDER OF THE BATH

Companions (Civil)

G/C. A. S. W. Dore, chairman, T. and Aux. Forces' Association, Middx; W. G. A. Perring, director, Royal Aircraft Establishment, Farnborough; W. D. Wilkinson, under-secretary, Ministry of Supply; A. H. Wilson, under-secretary (ground), Ministry of Civil Aviation.

Knight Commander (Military)

Air Chief Marshal Sir James Robb.

Companions (Military)

Air Vice-Marshal R. Ivelaw-Chapman, F. J. Murphy, R. L. Ragg and F. N. Trinder; Acting Air Vice-Marshal K. B. Lloyd and A. MacGregor; Air Commodores J. W. F. Merer and R. N. Waite.

ORDER OF ST. MICHAEL AND ST. GEORGE

Companion (Civil)

J. R. Smyth, assistant secretary, Air Ministry.

ORDER OF THE BRITISH EMPIRE

Knight Commander (Civil)

F. H. Sandford, deputy under-secretary of State, Air Ministry.

Commanders (Civil)

G. H. A. Field, director of research, Aluminium Laboratories, Ltd.; C. S. Franklin, consultant, Marconi's Wireless Telegraph Co., Ltd.; A. Gibb, Director of Contracts, Ministry of Supply; T. K. Lyle, civil consultant in ophthalmology to the Royal Air Force; A. Cdre J. G. Murray, Scottish Divisional Controller, Ministry of Civil Aviation; J. M. Ormston, director, Vickers-Armstrongs, Ltd.; E. W. Short, assistant secretary, Air Ministry.

Officers (Civil)

A. G. Attridge, lately senior executive officer, Ministry of Civil Aviation; J. S. Clarke, director of research, combustion research laboratories, Joseph Lucas, Ltd., Burnley; Miss Caroline M. Hall, matron, Queen Victoria Hospital, East Grinstead, Sussex; A. E. Manning, principal, Ministry of Civil Aviation; G. Tideswell, assistant director of Accounts, Air Ministry; W. J. Walder, principal, Air Ministry; R. L. Weir, chief accountant, B.E.A.C.; F. Walker, chief engineer, Fort Dunlop; G. W. H. Young, chairman, Southampton Committee, A.T.C.

Members (Civil)

H. D. Blow and W. J. Cain, senior executive officers, Air Ministry; C. E. Chambers, staff officer, Air Ministry; E. S. Cleave, chief designer, aircraft engine starters, Plessey Co.; G. A. M. Corner, senior executive officer, Air Ministry; G. W. Denny, B.O.A.C. Regional Representative, Burma; R. D. Edge, secretary, Manchester Wing Committee, Air Training Corps; H. Edwards, higher executive officer, Ministry of Civil Aviation; S/L. D. Hodgson, Senior Organization Staff Officer, H.Q., No. 21 Group, R.A.F.; C. Pengelly, higher executive offi-

cer, Ministry of Civil Aviation; H. W. Robinson, chairman of committee, No. 2168 (Yeadon) Squadron, Air Training Corps; H. A. Rowland, signals officer, Ministry of Civil Aviation; A. Thomas, chief designer (aircraft engines), Armstrong Siddeley Motors, Ltd.

Dame Commander (Military)

Air Commandant Felicity H. Hanbury, W.R.A.F.

Commanders (Military)

Group Captains G. A. G. Johnston, G. Silyn-Roberts, and G. D. Stephenson; Acting Group Captain E. C. Loveridge, R.A.F.V.R.; Acting Group Captain (now Wing Commander) G. P. S. Pollard; Acting Group Captains F. F. Rainsford and H. Seidenberg-Seymour; Acting Group Officer Alice Ida, Lady Seton, W.R.A.F.; Acting Group Captain G. E. Watt, R.A.F.

Officers (Military)

Group Captain J. J. Murphy; Acting Group Captain E. F. Hawkins; Wing Commanders G. K. Buckingham, J. L. Crosbie, C. J. Giles, L. E. Giles, C. H. Hartley, J. A. Hickey, T. S. Kennedy, S. J. Marchbank, D. A. Reddick, E. A. Rice and D. L. Rundle; Acting Wing Officer Eleanor M. Pitter, W.R.A.F.; Acting Wing Commanders H. Vatcher, C. V. D. Willis; Squadron Leaders C. C. M. Baker, J. S. Higginson, R.Aux.A.F., A. L. Partelow, R.N.Z.A.F.; G. E. H. Walker; Acting Squadron Leader S. V. Holloway.

Members (Military)

S/L. H. Bamforth, A. S/L. H. Jennings, W. N. Nadin, N. G. O'Brien and P. F. Varey; F/L. S. J. N. Bean, C. H. Bird, W. B. Day, T. Ferguson, G. E. Goodchild, H. T. Haggard, G. C. Harkus, G. N. Heath-Smith, J. H. Holloway, N. J. King, R. D. Phillips and K. F. W. Taper; A. F/L. S. G. Barrett, J. J. S. Cox, H. Crocker, P. H. T. Lewis and J. Sproson; F/O. K. E. Booth; A. F/O. S. K. M. Bright and E. Gwilt, W.R.A.F.; W/O. S. L. S. Bottoms, P. B. Carver, A. W. Custance, J. H. Dower, G. W. K. Durbridge, O. J. Millis, A. Patton, G. H. H. Thomas and T. A. Williams; Sister Olive Eirene Violet Craig, P.M.R.A.F.N.S.

AIR FORCE CROSS

Bar to A.F.C.

W/C. C. Scragg; F/L. G. Francis.

A.F.C.

S/L. S. P. J. S. Finlayson, D. B. Fitzpatrick and P. J. S. Shaughnessy; A. S/L. S. W. Hampson, P. W. Helmore, J. Lomas, P. A. H. McKeand and J. R. Ramsden; F/L. S. T. L. Bourke, R.A.A.F., E. A. Brittain, H. R. Clasper, R. Currie, C. R. Cut-

hill, H. J. Dodson, R. A. Hayward, S. J. Houghton, J. S. Knox, J. F. Manning, G. A. Martin, A. Y. Mason, R. Mather, R. S. Murdoch, R.A.A.F., J. Murphy, P. Needham, R. L. G. Ray, R.A.F.V.R., S. B. Stephens, W. R. Tait, A. G. Weller, C. L. Wenzel, G. E. Willis and E. R. J. Wythe; F/O. R. M. Jenkins; W/O. E. Harris; M. Plt. J. A. Dixon; M. Sig. A. Penny.

A.F.M.

Plts. I W. J. Hole, G. Jackson and G. H. Owen, R.A.F.V.R.; Air Sgt. A. D. Emslie, S.A.A.F.; Navs. I J. E. Allanach and F. J. Baylis; Sig. I D. G. Dickie; Eng. I J. F. G. Martin; Plts. II D. A. Borland, V. W. Brown, W. W. Green, R. F. McLaren, H. McMaster, L. H. Phillips, D. Pow and A. Rhodes; Nav. I E. G. Saker, R.N.Z.A.F.; Navs. II E. H. Hubbard, J. Mortimer, P. E. S. Nutall; Sig. II T. M. Rae; Engineers II J. R. Bradbury, H. R. Sinton.

ROYAL RED CROSS

R.R.C. (Second Class)

Acting Senior Sisters Eileen Mary Knox, P.M.R.A.F.N.S.; Lucie Mary Wainwright, P.M.R.A.F.N.S.

BRITISH EMPIRE MEDAL

(Military)

Chief Air Artificer A. Bennett, D.S.M.; C.P.O. Air Mechanic (A) F. Dey; F/Sgts. T. R. H. Briggs, T. J. Byrne, R. C. Cowan, D. W. Gilbert, W. T. Griffiths, P. C. A. Hinxman, R. Hogg, G. C. Holness, J. A. Johnson, J. McDermott, G. P. McKann, H. T. Massam, W. J. Meighen, A. H. Ransdale, B. E. Sandham, G. H. Thompson, and J. V. Warner; A. F/Sgt. E. E. Richards; Sgts. E. Bonavia, A. N. Dawson, M. E. Graham, T. J. Kennelly, G. H. Maples, F. H. Palmer, D. A. Poole, W.R.A.F., W. R. Reynolds, R. Shields, J. A. Steed, A. P. Tyler, P. D. Weston, J. Wood and J. Yeoman; Cpls. D. C. Masters, J. Prentice, R. K. Reed and D. A. J. Taylor; L.A/C.W. R. Hamme; L.A/C. J. L. Steel; A/C.W. J. C. Burns.

(Civil)

R. H. Beagley, senior storekeeper, B.O.A.C., Whitchurch; F. W. Briggs, fitter, de Havilland Engine Co., Ltd.; J. H. Connelly, civilian instructor, Grade I, Air Ministry; B. Fortes, research and experimental mechanical (special) chargehand, A. and A.E.E., Boscombe Down; T. Hiscock, officers' mess steward, 1st Class, R.A.F. Station, Sealand; F. D. Napier, senior instrument maker, Air Ministry; S. C. J. Palmer, assistant foreman, R.A.E., Farnborough; C. E. Richardson, fitter, Vickers-Armstrongs, Ltd.; S. W. Swetman, foreman, Westland Aircraft, Ltd.; G. Wright, foreman, Broom & Wade, Ltd.

Surrey Reservists Rally

(Concluded from opposite page)

these two team items was enthusiastically filled by an aerobatic Tiger from Cambridge University Air Squadron. Two members of this unit later performed the "instructor and pupil" act. Mr. Lorne Welch, chief instructor of the Surrey Gliding Club, was the afternoon's sole civilian demonstrator. His scarlet Olympia was towed over from Redhill by an Auster (piloted by Mrs. Ann Douglas) to give a smooth, silent and precise display of glider gymnastics.

Squadrons of the Royal Auxiliary Air Force have lately given most positive proof that, despite their necessarily irregular periods of training, they can, when necessary, apply truly professional

polish to their air display show-pieces. At Kenley last Sunday, the good work was continued by four speedy items, of formation flying and aerobatics, by Meteor 3s and Spitfire 22s of, respectively, No. 500 (County of Kent) Squadron and No. 615 (County of Surrey) Squadron. Making a first public appearance were two Austers of the newly formed No. 661 (A.O.P.) Squadron, R.Aux.A.F., two flights of which are based at Kenley; they departed from their duties of observation to do a mock-bombing act with flourbags. Ansons of No. 61 Group Communications Flight concluded the Rally with a formation fly-past.



CIVIL AVIATION NEWS

Airworthiness Report: U.S. and Canada Agree on Routes : B.E.A. Through-bookings

ON THE LINE : Boeing Stratocruisers under construction for B.O.A.C. at Seattle, Washington. The Corporation will probably receive four other Stratocruisers—originally intended for S.A.S.—before their own order is fulfilled.

AIRWORTHINESS RECOMMENDATIONS

THE Helmore Committee on Certification of Civil Aircraft and Approval of Equipment has made certain recommendations, as follows: Before a new type of aircraft is certified as airworthy for fare-paying passengers it should be tested in all those operating conditions which it might be expected to encounter in service; the present airworthiness trials should be extended; the responsibility for supervising tests and for certification should remain with the certifying authority, but constructors and operators should participate in them; the whole of the annual deficit of the certifying authority should be met from public funds; and a new certifying authority should be established, preferably as a reconstituted Air Registration Board.

It is further recommended that members of the Council should be appointed by the Minister of Civil Aviation for a period of three years and should be eligible for re-election; the title "Air Registration Board" should be retained and the authority should continue to rely on the Ministry of Supply technicians and test and research establishments for assistance with its problems; full use should also be made of the Ministry of Supply flight testing establishments; the authority should be responsible to the Minister of Civil Aviation but remain as independent as possible; and it should review the conditions of issue of Daily Inspection Certificates and renewal of certificates of airworthiness.

On the subject of private and club aircraft, it is recommended that these categories should continue to be certified, but that airworthiness restrictions should be kept to a minimum. Devolution of responsibility for the inspection and certification of ultra light aircraft and private gliders should be encouraged; a Glider Maintenance Engineer's Licence should be introduced; and gliders used for hire or reward should be subject to the same regulations as aircraft used similarly. The procedure for certification should remain unchanged, it is suggested, but responsibility for inspection and certification of airborne radio equipment should be transferred from the M.C.A. to the new authority.

OBSTRUCTION TO CHARTERING

THE British Air Charter Association states that it has learned that certain information is required by the office of the Director of Civil Aviation in Malta before the departure or arrival of a non-scheduled traffic flight. All charter operators wishing to embark or disembark loads in Malta, says the B.A.C.A., are being instructed to obtain prior permission and send the following details to the D.C.A.: (1) Aircraft registration, (2) type of aircraft, (3) owner or charterer, (4) itinerary of flight from point of origin to point of destination, (5) details of passengers and weight and type of freight destined to be embarked or discharged at Malta, and (6) any supporting details which are deemed to be necessary.

These regulations, about which no information is obtainable from the Ministry of Civil Aviation, must inevitably

impose hardship upon all charter operators, since unavoidable delays will result and the ultimate sufferers will be the passengers or consignors of freight. It is understood that if the charter service is running on sub-charter on behalf of one of the Corporations such prior permission is not required. Although there may be other and undisclosed reasons, on the face of it this distinction might be interpreted as a further example of protecting the interests of State corporations at the expense of private enterprise.

CANADA-U.S. AGREEMENT

A NEW bilateral agreement on scheduled services between Canada and the United States has been signed. Under the changes made in trans-border services the United States has been granted a direct route between New York and Toronto, which replaces the existing one from Buffalo to Toronto. This route will run parallel with the existing Canadian route from Toronto to New York. The U.S. has also received a route from Great Falls, Montana, to Edmonton, Alberta, which may be operated in conjunction with the existing American service from Great Falls to Lethbridge. Canada has received a direct route from Montreal to New York, which is parallel to the U.S. New York-Montreal route. Thus operators of both countries may operate between the largest city in America and the two largest in Canada.

Under the agreement the United States has been granted two international through-routes, the first from America through Gander, Newfoundland, and on across the Atlantic, and the second from America through Edmonton to Alaska and the Orient. United States carriers on these routes may pick up and set down traffic at Gander and Edmonton. Canada has been granted a through route to Hawaii and on to Australasia, and a through route to Florida and on to the Caribbean. On these routes Canadian carriers may pick up and set down traffic at Honolulu and at Tampa, Florida. C.P.A. will be responsible for routes to Australasia and T.C.A. for those to the Caribbean.

TO AID VISIBILITY

A CANADIAN scientist, Dr. D. F. Stedman, of the National Research Council's Chemistry Division, Ottawa, has reported results of further tests of the water-repellent mentioned in *Flight* of April 14th. It has been known for a considerable time that optical errors caused by rain on windcreens are usually greater than are realized by pilots; investigation by the National Research Council has shown the degree of error to vary considerably with the size of the water drops, the volume of water, the air speed and the angle of the screen. Tests revealed that the average angular error in the line of vision might amount to 5 degrees, which meant that an obstruction half a mile ahead of an aircraft flying in rain could appear to the pilot to be as much as 200ft lower than its actual height.

Windscreens treated with Dr. Stedman's FC-10 preparation

20,000

made & sold

*and another
20,000 on the way!*

A.I.D. MODEL 2 SPRAY
GUN USERS PAINT THEIR
WAY TO NATIONAL RECOVERY

main features of our production

- ★ STANDARDIZATION
- ★ REPLACEMENT & SPARES SERVICE
- ★ PRECISION BUILT
- ★ ECONOMICAL PERFORMANCE

By adhering to the policy of standardization called for by the Ministry of Supply, A.I.D. Ltd., have, in two years, achieved this remarkable Production and Supply figure for their Model 2 Spray Guns; sure evidence of the incomparable quality and efficiency of this outstanding model. Another great factor in this success is the A.I.D. Spray Gun Instant Replacement Scheme which ensures that you are never without as many Model 2 Guns as you need. New Guns if you want them, or worn or damaged Guns can be

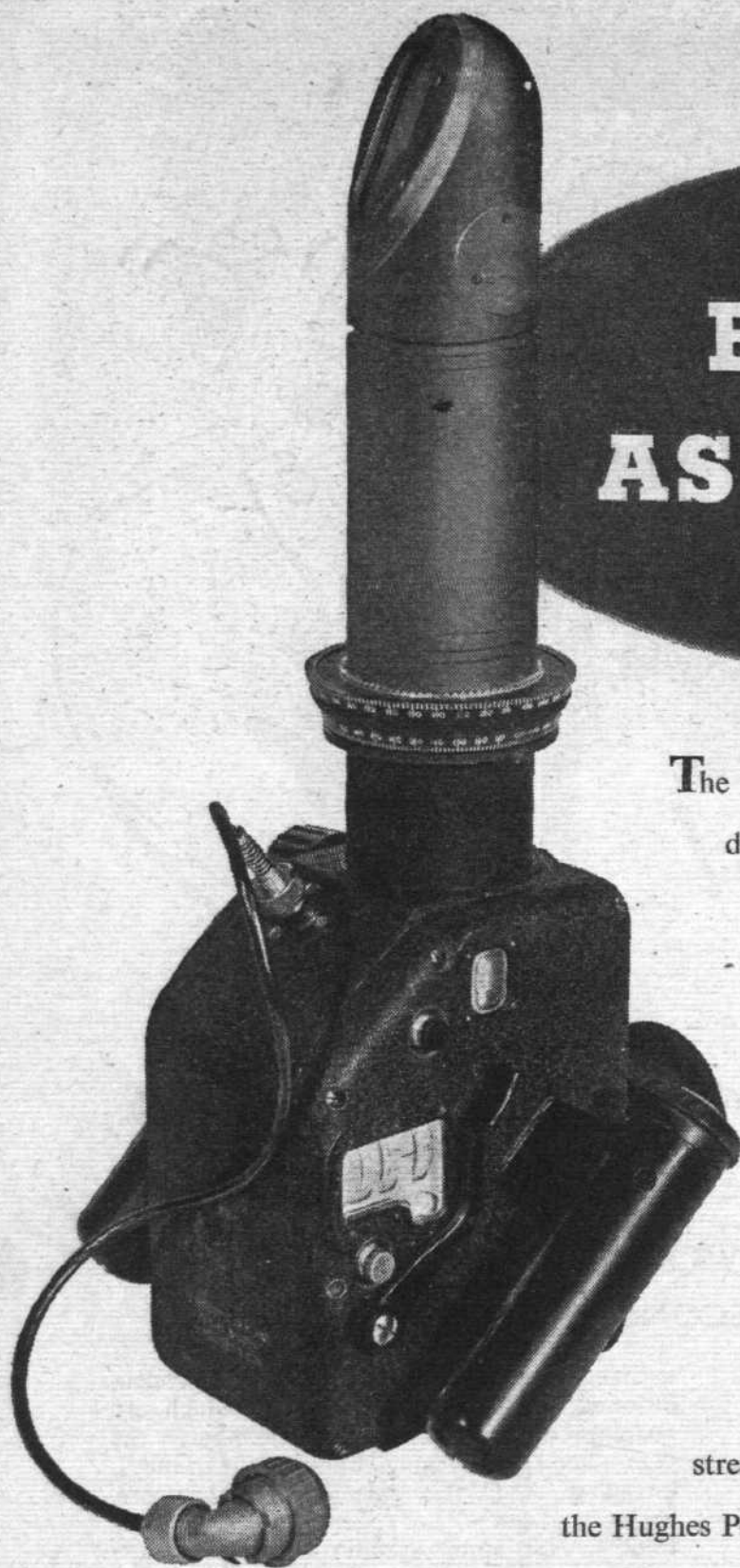
exchanged immediately for completely reconditioned and tested replacements which are guaranteed as good as new. Remember, "the Gun — and everything behind the Gun", including A.I.D. Portable Air Compressors, Pressure Feed Paint Containers, ★ Spray Booths, Hot Spray Lacquer Units and many other appliances, all backed by a complete Spares and Maintenance Service covering the entire country.

★ Dry Back Spray Booths are available for immediate delivery and other types for early delivery.

A.I.D.
COMPRESSED AIR EQUIPMENT

The Gun, and Everything Behind the Gun

Sole Manufacturers: AIR INDUSTRIAL DEVELOPMENTS LIMITED, Aidspray Works, Shenstone, Nr. Lichfield, Staffs, England. Phone: Shenstone 341/5. Grams: Aidspray, Shenstone. LONDON, 28 South Molton Street, W.1. Phone: Mayfair 6318. Grams: Aidspray, Wesdo. MANCHESTER, "Stamford Villa," 97 Manchester Road, Fairfield, Manchester. GLASGOW, Hillington Factory Estate, Glasgow. Phone: Half 3258. BRISTOL, Little Court, Golden Valley, Bitton, Nr. Bristol.



EXIT THE ASTRODOME

The introduction of the HUGHES PERISCOPIC SEXTANT, designed especially for pressurised aircraft, heralds the exit of the astrodome. In its place a sextant mounting is built into the aircraft as a permanent fixture. This has a sealing piece interconnected with safety locks to hold the sextant in position and maintain cabin pressure. The sextant itself is a portable unit stowed in a transit case when not in use. In operation the periscope tube protrudes only three inches above the skin of the aircraft. When the sextant is retracted the sealing piece is flush and streamlined with the aircraft's skin. Literature describing the Hughes Periscopic Sextant is obtainable on request.

Designed and manufactured by:

HENRY HUGHES & SON LTD

Sole Sales Concessionaires:



SMITHS AIRCRAFT INSTRUMENTS LIMITED



The Aviation Division of S. Smith and Sons (England) Limited

CRICKLEWOOD · LONDON · NW2 · ENGLAND

Telephone: GLADSTONE 3333 · Telegrams: AIRSPEED, PHONE, LONDON

Civil Aviation News

were found to prevent such distortions, since raindrops on striking the surface were broken down into minute droplets, invisible to the eye, which were swept off by the air stream. Satisfactory results, it is stated, have been obtained in very heavy rain up to speeds in excess of 600 m.p.h. and under all conditions of de-icing both by alcohol or heat. It is understood that consideration is being given in Canada to the compulsory use of the new repellent. Tests have been carried out by the R.C.A.F., by Trans-Canada Airlines, and—in England—by the R.A.E., Farnborough, and the B.E.A. Helicopter Unit, which now has the repellent in regular use.

B.O.A.C. CANADAIRS NAMED

CLASS name for B.O.A.C.'s 22 Canadair aircraft is to be "Argonaut," and names of individual aircraft in the fleet will also be in the classical tradition; they are as follows:—*Ariadne, Ajax, Amazon, Atlas, Aurora, Attica, Antares, Arcturus, Atalanta, Altair, Antaeus, Argosy, Althaea, Aethra, Antiope, Astra, Athena, Artemis, Adonis, Aeolus, Astraea, Arion.*

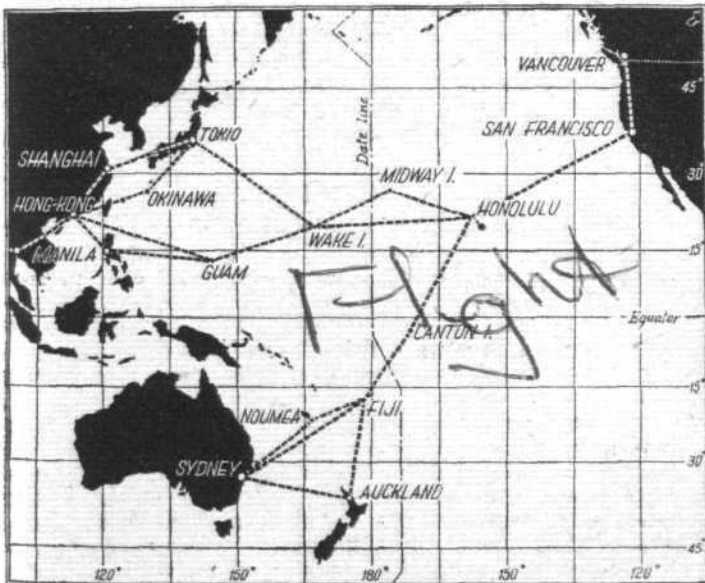
"Argonaut" was submitted by members of the B.O.A.C. staff in many parts of the world who took part in a Canadair naming competition organized through the Corporation's house magazine.

Two of the new aircraft have so far been delivered to B.O.A.C. and they are expected to be in operation later this year.

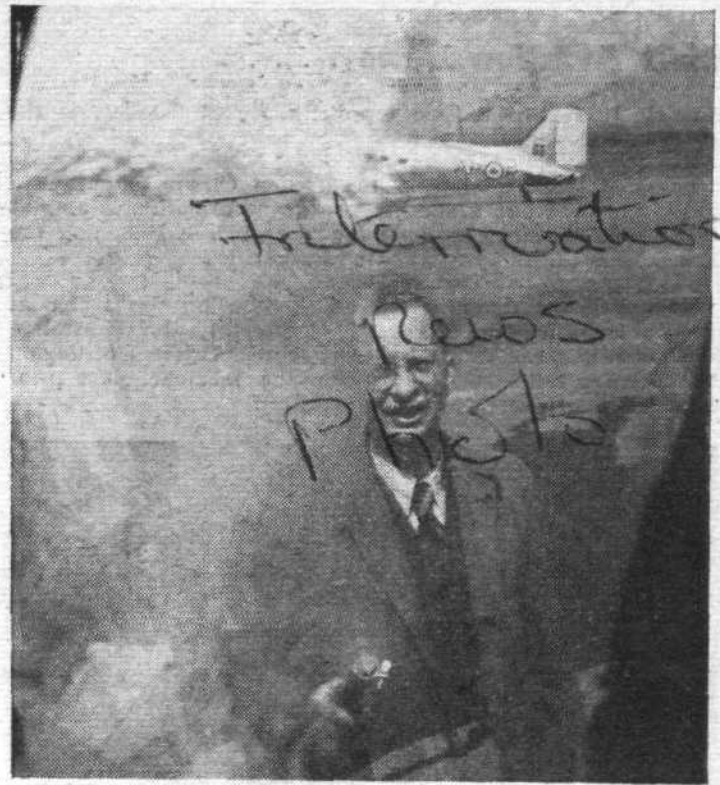
NEW INTERLINE BOOKING

WITH effect from July 1st, Pan American Airways and American Overseas Airways in the United States, Trans-Canada Airways in Canada, and British Overseas Airways Corporation's offices in both America and Canada will offer a new booking facility. Passengers wishing to travel on to Europe out of London will be able to secure seats on whichever of B.E.A.'s Continental services they wish to use, without the need of first applying for reservations to London. This also applies to return reservations.

Similar booking arrangements, known to the trade as "sell and report," previously applied to some of the B.E.A. European routes, but it is only now that they apply to all of them, including points in Austria, Belgium, Czechoslovakia, Cyprus, Denmark, France, Germany, Greece, Holland, Italy, Malta, Norway, Portugal, Sweden, Switzerland, Turkey, as well as to the service to Gibraltar. This arrangement, it is understood, has been made possible by the greatly increased frequency of the B.E.A. network.



TRANS-PACIFIC ROUTES: On July 13th Canadian Pacific Airlines will fly a Canadair four on the first scheduled service from Vancouver to Sydney. There are connections at Fiji to and from Auckland, and services fly between Auckland and Sydney. British Commonwealth Pacific Airlines introduced Douglas DC-6 aircraft on the "Southern Cross" route from Auckland to Vancouver on February 16th. Pan American Airways fly over the same route calling at Noumea, and also to the islands in the west Pacific and the mainland. With the exception of a service from San Francisco and Los Angeles to Honolulu with Stratocruisers, all P.A.A. Pacific routes are flown with DC-4s.



A practical demonstration by the inventor of the rain-repellent referred to in the adjacent column. This photograph appears to support the claim that the treated area of the aircraft windscreen permitted a visibility of two miles, whereas the untreated portion was completely obscured.

BREVITIES

IT was recently announced by the Acting Director of Civil Aviation for Northern Rhodesia that the new airport under construction at Livingstone will not be open for traffic until November, 1949.

It is understood that although the Ministry of Civil Aviation had been previously informed of the air display at Sywell on May 21st, the usual notice was not circulated and that aircraft were not warned to avoid the airfield during the period of the display.

During the summer season Pan American Airways are scheduled to fly 36 return trips each week across the Atlantic. Twenty-six flights follow the northern route to the British Isles and Europe; of these, London is the terminal for 14 and constitutes a transit stop for the remainder.

Passengers flying by B.S.A.A. are now invited to voice their likes and dislikes in a new "Passenger Comments Card." In this way the airline also elicits from passengers such information as why they travel, and the sort of air journey preferred, with or without night stops.

Trans World Airlines have purchased twenty additional Lockheed Constellations at a cost of \$20 million, bringing their fleet of four-engined aircraft up to 55, of which 35 are Constellations. The growing volume of passenger travel, both on the international and on the domestic routes of T.W.A., has necessitated this purchase.

On June 3rd Olley Air Service, Ltd., started their regular week-end services between Croydon and Le Touquet. The service operates Fridays to Mondays until the end of September, flights leaving Croydon at 1730 hr and reaching Le Touquet at 1820 hr on Fridays, Saturdays and Mondays. On Sundays the flights leave Croydon at 1000 and reach Le Touquet at 1050. Return flights leave Le Touquet at 1950 on Fridays, Saturdays and Mondays and at 1830 on Sundays. Fares are £4 single and £7 4s return (valid for 60 days).

A golf and country club has been formed at Gander, Newfoundland. With the backing of the Newfoundland Tourist Department, it is intended to offer full club facilities to the staffs and customers of subscribing companies when they visit Gander Airport. The club has been formed on an international basis and companies in the aviation industry are invited by the sponsors to subscribe to the stock shares of \$50. Mr.

Civil Aviation News

Hartley J. Bell, the Esso representative at Gander, is the organizing secretary.

The first weather ship in the Indian Ocean to act as a radio beacon and to broadcast weather information is now at its station. It is under the joint control of K.L.M. and the Netherlands Indies Civil Aviation authorities.

Following the detention of an Air Ceylon Skymaster at Darwin (reported in *Flight* of June 9th), the Australian Minister of Air has announced that the Government of Ceylon has accepted full responsibility for the incident, since prior authority for the flight was not obtained.



Capt. G. S. Brown who, as mentioned below, is now inspector of accidents in B.O.A.C.

After 14 years' service with Imperial Airways and later B.O.A.C., Captain G. S. Brown has succeeded Captain G.R. Thompson, who recently retired, as the Corporation's inspector of accidents. In this position Capt. Brown will be responsible for the investigation of every incident, however trivial, which might have some bearing on the safety of passengers and aircraft.

Pan American-Grace Airways have flown more than 600,000 Panama hats, weighing approximately 22 tons, from Ecuador to the United States. The airline recently reduced its freight rates on this commodity to enable importers to meet the demand.

An increasing market for Australian orchids has been found in America. The export of these flowers started in 1946, when 8,000 were exported, a figure which increased to 70,000 in 1947 and 82,000 in 1948. During the coming season it is expected that some 125,000 orchids will be sent by air to San Francisco.

Mr. N. A. H. Luke, A.R.Ae.S., M.S.L.A.E., chief engineering instructor with Air Service Training, Ltd., has been elected Chairman of the Society of Licensed Aircraft Engineers for the year 1949-50. Mr. D. W. Richardson, M.B.E., A.F.R.Ae.S., will be vice-chairman, Mr. D. G. Thorpe, A.F.R.Ae.S., hon. treasurer, and Mr. I. J. Gregory, hon. librarian.

Israel and Cuba have ratified the convention on International Civil Aviation and will become members of I.C.A.O. this month, bringing the total membership to 54 states. The Third Assembly of I.C.A.O. opened in Montreal on June 7th. Mr. E. A. Armstrong, C.B.E., of the Ministry of Civil Aviation, led the United Kingdom delegation. The work of this Assembly is confined to matters of administration and finance.

Last Whit Monday, 10,245 people visited the public enclosure at London Airport. This number has only once been exceeded in this country—on Easter Monday this year, when 11,557 visitors were counted at London Airport. On Whit Sunday, 415 cars brought visitors and the same number arrived on Whit Monday. Already this year more than 100,000 people have visited the public enclosure.

The Australian Minister for Air recently announced that just over 1½ million dollars had been made available to Trans-

Australia Airlines to pay the balance of the purchase money on the five Convair 240s bought from Consolidated Vultee. The managing director of Australian National Airways, Ltd., the independent airline, has pointed out that his company was refused dollars to buy aircraft during the last two years but some had been purchased for sterling.

A Lancastrian tanker operated by Flight Refuelling, Ltd., carried the 100,000th "civil" ton to Gatow Airport, Berlin, on May 31st. The pilot and crew were greeted on arrival by the Deputy Mayor, who held a reception in their honour, as representatives of the air charter companies engaged on the airlift. The pilot was Captain Dennis Hanbury, D.S.O., who has made 200 sorties carrying petrol; Air Marshal T. M. Williams, C.B., A.O.C., British Air Forces in Germany, flew as a passenger.

Production of small personal aircraft in the United States dropped from 33,000 in 1946 to about 3,000 this year, and Mr. Grover Loening, who announced these figures at the recent Anglo-American Conference of the Royal Aeronautical Society and the Institute of the Aeronautical Sciences, considered that there would be increased use of small aircraft if the problem of landing on small fields could be solved. He said that during the last 15 years the cost of producing light aircraft was four times as great, but the cruising speed was only 40 m.p.h. faster.

FROM THE CLUBS

AT the annual general meeting of the Royal New Zealand Aero Club, the Minister of Defence, Mr. Jones, announced that there could be no increase in the amount of financial assistance given to the Club. Speakers at the meeting stressed the need for further assistance if clubs were to be of any use for defence-training purposes.

THE Swiss Aero Club are holding an international air display at Lausanne on Sunday, June 26th. Among the events will be demonstrations by the Swiss Air Force—flying Vampire, Mustang, Fieseler-Storch and Buckler aircraft—and there will also be a static aircraft exhibition. Among well known French pilots who will probably take part in the display are Marcel Doret, M. F. Nicole and F. Malinvaud. The programme will include a demonstration by parachutists and a free-balloon ascent.

NORTH-EAST FLYING SERVICES have recently taken over the lease of the West Hartlepool Airport, including the Tees-Side Flying Club, which offers, in addition to normal club-house facilities, such outdoor attractions as a tennis court and a swimming pool. Full club-flying facilities are available with a small fleet of Autocrats, and there are Proctor aircraft for light charter work. Private owners are welcomed as guests; landing fees are not charged for social visits and special hangarage fees are available to charter operators.

B.G.A. CONTESTS

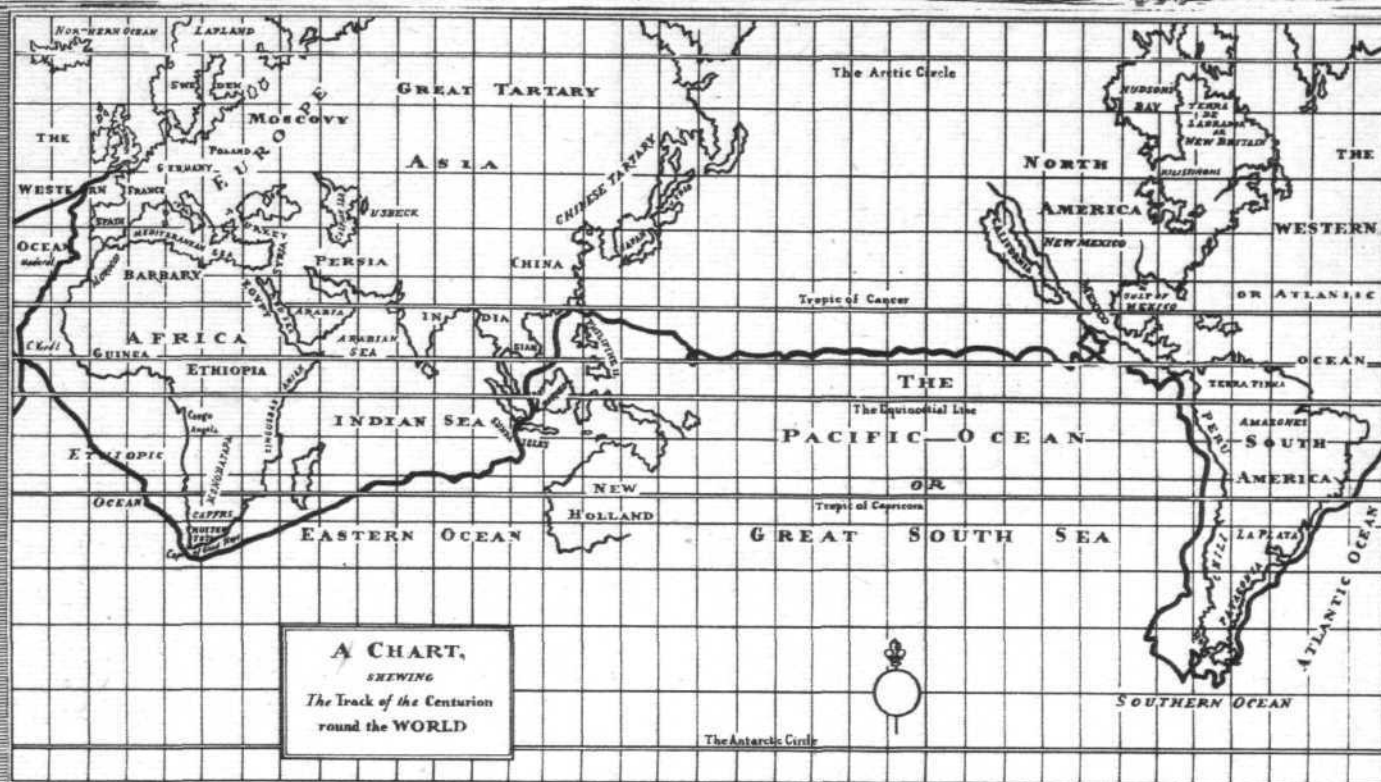
THE British Gliding Association's National Contests will be held this year on the Great Hucklow site of the Derbyshire and Lancashire Gliding Club from August 21st to 28th inclusive. If the weather is suitable two experimental competitions may be tried, but the meeting generally has been designed to provide contests which are inexpensive and simple; it is, in fact, on a far less elaborate scale than was the meeting held in 1947.

One of the experiments will be a cross-country flight—to a point some 40 miles away—for which an additional bonus will be awarded, calculated on average speed. The second innovation will be a race round a circuit of five or six miles. Details have not yet been worked out, but it is expected that a period of perhaps eight hours will be allowed, in which each sailplane may be flown by a team of up to four pilots: the one making the greatest number of circuits will be the winner. Launching will be by winch.

It is expected that there will be about 35 competing gliders and in the 15-metre class the British Olympia (of German design) is likely to predominate. There will also be a number of Slingsby Gull IVs. It is hoped to offer daily prizes and awards.

Official entry forms, with complete details of rules and regulations, will be issued shortly but in the meantime prospective competitors are asked to notify the secretary of the Derbyshire and Lancashire Gliding Club, Mr. B. Thomas, 87, Fargate, Sheffield, 1. For the general public attending the contests there will be an enclosure and car parks.

FOLLOWING THE GREAT EXPLORERS



“...UNDER THE EYE OF MR. ANSON HIMSELF...”

That eye which, on the four years' expedition of the Centurion scrutinised and approved the drawings and charts of little known lands drawn by the hand of Lt. Brett. This historic voyage epitomizes the spirit of reconnaissance which sees and notes vital information with meticulous care.



Today, reconnaissance aircraft, of which the Shackleton is the most modern example, can range the seven seas swiftly and certainly, returning to base in a time which would have amazed the great explorers of 200 years ago.

The illustrations above, by H. A. Crosby, are based on the original work by Lt. Brett in Richard Walter's narrative "A voyage round the world."



The AVRO
Shackleton

Designed for maritime reconnaissance
and built to range the seven seas



THE ROLLS-ROYCE

CIVIL MERLIN ENGINE

is in ever-increasing use



The **CIVIL MERLIN** flew

7,818,000 aircraft miles in 1946

17,455,000 aircraft miles in 1947

24,850,000 aircraft miles in 1948

on scheduled airline services
throughout the world



ROLLS-ROYCE

ROLLS-ROYCE LTD DERBY ENGLAND



The first B.C.P.A. DC-6 to visit New Zealand touching down at Ohakea on December 7th, 1948.

South Pacific Traffic

Personal Impressions of Some Important Routes and their Equipment

By IAN H. DRISCOLL

THE tabling in the New Zealand Parliament last year of the report of the United Kingdom Civil Aviation Mission to New Zealand, led by Sir Frederick Tymms, K.C.I.E., M.C., F.R.Ae.S., provided a concise review of the Dominion's civil aviation organizations and a series of well-conceived recommendations. One problem ably dealt with was the situation of international airports in New Zealand, which for some months had brought forth claims—invariably supported strongly by civic pride, if by nothing else—from a score of different centres throughout the country. The Mission, making it clear that its recommendations were based primarily on density of population, considered that Auckland, Wellington and Christchurch were the only centres justifying international airports. This would probably bring about the construction of a new airport at Auckland and the development, including the laying down of concrete runways, of Harewood, Christchurch; in the matter of Wellington, the capital city, insuperable difficulties of terrain would make the construction of an international land airport within forty miles of the city impracticable and the establishment of a marine base for overseas traffic appeared the only solution. This

AUSTRALIAN and New Zealand airlines now fly a number of services between the islands of the South Pacific, while several international operators are in process of opening up routes between that area and North America. The author of the accompanying article has had the opportunity of studying these developments and of assessing the value of recommendations made by the South Pacific Air Transport Conference

suggestion must lead to the consideration of the economics of flying-boat operations in this part of the world, having regard to the financial outlay for such a base. Development of Rongotai Airfield, Wellington, to a Class E airport for internal traffic was recommended, and other recommendations included additional support for private flying clubs by the Government, the issuing of air-taxi

licences to clubs and private operators, and higher salaries for senior officers of the Civil Aviation Branch of the Air Department. The requirement that the national operator, New Zealand National Airways Corporation, must qualify for an A.S.C. Rating issued by the Civil Aviation Branch of Air Department was deemed unnecessary, since a policy of one government branch supervising another could be carried on *ad infinitum*; private operators, however, should qualify for an A.S.C. Rating.

As was reported at the time in *Flight*, the South Pacific Air Transport Council met in Wellington last autumn and the following recommendations were made:—

(1) The adoption of Short Solent flying boats by Tasman Empire Airways, Ltd., for the Auckland-Sydney and possibly Wellington-Sydney routes.

South Pacific Traffic

(2) Purchase of four Douglas DC-6 aircraft by British Commonwealth Pacific Airlines, Ltd., from the Australian Federal Government (the aircraft had recently been obtained for sterling payment from S.A.S.).

(3) Ultimate operation of a landplane service between Christchurch (South Island) and Australia.

(4) Construction of a new international airport in Fiji at Suva Point, some two miles from the capital.

The conference closed on December 7th. By that date two of B.C.P.A.'s newly acquired DC-6s had arrived in Australia from the Douglas factory in California, and the second of these had made a flight to Auckland on December 4th under charter to Tasman Empire Airways; it continued to Ohakea R.N.Z.A.F. Station, some 100 miles north-west of Wellington, on the following day. The 1,200-mile flight between Sydney and Auckland was completed in 4 hr 27 min.

Members of the Conference returning to Australia departed by this aircraft on December 7th and the writer was fortunate in travelling on the same flight. B.C.P.A.'s new aircraft provide accommodation for 48 passengers by day and 37 by night; there is a crew of nine, including a purser and two hostesses. The forward cabin has seating accommodation for 32 and the after cabin for 16; upholstery in the larger cabin is green and in the smaller one wine-coloured, and cream curtains with a dark floral pattern are hung throughout the aircraft.

Expansion at Mascot

The writer had not visited Mascot, Sydney, for over two years, and developments to the land strips and the increase in traffic, both here and at Essendon, were most noticeable. Flights made included Sydney-Melbourne by T.A.A. Skymaster, a return by DC-3, and Sydney-Brisbane return by T.A.A.'s Convair service. T.A.A. Skymasters operate Sydney-Melbourne-Adelaide-Perth return daily. It was good to make a flight in a DC-3 after all this "latest and biggest" flying and to find oneself still appreciative of the comfort and lack of noise in the full passenger version of this "old faithful."

The Convair is undoubtedly a fine aircraft for short-hop operations and ideally suited to Australia. T.A.A. has taken delivery of three, and will shortly have the complete set of five. At present they are operating once daily Melbourne-Hobart and Melbourne-Sydney-Brisbane. The overall effect in the 40-seater cabin is a restful grey, with lighter-coloured ceiling and racks, while the chairs provide adequate comfort. The pantry is forward, immediately abaft the flight deck; the carrying out of this aspect of service before the full gaze of the customers did not altogether appeal.

In matters of noise and vibration, the writer noted an unusual quietness in the DC-6, but there was a very slight vibration in seats and bunks immediately alongside the inboard motors; the floors of the aircraft are lined with a sponge material to offset this effect. The Convair had no suggestion of vibration, but was fairly noisy in the two back rows of seats, which are situated aft of the exhaust stacks. At other points noise was in no way noticeable. The Australian public appears to like the Convairs, and this is particularly interesting in view of the intense competition between T.A.A. and A.N.A.—nationalization versus private enterprise. All things being equal, the public will patronize private enterprise, but if the government airline produces an aircraft that the passenger prefers, or an aspect of service that appeals, then that line will be patronized; which is pleasing, because it means that the best man may still win, whatever his politics may be.



Local colour—Polynesians of Western Samoa. (Top) Apia, the capital of the Islands.

An amusing sideline on T.A.A. aircraft registrations was to be noted. The series VH-TAA to VH-TAZ inclusive has been taken up fully, with the exception of VH-TAX—it was thought wiser to leave that one alone.

The writer departed by regular B.C.P.A. Skymaster from Sydney for Fiji. These aircraft maintain the Sydney-Vancouver route three times fortnightly and the Auckland-Vancouver service once fortnightly. With the introduction of the DC-6, schedules will probably be increased to twice weekly Sydney-Vancouver and weekly Auckland-Vancouver. The four Skymasters are to revert to the Australian Federal Government as soon as the DC-6s go into trans-Pacific service. Their future is as yet undecided; Qantas wants three for the Sydney-Hong Kong, Sydney-Tokyo and Sydney-Perth-Cocos-Mauritius-Johannesburg routes, possibly starting next August; T.A.A. would like two; and it is possible that other B.C.P.A. shareholders are interested in the matter of disposal of these aircraft.

The B.C.P.A. flight to Vancouver departs Mascot at 2000 hours and reaches Nadi, Fiji, at 0800 hours L.S.T. the following morning. The transfer of the Fiji international airport from Nadi, with a hinterland of mountains reaching to 4,000 feet, to Suva Point, 130 miles away on the southern side of the island of Viti Levu, was a recommendation from the S.P.A.T.C. that came as a pleasant surprise; desirable as was the move to put the airport near the capital, it was felt that it might founder

R.M.A. "Auckland," one of Tasman Empire Airways' Sandringham flying boats.



Tam. H. Driscoll



Nadi Airport, Fiji, as it appeared in July, 1948.

due to cost. Happily, it has not done so, and Fiji has every reason to congratulate itself. Incidentally, the European papers in Suva had long been demanding the transfer of the airport to a point near the capital; the writer was therefore amused to read on his arrival—with the airport now destined to be within two miles of the General Post Office—an even more bitter editorial criticizing all those responsible for having brought it too close!

B.C.P.A. undoubtedly operates a first-class service and it is an anti-climax to step off the aircraft, purring with contentment, to be faced with 146 miles of dusty driving along a poor road, not to mention a £10 taxi bill. P.A.A. passengers are faced with the same problem if they wish to reach Suva. It can be resolved for passengers from Australia and New Zealand to Fiji, since Qantas operates a Catalina service fortnightly between Sydney, Noumea and Suva, and New Zealand National Airways Corporation maintains a weekly service with Sunderlands between Auckland, Suva and Labasa (Vanua Levu). The flying-boat base at Laucala Bay is only two miles from the capital and beside the site of the Suva Point airport. There is also a further service of New Zealand National Airways Corporation, maintained fortnightly by DC-3Cs, between Auckland, Norfolk Island and Nadi; it continues to Nausori, which is 17 miles from Suva but unsuitable for regular operation by larger aircraft.

This route also goes on to Tonga, Western Samoa, Aitutaki

and Rarotonga, in the Cook Group. It has been in operation as a civil airline just over a year at the time of writing. The majority of services operate to capacity. Passengers are European, Polynesian and Indian. The local pride displayed in these remote islands in catering for the air service is most impressive; a year ago accommodation was primitive, but today luncheon is taken at Tonga in a specially constructed *buere* or native house, passengers sitting round a circular table with the courteous Tongan caterers operating from within the enclosure of the circuit. The lifting of quarantine restrictions, in force for over a year in Western Samoa on account of poliomyelitis in New Zealand, has made things a deal more pleasant on the very beautiful island of Upolu, where a night-stop is made.

Visitors Not Encouraged

The writer recently travelled by a service that called at American Samoa, touching down at Tafuna airstrip, Pago Pago. This is the setting of Somerset Maugham's famous short story *Rain*—and it was raining during the visit. Visitors are not encouraged, and Pago Pago, and its island of Tutuila, consist principally of a United States naval base and the Samoan community, which latter is left largely to conduct its own affairs. Some operators would like to consider Pago Pago as a trans-Pacific calling point, but it is doubtful whether it would ever be licensed. The island consists of high, densely vegetated, volcanic peaks and ridges, which fall steeply to the sea; the airstrip at Tafuna juts from the bases of the hills and out into the ocean, like a jetty. Our aircraft, granted special permission to call for trade purposes, was commanded by Captain M. Pirie, who got to know the place well during the war years and is now N.Z.N.A.C. Senior Route Pilot for the Rarotonga service. He descended through the rain out at sea, came in to find the island, hugged the hills close, banked sharply to starboard and pushed her down smartly on to the strip. It was beautifully done, but it seemed as well to know the locality.

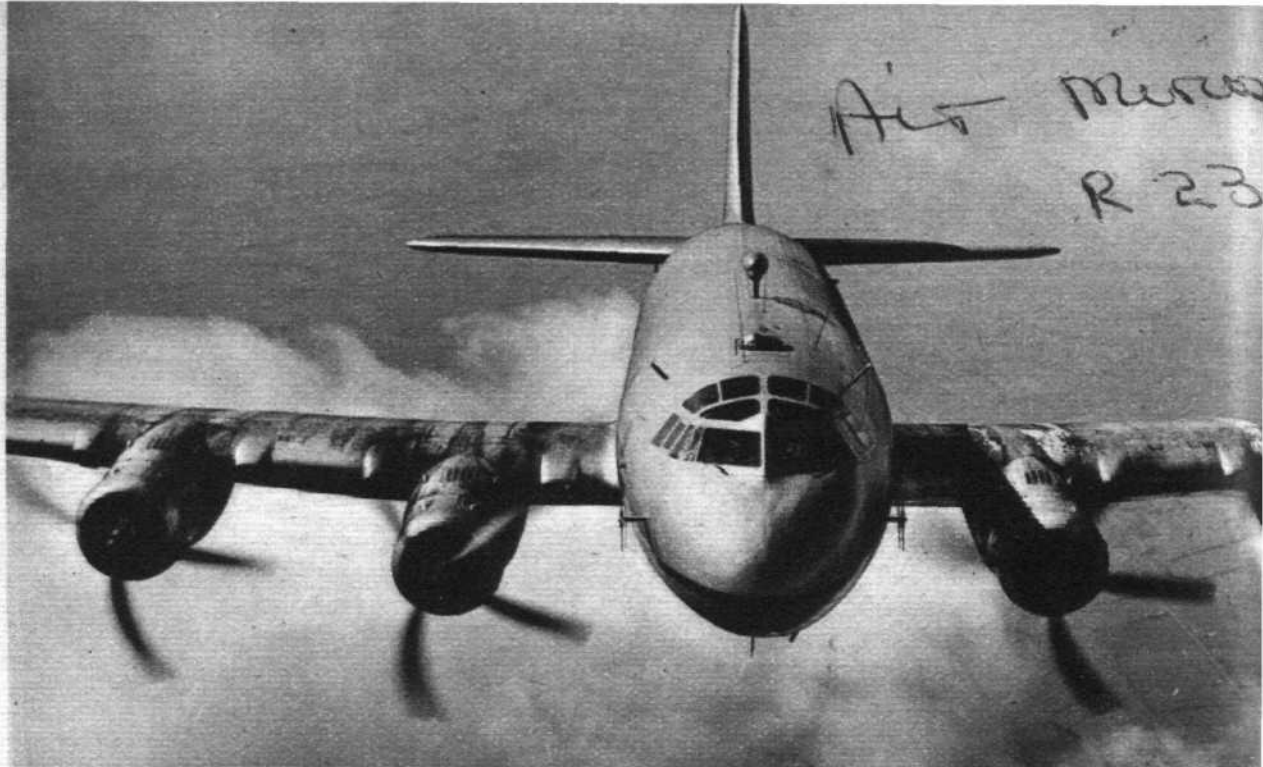
Nearly a thousand miles away to the south-east is Aitutaki, one of the Cook Islands. Here the Public Works Officer has constructed a fine reception and refreshment building which is delightfully cool; the laughing Islanders provide service, and the tireless P.W.O. has even converted a jeep into an airways bus! And so the flight continues another 130 miles to Rarotonga, justly renowned as the ultimate in South Sea Island tranquility and loveliness.

The writer finally returned to New Zealand by the delivery flight of the third B.C.P.A. DC-6, which carried British settlers from San Francisco to the Dominion. The flight from Fiji (Nadi) to Auckland took approximately five hours.

Interest is shown in a B.C.P.A. DC-6 at Ohakea.



Tam. H. Driscoll



Handley Page Hastings (four Bristol Hercules)

Each to its Trade

THE Handley Page Hastings C.1, seen at the head of the page nuzzling the photographic machine, is the largest—and yet the fastest—transport now serving the R.A.F.

Few published views have suggested to better advantage the capacity of its fuselage. The D.H. Devon C.1 (below) is one of the smallest—though certainly not the slowest—of Service transports; the example shown is the personal aircraft of the A.O.C. in C. Coastal Command—Air Marshal Sir John Baker, K.C.B., M.C., D.F.C. Only in equipment does the Devon differ from the civil Dove. Heading the opposite page is a Bristol Brigand B.1—officially categorized as a bomber, but perhaps better described as an attack aircraft; it is the only machine of its class in British service and represents a great advance on the historic Beaufighter. A three-seater, as will be seen, it is an extremely useful compromise between speed and climb, range, and striking power. The B.1 variant was developed from a torpedo-fighter version (T.F.1). The Avro Lincoln B.2 below it is the Empire Air Armament School's *Thor II*—the vehicle for propagation of official armament doctrines. Finally, there is a Buckmaster T.1—a near relative of the Brigand, but equipped for advanced training. It is the world's most powerful piston-engined trainer, and, as will be gathered, flies very comfortably with one of its Centaurus power units stopped.

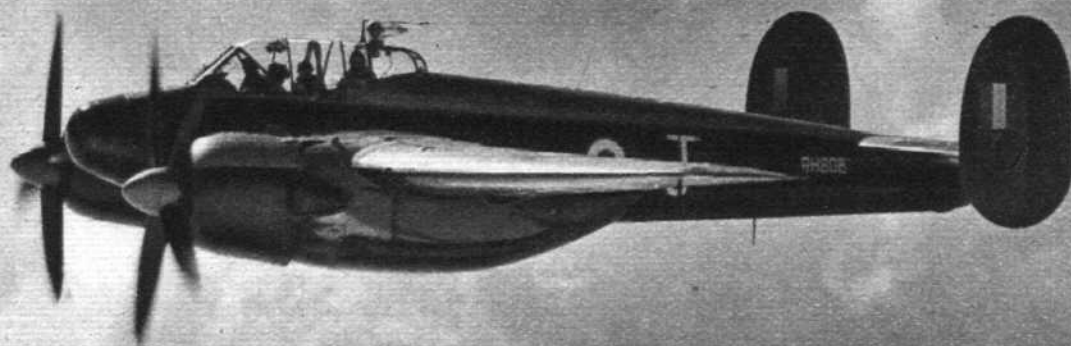


De Havilland Devon (two D.H. Gipsy Queen)



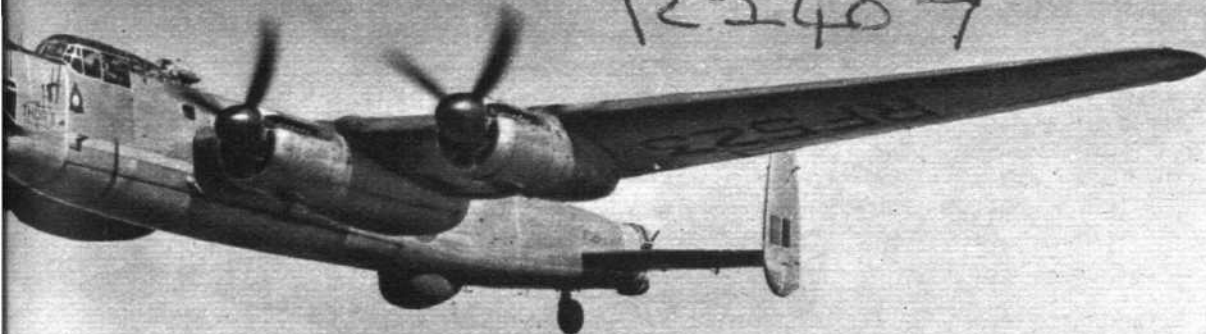
June 16th, 1949 709

Air Ministry
R 2377



Bristol Brigand (two Bristol Centaurus)

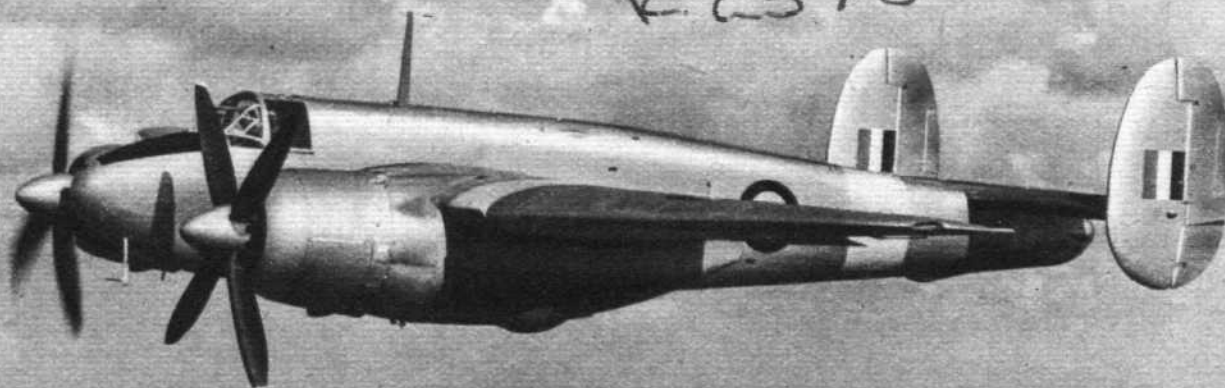
Air Ministry
R 240

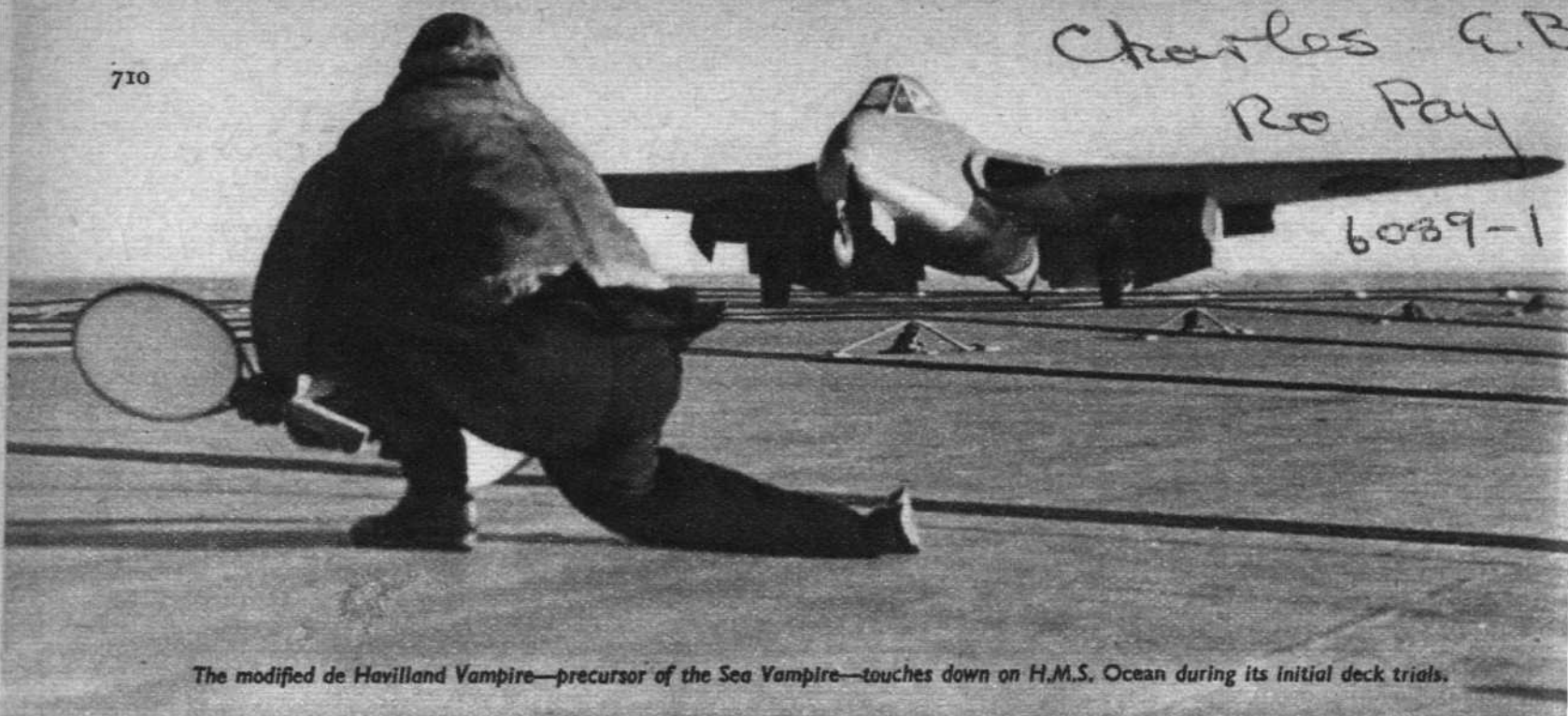


Avro Lincoln (four
Rolls-Royce Merlin)

Bristol Buckmaster (two Bristol Centaurus)

Air Ministry
R 2370





The modified de Havilland Vampire—precursor of the Sea Vampire—touches down on H.M.S. Ocean during its initial deck trials.

Deck Landing

A Comparison between British and American Methods

By Roger Gordon

SINCE 1917, when the first aircraft was landed and brought safely to rest on the deck of a ship at sea, the basic technique of deck-landing has remained practically unchanged. Alterations and improvements to the arrestor gear and flight decks of aircraft carriers have, of necessity, followed closely on the heels of naval aircraft design, but the method of "landing-on" has remained very much the same.

The object of any system of deck-landing is, quite simply, to bring the aircraft to rest on the flight deck with the minimum amount of strain both on pilot and aircraft—in other words, to land the aircraft in a predetermined area

at the lowest speed compatible with safety and ease of handling. Clearly, this object can best be achieved—perhaps can only be achieved—by means of a power-assisted approach followed by a three-point landing. It is evident, therefore, that all tried and proved techniques—such as those used by the Americans and ourselves—must be fundamentally the same and will differ only in detail. At first sight, the small differences might appear to have little significance, but on looking into them it becomes apparent that a comparison merits further attention.

In using the British method, the aircraft is flown to within a few feet of the deck at a constant rate of descent, and at an air speed of 4-5 knots above the stalling speed. This is achieved, from an altitude of approximately 400 feet, by a power-assisted glide with the aircraft in the three-point, or landing, attitude, the rate of descent being governed largely by use of the throttle.

The "batman," or Deck-Landing Control Officer, who is stationed about one-third of the way up the landing area, directs the aircraft to a position abreast himself and a few feet above the flight deck. He then signals the "cut" and the pilot immediately closes the throttle and, the aircraft being in the landing attitude, holds the control column steady, so allowing the machine to drop on to the deck.

U.S. Navy Technique

In the American method, although air speed and attitude are to all intents and purposes the same as in the British system, the "constant rate of descent" which is implicit in the latter procedure is replaced by a "constant altitude" final approach.

Circuit altitude is approximately 200 feet, and from this height the aircraft descends gradually to within approximately fifteen to twenty feet above the deck. The final approach is then flown level at this height with a power setting sufficient to maintain an air speed a few knots higher than the stalling speed. Small corrections in height are made by use of the control column, throttle movement being unnecessary since the aircraft need only "step" down or up, as the case might be, and then continue level flight with the original power setting.

The batsman is stationed well aft on the deck, as near to the round-down (the curved-over after-portion) as



Two phases of the approach of a D.H. Sea Hornet fighter (two Merlins) to H.M.S. Triumph during deck-landing trials in 1946.



June 16th, 1949

possible. He signals the "cut" to the pilot when he judges the aircraft to be well in position over the stern of the ship. The pilot closes his throttle, and the aircraft, losing power, noses down. On nearing the deck, the control column is pulled back to complete a normal three-point landing.

It is evident from the foregoing description of the two systems that the principal difference lies in the fact that, whereas the British practice involves a constant rate of descent, the American system requires a normal landing off a level approach.

There is one point in favour of the British method that is immediately apparent; the aircraft is controlled by the batsman to within a few feet of the deck virtually throughout the whole landing procedure. There should, therefore, be little risk of a last-minute slip or skid developing; and the attitude, controlled throughout the final stages of the approach, should eliminate the possibility of an arrival on the front wheels alone with the consequent tendency to bounce.

Room for Error

There is, too, the fact that the attitude remains unaltered throughout the landing. And, given the right attitude—and the batsman would send the aircraft round again should the attitude be wrong—the aircraft can be flown at an air speed in excess of the correct one, without the risk of "floating" over the arrester wires; the "float" would be aggravated by pulling back the control column.

In a comparative assessment of the two deck-landing systems, the balance is found to weigh heavily in favour of the American technique. Essentially, the advantage lies in the level approach. For small corrections in height only the control column need be used to lose or gain the amount required. No alteration of power-setting is necessary to maintain the correct air speed, since the changes in height are but momentary and quite small. This eliminates a great deal of the "throttle pumping" which is the rule, rather than the exception, when a pilot flying an aircraft at, or near the stall, attempts to maintain a constant rate of descent without altering attitude.

Another simple, although perhaps not so obvious, factor in favour of the level approach is that there is no tendency for an aircraft to sink when taking a last-minute "wave-



A Hawker Sea Fury fighter-bomber (Bristol Centaurus engine) returns to the 23,000-ton Fleet carrier H.M.S. Implacable.

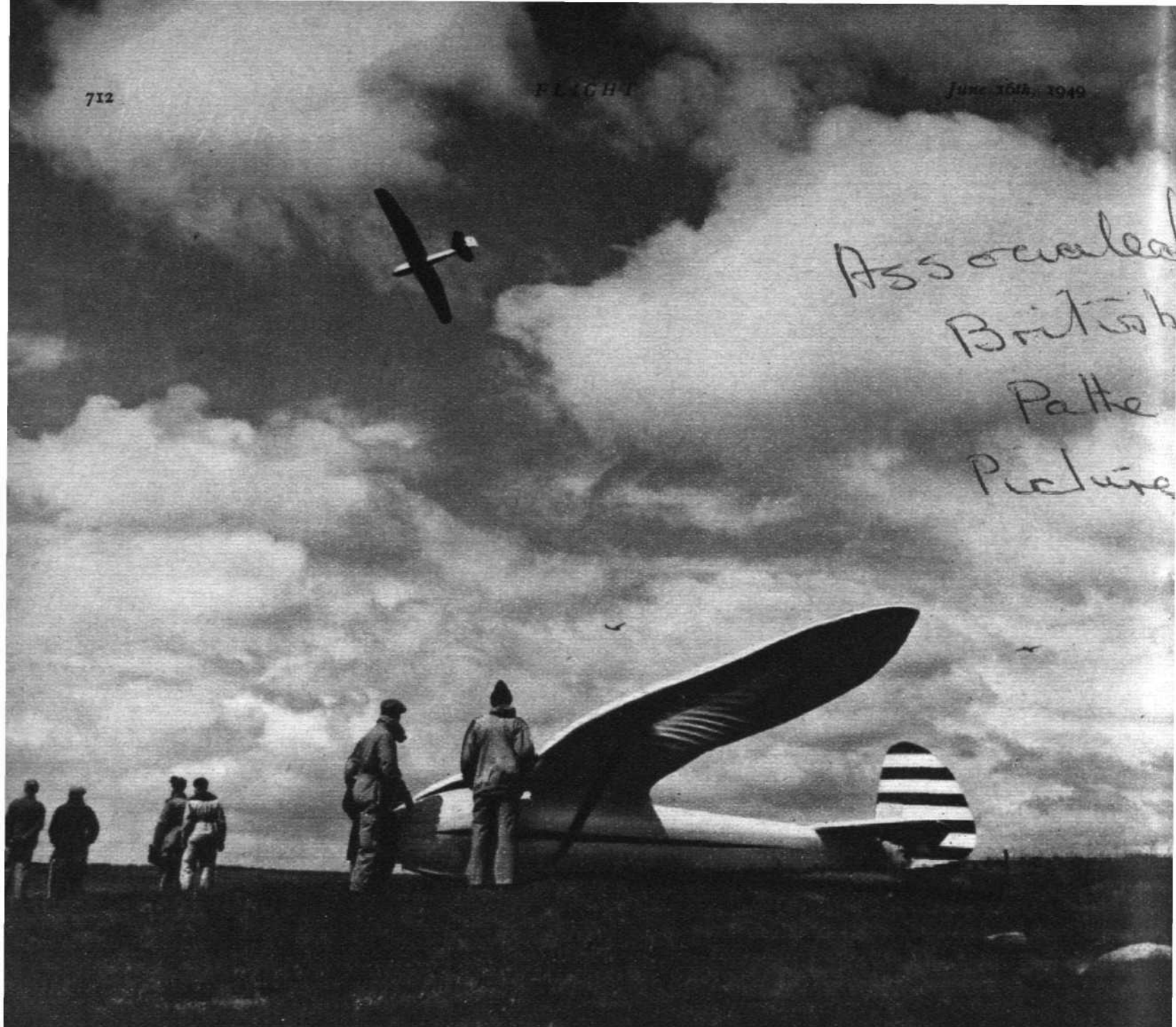
off," or during the final stages of the approach before the round-down has been crossed in safety.

With the introduction of jet aircraft into Naval Aviation, this question of a last-minute wave-off has become increasingly important. Using the American technique, the jet aircraft has sufficient thrust available to maintain level flight at all times; consequently it is in a position to "go round again" whenever the need for this action should arise.

There are, of course, other advantages and disadvantages of both systems; but they are too small to stand alone and, weighed in the balance with the rest, the one would cancel out the other. Both the British and American techniques for deck-landing have been exhaustively tested and both have proved successful. But perhaps the situation can best be summed up in the words of the old adage—"Where there's little to choose between the two, the best is good enough."

This twin-jet McDonnell Phantom of the U.S. Navy appears to be "going round again" for a landing aboard the U.S.S. Saipan.





“Wings: Sc. 34 Take 1”

THE technical jargon of film making was heard at Great Hucklow when Times Film Productions made a documentary picture, “Wings for Pauline” (reviewed in “Flight” of May 26th) with the co-operation of the Derbyshire and Lancashire Gliding Club. Admirably typifying the atmosphere of the sport of gliding, these scenes show (above) a Kirby Kite waiting to be launched while a Tutor circles above, and (left to right below) the camera crew at work, with G. O. Smith (chief

instructor) alongside the Cadet; L. R. Robertson (instructor and “Silver C” pilot) describing a 130-mile cross-country to club members Pat Dickson and Derek Roper; and Miss Margaret Swale, the member who played the principal part in the film. An unusually photogenic subject, gliding offers great scope to an imaginative director, and in this particular case an intelligent commentary and a careful avoidance of “phoney” situations contributed to the successful result.

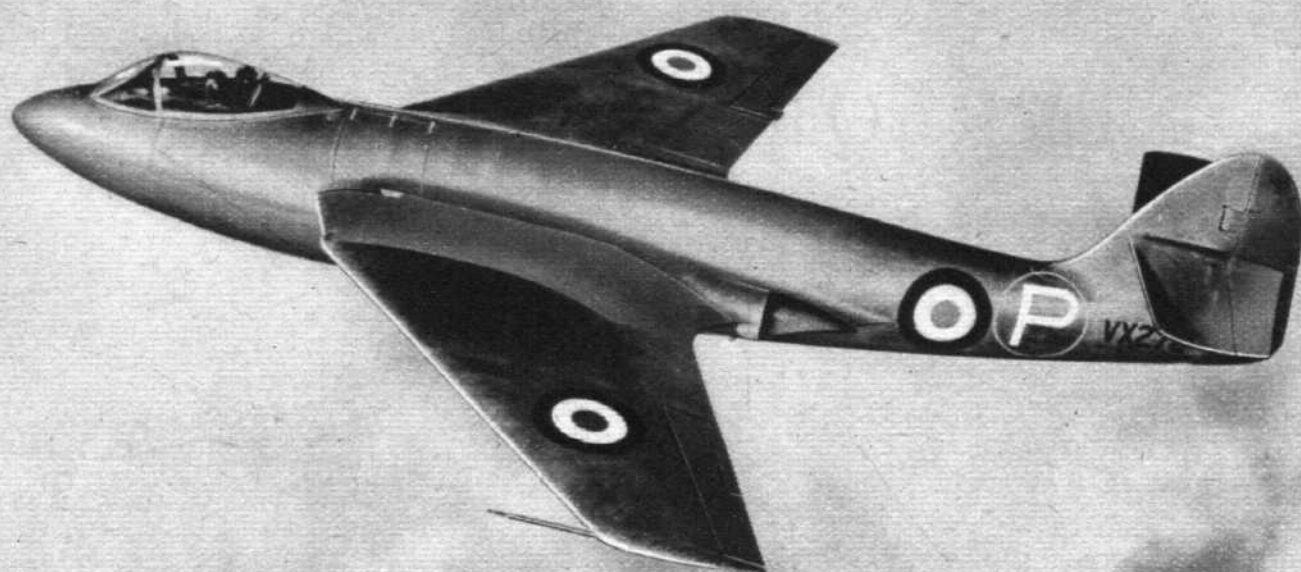


PERFORMANCE OF AN ORGANIZATION



The *Canadair* Organization is proving its ability to meet urgent delivery requirements by completing aircraft on all current orders months ahead of exceptionally fast schedules.

Canadair
LIMITED · MONTREAL



HAWKER P.1052

DOWTY

Equipped

LIQUID SPRING MAIN AND NOSE UNDERCARRIAGES
LIVE-LINE PUMP AND HYDRAULIC SYSTEM

DOWTY EQUIPMENT LIMITED, CHELTENHAM

TO appreciate what the foundation of an aircraft company meant in June of 1909, it is necessary to recall that Louis Blériot had not yet flown the Channel; that was not to happen until more than a month later. In Great Britain the experimenters had mainly concentrated on biplanes or triplanes (A. V. Roe made hops on a machine of the latter type) and, even several years later, the monoplane was to have a hard fight to win recognition. Mishaps were to occur which led to the type being "banned" for a time.

When Mr. (now Sir Frederick) Handley Page founded his company on June 17th, 1909, *Flight* had already been

THIS week the firm of Handley Page, Ltd., celebrates the fortieth anniversary of its founding by the pioneer pilot and designer whose name it bears. Everybody in British aviation to-day knows "H. P." and his proclivity for shooting well-barbed shafts of wit across dinner tables. Not so many know the story of his early endeavours, told on this page by one whose work brought him into frequent contact with them. The author is C. M. Poulsen, who recently retired from the Editorship of *Flight* and upon whom we hope to prevail, from time to time, to contribute other recollections of a lifetime in aviation.

In our next issue a special feature will be devoted to a history of Handley Page aircraft.

in existence for a little more than five months, the first number having appeared on January 2nd of that year.

It could scarcely be argued that the times were propitious, for the British Government of the day was very lukewarm about the potential usefulness of the flying machine as a military weapon. Nor was this doubt confined to Government officials. When Mr. Stanley Spooner founded *Flight*, he received from Mr. Claude Johnson, then managing director of Rolls-Royce, a letter commending him for his courage but stating in no uncertain terms that the venture was foredoomed to failure, "as flying can obviously never amount to anything more than a sport for the few rich."

However, Mr. Spooner was not deterred by this or by many other expressions of doubt. Nor was "H. P.," as he was then always called, and still is by his friends. He formed his company and began to advertise in *Flight*. I do not remember what were the advertising rates in those days, but they were certainly very modest. Even so, at times they proved too much for H. P., and the advertising manager, Mr. Hawkins, more than once had to go to the little office in Victoria Street and argue with H. P., who would hold out as long as he could but would finally write a cheque for £5 "on account." From such slender beginnings has grown the great Cricklewood firm.

Here it should be recorded that H. P. believed in the monoplane. His earliest machines were of that type, and his great aim was to achieve what in those days we used to call inherent stability. In the Handley Page monoplanes, this stability was based on a crescent-shaped plan form with the tip trailing edges swept upwards so as to give a "wash-out" in incidence. My own knowledge of aerodynamics was of the sketchiest sort at that time, and it was to H. P. that I owed the first glimmerings of under-



"H. P." in the cockpit of "The Bluebird," circa 1909.

standing of what he was driving at, and how his wing design was intended to work.

I well remember that it was in the Hall shed at Hendon that H. P. gave his discourse on automatic stability, using as a living example the little monoplane which was later to become known as "The Yellow Peril"—owing to its colour scheme, and not because of any vices in its flying characteristics. That little monoplane did much flying at Hendon, and it was certainly stable. There is no doubt that H. P. had a more thorough understanding of the principles of flight than had many of his contemporaries. He was trained as an electrical engineer, and for a considerable time he lectured at the Northampton Polytechnic in Islington. Perhaps that partly explains how it was that he was able to convey even to my untutored mind at least a hazy notion of how inherent stability could be achieved.

To the modern generation it may appear almost unbelievable that in those days few aircraft firms could or would supply general-arrangement drawings. It fell to me to do those which were published in *Flight*, and that meant going over the machines carefully with a long tape measure.

"The Yellow Peril" was one of the machines which I had to tackle in this fashion. It was at Hendon, and while Max Millar was doing the detail sketches (published in *Flight* of October 26th, 1912) I was busy with my tape measure. Due to the plan form, with no straight lines in the wing, the task was a difficult one, but I had made up my mind to make a good job of it, for Mr. Spooner was a great believer in Handley Page's work, and had impressed me with the need to get a really accurate g.a.

Subterfuge

I spent most of the day doing the measuring, and towards evening H. P. came along to see how I was getting on. After studying the drawing for a few minutes, he said, "You have managed to get down an awful lot of dimensions." I explained that this was very necessary, owing to the difficult shape of the wing, but he thought the drawing looked too accurate and scored through many of the figures which I had so painstakingly acquired. I pleaded with him, but to no avail. "I am not going to give away too many and too accurate dimensions," he said.

H. P. did not know at the time—and I do not think I have ever told him until now—that I had already realized that he might take a dim view of those dimensions; accordingly, while making the drawing I had a sheet of carbon paper underneath the drawing in my sketch book. When I saw H. P. approaching, I took the carbon paper out, and fortunately it did not occur to him to lift the top sheet to see what was underneath. Otherwise I should have been sunk! As it was, I think my g.a. drawing of "The Yellow Peril" was fairly accurate. There is now no way of finding out, for someone who should have known better had the aircraft burned a few years ago, and thus was lost a very remarkable and historic aircraft; I understand that the original drawings no longer exist.

C. M. P.

JOINT CONFERENCE

Two Further Important Papers: Experience with the Turboprop and the Outlook for Flying Boats

IN his paper entitled "The Propeller Gas Turbine in Service," Mr. Owner started by saying that it had to be freely confessed that much more experience must be gained before the turboprop could occupy its rightful niche in its appropriate field; nevertheless, a certain amount of "taking stock" of achievement seemed justifiable. Without question, the main advantage of the turboprop lay in the improvement in propulsive efficiency from take-off up to moderately high speeds which it afforded over the jet engine. This had greatly simplified its development, flight testing and early operational use, and furthermore it could be fitted without serious redesign to a comparatively large number of existing aircraft.

These considerations led to the selection of the Lincoln heavy bomber for the initial flight testing of the Theseus, on the grounds that aircraft and spares were readily available and the structure was adequate for the power and speed expected. The initial flight development testing was so satisfactory that, at the instigation of Air Marshal Sir Alec Coryton, C.S. (A), two further conversions were put in hand substantially to the same specification, so that they could be operated under Service transport conditions by R.A.F. Transport Command.

In relating experience with the Theseus, Mr. Owner devoted attention to a brief description of the engine and then went on to consider bench testing. Most of the bench testing that had been done so far was of a development nature. It was found in the early days of the Theseus that there was a tendency for performance to vary considerably between engines built to the same specification, and it became the practice to carry out a performance curve immediately prior to whatever test was scheduled. This not only enabled performance to be checked against the required standard, but also in time established the identity of the variables affecting performance; the most critical factor was found to be variation in the turbine stator throat areas.

The lecturer postulated that the technique of bench testing should avoid devoting engine running time to the development of components which could be tested separately. In the case of the Theseus, this policy had proved so fruitful

THE first paper presented by a British delegate at the joint I.Ae.S.-R.Ae.S. Conference in New York was "The Propeller Gas Turbine in Service," read by the author, Mr. F. M. Owner, M.Sc., F.R.Ae.S., M.S.A.E., chief engineer (engines), Bristol Aeroplane Co., Ltd. In last week's issue of *Flight* there appeared a condensed resumé of this and other British papers which were presented. Here, and on the succeeding pages the papers delivered by Mr. Owner and by Mr. Keith-Lucas, B.A., A.M.I.Mech.E., F.R.Ae.S. (chief designer, Short Bros. and Harland, Ltd.), respectively are abstracted in considerably more detailed form.

that relatively little development work on bearings, combustion chambers and so forth needed to be carried out on the engine.

Due to the nature of the power/r.p.m. curve associated with turboprops, in which the s.h.p. increased approximately as the fifth power of the r.p.m. in the region of full throttle, it was essential that speed measurement instruments should be sensitive, accurate and reliable. For performance calibration, an oscilloscope had been adapted for the purpose of measuring r.p.m. This consisted of a tuning fork vibrating at a constant frequency of 1,000 c.p.s., this frequency being mixed with one phase of the three-phase tachometer on a circular time base.

Due to the turbulent nature of the airstream entering a turboprop, it was almost impossible difficult to measure mass flow with any degree of accuracy. It had been found quite recently, however, that the most accurate record of air mass-flow was that obtained from a pitot-static rake situated at the outlet from the jet nozzle.

Temperature and Thrust

Regarding the measurement of temperature, Mr. Owner confined himself to the observation that it was still extremely difficult to assess the true mean turbine inlet temperature, outlet temperature and metal temperature, and that much more work must be done on these problems before temperature readings could be interpreted with confidence and accuracy. As regards power measurement, although the power developed at the airscrew shaft could be obtained accurately enough, the magnitude of the residual jet thrust had to be obtained indirectly. At Bristol, this was estimated by means of a pitot-static rake at the jet nozzle outlet. The error in thrust measurement affected only a small percentage of total power so that resultant error on the total power was quite small, being of the order of 1 per cent of total ground-level power for a 10 per cent error in measurement of thrust.

By December, 1946, i.e., some 17 months after the engine first ran, sufficient progress had been made to embark on a comprehensive programme of flight testing. Piston engines were retained in the inboard power plants as this permitted economies in the provision of Theseus engines with an adequate safety margin during deliberate scheduled tests covering engine blow-out conditions.

Mr. Owner went on to say that in choosing parameters for the flight test programme, instead of running the engine at fixed intervals of height, forward speed and engine speed, it was decided to run at fixed intervals of height, $\frac{V_a}{(T_a)^{1/2}}$ and $\frac{N}{(T_a)^{1/2}}$ (where V_a is the true aircraft speed, N the r.p.m., and T_a the ambient absolute temperature °C).

The three values of $\frac{V_a}{(T_a)^{1/2}}$ chosen were 10, 15 and 20 m.p.h., and these covered a large field within the stalling and maximum speed of the aircraft at all heights. By this method, it was thus possible to derive the non-dimensional groups of the various observed quantities and plot a series of graphs for various values of $\frac{N}{(T_a)^{1/2}}$ and $\frac{V_a}{(T_a)^{1/2}}$. A specimen non-dimensional plot for horse-power is shown in Fig. 1. From this, and similar curves, the performance of the engine at any height, forward speed and r.p.m. in I.C.A.N. conditions could be derived by substitution and extrapolation, as illustrated in Fig. 2.

The full calibration of the engine up to 20,000ft at 300 m.p.h. at five height intervals took less than 15 hours of scheduled flying.

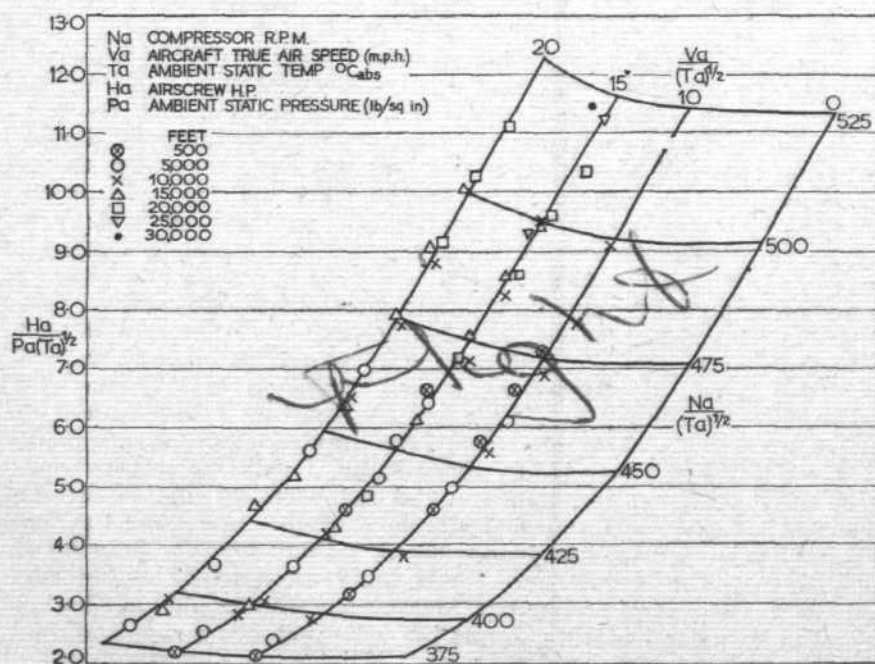


Fig. 1. Typical non-dimensional grid plot for airscrew horsepower.

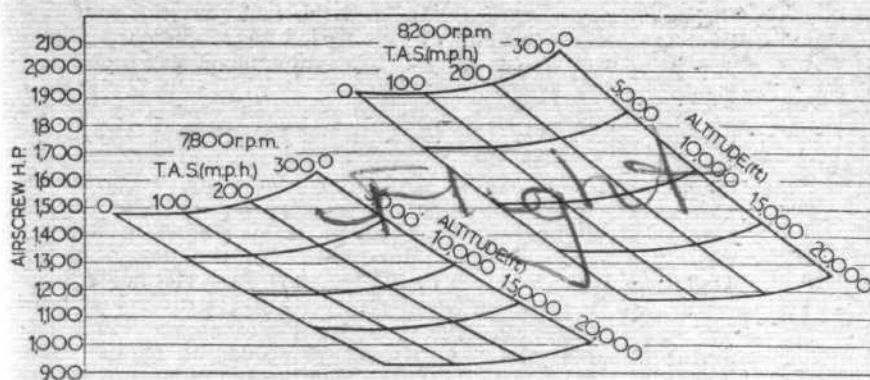


Fig. 2. Airscrew horsepower grid plots for I.C.A.N. atmosphere conditions.

although approximately 50 hours of flying were then completed in order to build up some endurance time. During this period, readings were taken at 25,000 and 30,000ft.

The accurate measurement of jet thrust in a turboprop installation offered formidable difficulties, as the effects due to airscrew thrust entirely masked the much smaller jet thrust. This difficulty affected the accuracy of specific fuel consumption, since at cruising altitudes the jet thrust was quite a significant contribution to the total power developed. The use of a variable-area jet pipe in flight testing had accentuated this difficulty and, in fact, loss of total power was recorded in flight when the nozzle area was reduced, although the aircraft actually increased its speed and the piston engines had to be throttled back to restore the original conditions.

The general impression of the progress made up to the time of the first flight trials could be gained from the fact that, with practically no maintenance, the first pair of engines ever to fly had a total life of 100 hours before being removed from the aircraft for strip and inspection.

Mr. Owner then went on to deal with the use of the Theseus-Lincoln by R.A.F. Transport Command and, after reviewing personnel training, the necessary modification to the airframe, and the clearance of the aircraft for operational use, he stated that the original proposal was to fly over the Transport Command main route to Singapore. It was ultimately decided, however, that the route from England to Fayid (Egypt) and return, with an intermediate stop at Malta, would provide the required conditions. It was found that the aircraft could fly the 1,330 miles from London to Malta at 10,000ft with a reasonable payload and with sufficient fuel to cover all normal contingencies.

Flight Conditions

The Theseus engines were to be operated at conditions laid down by the Bristol Company, but in view of the nature of these tests it was not thought possible for Transport Command to fly to a strict schedule comprising a number of different engine conditions, and, accordingly, recommendations with regard to desired engine conditions were made and discussed with Transport Command, from which they were able to formulate a flight plan.

A cruising speed of 7,200 r.p.m. was suggested, and this was followed during the first "leg" of the first route flight. Later on, however, the normal cruising speed of 7,800 r.p.m. was adopted and used for all subsequent flights. It was evident that the altitude conditions at which the aircraft was to be flown would depend largely on the type of weather encountered, and it was left for Transport Command to use their discretion in this matter. Most flying had been done at altitudes between 10,000 and 15,000ft.

Since the main object of these trials was to secure as many Theseus flying hours as possible under conditions obtaining in the R.A.F., the Bristol Company was content with endurance flying at conditions within the engine operating limits as laid down, detailed flight plans being left to Transport Command entirely.

Turning to control problems and improvements, Mr. Owner stated that a remarkable stability was noted at all r.p.m. conditions, very little interference with the throttle lever for speed adjustment being necessary throughout the entire trip. This received very favourable comment from the pilots, who found the continual resetting of boost pressures on piston engines to be somewhat irksome by comparison. They had previously accepted this matter of continual adjustment as being part of the job, but the use of turboprops in the same aircraft now showed that this point was one of no small magnitude. However, notwithstanding the excellent stability of the Theseus engine, it was considered that to obtain

maximum consistency in r.p.m. and fuel consumption on very long-range flights some form of governor should be employed, and work was proceeding satisfactorily in this respect.

For take-off, with the aircraft brakes on, the Theseus engines were first set at 5,000 r.p.m., then the Merlins and Theseus were opened up to take-off r.p.m. simultaneously or separately as required, the brakes being released at the same time. With the lower idling speeds permissible on later engines, it would not be necessary to use the brakes in this manner.

In cold weather and with low oil temperatures some airscrew r.p.m. surge might be encountered on starting, due to the presence of viscous oil in the airscrew hub cylinder, and, although this surge had never been sufficient to effect directional control, it was wise to take the precaution of feathering and unfeathering the airscrews once or twice to distribute warm oil around the airscrew hub whilst the engine was idling. After this, the normal take-off routine could be followed. This ability to circulate warm oil through the airscrew system whilst the engine was idling was a unique advantage of the free power turbine engine.

The required cruising power was set by positioning throttles only, this being a considerable advantage over the piston engine where a precise relationship between boost and r.p.m. had to be kept, and boost resetting was usually accompanied by an adjustment to the r.p.m.

When throttling back the Theseus for approach and landing, the airscrew pitch coarsened, and consequently the drag was considerably less than that experienced during the same operation on a piston engine. The absence of drag on throttling back gave the pilot the feeling experienced in a car fitted with a free-wheel mechanism, and the approach technique adopted utilized a lower approach speed and earlier closing of the throttles at touch-down.

Mr. Owner went on to say that although the maintenance crew had to "learn their way about" the new units, the turbines had already thoroughly established their claim to need far less maintenance than the piston engines alongside which they had been working—indeed, maintenance had been virtually negligible, such time as had been recorded against the engines having been spent almost entirely on inspection.

Throughout the second and subsequent route-flights, the Theseus engines were entirely satisfactory. The original "life" of 100 hours was extended to 150 hours and, in view of the satisfactory performance and conditions at this stage, it was further extended to 200 hours. After 212 hours' flying time it was decided to remove the engines for examination.

One of the engines removed was submitted for bench check

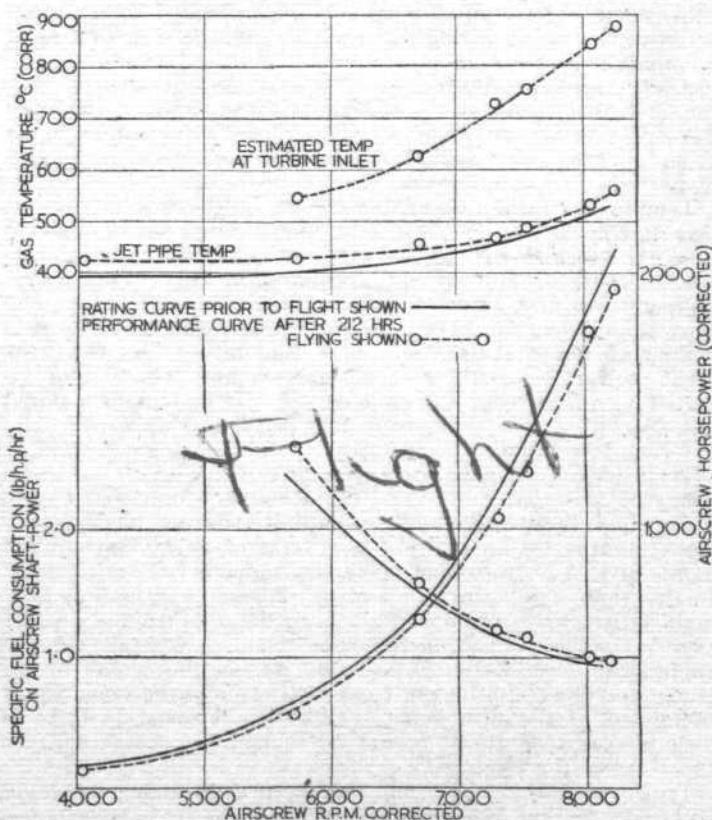


Fig. 3. Comparative curves of performance before and after 212 hours' flying.

Joint Conference

and proved to have lost very little in power compared with the power developed as a new engine, the fuel and oil consumptions showing no appreciable change (Fig. 3).

Dealing with icing experience on the Theseus, the lecturer stated that, on one flight, the port Theseus engine cut out at 20,500ft due to an interruption in the fuel supply. This altitude had been reached on account of weather, but with only three engines functioning it was impossible to maintain height and a forced descent through cloud was made from 20,500ft down to 12,000ft. At 19,000ft and an ambient air temperature of -7 deg C, rime ice began to form on the leading-edges of the wings, on the airscrew spinners and on the leading-edges of all engine cowlings.

The starboard Theseus engine could be seen from the cockpit, and it was noted that during the descent the ice began to form on the stoneguard, starting on the outer circumference. The build-up of ice, however, ceased at about once inch from the spinner fairing, leaving an annulus of this width free of ice, despite the fact that the remainder of the guard had a deposited ice layer of at least one inch thickness. This annulus was obviously kept clear of ice because of the spinner boundary layer, with a contribution from centrifugal effects, and it was fortunate that it enabled the engine to continue running. In fact, the engine r.p.m. of 7,000 was not only maintained constant throughout the descent, but no indication of altered performance due to icing was observed on the instrumentation provided in the aircraft.

Uncritical Icing

The important factor to note was not that an ice-free annulus was maintained around the spinner, although it might be possible to make use of this feature for warm-air dilution, but that ice did not pass into the engine in solid pieces either during the forming or the dispersal process, and that there was no sign whatever of ice damage to the compressor blading on subsequent inspection. This was the second occasion on which ice had formed on the guard at the entry to the air intake, the first being on the test bed, and on this occasion there had been no sign whatever of damage to the compressor blading.

Turning to the condition of the engines after flight, Mr. Owner recalled that, at the conclusion of the special 500-hour test, the condition of the Theseus test-bed engine was similar to that of the two flight-engines described, with particular reference to the reduction gear, combustion chambers and turbine assembly. It was considered that, after a certain period of running, during which the engine settled down, subsequent deterioration was very slow, and it was hoped to prove this point during the next few months with Transport Command.

A certain amount of tropical operational experience with the Theseus-Lincoln was obtained, said the lecturer, since the Transport Command route for the aircraft stretched as far as Fayid in the Suez Canal Zone, and an assessment was made of performance deterioration with temperature rise.

Due to the rather unreliable nature of the instruments, it was thought advisable not to rely upon a single set of observations, but to take the tropical observations in bulk, and derive the horse-power and specific consumption curves at various temperatures and different heights. From these it transpired that approximately 1 per cent of power was lost for each degree of temperature rise. This was rather less than the static power loss with rises in temperature, which approximated to 1½ per cent for each degree. It had to be pointed out that the 1 per cent power loss per deg C appertained to a forward speed of 270 m.p.h.

Mr. Owner then gave some general conclusions to be drawn from the fact that more than 1,000 hours' operational engine flying had been successfully completed during a period of eight months by an entirely new form of power unit in the hands of R.A.F. personnel operating under Service conditions. In this time, the performance of the Theseus had been exceedingly satisfactory, and it had given virtually no trouble whatsoever. The very small maintenance claimed for this type of engine had been well substantiated during the course of the trials, and the conditions of engines after more than 200 hours' flying led to the firm belief that overhaul costs, in spite of long life between them, would be economical compared with those for piston engines.

Improvement in operating characteristics, such as reduced fuel consumption, ease and simplicity of control and satisfactory functioning in climatic conditions should be achieved within a relatively short period. The trifling oil consumption

throughout 200 hours' flying, and the fact that the consumption was less at the end of this period than when the engine was new, was an economy in operation never experienced in piston engines of equivalent power.

Since a power plant was not designed especially for the present installation and the type of power plant already in use in the Theseus-Lincoln was fitted, the maintenance time for removal of cowlings and other inspection requirements was greater than would have been the case on a redesigned unit. Useful experience was gained in this respect, permitting the elimination of such shortcomings in the design of the Theseus units to be fitted to the Handley Page Hermes V.

Turning to prospects in the future, the lecturer concluded by stating that the development of the engine itself was proceeding apace, and the addition of protection against icing, reversing airscrews for braking, gear boxes, and cabin blower drives was well under way. When these had achieved a degree of development corresponding to that of the engine, a power plant which was mechanically safe and suitable for both military and civil air transport would have been produced.

Fuel consumption was, as ever, the burning question (in more senses than one), and here, in fairness, it had to be reiterated that the tests reported were quite unrepresentative. Whilst it was true that the aircraft concerned had an endurance well in excess of 10 hours and, apart from the dictates of prudence, could probably have made the England-Egypt run non-stop, they were fitted with long-range tanks to compensate for the fact that the consumption of their early experimental engines was appreciably in excess of that proved to be possible on later marks of engines; a further reduction had already been proved experimentally to be possible within the framework of the existing design.

There was, of course, no reason to doubt the theoretical conclusions, which indicated that, with the component efficiencies already established, it should be possible to achieve a substantial further reduction in consumption by proper matching and detailed design of the various sections of the engine, without going beyond the stress and temperature limitations covering the body of satisfactory operational experience built up to date. When the potential improvements, such as blade cooling (which yielded far more dividends on the turboprop than on the "pure" jet engine), higher speed, more compact design, etc., were taken into account, it was the author's firm conviction that the turboprop had a very bright future before it, and it was reasonable to hope that it would have a considerable length of useful life before it was finally superseded by the "pure" jet.

LANDPLANE v. FLYING BOAT

Mr. Keith-Lucas' Paper

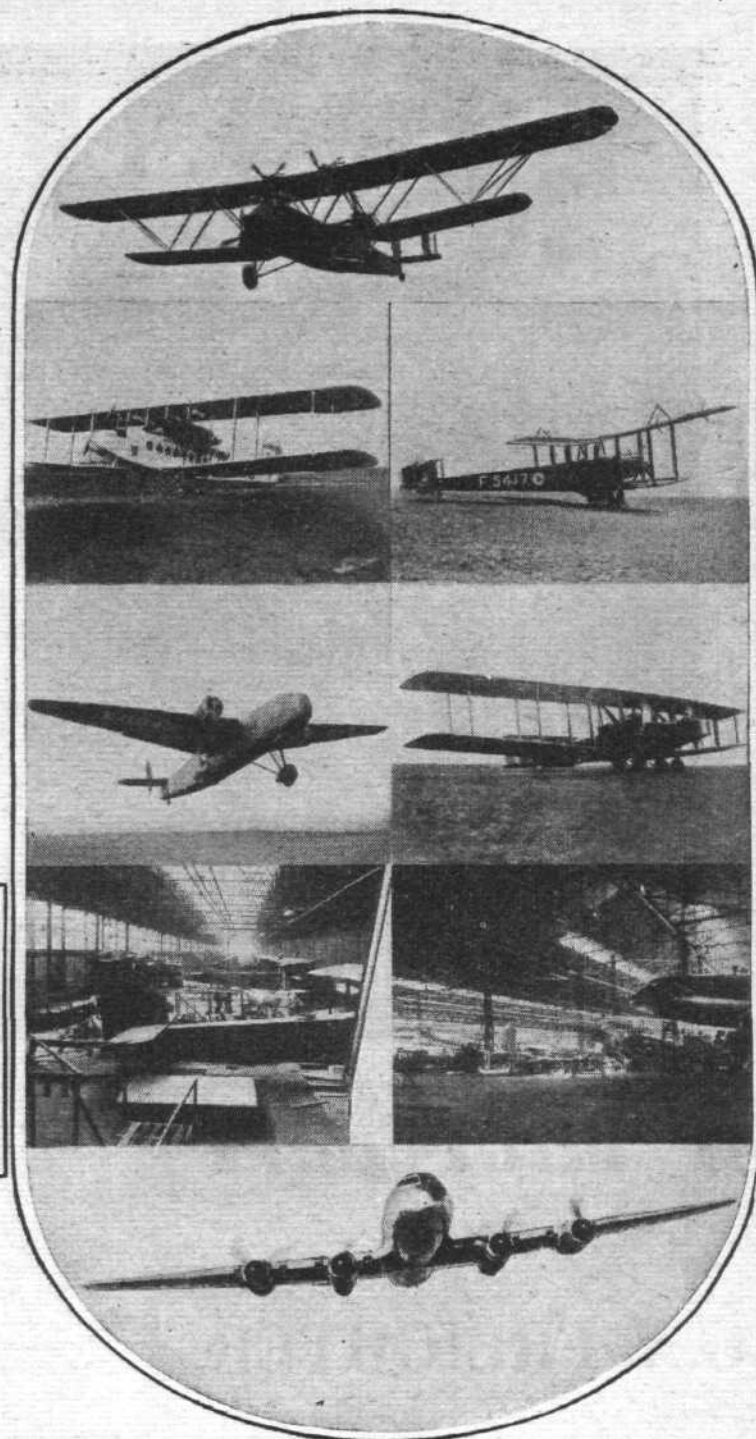
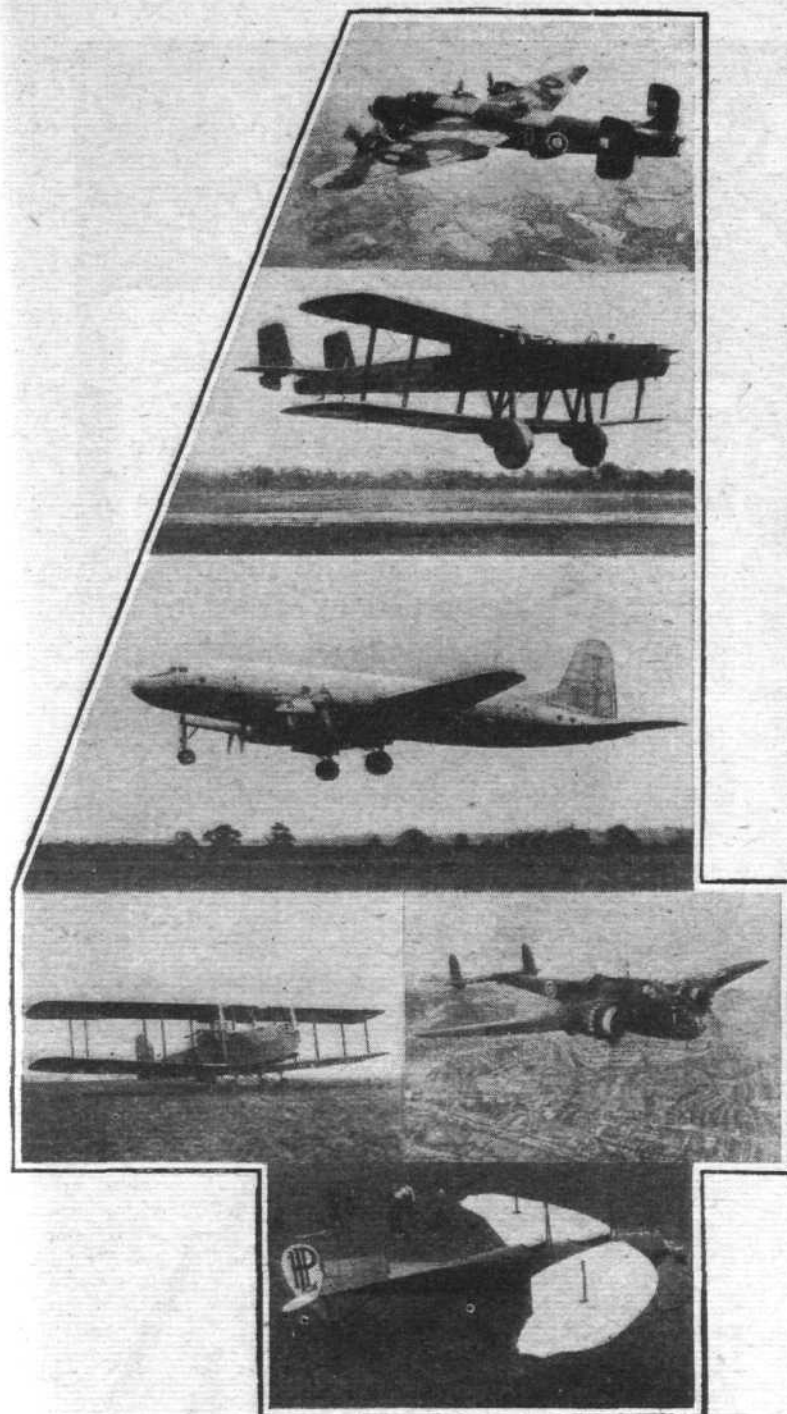
THE paper read by Mr. D. Keith-Lucas was entitled *The Relative Efficiencies of Large Landplanes and Flying Boats*. A large part was devoted to the justification of the assumptions made in comparing projected landplanes with equivalent flying boats.

The lecturer began by making a brief study of the effect of size on land animals and aquatic animals. He then carried the analogy to surface transport—ships and road vehicles—in order to show that, instead of following the square-cube law, percentage structure weight tended actually to fall with increased size for ships, road vehicles and aquatic animals, but for aircraft and land animals it remained sensibly constant.

The most important square-cube law assumption, he said, was that structure was everywhere the ideal structure and working at the maximum allowable stress throughout. This assumption was vital if we were to assess at all accurately the effect of loads and dimensions on structure weight; it was, nevertheless, a long way from the truth for anything made by man, and was almost certainly the main reason why the square-cube law was not followed in practice.

It had also to be assumed that the loads imposed on the structure were in accordance with the laws of similarity. In fact, they were not, for the range of weights to which we had built aircraft up to now. Stressing factors had decreased somewhat arbitrarily with increase of size, but this was a process which could not continue much farther. Lastly, it had to be assumed that the same materials were used for large aircraft as for small, but this also was not necessarily true. It was quite common for the larger aircraft to employ higher grade materials, but on examination of the stiffness criteria, no help from these high grade materials could be found, because the modulus of elasticity had been, up to the present time, as immutable as the laws of the Medes and Persians.

The lecturer then made a comparison between design studies



PROGRESS

1909-1949

Handley Page Ltd. has made aviation history since it began forty years ago as the first limited liability company exclusively devoted to aircraft manufacture.

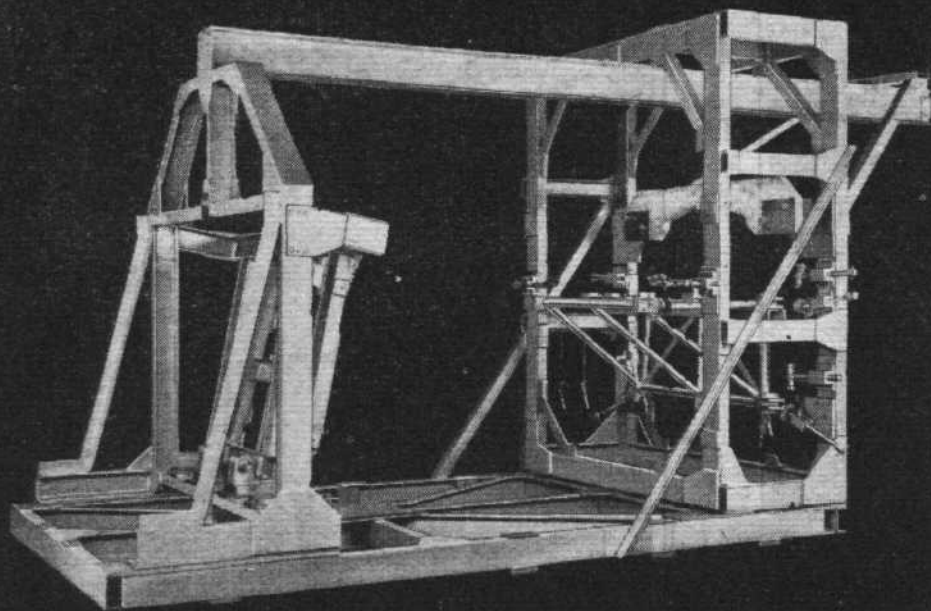
It has developed the big aeroplane in both military and civil spheres ; it pioneered Britain's overseas airline services thirty years ago ; its famous slot is the biggest single contribution to air-safety since man first flew ; its efficient aircraft production methods, widely followed, are the criteria of efficiency.

Through four decades Handley Page Ltd. has been in the forefront of aeronautical research, endeavour and achievement. It embarks upon the next forty years with confidence.

H A N D L E Y P A G E
HANDLEY PAGE LIMITED · LONDON · ENGLAND

CORNERCROFT

for Special Jigs



Typical of the larger type jig-work is this Vampire fuselage assembly jig manufactured to the instructions of the De Havilland Aircraft Company Limited.

We welcome your enquiries.

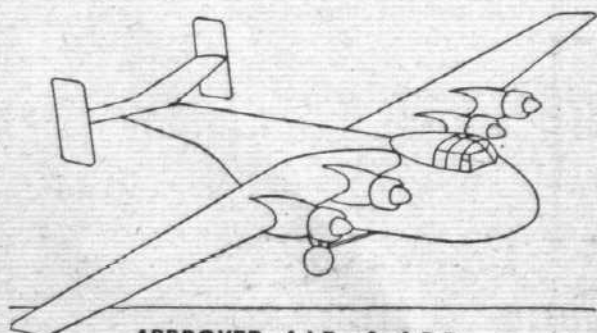
CORNERCROFT LTD.
ACE WORKS, COVENTRY

J.T.H.

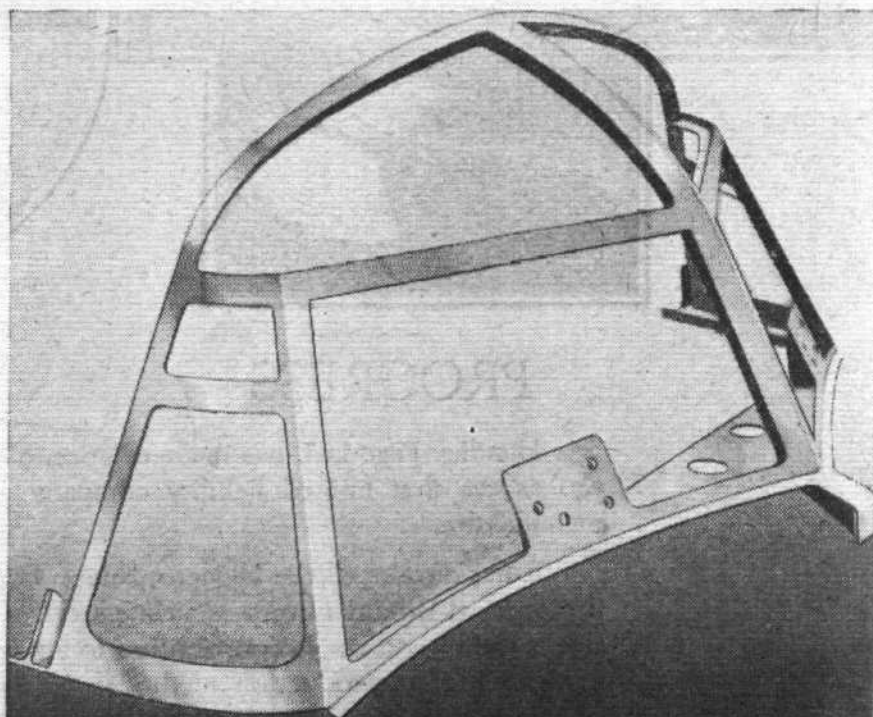
A vital part of the **G.A. FREIGHTER**

The windscreen framing is a one-piece welded magnesium fabrication—by the specialists in Magnesium. The framing is constructed of machined and extruded sections jig-welded with oxy-acetylene equipment.

Although the total width is 7 ft. 8 ins., the depth from front to back is 2 ft. 6 ins., and the height 2 ft. 6 ins., the weight is only 29 lb.



APPROVED A.I.D. & A.R.B.



Constructed by the
SPECIALISTS in MAGNESIUM
ESSEX AERO LTD

GRAVESEND KENT

Joint Conference

for a landplane and flying boat at about 140,000 lb a.u.w. Both aircraft were designed for the England-Australia route, to fly at about 250 m.p.h. at 20,000ft and carry a payload of 22,000 lb over a still-air range of 3,310 statute miles. The designs were taken to about the normal tender design stage, and it was found that the boat had an appreciably lower structure weight, viz., 30.3, against 31.9 per cent for the landplane. However, the latter had the lower drag and therefore required less fuel, but against this, the all-up weight of the boat was just less than that of the landplane, although the latter was 10 m.p.h. faster. Nevertheless, this higher speed had to be offset against the additional maintenance required on the tyres, undercarriage and retraction mechanism.

It was clear that the choice of landplane or flying boat would rest on such factors as the location of the respective bases, and the overhead costs of operating them. The indirect costs would be the deciding factor rather than the direct costs, which were so obviously very nearly equal. This meant that attention had to be turned to the larger sizes to see the whole picture, but it was worthy of note that at 140,000 lb the "point of equal weight," i.e., the point at which, to accomplish a given duty, the all-up weight of the landplane and flying boat were equal, had been passed.

Extrapolated Comparisons

In making comparisons at extrapolations of twice and four times the weight of the original aircraft, Mr. Keith-Lucas stated that it had been assumed that the laws of dynamic similarity would apply. In that the basic structure weight percentage increased as the linear dimensions, it paid to keep the latter as small as possible. However, the laws of dynamic similarity assumed that aerodynamic forces were proportional to weight, but this was not borne out in practice. For comparative purposes, therefore, the power had been taken as approximately that necessary to give the required speed.

At the 270,000 lb category, the comparison showed that the flying boat with fixed floats was just the lightest of the three designs; the landplane was faster than the flying boat with retractable floats, but only by $3\frac{1}{2}$ m.p.h., whilst the flying boat with fixed floats was 3 m.p.h. slower than its counterpart with retractable floats. It was a nice point to decide whether the 3 m.p.h. would be worth the additional maintenance costs.

The 540,000 lb figure was the maximum selected for consideration, not because it represented the maximum which could be envisaged or would be practical (there was, indeed, no reason why flying boats should not be built at twice this weight), but simply because there seemed no need to extend the investigation much beyond the "point of equal speed," i.e., the weight at which the cruising speed of the flying boat equalled that of the landplane. This point was just passed in the comparison, providing that the wing-tip floats of the boat were made to retract.

Throughout the investigation, it had been the deliberate policy when in doubt to give the benefit of the doubt to the landplane. Repeat calculations had therefore been made after reducing the structure weights of the flying boats respectively by 0.5, and then 1 per cent of the all-up weight. These resulted in the point of equal speed being reduced from about 500,000 lb roughly to 350,000 lb and 250,000 lb respectively. Whilst, therefore, it would be unwise to quote a definite weight at which the performance of the flying boat was equal to that of the landplane, it could be deduced that the performance was very nearly the same at weights between 250,000 lb and 500,000 lb, and that the flying boat would become relatively faster as weight increased.

Design Assumptions

The lecturer then devoted attention to the effect of design assumptions, dealing firstly with speed and range, and showed that an increase in speed would, of course, favour whichever aircraft was the faster, that is to say, the landplane in the smaller sizes, and the flying boat at weights above the point of equal speed. The same argument applied to an increase of range, provided that the payload carried was still sufficient to demand a two-deck cabin. As payload capacity was a function of floor area rather than cabin volume, as size increased it became increasingly difficult to provide sufficient capacity; a double-bubble cabin would therefore be required on a 270,000-lb aircraft for all ranges up to about 5,000 miles. At the larger sizes, the circular-section cabin became less efficient and its advantage over the double-bubble type became less. The Bristol Brabazon and the Saunders-Roe Princess would offer a most interesting comparison when they became operational.

Turning to a consideration of higher speeds, Mr. Keith-Lucas stated that the use of the jet engine which, for economy,

must operate at high altitudes, brought with it other factors of comparison, the chief of which was the drag rise due to Mach number. Contrary to popular expectation, the SR/A1 jet fighter flying boat had demonstrated that the hull of a flying boat with normal chines and steps was very nearly, if not quite, as good as a conventional fuselage at high Mach numbers. What difference there might be was unimportant because the drag rise would almost inevitably occur on the wing first.

High Mach number had one other important effect on the comparison, viz., that it caused a decrease in the maximum lift coefficient and so might limit the lift coefficient which could be used for cruising. Wing loading would then be dictated by considerations of cruising and not landing, which was important in relation to the effect of varying the wing loading.

The depth of a flying-boat hull had usually been dictated about equally by airscrew clearance and landing flap clearance requirements. The deletion of the airscrew would not therefore ease the problem appreciably unless something were done about the flaps, too. It had already been noted that the wing loading would have to be moderate on account of the cruising lift coefficient; high-lift flaps would not therefore be necessary to mitigate high landing speeds. Flap drag was not important on a flying boat because of the excellent braking effect of the water. All that was necessary was to be able to steepen the approach path, which could be done by dive or brake flaps which, in any case, would be necessary for the descent from altitude.

Regarding wing loading, the lecturer stated that occasions were certain to occur when, for some reason, the aircraft could not reach, or could not be accepted at, the scheduled destination; it had then to be able to land elsewhere. Alternative landing places would be few and far between for the large landplane with high wing-loading. No such problems arose with the flying boat. Even a forced landing on land was a much safer proposition than for a landplane. In consequence, the wing loading of a large boat could be greater than for the equivalent landplane.

To be capable of landing at a reasonably wide choice of aerodromes, the landplane must have a landing distance from 50ft of not more than 1,600 yd under I.C.A.N. conditions, and for this the wing loading had to be limited to about 68 lb/sq ft. Making a new comparison on this basis between landplane and flying boat showed that the largest landplane was over 20 m.p.h. slower than the rival flying boat.

Economic Aspects

Turning to considerations of economics, the lecturer thought that the cost of fuel was likely to be about 20 per cent of the total cost of operating the aircraft under consideration. The fuel consumed could be taken as directly proportional to the reciprocal of the speed, and the difference in fuel cost expressed as a percentage of the total operating cost was therefore hardly more than 0.5 per cent in all cases, and was reduced to zero at something like 500,000 lb.

At the point of equal speed, the weight of the flying boat was less than that of the landplane. The prime cost of the airframe, the insurance premiums and so forth should, therefore, be less than for the landplane. On this basis, the point of equal economy could justifiably be expected to fall somewhere between the point of equal speed and the point of equal weight.

Mr. Keith-Lucas made the trenchant observation that, until now, landplanes had often operated with a hidden subsidy in the form of aerodromes built for military reasons. This was particularly true in Britain and parts of the British Commonwealth. The additional cost should, he suggested, be included in the overall accounts of the British Airlines, which were owned by the State, so that any profit and loss would have eventually to come back to the individual taxpayer.

The new safety requirements of I.C.A.O. looked as if they would demand runway lengths greater than were dictated by military necessity and many of the existing aerodromes would be rendered obsolete for civil aircraft. It should then be reconsidered whether flying boats or landplanes, and consequently waterways or new aerodromes, would provide the more economic solution.

Large aircraft of 300,000 to 500,000 lb were bound to come so as to obviate the congestion at the terminal airports as the volume of traffic increased. They also showed improved economy of operation over the small types when they could be operated at the same load factor. The question was whether we could afford the capital expenditure to realize these advantages unless we used the runways which Nature had supplied. Better docking facilities were wanted for flying boats, but even the best dock which could be imagined was likely to cost only a fraction of the equivalent aerodrome.

Revolutionary Refuelling

*—will be Demanded
for Ultra-large Air-
craft : The Principal
Problems Reviewed*

By C. G. COLLINGS

THE increasing size of aircraft has presented a number of new problems to those who have to service them. The Constellation at 93,000 lb has been eclipsed by the French S.E.2010 at 116,000 lb and the Stratocruiser at 142,500 lb. We are told that by 1951 the Brabazon at 285,000 lb and the S.R.45 at 310,000 lb all-up weight will be in operation.

The fuel capacity of the Brabazon is 11,500 gallons. To refuel it completely, therefore the normal type of 2,000-gallon road tanker delivering petrol at a total rate of about 120 gallons per minute from two pumps would take 96 minutes pumping time and would itself need refuelling five times. By the use of six such tankers the time can be brought down to about a quarter of an hour. This, however, would not be a very good way of securing a quick turn-round for aircraft of this size. Most of the airfield tanker vehicles would be monopolized for one aircraft and there would be serious duplication of very costly pumping equipment that is required.

Here, then, is a problem for those engaged in the design and production of airfield refuellers and, more than ever before, it is one that will have to be solved in conjunction with the aircraft designers.

In the past the problems of refuelling have always been something apart from those concerned with the actual aircraft. The big oil companies, with their own personnel and the backing of organizations that are larger than all civil aviation, have been considered by airfield staff as completely separate units which invariably lived "over on the far side." Their problems have not been those of the airfield controller and, although they have been eager to co-operate, their coming and going, and the petrol they had available, has been entirely their own business, beyond the knowledge of the controller.

Now that several giant aircraft are an accomplished fact the mutual problems of the oil companies, the aircraft designers and the aircraft operators will have to be met together.

Airfields in America—particularly La Guardia—have taken active steps to install pipe-runs and connection hydrants for refuelling. In this country prototypes of new tankers and pumping arrangements are constantly being developed by specialist firms, at the insistence of the oil companies, in an effort to satisfy the changing demands. One of their difficulties is



Today's methods may suffice for the aircraft of today: the ultra-large machines which will shortly be appearing will demand new refuelling equipment and a different technique.

lack of knowledge of the strength of aircraft internal tank and pipe connections under the considerable stress of high pressure, high-speed refuelling, and what the trend is in this direction.

It is to be hoped that aircraft design may be changed to include underwing or lower-fuselage refuelling-points, thus obviating the clumsy and dangerous business of dragging heavy pipes over de-icing equipment and clambering about on the upper surfaces of the wings.

There is a 2½-in-diameter underwing connection produced which will take a delivery of 200 gall/min, but it is doubtful whether all internal pipe-runs can stand much increase on this rate of delivery. That is the problem of the aircraft designer. The refueller designer has the problem of increasing the rate of delivery through his air-eliminators, filters, flow-controllers and meters, and this is by no means simple.

One firm has experimented with delivery through 2½-in pipe of up to 300 gall/min. For rates greater than this, there are a host of attendant troubles. Liquid forced at this rate through a certain size of pipe soon reaches a limit at which it is discharged with terrific force, frothing and turbulent, and with the risk of generating a considerable charge of static electricity.

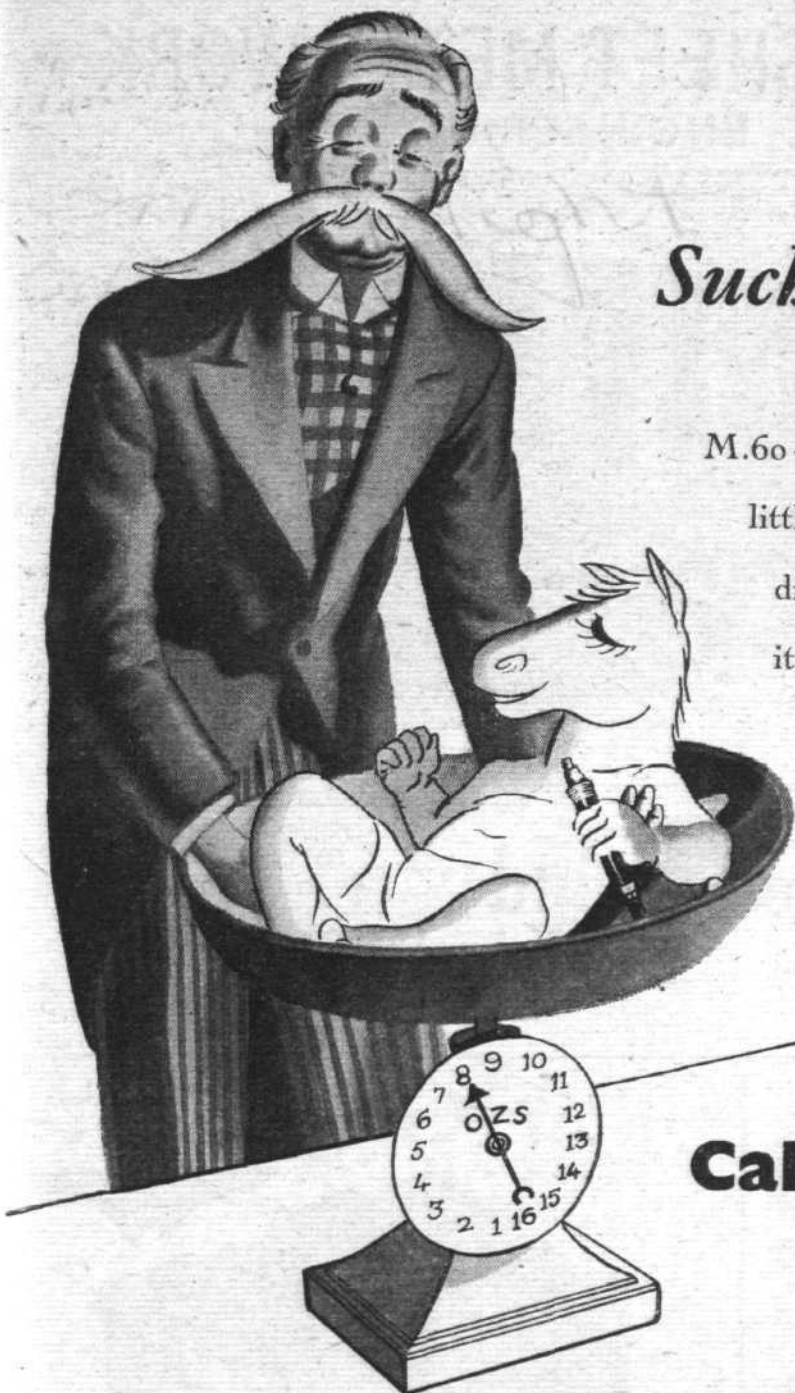
The writhing hose of a fire engine, delivering at about 60 gall/min, is quite difficult to hold; delivery at about 300 gall/min makes a flexible hose almost entirely unmanageable.

A nozzle is a considerable restriction and, for any high rates of delivery, it must be dispensed with in favour of some form of direct underwing connection. The necessity of such direct-connection fuel points is very apparent for all large-capacity aircraft.

If two pumps are sufficient to discharge petrol at the rate of some 300 gall/min each, the 2,000 gallon tanker, which is the normal large-capacity



"It is to be hoped that aircraft design may be changed to include underwing or lower-fuselage refuelling points." The 200 gall/min underwing connection on the Martin 2-0-2.



Such a lovely Baby

M.60—we call him, the quietest, best behaved little darling of a baby screwdriver you ever did see. And quick! Well you won't believe it but he revolves at 14,000 r.p.m. Bad for him? Not a bit, dearie, the little sweet stays as cool as a cucumber. Never tires, never complains. Like to hold him? Well so you shall, dearie! Just send us a postcard to say you're interested.

Call up the little

teeny-weeny

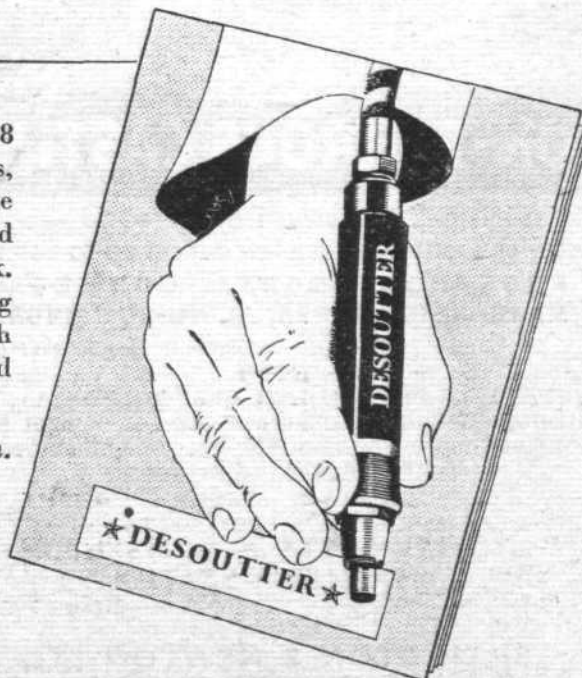
horse

THE DESOUTTER MINIATURE SCREWDRIVER weighs 8 ounces. Size: $5\frac{1}{2}$ " long by $\frac{7}{8}$ " diameter. Capacity: Screws, No. 3 to 10 BA, and equivalent nuts. Operation: The air is automatically switched on when the tool is applied to the head of the screw and pressed on to the work. The tool can quickly be reversed by turning the ring switch fitted in the head of the tool. The impact clutch of new design gives perfect torque selection when used with pressure regulator on the air line.

Write for literature giving much more information.

DESOUTTER

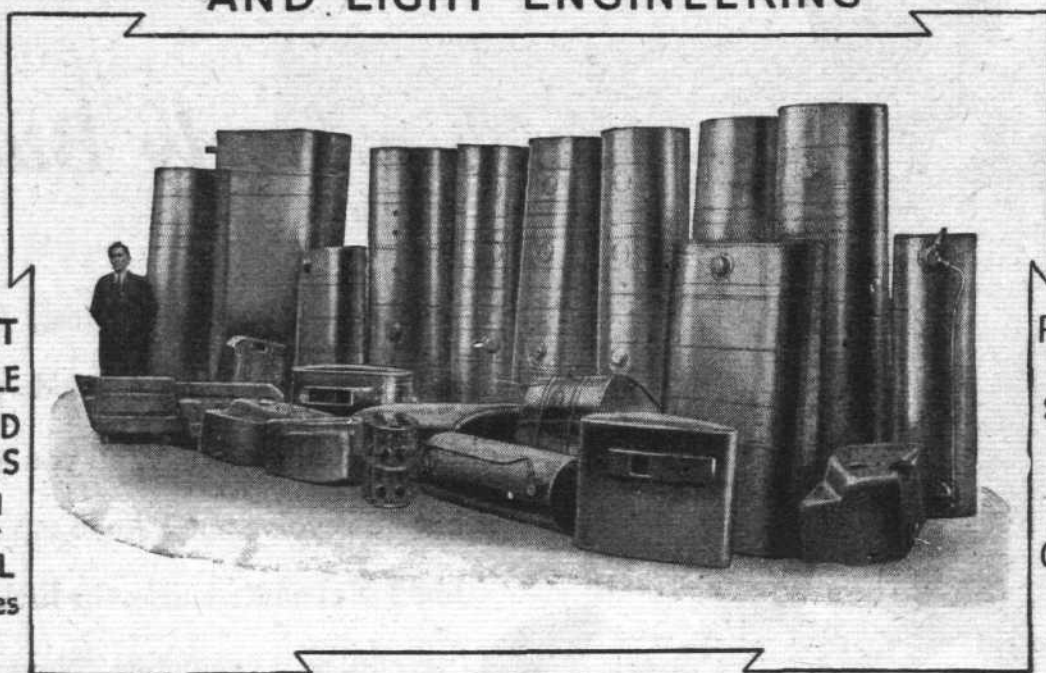
Specialists in Lightweight Pneumatic and Electric Portable Tools.



EVERYTHING IN SHEET METAL WORK AND LIGHT ENGINEERING

**AIRCRAFT
AUTOMOBILE
COACH AND
BUS BODIES**

Municipal
and other
**ALL-METAL
Vehicle Bodies**



Refrigeration
**COLD
STORAGE
HEATING
DRYING
AIR
Conditioning
MINING**

TELEGRAMS:
BROMELPAR, SOUTHOT.
LONDON

161 West Rd., TOTTENHAM

E.G. Brown & Co Ltd

TELEPHONES:
TOTTENHAM
2257, 2258 & 2259

LONDON, N.17



NON-FERROUS CASTINGS

Our specialised knowledge is offered to you in the supply of Castings from a few ounces up to 5 tons—in

**PHOSPHOR BRONZE, GUNMETAL,
MANGANESE BRONZE, ALUMINIUM BRONZE**

(Tensile Strength 45 tons per sq. in.)

ALSO

Light Alloy Castings • 'BIRSO' Chill-Cast Rods and Tubes
Centrifugally-Cast Worm-Wheel Blanks • Ingot Metals
Phosphor Copper • Phosphor Tin • Precision Machined Parts
Finished Propellers, etc.

Fully approved by Admiralty and A.I.D.

**T. M. BIRKETT & SONS LTD.
HANLEY • STAFFS**

'Grams: Birkett, Hanley

'Phone: Stoke-on-Trent 2181-5-6

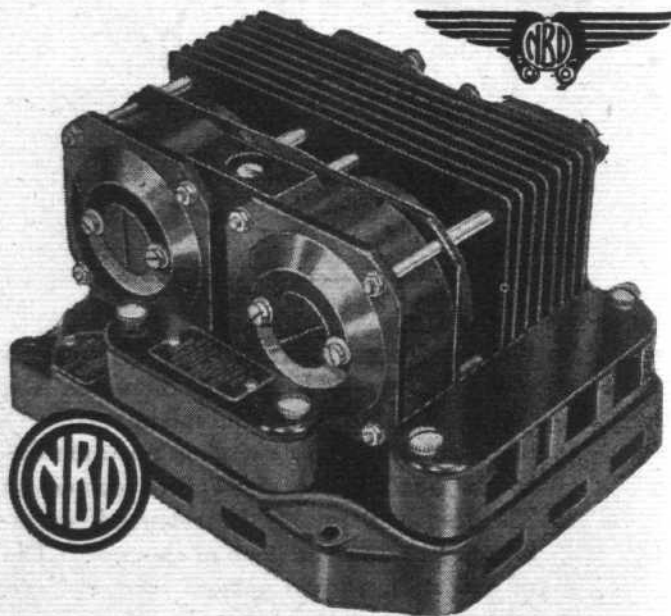
in association with

**BILLINGTON & NEWTON LTD.
LONGPORT, STOKE-ON-TRENT**

'Grams: Bronze, Phone, Longport 'Phone: Stoke-on-Trent 87303-4 & 88147

B108

NEWTON-DERBY



AUTOMATIC VOLTAGE REGULATORS

Also Makers of

Rotary Transformers and Anode Converters,
Wind and Engine-Driven Aircraft Generators,
High Frequency Alternators and High Tension
D.C. Generators.

ELECTRICAL PLANT SPECIALISTS



NEWTON BROTHERS (DERBY) LIMITED

HEAD OFFICE & WORKS ALFRETON ROAD, DERBY
TELEPHONE DERBY 4286/7 TELEGRAMS DYNAMO, DERBY
LONDON OFFICE IMPERIAL BUILDINGS, 56 KINGSWAY W.C.2

Revolutionary Refuelling

type seen on the roads today, will be empty in about three minutes, having filled only one-sixth of the aircraft's tanks! Some alternative will certainly be necessary.

The best solution appears to lie in bringing the bulk petrol nearer to the aircraft by underground pipe-runs to various connecting points on the tarmac. Connection, almost direct, is then made through a mobile pumping unit to the aircraft. Although America may have sufficient foresight to start these expensive installations, one cannot imagine that such refinements would be an accomplished fact in this country by the time the large capacity aircraft are in full operation.

An alternative is for the mobile pumping unit or servicer, near the aircraft, to pump the petrol from a line of large-capacity storage tanks on trailers, which are towed as near as possible to the aircraft being refuelled. There is little difficulty in this arrangement provided that the

pumping unit—two, if necessary—can reach the required delivery rates, and provided the aircraft's internal tank connections are adequate for high-speed refuelling.

The conception of a servicer—which in either case is necessary—is not a new one. One large oil company has gone to some lengths with its development in America, but in this country there has been slower progress.

The principal duty of such a servicer is, of course, as a pumping unit for refuelling; but it can well incorporate an adjustable maintenance and inspection platform to reach aircraft engines, and that at least is the trend of the designs. If the vehicle carried all the necessary bulk liquids—hydraulic fluids, de-icing fluids, and and water—with an air compressor adequate for pre-flight inspections and B.E.A.'s No. 1 check, it would fill a very long-felt want.

The principal condition for such development is much closer co-operation between the oil companies and those concerned with general flight servicing.

PAPERS IN R.Ae.S. QUARTERLY

"TO encourage workers to submit papers describing new and original work, or papers reviewing progress in some specialized field of activity, and, through the medium of this new publication, to make the results of these researches available to all workers or design groups concerned with aviation." This, it is stated, is the primary aim underlying the production, by the Royal Aeronautical Society, of a new publication entitled *The Aeronautical Quarterly*.

In the first issue, now available at 10s from the Society's offices at 4, Hamilton Place, London, W.1, are seven papers, the subjects and authors being as follows:—

"Control Reversal Effects on Swept-back Wings," by Haydn Templeton, B.Sc., A.F.R.Ae.S.

"Calculation of Downwash behind a Supersonic Wing," by G. N. Ward.

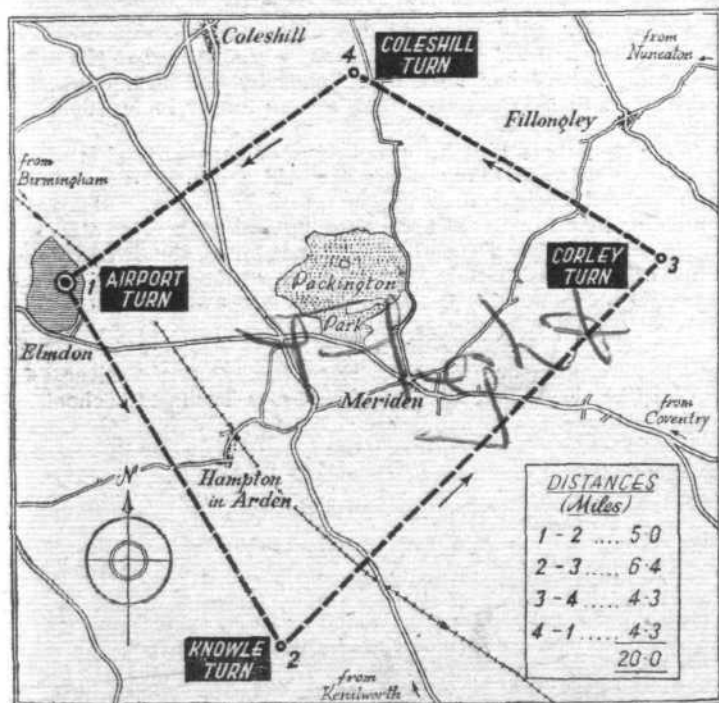
"Estimation of the Effect of a Parameter Change on the Roots of Stability Equations," by K. Mitchell, Ph.D., A.F.R.Ae.S.

"Flutter of Systems with Many Freedoms," by W. J. Duncan, D.Sc., F.R.S., F.R.Ae.S.

"Notes on Propeller-turbine Reduction Methods," by E. C. Pike, M.A., A.F.R.Ae.S.

"Determination of Drag of Jet-propelled Aircraft in Flight," by G. W. Trevelyan, M.A., and D. R. Blundell, Grad. R.Ae.S.

"Notes on the Linear Theory of Incompressible Flow Round Symmetrical Swept-back Wings at Zero Lift," by F. Ursell.



QUICK QUADRILATERAL: The Birmingham Airport (Elmdon) course over which the seven events comprising the National Air Races will be flown at the week-end of July 29th—August 1st. The organizers remind intending competitors that entries at single fees must reach the Royal Aero Club, 119 Piccadilly, London, W.1, by 1700 hr B.S.T. next Saturday, June 18th, or at double fees by 1700 hr on Monday, June 27th. Preliminary details of the events appeared in "Flight" of May 26th.

TURBINE TEMPERATURE CONTROL

SET up for the primary purpose of conducting experimental and development work in connection with automatic controls and instruments for gas turbines, a new research laboratory has recently been established by Smiths Aircraft Instruments, Ltd., at the K.L.G. factory, Putney Vale, London.

The first major production from the laboratory is a gas-turbine temperature controller which, on a power supply of 3.7 amps at 27 volts, will give an output of 2 watts to the controlling solenoid for a change in jet-pipe temperature of only 2 deg C. Since the temperature-sensing elements are thermocouples, from which the available power is extremely small—of the order of 0.0002 microwatt—the measure of the achievement in providing compact power amplification of 10^{10} may be realized. A typical model measures 10in x 6.5in x 6.5in and weighs 8 lb 3 oz.

There are four basic items making up the full controlling equipment, viz.: the thermocouples, a temperature selector, an amplifier, and an electro-mechanical unit which controls fuel supply to the burners. Four thermocouples are normally used, connected in parallel to the temperature-controller amplifier. Power to operate the amplifier is derived direct from the aircraft 24-volt supply.

The temperature selector may take the form of a panel-mounting instrument if required for bench work, or it may be made integral with the throttle valve for turbine test and flight use. In the latter instance it can be ganged to the throttle valve, and is set or varied to predetermine the actual controlled jet-pipe temperature.

R.Ae.S. COUNCIL

THE Royal Aeronautical Society announces that Mr. W. G. A. Perring, Mr. N. E. Rowe and Dr. H. C. Watts were elected vice-presidents at the May council meeting for the year 1949-50. The complete council for the year is as follows:—

President.—Sir John S. Buchanan, C.B.E., A.M.I.MECH.E., F.R.Ae.S.

Past Presidents.—Dr. H. Roxbee Cox, D.I.C., B.Sc., F.R.Ae.S., and Sir Frederick Handley Page, C.B.E., F.R.Ae.S.

Vice-Presidents.—Mr. W. G. A. Perring, F.R.Ae.S.; Mr. N. E. Rowe, C.B.E., B.Sc., D.I.C., F.R.Ae.S.; Dr. H. C. Watts, M.B.E., D.Sc., M.INST.C.E., F.R.Ae.S.

Council Members.—Lord Brabazon of Tara, M.C., F.R.Ae.S.; Major G. P. Bulman, C.B.E., B.Sc., F.R.Ae.S.; Mr. S. Camm, C.B.E., F.R.Ae.S.; Mr. A. V. Cleaver, A.R.Ae.S.; Dr. G. P. Douglas, O.B.E., M.C., D.Sc., F.R.Ae.S.; Mr. G. R. Edwards, M.B.E., B.Sc., A.M.I.STRUC.E., F.R.Ae.S.; Mr. A. G. Elliott, C.B.E., M.S.A.E., F.R.Ae.S.; Mr. W. S. Farren, C.B.E., F.R.S., F.R.Ae.S.; Sir A. H. Roy Fedden, M.B.E., F.R.S.A., D.Sc., M.I.MECH.E., M.S.A.E., HON.F.I.Ae.S., F.R.Ae.S.; Sir Arthur Gouge, B.Sc., F.R.Ae.S.; Major F. B. Halford, C.B.E., F.R.Ae.S.; Professor A. A. Hall, M.A., F.R.Ae.S.; Mr. S. Scott Hall, A.C.G.I., M.Sc., D.I.C., F.R.Ae.S.; Mr. J. W. F. Housego, GRAD.R.Ae.S.; Mr. P. G. Masefield, M.A., F.R.Ae.S.; Mr. W. Tye, B.Sc., F.R.Ae.S.; Captain C. F. Uwins, A.F.C., O.B.E., F.R.Ae.S.

Honorary Librarian.—Mr. J. E. Hodgson, HON.F.R.Ae.S.

Honorary Treasurer.—Captain C. F. Uwins, A.F.C., O.B.E., F.R.Ae.S.

Solicitor.—Mr. L. A. Wingfield, M.C., D.F.C., A.R.Ae.S.

Secretary.—Captain J. Laurence Pritchard, HON.F.R.Ae.S., HON.F.I.Ae.S.

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.

R.Ae.C. JUBILEE

A Reader Advocates Appropriate Celebrations

ON September 24th, 1951, the Royal Aero Club is to celebrate the 50th anniversary of its founding in a balloon. The Club should at once invite its members to subscribe to a fund so that this historic occasion can be celebrated adequately.

There should be an exhibition of "milestones," a commemorative balloon ascent, a banquet with the surviving pioneers present, and the issue of a pictorial booklet, showing the history of the club. Two years is not too far ahead to begin making plans.

GEOFFREY DORMAN.

London, S.W.3.

A NATIONAL AERONAUTICAL MUSEUM?

Support for a Suggestion

I THINK Mr. Griffin's suggestion (May 12th) an excellent one and I trust he has received, or will receive, all the support he needs in launching his idea of a central place or building in which all items of historical aeronautical interest may be gathered.

To many of us "older ones" it was a matter of great regret that no one at the Air Ministry had the foresight to start a comprehensive collection of aircraft and documents after World War I, and it would appear that no one is now officially interested in a similar way since the end of the recent war.

It is gratifying to learn that Mr. Griffin has started something which I feel sure many thousands in this country will support, and I look forward with great interest to his further reports.

J. D. BROWNING.

Croydon, Surrey.

"WATER WITH IT"

That Down-tide Take-off: A Slight Slowing Effect

YOUR correspondent Mr. Barrie Aldbury (issue of May 19th) raises some interesting points regarding the down-tide take-off of a Sunderland, reported in relation to the Yangtse incident. The following points may help to elucidate the matter.

The aircraft rises upon the step approximately 35 knots below its stalling speed (when "hydroplaning" the aircraft is not at its stalling angle, therefore the mainplane is producing less lift than just prior to the stall). Most of the "lift" is produced by the hull at this stage.

Once the aircraft is hydroplaning, acceleration takes place at a progressively increasing rate due to lessening of the water friction, so allowing an increase in speed; increase in speed equals more lift, more lift equals less water friction, and, lo we are airborne!

It may thus be seen that running down-tide will reduce water speed and, therefore, the time taken to get up on the step will be greater. This is to some extent offset by the lower value of water-friction (due to the following tide) in the latter stages of the take-off run.

Experience has shown that the overall effect of taking-off

down-tide is to increase the time from "throttles open" to "airborne" by one or two seconds only. Conversely, taking off into the tide, other factors being equal, decreases the total time by one or two seconds.

Cross-tide take-off time is roughly equal to down-tide conditions, since a cross-tide may cause a slight tendency to swing. This can easily be held on the rudder, but the extra drag puts the odd second on the take-off time.

It may thus be seen that the tide consideration is not important in practice and may be ignored unless the speed of the tidal stream be exceptionally high.

FLYING-BOAT FLYING INSTRUCTOR.

Southampton.

THE HOOK HYDROFIN

Designer Replies to a Criticism

IN your edition of November 11th last you were kind enough to publish an article describing my work on hydrofoils, and this was followed on November 25th by a letter from K. J. G. Bartlett describing some disappointing results obtained with a seaplane in 1912 and 1913.

I am afraid Mr. Bartlett's letter rather left the impression that the "hydrofoil had been tried out and would not work," since remarks which come to the same thing have been repeated to me from all sides since that time. Perhaps, therefore, I may be allowed a little space to explain that the lurching effect so well described by Mr. Bartlett has been exhaustively studied in the development work undertaken in connection with the Hydrofin, both in England and abroad, and that it is simply a matter of air bleeding to the upper foil surface which effectively destroys lift. The cure is quite simple and consists in mounting the foil ahead of the supporting strut or hydrodoped. This has been done on my full-size craft, the HN/4B, which you have perhaps seen in the Paramount newsreel. There is no entry of air and no lurching is possible with the foil system as now used.

CHRISTOPHER HOOK.

Cowes, I.O.W.

MILES TECHNICAL SCHOOL

Its Status Under the New Regime at Woodley

IN your May 19th issue, in describing the rearrangement of the former Miles Aircraft factory, you stated that the Miles Technical School has been taken over by the local education authority and that aerodynamics are no longer included in the syllabus.

While it is true that no new intake of aeronautical students has yet been undertaken, there are still a number of students who started their course in the pre-L.E.A. era. To these students aerodynamics and aeronautical subjects are still taught, and in the December examination of the Royal Aeronautical Society, beside many other successes, two of our students took first places and another was awarded the Baden Powell Memorial Prize.

L. J. CHANTLER, A.F.R.Ae.S.,

Senior Assistant, Reading Technical College,
Woodley, Berks. (late Miles Technical School).

FORTHCOMING EVENTS

June 16th to July 2nd.—Royal Tournament, Olympia.
June 17th.—Institute of Navigation: Discussion, "Astronomical Navigation in the Air," Royal Geographical Society.
June 18th.—Bristol and Wessex Aeroplane Club: Annual Garden Party.
June 18th.—R.Ae.S. (Brough): Flying meeting and Cirrus Trophy Competition, Brough.
June 18th.—Parachute Regimental Association: Old Comrades' Day, Aldershot.
June 18th and 19th.—Aero Club de Basse Normandie: Fiers de l'Orne Rally.
June 19th.—Air League of the British Empire (Portsmouth): Garden Party, The Airport, Portsmouth.
June 19th.—Cowes Aero Club: Air Display.
June 22nd to 24th.—Institute of Transport: Congress at Buxton.
June 26th.—Northern Heights Model Flying Club: Gala Day, Hawker airfield, Langley, Bucks.
June 26th to July 3rd.—Aero Club d'Italia: International Air Week, Milan.
June 26th.—Grande Fete de l'Air, Lausanne, Switzerland.
July 1st.—R.A.F. Golfing Society: Summer Meeting at Moor Park Club, Herts.

July 2nd.—R.N. Air Station, Lossiemouth: "Open Day" and Flying Display.
July 2nd to 4th.—Royal Aero Club: Private air rally at Deauville. Guests of M. André.
July 2nd to 10th.—Tour de France Aérien.
July 2nd and 3rd.—Aero Club de l'Orne: Rallye du Point d'Alençon.
July 4th to 11th.—Royal Aero Club: Private Air rally to Spain.
July 9th.—Royal Naval Air Station, Culham, Oxford: Air Display.
July 9th.—Redhill Flying Club: Garden Party.
July 16th.—Royal Naval Air Station, Anthorn, Kirkbride, Carlisle: Navy Day.
July 16th and 17th.—Royal Aero Club: Private air rally at La Baule, St. Nazaire. Guests of Mme. André.
July 17th.—Cowes Aero Club: Air Display.
July 23rd.—"Daily Express" Air Pageant, Gatwick Airport.
July 30th to Aug. 1st.—King's Cup Race and National Air Races, Elmdon Airport, Birmingham.
Aug. 6th.—Southend Flying School: Flying Meeting and Air Display.
Aug. 19th to 26th.—British Gliding Association: National Gliding Contests, Gt. Hucklow, Derbyshire.



This is *your* business, Sir...

Our function is to help your trade—by air. It was trade that made these islands into something greater than a mere 95 counties in the North Sea. It was trade that filled up great empty continents, like South America—to-day vast potential markets for British goods. It is trade on which we now utterly depend

The three great British air corporations can help you to expand your business all over the world. We offer 190,000 miles of route radiating from London to all major commercial centres. Fly yourself—let your executives fly—fly your freight. And fly British.



BEA between the principal cities of Britain, and from London to the principal cities of Europe. BOAC and associated companies link Britain with the USA, the British Commonwealth and the Far East. B.S.A.A. links Britain with South America and the West Indies.

BRITISH OVERSEAS
EUROPEAN
S. AMERICAN **AIRWAYS**

DE HAVILLAND
JET ENGINES



Goblin and Ghost
PIPELINES

- TUNGUM Alloy—corrosion resisting.
- High strength-to-weight ratio.
- Withstands high pressures.
- High resistance to torsional and vibrational fatigue.
- High thermal conductivity.

'Tungum' BRAND
Trade Mark
ALLOY

TUNGUM SALES COMPANY LIMITED
BRANDON HOUSE, PAINSWICK ROAD, CHELTENHAM, GLOS.

**R.J. COLEY
& SON**
(HOUNSLOW) LTD.
HOUNSLOW 2266

**FOREMOST SCRAP METAL MERCHANTS
TO THE AIRCRAFT INDUSTRY**

*All grades of scrap
aluminium & other
non-ferrous metals*

Keenest prices - First-class service

Also at TAME ST., STALYBRIDGE
STALYBRIDGE 2217.

R. A. F. QUARTERLY

(AND COMMONWEALTH AIR FORCES JOURNAL)

In its new, pocket-size, format, the new R.A.F. Quarterly deals with the R.A.F. of to-day—and the R.A.F. of the future.

Articles of immediate interest by writers with real qualifications. *Special features of July issue are:—*
FOREWORD BY LORD TEDDER: A BOMBER STATION TO-DAY: BIOGRAPHY OF SIR JOHN SLESSOR: THAT NEXT WAR—also R.A.F. News and Views. R.A.F. in Parliament. News of Dominion Forces. Sport in the R.A.F. Discussion Forum.

Profusely illustrated, and unique in its scope and in the authoritative nature of its contents, it is now under the editorship of Group Captain A. H. Stradling, O.B.E., R.A.F., assisted by Air Ministry Advisory Committee.

Make sure of your copy by ordering at once from Printers and Publishers: Gale & Polden Ltd., Ideal House, 1, Argyll St., Oxford Circus, London, W.1. GERrard 4171.

Now only 3/6

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements

Vampires Over Cyprus

SINCE re-equipment with jet aircraft of R.A.F. home-defence squadrons was completed last year, a number of overseas fighter squadrons have also 'handed in' their piston-engined machines. Complete re-equipment is planned by June of next year. D.H. Vampire 3s now replace the Spitfire 18s of No. 32 Squadron, which has been based at Nicosia, Cyprus, since May, 1948. Several of the new aircraft were flown out from England by Squadron pilots via Manston, Istres, Luqa, El Adem and Fayid.

When 32 Squadron was formed in January, 1916, its first aircraft were D.H.2s, so that the re-equipment revives an early association between the de Havilland Company and the unit. After a few months of intensive training under Major L. W. B. Rees—who was awarded the V.C. for tackling 10 German scouts single-handed—the Squadron moved to France in May, 1916, and remained on active service throughout the war. Returning to England in March, 1919, it was disbanded nine months later. It was re-formed at Kenley in 1923, and made frequent appearances at several pre-war air displays and tattoos.



NEW ARRIVALS: First of the R.A.F. Middle East Air Force fighter squadrons to acquire jet aircraft is No. 32, a brief history of which appears on this page. Six of its Vampire 3s are shown above the salt lakes bordering Larnaca Bay, on the south coast of Cyprus, the Squadron's present base.

Hurricanes were delivered to the Squadron in 1938, and remained in service for five years. During the Battle of Britain, the unit was led by S/L. "Mike" Crossley, D.S.O., D.F.C., and scored 49 victories and 25 probables. When re-equipped with Spitfires in May, 1943, it was concluding a prominent part in the North African campaign. Further operations followed in Italy, Greece and Palestine, where 32 Squadron provided air cover for the last British forces to leave Haifa, before moving to Cyprus. Present commander of the Squadron is S/L. L. F. Kelley, and his flight commanders are F/L. E. W. Hewett, A.F.C., D.F.M., and F/L. J. K. Porteous, D.F.C.

Physicians to the King

NEWLY appointed as Honorary Physicians to H.M. the King are A. Cdre. A. Briscoe, M.B., B.Ch., B.A.O., and A. Cdre. C. T. O'Neill, O.B.E., M.B., B.Ch., B.A.O., the Principal Medical Officers of, respectively, Maintenance Command and Far East Air Force.

Ex-Nazi N.A.A.F.I.

FOR airmen and airwomen below the rank of corporal, a new N.A.A.F.I. has been opened at R.A.F. Station Gatow, the major British Air Lift terminal. Formerly a Luftwaffe aircrew cadet mess, the building has since been used as a kitchen for German workers on the Air Lift. It has now been completely redecorated, and contains games, coffee and writing rooms, a smoking lounge, cafeteria, and a bar built to resemble an English tavern. The work of reconstruction was completed under the supervision of No. 5357 Airfield Construction Wing detachment, Gatow, commanded by S/L. W. N. Lenton.

Naval Air Appointments

TAKING effect from the end of August, the appointment is announced of Rear-Admiral E. W. Anstice as Flag Officer, Flying Training. Until recently, he has been Flag Officer, Training Squadron. Admiral Anstice is an officer with wide experience of Naval aviation, having served as assistant director in the Naval Air Division at the Admiralty at the beginning of the war; he has also commanded escort carriers.

In May, 1944, he became Chief of Staff to the Flag Officer Carrier Training, and, in August of the following year, the Commodore Flying Training. Admiral Anstice went to Australia in October, 1946, on loan to the Royal Australian Navy and he has been serving as fourth member of the Australian Commonwealth Naval Board.

The present Flag Officer, Flying Train-



AIR COMMANDANT FELICITY HANBURY, the Director of the W.R.A.F., returned last week from an extensive tour of America and Canada. Welcoming her at Rockliffe Air Station, Canada, were (L. to R.) A. Cdre. Ross, A.O.C. Transport Command, R.C.A.F., A. Cdre. Kerr, Deputy Air Member for Operations and Training, A. Cdre. Busk, senior R.A.F. representative in Canada, and G/C. Doyle, Station Commander.

Service Aviation

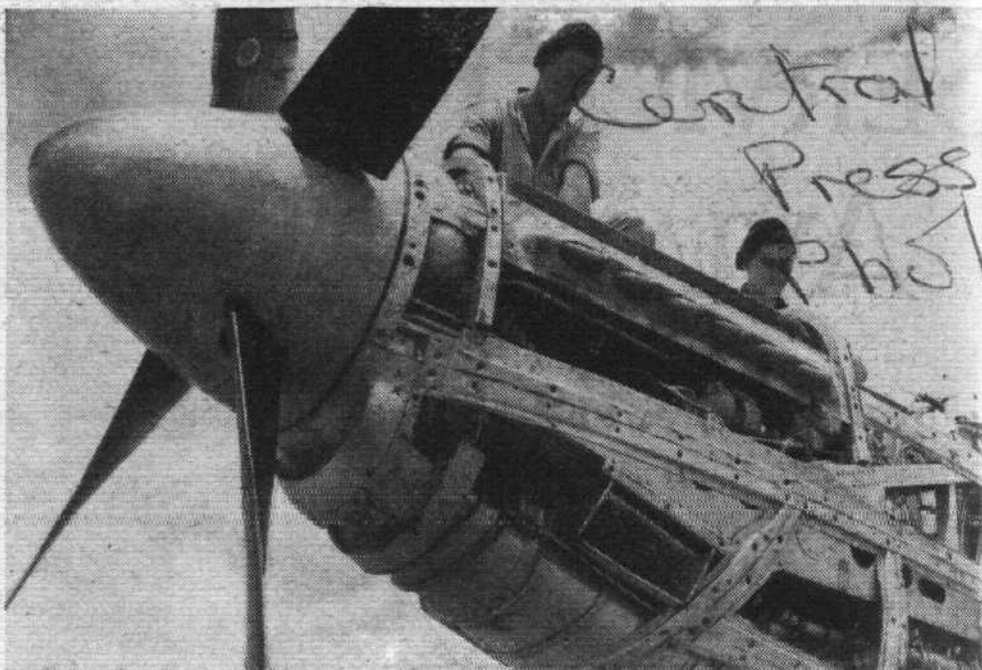
ing, is Rear-Admiral C. E. Lambe, C.B., C.V.O., who will take over command of the Third Aircraft Carrier Squadron on September 8th. A former Assistant Chief of Naval Staff (Air), Admiral Lambe's interest in aircraft extends beyond the Service. In private life he holds a pilot's "A" licence. During the war he commanded the aircraft carrier H.M.S. *Illustrious* in Far Eastern operations against the Japanese.

D-Day Commemoration

MEMBERS of No. 600 (City of London) Squadron, Royal Auxiliary Air Force, spent the Whitsun holiday as guests of *l'Association Nationale des Officiers des Réserves de l'Armée de l'Air*. The occasion was the first post-war revival of the annual rally attended by officers from all over France, and was held at Cherbourg to commemorate the Allied landings five years ago to the day.

Six Spitfire 22s with two Ansons carrying ground crew left Biggin Hill for Maupertus, Cherbourg, on the morning of Saturday, June 4th. In the afternoon they were inspected by M. Jean Moreau, Minister for Air, and a letter from the Lord Mayor of London to the Mayor of Cherbourg was presented by the C.O. of 600 Squadron, S/L. D. R. Proudlove. An exhibition of air drill by the Spitfires brought from the Assistant Air Attaché, W/C. W. G. Moseby, D.S.O., D.F.C., the remark that it was "positively pre-war." On landing, the pilots were piled into a jeep for a triumphal ride in front of the cheering crowd. Demonstrations followed by Thunderbolts of the French Air Reserve and by four Stamps of the Aerobatic Flight of *l'Armée de l'Air*, which gave a magnificent display of formation and individual aerobatics, including bumps and stall turns in formation.

A municipal reception in the Town



CITIZEN FITTERS: Following the inauguration of Australia's Citizen Air Force—the equivalent of our own R.Aux.A.F.—recruiting campaigns in all States are reported to have had a good response. Seen at work on the Australian-built Merlin of a Mustang are two "weekend" flight mechanics of a squadron near Brisbane.

Hall was followed by a banquet at the sixteenth-century *Chateau de Tourlaville*, where the Squadron was welcomed by the Minister for Air, and the Squadron Commander replied in French. This was followed by a grand ball. On the Sunday the President of the French Reserve and S/L. Proudlove laid wreaths on the Cherbourg War Memorial. After an excellent lunch at Barfleur, the party toured the battlegrounds and took part in a ceremony at Sainte Mère Eglise, the first town liberated by the Allied troops in 1944, where they were presented to the Minister of Pensions.

On the Monday afternoon the party flew back to "Biggin" via Rouen, where

it took part in a second display. Members of the Squadron report enthusiastically on French hospitality, and hope that the *entente* established will be maintained and continue to prosper.

Two New Trades

SUPERSEDING the previous single title of "clerk (special duties)," the trades of fighter plotter and operations clerk have now been introduced to the R.A.F. Duties and responsibilities of the new trades—those of manning, respectively, fighter-defence operations rooms and other air-traffic control centres—will remain approximately the same as those of the clerk S.D. However, the impression that airmen and airwomen employed on these duties merely perform specialized clerical work will be dispelled by the new, and more imaginative, titles.

R.A.F. Permanent Commissions

THE following officers have been selected for permanent commissions in the Royal Air Force, in the branches shown:

GENERAL DUTIES BRANCH.

Flight Lieutenants: D. Andrew, D. J. Corbet, E. J. Eames, C. J. Landrey, J. H. Mitchell, H. Neubrock, H. Peebles, W. G. Spencer, T. A. Warren.

Flying Officer: F. E. Smith.

TECHNICAL BRANCH.

Squadron Leader: E. J. MacCallum, M.B.E.

Flight Lieutenants: P. Buchanan, E. Burchmore, M.B.E., A. E. Clowes, D. P. Dunn, M. G. Gardiner, D.F.M., D. E. Gray, H. N. Marsden, A. Mercer, A. E. G. Pye, G. Rollings, A.F.M.

Flying Officer: E. J. Hobart.

EQUIPMENT BRANCH.

Flight Lieutenant: G. W. G. Bazlington.

Flying Officers: J. E. Currie, L. J. Jacobs, R. Morgan.

R.A.F. REGIMENT.

Flying Officer: C. F. P. Thompson.

AIRCRAFT CONTROL BRANCH.

Flight Lieutenants: D. F. J. Tebbitt, A. B. Tucker.

Flying Officers: L. Brookes, D.F.C., T. M. Charlesworth.

MARINE BRANCH.

Flying Officer: D. S. Hunt.



COMBINED OPERATIONS: Like British spare-time fighter squadrons, the Commonwealth units each have a number of regular officers and men. Two auxiliary pilots, F/Os Andrews and Hoare (left), are shown discussing the training programme with F/Ls Thwaites and Bibben, both permanent instructors.

All enquiries to
British Wire Products Ltd.,
Stourport-on-Severn,
Worcs.



'TRU-LOC'

COMPRESSION FITTINGS

will not pull off at 100%
of the breaking load

'TRU-LAY'

REFORMED ROPE
as balanced load on every
strand and internal stress
is reduced to a minimum

Hercules 630 - 670 series

overhaul period now

extended to

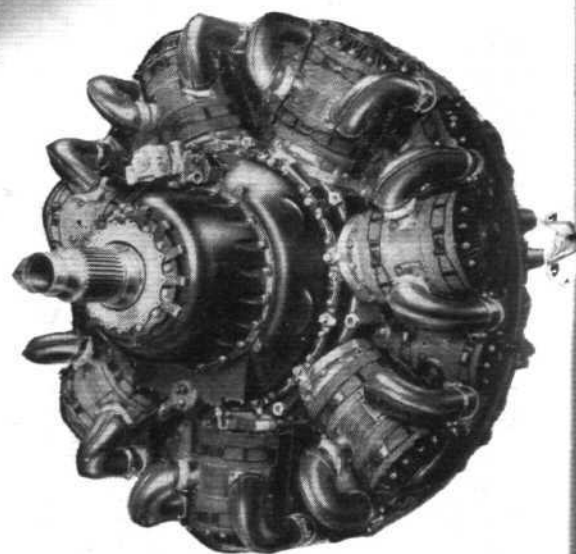


hours

*... a tribute to a reliable engine
and expert maintenance*

Overhaul periods for "Bristol" Hercules 630 and 670 series engines have been extended from 600 to 700 hours. Subsequent inspection of these engines has shown that this operating period between overhauls is well within their range. Approval of this life before overhaul is restricted to operators who have demonstrated by practical experience that this is consistent with operating conditions imposed and the degree of efficiency of maintenance services available.

The original planned programme of overhaul extension, based on service experience, is being continued and, as a next step, certain selected engines will be run — with A.R.B. approval — to approximately 800 hours.



Bristol

... dependable sleeve-valve engines