

FLIGHT

Official Organ of the Royal Aero Club First Aeronautical Weekly in the World Founded in 1909

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What is a Hovercraft?

THERE was no doubt in the mind of the former Minister of Aviation, Mr Duncan Sandys, that the hovercraft is an aircraft. This is what he said during the passage through Parliament of the Civil Aviation (Licensing) Bill, 1960: "*The hovercraft is a little like a duck-billed platypus, which is both bird and mammal. I do not suggest that the hovercraft suckles its young, but I have no doubt at all that it is an aircraft.*"

And indeed it is, so far as registration and design standards are concerned. Technical responsibility for ensuring that ground-effect machines are safe vehicles for public transport is carried by the Ministry of Aviation and the Air Registration Board. But now that Starways—and, last week, P. & A. Campbell Ltd—have applied to the Air Transport Licensing Board for licences to operate hovercraft services (see page 520), the question arises of responsibility for licensing the *commercial* operation of these craft.

Starways' historic applications to the Board, published in *Civil Aviation Licensing Notice 36*, raise a question with a touch of irony: The applicant and other would-be hovercraft operators may well, to quote the Act, be "competent, fit and proper persons" to operate hovercraft services; but is the Board—we ask without disrespect—a competent, fit and proper authority to license such services?

It is significant that some weeks elapsed between the lodging of Starways' applications and their publication in the Board's *Notices*. The most likely reason for the delay was that the Board decided to take advice on whether or not to accept the applications. Evidently it found that it was obliged to do so; but will it, we wonder, ever hear the applications?

New Legislation Required?

It may well happen that the Minister, while not disputing that hoverworthiness (as it might be termed) comes within his purview, will decide that these craft are exempt from the requirements of the Civil Aviation (Licensing) Act, 1960. He has the power to exempt a hovercraft operator from the requirements of an Air Service Licence by extending the scope of Regulation 3. The question would then arise as to which authority, if any, should be responsible for the operational licensing of hovercraft; and this may well result in new legislation. It would certainly be a pity if the commercial future of these promising vehicles, in the development of which this country is well ahead, were to be compromised by the restrictions that confine air transport, and particularly international air transport.

Meanwhile Starways, and others wishing to reap the commercial fruits of promising British developments in the hovercraft field, want an early clearing of the air, or whatever the right word is in this context. In its applications Starways makes a special point of asking for an early decision "to enable a very extensive experimental and training programme to be undertaken." What Mr Sandys should have said, and what his successor Mr Thorneycroft should now say, is that the hovercraft—at any rate from the commercial licensing viewpoint—is neither a duck-billed platypus nor an aircraft. It is a hovercraft.

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FROM ALL QUARTERS

P.1127's Successful Transition

FULL transitional flights, using the Bristol Siddeley Pegasus lift/thrust engine, have now been completed by the Hawker P.1127 VTOL strike/reconnaissance aircraft. Announcing this last week, Hawker Siddeley Aviation stated that these complete transitions had been accomplished only 11 months after the first hovering flights.

Since that time, a second P.1127 has joined the programme. One aircraft has been used to investigate hovering and translation at increasing speeds, while the other has been tested in wing-borne flight at progressively lower speeds with the object of "closing the gap" from both ends of the speed range. The recent transitions mark the final bridging of the gap by one aircraft. A key factor in the operation has been the provision by Bristol Siddeley of an engine developing sufficient thrust to allow acceleration from hovering flight into horizontal wing-borne flight.

The programme of flights which led up to the first full cycle was begun early this month and completed very easily in two-and-a-half weeks—a time which has delighted test pilot A. W. "Bill" Bedford and everyone at Dunsfold. Flights involving vertical take-off and conventional landing or conventional take-off and vertical landing had been made, but the important achievement is vertical take-off, transition into wing-borne flight and return to a vertical landing. The aircraft in which this was achieved was XP 831, the first machine, fitted with a Bristol Siddeley Pegasus development engine of a thrust rating which at one time was not thought completely adequate for full transition. During the flight the undercarriage was left down and the intake lips inflated—they will probably be operated



MACH-BUSTING MINISTER: Mr Peter Thorneycroft in the right-hand seat of the Hawker Hunter Two-seater at Dunsfold (see opposite page)

together at a later stage—but the flaps were lowered during the deceleration into hovering flight.

Several further transitions have since been made, by both Bill Bedford and Hugh Merewether, and the pilots have reported that the operation is remarkably straightforward: "You just do what comes naturally, looking outside the cockpit and at the a.s.i. in the normal way." Meanwhile, the second P.1127 has also been flown at high speeds. Mach 0.9 and 600 m.p.h. have been reached, and aerobatics were demonstrated to the Minister of Aviation during his visit to Dunsfold, mentioned in the succeeding news item. The flight envelope has therefore been extended far beyond the immediate VTOL field.

Simplicity is the keynote of the P.1127 system. The Pegasus lift thrust turbofan has four jet nozzles which are directed vertically downwards for VTO, and control of attitude is achieved by jet-reaction units at nose, tail and wing-tips. For transition the nozzles are partly rotated to direct their thrust rearward, and the aircraft begins to move forward at increasing speed, the conventional flying controls progressively becoming effective. When the nozzles are directed fully rearward the P.1127 moves forward in the manner of

COMING . . .

The Hawker P.1127 prototype hovering at Dunsfold during transition trials. Note the inflated "thick lips" of the intakes and the small fence aft of the nose gear to inhibit forward recirculation of the airflow

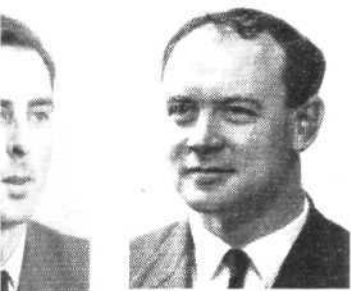


GOING . . .

Other features of the P.1127 noticeable in this second picture during the transition trials are increased area of fairing aft of the rear nozzles, and the fully lowered flaps. Undercarriage fairings and doors are absent



LESS VENTUROUS for Mr Peter Thornycroft, though doubtless no less interesting, was a recent visit to Rolls-Royce to see the latest engine developments, including new VTOL units. From the right: Mr A. C. Lovesey, chief engineer, aero engines, and director of Aero Engine Division; the Minister; Mr D. W. G. L. Haviland, Deputy Secretary (C), MoA; and Mr D. A. Lovelock, PS to the Minister



WESTLAND POSTS: Mr J. Speechley (left) who has been appointed chief development engineer, Yeovil. Formerly chief of group project analysis, he is succeeded in that post by Mr D. M. Davies (right). John Speechley joined Westland in 1941 as a student apprentice. Mostyn Davies was formerly deputy chief project engineer with Fairey Aviation, later the Fairey Division of Westland Aircraft

an orthodox jet aircraft, the whole of the engine power being available for propulsion. For vertical landing, these transition stages are gone through "in reverse."

Bristol Siddeley's announcement of the transition goes on to say: "Advantages of the 'vectored-thrust' system include the simplicity both of design and maintenance which comes from the use of a single engine. Moreover, the whole of the installed power is available for take-off and the employment of movable nozzles makes more economical use of the available thrust than is possible with any combination of vertical and horizontal thrusts. It also avoids most of the ground-erosion problems associated with fixed lifting engines, because taxiing and all ground running can be done with the nozzles facing backward."

"Although the Hawker P.1127 is a transonic aircraft the Pegasus is equally suitable for supersonic operation. It can also be used to advantage in single-, twin- and four-engined configurations for military and commercial transports and long-range aircraft where vertical and short take-off characteristics are a requirement."

"Since the Pegasus is a ducted-fan engine with a high by-pass ratio its specific fuel consumption is low even when it is throttled well back, and, in consequence, it can give good range characteristics even in the single engine context. Used in combination with pure lift engines, the Pegasus can provide at its most economical throttle setting all the propulsive thrust necessary for an aircraft in conventional flight and, at take-off and landing, contribute its maximum thrust to meet the VTOL requirement."

"Several major aircraft constructors in Europe and America are studying projects using the Pegasus, ranging from supersonic strike fighters to commercial transports."

As noted in the succeeding news-item, a transition was watched by the Minister of Aviation during a visit to Dunsfold.

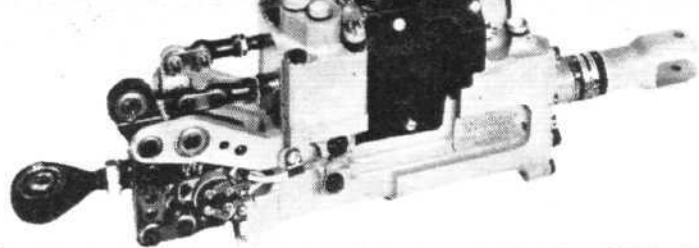
M1 Ministers

TWO Ministers flew supersonically last week, the Minister of Aviation, Mr Peter Thornycroft, in a Hawker Hunter Two-seater at Dunsfold, and the Air Minister, Mr Julian Amery, in an English Electric Lightning at Warton. Mr Thornycroft's pilot was A. W. "Bill" Bedford, Hawker Aircraft chief test pilot; Mr Amery was flown by R. P. Beamont, manager, flight operations, English Electric. The Air Minister said he was particularly impressed by the climbing speed—"up to 36,000ft in two-and-a-half minutes." Earlier in the week Mr Amery had tried the opposite end of the speed scale, in a glider at RAF Bicester. There he had flown with Sgt John Williamson, this year's inter-Service and British gliding champion, in a T-42. He also tried his hand in a Sedburgh T-21, commenting afterwards: "I have a good mind to take up gliding."

At Dunsfold, Mr Thornycroft saw two P.1127s demonstrated on Tuesday of last week. One was flown by "Bill" Bedford; the other, which carried out conventional flying and aerobatics, by Hawker assistant chief test pilot Hugh Merewether.

Russians Claim Flying-Boat Records

IT is reported from Moscow that "eleven world records were smashed by Soviet pilots this September in a jet-powered seaplane designed by Gheorgi Mikhailovich Beriev." The crew consisted



ELECTRO-HANDRAULIC: Fairey's powered control unit for Hawker P.1127 accepts both mechanical and electrical signalling. It is fully duplicated hydraulically and is exceptionally small and light in weight

of test pilot (first-class) Gheorgi Buryanov; navigator Vladimir Bogach; and radio operator Viktor Perebilov.

The records were claimed as follows:—

Payloads of 1,000, 2,000 and 5,000kg (2,204, 4,409 and 11,023lb) lifted to 14,042m (36,069ft); 10,000kg and 15,000kg (22,046 and 33,069lb) lifted to 12,120m (39,763ft); 15,204kg (33,517lb) lifted to 2,000m (6,561ft). Without payload, the aircraft reached 14,742m (48,365ft).

In a 1,000km closed-circuit flight with payload of 5,000kg (11,023lb) an average speed of 875.86km/hr (544 m.p.h.) was recorded.

Glider Aerobatic Champion

WITH a well-planned and impeccably executed series of manoeuvres, Derek Piggott won the National Glider Aerobatic Contest in an Olympia 403 at Dunstable last Sunday. Flt Lt B. B. Sharman (1959 winner) was second and D. A. Smith third, both flying a Swallow. G. W. Scarborough, placed fifth in a Skylark 2, won the spot landing competition. Although Piggott is well known as a display pilot and as CFI at Lasham Gliding Centre, this was his first entry in the national aerobatic contest.

Air Chief Marshal Sir Theodore McEvoy, who as president of the RAF GSA presented the prizes, congratulated all competitors on having done so well though restricted to a maximum altitude of 1,500ft. This was determined by low cloud at the start of the event; but during it conditions improved rapidly, competitors and spectators alike being blessed by clear, sunny skies.

IN BRIEF

Next Sunday, October 1, the Tiger Club is holding "Tiger Moth Sunday" at Redhill Aerodrome, to celebrate 30 years' service by this famous D.H. type. All Tiger Moth owners will be welcome.

A recent announcement by the French aircraft industry states that its export orders during the first half of this year reached a total of 754m New Francs (about £55,850,000). Civil orders—largely accounted for by the Caravelle—contributed over two-thirds of the total figure. More than 40 per cent of the industry's total production was exported.

A \$180.1m contract for F4H-1 Phantom IIs for the US Navy has been awarded to McDonnell Aircraft Corporation. A Phantom II set up what has been claimed as a new world low-level speed record of 902.769 m.p.h. over a 3km (1.8 mile) course on August 28 (*Flight*, September 7).

Mr D. E. Haynes, formerly secretary of Hawker Siddeley Aviation Ltd, is to be secretary of Bristol Siddeley Engines Ltd from October 1. He succeeds Mr F. Shutt, who held the post since April 1959 and has now taken up an appointment as financial comptroller of Hawker Siddeley Industries Ltd.

The Royal Aero Club plans to move from 119 Piccadilly to new premises in Fitzmaurice Place, Berkeley Square, which it will share with the Lansdowne Club, at the beginning of next year. A special meeting to discuss this will be held at the Royal Aero Club at 5.30 p.m. on Wednesday next, October 4.

Mr Jerome Lederer, director of America's Flight Safety Foundation, has been chosen to receive the 1961 Daniel Guggenheim Medal, presented jointly by the ASME, SAE and IAS. The award is in recognition of his "lifelong dedication to the cause of flight safety and his constant and untiring efforts to reduce the hazards of aviation."

Walter Moody, of the Max Conrad ferrying organization, flew a Mooney Mk 21 non-stop from Massachusetts to Bulltofta airport, Malmo, Sweden, on September 17. The flight took 22hr. Earlier in the summer Mr Moody ferried a Mk 21 non-stop from Boston to London Airport—the first single-engined aircraft to land there under the new dispensation.

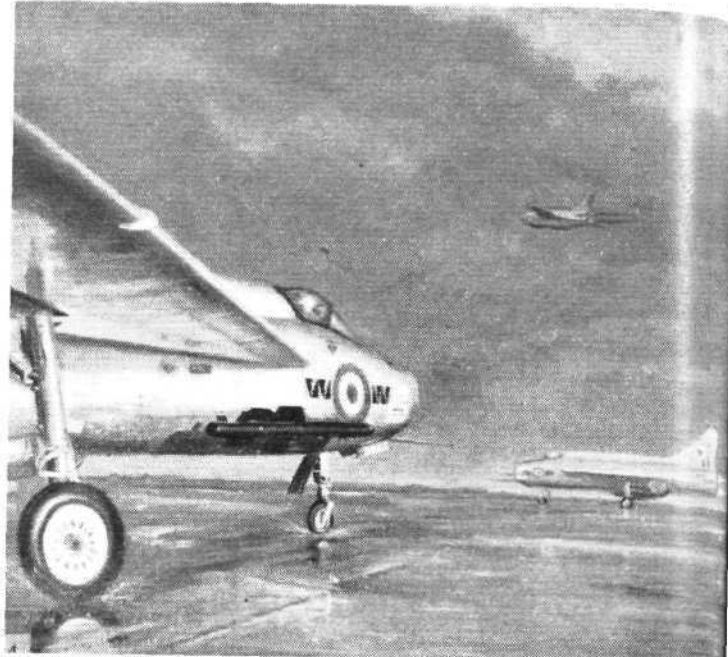
Five well-known test pilots are appearing at the London Society of Air-Britain 6th annual test pilots' forum next Wednesday (October 4) from 7 to 9.30 p.m. in the lecture theatre of the new Holborn Central Library, 38 Theobalds Road, London WC1. Led by LSAB's new president, S. B. Oliver (chief test pilot, Hunting Aircraft), forum members will be E. A. Tennant (Folland), W. R. Gellatly (Westland), J. M. Nicholson (Beagle) and R. C. Rymer (Vickers-Armstrongs).

The Institute of Transport's Award of Merit—a bronze statuette of Pegasus, presented not more frequently than once in three years—is to go to Air Chief Marshal Sir Ralph Cochrane for his 1961 Brancker Memorial Lecture, *Aviation—the Next Stage*. Formerly Vice-Chief of the Air Staff, Sir Ralph has since been in charge of Rolls-Royce long-term research. Another Institute award for 1961—the Bristol and White-Smith Air Transport Student Prize—goes to Mr J. Doyle of Aer Lingus, for his paper *Some Aspects of Airline Operations*.



CROSS COUNTRY

Ann Welch



THUNDER AND LIGHTNING

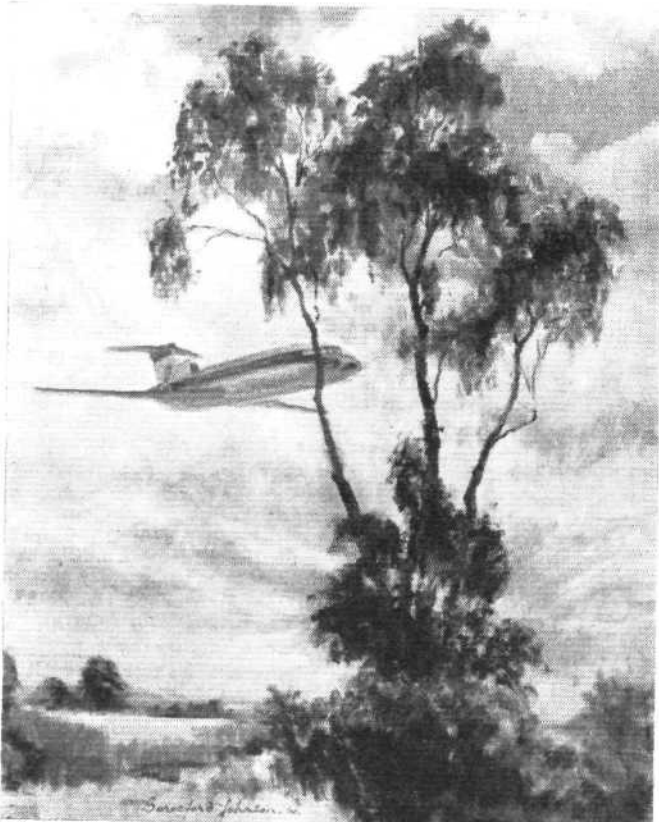
C. W. E.

A WIDER HORIZON

**Aviation Artists—now
"The Industrial Painters' Group,
incorporating the Society of
Aviation Artists"—Hold their
Annual Show**

THE TRIDENT

Beresford Johnson



FOR THEIR EIGHTH EXHIBITION at Guildhall, London (continuing until October 7), the Society of Aviation Artists have widened their scope: now, incorporated with the Industrial Painters Group, they display their talents over a wide range of other subjects. As Roy Nockolds explained at the opening of the exhibition, pressure to make this extension came from within the Society.

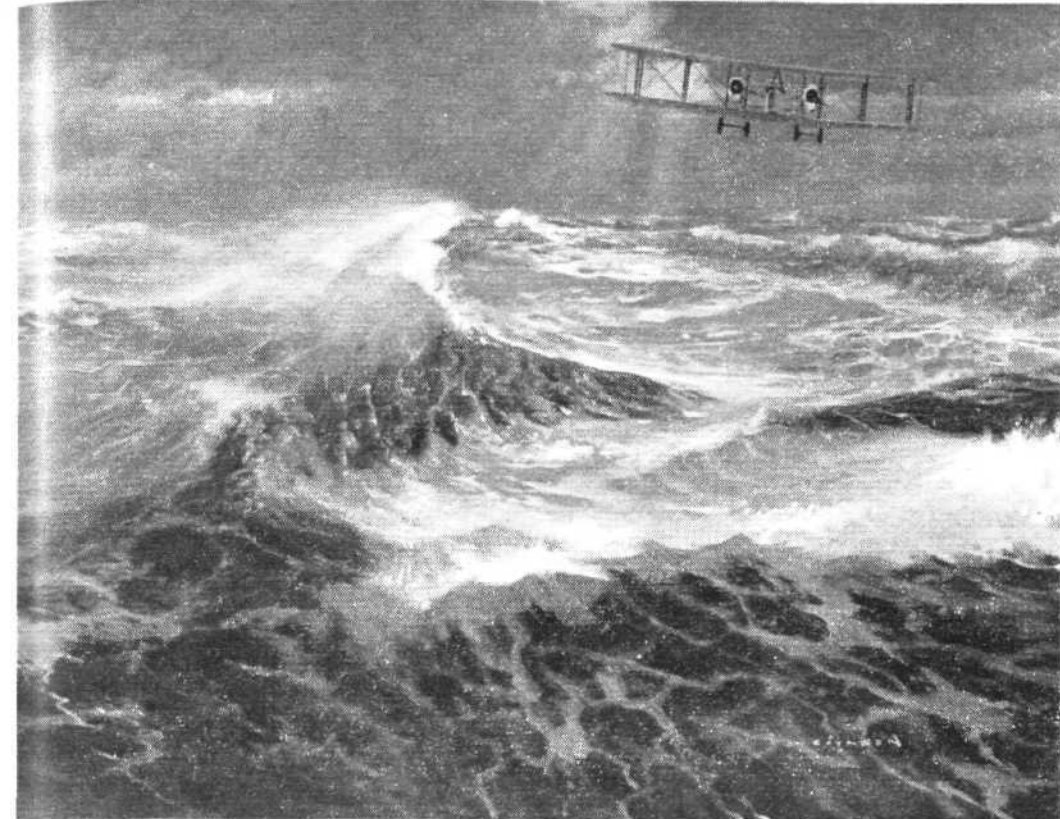
Among the widely differing pictures, however, the aviation paintings more than hold their own. Indeed, one of the most attractive of any in the exhibition is that of the historic Alcock and Brown flight, by G. Davison Coulson. Full of movement and drama, the heaving, spume-streaming waves compel one's attention. As the night clouds thicken and close down, the pale rays of the sun bleakly light the Vickers Vimy as it roars low above the menacing dark blue-green Atlantic.

Close by, and in immediate contrast in time, two flights of brightly chequered Lightnings, armed with Firestreak, hurtle out from high piling clouds in a purposeful manner in a painting by E. R. Linklater.

"RENDEZVOUS"—SKEETER AND CENTURION ON
THE TANK TRAINING RANGES AT DETMOLD

David S.





FIRST ACROSS, ALCOCK, BROWN AND VIMY

G. Davison Coulson

There are Lightnings, too, in C. W. E. Waller's picture, but here lowering thunderclouds pile ominously over the rain-soaked ground, as one fighter with flame-spitting tail streaks fast down the runway, whilst another splashes wetly through puddles to join a third fast-vanishing in the threatening purple mists.

Sailing gracefully high in an airy silence, Ann Welch's sailplanes sweep down the sky in noiseless flight towards the lofty cumulus, deep shadowing a multi-coloured pattern of fields and roads.

Another attractive portrayal of vast airiness is that by E. J. Hewitt, showing a Sunderland parading majestically over a purple and green sea. Far below the waves surge at the foot of rugged cliffs; inshore, houses nestle in the smooth green folds of the earth.

The Trident, by Beresford Johnson, is a burst of orange and yellow and blue in a colourful rendering of a take-off at dawn, beneath a variegated sky and dominated by the silhouette of a delicate three-forked tree in the foreground.

With expected competence, David Shepherd's sure touch in *Rendezvous* shows us a Skeeter hovering over soggy grass, before

a purple-grey backcloth of low cloud and mist. Below, a camouflaged Centurion tank crew waits for the helicopter to land.

Not illustrated here, but of interest for their different approach, are Harold Dent's abstract impressions—particularly *Reheat*, where, in a shimmering blue haze, the aircraft explodes away from one's view in an incandescent burst of fiery reds and yellows.

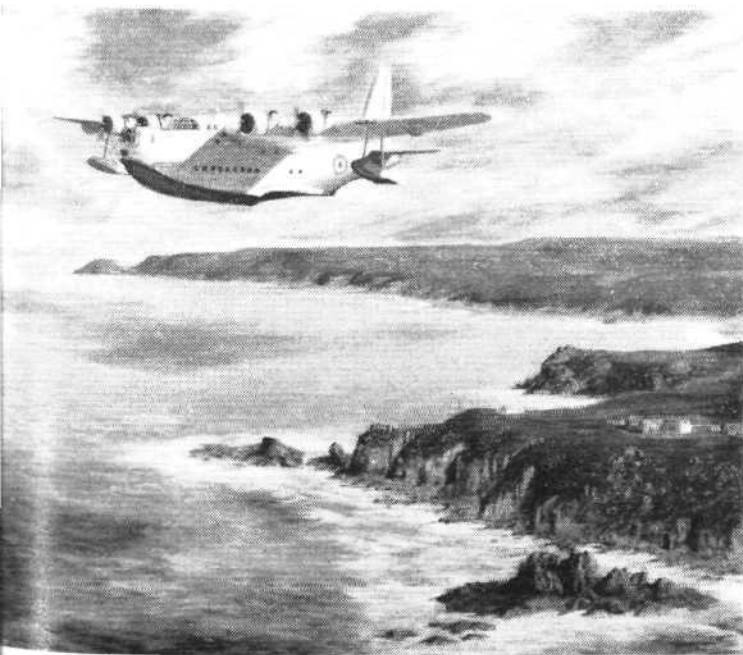
Of historic interest, a vivid memory of the last war occurs in *Mosquitoes Attacking Amiens Prison*, by Roy Nockolds, a cold grey wintry landscape in which the three aircraft, having breached the squat walls of the prison, race out across the flat and uninviting terrain.

It will be seen that, in spite of the competition offered by the industrial paintings—and there are several of considerable appeal—enough aeronautical spice remains to make a visit well worth while. It is to be hoped that the aviation side will not eventually be swamped by industry. To avoid this possibility, past exhibits could well be shown again. Next year, incidentally, the exhibition will be held in May.

R. E. M.

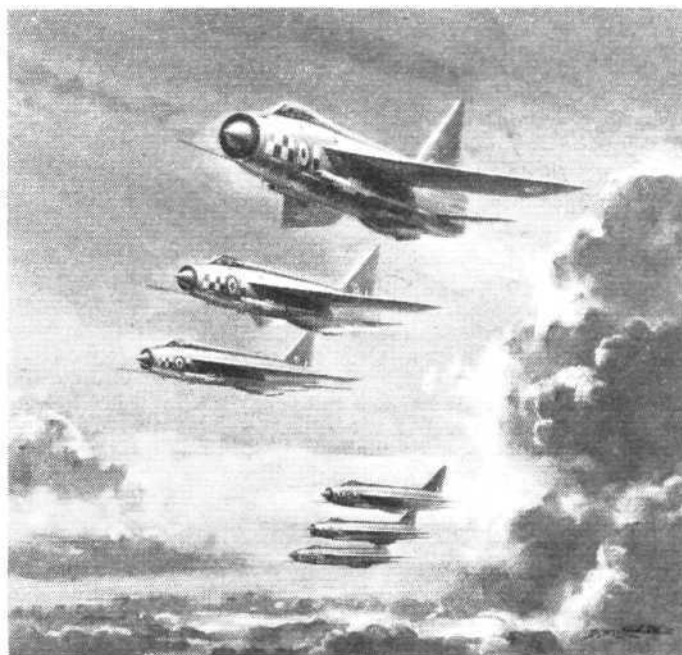
SUNDERLAND OVER LAND'S END

E. J. Hewitt



SUNLIT LIGHTNINGS, 56 SQN

B. R. Linklater



"FLIGHT" PHOTOGRAPHS

RILEY 65 in the Air

BY MARK LAMBERT

No. 153 of the series



It is always possible to smooth off a production aircraft and obtain extra performance, but it can rarely be done economically on a reasonable scale. Nevertheless, an outstanding example of this process is now available in Britain, and at a remarkably reasonable price. Riley Aircraft Inc are buying second-hand Cessna 310s of up to 310C standard (straight fin), and completely rebuilding them with extensive structural modifications, which produce not only a brand new airframe but also considerably better performance than the original. Over and above this, the Riley 65, as the new aircraft is called, is sold as a complete package including a sumptuous interior décor, full airline radio, oxygen equipment and heater for a flat price in Britain, with public transport or three-year C of A, for the remarkably fair price of £24,500 with 240 h.p. engines or £28,500 with 260 h.p. engines. The standard Riley 65 with 240 h.p. engines has performance as good as that of the 260 h.p. Cessna 310D; and the latter costs about £15,000 more when equipped to equivalent standard. The 310D cruises at 220 m.p.h. TAS at 75 per cent power, while the 240 h.p. Riley 65 cruises at the same speed at 63 per cent power. Standard tankage of the 65 is the same as the full optional tankage of the 310D, and the 65 has a maximum range of 1,400 st ml or an extreme endurance at 63 per cent power of 6hr 20min.

The British distributors for the Riley 65 are Keegan Aviation Ltd, based at Panshanger, Herts. They offer delivery in four to six weeks with full new-aircraft warranty and the first 25hr or three-month check free, wherever it is performed. In addition they offer the services of a pilot for conversion training at an "expenses only" charge for seven days. Individual colour schemes are also offered at no extra cost. This package deal is unique in American aircraft sales practice and is already proving to be an important sales factor. Two Riley 65s have already been sold in Europe and more will certainly follow. Full performance checks have been carried out in conjunction with Harold Best-Devereux, aviation consultant at Panshanger, and it is hoped that the Riley 65 will in due course be recognized by ARB as a new aircraft type and not just a modified Cessna.

Incidentally, Riley was at one time de Havilland agent in the US and sold several score Doves there. He is even now converting a Dove, with de Havilland approval, for four Lycoming 250 h.p. engines and giving it a swept fin. This should be a pretty potent machine. He is also responsible for the twin-conversion of the Navion, an example of which is now in Britain.

The 65 designation is reported to have arisen because Mr Riley considered that it would be 1965 before Cessna themselves introduced the same improvements. The third side-window and tankage in the engine nacelle are examples of features since adopted by Cessna themselves. Riley have reworked the engine installation, replacing the over-wing exhaust with a very short ejector assembly below the wing and mounting a 16 Imp gal plastics tank to form the overwing fairing. Extensive structural stiffening has been added and all skin up to 50 per cent back from the nose and leading edges has been treated with ceramic and epoxy resin finishes to make a glossy smooth, hard surface in which not a single rivet is discernible. Special vibration-damping engine mountings have been added and the airframe has been extensively coated with metal foil and foamed plastics to improve soundproofing. Thick carpet on the baggage compartment floor, a thick, single-piece "panoramic" windscreen and an entirely new interior décor including real leather upholstery and gold walls add an atmosphere of luxury. The cabin head-lining is of "royal silk" with a buried lighting channel running right back over the baggage compartment and giving a real feeling of spaciousness. All this is part of the standard air-

craft. A maximum of 200lb can be stowed in the baggage compartment, which has its own external door, but can also be reached in flight over the back of the three-place rear bench seat.

Noise and vibration levels have been vastly improved in the Riley and one can converse quite comfortably at cruising power. Instrument layout has been improved to form almost an "airline T" in front of the pilot. Full dual control, including duplicated toe-brakes, is provided, together with comprehensive engine instrumentation, individual gauges for the main tanks and a quick-reading, switchable gauge for the additional tanks. Engine controls are levers on a central pedestal which also holds the three trim wheels and their indicators. Radio, including 360-channel Collins VHF, small Collins transmitter and receiver with VOR/ILS, marker and Motorola ADF-T-12 are all in the middle with room to spare for more radio still. The switches are well arranged and easy to learn. Undercarriage and flap are electric and operate quickly. Steering is by light spring link from pedals to nosewheel, with differential-brake assistance for tight turns. There are plenty of ventilators and the d.v. window is big. The Southwind combustion heater provides cold or hot air, burning about $\frac{1}{2}$ gal of petrol per hour when heating. Instrument panel lighting is by Grimes pillar lights next to each dial and by ultra-violet lamp in the roof as well.

I flew a 240 h.p. Riley 65 from Panshanger with Kevin Keegan for just over an hour. Although I started out with a distinct personal dislike of Cessna 310 handling, gained during a demonstration flight some years ago from Blackbushe, I finished the flight with a strong liking for the Riley 65. If analysed piece by piece, 310 handling has a few markedly poor points, but these do not show up to any extent when the aircraft is flown in routine operations. More of this later. The great attraction of the Riley is its exceptionally good finish and comfort and the remarkable performance achieved. Keegan also pointed out that you can buy a Riley 65 and a £15,000 house—or some Rolls-Royces—for the price of a Cessna 310D with the same equipment.

The demonstrator Riley was registered G-ARRR—"Golf Treble Romeo." Someone asked Keegan in the circuit at Southend "Wherefore art thou Romeo?" and the answer was, of course, "Down-wind." Kevin Keegan and I settled down and worked through the settings connected with engine starting and preparation for take-off. The standard list sufficed, although fuel boost pumps were better left off for starting and little priming was needed. Visibility through the single-piece windscreen was very good and the broad side-pillars interfered little. The ride on Panshanger's turf was comfortable and steering was very light. Some engine or brake was a help in initiating turns.

I lined up and opened up to full power, just holding the slight left swing with full right rudder. I was told to hold the nosewheel off the bumps and was surprised to be able to raise the nose almost immediately. The Riley fairly roared off the ground with one long wail of stall-warner, unsticking very smoothly at about 80 m.p.h. This is apparently a standard grass-field technique and very easy to control. The stall-warner sounded much too early. Keegan raised gear and we accelerated very fast to the climbing speed of 120 m.p.h. before sailing upwards at a great rate. Very soon we levelled off at 4,500ft and set 22in and 2,350 r.p.m. to get 63 per cent power. We had the ADF tuned to Brookman's Park and the VOR to London. There was no cloud, but considerable haze.

In smooth air the indicated speed soon built up to 190 m.p.h. and I wound the trimmer more and more forward. Once settled, the Riley raced smoothly along and was very pleasantly manoeuvrable. I could initiate and reverse turns with barely any rudder,

The Riley 65, with flap down in deference to our Gemini's mere 140 m.p.h. formation speed. The Riley can cruise on one engine faster than an Apache on two



and wheel forces were light. The noise level was particularly good. Although the engines seemed to snarl a good deal, Keegan and I could talk comfortably to each other with only slightly raised voices. Control cable friction masked many of the finer points of control when I tried tweaking and releasing the wheel and pedals and, perhaps for this reason, the Riley had a slight tendency to depart from straight and level during hands-off flight, but it was light and comfortable to hold. If released in a 30° bank, the aircraft showed a distinct tendency to raise its nose out of the turn, rather than to drop it and tighten into a spiral. Longitudinal stability appeared strong, probably by virtue of a firmly downloaded elevator and correspondingly rapid response to changes in speed.

More surprising was a pronounced response to reduction in power. When I closed the throttles the nose dropped very quickly, and I rapidly grasped the wheel to restrain the dive. At 115 m.p.h., clean with only 15 to 18 in power, control friction really masked the hands-off flying characteristics, and the inertia of the almost-full tip-tanks could be distinctly felt in the effort required to start and stop fairly high rates of roll. But the Riley was still light and pleasant to handle and very manoeuvrable. Closing the throttles again brought a sharp nose-down lurch, but after I let it down gently the aircraft settled at 135 m.p.h. without retrimming. Below 100 m.p.h., the ailerons lost a good deal of their bite, but rudder and elevator were still powerful and light. With power off, speed dropped off slowly until the warner sounded at 90 m.p.h. A distinct judder appeared at 85 m.p.h. and the stall came with a firm tug to the right on the ailerons at about 80 m.p.h. The Riley rolled slowly towards a right spiral dive, but recovered very quickly without use of power. Application of full power in the dive brought a very reasonable nose-up trim change. A stall with power came at below 80 m.p.h. with the same characteristics. Some aileron control remained right into the stall.

I next trimmed hands-off at 130 m.p.h. and selected gear down. There was a very slight nose-down trim change. Selecting 15° of flap produced a sharp nose-up trim change which continued as I lowered the full 45°. The speed dropped to about 100 m.p.h. Longitudinal stability remained strong, but aileron was fairly weak. Retraction of everything produced a fair sink and surge forward with rather less strong trim changes. With everything down and power off the Riley descended at 1,700 ft/min at 100 m.p.h.—a remarkably steep angle which, though useful on occasion, would be excessive for normal operation. Cessna traditionally provide this high-drag flap feature and I personally like it very much. Application of full power in this configuration produced a pleasantly

mild nose-up tendency and an overshoot at the last moment should be straightforward.

Bringing the Riley back to the stall with everything down and a moderate amount of power was another eye-opener. At something below 80 m.p.h. buffeting became so violent that I did not take it right back to the stall. We still had aileron control and the wheel was far from fully back. One would have to be anaesthetized to stall the Riley in fully "dirty" configuration.

Finally I closed the port throttle and feathered the port propeller at about 150 m.p.h. and cruising power, flying at 4,000 ft in rather warmer than standard air. The Riley lurched hard, but was then easy to hold. Keegan have actually demonstrated that the aircraft will cruise faster on one engine than an Apache at normal cruising power—some achievement! Riley are claiming a *single-engined* cruising speed of 170 m.p.h. for the 240 h.p. version. I did not try it and let the speed fall off as soon as I had trimmed hands-off. Aileron trim was useful here because the Riley responded very well to slight bank into the "good" engine when flying on one. Rudder trim ran out at 130 m.p.h., but at 113 m.p.h., the recommended single-engined climb speed, the residual loads were reasonable and we went firmly uphill at an indicated 200 ft/min. The true performance should be timed, and careful tests by Best-Devereux have actually shown figures better than the brochure value of 390 ft/min at full load at sea-level. On one occasion 100 ft/min was recorded at 13,000 ft. Minimum control speed is 93 m.p.h. and I was able to take the Riley happily below this speed with no other deterioration than a very slow yaw. Full rudder was then being used, but aileron still helped considerably in directional control. Relighting the port engine was quite straightforward.

RILEY 65

(Two Continental O-470M or IO-470D engines, 240 and 260 h.p. respectively)

Span, 36 ft; length, 27 ft 9 in; empty weight, 3,000 lb; useful load, 1,600 lb; gross weight, 4,600 lb; standard tankage, 116 imp gal.

Performance with 260 h.p. engines (in brackets for 240 h.p. engines where different) Cruise at 65 per cent power, 235 m.p.h. (220 m.p.h.); minimum stalling speed, 65 m.p.h.; limiting speed, 246 m.p.h.; approach speed, 90 m.p.h.; twin-engined climb, 2,100 ft/min (1,800 ft/min); single-engined climb, 410 ft/min (390 ft/min); single-engined cruising speed, 170 m.p.h.; single-engined safety speed, 93 m.p.h.; take-off run, 270 yd; landing run, 210 yd; service ceiling, 21,500 ft; distance to accelerate to 93 m.p.h. and stop on dry runway, 3,200 ft.

By now I had the feeling that the Riley was generally very pleasant to fly and really comfortable for travelling, though I had reservations about the rather pronounced trim-changes I have mentioned. But when I let down to Panshanger and "dirtied-up" in the normal way on the down-wind leg, the trim changes all cancelled themselves out very nicely and I had a total of two or three degrees of elevator trim movement to make after the complete cycle of gear, 15° flap and reduction in power. Unless one tries them all separately, as I first did, the trim changes do not really show up at all. The approach was also very easy, using 30° of flap and some power at 100 m.p.h. Everything went extremely smoothly until I had half completed the round-out and slowly closed the throttles. Then I glanced at the flap lever to lower full flap and, before I looked up again, we had sunk into the up-sloping runway with a resounding thud.

This was pure foolishness on my part. I should have kept my eye on it till we had actually touched down, because these aircraft do come down firmly once the throttles are closed. There was no need for full flap. Keegan later landed almost in formation with *Flight's* Gemini and turned off the runway not more than 50 yd after the Gemini. I also saw Keegan get off the ground in what looked like about 200 yd. That Riley is not only smooth and fast, but very manageable.

Riley have made a fine job of the cabin, with good instrument layout and pillar lighting as well as ultra-violet. The gold cabin trim, real leather seats and airline radio are found in the standard aircraft, which is delivered in Britain for £24,500 or £28,500, according to the engines chosen



Missiles and Spaceflight

ON TARGET AGAIN

Accurate placing of a second Russian test rocket in the Pacific was reported in a Moscow statement on September 18, which said that the dummy of the last stage had landed "in the immediate proximity" of the spot where the first rocket (launched on September 13) landed. Both the flight and the functioning of instruments had been "in full conformity with the set programme." Stressing the range of the firing—7,500 miles—the statement said that "the high level of precision of the functioning of the carrier rocket's control system at a distance exceeding 12,000km is another big achievement by Soviet rocketry." Russia plans to continue launching carrier rockets into the area. A third was fired on September 20.

JODRELL BANK'S ADDITIONAL ROLE

A new capacity, that of detecting missiles if the need should arise, is to be given to the radio telescope at Jodrell Bank. The Ministry of Defence, in a statement last week, said that the Air Ministry was installing some equipment there "which will be of assistance to Prof Lovell in his work on the observation of satellite behaviour and which will in addition have some capacity for the detection of ballistic missiles." It was stated from Jodrell Bank last Friday that this assistance from the Air Ministry—"which will help us in our astronomical research"—was welcomed: it betokened a continuance of the co-operation the staff had had over the past four years with various Government departments.

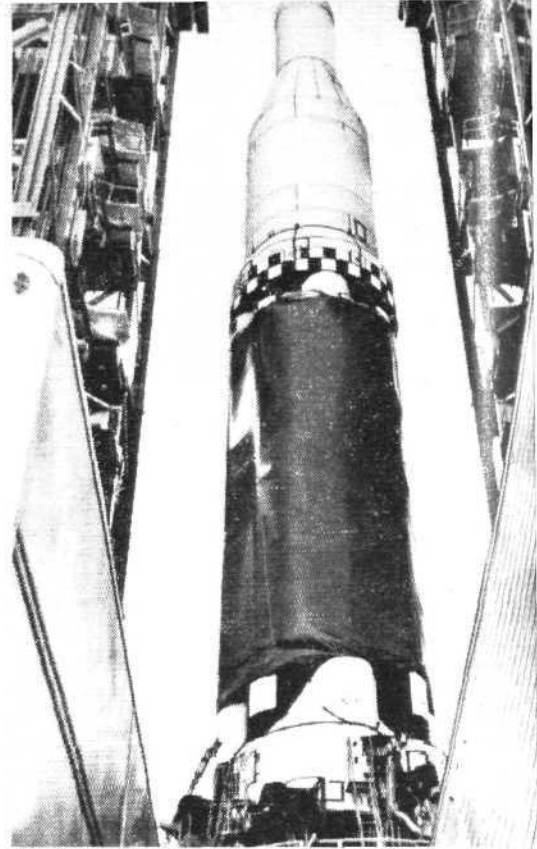
SOVIET SPACE HISTORY DISCUSSED

Speaking before the British Interplanetary Society in London on September 22, Dr G. A. Tokaty of Northampton College Department of Aeronautical Engineering said that rocket engineers in the Soviet Union were regarded as members of an élite branch. Those responsible for the general guidance of this branch also formed a high quality élite, and many of the top men involved in Government ministries and establishments were engineers and experts. This fact, together with background essentials of a national belief in space exploration and a plentiful supply of well-trained technologists, not unexpectedly led to a methodical and logical programme.

Dr Tokaty's lecture, entitled *Soviet Space Technology*, included a full account of the historical background to the Soviet Union's space achievements. The problem of the supply of technologists, he claimed, had been solved by the end of the 1930s, and there were now some 51 higher institutes of aerospace technology in the USSR in addition to university departments and technical colleges.

As far back as 1924, Dr Tokaty stated, the Soviet Government was enthusiastic towards space exploration, and by 1930 there were in existence three Government-sponsored societies and groups engaged in studying the step to be taken in moving from theory to practical achievement in rocket technology. A number of experimental rockets were built during the 1930s, including a two-stage vehicle in 1936. In 1940, the speaker suggested, the Soviet Union, was as advanced in ideas and projects in this field as "any other European country."

Mounted on the pad at Cape Canaveral after its sea and canal journey on a special barge is the massive Saturn booster. Its first test flight is scheduled to take place next month



War-time German work at Peenemünde, Dr Tokaty continued, did not assist the Soviet Union in the immediate post-war period as much as had been popularly supposed. At least 130 leading German experts from Peenemünde went to the USA, while the Soviet group at Peenemünde (of which Dr Tokaty was a member) "did not get hold of a single outstanding German rocket scientist"—only working engineers and technicians. As for the V2s, no whole example was obtained—only parts and damaged vehicles.

By 1946, series V2 production was under way at Peenemünde, and in September 1949 series production of improved versions of the V2 began in the Soviet Union. Dr Tokaty's main conclusion from an appreciation of the German work at Peenemünde was that although the USSR lagged at that time on the production side of rocket technology, the Union was not behind in theoretical and other aspects. In 1952 the Soviet Union began thinking of a co-ordinating centre for space research, and later this was formed under academician Leonid Sedov.

Confirming the differences between Soviet rockets and those "of another country," Dr Tokaty gave two hints. First, the rocket engines shown in published Soviet drawings of the three-stage TT-1 (shown with Sputnik 1 payload) and of other rockets were all depicted as having some form of spiral construction. Secondly, it was "not only fuels" which provided high thrust, although the Soviet Union had possessed since 1950-51 high-energy fuels which differed from "those somewhere else." Although the immediate aims of Soviet space exploration should be regarded as scientific and strategic, its general purpose stemmed from an even more basic concept. As Tsiolkovsky had expressed it, mankind simply would not remain for ever on this Earth.

On the subject of an orbiting manned space station, Dr Tokaty said "it is known that there are a group of experts in the Soviet Union working on this." The available thrust of Soviet boosters, he thought, would be doubled over the next three to five years.

The three foundations on which Soviet space achievements had been based, Dr Tokaty concluded, were (a) excellent mathematical, mechanical and analytical traditions; (b) the very intensive attention given by the Government to rocket technology and (c) the completely reorganized educational system, dating back to the 1930s.

AEROJET'S GIANT SOLID BOOSTER

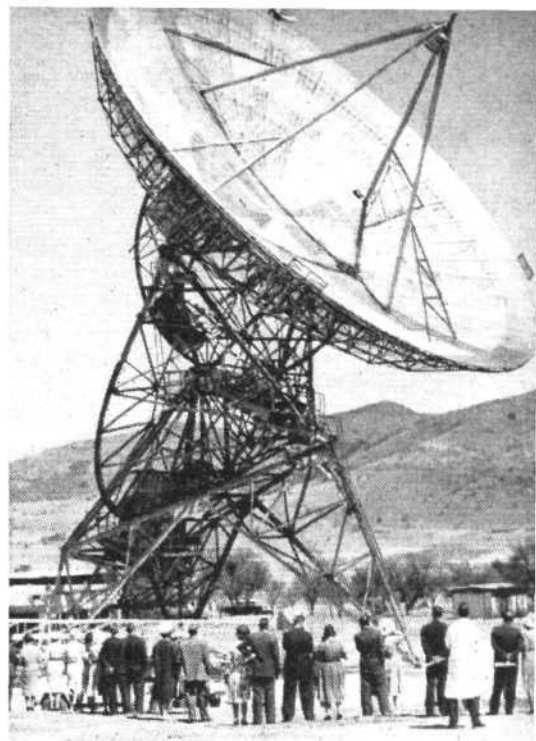
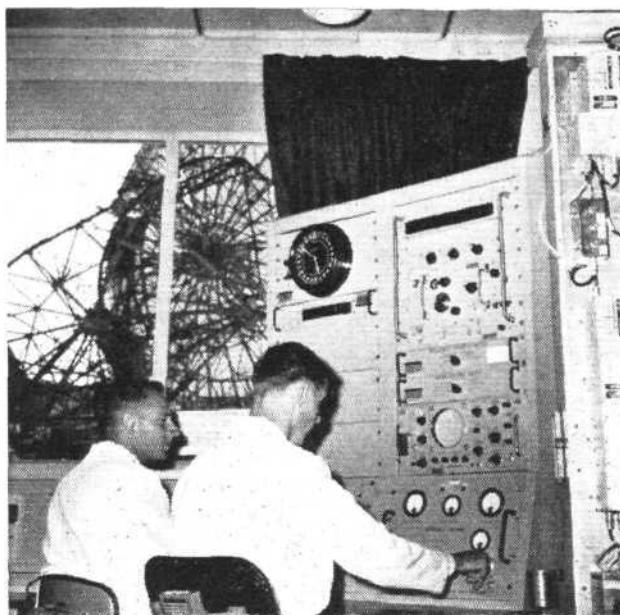
In our Sept 7 issue (page 363) news was given of the successful static firing by Aerojet-General Corporation of a solid-propellant booster giving a thrust of more than 500,000lb. At that time it was not possible to report with assurance upon the precise configuration and weight of charge (reports had given the weight as 75, 78 and 80 short tons). It is now learned that the charge weight was actually of the order of 100 short tons, disposed in four segments as previously reported. The lower weights referred to earlier three-segment boosters developed by the company, one of which was successfully fired in June and reported upon in our July 6 issue. At present the trouble-free nature of this programme has been most encouraging.

Photographed from the Mercury spacecraft launched from Cape Canaveral on September 13 (this page, last week): a tropical disturbance in the Atlantic, which NASA "could not confirm" as hurricane Esther. This picture was taken approximately 18min after launch



Missiles and Spaceflight . . .

Located at Hartesbeesthoek, near Krugersdorp, the South African station forming part of the NASA Deep Space Instrumentation Facility was officially opened on September 8 by Dr N. Diederichs, Minister of Economic Affairs. In addition to the 85ft-diameter radio telescope (far right) used for space-probe tracking, the station includes a Minitrack satellite-tracking facility. At right is a view inside the control room



IDEAS ON COMMUNICATIONS SATELLITES

A review of US industry proposals for satellite communications systems was given earlier this year at the first National Conference on the Peaceful Uses of Outer Space—held at Tulsa, Oklahoma—by Mr Herbert Trotter, president of General Telephone & Electronics Laboratories Inc. The proceedings of the conference have just been published by the US Government Printing Office, and the following account of Mr Trotter's review is taken from this publication.

The satellite systems that have been proposed by industry [Mr Trotter states] fall into three types:—

(1) About 50 satellites in random polar orbits at a height of 2,000 to 8,000 miles.

(2) Ten satellites in precise equatorial orbits at a height of 6,000 miles with precise station-keeping so that they maintain equal spacing around the equator.

(3) The 24-hour or stationary orbit at 24,300 miles.

In their proposals to the Federal Communications Commission, the companies answering the enquiries had a variety of methods for the technical operation and business management of a world-wide satellite system:—

(1) American Telephone & Telegraph Co proposed that their random polar-orbit system be jointly owned by the US international communication common carriers and their counterparts abroad. The US ownership would be divided according to the estimated use by each of the participating carriers.

(2) The General Electric Co proposed that the ten station-keeping equatorial-satellite system be a joint venture owned by interested companies with no company owning over ten or less than five per cent. Their system would allow five ground stations to talk to one another through one satellite. The twelve channels through each

satellite allow four 252-voice channels and eight 24-voice channels.

(3) General Telephone & Electronics proposed a highly flexible world-wide communication system having the characteristics that (a) each ground station is capable of communicating with every other ground station; (b) each two-way communication channel through the satellite can be used by any pair of Earth terminals; (c) channels are allocated to customer common-carrier companies only as the demand for service requires. They proposed the formation of a commercial satellite communications company to be owned by all existing and future domestic and international US communications common carriers that elect to participate with availability for use by all, regardless of ownership.

(4) Hawaiian Telephone Co wants to participate financially in the system that will serve the Hawaiian Islands.

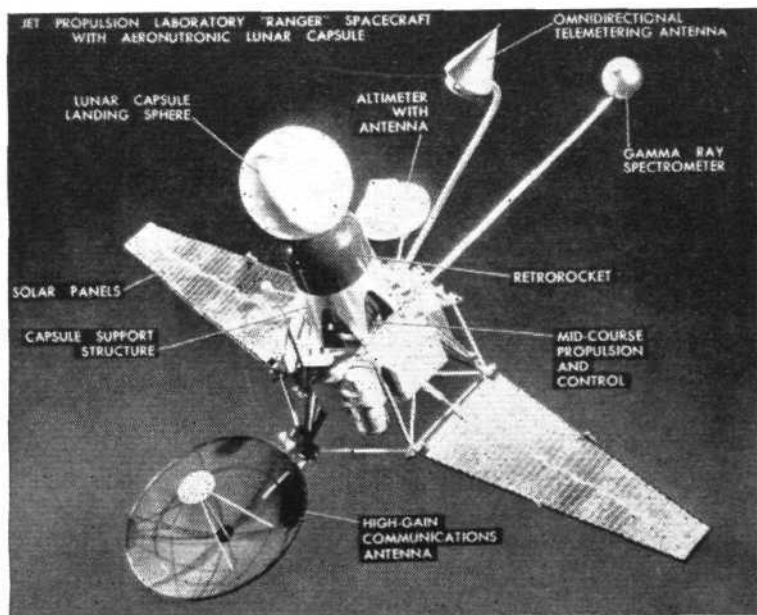
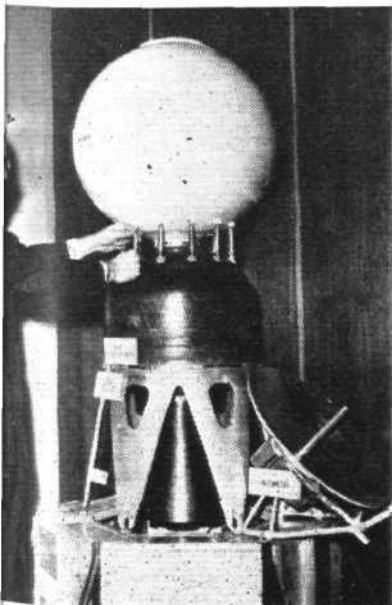
(5) International Telephone & Telegraph proposed that ownership of the system be in proportion to use but with right to lease facilities if ownership is not desired.

(6) Lockheed proposed a satellite system identical to General Telephone & Electronics. It proposed "Telesat," and "common carrier" concept with ownership by three groups: (a) US common carriers; (b) other private industrial and commercial companies; (c) the general public.

(7) Press Wireless proposed that each US international communication carrier should be allowed to use satellites either by lease or purchase.

(8) RCA proposed the stationary satellite system with each US carrier and each overseas administration owning its own ground stations and allowed to operate through the satellite.

(9) Western Union Telegraph Co proposed a joint common carrier owned by private industries and providing service to each common carrier through their ground connection to the satellite base.



A model of Ford Aeronutronic's lunar capsule and retro-rocket (far left) was shown for the first time on September 14 at Newport Beach, Cal. The annotated drawing is of the Ranger spacecraft—developed by the Jet Propulsion Laboratory, Pasadena—in which the capsule will be carried. Released from the vehicle some 25 miles from the surface of the Moon, it will strike at about 150 m.p.h.

VTOL Problems Discussed

PAPERS FROM THE CONFERENCE: AERODYNAMICS, PROPULSION, DESIGN AND CONTROL

ONE of the three main themes of the recent Anglo-American Aeronautical Conference in London was that of aircraft capable of vertical and short take-off and landing. Among the general papers presented, *Looking Ahead in V/STOL*, by George S. Schairer of the Boeing Company, will undoubtedly become recognized as a reference "classic," and the forecast of types included in this paper makes an excellent introduction to this review of some of the points made and discussed at the meeting.

Helicopter The helicopter appears to have no serious competition in those applications where silence is required [Mr Schairer declared] or where long hovering is needed. Where the distance to be flown is short, speed will usually be unimportant and the helicopter is likely to remain supreme. By a drag clean-up and by proper blade-aerofoil choice and by boundary-layer control, helicopters can be built with speeds above 200kt. Much improvement remains to be accomplished in this area. These improvements will increase the range of the simple helicopter as much as 30 per cent. The compound helicopter is a compromise type and pays a large weight-empty penalty for a relatively modest improvement in range and speed. It is difficult to predict the extent to which these small improvements will justify bringing the compound helicopter into common use. The compound type will be little better than the conventional helicopter unless the rotor can be both unloaded and slowed down. This will raise the question of what is the maximum tip speed ratio, μ , which may be used on an unloaded rotor.

The fail-safe provisions of helicopters are less than those of conventional fixed-wing aircraft. It is likely that major advances can be made in the development of helicopter fail-safe design in the future, particularly for the larger sizes.

Tilt Wing and Tilt Rotor Substantial drag can be saved by turning the rotor or propeller shaft axis into the wing. Several different arrangements of vehicles are possible in which a propeller or rotor is used for vertical lift. In these cases the propeller or rotor axes can be tilted into the wind for cruising flight. Such aircraft, if provided with reasonable wing span, will have much better range and speed performance than conventional or compound helicopters. The drag of a rotor with the shaft into the wind is substantially less than that of a rotor, even windmilling, with the shaft at right angles to the wind. If the rotors or propellers are relatively small in diameter and large engines are installed, the aircraft will have enough power to fly at high speed as well as at long range. The range will be relatively independent of the installed power, but the speed will vary with the installed power, as will the hovering fuel consumption. The hovering fuel consumption of a highly loaded propeller will be acceptable for most uses. Tilt-wing or tilt-propeller types are likely to have attractive range-payload-hovering performance. For those circumstances where the increased velocity of the downwash does not rule them out, and where the increased noise over that of a helicopter is acceptable, the tilt-wing or tilt-propeller types can demonstrate excellent range-payload-speed performance.

The question of arrangements of these aircraft is likely to be determined by considerations of stalling of the wing and other surfaces. It is not obvious that the future aircraft will have any particular currently used relationship of tilting propellers to wings and to bodies, and so on. Certainly there are arrangements of wings

and propellers where the interactions and flow circumstances are such as to provide good flow characteristics. These are the schemes which are likely to prevail. Much wind-tunnel testing to find these suitable schemes is urgently needed. The high speed of these tilting-propeller types may well be dictated by the question of how fast it is practicable to operate the propeller, since the propeller will be many times larger in blade area than the corresponding propeller for a normal aircraft. The tilt-wing built to operate at moderate speeds is likely to be very successful. The very high speed tilt-wing is likely to have great propeller or rotor development problems.

Tilting wing and propeller aircraft are quite efficient for cruising operation and hence can gain materially in payload and in range when over-loaded and flown in the STOL mode. It is likely that all such aircraft will be designed with provisions for normal operation in the STOL mode, as well as in the VTOL.

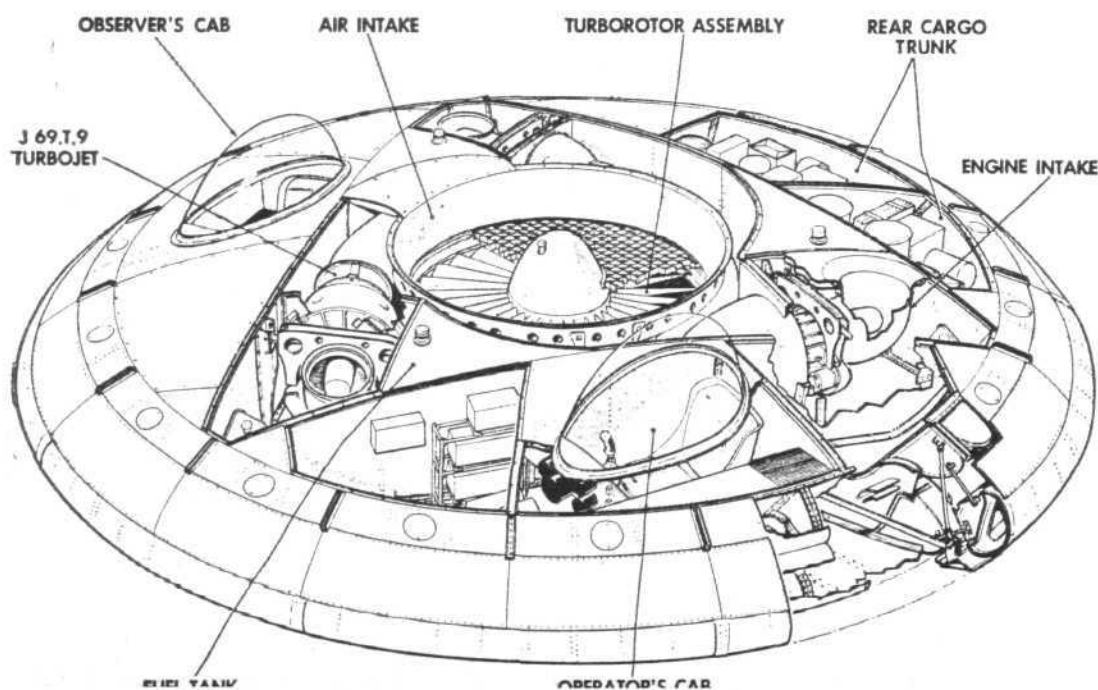
All current tilt-wing and tilt-propeller types suffer from great complexity of the mechanical systems. This complexity is largely present to provide for fail-safe operation following the failure of a power unit. This very great complication introduces a lack of fail-safe reliability. The failure of many other portions of the aircraft, including much of the gearing, shafting, propeller structures, and some of the control systems, must be considered. These tilting schemes have all of the propulsion systems tied together and include several times as many components which must not fail as are found in a conventional helicopter.

This is the principal deficiency of such aircraft and, unless this fail-safe problem is solved, is likely to limit their application to special usage. Consideration should be given to removing the cross connections and installing two higher-power engines in each nacelle so that a much larger percentage of the mechanical elements of the aircraft can have provision for failure. Preferably the standard of failure provision should be as good as that on modern turbo-propeller aircraft.

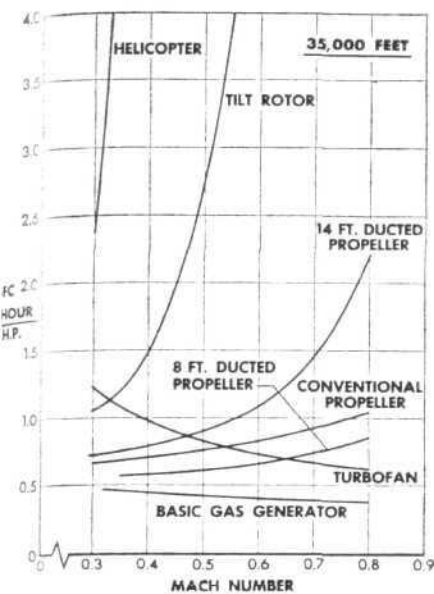
Jet Lift and Fan Lift Aircraft Jet and fan lift aircraft appear to offer good range-speed-payload performance where substantial range is required and where hovering requirements are at a minimum. Where these aircraft are subsonic, it is likely that the lift engines and the propulsion engines will be of the turbofan type. These give minimum fuel consumption for both cruising and for hovering. Subsonic turbofan-lift aircraft probably will not require the thrust of more than a fraction of the powerplants in cruising.

It appears likely that all of the engines will be arranged so that they may be directed downwards for vertical take-off and landing. The thrust of a portion of the engines will be available for forward propulsion and cruise operations. This is likely to be at least three engines and probably four, so that the failure of one engine will not disable the aircraft in cruising operations. The tilting requirements on the thrust are likely to require a certain amount of tilt control of all the engines. Vectoring from all the way aft to all the way forward, and vertically, appears necessary for some of the engines.

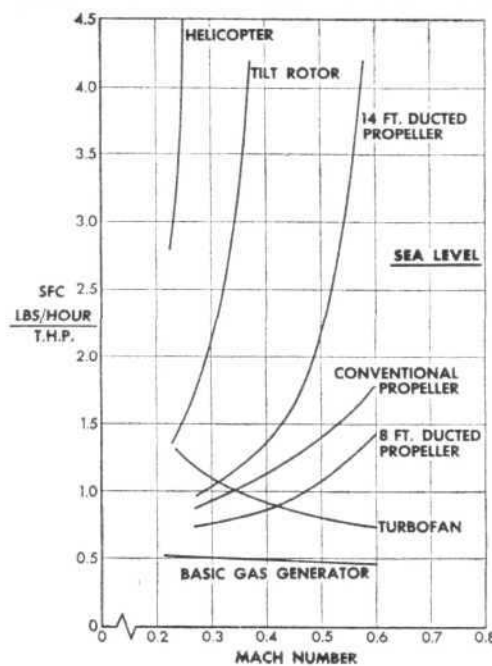
In the area of reliability one finds much difference in philosophy between VTOL aircraft and conventional aircraft. Current commercial passenger-carrying aircraft, as exemplified by the modern jet transports, are designed in such a way that almost any single part can fail at almost any time during a flight without the expectation of catastrophic results. Nearly every structural member is redundant and retains adequate normal strength in spite of almost any



This illustration of the Canadian Avrocar was included in a paper by D. C. Whittle and J. R. Bissell entitled "On the Nature of Aerofoil Characteristics with a Sink Located in the Upper Surface, Including Comparison of Theory with some Fan-in-Wing Experiments." The tip-driven fan is powered by three Continental J69 engines used as gas generators. The aircraft is supported by an annular jet for hovering, and for forward motion the jet is directed to the rear. In the latter case a measure of spanwise blowing is obtained and the rear jet acts as a jet flap



Thrust horsepower specific fuel consumption at rated thrust at an altitude of 35,000ft (left) and at sea level (Schairer). S.f.c. is defined as the fuel flow divided by thrust horsepower remaining to propel the rest of the aircraft, above that required to move the propulsion system itself



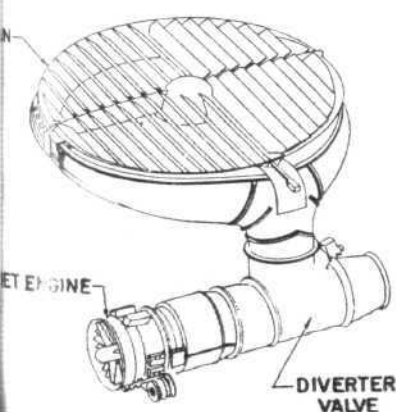
single failure. Powerplants are so designed that almost any failure within the powerplant will not result in the powerplant destroying the aeroplane. In nearly every case, powerplants and similar equipment are installed in such a way that their failure during flight only slightly inconveniences the accomplishment of the flight and a failure is not in itself a major safety problem.

The turboprop-lift type of aircraft is very attractive in those circumstances where a number of people are to be carried, since it is a relatively straightforward matter to design such an aircraft so that almost any structural or mechanical element can fail at any time and still permit safe termination or continuance of the flight. This is the only type of vertical-lift aircraft which appears to give promise of equalling the fail-safe reliability expected of fixed-wing aircraft. Therefore, it is likely that the engines will be divided into enough units to permit safe failure of any one of them. They will be so arranged and controlled that control will be retained, as well as adequate thrust, following the failure of any element of the system.

Much has been said over the years about where to mount engines. It seems likely that in turboprop-lift aircraft the engines will be mounted in nacelles probably attached to the side of the body. Possibly some of the engines will be mounted on the wing in some form of pod. Perhaps some of the units can be mounted in the front or back ends of the body in special space provided for them. In any case, it appears that the engines will always be placed in space provided especially for them. It is most unlikely that there will be spare space in either the wing or the body for the engines. Certainly the engine installation will benefit from specialized attention. It seems most unlikely that the engines will be mounted in the wings.

Turboprop-lift aircraft will have high downwash only in a limited area directly under the aircraft. In those applications where there is a prepared landing spot and where noise is not too important, turboprop-lift aircraft can operate very satisfactorily. Prepared landing spots will seldom have an erosion problem with turboprop engines. Furthermore, when the landing place is specially prepared it is unlikely that long hovering times will be required. Thus, the turboprop type of direct-lift aircraft is likely to operate very successfully where there are prepared take-off and landing spots. The benefits of STOL operation of fan-lift aircraft are large and the penalties relatively small.

Shrouded Propellers Small-diameter shrouded propellers are frequently proposed as a means for getting adequate vertical take-off thrust. Such devices require a lot of power and hence potentially



Left, typical convertible lift-fan VTOL powerplant arrangement (Adamson and Cochran)

Right, lift/weight ratios for engines plus fuel (Adamson and Cochran)

propeller combination without reverting to connecting mechanically the driving systems. Further attention to such aircraft is well warranted.

Short Take-off and Landing In the area of short take-off and landing, it is evident that much attention will be given to vectoring the lifting thrust in the directions which will give shortest possible take-off and landings. It is probable that most current arrangements are inadequate in this matter, but it is likely that the deficiencies can be readily corrected.

Of special interest in the short take-off and landing discussion is the question of blown flaps. It is entirely possible that flaps with extensive blowing will be very attractive for the STOL mode of operation. Further testing of blown-flap arrangements is urgently needed to clarify their characteristics.

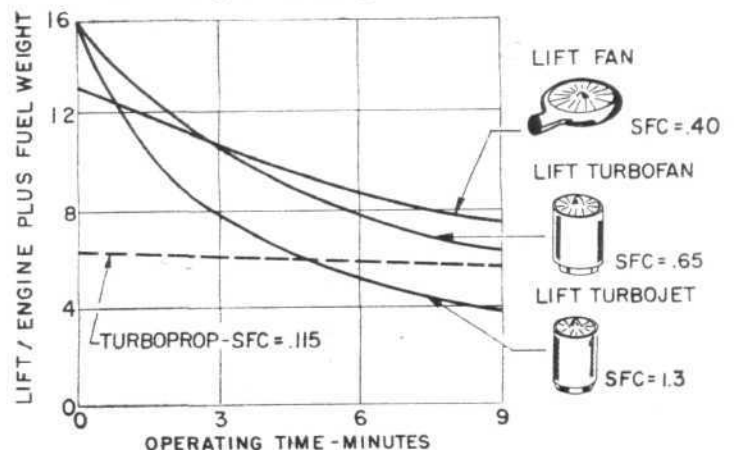
When aircraft with a vertical-landing capability are to be flown long ranges, such as across oceans, it is difficult to understand why the take-off should not be made in the short-take-off mode. It would appear that much attention should be given to aircraft in which short take-offs are used for flight ranges beyond about 1,000 miles, but which provide for vertical take-off with full payload and vertical landing with full payload for short-range operation.

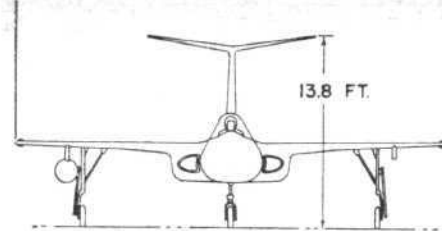
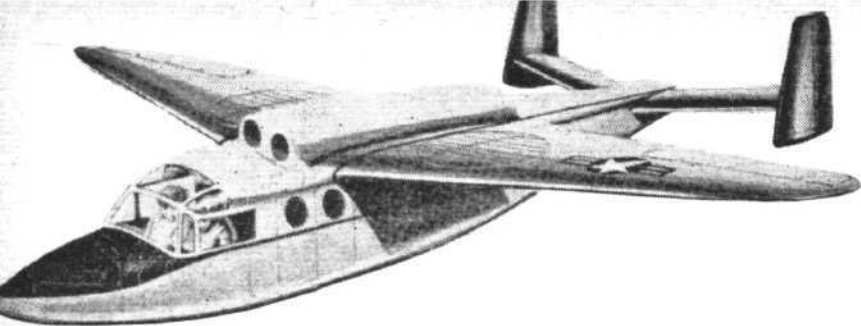
Cranes An aerial crane is a specialized type of vertical take-off aircraft where range is usually of little or no importance but where hovering endurance is exceedingly important and efficient weight-carrying capability is primary. The data available to the author indicate that lightly loaded rotors or propellers will be the basis for such aerial cranes. The primary attention will go into obtaining satisfactory light, efficient hovering performance.

Engine-out Safety

The subject of engine-out safety in VTOL aircraft, mentioned by Mr Schairer, was discussed in detail in the paper *Some Considerations In Selecting VTOL Propulsion Systems* by A. P. Adamson and D. Cochran of the General Electric Company. The problem, the authors stated, had been approached in two ways: the lifting device might be interconnected; or many small lifting devices might be used. Both methods required a degree of engine over-sizing or emergency ratings if engine-out aircraft climb performance was to be retained. Interconnected systems had the advantage that roll torques due to engine power variations which might be caused by hot gas re-ingestion would tend to be smoothed out.

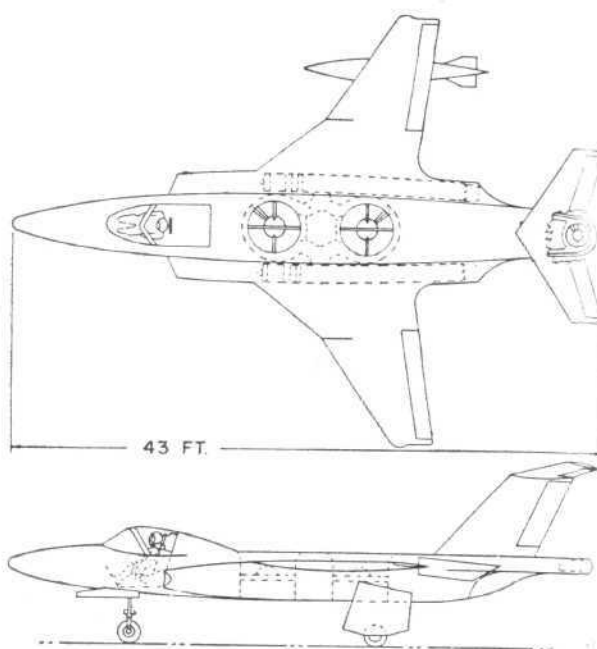
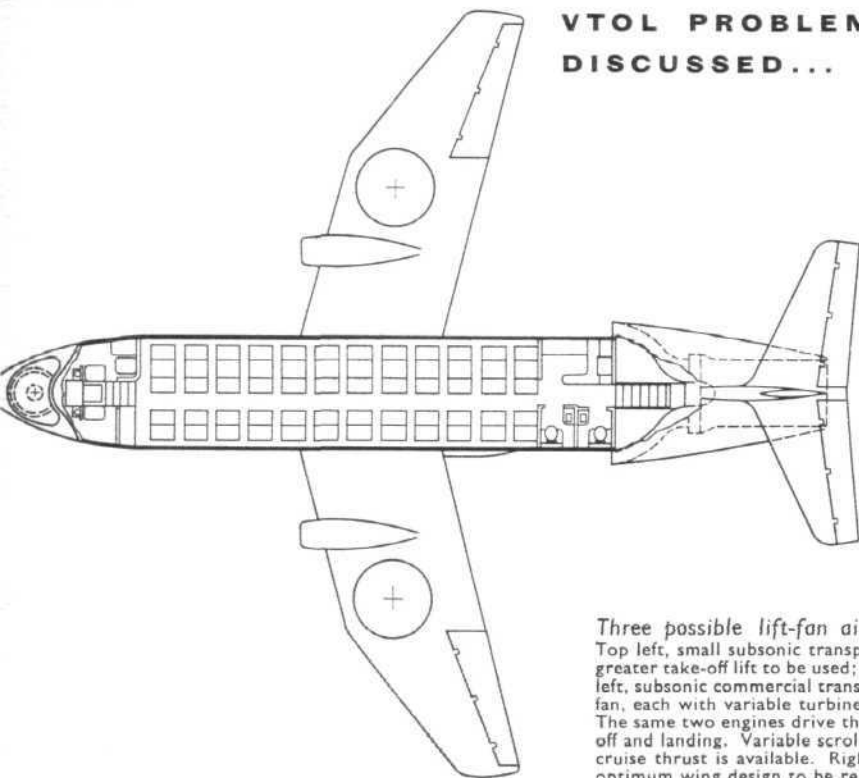
Lift fans would generally be interconnected by means of hot gas ducts, so that the aircraft would remain balanced in the event of a single engine failure. Direct-lift jet engines or turboprop engines would not be interconnected, and the opposing engines would be shut down to maintain balance. Lifting propellers would generally be interconnected by shafts and gears to maintain balance in the





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VTOL PROBLEMS DISCUSSED...



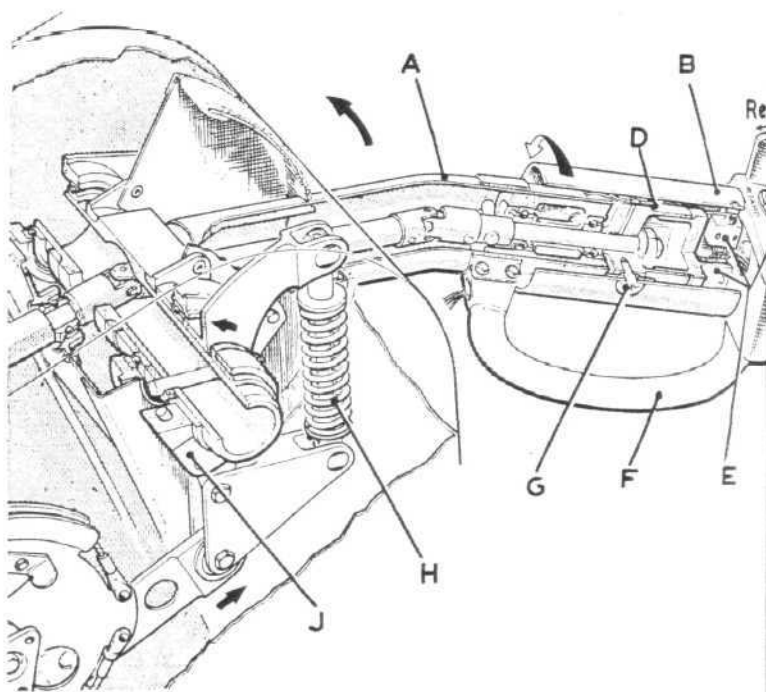
Three possible lift-fan aircraft configurations illustrated by Adamson and Cochran in their paper. Top left, small subsonic transport and liaison aircraft whose wing-mounted fans permit a larger fan area and hence greater take-off lift to be used; a thrust equal to approximately three times cruising thrust is available for take-off. Lower left, subsonic commercial transport in which two engines drive a tail-mounted fan, and, through valves and ducts, a nose fan, each with variable turbine admission arcs enabling power to be transferred fore-and-aft for aircraft pitch control. The same two engines drive the rear fan during cruise, and two additional engines drive the two wing fans during take-off and landing. Variable scrolls on these fans provide roll control, and a take-off thrust of four to six times maximum cruise thrust is available. Right, small high-subsonic reconnaissance aircraft. Here the fan-in-fuselage layout permits optimum wing design to be retained, and a take-off thrust equal to 2.5 times cruise thrust would typically be available.

event of engine failure. None of these provisions was ideal. The interconnecting ducting occupied a substantial volume, placed serious constraints on the mechanical arrangement of the aircraft and, in military aircraft, was vulnerable to damage by gunfire. Fortunately the duct would generally be unpressurized except at take-off and landing.

Although the use of many small engines, together with accompanying control-system and fuel-system duplication needed to retain true multi-engine reliability, was "a joy to contemplate" for the engine-maker, this joy was not universally shared. Furthermore, any system which required the rapid and automatic operation of engine shut-down equipment (or other power-transfer equipment) to enable the pilot to retain aircraft control in the event of engine failure must be viewed with suspicion, since automatic shut-down and switching equipment might be less reliable than were the engines. In addition, the start-up problem when preparing for landing would need careful handling to avoid the application of serious transient torques to the aircraft.

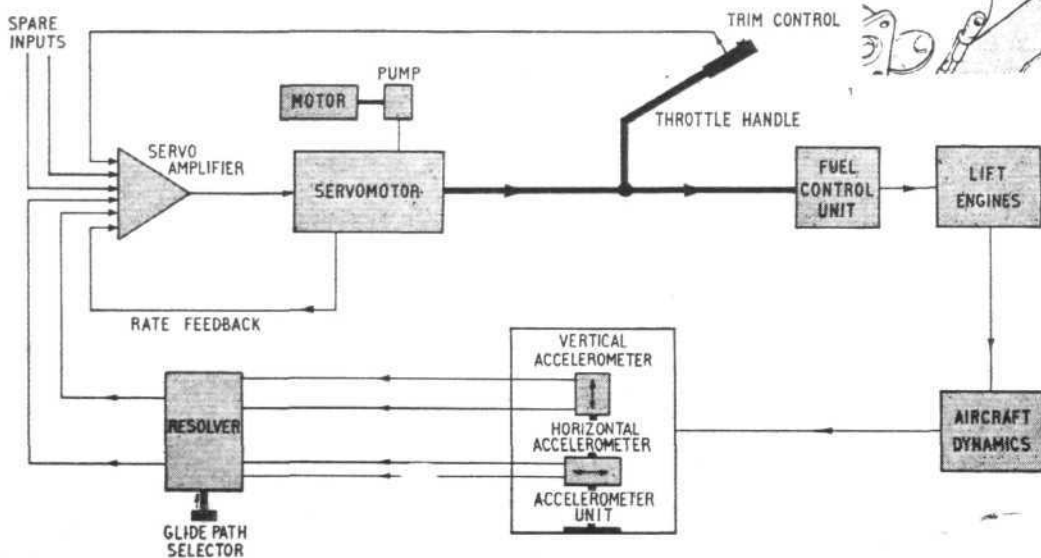
The shaft-interconnection system was heavy, seriously restricted the designer's freedom in aircraft layout, and was apt to present severe maintenance problems. "Some studies have indicated that a shaft system of acceptable weight may cause as many accidents as it prevents."

The lift-fan and lifting-propeller systems, even when intercon-

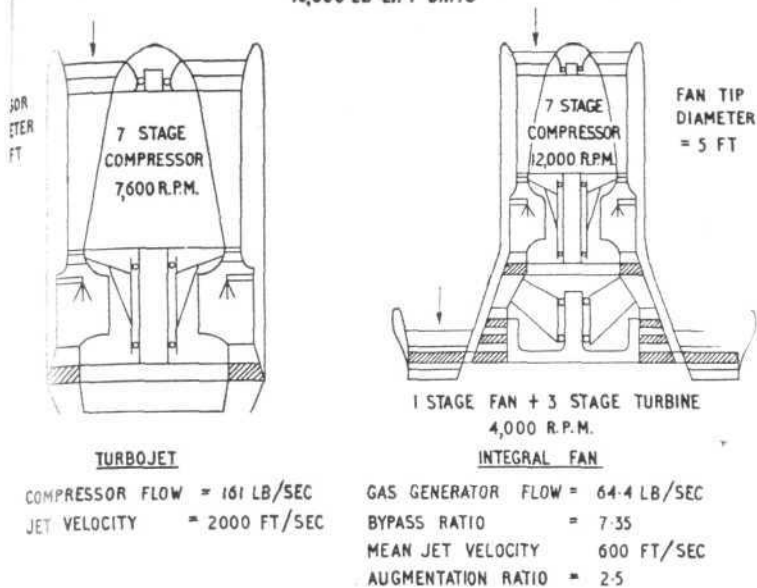


Above, SC.1 lift throttle, from paper by J. J. Foody.

A, lift-engines throttle control tube (raise to open); B, propulsion-engine throttle control twist-grip; C, lift "engine tilt" switch; D, leaf spring; E, lift compensator master switch and microswitches; F, switch support tube and cable conduit; G, pivot pin; H, over-travel mechanism; J, friction block (adjusted by knob on console).

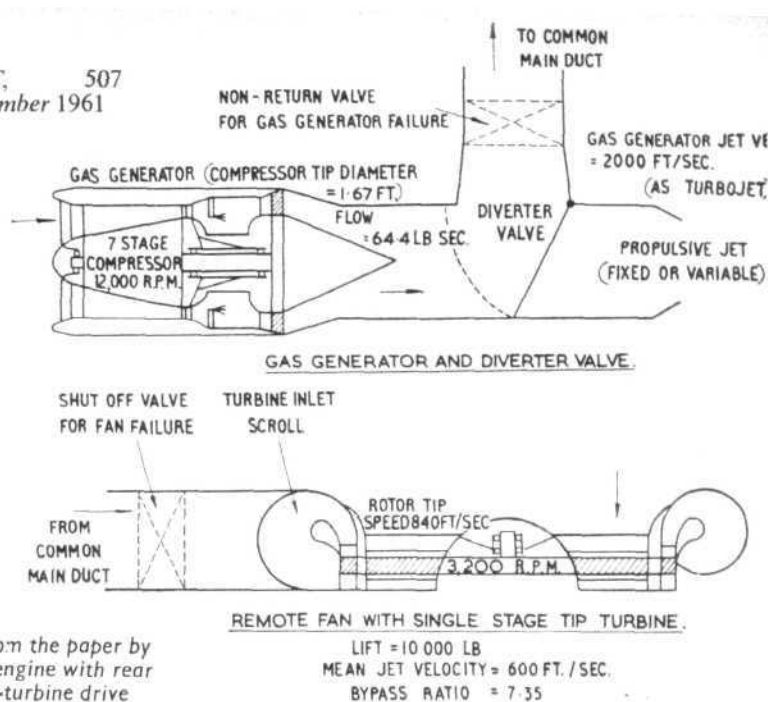


Left, block diagram of the lift compensator used on the SC.1 and described by J. J. Foody (see text).



These two diagrams showing specialized lightweight power units for VTOL use are from the paper by Sutcliffe, Merrick and Howell. Left, a comparison between turbojet and integral fan engine with rear fan, both of 10,000lb thrust or lift. Right, remote lifting fan configuration with tip-turbine drive

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nected, were absolutely dependent upon the continued integrity of the lifting element, even though failure of the power element could be tolerated. In this respect they resembled the helicopter, where safety was dependent upon the rotor. The lift fan was a relatively simple device which operated only for short periods, and hence the required reliability should be readily achievable. Lifting propellers could draw on the extensive experience and highly developed technology used in cruise propellers and again should be able to attain the required reliability.

All of the systems were subject to lift loss if engine failure occurred. If full take-off lift was to be retained, the engines must be oversized or over-rated by one-third in a four-engined lift fan or propeller-powered interconnected system; or by one-quarter in a ten-engined non-interconnected system. Exceptions would occur for aircraft having the lift devices clustered at the aircraft centre of gravity, or for aircraft using two or more engine sizes.

"Perhaps the final solution will employ one large fan in the centre," the authors concluded, "driven by numerous peripheral engines. As a matter of interest the four-engined interconnected system loses only 18 per cent lift if one engine is shut down. Many configurations will be able to tolerate such a loss, provided a modest-sized dead man's zone is avoided. The engine-out situation can be considered properly only as part of the overall aircraft control problem, but it has been separated here to simplify the discussion."

Also included in the paper by Adamson and Cochran was an account of work on tip-turbine lift-fan engines carried out by the General Electric Company under contract with the US Army and with the USAF in co-operation with NASA. This work is illustrated in a number of the accompanying diagrams.

The company, it was reported, had been testing since December 1959 a lift fan employing a J85 engine and fitted with exit louvres used to direct the exhaust flow. The J85 nominally produced about 2,500lb of thrust, and the fan design lift was 7,430lb. Static testing had also been carried out with fan-in-wing and fan-in-fuselage installations. A full-scale fan-in-fuselage model had been tested in the NASA 40ft x 80ft wind tunnel at Ames Research Center, and fan-in-wing model tests were scheduled for the near future.

The authors gave the following main conclusions from this programme:—

- (1) The inlet, originally judged to be aerodynamically very difficult, had given excellent performance.
- (2) The fan possessed good mechanical life and reliability.
- (3) The diverted valve used to direct the engine exhaust on to the fan had demonstrated good life and reliability with low aerodynamic loss.
- (4) Aircraft pitch-up moment in transition was controllable by a moderate-sized tail together with hover reaction controls, and was predictable to a degree from a knowledge of the aircraft configuration.
- (5) Overall aircraft and engine aerodynamic performance indicated that "little difficulty should be encountered in adapting conventional aeroplane aerodynamic configurations to VTOL use with lift fans installed in the wing or fuselage."
- (6) The exit louvres provided ample thrust to propel the aircraft forward well in excess of stalling speed so that adequate transition speed margin was available.
- (7) "Lift droop," i.e., decay of lift as the aircraft moved forward, had not been a problem.
- (8) At constant engine-throttle setting the variation of fan speed with forward flight speed had been small, indicating that any fan speed-control problem would be negligible.

- (9) Fan acceleration and deceleration was rapid, and followed diverter-valve position changes or throttle changes in a predictable manner.
- (10) The fan could be started without serious stress problems when the aircraft was flying at transition speed prior to landing. The aircraft could then be decelerated promptly by vectoring the louvres.

Control of the SC.1

In *Control of VTOL Aircraft*, by J. J. Foody of Short Brothers and Harland Ltd, the principles of the Short SC.1 control system were fully described. The paper included an account of the new lift compensator device (illustrated on the opposite page), which works on the following principle:—

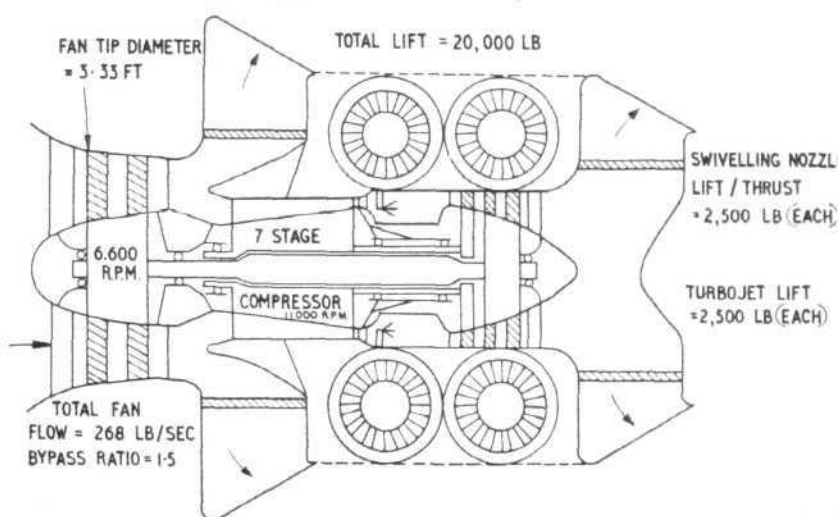
As the aircraft speed is reduced prior to transition and landing, aerodynamic lift is lost and the lift engines must be opened up to compensate for this. This procedure may be quite slow but it imposes an extra burden of control on the pilot which could be taken care of by a simple automatic system. The lift compensator proposed by Shorts consists of two fixed accelerometers with their sensitive axes mutually orthogonal. The accelerometer signals are proportional to the vertical and horizontal accelerations of the aircraft when flying straight and level, and are fed to a resolver which produces a signal corresponding to the acceleration perpendicular to the chosen flight path (which can be set to different levels corresponding to pilot-selected glide angles).

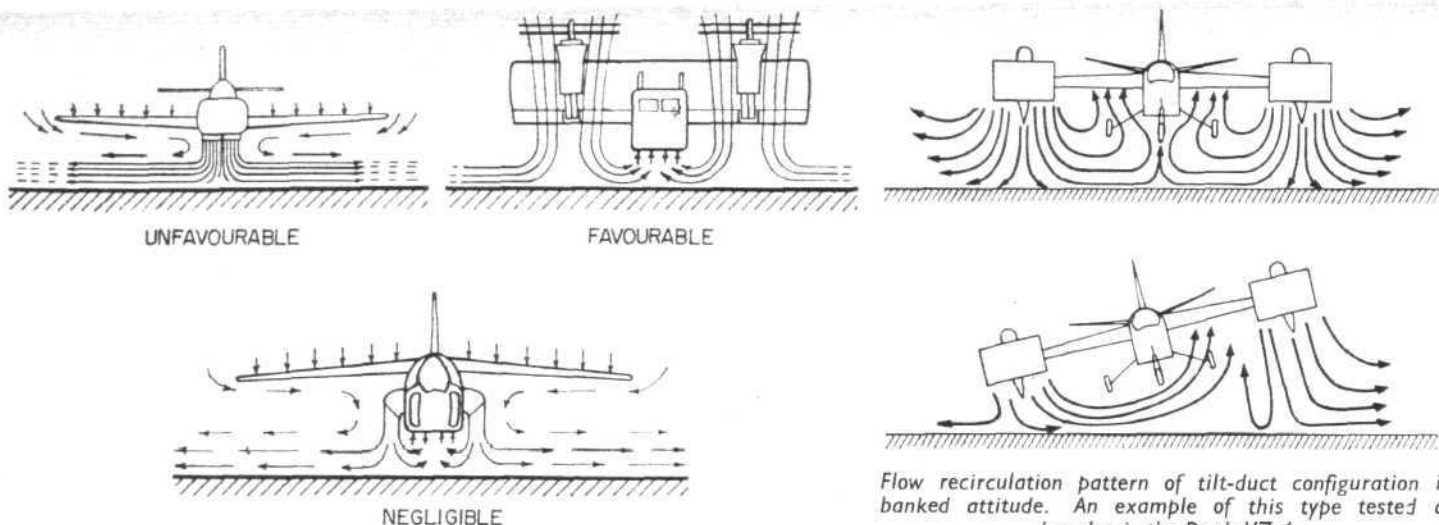
The modified acceleration signals are then fed to a servo amplifier driving a self-contained electro-hydraulic servo-motor. The servo-motor is directly coupled to the lift-engine throttle handle and fuel-control unit, and hence the throttle is driven by an aircraft acceleration signal perpendicular to the required glide path. It is also possible to apply trimming signals to the system by tilting the top of the lift throttle (see diagram).

The main function of the lift compensator is to relieve the pilot of the major throttle manipulation as the aircraft speed falls off, leaving him to supply only the trimming signals. Simulator studies have shown that this form of assistance on lift throttle improves the quality of control in elevation. Control is significantly improved by relieving the pilot of tasks which require only slow response. From this it is argued that, at least in the case of an instrument approach, the pilot is virtually saturated if only pitch and roll damping is provided, and he could not be expected to deal with even a minor emergency.

A paper on *Aerodynamic and Propulsion Considerations of Minimum-Field Aircraft* was presented by P. L. Sutcliffe and

Combination of single lift-propulsion engine and four turbojet lift engines (Sutcliffe, Merrick and Howell)





Examples of VTOL configurations having negative, positive and negligible ground effects from the paper "Ground Proximity Effects Associated with V/STOL Aircraft" (John P. Campbell, NASA Langley Research Centre)

VTOL PROBLEMS DISCUSSED...

V. K. Merrick of Hawker Siddeley Aviation, and A. R. Howell of the National Gas Turbine Establishment. They concluded that, if a performance better than about 1,500ft to and from a height of 50ft were required, some form of deflected thrust system must be used. Whatever the system chosen, it appeared that it would always pay to deflect the thrust that was installed for the normal parts of the flight plan. In almost every case it would also pay to choose the powerplant from cruise and climb considerations rather than degrade these for airfield performance.

If a performance better than 1,000ft were required, more thrust than was normally needed for climb and cruise must be installed, and the authors' studies led them to suggest that this additional thrust might best be provided by specialized lightweight lift engines. In this way it should be possible to minimize the total installed weight of the propulsive/lift system without greatly affecting the climb and cruise performance.

General Discussion

Among the points arising in the various discussion sessions following the V/STOL papers at the conference, it was emphasized by Mr F. B. Greatrex of Rolls-Royce and Mr Cochran of General Electric that the effective use of VTOL machines for commercial transport depended on operation between city centres. Mr Greatrex submitted that two major problems made this development extremely difficult: these were the factors of noise and of engine-out safety. Mr Cochran mentioned that the tip-turbine lift-fan combination was less noisy with engine and fan running than with the engine alone, and agreed that, until the noise problem was solved, practical operation between city centres would not be possible. On the subject of engine-out safety, he reaffirmed his opinion that the lift fan should be considered in broadly similar fashion to the helicopter rotor, although the former was less complicated in many ways.

The type of operation for which VTOL aircraft would be economic, Dr T. P. Wright of Cornell Aeronautical Laboratories suggested, was that of local services for stage lengths between 50 and 300 miles. For smaller distances the helicopter would be more efficient, while for longer distances more-conventional aircraft were more economic. Dr Wright, also, made the point that safety was the key factor in obtaining city-centre operation, either by the use of multiple engines or otherwise.

Flow recirculation pattern of tilt-duct configuration in banked attitude. An example of this type tested at Langley is the Doak VZ-4

The respective merits of using a large number of separate lift engines, and of combined lift/propulsion powerplants using a deflected jet, were argued more than once during the meeting by Rolls-Royce (Mr Pearson) and Bristol Siddeley (Dr S. G. Hooker). Mr Schairer of Boeing said that he was cautious, not about the powerplant, but about the aircraft/powerplant combination. He refused to vote for a particular engine choice until he knew what the aircraft would look like. At present this was uncertain. Mr Schairer asked why, if one had a jet engine driving a lift fan for take-off and landing, one did not keep the fan running during the whole of the flight.

Mr Schairer suggested that we might really be seeking something half-way between the respective schemes favoured by Mr Cochran and Mr Greatrex. One difficulty was the problem of where to add the lift units: they could be carried externally, but this would increase drag; while if they were installed inboard the aircraft structure weight must be increased. For the effective development of VTOL aircraft, the speaker suggested that specific jobs should be delineated; different requirements applied, for example, to city-centre transports, army reconnaissance aircraft, and ground-support machines.

An American speaker mentioned the successful flight record of the Doak VZ-4 tilt-duct aircraft flown by NASA at its Langley Research Center. In spite of what Mr Schairer had said, the propeller shrouds on this machine did not stall, even at extreme angles. The power margin was adequate to give safety on the approach in the event of failure of one engine, but the speaker agreed that a failure in the power transmission system during the short critical period at transition could be catastrophic.

Mr N. E. Rowe of Hawker Siddeley Aviation commented that it seemed that aircraft were now to be made to take the engines of the engine manufacturers, and the lift from the wings was becoming unimportant—a point denied by Mr Sutcliffe. In the civil field, Mr. Rowe suggested, economics were of prime importance: it appeared that 1,000–1,500ft take-off distances might well suffice.

Mr D. M. Jameson of the Air Registration Board asked what happened to the STOL aircraft when it met a tail-on horizontal gust. He felt that the g allowance must depend on the stalling characteristics, and that the assumption made in the studies by Sutcliffe *et al* would only hold for civil aircraft if the stall were mild and gave reasonable warning.

Paper studies were insufficient, said Mr R. A. Shaw of the Ministry of Aviation. The airframe designers must get down to actual powerplant installation design in order to ascertain the installational problems, weights and volumes involved.

FORTHCOMING EVENTS

Oct 2-7	12th International Astronautical Congress, Washington DC.	Oct 11	RAeS Agricultural Aviation Group: "Agricultural Aviation in New Zealand," by G. G. Lindsay.
Oct 4	London Society of Air-Britain: Sixth Annual Test Pilots' Forum.	Oct 12	RAeS (main lecture at Isle of Wight Branch): "Experiences in Constructing and Flying Bell's Recent VTO Aircraft," by J. O'Malley Jr.
Oct 4	BritIRE: "Methods Used for the Study of Vibration in Aero Engines," by D. A. Drew.	Oct 12	Guild of Air Pilots and Air Navigators: Lecture, "Stress and Human Performance," by Air Cdre W. K. Stewart.
Oct 4	Kronfeld Club: Debate on "Gliding should be Government Subsidized."	Oct 12	Radar and Electronics Association: "Space Communications" Part I, "Systems and Equipment," by L. F. Mathews.
Oct 5	International Airline Navigators Council: Pacific Regional Meeting, San Francisco.	Oct 16	RAeS Astronautics and Guided Flight Section: "Packaged Liquid Rocket Propulsion Systems," by W. N. Neat and K. G. Page.
Oct 5-6	Aerodrome Owners Association (Leeds and Bradford): Conference, Harrogate.	Oct 18	Kronfeld Club: "Indian Expedition," by Brenning James.
Oct 6	RAeS Rotorcraft Section: "Integrated Flight Systems for Multi-engined Rotorcraft Transports," by N. Sullivan, J. A. Simpson and a US representative.	Oct 19	RAeS: Fifth Lanchester Memorial Lecture, "From Ship Accompanying Waves to Shock Waves of Supersonic Aeroplanes," by R. Legendre.
Oct 7	Kronfeld Club: Annual Dinner and Dance.	Oct 23-24	International Airline Navigators Council: European Regional Meeting, Paris.
Oct 7-8	Genoa Rally.	Oct 25	Kronfeld Club: Annual General Meeting.
Oct 10	RAeS (Luton Branch): Film Evening.	Oct 30	RAeS Historical Group: Lecture by Sir Frederick Handley Page
Oct 11	BritIRE (South Western Section): "General Introduction to Inertial Navigation," by R. Collinson, and "Components and Techniques Employed in Inertial Navigation Systems," by E. Bristow.		
Oct 11	Kronfeld Club: USAF Film Evening.		

RAeS Branch Fixtures (to Oct 5): Oct 2, Derby, "The SC.1," by D Keith-Lucas. Oct 3, London Airport, "The D.H.121," by J. P. Smith.

BOAC and its Associates



KEITH GRANVILLE interviewed by FRANK BESWICK

THE net loss returned each year by the subsidiary companies of BOAC has been one of the most conspicuous and exasperating features of British civil aviation. The persistence of some of these deficits has bordered on the grotesque. Financially, the subsidiary tail has often wagged the corporation dog. There are cases where the ratio of losses made to hours flown has been so great that one feels that a touch of genius was needed to secure such results.

This is not a criticism of any particular man or Ministry. The net deficit ten years ago was a little over £287,000. Solemnly we said in the Commons that steps were being taken; that improvements would result. Each year it has been the same. Always there were special difficulties.

Honest efforts were made. Most recently, when the subsidiaries were put under the general direction of BOAC Associated Companies Ltd, Sir George Cribbitt, as chairman, tackled the problem. No more conscientious and devoted champion of British civil aviation could be found. Yet the fact remains that the net deficit of BOAC AC for 1960-61 was £2,071,000—nearly £960,000 more than in the previous year.

So I put some questions about this phenomenon to the present chairman of the Associated Companies, Mr Keith Granville. One might call Keith Granville a "professional" air transport man. He started with Imperial Airways. He is one of the very few now at the top in Britain who have always been in civil aviation. To him it is a business—to be operated efficiently. He could scarcely have been given a tougher assignment and I was particularly interested to hear what he said. Here is the record of my questions and his answers.

First: about the general thinking on these subsidiaries. They have been justified in part because of their contribution as feeder lines and as a means of maintaining traffic rights, but other airlines contrive to secure rights and traffic without such an expensive supporting network. Is it not possible that these claimed benefits have been over-exaggerated?

No, I think not. It is easy to criticize now but it is worth looking back behind some of the present figures. This policy is not a new one—to some extent it was followed before the war. Look at some of the previous instances where we had a financial interest; there is Central African Airways, where we now enjoy a full partnership, similar equipment, and a pooling arrangement. This position might or might not have existed if we had not had our previous interest. The same applies to East African Airways. We have a successful record with Nigeria Airways and similarly with Ghana and others. Take into account the present partnerships, plus sales of British equipment, and it isn't a depressing picture.

Nevertheless, it remains true that there are other companies—American operators, for example—who do not rely on similar arrangements?

Not to the same extent, it is true, but much of what we have done has been in colonial territories. Someone has had to help along these countries and it is reasonable to expect that it should have been Britain.

That brings me to the other justification for this policy—that assistance has been given in accordance with Government requirements; how far is this now true?

There is only one case in which we have had a definite request from HMG—in Kuwait. But on the other hand we have not exactly been discouraged in helping elsewhere.

If you have not been under pressure to get in, am I not right in saying that you have been under real pressure to stay in when you would have preferred to get out?

You can say that, but today the position is completely clear; the decision to go in, stay in, or to come out, is one for us to make on the basis of our own commercial judgment, without any Government pressure at all.

If a commercial judgment is now the only criterion, how can you justify maintaining this financial support on the present scale?

In the first place, not all these companies make losses. Aden Airways shows a small loss this year but it has previously broken even, and will do so again; Borneo Airways is a borderline operation—it had a £7,000 loss last year but will make a profit this year; Cathay Pacific has returned a profit; Fiji Airways has been doing better and will break even this year; Gulf Aviation has over £9,000 profit; Malayan Airways has a profitable record. All these companies are self-administered, with help from here; they are all providing an excellent service and their contribution to BOAC is extremely valuable. Unfortunately, their very creditable record has been swamped by the publicity given to the losses of two or three of the other companies. I must say that all the successful companies are considerably aggrieved when they read in the British press sweeping statements about the necessity to slash the associates.

Can we look at those companies which have made the big losses? Middle East Airlines are not your responsibility now, but how much money was lost altogether there?

I cannot give any specific figures beyond those that will be published in next year's accounts.

You will have seen that the chairman of MEA has issued a statement in which he says that only £1,500,000 was owed to BOAC, although the records show that something between £5m and £9m has been lent; how are these figures reconciled?

I prefer not to comment, though one can say that losses of recent years have been written off by us.

One of the other items in Sheikh Alamuddin's statement is that the company has made a profit in the last two years whilst BOAC's accounts refer to a loss for the three months of £134,000 and a share of MASCO [Mid-East Aircraft Servicing Co] loss for the year of £418,000. How are these statements to be reconciled?

The figures are as published in our accounts, of course, and end at March 31 each year, whilst MEA accounts end at December 31—this sometimes creates a slightly different picture.

The statement also confirms that MEA has taken over MASCO; can you say what was paid and whether all loans will be repaid?

I am not in a position to give figures at the moment.

On the general question of the sale: there have been similar proposals in the past—can you say what was different in the present situation which led to a decision to sell?

It is fairly straightforward. We felt we had done all that a British partner could do in a Middle Eastern company. They are now equipped with British aircraft but they needed more capital for expansion and they had the possibility of raising it locally. This seemed an opportunity for us to withdraw.

What about Bahamas Airways? To many observers this seems a most odd affair. The company is sold and with a great flourish the new owners say they are going to make it pay; yet you buy it back within two years and show a loss in the next accounts of over £400,000. How can this transaction be justified?

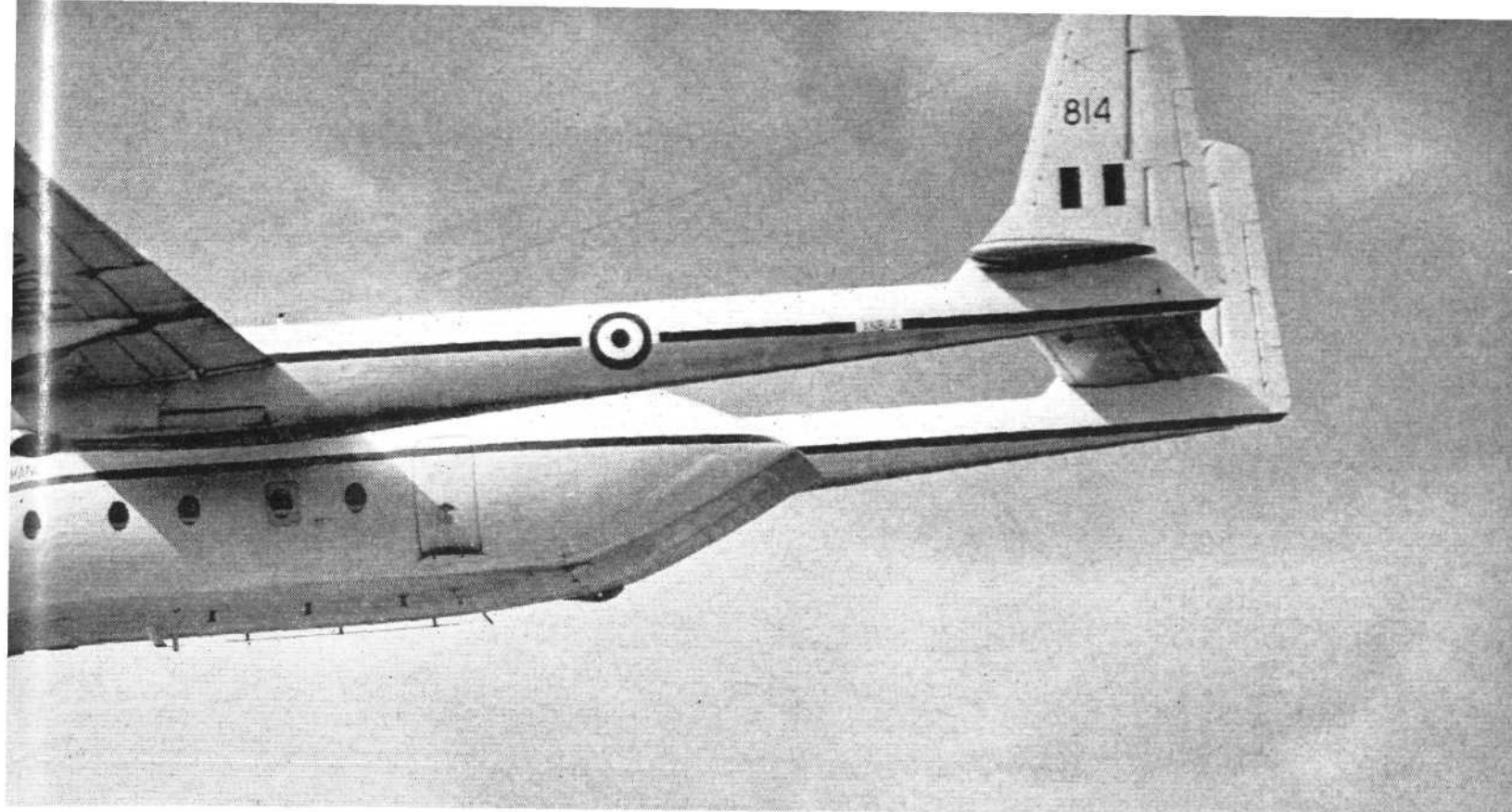
Under its new management, Bahamas Airways got into a very bad way indeed; the decision to re-purchase was a rescue operation based on commercial and moral grounds. We had to face the fact that, if the company had gone under, the licences would have lapsed—or gone to a foreign operator. Moreover, we felt Britain had some responsibility to the Bahamas. The inter-island services have been subsidized but the traffic is increasing, and under Air Cdre Powell's direction the regularity and reliability have greatly improved. The company should soon be breaking even, without Government subsidy. As for the other services, where the losses have been made, the fact is that our continuing interest is a necessary feature of the BOAC operating pattern. (Concluded on page 524)



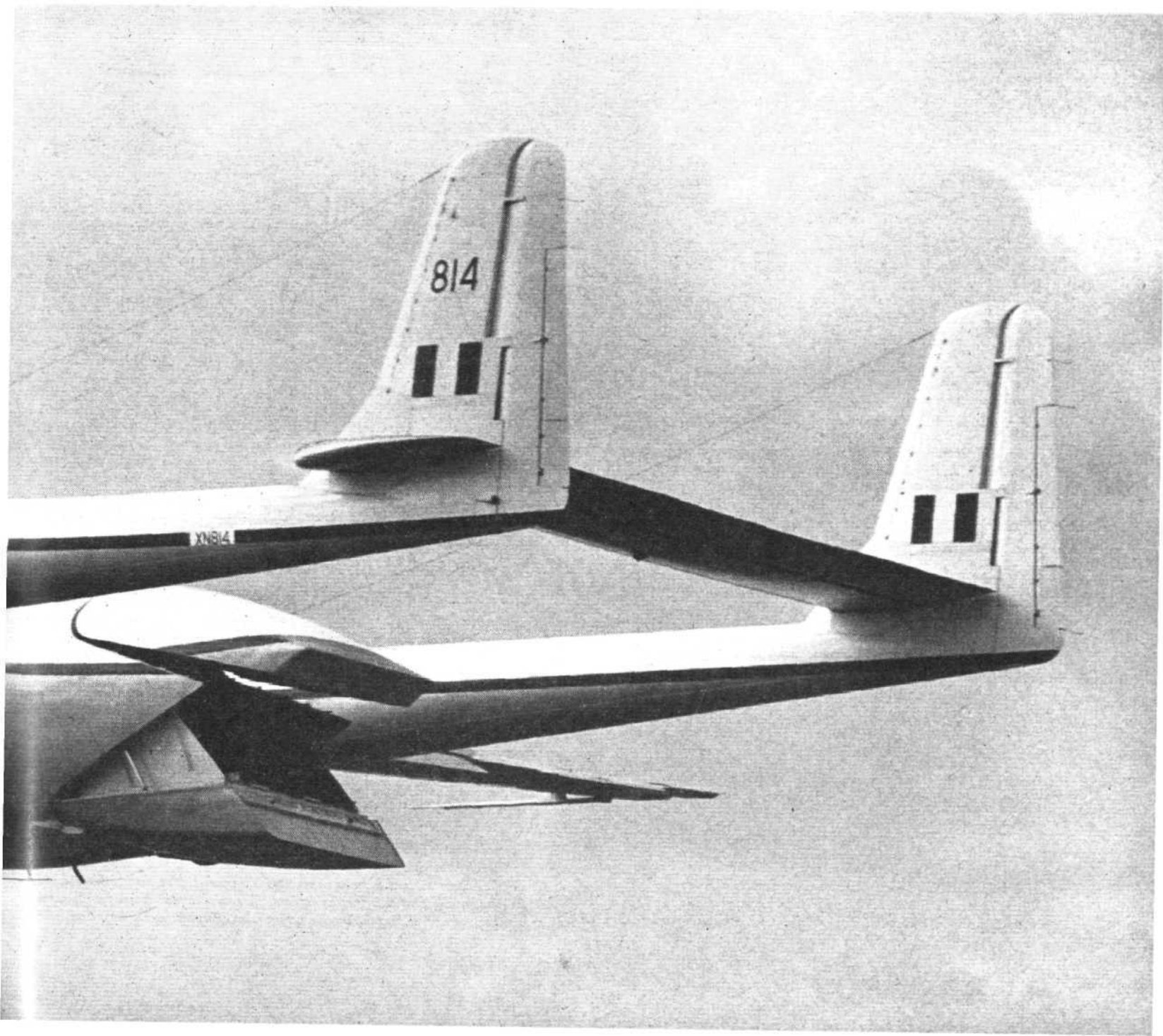
Aspects of the Argosy C.1

CONSIDER on these two pages the Whitworth Gloster Argosy C.1, military counterpart of the Argosy civil freight-and-passenger transport. Regard it, above, approaching with its crocodile-jaw rear doors fully open, as for the dropping of heavy supplies and weapons. View it again, on the right, in the clean condition with the doors closed and flaps raised; and finally, from the port quarter and in somewhat closer proximity, with the doors partially open. Consider this aircraft also as future equipment for RAF Transport Command, for which 56 examples are on order. As a trooper it will take 69 fully equipped soldiers or 54 paratroops, and as an ambulance it has provision for 48 stretcher cases with medical attendants. Average cruising speed is 268 m.p.h., and the maximum payload of 29,000lb can be carried for 345 miles. A 20,000lb load can be lifted for 1,090 miles. Engines: four Rolls-Royce Dart RDa.8s each of 2,680 e.h.p.





ABOVE AND BELOW: "FLIGHT" PHOTOGRAPHS



Sport and Business

AUSTRALIA'S NEW CLUB SUBSIDY SCHEME

THE Australian Government will pay £A637,000 in subsidies to Australian flying organizations—mostly to the aero clubs—in the years 1961-65, the Minister for Civil Aviation (Senator Paltridge) announced recently. This will replace the former subsidy agreement between the Federal Government, the aero clubs, the commercial flying schools, and the Gliding Federation of Australia. The former agreement lapsed on June 30, 1961. The subsidy rate for the financial year of 1961-62 will be the same as in the 1960-61 year—£185,000—but this will be reduced to a regular annual £150,000 over the rest of the four-year agreement period.

The Government has been subsidizing flying training in the Australian aero clubs since 1926. Until recently the potential defence advantage of having large numbers of weekend pilots was considerable, but the Government now considers that the situation has changed. There has been considerable feeling in political and public circles for some years that too much of the subsidy has gone towards social flying. Critics have been pointing to the success of the Singapore Aero Club, which has shown profits without any subsidy and is entirely dependent on unpaid instructors. The majority of Australian instructors are professional pilots. The Australian aero club movement would not last a year without the Government subsidy. The commercial flying schools, naturally, have been very critical of this state of affairs.

To offset this situation, the Government will institute as from the 1962-63 financial year a scheme for the annual award of up to 50 Australian flying scholarships, each worth around £1,000. These will be awarded to young men who undertake to make their careers in flying. The scholarships will assure them of their Private and Commercial Pilots' Licences, but will not take them to the standard at which airline operators can employ them.

At present the only scheme in Australia for training pilots to join the airlines is that instituted by the Royal Federation of Aero Clubs of Australia two years ago. Until then, the Australian lad who wanted to make his career in flying had to learn to fly at his own expense, get through to the commercial licence standard, and then find odd jobs with the clubs or small operators in order to pile up the hours needed by the airlines before he could even apply for a job. The airlines in Australia will not subsidize any scheme for the training of pilots, as they say plenty are available for foreseeable needs.

The Australian airline operators maintained this attitude even when the Federation president, Mr G. A. Lloyd, Jr (a Sydney businessman, who, in his terms as president of the Royal Aero Club of NSW, has revived that organization from a slow death), proposed a pilot training scheme. For £2,000 a lad can now be trained right through to the standard at which he can secure a job with the airlines as a trainee second pilot in DC-3s. The first entry graduated some weeks ago, with 13 of the original 15 successful.

The 15 boys were selected from several hundreds who applied all over Australia after very little advertising. Advertisements have just recently appeared calling for applications for the second course. Members of the original course joined in May 1960 for part-time training at their nearest aero club, carrying out 80 hours' flying in Chipmunks as well as ground training. For their twin-engine training and for advanced theory they all went to the Sydney light aircraft aerodrome at Bankstown and studied full time with the Royal Aero Club of NSW, living in. They did 45 hours in a

Comanche and 40 hours in a Cessna 310B. Lectures covered 200 hours, and included basic turbine engines (50), navigation (50), radio (ten), airline administration (ten), performance (ten), aviation medicine (ten) and PT (50). Many of the instructors were supplied by the airlines and the Department of Aviation.

The whole organization is controlled by a former RAAF group captain, Brian Walker, DSO, who was a de Havilland test pilot in the postwar years. The cost of his salary (and his actual appointment) was carried by a contribution from a local well-wisher outside the industry. The airlines have not put a penny into the scheme, though they did provide free air travel for Walker and for the people engaged in the scheme. The boys had to pay the whole of the £2,000 themselves. Despite the promises made by the operators, who undertook to give employment as pilots to the graduates, some of the lads are securing only part-time employment because of the current depressed state of the industry due to Mr Menzies' credit squeeze.

The Federation, on making up its books, found it was several thousands of pounds out of pocket on the scheme, and appealed to the operators to put in £250 each to help. It is a matter of record that they have had the greatest difficulty in getting this pocket-money out of Ansett-ANA and TAA, and that the first to send the cheque was the little MacRobertson-Miller organization. Two banks, an insurance company, and some other firms have also contributed, with a grace that should shame the airline operators.

The Federation proposed that the operators put up half the money as a scholarship system, but this was refused. The operators came back with a proposal that they should look over the lads at the end of the part-time period and those whom they considered suitable would be loaned £1,000 at 5 per cent interest, the money to be recouped by the operators from the lads during their first years of employment.

The Federation now has a plan to take lads who have already secured their commercial licences and to give them a full-time six-month course at a cost to each of £1,700. Any more all-through courses would cost each lad £2,500. The intake is being raised to 30 a year over this double system. It is understood that the Department of Civil Aviation will station one of its Aero Commanders at the Melbourne light aircraft aerodrome, Moorabbin, to allow the Royal Victorian Aero Club to run a second full-time course at the same time as the Sydney course.

The Government's decision to award 50 Australian flying scholarships from next year will, of course, make a great contribution to the Aero Club Federation's scheme. Whether the operators will now be shamed into contributing to the scheme is not yet known. They have a different outlook to the Department. DCA claims that in the period 1961-65 the industry will require 640 pilots for the airlines alone. The Federation says that the whole industry, including agricultural and charter operators, etc., will need a minimum of 200 pilots a year from 1961. The airlines deny this, though the operators outside the airlines agree. The airline operators simply say that they can get enough from recruiting among ex-RAAF and from the flying instructors who are continuously trained by the individual aero clubs. The "poaching" of aero club instructors has been a very bitter subject of argument between the Aero Club Federation and the airline operators, and one which is not yet resolved.

STANLEY BROGDEN

ENTRIES for the Kronfeld Club's fourth annual competition and exhibition of aeronautical paintings and drawings, to be held at the club during November 15-25, must be received by the organizers by November 1. Judging will be by a panel from the Society of Aviation Artists, and details are available from Mrs Y. Bonham, 14 Little Brownings, Sydenham Rise, London SE23 (Forest Hill 9390).



AERO COMMANDER'S contender for the jet executive market, the Model 1121 Jet Commander, is to be sold for "a firm price" of \$475,000 (£170,000). Deliveries are due in the third quarter of 1963 and it is said that a number of delivery positions have already been assigned.

A CESSNA SKYHAWK is being displayed in Moscow, Stalingrad and Odessa as part of a transport exhibition organized by the US Information Agency. Mr Thomas R. Shockey, Cessna engineer and pilot, is accompanying the aircraft.

THE FIRST PRODUCTION Morane-Saulnier 880 Rallye Club made its first flight at Tarbes last month, flown by test pilot Colomes. It is the first of a series of 500 aircraft (including 90 h.p. and 100 h.p. versions of the Rallye Club and the 145 h.p. Super Rallye) to be produced at the company's Tarbes factory.

This Viking 1 glider is operated by Coventry Gliding Club. Flown by L. A. G. Glover, it was the oldest aircraft to compete in this year's National Gliding Championships



Straight and Level



A FINE appreciation of the abilities of *Flight's* Gemini is displayed by the Army Air Corps. When the aircraft visited the AAC Centre at Middle Wallop during SBAC Show week, to fly with the Army Skeeters, the following kindly note was found in the cockpit before the return flight to Fair Oaks: "Lightnings operating at 25,000ft for radius of 5 miles."

Well, we kept out of the way. It's best to give these Fighter Command chaps a chance.

● Marquardt make the ram-air turbine fitted to the Chance Vought F8U Crusader. A recent issue of the US firm's magazine quotes a young Navy reservist as saying: "Power failures don't happen too often in the F8U ... even if you have a power failure when you're high enough to eject, the F8U is a lot of aircraft to abandon. The emergency power package can save taxpayers' dollars and also eliminate the bailout—which, believe me, isn't pleasant."

And, say Marquardt, there are estimates that at least 100 F8Us have been saved solely through use of the ram-air turbines. This is a remarkable figure, representing a saving of well over £30 million.

Our solution in Britain is to carry a second engine around, as in the Lightning; or a second engine and a ram-air turbine, as in the Javelin and Sea Vixen. Even the VC10 will have a ram-air turbine—the concept, I suppose, of four pairs of braces and a belt.

● *The Economics of Air Displays*, by Sir Charles Boost, Imperial British Air Power Publications Ltd, Air Power House, Strand, London, WC2, price 35s.

How timely is the appearance of this splendid book, the latest from the pen of the greatest man in aviation today! Every year (writes *Straight and Level's* book critic, Gen Sir Jocelyn Flame-thrower) people in the British aircraft industry ask themselves whether the SBAC Display should continue to be held every year. Some say it should be held every other year, alternating with the Paris Salon; others say that it should be abandoned altogether.

Sir Charles, dismissing these suggestions as the "twittering inanities of spoilsports, killjoys and technololological Jeremiahs," suggests that the display should be held every day throughout the year, with half-day closing on Thursday afternoons only. A mere week, he maintains, is too little for the maximum economic benefits to be derived from what he so aptly describes as "this shop window of British aviation." Sir Charles complains that, even under the most

Memo to the Curator of the Valletta Museum, Malta: Straight and Level presents its compliments, and is gratified to know how Malta keeps Faith

Memo to the Curator of the Imperial War Museum, Lambeth Road, London SE1 (with reference to the last few words on the name-board): Perhaps you ought to have a few words with your Maltese colleague



favourable circumstances, he has never had time to visit all the exhibitors' enclosures (his record was 58 in 1959) and no time at all to see the exhibition itself. He describes this situation as an "absurd mix-up of priorities," and calls for a Royal Commission of Inquiry.

* * *

Other proposals made by Sir Charles are that the economics of a permanent show would be made "extremely viable" by levying a charge on all visiting foreign customers. He urges, too, Ministry support for the ever-increasing cost "in this technololological age" of designing, developing and producing brochures and house magazines that will "hold their own in an increasingly competitive world." He also feels that manufacturers' aircraft should be allowed to join in the Services' flying displays.

Finally, Sir Charles urges the striking of a medal, to be awarded by "an appropriate benefactor" to members of the industry for "long service and devotion to duty" at SBAC displays. Ten consecutive years' attendance would qualify a person for the medal, with a clasp for 20 years' service, and a bar for the most hospitable entertainment of guests.

● **Interesting Jobs Dept:** At the recent joint Anglo-US conference in London, a colleague met a most affable American who is Director of European Operations for a major US space company. Enquiring about the appoint-

ment, my colleague was told: "Actually, we have no European operations."

Aviation History Dept: At the same conference, the same colleague discovered a fascinating new piece of aeronautical history in the office of RAeS librarian Frank H. Smith. Purely in the interests of research he identified this as Miss Gillian Cody, 18-year-old grand-daughter of the man who made the first flight in Britain at Laffan's Plain in 1908.

Diversification Dept: Yet another glance back to the Anglo-American Conference. Guess what made life bearable during the coffee-breaks and tea-breaks? Beverage dispensers, all over 4 Hamilton Place, automatically delivering cups of selected liquids at the touch of a button. And guess who makes the beverage dispensers? The Gloster company, late of Javelin and Meteor fighters.

Positively my last conference story: A question from Dr von Karman during a discussion period: "Which is the greater science-fiction, spaceflight or a Mach 3 VTOL airliner?"

● Cable from foreign civil aviation authority:

"We beg your pardon and we ask you if it is possible to send us [— — —]. If it is possible to get them twice we have no one and also we have not other way to get them. They were missed probably in distribution. We beg your pardon once more and thank you very much. Be so kind answer immediately. We need it."

ROGER BACON



The W.9 experimental helicopter mentioned by Mr Leslie Hunt: actually it was the Cierva W.9, Cunliffe-Owen Aircraft Ltd being concerned as prototype-builders under contract to the Cierva Autogiro Co Ltd

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

"The Day of the Fighter"

FOLLOWING the BBC's documentary *The Day of the Fighter* there will no doubt be a spate of carping remarks, jibing at the interesting shots presented. The only faults as far as I could see occurred outside the programme by the failure of the BBC to call a spade a spade.

Having gathered together an interesting miscellany of aircraft shots and found that fighter aircraft were in a slight majority, an unfortunate choice of title was made and it was rather untruthful to claim, in the *Radio Times*, that this was a story of fighter development. How could it be when the salient points of fighter development were completely missed after 1918! It was not even representative, for only two of the famous five American fighters—P-38, P-39, P-40, P-47 and P-51—were mentioned, not one twin-engined fighter such as the Beaufighter or Mosquito appeared, the Fw190 and its contemporaries Typhoon and Tempest were ignored, Whittle was not even whispered and not one Meteor, Vampire or Sabre appeared to bridge the gap from 1945 to today. As for the delta-wing fighter, its existence was not recognized.

When it came to fleet fighters, we saw interesting shots of a D.H.9A bomber, an Avro 504N trainer and an Osprey reconnaissance aircraft landing on carriers; and there, still pre-war, without having seen a fleet fighter, we were left—which only emphasizes how unfortunate that title was and how misleading that patter in the *Radio Times*. I hope we have lots more of these miscellanies, but correctly labelled as such. They're jolly good!

London SE4

BRUCE ROBERTSON

Fifteen Years Back

COMPARING the 1961 Farnborough with previous years makes one think how much progress has been made since the 1946 SBAC show at Radlett—a landmark indeed; and claimed then as the biggest ever staged in this country!

What happened to the Cunliffe-Owen W.9 "Flying Drainpipe" [illustrated on this page—Ed] which "starred" in the 1946 show? Leigh on Sea, Essex

LESLIE HUNT

Russians First Again?

RECENTLY I read in foreign aviation magazines information that inventors of the University of Northern Ireland had collaborated to produce a flying machine without an engine. The "engine" of this flying apparatus is a cycle. The energy which arises from rotation of the pedals is transferred by chain to the axle of the airscrew. On this aircraft two passengers can fly. Their effort is enough for flight with a speed of 50-70km/hour.

It is of interest to note that in the Russian archives there exists a drawing of the inventor, a self-taught person, I. Bykov, who in 1897 proposed to unite the airscrew with the cycle: the airscrew is set in motion by the feet of the cyclist and provides the flying power of the apparatus. Another inventor, a farm and handicraftsman of the Moscow District, Nikita Mironovich Mitreikin, on September 2, 1899, offered to the headquarters of Moscow Military District a model of the flying cycle with a detailed description of the principles of its mechanism:

"... As I have not learned to draw, it was very difficult to invent and to make in wood this model, therefore many details are inaccurate. Gentlemen scientists! Men can make the model in metal incomparable, correct and clean, but the practice and power of action nobody can change. ..."

N. M. Mitreikin described in detail the gabarits and the material of his model. The inventor finished his description of the construction thus: "Although I could not climb in the air higher than 1 arshine (seven-tenths of a yard) and flew no farther than five arshines, I am convinced of the practicability of the flying cycle."

Therefore if my work may be lost only because the gentlemen scientists did not devote their attention to my model. ... I am a poor man; my family consists of seven persons. I am working alone, my children are little, my wife is ill, my aunt is miserable and my mother is 70 years old."

In fact the Russian "gentlemen scientists" in the Aeronautical Department and the Electrotechnical Committee (six generals, three colonels and a captain) did not devote their attention to the model of the self-taught person Mitreikin, and on October 28, 1899, it was given over to the Museum of the Aeronautical Park. It is astonishing that construction of the flying cycle of N. M. Mitreikin is coincidental with the model of the flying cycle invented at the University of Northern Ireland.

Tartu, Estonia, USSR

E. MEOS

ARB and the Air Operator's Certificate

I WOULD like to point out a slight error in the announcement on page 457 of your issue of September 14, 1961, under the heading "How to Satisfy the ARB."

You refer to *Notice to Licensed Aircraft Engineers and to Owners of Civil Aircraft No 60*, Issue 2, as having been "published for the first time." As the issue number denotes, this is not correct: the *Notice* was first issued on January 9, 1961, and a copy was sent to you under cover of a letter from the Board's Technical Publications Department dated January 16.

Since the Air Operator's Certificate came into force on March 30, 1961, your statement may give the impression that the Board is somewhat late in publishing its requirements.

London WC2

R. E. HARDINGHAM
Secretary, Air Registration Board.

No Way to Run a Railroad?

IT is widely agreed that our future standard of living depends on our ability to increase production and our export trade; we are constantly being exhorted by the Government to do so.

This company, anxious to play its part in this national effort, recently completed an additional extension containing over a third-of-a-million pounds' worth of manufacturing facilities. Having been promised the appropriate housing accommodation by the Bracknell Development Corporation some many months ago, energetic steps were taken to recruit the necessary skilled staff to man the extension as soon as it was completed. At this late stage, however, Bracknell Development Corporation, apparently in complete disregard of all essential realities, calmly informed us that only a small percentage of the houses promised would now be available, owing (it is understood) to the "necessity" for housing administrative and non-productive personnel from new organizations who have only recently arrived in this New Town. We are now inextricably trapped in the sticky web of ineffectual Bumble-dom without the houses needed for our skilled staff.

New machines lie idle, research and development are curtailed, exports are heavily hit and the Government's exhortations for initiative and enterprise are effectively frustrated. Lethargy and the forces of smug apathy achieve another major victory.

Research ... development ... exports ... Who cares? As our American friends would say, "What a way to run a railroad!"

Bracknell, Berks

L. SEFTON
Chairman and Managing Director, Premier Precision Ltd.

Dutch Dogmatism

READING the letter from Kurt Kaye-Nein in your August 17 issue (page 235) I was reminded of another example of a dog who loved flying. His owner was a Dutch military pilot flying a B-25 in a Dutch bomber squadron operating from an airbase near Darwin (Australia) during the Second World War.

This pilot took his dog, a terrier called "Stupid," with him on all his missions, at least forty. "Stupid" was never nervous during raids or air fights, but he always became very excited as soon as the aircraft came near to the runway on the final approach.

"Stupid" and his master both survived the war.

The Hague

K. AKKERMAN, Lt Col,
Royal Netherlands Air Force

"Local" Flying

AFTER reading in a recent issue of *Flight* (August 10) about the scarcity of aeronautical inn-signs, I thought you would be interested to hear of another which I discovered this year.

At Newlyn, just outside Penzance, there is a pub whose sign bears on one side a swordfish (aquatic variety) and, above, *The Swordfish*, while on the other side is a Fairey Swordfish in a diving attitude under the caption *Stringbag*.

West Byfleet, Surrey.

PETER CAMPBELL

THE INDUSTRY

Generator Systems Laboratory

A NEW laboratory built by the Plessey Co Ltd for the testing and development of aircraft generator systems is now operational at Eastern Avenue West, Romford, Essex.

The initial installation, currently proving a four-generator system of 160kVA total for the Vickers VC10, is capable of handling four paralleled channels of equipment up to 120kVA normal load per channel "with complete simulation of environmental conditions likely to be met by aircraft of the next decade." Future projects include systems testing for the BAC One-Eleven and for military aircraft. The generator drives have a speed range in excess of 3.1 with controlled acceleration up to 1,200 r.p.m./sec and a capacity of 200 h.p. per drive. Three-phase loading, both resistive and reactive, is variable between zero and 150KVA per channel. Comprehensive cooling facilities permit direct simulation of supersonic flight conditions.

Forging the Transall's Propellers

WHAT is described as the biggest die-forged aluminium propeller blade yet made in Britain was recently produced for the de Havilland Aircraft Co Ltd (who are supplying propeller equipment for the three prototype Transall C.160s ordered for the French and West German Air Forces) at the Handsworth, Birmingham, works of Alcan Industries Ltd.

The Type 4/8000/6 propeller, with a diameter of 18ft, was specially designed for the Transall and is the result of six years' intensive development work on the Rolls-Royce Tyne engine. The four blades, of double-taper plan form, are machined from forgings produced at Handsworth on a 45,000lb forging hammer. They are made from extruded stock in Noral 17S alloy.

Prior to forging, the stock is scalped to a diameter of 7½in and one end is machined to provide a 7in-long tong-hold. The stock is then soaked in a pre-heat furnace and, having been brought up to a temperature of 450°C, receives the first of three part-stampings in the preparation dies of the forging hammer, alternated with intermediate pre-heats. The part-forged blade is closely inspected between each operation and flashes removed. This pre-heat/part stamp sequence continues with the finishing dies, after which the tong-hold is removed and the hub machined. At this stage, the blade measures 108in long, with a maximum width of 19½in. An upsetting operation, which reduces the length to 105in, is followed by solution heat-treatment, trueing of the blade and ensuring a twist of 48½°, and finally by polishing of the thrust rings.

At the de Havilland works at Stevenage, the blades are machined to a maximum width of 18.4in, after which they are anodized.

Synthetic Rubbers v Hydraulic Fluids

CONSIDERABLE research has been carried out by Precision Rubbers Ltd of Bagworth, Leics, into the development of rubber compounds for use with Skydrol 500A, the fire-resistant hydraulic fluid widely used in US civil aircraft.

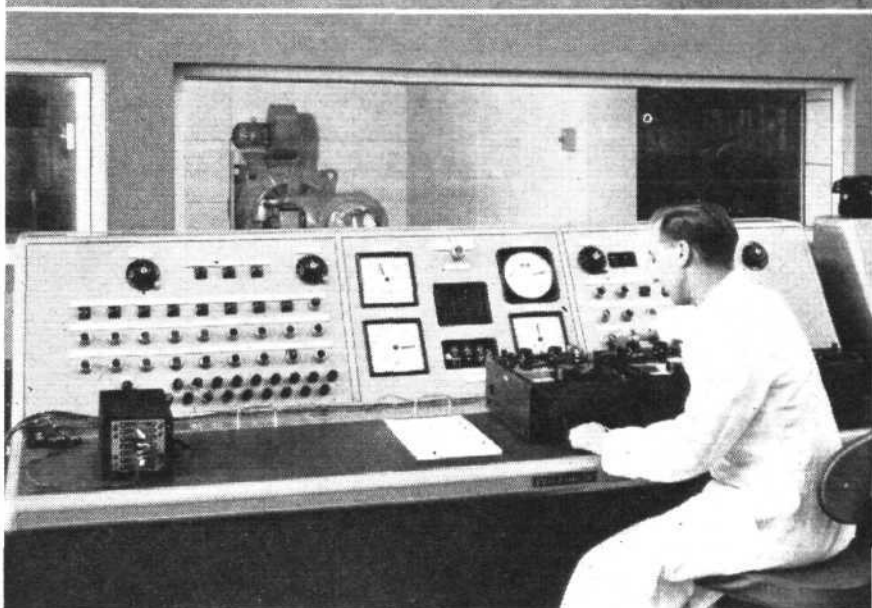
Following approval some months ago of their compound X213X by Douglas Aircraft Corporation for seals for use with this fluid, Precision Rubbers have now received approval from the Boeing Company for their B370 Skydrol-resistant rubber compound for use on Boeing 707s and 720s. Continuing research has led to the development of an entirely new series of compounds resistant to Skydrol which will be known under the trade name "Prescothane." Technical data sheets are now in print and will shortly be circulated to the industry.

With the introduction of Silicodyne H by Imperial Chemical Industries Ltd as a non-inflammable high-temperature-resistant hydraulic fluid, Precision Rubbers published a few months ago a technical report dealing with rubbers they have developed for use with this fluid.

Silicodyne H, previously known as DP47 (and also in the USA as GE81406 and Versilube F50), is a silicone-based product with a temperature range of -60°C to +200°C. It causes shrinkage and hardening of most of the synthetic rubbers used for hydraulics.

In the technical report referred to above, two series of compounds based respectively on silicone and viton were recommended. The former, it is stated, have the advantage of excellent resistance to both low and high temperatures; the latter show superior tensile properties and oil resistance, but poorer low-temperature resistance. All the compounds show positive swelling in Silicodyne H.

In view of the high cost of both silicone and viton, and the fact that, for many applications, an upper temperature limit of 100°C is adequate, Precision Rubbers have developed and now offer a new series of compounds which are dealt with in the second issue of their technical report, just published. These compounds possess adequate tensile, compression set and low-temperature properties and all show a positive swell in the fluid.



Plessey generator systems laboratory at Eastern Avenue West, Romford (see item in Col 1). In lower picture, a technician oversees a series of tests being carried out on a 40kVA system

IN BRIEF

Gp Capt Hamish Mahaddie, DSO, DFC, AFC, AFRAUS, RAF (ret), has been appointed aeronautical adviser to the Derritron Group, with special reference to ultrasonics, vibration and environmental engineering. His address is 64 George Street, London W.1.

In a recent *Flight* note on the GAF Malkara missile, the makers of the vehicle on which it is deployed were named as Wharton Engineering. Correctly, their title is Wharton Engineers (Elstree) Ltd.

Commenting on a reference in our Farnborough Review (September 14) issue to the BP Aquascan water-detecting and measuring equipment, BP Trading Ltd point out that the device was invented and developed by the British Petroleum Co Ltd and is manufactured (in the UK only) by Thermal Controls Ltd, of Hove, Sussex. The vehicle on which it was shown was a Hertford refueller. Operation of the instrument was described in *Flight* for June 8.

Electro Mechanisms Ltd, one of the King group of companies, which also includes SFIM (Gt Britain) Ltd and Flexonics Ltd, have announced a link with Schaevitz Engineering of Pennsauken, New Jersey, USA. Existing directors of Electro Mechanisms—Sir Harold T. Lydford, KBE, CB, AFC, RAF (ret); D. M. Read, ARAES; J. Staples; W. E. Cole; and S. H. Parsonage, AMIEE—are now joined by Herman Schaevitz (US) and Louis Bernant (US). To the Electro Mechanisms range of transducers and amplifiers will now be added the Schaevitz range of linear and rotary differential transformers, dynamometers, transducers and the full range of Schaevitz centrifuges for calibrating small instruments to large electro-mechanical assemblies.



New Microcell directors are Mr F. T. Jones, AMIProdE (left), and Mr J. A. Grace. Mr Jones was production manager of Hunting Aircraft Ltd before joining Microcell Ltd (a subsidiary of BTR Industries Ltd); Mr Grace, who becomes commercial director of Microcell, was formerly manager of the Sales and Commercial Division, de Havilland Aircraft Co

SERVICE AVIATION

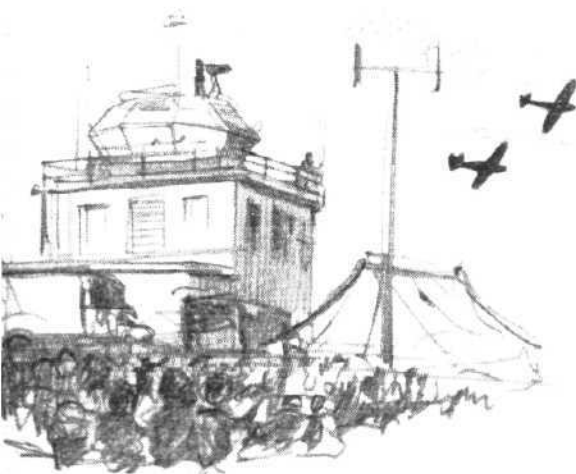
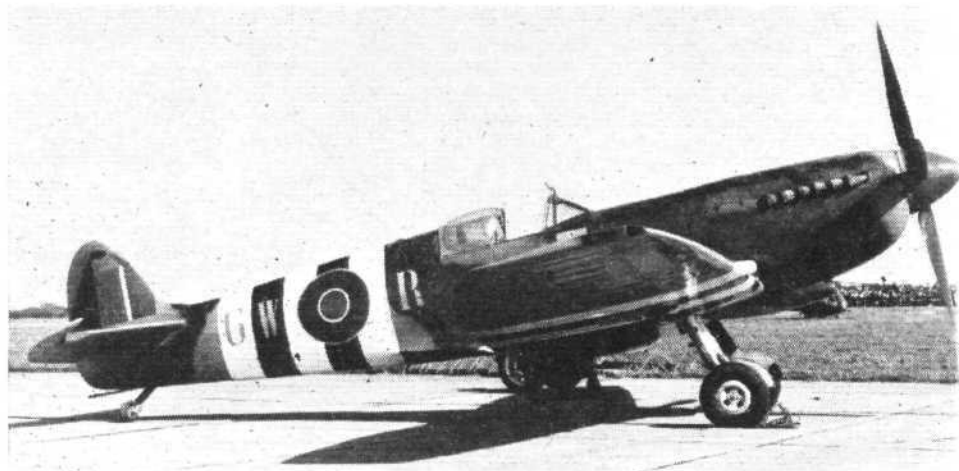
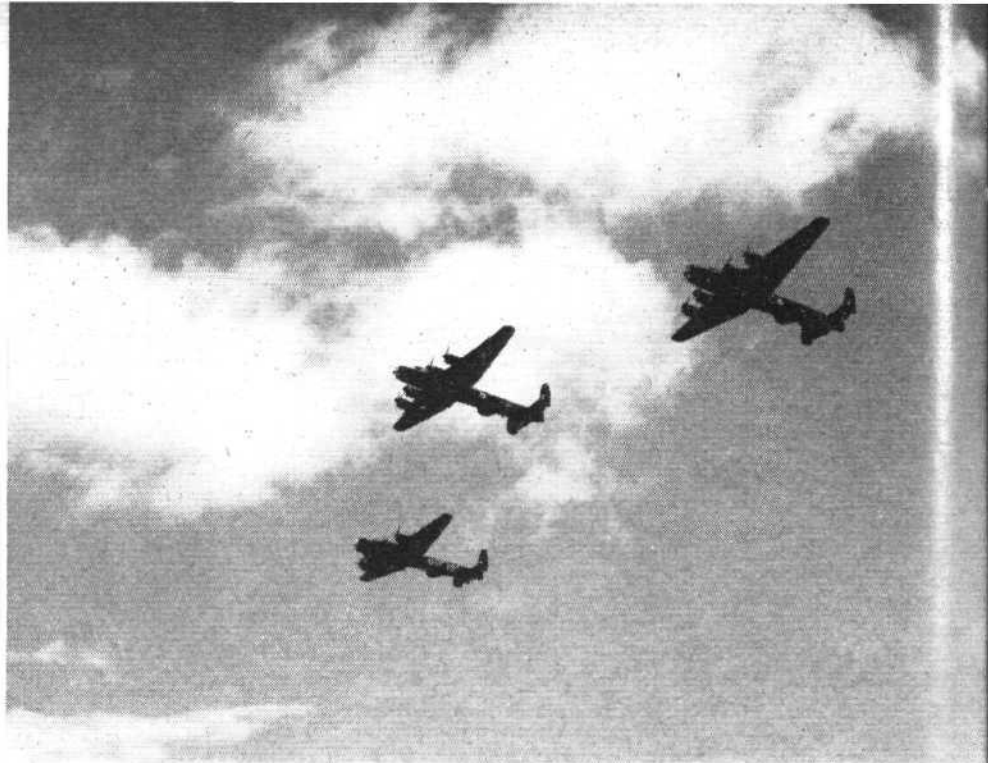
*Air Force, Naval and
Army Flying News*

Australian ADCs

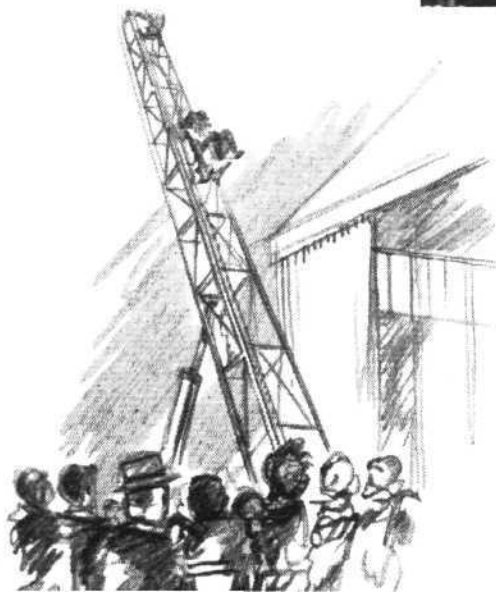
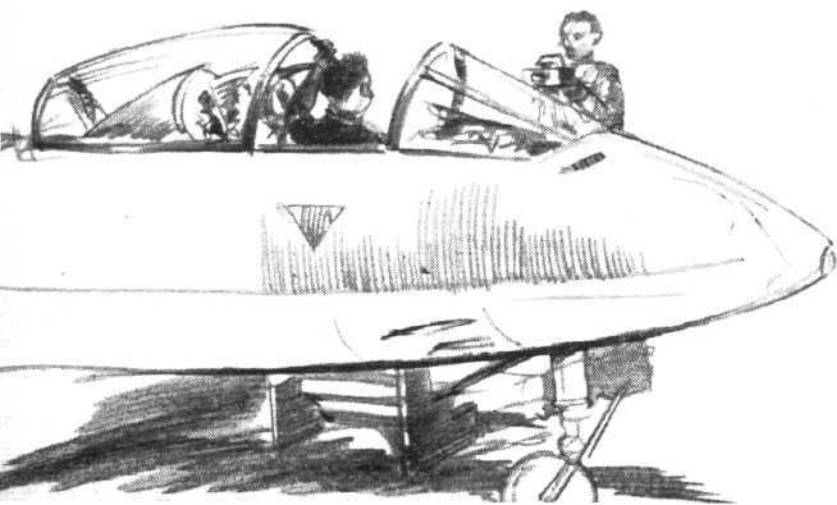
TWO RAAF appointments as Honorary Aides-de-Camp to the Queen were announced in Canberra recently by the Minister for Air, Senator Harrie Wade. The new ADCs are Air Cdre K. R. J. Parsons, CBE, DSO, DFC, AFC, and Wg Cdr C. G. C. Olive, DFC. They take over from Gp Capt D. W. Colquhoun, DFC, AFC, and Wg Cdr J. B. Nicholls, DFC, who have completed their terms of appointment as Honorary ADCs.

Air Cdre Parsons, one of the most highly decorated officers in the RAAF, at present commands Point Cook and is Commandant of the RAAF Academy. During the Second World War he served in both the South-west Pacific and European theatres. While in the United Kingdom he commanded the bomber base at Binbrook.

A member of the RAAF Reserve like Wg Cdr Nicholls, Wg Cdr Olive is a Brisbane businessman and is Queensland State Commandant of the Air Training Corps. At the outbreak of the Second World War he was with 65 Sqn, RAF, and flew on operations over Dunkirk and in the Battle of Britain. In 1941 he formed and commanded 456 Sqn, RAAF.



Lincolns and a Spitfire (above) at the Biggin Hill, Kent, Battle of Britain display on September 16; and at left and below, "Flight" artist Arthur Bowbeer's impressions. The Lincolns, belonging to Signals Command, were from Watton; the Spitfire, a Mk 9 in Free French Air Force markings for the film "The Longest Day," had been flown over from Ostend by its owner M Pierre Laureys (right), director of a French aeronautical publishing group and a commodore in the FFAF: he made the trip, it is reported, without compass or maps. Bowbeer's sketches illustrate the Biggin Hill "at home" scene (top left); "say cheese" request to a young visitor seated in Seahawk WM915 (lower left); and "Wham!" up goes another Service demonstrator in the ejector seat rig





56 Sqn "as was" and "as is," depicted by the Bristol Bulldog (squadron equipment 1932-36) and English Electric Lightning (1961-). The Bulldog, recently restored, was flown by Bristol Aircraft chief test pilot Godfrey Auty; the Lightning by the commanding officer, Sqn Ldr J. R. Rogers. 56 wear red-and-white checkerboard markings. K-2227 was featured in last week's issue

Back from the Cameroons

AFTER a year's service in the Cameroons, more than a hundred officers and men of 230 Sqn have returned to the United Kingdom. With three Twin Pioneers they have been supporting the 1st King's Own Royal Border Regt and later the Grenadier Guards in internal security duties during the plebiscite to determine the country's future. The three aircraft were flown home in mid-September and the main detachment was airlifted by Beverley from the Cameroons to Nigeria and thence flown home by Britannia.

In the first six months of their mission, which began in September last year, the detachment carried 54 patients and 142,345lb of freight, flew anti-smuggling sorties and carried mail to isolated Army units. Although pilots frequently had to fly in cloud at 4,000ft over mountainous terrain, or were sometimes forced down to tree-top height, only very few flights were stopped by weather. Members of the

detachment had to cope with the Hamadan, a hot wind from the Sahara carrying with it hot dust and sand reducing visibility to 100yd, and a wet season lasting five months. The squadron CO is Sqn Ldr H. J. West and the detachment has been commanded by Sqn Ldr K. N. Rice.

Reg Graveley

FIRST RAF winner of the George Cross, Reg Graveley died in hospital on September 16 after a brief illness. As Fg Off Graveley, he won the GC (then the EGM) when a Fairey Battle pilot with 88 Sqn in France in September 1939. When two of a formation of three Battles were "jumped" by Me109s, Graveley forced-landed his blazing aircraft, extricated his badly wounded observer and returned for his air gunner, only to find him dead. He received his award from King George VI at an "in the field" investiture at Plivot Aerodrome in December 1939. After the war, Graveley became a test pilot with Gloster Aircraft.

IN BRIEF

Headquarters 11 Group, Fighter Command, moved to RAF Leconfield, Yorks, last weekend from Ouston, Northumberland.

A silk ensign of 614 (County of Glamorgan) Sqn, RAuxAF, was laid up in the squadron chapel in Llandaff Cathedral on Battle of Britain Sunday, September 17.

Sqn Ldr H. M. Archer, on exchange posting with the USAF, was co-pilot of the B-52 from which the X-15 was launched on its recent record flight. He graduated on No 16 course at the Empire Test Pilots' School.

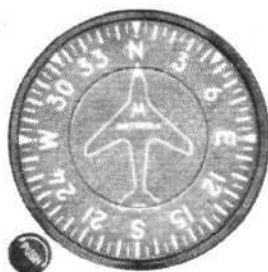
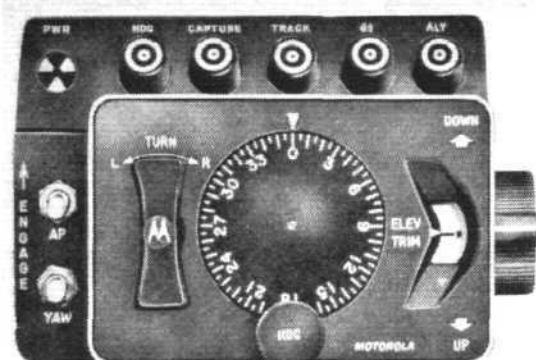
A Hastings and a Beverley took Arnhem veterans from Odiham on September 19 over the same route used to their dropping-zone on September 17, 1944. Now with the 10th Parachute Battalion, TA, six of the former members of the wartime 1st Airborne Division parachuted into the DZ used in the historic assault, in a commemorative drop by 94 troops.

Argosy seating for Transport Command, by Short Bros: at right, the 260-series seats seen installed. They can be folded and swung up against the fuselage side to convert to freighter configuration



Episcopalian Mach-buster: the Bishop of Bath and Wells, Rt Rev E. B. Henderson, DSC, who is chaplain to the RNVR, in the cockpit of a Hunter T.8 at RNAS Yeovilton where he was flown at M1





Control panel, course selector and flight director of the new Motorola M-4 autopilot for executive aircraft



SYSTEM SURVEY

Confirming Doppler on the Atlantic

FOLLOWING approval in principle of the use of Doppler radar in TWA's Boeing 707s on the North Atlantic route (these columns last week), the airline is running a further series of trials in which crews on routine services will demonstrate their ability to use the equipment and the airline will demonstrate its ability to maintain the Doppler adequately. The first trials in May and June involved 76 Atlantic crossings.

TWA are hoping to replace the navigating officers normally carried by the Doppler system, allowing the pilots alone to navigate without specialist assistance. FAA wants to be assured that the navigation task can be satisfactorily performed in this way, but additional trouble is already looming in the form of a threatened navigating officers' strike against the use of Doppler.

The FAA has already insisted that Edo Loran, VOR, ADF, Consol and ground and air radar should be employed to monitor Doppler and that the Doppler itself should be duplicated, but the agency will probably approve the new method. The navigators are strongly resisting the proposal and claim that accuracy has been poor on several crossings and that unserviceability has caused several lengthy delays to flights. This must be something of a test case for Doppler and it will be interesting to see whether it does emerge as an aid of recognized accuracy and reliability for long-range airline flying.

Assumption of the main navigation task by the second pilot must increase his work-load and his personal responsibility to a certain extent. The requirement for duplicated Doppler and a specific complement of "traditional" aids also slightly increases the equipment load. The day of the integrated navigation and flight management system centred on a digital computer is coming nearer, but the present Doppler case indicates that the human problem of aircrew redundancy—for navigators and flight engineers—is going to be a major issue. Yet reduction in manpower is as attractive to the airline as it will be repugnant to the redundant crew members. It remains to be seen when the airworthiness or reliability conditions, calling for costly maintenance and possible duplication, will cease to be a serious economic obstacle to adoption of such integrated systems. The trend seems to be towards a progressive reduction in the number of specialist navigators and engineers; but, ultimately, the pilots will have to have such wide competence in the management of the integrated equipment in all its ramifications that specialist crew-members of a new type will perhaps be required once again. It is conceivable that these specialists might not form part of the flight crew, but would perform the combined function of flight-planning, programming and pre-flight check-out technicians—a branch of the present dispatchers' trade.

Motorola's M-4 Autopilot

A NEW autopilot likely to become available in Britain through Smiths Aviation Division is the Motorola M-4, which was exhibited for the first time anywhere at the recent SBAC Show. Able to provide both flight control with manometric locks and radio coupling, the M-4 is designed for executive aircraft and uses air-driven, panel-mounted instruments for attitude, course and yaw references. The servos and computer are electric. A useful feature is that electric pick-offs from a turn-and-slip gyro can be applied for yaw-damping alone, without engagement of the complete autopilot system and without restricting rudder pedal-movement. The main control panel contains push-buttons for engagement of

heading-hold, beam capture and tracking, glide-slope following and barometric height-lock, this last being derived from a twin-capsule barometric unit which will govern either constant altitude or constant rate of descent or climb. Yaw-damping, roll trim and gyro heading or constant-rate turn control are available. A compass-card heading selector as well as turn knob and elevator trim indicator are provided.

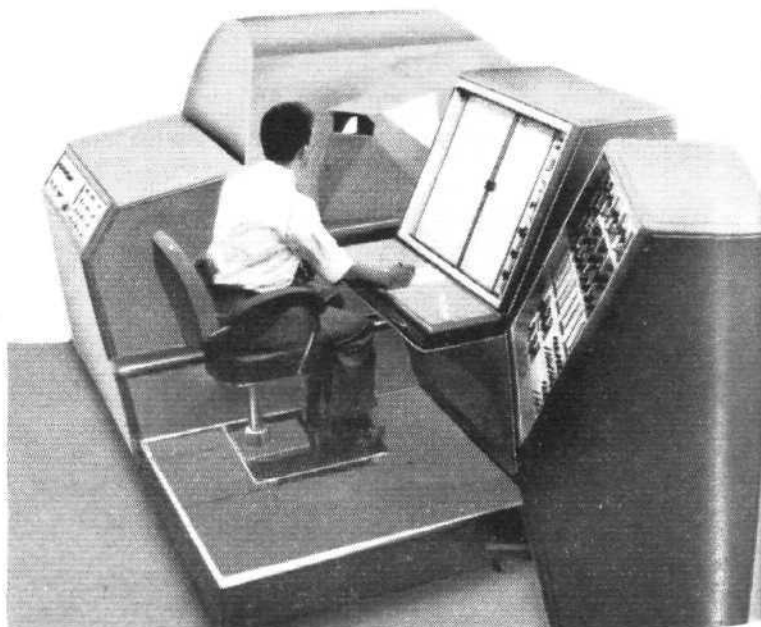
Radio coupling covers VOR radial flying and ILS approaches with drift compensation, the signals used by the autopilot being displayed on a cross-pointer flight director instrument. The operation of the system can be checked by switching the cross-pointer to show uncomputed VOR/ILS signals and therefore the angular relationship of the aircraft to the chosen radial or beam. ILS back-beam approaches can also be made by reversing the coupler selecting switch. The three electric servos and pitch trim servo together weigh 21.3lb and the computer/amplifier, in a 3/4 ATR case, weighs 8.5lb.

One of the instrument layouts for the Beagle B.206 at the SBAC Show included the M-4 autopilot control panel. Combinations of Motorola radio are already offered as standard radio packages for the Airedale. Among them are 360-channel and 190-channel communications equipment, including the European 117.9 Mc/s channel, VOR/ILS, glide-slope, marker beacon and the Motorola ADF-T-12 radio compass.

Undersea Navigation

UNDER a six-month, \$99,000 contract from the US Navy Bureau of Ships, the Martin Co is to investigate the provision of a navigation aid for submerged submarines. It appears that sound propagation in its various forms will be tried, using both "active and passive" systems and equipment mounted either in the submarine or on the ocean floor. The aid, when a prototype is ready, will be installed in the US Navy Atlantic Undersea Test and Evaluation Center (AUTEC). Nuclear fuel is one of several sources of power being considered for the undersea stations. Martin have successfully developed the SNAP-1A, 2 and 3 isotopic power generators, one example of which is already functioning in the US Navy's Transit satellite. Reliability of a high order is essential, because some parts of the system will have to be placed at depths from which they will be very difficult to retrieve.

Direct acoustic propagation, similar to radio broadcasting, may be tried, but the most promising method seems to be a "bottom bounce" technique in which the signal is transmitted downwards at an angle to the ocean floor, to be bounced to the surface and scattered downwards again, either in one or several cycles depending on depth and temperature of the water and characteristics of the ocean floor. The variables which could have important effects on the system seem to be legion. No indication is given of the range over which the navigation signals would be transmitted.



The new radio aids flight trainer made by Electronic Control Engineering and described in these columns last week. From left to right, the units are power supply cabinet, cockpit (with peep-hole for the instructor), plotting board and control panel

On September 18 the first Qantas turbofan Boeing 707-138B (P & W JT3D) visited London Heathrow. The all-red fin is a new addition to the Qantas colour scheme



AIR COMMERCE

WELCOME NEW STATISTICS

FOR the first time individual traffic figures are published for Britain's independent airlines—or at any rate for those (the majority) who operate scheduled services.

Just published by the Ministry of Aviation, under the powers given to it by Regulation 18 of the Civil Aviation Licensing Regulations, 1960, are a set of tables giving scheduled and non-scheduled traffic for 14 independents for the month of April 1961. Admittedly the figures are dated, but the Ministry (describing the delay as "regrettable") refers to the fact that publication has been deliberately delayed until figures for all companies could be included. In future, says the Ministry, "in order to ensure desirably prompt publication, it may be necessary from time to time to omit . . . statistics relating to companies who are late in submitting returns."

Clearly much depends on the co-operation of the independents in promptly filling up and returning the Ministry's traffic questionnaire forms. Hitherto, of course, the independents' traffic figures have been published in collective form by the Ministry; only by waiting a year or more for the international publication of the ICAO *Digest of Statistics*, and converting the metric figures to British units, has it been possible for the industry to know (for example) how many passenger-miles Jersey Airlines flew on domestic services in a given year. Now these figures are to be made available for all the main independents month by month, starting with the figures just published for April 1961.

A glance through the relevant table included in the monthly set published by the Ministry (AEA3 Branch, Shell-Mex House, Strand, WC2, Temple Bar 1207, extension 425) shows that, in April 1961, British United carried the most load ton-miles, 998,000, followed by Silver City with 649,000. In terms of passenger-miles flown, the biggest operator was again British United, with 6,575,000, followed by Skyways with 2,361,000.

The largest domestic operator, in terms of passenger-miles flown, was BKS—2m passenger-miles, followed by Jersey Airlines with 1,553,000. On the non-scheduled front the biggest carrier again, in terms of capacity ton-miles, was British United with 6,404,000 followed by Cunard Eagle with 2,985,000 and Skyways with 1,931,000.

The Ministry hopes to publish figures for May, June and July 1961 at intervals of from two to three weeks until the statistics are reasonably up to date. It will be interesting to examine future tables to see whether the Ministry does in fact find it necessary "from time to time to omit statistics relating to companies who are late in submitting returns."

OPERATIONAL EXPERIENCE WITH SATCO

AFTER a "debugging" and training period of some six months, the first phase of the Netherlands automatic air traffic control system (SATCO) was put into operational use in the middle of January this year. The Netherlands Department of Civil Aviation has thus now had some nine months' operational experience with the equipment.

SATCO Phase I consists of a fully transistorized unduplicated digital computer with teleprinters and strip-printers as the means of input and output. The system covers the airways and terminal areas in Holland; it also caters for "off-airways" flights in the FIR. Its main purpose is to serve the controllers in the area control centre at Schiphol (where it is installed) by providing the controllers with a very rapid means of calculating all types of flight paths and by displaying the results in the form of printed progress strips. The increase in efficiency and the main saving in labour expected from this first phase of the system was therefore an improvement on, and a saving in, mental arithmetic and a saving in clerical work.

Technically, experience so far has shown that the performance and reliability of the computer are satisfactory. Apart from half a day's maintenance per fortnight and two periods of one week each (when the system was switched off for major changes) the computer has now been operating 24 hours a day since October 1960. During this time, there have been 17 breakdowns, each averaging about one and a half hours to trace and repair, thus giving a serviceability factor of a little more than 99 per cent. With the duplicate computers which will be installed in Phase II, it is expected that serviceability will be very close indeed to 100 per cent. It is noteworthy that the great majority of failures were the result of failures of

transistors. Out of somewhat more than 8,000 transistors used in the computer, 40 failed during the 11 months under review. By contrast, of the 30,000 diodes only one failed, and there have been no failures of resistors. Performance of the main memories has been entirely satisfactory.

Operationally, many lessons have been learnt. The principal lesson was that, even with inputs and outputs which differ only very slightly in format and presentation from the old manual system, "on-the-job" training of assistants and D-Controllers is unwise; and, although some initial training was of course given with simulated traffic, this training proved insufficient. The result was that in the first two or three months of operational use, both controllers and assistants, particularly in peak periods when they naturally had no time to bother with new-fangled gadgets, tended to revert to the old ways of ball-point and paper. Since then, however, two major changes have been made in the programme unit of the computer: the quality and colour of the paper strips has been improved, and certain other changes in organization have been made, all designed both to meet the criticisms of the controllers and to make the switch from manual to automatic much more smooth than was originally thought necessary. It is pleasing to record that all flights are now put through SATCO, that the controllers and assistants appear to be satisfied, and that some are already enthusiastic about the system. More important still, the lessons that have been learnt have proved invaluable in the design of Phase II which is now in production and scheduled for delivery towards the end of 1962.

BOAC BRITANNIAS FOR BUA

BRITISH United Airways are to operate two Britannia 312s, G-AOVE and G-AOVI, following a lease-purchase agreement concluded with BOAC, the registered owners (see photograph on page 521). The lease is for a period of two years nine months, until June 20, 1964, with an option to purchase. These Britannias will be used for troop services, releasing British United's own two Britannia 317s (with their water-injection Proteus 765s), for operation on African services—as from October 2—at present operated by Viscounts. These aircraft, fine service though they have given, have not been competitive; and BOAC note that their replacement by BUA with Britannias "is intended to strengthen the competitive position and thus enhance the commercial results of the two airlines' combined operations on these routes."

The first BOAC Britannia delivered to BUA, G-AOVE, was just off a Check 4 and was painted by BOAC in the independent's colours; the interior was also redecorated by the corporation, though British United are putting their own seats in it. G-AOVE had, on being handed over, flown 8,811 hr. G-AOVI was delivered with a Check 1, and without a repaint or interior refurbishing. This aircraft had flown 8,888 hr.

MORE FOR THE DC-8F

INCREASES in gross weight and take-off weight of the DC-8F Jet Trader are announced by Douglas. Design gross weight is increased from 312,000lb to 318,000lb, and maximum take-off weight from 310,000lb to 315,000lb. Besides these increases to the weight of the original DC-8F announced in April (*Flight*, April 20), new interior arrangements are offered. These range from the all-cargo aircraft, capable of carrying up to 94,668lb of bulk-loaded freight or 91,113lb on pallets, to an all-passenger transport capable of seating 183 economy-class passengers. A typical mixed configuration quoted by Douglas is 54 passengers with baggage, 54,500lb of cargo and fuel reserves to give an operating range of 4,000 miles.

Exterior dimensions and powerplants are identical with those of the DC-8 Series 50 (Pratt and Whitney JT3D-3 turbofans). The new wing leading edge is included, and the forward cargo door measures 85in by 140in. Maximum flexibility is provided for by a removable bulkhead, replacing the fixed bulkhead midway between the cargo and passenger sections in the original model. This enables passenger loads of 24, 54, 84 or 114 to be carried with a proportionate reduction in cargo space. With the bulkhead at the midway point, the DC-8F will carry 84 passengers and six 81in by 110in pallets, and a payload amounting to 87,440lb. Payload increases as the passenger volume is decreased because of the greater density of freight.



Here is the first of three Viscount 838s for Ghana Airways, which was accepted by the airline on September 20 at a ceremony at Vickers' flight test centre at Wisley. Ghana's new Viscounts are 52-seaters, having tourist-class accommodation in the forward and centre cabins for 38, and a first-class cabin for 14 aft. Ghana Airways also has three VC10s on order; the airline recently cancelled its order for two Boeing 707-420s (not 720Bs as reported last week)

AIR COMMERCE...

THE UN TRAGEDY

SO commonplace nowadays is the use of air transport by statesmen and leading world figures that the tragic death of Mr Dag Hammarskjöld, United Nations Secretary-General, came as a particular shock. He was flying to Ndola to meet the president of Katanga on September 18, in a DC-6B chartered by the UN from Transair Sweden AB. Of the 16 people on board, including a Transair crew of five, only one (an American security guard) survived. The aircraft left Leopoldville on the afternoon of September 17 for Ndola, and last contact was made with the Ndola control tower at midnight. Although the aircraft should have arrived two-and-a-half hours earlier, the delay was probably due to a detour as a precaution against air attack. According to the sole survivor, Mr Hammarskjöld changed his mind and decided not to land at Ndola, but gave instructions to the pilot to alter course for another destination.

Suggestions that the aircraft was shot down were discounted by officials in Ndola. A Swedish Aviation Board team is conducting an investigation into the crash, and investigations have opened at Leopoldville into repairs carried out on September 17, after the aircraft returned from Elisabethville damaged by anti-aircraft fire.

HOVERCRAFT IN THE AIR

A SECOND company has applied to the Air Transport Licensing Board for a licence to operate hovercraft services. The company is P. & A. Campbell Ltd, the Cardiff shipping concern, who are seeking an E licence to operate hovercraft "to and from all ports in the Bristol Channel, between and including Cardiff and Swansea on the north side and Clevedon and Ilfracombe on the south side." The hovercraft to be operated are, it is stated, to be "acquired from one of several British manufacturers who are at present producing prototypes." The craft needed for this service may not be available for some years, say Campbells, but the estimated capacity is 200 passengers or 20 tons of freight or a combination of both. The licence is to be valid for an unlimited period from January 2, 1962, "or such later date as craft are available." The service would be operated daily at a frequency in accordance with traffic demand and would be complementary to Campbell's steamship services at present operating in the Bristol Channel.

Our leading article discusses the implication of this and the previous (historically the first) application to operate hovercraft services made by the Liverpool independent airline Starways.

Starways told *Flight* last week that it has been "in touch with all six main companies developing ground-effect vehicles and have had discussions with some." Several craft have been projected which, they say, meet their requirements; the type for which the company is looking in particular is the larger-size vehicle. For the record, Starways specify in their application to the Board "hovercraft of the most suitable types of several models, seating from 20 to 100 passengers, expected to be available within a few years." Ten A licences are sought for scheduled services as follows:—

(1) Liverpool - Belfast; (2) Liverpool - Isle of Man; (3) Glasgow and/or Stranraer - Belfast; (4) Plymouth and/or Southampton and/or London - Jersey and/or Guernsey; (5) Scilly Isles - Newquay and/or Penzance; (6) Portsmouth and/or Bournemouth and/or Southampton - Isle of Wight. The international services requested are: (1) Harwich - Rotterdam and/or Antwerp; (2) Liverpool and/or Holyhead - Dublin; (3) Dover - Calais; (4) London - Calais. In addition three E licences are requested for a series of unscheduled flights (1) between any two places on the north or south side of the Thames, including Canvey Island; (2) between any two places on the north or south side of the Mersey and/or any two places on the north or south side of the Dee; (3) between any two places on the north or south side of the Bristol Channel and the Severn.

BEA's OCTOBER FARE CUTS

DURING the month of October, BEA is offering substantial fare reductions to late holidaymakers, who will still be able to take advantage of the frequencies in summer timetables, since the winter schedules do not begin until November 1.

Typical fare savings, which are available only from October 1-31, are £21 7s on the London - Rome return fare, £16 4s between London and Athens and £15 9s between Manchester and Nice.

INCIDENT AT DUBLIN

WHILE attempting to land at Dublin on September 19 in rain and low cloud, a Starways DC-4 overshot the runway. The aircraft was on a charter flight carrying pilgrims from Lourdes to Dublin. According to an airport spokesman, the DC-4 was making a normal approach when it swung to the left and skidded along the ground, narrowly missing the airport terminal buildings.

The aircraft, which was extensively damaged but fortunately did not catch fire, finally came to rest blocking a busy main road just beyond the perimeter. To quote a police spokesman, "it was a miracle that it did not hit a car or bus." The 69 passengers and four crew evacuated the aircraft without serious injury. Officials of Starways flew to Dublin to investigate the crash.

BUSINESS AT THERESE HOUSE

MUCH of the Air Transport Licensing Board's time in recent weeks has been occupied with clearing the great volume of applications for 1962 inclusive tours. The Board is now devoting more of its time to dealing with the weightier applications for scheduled services, one of the most interesting of which began on September 15. This was BEA's application to offer three-guinea off-peak fares on its domestic services to Edinburgh, Belfast and Glasgow, an application objected to by British Railways, represented by Mr E. S. Fay, QC. The meeting went on rather longer than had been anticipated, and October 6 has been set as the day on which it will be resumed. We hope to summarize the proceedings in a later issue.

Meanwhile, last Tuesday, September 26, the Board was due to hear applications from Cunard Eagle, for a service from Heathrow or Gatwick to Perpignan, and from Air Safaris for a service from Southampton and/or Bournemouth to Dublin and/or Belfast. The latter independent was also presenting its case for a domestic service between Shoreham and Southampton and/or Bournemouth. BEA were objecting to the Perpignan and Dublin/Belfast applications, and British Railways and two road operators to the proposed Shoreham - Southampton/Bournemouth services.

Coming up next Tuesday, October 3, and continuing on October 4 and 5 if necessary, is a series of 19 applications for services to and from the Channel Islands. These applications are from British United, Dan-Air, Cunard Eagle, Autair, Derby Aviation, Starways, Cambrian, East Anglian, Silver City, Air Safaris and Jersey Airlines. The applications embrace proposals for services to these holiday islands not only from London (mainly British United and Cunard Eagle) but also from provincial centres including Nottingham, Derby, Coventry, Northampton, Wolverhampton, Birmingham, Oxford, Chester, Liverpool, Cardiff, Swansea, Exeter, Bristol, Leeds/Bradford, Bournemouth, Glasgow, Edinburgh and Plymouth. All but six of the applications are being objected to by BEA. The meetings start at Therese House at 10.45 a.m. each day.

YS-11 TO FLY IN FEBRUARY

FIRST flight of the Namco (Nihon Aeroplane Manufacturing Co) YS-11 twin-Dart 10 feederliner is scheduled for mid-February, and the first prototype is due to be rolled out of Mitsubishi's factory in December. The programme thus is running only about six weeks behind the schedule announced a year ago.

Increased domestic orders for the type are in prospect; the Japanese Ministry of International Trade and Industry originally envisaged a demand for 90 YS-11s for domestic trunk lines and a further 30 for local-service lines. These numbers have now been increased, respectively, to 110 and 45. It is anticipated that a total of 155 YS-11s will be necessary to meet the needs of Japan's fast-growing domestic air transport business by 1965. The project is being handled by a consortium of companies, the prime one of which is Mitsubishi, as described in *Flight* for November 18, page 818.

CHANGES ON THE US HORIZON

FOR those who shape Britain's air transport policies, perhaps the most interesting passages in the *Project Horizon* report,* presented to President Kennedy by the FAA (*Flight* last week) relate to the Bermuda Agreement. Without mentioning any names, the report concludes a 16-page review of US air transport relationships with other countries with the words: "The ever-increasing numbers of foreign carriers attempting to secure footholds in US markets makes it clear that in the future the US must be more sensitive to the relative economic benefits resulting from route exchanges. This involves a more careful trading of routes, as well as better policing of the capacity provisions of our bilateral agreements. Perhaps it is time to raise the question as to whether a bilateral exchange of routes, and hence traffic rights, under Bermuda-type principles any longer affords a valid basis for international air carrier negotiations."

This of course is basically the view expressed by the CAB, whose demand to foreign carriers for traffic statistics has, according to the report, been "unsuccessfully contested" by foreign carriers. But now a firm recommendation for a change in policy is on the desk of the President. Of particular interest are a series of tables showing the declining percentage of US traffic carried in relation to that carried by other countries; Table 5 shows, carrier by carrier, the number of passengers carried to the US by foreign airlines over the decade 1950-60.

Equally significant are hints of a possible major change in the traditional US outlook on pooling. "The US as a matter of policy should continue to rely mainly on the creative power of competition," says the report. "However, the proliferation of pools among foreign airlines makes it necessary to search for effective ways to deal with the resulting shifts in competitive relationships. For example, we might be prepared to recognize the existence of a pool among foreign carriers operating their services to the United States. On the other hand, when a small country suggests pooling of its services with that of a US competitor, we might seek first a substitute arrangement which would support that country's opera-

tion. In some other circumstances, participation of US carriers in pools might be permitted on a case-by-case basis and upon a showing that the total effect would be in the public interest."

The report contains figures and statistics that sum up the problems of present-day US air transport: Boeing, Douglas, Convair and Lockheed have so far written off more than \$800m in their jet and turboprop airliner programmes; the 58m passengers carried by US scheduled airlines in 1960 still represents no more than about 10-15 per cent of the US population; the return on total investment was only 2.86 per cent for the US domestic trunks last year, compared with a desirable rate of return postulated by the CAB in its General Passenger Fare Investigation of 10.5 per cent. The ratio of debt to net equity (stockholder ownership in the company) for the eleven domestic trunks, PanAm and Panagra averaged 1.5 to 1 last year, which contrasts with the more usual debt-equity ratio of about 0.5 to 1 during the 1950s. "Earning power—past and present—is the fulcrum upon which the financial fortunes of the airlines rest," declares the report. The CAB is urged to give "prompt and sympathetic attention" to merger proposals necessitated by multiple competition. The report also urges a refusal to certificate new competition except where clearly justified on economic grounds. The CAB, it is considered, has not been successful in solving the problems of competitive balance between the US domestic carriers; these problems, says the report, "were inherited and then compounded by lack of thoughtful planning." The point is also made that much of the excess capacity problem now facing US carriers may stem from the fact that levels of competition which were perhaps economical with smaller piston-engined equipment cannot be profitably maintained with large jets. By this reasoning the supersonic airliner becomes more closely equated with monopoly in air transport.

The report is adamant about the need for a more elaborate promotional fare structure to reduce off-peak losses (BEA's promotional fares, it will be recalled, have been of great interest to US carriers). The study concludes that a subsidy for all-cargo carriers would not be justified, partly because it would divert traffic which surface carriers could carry more economically and for which they are vigorously competing.

* The Report of Task Force on National Aviation Goals, *Project Horizon*, September 1961, The White House, Washington DC. Price not quoted.

SAFETY AND PUBLIC ACCOUNTABILITY

ONLY rarely are British air transport operators brought before a magistrate for misdemeanours. Such is English law, standing as it does above Government, that the Ministry of Aviation has to be absolutely sure of a case before handing it over to the Director of Public Prosecutions, who even then may decide that the evidence is not strong enough to justify legal action. The Ministry's safety people, notwithstanding their respect for the independence of the judiciary, must often feel frustrated by an undoubted weighting of the scales of justice in favour of the unscrupulous operators, few though they may be, who persistently sail close to the wind of safety and get away with it.

The difficulty of punishing offenders, notwithstanding the Minister's power to revoke licences, means that the administration of safety is largely a private matter between the Ministry and the operators. Offenders may receive stiff warnings from the Ministry but their offences are only rarely made public.

Safety in air transport does not sort well with secrecy, for two reasons: firstly, public accountability is a deterrent to the bad operator; secondly, safety experience must be shared as widely as possible throughout the air transport industry. No one really

disputes that safety and secrecy do not go together; the problem always is that the rights of the individual must be protected. Unfortunately, so weighted is the system in favour of the sharp operator that, all too frequently, the wrongs or mistakes of a company or of an individual are protected too.

For example, nearly a year ago a serious accident occurred to a British aircraft in which, fortunately, there was no loss of life. It is unbelievable that the causes and circumstances of this accident were not established within days; yet, nearly a year later, the Ministry declines to say anything other than that "the investigation is not yet complete." If an individual is to be blamed for an accident, then of course the Ministry must allow him to state his case. If in this case an individual was at fault, his case must surely by now have been heard. But it is extremely unlikely that the causes and circumstances of the accident will ever be published; information which might enhance the safety of air transport, which might prevent a recurrence of a similar accident, is for ever locked away in a Ministry filing cabinet.

Again, when two jets nearly collided near London Airport last February, the Ministry declined to reveal the full causes and cir-

Two of BOAC's Britannia 312s are now flying with British United, under a 33-month lease-purchase arrangement first discussed earlier this year. One is seen here at BOAC's London Heathrow base before delivery. The aircraft will be used for troop transport flights, replacing British United's two Britannia 317s which have been refurbished for the operation, in place of Viscounts, of the Safari routes to Africa in pool with BOAC. See also page 519





This Pan American DC-8, carrying 124 passengers bound for Bermuda, suffered an undercarriage collapse at New York Idlewild on September 16. The aircraft had taken off for Bermuda but a hydraulic fault caused it to return.

AIR COMMERCE...

cumstances, and has never done so. In response to persistent pressure from the Press, a statement was at length published, four months after the near-tragedy occurred. This statement guardedly referred to "cockpit procedures" employed by one of the airlines concerned. The cause of this incident was probably known within days of its occurrence; yet four months elapsed before, under pressure, the Ministry issued even a guarded statement. What is believed to have occurred is that one of the pilots did not hear an ATC instruction because he was concentrating on a "noise-abatement count-down" that was being given to him from the ground to tell him where to cut back power. This is a common practice among airlines, and its possible hazards should have been made widely known by the Ministry as promptly as possible; this could have been done the following week in general terms in a routine *Civil Aviation Information Circular*, without reference to the actual incident concerned.

The Americans approach the problem of safety and public accountability quite differently. By means of their different judicial system they confer on a public authority, the Federal Aviation Agency, the power to impose fines on those who break the law. The FAA publishes regularly the fines that it has imposed on individuals and companies for offences, all of which are described. The most interesting recent example was the fine of \$300 imposed on Capt R. W. Mitchell, pilot of the Boeing 707 that, because of a violation of ATC procedures, narrowly missed colliding with a BEA Viscount over Rome on August 11 last year. One of the largest FAA fines was \$8,900 imposed on National Airlines last July for violations of US civil air regulations that were listed as follows: (1) Operating four Electras on 228 flights after the deadline for modification of Electra engine tailpipe door assemblies as required by an airworthiness directive; (2) failing to report to FAA, as required, nine incidents between March 14 and May 10 in which National pilots, after shutting down an engine, picked an airport for landing which did not represent the shortest flying time; and (3) operating a DC-6B on five flights, despite repeated pilot "squawks" in its log, with its flaps extendable only by pumping of the flap handle. The "docket" in this case listed eight other incidents. United Air Lines has been fined \$300 because a mechanic left his tool box in the tail heater compartment of a DC-7. Frontier has been fined \$1,000 for maintenance violations including the use of "landing gear compensating cylinder eyebolts that had been

altered to fit by grinding off a threaded portion of the bolt." The FAA found the bolts "covered with corrosion" on at least ten aircraft, and said that the unapproved modification of them could have weakened such a highly stressed part. Frontier have also been cited for using an unauthorized mechanic for a DC-3 welding job. Again, Northeast have been fined \$250 for an incident in which a Viscount returned to Boston with elevator vibration. It was discovered to have its port elevator inspection plate bent and nine of its eleven screws missing. More recent fines have been imposed on Boeing Vertol—\$300 for carrying "non-essential" officials and "various Boy Scouts" on an experimental flight on February 7. Alaska Airlines have been fined \$250 for not providing personnel with manual instructions for loading and tying down cargo, as a result of which two pallets broke loose in a DC-4 in flight, moving 13ft aft. Piedmont Aviation have been fined \$750 for an "unapproved alteration" to the pneumatic panel door of an F.27 undercarriage.

These are a few examples, picked at random, illustrating safety and public accountability in action. Very often, individual mechanics and pilots are named and fined by the FAA for minor offences of the kind which happen frequently in even the best-run airlines—more frequently, perhaps, where the deterrent of public accountability does not exist. The greatest deterrent to careless or deliberate neglect of safety standards is of course the possibility of an accident: neither penalties nor public accountability provide a greater deterrent than this.

The Americans appear to have reconciled the conflict between the need to protect the rights of an individual, and the need—so important in air safety—not to protect his wrongs or his mistakes. The logical progression of this line of thought is that a British Ministry which is criticized for having too much power should be given even more, a prospect bound to give rise to misgivings. And the thought of publicly naming and blaming an individual or a company is bound to give rise to graver misgivings. Although the time may well have come to reconsider whether the enforcement of UK civil aviation safety legislation is adequate, more important than anything else is the need for a fresh approach by the Ministry to the dissemination of safety information. Excellent work is being done by an independent body, the Transport Flight Safety Committee, which publishes—at present for private circulation only—*Flight Safety Focus*. But final responsibility for safety, the furtherance of which depends so much on the sharing of experience, lies with the Ministry.

J. M. R.

A-WOOING IN CEYLON

THAT Air Ceylon is at a familiar crossroads is apparent from the latest reports. Like Philippine Airlines and CAA in the past, Air Ceylon has to decide whether to give up international services and concentrate on developing domestic and regional services. As reported in *Flight* for September 14, Air-India has shown interest in operating international services for Ceylon, following the withdrawal of KLM. And Pan American, represented by Mr E. F. Gerald, has been in Colombo with an offer of technical assistance whereby Ceylon would be financed by the US International Co-operation Administration, with technical assistance from PAA. Alitalia, too, has joined the queue and is interested in concluding a partnership agreement with Air Ceylon.

Various proposals are being put forward, especially in Ceylon's House of Representatives. One is that Air Ceylon should continue to provide regional feeder services connecting with KLM. Another proposal is for Air Ceylon to develop regional and internal air services from new airfields constructed in essential areas, or with small amphibious aircraft.

Mr A. Krytzer of the Netherlands Government and Mr J. Cammell, KLM schedules department, were recently in Ceylon at the invitation of Mr M. F. de Jayaratne, Air Ceylon's chairman, to make recommendations.

A BLACK SEPTEMBER

A TOTAL of 995 passengers and crew on commercial transport aircraft, scheduled and non-scheduled, were killed in 34 accidents during the period January 1 to September 23, 1961. The *Flight* table on the opposite page, compiled mainly from *Lloyd's List* of aircraft casualties, is provisional only, but some conclusions can be drawn. It is not known in all cases which services were scheduled, nor do all reports differentiate between passenger and crew fatalities.

An approximate estimate of the number of people who have so far lost their lives on scheduled services is 773. Deducting an estimate for crew members, the number of passengers killed is approximately 675. A glance through the table shows that out of a total of 34 accidents, four involved jet aircraft.

September 1961, according to *Flight* records, is the worst month on record in the history of air transport, 316 passengers and crew having been killed during the first 23 days of the month. The previous worst month was in 1956, between June 24 and July 21, when 239 people lost their lives.

The most recent accident, the seventh this month, occurred on September 23 when a Friendship of Türk Hava Yollari crashed a few minutes before landing at Ankara. Of the 25 passengers and four crew, only one—a passenger—survived.

1961 ACCIDENT RECORD

(See note on opposite page, col. 2)

Date	Carrier	Aircraft	Location	Fatalities Pass. Crew	Circumstances
Jan 2	CSA	11-14	Ruzyne	5 5	Hit HT wires on take-off
Jan 3	Finnair	DC-3	Vasa	22 3	Pilot error
Jan 18	Aeronaves de Mexico	DC-8	Idlewild	— 4	Crashed on take-off in snowstorm
Jan 19	Sabena	?	Kasenga	1 1	Unknown
Jan 22	Capitol Airways	C-46	Brookshire, Texas	— 2	Port engine caught fire; wing came off
Jan 24	Garuda Indonesian	DC-3	Mount Burangrang	16 5	Flew into mountain
Feb 3	Garuda Indonesian	DC-3	Between Surabaya and Balikpapan	21 5	Unknown
Feb 6	UAT	Max Holste Broussard	Grenoble	— 1	Unknown
Feb 15	Sabena	707-329	Near Melsbroek	61 11	Crashed on finals
March 10	LAV	DC-3	Near Carache, Venezuela	12 total	Flew into mountain
March 28	CSA	11-18	Near Nuremberg	52 total	Explosion in mid-air
April 4	LAN (Chile)	DC-3	In the Andes	20 4	Missing; icing presumed cause
April 20	Papuan Air Transport	Piaggio P.166	Between Popondetta & Pt Moresby	— 1	Unknown
April 20	Ethiopian	Bell 47J	175 miles n.w. of Addis Ababa	2 1	Unknown
May 10	Air France	L.1649A Starliner	Over the Sahara	69 9	Mid-air disintegration
May 12	LACSA (Costa Rica)	DC-3	Mount Arenal	— 2	Flew into mountain
May 24	TAA	DC-4	Near Brisbane	— 2	Unknown
May 30	VIASA	DC-8 (on lease from KLM)	Between Lisbon and the Azores	48 14	Unknown
June 12	KLM	Electra	Cairo	17 2	Hit hill on approach
June 18	CDL (Hamburg)	DC-4	Kano	— 1	Crashed on approach
June 30	Transcontinental	C-46	Buenos Aires	21 2	Crashed on landing
July 11	United	DC-8	Denver	16 (plus lorry driver)	Crashed after landing
July 11	CSA	11-18	Casablanca	73 total	Hit HT wires on approach
July 17	Aerolineas Argentinas	DC-6	150m west of Buenos A.	60 7	Struck by lightning
July 21	Alaska Airlines	DC-6C	Shemya Is	— 6	Crashed on approach
Aug 6	Malev	DC-3	Budapest	30 total	Sight-seeing flight
Aug 9	Cunard Eagle	Viking	Stavanger	36 3	Hit mountain 21 miles n.e. of airport
Sept 1	TWA	Constellation	Chicago	78 total	Crashed shortly after take-off
Sept 5	Ethiopian Air Lines	DC-3	Near Addis Ababa	4 —	Unknown
Sept 10	President Airlines	DC-6B	River Shannon	83 total	Crashed shortly after take-off
Sept 13	Air France	Caravelle	Rabat, Morocco	72 6	Hit hill on approach
Sept 17	Northwest	Electra	Chicago	31 5	Crashed shortly after take-off
Sept 18	Transair (UN charter)	DC-6B	Ndola	11 5	Crashed 7½ miles from airport
Sept 23	THY	Friendship	Ankara	24 4	On approach

THE FIRST APPEAL

ALTHOUGH the first appeal, from Falcon Airways, against an Air Transport Licensing Board decision has now been through the mill, the machinery has yet to be put to its real test. This will be when an appeals commissioner recommends to the Minister—as one day is bound to happen—that he dismiss a BOAC or BEA appeal against a major licence granted by the Board to an independent.

The Minister must have had little difficulty in accepting Sir Leonard Stone's recommendation, qualified though it was (see later), to dismiss the Falcon appeal. This appeal was against the Board's decision to refuse the independent's application for a licence to operate inclusive tours to Tangier, and to limit the required period of a licence for ITs to Malaga. Falcon's application had been opposed by BEA and Gibraltar Airways.

Sir Leonard Stone's report runs to nearly seven pages of foolscap, and comprises an introduction, a summary of the proceedings at the hearing before the Board, his recommendations, and three observations "of a more general character." The grounds of Falcon's appeal are given in an introduction, these grounds being (1) that the Board wrongly exercised its discretion in allowing Gibraltar Airways to be heard as objectors, and (2) that the Board failed to take into account the evidence of the need and demand for the service, that it should not have been satisfied that BEA's services are adequate, and that it was influenced by inaccurate evidence.

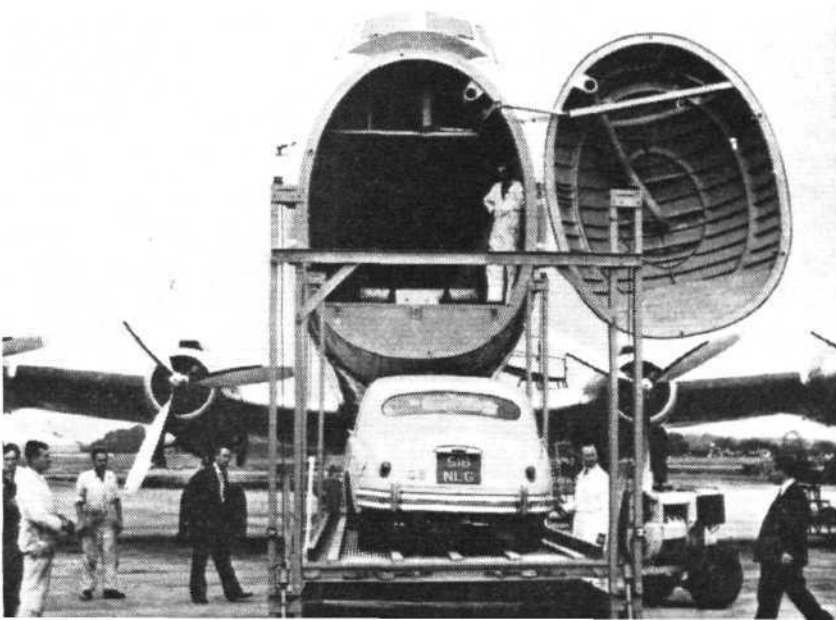
The commissioner's report admonishes both a Falcon witness and a BEA witness for "reprehensible" evidence at the hearing. Mr Peter Sinclair of the travel agent Flightways produced a bogus letter in support of Falcon's application before the Board, and the report recounts the story of this letter. The commissioner was "not impressed" with Mr Sinclair as a witness. Mr Cedric Jones of BEA is said in the report to have given an "untrue" answer to a question put to him in cross-examination; and his evidence is described as "just as reprehensible as Mr Sinclair's attempt to mislead the Board." BEA's advocate may not have expressed himself very well at one point; but to say that his evidence was as "reprehensible" as that of Mr Sinclair's bogus letter is going too far.

The actual recommendation as to the disposal of the appeal is put in the form of alternatives. The commissioner recommends that, if it is legal for BEA to combine a cabotage fare (London - Gibraltar) with a IATA fare (Gibraltar - Tangier) and to sell tickets for both at the same time in London to passengers flying to Tangier, the appeal be dismissed. If, on the other hand, it is *not* lawful for BEA so to operate, then the appeal should be allowed. The Minister does not accept the view that it is necessary to decide whether the BEA practice is legal or not, and orders that the appeal be dismissed.

In his general comments the commissioner considers it "absolutely essential" that witnesses should "treat the Board frankly and honestly." He also desires that nothing in his report should be taken as a criticism of the Board, which on the information before it was, he says, entitled to come to the conclusions it did.

Sir Leonard Stone's report is a thorough piece of work, although some of its readers might wish that it were better written and punctuated. One passage is particularly difficult to follow: "At the hearing of this Appeal the appellant and the Objectors each called two additional witnesses, and Mr Marking, for the Objectors consenting Mr Peter F. Sinclair was recalled, all this evidence was relevant." Well written or not, it is a contribution to the case law which will influence future applications, objections and Board decisions, and is therefore a piece of British air transport history.

Seen here at Southend before the open nose of the Aviation Traders Carvair prototype is a vehicle on the so-called "Car-go" platform. This platform lifts the car up towards the waiting aircraft



Left, Wg Cdr Peter Mitchell, Handley Page sales representative for Africa and the Middle East, who left England on September 25 to promote the Herald in Africa—in particular executive versions. Right, Capt Gordon Buxton, who has just logged 33 years of service with BOAC and Imperial Airways. Now a 707 skipper, he has 20,000hr in his log book



AIR COMMERCE...

BREVITIES

Mr Frederick Beezley, joint managing director with Capt M. Kozubski of Falcon Airways, has resigned "for domestic reasons."

Ansett-ANA has now been authorized to extend its services to Darwin in competition with TAA; this extension means that all Australian cities now have competitive air services.

Lambeth Council has protested to the Minister of Aviation against the proposal for a heliport at Nine Elms on the grounds that "too many people will be made to suffer from noise for the rest of their lives." The Council reckons that 13,000 people would be subjected to "intolerable" noise.

Pratt & Whitney turbojets in commercial and military service had accumulated over 20,500,000 hours flight time by August 31, 1961. Maximum JT3 overhaul time is 2,200 hours for TWA's 707s and 2,000 hours for those of Qantas. The latter has achieved a record of only one JT3C-6 in-flight shutdown per 80,750 hours of operation.

Evidence given to the Air Transport Licensing Board by Air Safaris applying for a Gatwick-Pisa IT service reveals that Air Safaris were to have used Avro 748s on this service this year, but the aircraft "did not materialise." Earlier this year a Dart Herald was demonstrated to the airline.

Mr B. R. Patel, vice-chairman and general manager of Air-India, said on arrival at London Airport recently: "The only way to correct the slump in present trans-Atlantic passenger figures is to cut the fares by about 10 or 14 per cent." Air-India is to raise this question at the IATA Annual General Meeting in Sydney next month.

Luxembourg Airlines announce an order for one Friendship 100 with an option on one more. At the moment Luxembourg Airlines are handling agents only, but they hope to start services in their own right in April 1962 between Luxembourg and Paris and Luxembourg-Amsterdam-Frankfurt. In advance of delivery of their own Friendship they are chartering Fokker's second prototype, which hitherto has been on lease to Lufttransport Union. Fokker are providing maintenance support.

Mr H. R. Cleaver has been appointed Secretary of the British Independent Air Transport Association from October 1. He succeeds Mr A. M. Blakemore, who, as already announced, is joining British United.

The Ministry has told Blackpool Corporation that if it wants to buy Squire's Gate airport it will have to pay £175,000 for the land and buildings plus £25,000 for equipment. Negotiations are still continuing.

Negotiations on a civil aviation agreement between Lebanon and the Iraq have broken down, it is reported, because the Iraqis insisted on capacity restrictions. Iraq also wishes to ban Air Liban aircraft from landing at Baghdad.

The Bibby Line shipping company's minority holding in Skyways Ltd has now been acquired by Eric Rylands Ltd. Skyways Ltd, Skyways Coach Air Ltd and Salmesbury Engineering Ltd (now to be renamed Skyways Engineering Ltd) are all wholly owned subsidiaries of Eric Rylands Ltd. The Bibby Line acquired a holding in Skyways in 1955.

Trans-European Airways has two Constellations, expects delivery of a third in October and has ordered two more for delivery next spring. Asked by BEA at a recent Board hearing to state the extent of Falcon Airways' interest in these aircraft the Trans-European representative said that Falcon had no interest, past, present or future, in them.

Nigeria Airways have confirmed their order for five Fokker Friendship 200s, with an option on a further two, for delivery in December 1962 and January 1963. The aircraft will replace the company's five DC-3s and provide the additional capacity needed for the expansion of Nigeria Airways' domestic and regional routes.

The first of three Armstrong Whitworth Argosies for British European Airways made its maiden test flight at Bitteswell, Leicester, on September 21. The aircraft was flown by the company's chief test pilot Mr E. G. Franklin. BEA have three Argosies on order and will start operating the aircraft on European freight routes in November. BEA have specified a number of modifications from the basic Argosy, including a revised instrument layout, special radio equipment, metal lining of the freight hold, and special cargo-lashing points in addition to provision for the Rolamat cargo handling system.

BOAC AND ITS ASSOCIATES (continued from page 509)

It is suggested that, despite the extraordinary circumstances in which your previous interest in Bahamas Airways was bought out and sold back again, the purchasers did not do so badly out of the deal; can you say what was the net financial result of the two transactions?

I am unable to give you the figures. A full report is now with the Minister.

Do you agree that the figures should be published—bearing in mind the evidence by Sir Basil Smallpeice to the Select Committee that it was not intended to shield the accounts of the subsidiary companies behind the holding company of BOAC AC?

We do not normally publish such figures, nor do other public companies; but we certainly have no intention of shielding anything.

Mr Bamberg of Cunard Eagle made some criticism last April that there had been rate-cutting from the Bahamas; has that added to the difficulties?

There has been no rate-cutting at all by this management. Indeed, we now have consultations with Cunard Eagle to ensure that there is a good service to the public, and without rate-cutting.

What is the present financial outlook for Bahamas Airways?

The accounts just published reflect the exceptional conditions under which we took over again. This year the loss should be halved, and within three or four years the results should be well within the limits of a good investment.

The other problem company with a major loss is BWIA; what do you intend to do there?

We have been in negotiation with the Federal Government and, more recently, with the Government of Trinidad. These negotiations will be resumed in October. With these negotiations immediately pending I cannot, of course, go into details, but the object is to allow the Federal Government and other local interests to take control and enable them to set up a national airline.

Can you say what you propose to do about the special case of Kuwait Airways, where your share of the loss amounted to nearly £300,000?

We shall carry out our commitments under the contract—entered into at Government request—which expires in 1963. After that we expect other arrangements to be made.

Looking at the operations as a whole, would you care to prophesy about the future financial results of BOAC AC?

Leaving aside BWIA, whose future is not settled yet, I would expect the financial picture in another two years to be an overall deficit of around £200,000; it may well be less. It will be possible in the future to concentrate more interest in and support on some of the smaller companies. There is still a big task facing BOAC in developing many of these companies.

Most people will agree that the longer-term benefits to Britain of our air association with some of these newly established national airlines should not be under-estimated. It is also fair and useful to stress the good work done by some of the otherwise under-published companies with which BOAC is now in association. But there still remain the two or three problem cases.

I cannot agree with Mr Granville that the shareholders of a public company would be content to accept losses on the scale of BOAC's with MEA and MASCO without demanding more information. Surely Parliament will want to know how much has been written off in that transaction. And there is Bahamas Airways. The Colonial Office would have had great difficulty in persuading Parliament to grant the same amount of money for colonial development which has been put into Bahamas Airways over the past ten years. And Nassau is scarcely a distressed area. How much did Skyways pay for BOAC's interest in BA? And for how much did they sell it back? Is there any good reason why the interested public should not have these figures? Public accountability can scarcely be satisfied with less information.

If Mr Granville's forecasts are fulfilled, the financial picture of BOAC AC will be radically changed. Yet I cannot forbear to note that his objective of a deficit reduced to £200,000 in two years' time is just about where we were ten years ago—a position which, as I said in the Commons at the time, was too bad to tolerate. All the same, I wish him well.