

FLIGHT

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TSR.2

HOW deep is the ocean? How high is the sky? How firm is a programme? How good is an unbuilt aeroplane? The rhetorical questions posed in the popular song differ little from those which could well be asked about any advanced aeronautical project, in particular the TSR.2 multi-purpose aircraft now being built for the RAF. In the one case no answer is expected because of the emotional context; in the other because of security regulations and the fallibility of aircraft builders. In any case, the TSR.2 has a singularity among weapon systems of the future, for although its physical characteristics have been preserved as one of the best-kept aeronautical secrets of our time a quite remarkable amount of miscellaneous information concerning the programme and predicted performance has been officially divulged. And if ever a programme was firm in a military and technical sense then we believe the TSR.2 to be rock-firm. It is an aircraft for which the RAF expressed not merely a requirement, but a passionate desire. It is definitely on. As for performance, it is known that its radius of action will be at least a thousand miles and a Mach number of about 2 should be obtainable at height.

In his recent appraisal of Australian deliberations on a Canberra replacement our Australian contributor Stanley Brogden suggested that the range of the TSR.2 might be "too short." It now appears, however, that his appraisal was based on consideration of the aircraft as a low-level type, whereas it has been officially stated that the TSR.2 "will fly at supersonic speeds at high altitude for a considerable part of the journey." There is, in fact, every reason to believe that the British Aircraft Corporation team in Australia has been able to satisfy the RAAF on this as on other essential points. The French and American contenders could certainly be available earlier; but both are probably inferior to the TSR.2 in important respects.

The political and military considerations confronting the Australian authorities are manifold; as Mr Brogden puts it in his latest communication, "Quite a problem, this bomber decision." The decision is, in fact, one which might well influence the future of what promises to be a British aircraft of quite exceptional capability: to influence it, however, not as a firm project for Britain's aircraft industry but as an export commodity of high potential.

A Cautionary Tale

OUGHT the senior civil servants who have so much technical say in British aviation to be "career men," fresh (for example) from the Ministry of Agriculture and Fisheries? Or ought they to be professional aviation people? So far as we know, there is only one top man in the Ministry of Aviation in the latter category.

What is the exception in this country seems, in America, to be rather more the rule. At any rate, let us give currency to this diverting little tale; it may or may not have a moral, but it is certainly cautionary.

At Washington National Airport last month a Cessna collided on the ground with a United Air Lines Viscount. The pilot of the Cessna has just been fined 50 dollars by the FAA for handling his aeroplane carelessly.

Indeed, the matter has been brought to the attention of no less an FAA official than Mr Najeeb Halaby, the agency's Administrator. He was the pilot of the Cessna.

FROM ALL QUARTERS

P.1127 Fault Isolated

IT is gratifying to record so soon that the cause of the loss of the second prototype Hawker P.1127 (page 938 last week) is of a localized nature. Moreover, a modification which would probably have averted the incident was in hand before the accident occurred.

As previously reported, Bill Bedford was flying from Dunsfold on high-speed trials, continuing a programme which has already taken the P.1127 beyond the speed of sound. While flying subsonically, straight and level at about 8,000ft, he experienced vibration which appeared to emanate from the Bristol Siddeley Pegasus lift/thrust engine. He said as much to his colleague Hugh Mere-wether, who was flying the Hunter chase-plane. Inspection showed that there was indeed a loss of thrust, but that r.p.m. and j.p.t. were normal.

After rejecting the idea of trying to reach Dunsfold or Boscombe, Mr Bedford began an approach to RNAS Yeovilton, Somerset. With very little power on, he lowered the flaps to about 30°. This made the aircraft tend to roll gently to port, but the effect was mild, and could easily be held. After lowering the undercarriage he got the aircraft properly lined up on the final approach, although it seemed that the engine had to be opened up a little more than usual. What must have happened next was that the application of full flap resulted in a greatly increased tendency to roll to port. More power was then applied to avoid undershooting, and the rolling moment at once became uncontrollable. The alternatives must have appeared to be either to undershoot or to arrive on the runway upside down. Mr Bedford ejected.

Cause of all the trouble was the structural failure of the forward, port, engine nozzle, handling half the airflow delivered by the fan and providing about 25 per cent of the total thrust. The final portion of the nozzle consists of a louvred cascade which turns the flow through some 90° and rotates to direct the jet downwards for lift or rearwards for propulsion.

The complete nozzle broke away over Sherborne, Dorset, where it was found by a farmer. Loss of the nozzle would obviously reduce propulsive thrust and impart a yawing moment, but the real trouble started when the flaps were lowered. From the configuration of the aircraft (and some later NBMR-3 designs may well be similar in this respect) it is clear that the jets from the front nozzles greatly influence the pressure-distribution around the depressed flaps. The effects normally are symmetrical on both sides of the aircraft, but loss of the port fan nozzle meant that there was no balancing load on the port flap—hence the severe rolling moment.

The material of the faulty nozzle was a glass-reinforced plastic. Such material would appear to be quite satisfactory for this application, for the fan air is only a little hotter than ambient and the weight of the large nozzles is critically dependent upon the material employed. Nevertheless, the use of a glass-fibre moulding was from the outset the subject of much argument, and at the time of the accident an all-metal (probably steel) nozzle was being produced. The new metal nozzle will be standard on all future aircraft. It is unfortunate that one announcement speaks of a faulty "nozzle system," suggesting that the trouble was of a more deep-seated nature.

LIFT AND THRUST are provided by the Bristol Siddeley Pegasus turbo-fan, by means of four rotating nozzles. The arrow identifies the front (fan) left-hand nozzle, key factor in the news-item above.

Sir George Edwards' New Posts

IT was announced last week by British Aircraft Corporation that Sir George Edwards, managing director, had been appointed chairman of the BAC subsidiary companies Bristol Aircraft, English Electric Aviation, and Vickers-Armstrongs (Aircraft). The retiring chairmen, respectively Sir Reginald Verdon-Smith, the Hon H. G. Nelson and Maj-Gen Sir Charles Dunphie, are all members of the BAC board, Mr Nelson and Gen Dunphie being deputy chairmen. These changes take effect on January 1.

The announcement is also made of the appointment of Mr J. E. Harper as managing director of Bristol Aircraft.

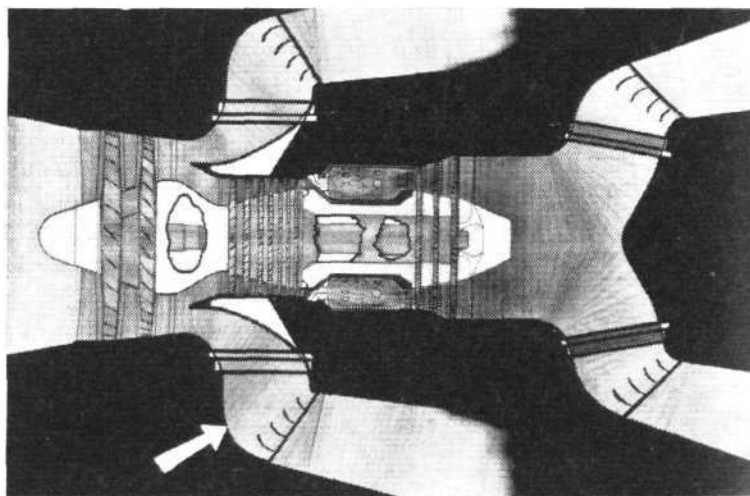
Bristol-Westland Bid for Fairey

AS we close for press, the Fairey Company announces receipt of a joint offer from the Bristol Aeroplane Company and Westland Aircraft Ltd for their entire share capital. The offer consists wholly of shares: two Bristols (15s 10½d) and two Westlands (16s 6d) for every three Fairey 10s Ordinaries. The latter sank to 11s earlier this year, but at the time of the offer were quoted at 17s 9d. The bid represents about 21s 7d per Fairey share, but the net-asset value is well over 30s per share, and indications are that holders will be advised to reject the offer. It will be recalled that Westland purchased all the aircraft interests of the former Fairey Aviation Co in April 1960, and the new offer appears to have been unexpected and not immediately easy to understand.

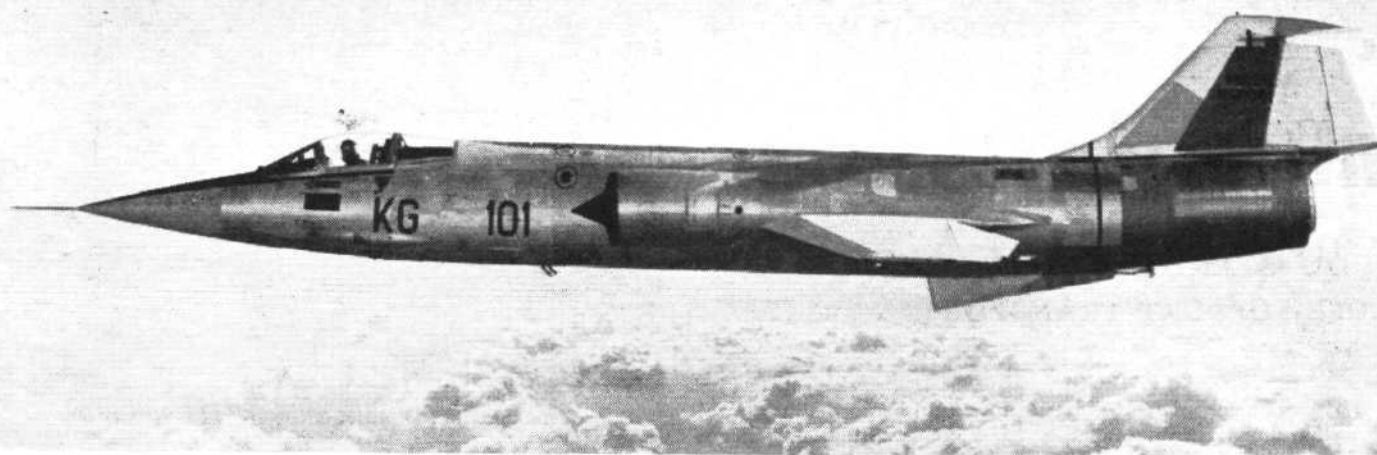
Importance of Design

SPEAKING recently about *Design and Designers* the joint managing director of Short Brothers and Harland Ltd, Mr H. G. Conway, said that at a time when we were being encouraged to produce more and to cheapen production by introducing automation he considered we were overlooking the most important thing—design. Addressing an RAeS meeting at Queen's University, Belfast, Mr Conway said that clever design could do more to reduce costs than all other things put together: it was the lifeblood of a manufacturing nation and the key to Britain's future prosperity. This would be accentuated by the Common Market. We must therefore find means of encouraging engineers to create on paper and to want to go on doing so. Education should teach design on a grand scale—in the sense of project design—as well as on the minor scale. Engineering training methods must bring design ability to the surface and industrial atmosphere must foster it instead of making young designers ambitious to get off the drawing board.

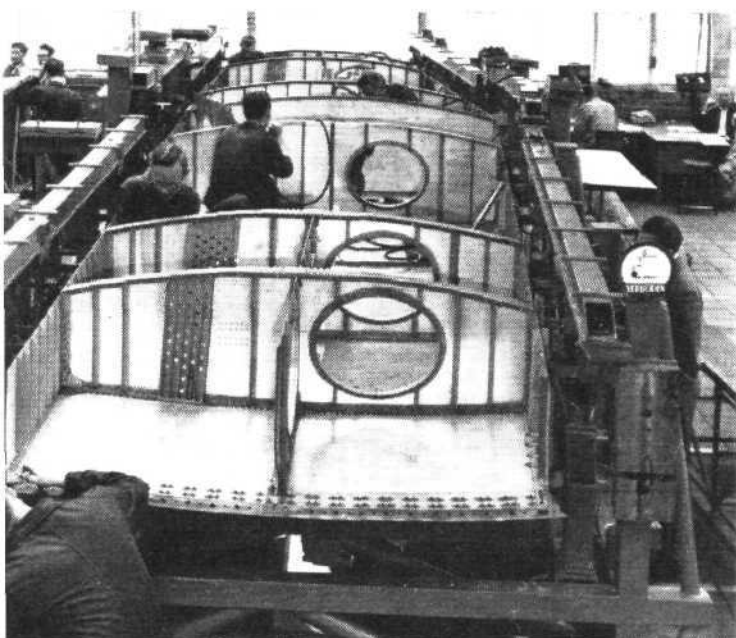
In his lecture Mr Conway traced the evolution of design in different fields and showed how many everyday items had developed from the ornate and often ugly to the practical and attractive. On the other hand he was of the opinion that quite a few supposedly modern designs were open to a great deal of criticism.



MIRAGE IIIR.02 is the designation of this second prototype of the reconnaissance version of Dassault's internationally successful multi-mission Mirage III series.



FOKKER-ASSEMBLED Lockheed F-104G Super Starfighter (using US-made components) forerunner of 325 from the Northern Group of manufacturers



FOKKER-BUILT centre-section for a Breguet Atlantic ocean-patrol and anti-submarine aircraft (two 6,000 h.p. Rolls-Royce Tyne)

Indonesian Industry

WITH Indonesia coming once again into the news headlines, it is of topical interest that prospects for aircraft production there were discussed recently in Djakarta by Col Nurtanio, director of the republic's newly formed "institute for the preparation of an aircraft industry." He said that Indonesian Belalangs and Polish PZL-104 Wilga all-purpose aircraft (*Flight*, July 27) should start coming off the assembly lines in 1963. For the sake of standardization, they were to be fitted with American-designed engines.

Col Nurtanio said that de Havilland of Canada, Lockheed and Dornier had offered to assemble, and later to manufacture, aircraft in Indonesia, which already had a number of D.H.C. Otters, given by Canada under the Colombo Plan. He added that "a neighbouring country" had already stated its willingness to buy Indonesian Otters, as soon as they were in production.

Experimental Aerodynamics Diploma

APPLICATIONS for entry from graduate engineers and scientists for the next one-year diploma course in experimental aerodynamics (October 8, 1962, to July 6, 1963) are now being received by the Training Center for Experimental Aerodynamics, Rhode-St-Genese, Belgium. The centre, under the chairmanship of Prof Theodore von Kármán, is an international educational institute

recognized by NATO and a condition of entry is citizenship of one of the NATO nations. There are no fees for the course and a number of fellowships are available to cover travel and living expenses. Students are required to be fluent either in English or French. Last year a British student, Mr J. Pitchford from Bristol Siddeley, won a special prize given by the Belgium Government. Further information and application forms (which should be returned by March 23 next year) can be obtained from the Director Training Center for Experimental Aerodynamics, 72 Chaussee de Waterloo, Rhode-St-Genese, Belgium.

IN BRIEF

The South African Air Force is reported to have ordered seven Lockheed Hercules C-130Bs and 20 Dassault Mirage IIICs.

Lycoming Division of Avco announce projects for turbofan derivatives based on the shaft-drive T53 and T55. The former engine leads to the PLF2A-1 (2,140lb thrust, s.f.c. 0.422, weight 600lb), while the T55 could form the basis of the PLF1B-1 (4,650lb, 0.355, 850lb). The specific consumptions are remarkably low.

In an accident near Seville on December 19, when a light aircraft which had been chartered by a Madrid newspaper to cover the arrival of lorries with gifts for flood victims apparently struck a high tension cable, some 20 people were killed and others injured when wreckage fell into a crowd of spectators.

The newly formed Midland Group of the Technical Publications Association is holding the first of its monthly meetings on Friday, January 12, at 6.30 p.m. at the College of Arts, School of Graphic Design, 53 Broad Street, Birmingham. All who are interested in the preparation of technical publications are invited to attend.

The classic aviation film *Hell's Angels* will be shown at next Thursday's (January 4) meeting of the London Society of Air-Britain, at 7 p.m. in the lecture theatre of the new Holborn Central Library, 38 Theobalds Road, WC1. Non-members are welcome. The London Society's annual subscription for 1962 remains at half a guinea though the parent association subscription is now £1.

Hovercraft Development Ltd announce that the name "Hovercraft" is now their registered trade mark, and should be applied only to the British ground-effect vehicles associated with HDL and their collaborators. HDL is a subsidiary of the National Research Development Corporation, whose accounts (published December 14) show that, of total development expenditure in the year ended June 30 of £812,000, £475,000 went on Hovercraft, Dracones and fuel cells.

Bristol Siddeley Engines announce that the first turbojet built entirely in India—an Orpheus 701, for a Gnat—has completed a 96hr quality approval test and subsequently stripped perfectly. Since the licence agreement with Hindustan Aircraft of September 15, 1956, the two companies have co-operated closely. The first engines incorporated British components, but the engine recently tested was manufactured from Indian raw materials.

South African Air Force helicopters recently airlifted a consignment of trout fingerlings from the Cape Provincial Administration's hatcheries at Jonkershoek, near Stellenbosch, to the upper reaches of the Elands River near Du Toit's Kloof, at a height of about 3,500ft. During the flight, which lasted 25 minutes, the fish were carried in plastic bags with a supply of oxygen. Previous efforts to stock the upper part of the river had involved long mountaineering expeditions.

TIPPED FOR 1962: Next year's Cessna 310G includes revised and raised tip-tanks in its general restyling. Selling at \$59,590, it has sea-level top speed of 240 m.p.h.



Military Herald

AN OUTSTANDING SHORT-FIELD
CLOSE-SUPPORT TRANSPORT

LIKE most aeroplanes of basically sound design, the Herald has shown itself amenable to a considerable amount of "stretching," and for at least two years it has been clear that the present civil transport could form the basis for an excellent military close-support and freight aircraft. Under the direction of the main Handley Page project office at Cricklewood, staff at both Cricklewood and Reading roughed out the basic form of the H.P.124 Military Herald during 1960, and by the middle of 1961 had completed most of the actual design work.

By this time extensive discussions had been held with various fighting services. According to unofficial reports the Royal Air Force have established a requirement for a substantial number of Military Heralds (a total of 45 aircraft has been mentioned), principally in order to meet a global close-support commitment to the Army. Last week *Flight* commented briefly upon the numerous statements which have appeared to the effect that the Minister of Aviation is unwilling to order these aircraft, for the sole reason that Handley Page Ltd is still a single company rather than a member of some giant consortium. This may or may not be the case; but no doubt surrounds the basic specification of the aircraft concerned.

In any evolutionary step of this nature it is obviously desirable to keep all changes to a minimum; yet, conversely, the introduction of later design techniques and equipment can obviously lead to a superior brochure performance. In the case of the H.P.124 a satisfactory compromise appears to have been reached, for although the aircraft differs very considerably from its predecessor in several important respects, most of the major portions of airframe and equipment, as well as more than 80 per cent of the jigs and tools, are common to both. The company examined a wide range of high-lift devices, all of which were rejected; and it is nothing less than the truth to assert that the entire Herald design was investigated in the most minute detail in the evolution of an optimized military version.

Principal differences between the Military Herald and the civil Herald 200 are shown shaded in the three-view drawing. The most obvious is the entirely new rear fuselage and raised tail unit, to provide for rear loading and air-dropping of vehicles and other heavy stores. Construction of the freight floor is also revised, and it extends right forward to the flight deck. Gross weight is increased, requiring minor modifications throughout the airframe to improve local strength factors, particularly at points where fatigue life is critical. Finally, performance (especially take-off performance) at the increased weight is markedly improved by the installation of the advanced Rolls-Royce Dart 640/10 engine.

As a diagram shows, the freight floor has an effective width of just over 80in, and it incorporates roller tracks at 30in pitch for handling standard pallets. Outboard of the tracks are deep metal sandwich strips on which vehicles can be driven, and down the centre the floor is made of metal/balsa sandwich. Details of the loads which can be carried are listed later.

Throughout its 40ft length the floor is level at a height of 36in

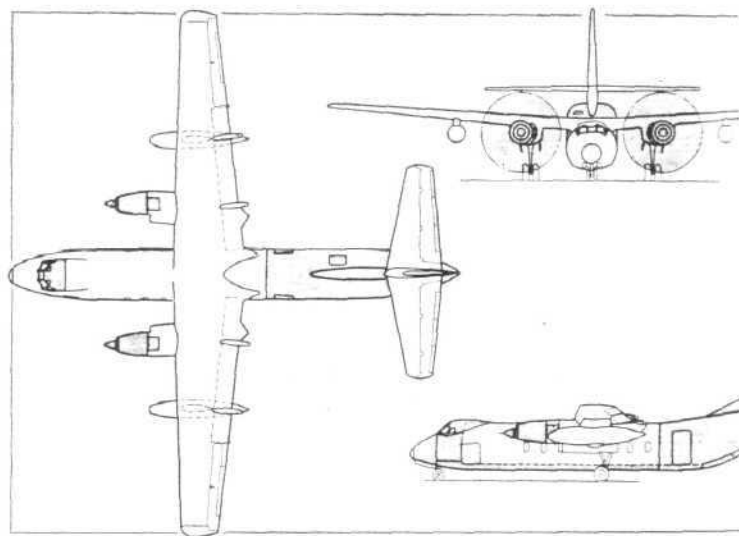
A civil Herald demonstrates short take-offs from an unprepared surface



A manufacturer's model of the H.P.124 Military Herald

above the ground line at an aircraft weight of 40,000lb. Most of the interior is 104in wide internally and 83in high, but these values are reduced to approximately 90in and 71.5in by the two spar frames. The rear door, the design of which can be clearly seen in another drawing, consists of an upwards-hinging rear portion and a forward section which folds downwards to form a loading ramp, which can be extended by two 7ft 10in bridge-pieces stowed above the rear part of the door. The nominal size of the rear-door opening is 88in wide $\times$ 76in high. The door is power-operated, can be opened in flight for air delivery, and incorporates novel locking and sealing mechanisms to bear the 4.2lb/sq in cabin pressure-differential. At the rear are a pair of paratroop doors, each 72in $\times$ 44in. These open outwards and forwards to provide an aerodynamic shield. They also serve as airbrakes.

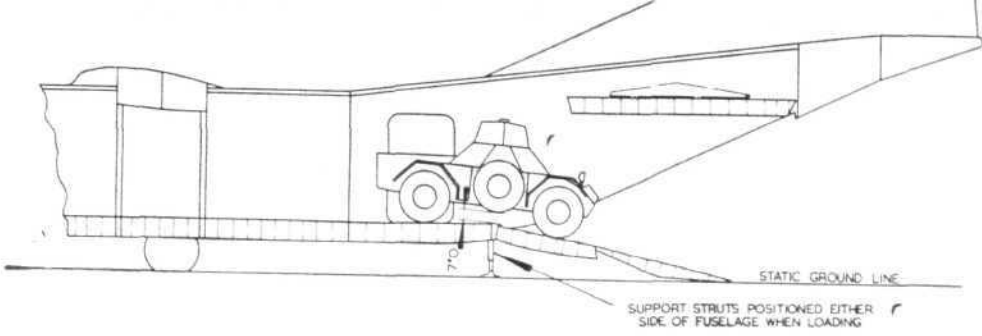
Apart from local strengthening, the wings and tail unit are standard Herald components. To increase drag during the assault-landing case and to hold the floor level in paratrooping, the flaps can be lowered to 35°, and aileron travel is increased to +15° -20° to provide greater power at low speeds. Fin and rudder effectiveness is enhanced by the longer moment arm and additional area below the tailplane, and the same factors increase elevator power to match the new flap setting.



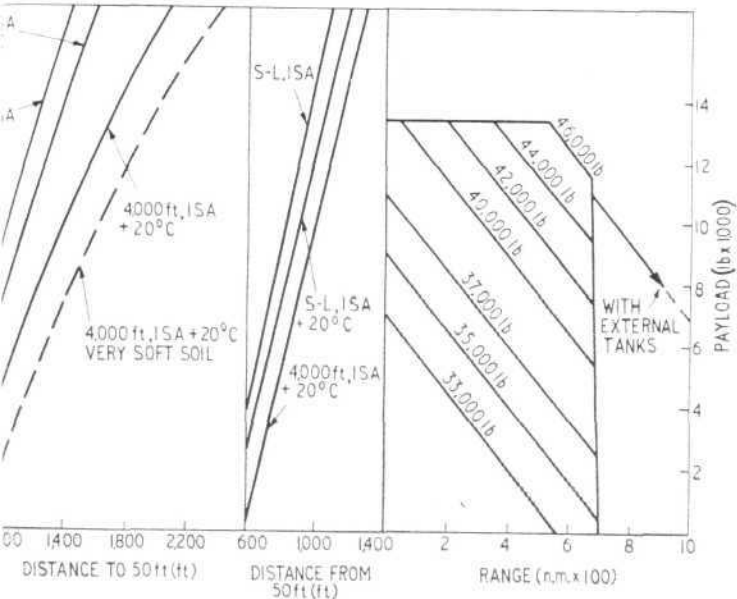
Dimensions of the H.P.124 are: span, 94ft 9.45in; length, 80ft; height, 30ft 6in. BOW, without role equipment, is 25,895lb; gross weight, 46,000lb; max ZFW, 39,300lb. Engines are Dart RDa.10 Mk 640/10, derated to a civil rating of 2,750 s.h.p. to give a long life



Unloading a Ferret Mk 2 scout car, using the 7ft 10in ramp extensions



(Below) STOL performance is obtained by using special techniques, which have been fully explored with the civil airliner in 30kt cross-winds. Take-off, for example, involves releasing brakes at full power, rotating at 1.1 Vsf-power-off and climbing away at 1.22 Vsf-power-off beyond 50ft



It is appropriate that on page 984 of this issue there should appear a description of the Japanese YS-11, for the existence of this aircraft has ensured the continued development by Rolls-Royce of the Dart RDa.10/1 turboprop. Much more powerful than the engines fitted to the present Herald, the Dart Mk 640/10 is nearly installationally interchangeable, although the Dowty Rotol propellers are increased in diameter to 14ft 6in. Standard Herald tankage of 1,080 Imp gal may be filled with any normal military turbine fuel without modification, and for ferrying purposes pylon tanks may be added under the outer wings to give a range of up to 2,850 n.m. with reserves. Similar tanks, modified from those used on the Hastings, have already been used on civil Heralds, and both the internal and pylon tanks can be pressured-fuelled in 12min. Water/methanol tanks are fitted in each nacelle.

Minor modifications to the Electro-Hydraulics/Goodyear landing gear permit operations at 46,000lb at a vertical impact velocity of 10ft/sec. The brakes are increased in capacity to match the landing weight of 41,000lb, and civil Herald demonstrations have proved the behaviour on unprepared surfaces of tyres deflated to 55lb/sq in at the STOL weight of 37,000lb. For emergency operations into very soft terrain, the inflation pressure may be reduced to 46lb/sq in although this halves the tyre life. Few changes have been made to the existing Herald accessory systems. The 3,000lb/sq in hydraulic

system is increased in capacity to drive the additional services, and new d.c. and a.c. electrical systems incorporate power equipment identical to that fitted in the Argosy C.1.

Primary role of the H.P.124 is the logistic support of battle areas. The specification supply operation is over a radius of action of 165 n.m. at low level, with STOL take-offs and landings at both ends. The 1,500ft airstrips are assumed at 4,000ft altitude in an ambient temperature of ISA + 20 C. The Herald carries 9,200lb, throughout this mission at 235kt. Five sorties can be made in 12hr. allowing 30min for turn-round. Turn-round at the forward strip is accelerated by the ease of loading and of rigging alternative seating, stretchers and freight lashing. Refuelling is not required.

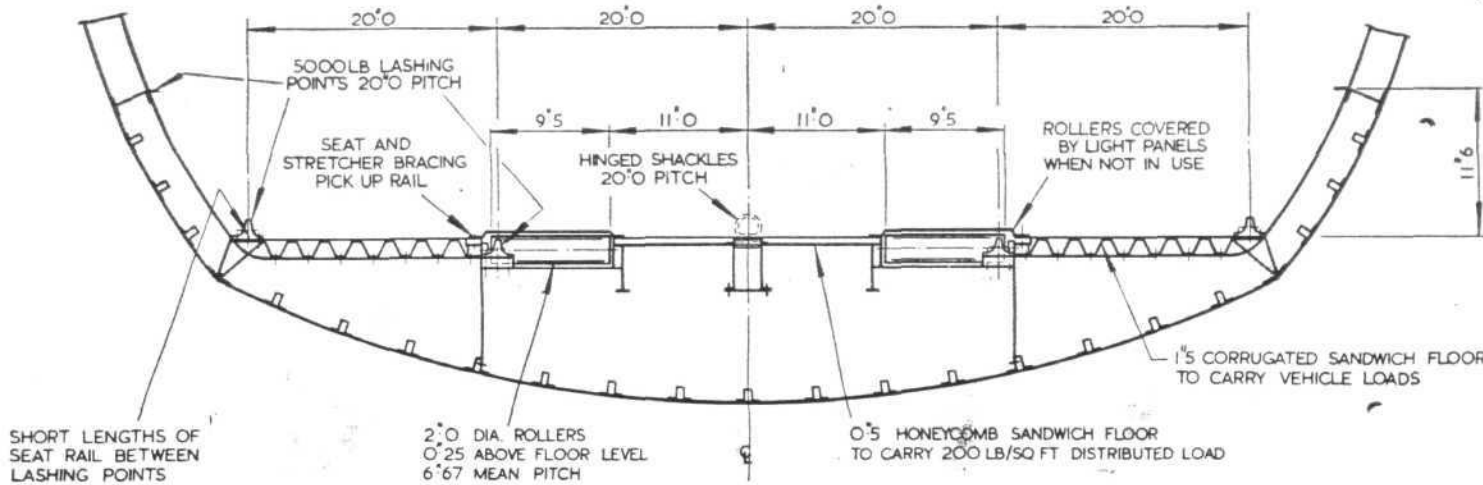
In this role, the payload is determined by the field conditions and operating range. It can be increased to 13,400lb for short ranges, or where, for instance, the airstrip is at 1,000ft, ISA + 20 C. Where the airstrip is very soft, the payload penalty for any particular operation is approximately 2,500lb. At a minimum useful operating weight of 32,000lb, the aircraft can land into a 1,000ft field at 4,000ft ISA + 20 C and take-off in 800ft, in both cases over 50ft obstacles.

A major secondary role is casualty evacuation, and provision is made for 24 stretchers with the usual electrical and oxygen services. As a troop transport, 48 Short SM.260 aft-facing 9g seats can be installed, together with two 26-seat dinghies. In the paratroop role inward-facing seats are provided for 35 to 40 troops, separated by safety nets, with their valises stacked down the centre. In the air-supply role, five 2,000lb containers can be discharged by conventional methods, and six such containers can be palletized in the air-landing operation.

The floor is designed for a loading of 200lb/sq ft and for axle loads of 3,000lb, except in two regions which will cater for axle loads of 5,280lb. Twin roller conveyors have 6in rollers of 2in diameter at 6in pitch. These are attached to the floor at 18in pitch, and will handle pallets up to 6,000lb. Rollers are preferred instead of wheels for weight reasons and for their superior performance with softwood skidboards or pallets. Lashing points (10,000lb) are fitted on a 20in grid, so that the minimum number of lashings have to be fitted for a given load. With pallets or loose cargo, standard fore and aft restraint barriers have a single vertical chain to each pallet. This reduces the time for lashing and the variations in lashing schemes which are normally necessary. An electrically operated winch is provided.

Trials with the Herald 200 have confirmed the STOL performance when operating from unprepared strips. In July at Martlesham Heath Service chiefs watched operations from deeply furrowed earth, thick mud and loose sand (both wet and dry), with tyres at 56lb/sq in, all completely successful. All the trials, including some last winter, were undertaken in adverse weather conditions, the Martlesham operation taking place in gusty rain with an average cross-wind of 20kt. Handley Page have used a Herald fuselage test-specimen as the basis for the H.P.124 mock-up, and the second prototype Herald is to be converted to military standard during the coming year.

Cross-section of a typical part of the main freight floor



Missiles and Spaceflight

MET OFFICE ON SATELLITES

The study of the high atmosphere by means of rockets and satellites is for the Meteorological Office "a story of planning and preparing more than of achievement," according to Dr R. C. Sutcliffe, Director of Research, writing in the annual report of the Meteorological Office.* Introducing an account of this planning by Dr R. Frith, the director emphasizes the importance of high-atmosphere information in gaining a full knowledge of weather near the ground.

All the energy which drives the winds and produces the weather, Dr Sutcliffe points out, comes from the Sun through the high atmosphere and, on its way, suffers important changes—especially due to absorption by ozone. Details of the satellite experiments planned to study the ozone layer are described by Dr Frith as follows:—

In the satellite field [Dr Frith states] we are of course studying results obtained from American satellites—especially the Tiros cloud photographs and the Explorer 7 radiation measurements (the latter being received direct from the satellite by the Radio Research

satellite sees the Sun through the Earth's atmosphere and from measurements made during these periods the distribution of ozone in the vertical can be computed.

Perhaps the main meteorological interest is in the region between 15 and 40km, where the lifetime of ozone molecules is rather long (days, or weeks, or even longer), and where ozone can therefore be used as a tracer. The satellite should provide an almost worldwide picture of the ozone distribution, day by day, for a year; we should learn much about the general circulation, and about vertical movements, in this little-known region. At higher levels the time constants of some of the processes are known to become very short; but little is known about the time constants of others.

Since we shall be making measurements in two very different circumstances, namely, when the levels being examined have been in sunshine for only a few minutes, after several hours of darkness; and, again, when the same levels have been in continuous sunshine for several hours, something may be learned about the several chemical and photo-chemical processes involved.

This technique, if it is successful, could be refined in a number of ways to measure ozone more accurately: it could also be used for other gases—for example molecular oxygen and water vapour. But tremendous advances in techniques, in knowledge and in understanding are constantly being made; it is impossible to foresee, at this stage, whether our next satellite experiment will be such a refinement, or something quite different.

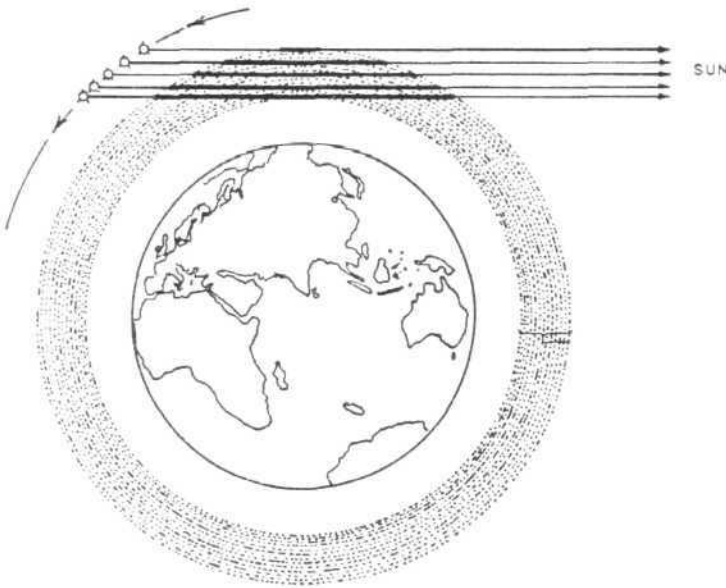


Diagram from the Meteorological Office annual report showing how the path in the ozone layer (shaded), and therefore absorption in the ozone band, increases as the satellite passes into the Earth's shadow at sunset

Station at Slough); but we are also ourselves building instruments for use on a satellite. These instruments are scheduled to go in the second British satellite, to be put into orbit by an American Scout rocket, possibly in the first half of 1963, and are designed to measure the vertical distribution of ozone in the Earth's atmosphere.

The measurements will be made in this way. Sensors on the satellite measure direct radiation from the Sun. The sensors are made to respond only to radiation in an ozone absorption band (part of the Hartley-Huggins band—about 2,500-3,500 Å—is used). For most of each orbit the satellite is either in complete darkness, or is in full sun; in either case no useful information is obtained. But for about a minute at "sunrise," and a minute at "sunset," the

* Meteorological Office, Report for the year ending December 31, 1961, HMSO, 4s 6d.

BOEING TO MAKE ADVANCED SATURN BOOSTER

First stage (S-1B) of the advanced Saturn launch vehicle will be developed for the National Aeronautics and Space Administration by the Boeing Company, with Rocketdyne assisting in the developmental ground firings. A contract worth more than \$300m is now being negotiated, covering development, construction and test of 24 flight boosters and several ground test versions, all of which will be assembled at the NASA Michoud Operations plant, New Orleans.

FORTY-EIGHTH SKYLARK

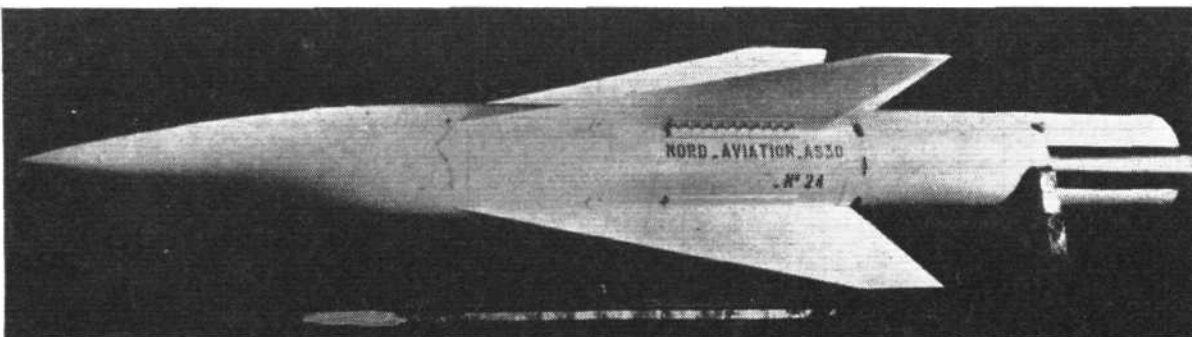
The 48th Skylark research rocket to be fired at Woomera was launched successfully on December 6, being boosted [by a Cuckoo first stage and reaching a height of 144 miles. According to Mr Alan Hulme, Australian Minister for Supply, this was the 17th and last Skylark to be launched from the Australian base this year.

Mr Hulme listed the experiments carried as follows:—

- (1) Birmingham University dielectric experiment to measure electron density and collision frequency in the upper atmosphere.
- (2) London University and Leicester University College camera to measure solar spectrum in the soft X-ray frequency band.
- (3) London University observations on the distribution of atomic hydrogen in the Earth's atmosphere and the presence of sporadic E-layer ionization.

RADIATION-BELT DATA

The National Aeronautics and Space Administration's Explorer 12 energetic-particles satellite, launched on August 15 from Cape Canaveral, transmitted 3,000m pieces of information in the period before its radio went out of action on December 6. Mr Paul Butler, Explorer 12 project manager, stated that the satellite had indicated that protons made up the major part of the outer Van Allen radiation belt, outnumbering electrons by almost 1,000 to 1. Previously it had been thought that the belt consisted mainly of electrons.



This photograph of the 24th Nord AS-30 air-to-surface missile was accompanied by a French caption stating that negotiations for purchase of AS-30 by the RAF are in hand. Comments on this possible order appeared in "Flight" of December 14



Four of the X-15 test pilots pose with a model of the research aircraft at the recent preview of a Hollywood film devoted to the X-15 programme. From the left, Jack McKay, Cdr Forrest Peterson, Joe Walker and Neil Armstrong

RAMJETS RECOMMENDED

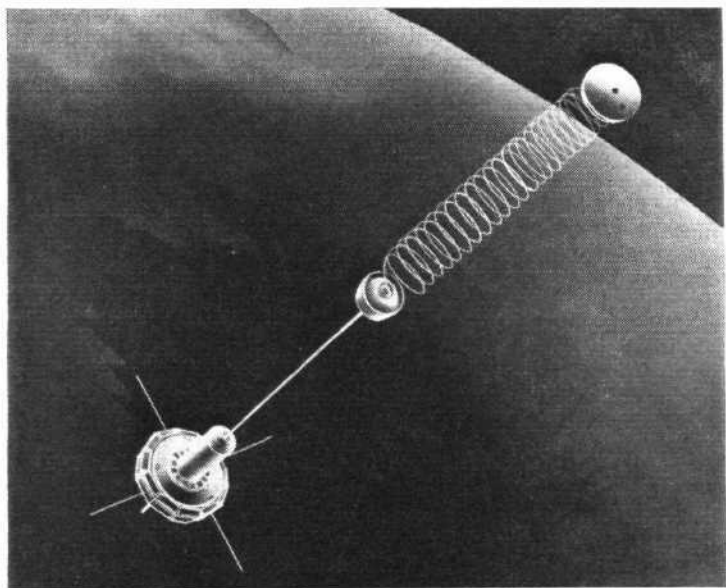
Speaking before the Rugby Engineering Society earlier this month, Mr David Andrews, chief designer (rockets) of Bristol Siddeley Engines, suggested that ramjet engines should be used for the initial stages (within the Earth's atmosphere) of space launchings in the long-term future. Chemical rockets would be used to inject the vehicle into the primary orbit around the Earth; thereafter electrical propulsion systems using nuclear generators would take over and enable orbital transfer to be made. The ramjet-propelled first stage would be a winged vehicle used only for take-off and later recovered by remote control.

MINIATURE TV RECORDER FOR SPACECRAFT

Development of a 30lb video recorder able to record and reproduce up to 30min of satellite television pictures or the equivalent amount of scientific data, was recently announced by NASA's Goddard Space Flight Center. The recorder occupies less than 1 cu ft, compared with the 1,500lb, 39 cu ft television recorders currently in broadcast industry use.

The recorder was developed by the Ampex Corporation, Redwood City, California, under Goddard's advanced technical development programme. It will receive and store more than 4m cycles of information each second for 30min; transmit, erase, and begin the cycle all over again. Although not designed for any specific spacecraft, the recorder is expected to play a prominent role in a number of large second-generation satellites currently under development at Goddard.

Artist's impression of the US Navy's TRAAC (Transit research and attitude control) satellite, launched aboard Transit 4B by Thor-AbleStar from Cape Canaveral on November 15, showing the weighted boom which was designed to use the Earth's gravity gradient to stabilize the satellite with one face towards the Earth at all times. This experiment was designed into the 200lb satellite by the Applied Physics Laboratory of Johns Hopkins University



Realistic test conditions for satellite guidance and control systems are provided by this space satellite simulator at Minneapolis-Honeywell's "new \$5m aerospace facility," which weighs two tons, is suspended on an air bearing, and was designed and built by company scientists

Maj Yuri Gagarin, the first Soviet cosmonaut, has agreed to become president of Glasgow University Communist Club.

A \$5,000 award to Mr William J. O'Sullivan Jr of NASA's Langley Research Center has been made by the space administration for his invention of the inflatable space vehicle, employed successfully in the Echo 1 and Explorer 9 experiments.

The first Blue Scout rocket to be launched from Point Arguello, California over the Pacific Missile Range was fired on December 4 in a 27,600 mile shot to measure solar radiation. Seven Blue Scouts had previously been launched from Cape Canaveral.

Mr Max W. Hunter, chief engineer, space systems of the Missile and Space Systems Division of Douglas Aircraft Company, has resigned from the company to join the National Aeronautics and Space Council, and is being replaced by Mr Theodore D. Smith.

Scenes at the Rocket Propulsion Establishment, Westcott, and the Royal Aircraft Establishment's missile trials establishment at Aberporth are included in the colour film *Rockets Away*, recently produced by Rank Film Distributors in the company's *Look at Life* series.

Maj Yuri Gagarin, the first Soviet cosmonaut, was quoted by Reuter as saying that a flight to the Moon would become a reality during the next five years, and that Soviet scientists were already working on the flight, during the major's visit to Calcutta earlier this month.

Mr F. W. Godsey Jr, retired president of Electronic Communications Inc and former vice-president of Westinghouse Electric Co, has joined the National Aeronautics and Space Administration as consultant. Policies and programmes leading to a worldwide communications satellite system are among the subjects on which he will advise.

The seventh consecutive successful test of a US Nike-Zeus missile was carried out from Point Mugu, California, recently. The US Army said that the missile and electronic ground guidance equipment worked perfectly, and a spokesman said that the test was of extended range, believed to mean the longest flight so far by a Nike-Zeus.

Four Centaure rockets were successfully launched from the Hammaguir test site and from a mobile platform at the Reggane atomic test site in the Sahara between December 6 and 10, as part of a French research programme on the upper atmosphere. Heights between 150 and 180km were achieved; and a fifth rocket failed to reach the scheduled altitude.

Support services at the National Aeronautics and Space Administration's Michoud plant, New Orleans, where Saturn S-1 and S-1B boosters and RIFT (reactor in flight test) nuclear stages will be built, are to be provided by the Mason-Rust company, whose parent organizations are Rust Engineering of Pittsburgh, and Mason and Hanger-Silas Mason of Lexington, Kentucky.

Answering a parliamentary question in the Baden-Württemberg State Parliament earlier this month, State Economics Minister Dr Eduard Leuze stated that West German rocket expert Eugen Sänger and three colleagues were promised DM2m (approximately £178,600) in connection with the production of rockets for the United Arab Republic. Dr Leuze added that he understood that half the amount had been paid. Prof Sänger recently agreed to the request of the supervisory board of the State-backed Institute for Jet Propulsion Physics to resign as its director after his work for Egypt had become known. Dr Leuze said that a firm was formed in West Germany to carry out the Egyptian order, and rocket parts were exported to Egypt.

Missiles and Spaceflight . . .

Environmental Testing of Bloodhound

Structural resonance investigations, similar to those made during normal aircraft prototype proving programmes, in progress on a Bloodhound

ENVIRONMENTAL engineering as a recognized and developed technology is largely a postwar development. As is so often the case, its techniques principally originated in meeting military requirements, and its growth reflects the increasing awareness of the need for an organized attack on unreliability.

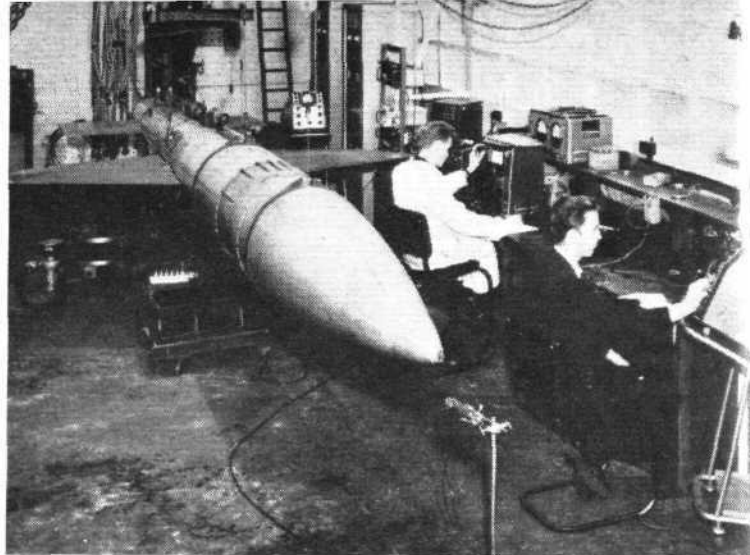
In no field is reliability more vital than in aviation and, as the boundaries of flight have been advanced, the aircraft industry has become increasingly environment-conscious. With such factors as kinetic heating and acoustically excited vibration to be taken into account, laboratory tests must reproduce service conditions so faithfully that equipment likely to fail in service will fail in the laboratory.

In guided-missiles, reliability is all-important. These complex weapons must lie quiescent for months, often in unfavourable conditions, and yet remain capable of instant operation under the most exacting environmental conditions. In manned aircraft, the failure of system components need not be disastrous; alternative services and emergency measures can be brought into play, and a crew is available to take corrective action. Missiles possess no such safeguards, and the failure or inconsistent operation of one part is usually failure complete.

The guided-weapons manufacturers have therefore had to build up considerable facilities, manned by specialist staff and employing specially designed equipment and advanced techniques, to simulate (often in combination) such physical effects as the near-vacuum conditions of high altitudes, the high temperatures resulting from aerodynamic heating or the low temperatures of stratosphere conditions, the accelerations attendant upon launching or flight manoeuvres, the static or dynamic loads resulting from flight aerodynamics, and mechanically or acoustically excited vibration.

The environmental laboratory of Bristol Aircraft, established primarily to develop and prove the Bristol/Ferranti Bloodhound surface-to-air missile, typifies the larger laboratories in being in Britain. It is grouped in relation to its principal test activities, which can be loosely classed as kinetic heating, vibration, natural environment, and packaging and transportation.

Of the environmental conditions peculiar to missiles and aircraft, one of the most difficult to synthesize on a large scale is kinetic



or aerodynamic heating. During sustained level-flight, the airframe will slowly attain a steady elevated-temperature condition. Rapid changes of speed and height, such as are demanded by missile manoeuvres, induce transient conditions which are particularly severe. The short active life of some missiles may include many varied load patterns, resulting from the demands of the guidance system, combined with rapid temperature variation, perhaps from well below zero to many hundreds of degrees Centigrade.

The task of the test engineer in proving structural integrity has been complicated by this need to include in ground test conditions the factors of heat and time. A complete theoretical analysis of the stresses due to combined aerodynamic loading and thermal stress conditions in a complex structure is not at present feasible. A comprehensive series of tests must therefore be carried out on a complete airframe structure, combining all the aspects of varying heat, load and time.

Heat is radiated on to the surface of the test structure by a number of quartz-envelope, infra-red lamps mounted in polished reflectors, shaped to enclose the test structure. By this means up to 20kW/sq ft can be delivered into large structures and up to 90kW/sq ft into small structures and specimen panels. Almost double this power is consumed in the lamp assemblies because of losses.

During the heating operation, structural loads resulting from aerodynamic forces or manoeuvre are applied as point loads and varied to reproduce the flight pattern under study. Generally the environment is simulated by closed-loop temperature/time programming of the skin temperature, while the mechanical load is manually controlled through orthodox hydraulics.

During tests of this kind, which cannot be repeated because of the deterioration of material properties, a great number of results has to be recorded, sometimes in as little as 30sec. The current technique is to record test results (temperature, deflection, strain, etc) upon punched tape for subsequent data processing; or the results can be transcribed immediately upon an automatic typewriter.

A more advanced control and recording technique is now coming into use at Filton. The control system is intended to provide a more accurate reproduction of the temperature/load/time relationship through closer simulation of the heat-flow conditions and more precise and rapid control of load variation. It is based upon synchronized electro-mechanical function generators which prescribe to the heat and load power sources instructions derived from flight parameters programmed on digitally punched tape.

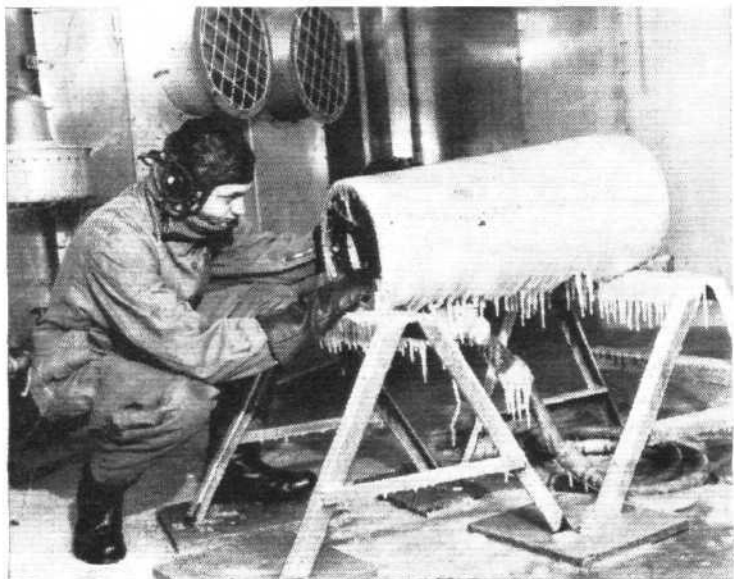
The heat control function generator converts the digital information into analogue form and computes the heat input appropriate to that instant in flight. This information is then compared with the output of the heating lamps, and the difference signal is used to control the power supply unit. By rapid sequential presentation of data, discrete control can be exercised of the heat input to a number of individually heated areas. The load control function generator operates in a similar manner but utilizes rapid-response hydraulic servos to modulate the jack pressures.

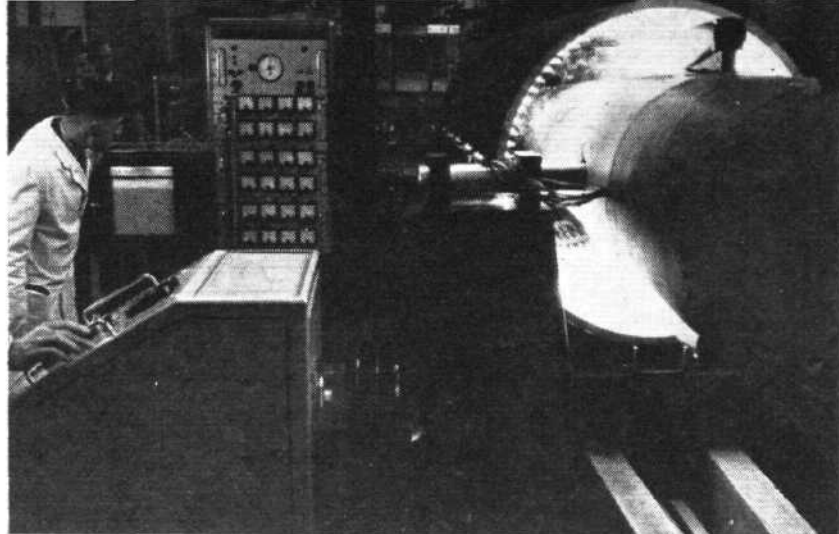
The flight load cases to be simulated are programmed to the load function generator as consecutive complete programmes. Two or three cycles of load can be applied within the transient heating time, enabling the progressive deterioration of structure stiffness to be determined. The recording system at present under construction utilizes telemetry multiplexing and high-speed magnetic recording.

Vibration testing has received considerable attention since the war. The electronics industry has provided much specialized equipment of advanced design, and simulation techniques closely representative of actuality are being studied.

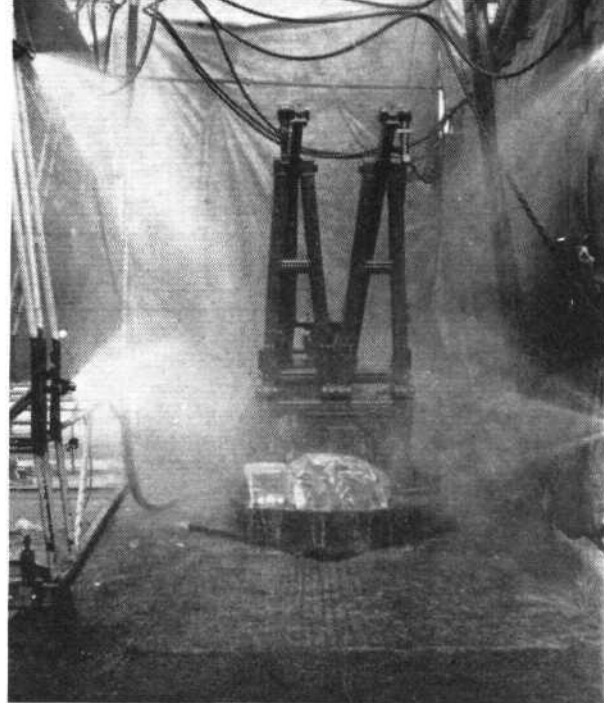
In the recently-equipped vibration section at Filton, structural resonance investigations are carried out to check the predicted aeroelastic characteristics of Bloodhound through the exact determination of the structure resonant frequencies, the identification and description of the modes of vibration, and the evaluation of structural damping factors. The test structure is suspended upon

Cold-chamber test of Bloodhound afterbody to prove the functioning of the co-axial cable connections in very low temperatures





Above, simulated kinetic heating test on a Bloodhound rear-fuselage. Right, a launcher with its power supplies undergoing a rainstorm test at the outdoor test-site



rubber cords in the normal manner for structures of this size, and is then sweep-frequency excited with constant force by small electro-magnetic vibrators. Vibration parameters are measured by piezo-electric accelerometers, in conjunction with manual or automatic resolving and plotting equipment.

In missiles, vibration as an environmental condition is a reliability hazard comparable in severity to kinetic heating. The principal sources of this vibration are the periodic and random engine forces, plus radiated sonic energy and aerodynamic turbulence or boundary-layer "noise."

Propulsion, guidance and control elements are tested in a simulated flight vibration environment in a sound-enclosing chamber which houses two large electro-magnetic vibrators and their forced-air cooling systems. The larger vibrator, driven from two 10kVA audio amplifiers in series, develops a peak thrust of 10,000lb at frequencies up to 1kc/s; the smaller, driven from a single 10kVA amplifier, develops a peak thrust of 3,000lb with a level response to 5kc/s. Each vibrator is rated for a maximum peak acceleration of 100g, vector. Both vibrators are mounted on a 40-ton concrete block sunk to floor level and isolated from the building foundations by supporting rubber sections. Each component or assembly is operated in a controlled vibration environment with frequency and amplitude characteristics representative of in-service conditions, often combined with low or high temperature conditions or with temperature cycling.

The flight vibration environment is determined from magnetic-tape recordings or telemetered accelerometer signals, supplemented from instrumented ground-level engine runs and missile static firings. A number of recordings taken from several general areas within the missile body are analysed by playback through a series of narrow-band filters. An envelope containing the acceleration/frequency relationship is derived, which, after the addition of safety factors, is applied as the acceptance test specification.

Current official environmental specifications and normal design-proving checks are met by subjecting the specimen to a programme of sine-wave excitation, wherein the applied peak acceleration is varied appropriately as the frequency range is continuously swept. "Equivalent sine-wave" testing is an expedient adopted to enable environmental vibration tests to be made with the basic minimum of equipment. It is sufficient to meet most current environmental specifications, but it is recognized that the vibration experienced by most missile components is random with time rather than periodic, with the characteristics of a continuous frequency spectrum. Random motion excitation is therefore almost certain to gain acceptance in the near future as the preferred technique.

Random motion is already applied to Bloodhound components in research and development testing as a complement to, and confirmation of, equivalent sine-wave tests. The noise signal is normally that generated by an electronic (i.e., "white noise") generator, rather than a playback of recorded in-flight noise.

Kinetic heating, vibration, shock and sustained acceleration are all typical induced active-life environments. The active-life of a guided missile is, however, only a very small part of its total in-service life. Indeed, the fatigue and wear design cases of a missile are provided by the ground drill and performance checking needed to maintain its state of readiness. The natural environments in which this state of readiness must be maintained become, therefore, an important area of study. The climatic simulation section of Bristol Aircraft's laboratory investigates the effects of dry and damp heat, sunshine, dust, driving rain, salt spray, low temperatures, snow, and deterioration due to storage and age, such as corrosion and fungus growth. The problems may often be aggravated by storage under tarpaulins or by transportation in a ship's hold, and the performance and durability of all types of mechanical and electrical equipment, materials, sealants, finishes and packag-

ing must be proved under many combinations of conditions.

Climatic extremes at ground-level ambient pressure are reproduced in one chamber, in which the air temperature can be varied under fully automatic control between $\pm 70^{\circ}\text{C}$. With all conditions, vigorous air circulation reduces the temperature gradients in the working area to $\pm 1^{\circ}\text{C}$. Relative humidity is controlled up to approximately 95 per cent RH within the dry-bulb temperature range 20° to 50°C , and is generated by water injected as a fine vapour into the airstream. Saturation is possible. To simulate driving rainstorms, water can be discharged into the chamber at up to 250gal/min through 44 nozzles.

A smaller chamber has a temperature range of -75° to 100°C , and the same humidity range as the larger chamber, but can also be evacuated to simulate altitude conditions up to 120,000ft. Twin 45 h.p. evacuation pumps can simulate rapid rates of climb, and automatic pressure control enables pre-selected levels to be maintained. This chamber is used for sub-assembly and equipment testing, and for materials evaluation.

Dust storms or the dust clouds caused by travelling over dirt roads can cause excessive wear or seizure of moving parts. These conditions are simulated in another chamber. Finely ground quartz dust is uniformly distributed by fans housed in the dust hoppers beneath the grating floor. During a test the internal air temperature is raised (to a maximum of 40°C) and the dust concentration, distribution and particle size are checked by sampling.

In another chamber, the salt-laden atmosphere prevailing at many coastal sites is reproduced. An aqueous solution of salts is sprayed into the chamber, and the missile remains for four weeks in temperature and humidity conditions conducive to corrosion.

Smaller, specialized chambers provide for the study of such problems as resistance to mould growth and the effects of hydraulic oil contamination. Tests are also carried out on the effects of long exposure to tropical day and night temperatures and humidity variations, icing conditions, exposure to sunlight, and other climatic conditions. Weathering trials of a long-term nature are made at outside sites, where the launcher and its power supplies are mounted on foundations representative of an actual launching site, with similar natural drainage, and checked daily throughout a month of operation.

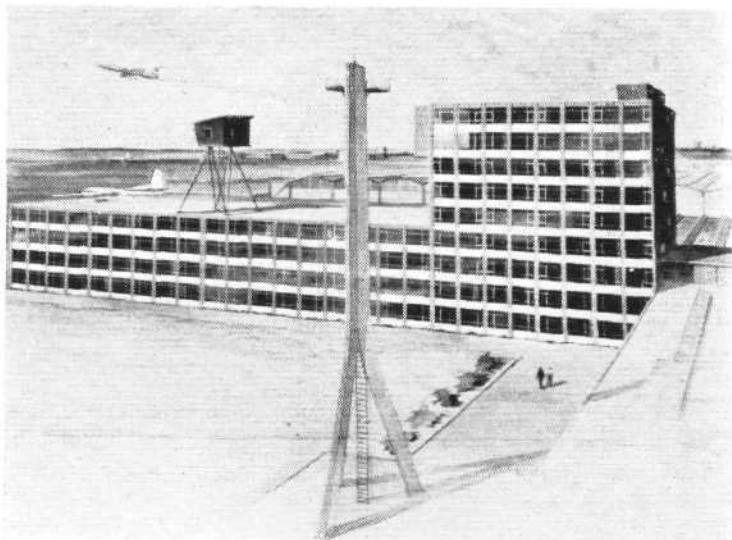
Finally, the laboratory is equipped with a wide range of apparatus designed specifically for the realistic development and acceptance of missile packaging. Shocks caused during rail shunting or by a crane swinging the package against the side of a ship's hold are simulated by placing the package on a low carriage which runs down a railway inclined at 10° and fetches up against a buffer. Measurements of the induced shock to the missile at impact are taken at several points on the airframe and in each plane.

Rough handling shocks, such as might result from toppling from the tailboard of a lorry, are simulated in drop tests, and bump test machines subject specimens to repetitive decelerations of about 40g severity at a frequency of 2-3 bumps per second to simulate the bumping and bouncing of an unsecured lorry load. A mechanical low-frequency vibrator reproduces the considerable vibration to which rail and road packages are exposed. Comprehensive testing on these machines is punctuated by periods of storage in dry heat and damp heat in the climatic chambers, and of exposure to the water spray in the rainstorm facility. The missile normally travels uncovered during local transportation and ground handling. The trolleys and mechanical handling equipment are proved to establish their ability to withstand fully-laden towing at speeds of up to 30 m.p.h. over third-class roads.



SYSTEM SURVEY

The Fokker electronics centre recently completed at Schiphol for the testing of F-104G radar, navigation, attack and flight control systems. In foreground is the radar reflector tower for NASARR



Fokker's F-104G Electronics Centre

THE F-104G production programme, the largest military venture Fokker have ever undertaken—they make wings, tail, tanks, radome and certain cover panels, and assemble and flight test the aircraft—has involved the building of a nine-storey electronics centre at the Schiphol factory. The building was completed in less than a year and is now occupied by some 42 Fokker electronics engineers and 13 representatives of electronics suppliers. The number of representatives will increase in due course to at least 120.

The complete F-104G radar, navigation, flight control and weapons systems are prepared and tested in the building, using techniques and equipment which, Fokker say, will keep them in the forefront of electronics technology. There is a standards laboratory for calibrating the extensive semi-automatic test equipment, which is in turn used to run and prove all the varied components. At a ceremony shortly before Christmas, the Netherlands Defence Minister formally opened the centre by remote control, observed by closed-circuit television.

Also by TV, those present were then shown some of the test operations in progress. The Litton inertial platform was tilted on a test table mounted on piles sunk 30ft into the ground beneath the building. Meanwhile the adapter was plugged-in to the test console. Flight control system accelerometers and force-sensing pilot's hand-grip were shown under test. The complete NASARR 15A radar was operated in its eighth-floor laboratory, being calibrated against "false echoes" returned by a wooden tower outside the window and fed with all its external inputs from a six-bay simulator. The tower must be at least 25ft above the tallest object in the neighbourhood: it is 100ft high at Schiphol. All radio boxes were systematically checked. Test equipment was mainly housed in two- and three-bay electronic cabinets. In the factory itself a two-bay, mobile cabinet was being used for checking all the wiring circuits in the aircraft under tape-controlled programme with automatic print-out of results. The equipment was made by California Technical Industries of Belmont, Cal.

Pre-flight checking and calibration certainly involves a surprising amount of test equipment of very high accuracy, and it is hard to believe that so much operational equipment can be stowed in the aircraft itself.

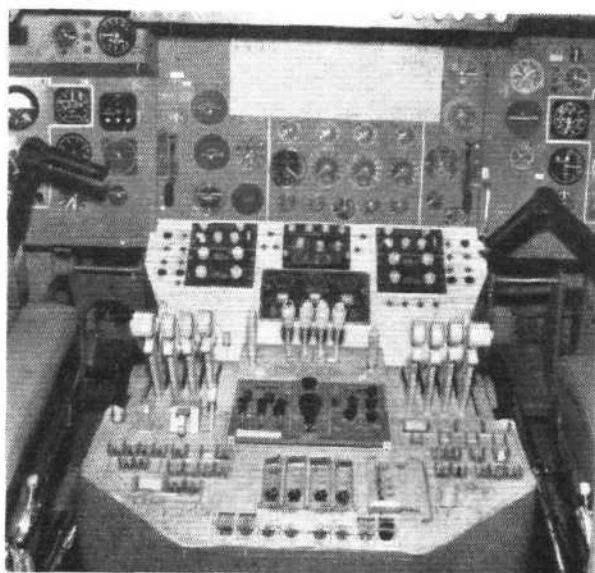
Belfast Flight Deck

FOR the first time, the flight deck layout of a new aircraft—the Short Belfast—has been designed to meet, without modification, the civil ARB and the MoA military requirements for control layout and equipment. Principal problem was the reconciliation of the different degrees of pilot visibility, and much careful work was needed to arrange the shape and size of the windows and the relationship of the pilot to them. The final flight deck has now been incorporated in the mock-up at Belfast and is illustrated here.

Smiths Autoland and its associated instruments are included, it being arranged that all related control panels shall be operated by the flight engineer from his jump-seat. They are located on the central console for this purpose. By this means, the pilots will be as little as possible distracted from flying. Rank Cintel Peep eye-level presentation is provided for the captain, the tilted glass screen being just above the coaming, with the c.r.t. unit at an angle within the coaming. By day, the pattern will be projected in green, but orange can be used at night, together with automatic brightness control to take account of changing light conditions.

"System control" has been applied to the flight engineer's control panels, each different aircraft system being displayed pictorially on a separate control panel and warning lights being located to give immediate indication of the area which has failed.

Noteworthy features marked on the instrument panels of the mock-up are a "taximeter," a low-speed a.s.i. for use while taxiing; an aileron emergency-disengage handle low on the left wall; a ground-run predictor for take-off, the dial being located to the left of the main blind-flying panel; separate Tacan range and bearing dials; VHF nav receiver; transponder; UHF and HF radios; a large Doppler navigation computer; and control-position indicators across the centre of the coaming.



The Short Belfast's flight deck is now approved by ARB and the MoA for both civil and military use—the first occasion of such joint clearance. Features include Rank Peep screen above the captain's instruments, Smiths automatic landing flight control and instruments, a ground-run predictor for take-off, low-speed a.s.i. for taxiing, control-position indicators in the coaming, advanced Doppler, VHF nav and Tacan, search radar and transponder

Sport and Business



Market demand for the five-seat Beechcraft A55 Baron during 1961, first year in production, caused the company to increase the production rate on three occasions and resulted in sales 25 per cent greater than anticipated. Above, the 1962 model of the Baron



Appearance of the 1962 Beechcraft P35 Bonanza (left) marks the type's 16th consecutive year in production. Almost 7,000 have been built during that time

COPENHAGEN PRIVATE FLYING CLUB is to sponsor an international aircraft fair at Skovlunde Airport, Copenhagen, during June 1-11, 1962. Light aircraft, gliders and associated equipment will be exhibited, in an effort to show the increased activity in light-aircraft flying in Scandinavia and the whole of Northern Europe. Business flying, in particular, is developing rapidly at present throughout Scandinavia.

FAIR OAKS AERODROME and Universal Flying Services Ltd, operators of Fair Oaks Aero Club, have been acquired by Mr Norman Jones, managing director of Rollason Aircraft and Engines Ltd and founder of the Tiger Club. The Tiger Club will now use Fair Oaks as a second base in addition to Redhill, with Fair Oaks

Aero Club continuing as at present. Previously Universal Flying Services was owned by Blackburn Aircraft Ltd.

TWO RAF OFFICERS, Flt Lt David Innes and Flt Lt Mervyn Singer, are to make an attempt on the United Kingdom gain-of-height and absolute-height records for gliders. They aim to reach 30,000ft in a Slingsby T.21 Sedburgh over the Rothes Glen area of Scotland, sometime between December 23 and January 22. Both are members of 120 Sqn, a Shackleton unit based at Kinloss, who glide at Milltown airfield, satellite for RNAS Lossiemouth. Another member of the squadron, Flt Lt Nigel Whitting, is to aerotow the Sedburgh by Tiger Moth.

THE ROYAL AERO CLUB was due to close at its 119 Piccadilly premises yesterday, December 27, and will re-open at 9 Fitzmaurice Place, Berkeley Square, London W1 on Monday, January 1, 1962.

A RESEARCH PROGRAMME intended to lead to a reduction in the number of accidents to light aircraft has been started by the Australian Department of Civil Aviation. The Director of Flying Operations of the Department has said that more than 220 light aircraft crashed in Australia during 1959 and 1960, killing 29 people. About 40 per cent of the accidents, the director said, occurred in agricultural flying.

NAPIER AERO CLUB, New Zealand, is claiming a world record for one day's flying after 20 of its members kept a light aircraft in the air for 23hr 24min on December 2. This is 5hr 14min longer than the time set up by 600 Squadron Flying Group at Biggin Hill on June 24.

FLIGHT TESTS of the Potez-Heinkel CM.191 four-seater executive jet are expected to begin next month at Toulouse. Flying will be carried out by Jacques Granette, chief test pilot of Potez, after which the official flight tests will be performed at Brétigny Flight Test Centre.

THE FIRST SERIES of 100 Potez 4E 90-105 h.p. four-cylinder engines should be complete by the end of the year, and will be followed by a second production batch of 100. Two prototypes of the 155 h.p. six-cylinder version known as the 6E are in final assembly now and will soon be bench-tested, and a third is being built.

REGISTRATIONS of Ulster Flying Club aircraft are Tiger Moth G-AOUR and Air-Rent Aircoques G-ARHD and RHE, and not as given in the news item on page 848 in our November 30 issue.



The single-seat Ferguson Special (upper picture) was built by C. R. Ferguson of Texas and is powered by an 85 h.p. Continental engine. Cruising speed is 125 m.p.h. At left is the latest version of the Wittman Tailwind, designed and built by Steve Wittman of Oshkosh, Wisconsin and featuring swivel nose-gear, 160 h.p. Lycoming and 175 m.p.h. cruising speed. Range is claimed to be over 600 miles



By D. N. MAY

YS-11

More about Japan's "Twin Viscount" DC-3 Replacement

AERONAUTICAL historians in Germany, Italy and Japan will mark the 1960s as the period in which their countries once again took their places in the forum of aircraft-producing powers. Since the war these nations have relied mainly on military programmes to develop their skills. True, they have been involved in the production of small civil aircraft, but these have never been of a type to attract world-wide airline interest and cannot therefore be considered real advances along the road to aeronautical maturity.

The development of an airliner poses problems not found in military aircraft. Apart from the all-important issue of finding finance, and from the technical considerations of long life, turn-round and reliability, there is the immense problem of building up a sales team to sell the aircraft and developing a good after-sales organization.

Because of these special difficulties, it is interesting to see which resurrected company will bring out the first successful transport. Italy's Agusta AZ-8 did not even sell in Italy. East Germany's VEB-152 was cancelled after a fortune had been spent on it, and West Germany's HFB.314 has not been taken beyond the study stage. In fact, it seems that the only airliner from Germany, Italy and Japan which has a remote chance of succeeding is the Japanese NAMC YS-11.

Broadly speaking, the YS-11 might be seen as a twin-Dart Viscount. It is a low-wing aeroplane which could be mistaken for an Avro 748; but there is room for 15 rows of seats, and each engine develops nearly twice the power of the Darts fitted in early Viscounts. The Rolls-Royce RDa.10/1 produces no less than 2,775 s.h.p. for take-off, using water-methanol, and compared with the RDa.7 has 16 per cent higher mass flow, a flame-tube temperature 65°C higher, and air-cooled blades in the high-pressure turbine. Increased-capacity reduction gear, a conical spinner and 14ft 6in Dowty-Rotol propellers complete the picture.

Around this powerplant the Japanese designed the YS-11. In 1957 the Transport Aircraft Development Association started work, and by June 1959 they had hammered out the basic configuration. In this month they were succeeded by the Nihon Aeroplane Manufacturing Co (NAMC), which was formed under the Aircraft Industries Promotion Law with both government and private capital. Its directors came from the old-established firms of Mitsubishi, Fuji and Kawasaki, who handle most of the production. There have been management changes, and production is the responsibility of six manufacturers in Japan alone; but NAMC has shown that it is no novice at aircraft production. The first YS-11 is due to fly this month (December) and is to enter service—after certification by the Japan Civil Aviation Bureau and the FAA—in the summer of 1963. By any standards, this is a creditable achievement.

The aircraft is a short-range feederliner and has been described as a DC-3 replacement. Its best operating costs are on routes of between 300 and 550 miles, and it is designed to use airfields that the DC-3 cannot. In short, it is tailored to the requirements of the East, where traffic between the small towns and big cities is increasing, and where airfields are short, hot and often high. NAMC estimate a demand for about 150 aircraft, including 40 for export (largely in the East). Basic price is £360,000.

Although the YS-11 is designed to do an unsophisticated job, its structure and systems compare favourably with the latest in any country. The airframe is largely fail-safe, and should have a life of over 30,000hr, which is adequate for a type which will take off and land at least once every flying hour. To prove these qualities,

two airframes are being subjected to testing, one fatigue and one static load. In addition, there is the normal testing of components.

The wing consists of three main sections, with the centre-section running through the underfloor of the fuselage in accordance with the theory of continuity. Construction is of the two-spar box type, and the fuel tanks are housed in the box both inboard and outboard of the nacelles. The outboard tanks are integral, with a capacity of 1,060 Imp gal, and they are used for all normal operations. Inboard are bag tanks, for long-range use, holding 490gal of fuel and 105gal of water-methanol. This suggests an operating range of much more than 400 miles—until it is realized that the fuel is sufficient for several stages; and there is enough water-methanol (which will probably not be needed at every airfield) for two take-offs.

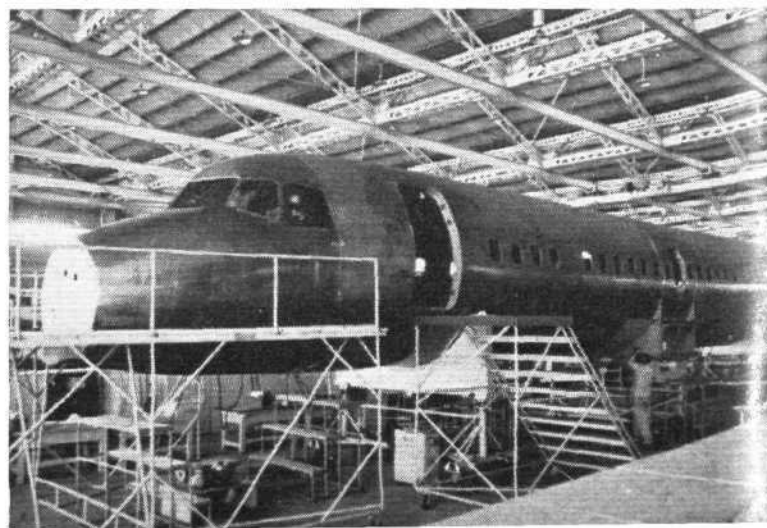
Although the YS-11 carries between 52 and 60 passengers, its short-haul duties keep its gross weight to 50,250lb. Maximum landing weight is 48,000lb. Standard seating is for 52 passengers at 38in pitch, but the same number at 34in pitch increases baggage space and 60 can be seated at 34in pitch. Seating is four-abreast, and there are 24 windows down each side of the unpartitioned cabin to allow changes in layout without impairing passenger visibility. Fluorescent lighting is used for cabin illumination. Toilet and galley are situated at the rear.

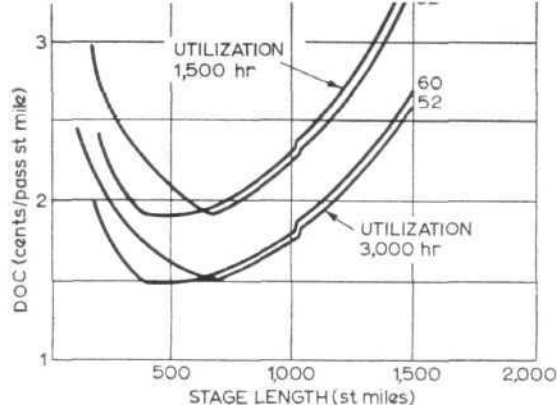
NAMC claim an "amazingly low sound-level" for the cabin. This is due to "effective use of modern sound-proofing materials and techniques," and is not prejudiced by propeller-to-fuselage clearance, which is 2ft 2in. Cabin pressurization is maintained at a differential of 4.16lb/sq in, which gives a cabin altitude of 8,000ft at 20,000ft. Superchargers installed on each engine supply the air, and with one engine out the aircraft can still be kept at its most economical altitude with pressurization unaffected.

To keep turn-round time low, the port engine has a hydraulic propeller-brake, so that passengers may safely enter the aircraft through a door on the left-hand side of the forward section. The servicing door is on the same side but at the rear, and the cargo door is opposite on the right-hand side. For emergency purposes, there are two hatches, each incorporating a window, above the wing.

Normal YS-11 crew is two pilots and a stewardess. The flight-deck is neatly laid out, although access to the pilots' seats seems to be rather difficult. Communication equipment is orthodox: one HF and two VHF transmitter-receivers, with space for an emergency radio, an additional HF and a Selcal. Navigational equipment includes duplicated ADF and VOR, a marker beacon and two glide-slope receivers. Space has been reserved for DMET and Loran, and space and wiring provision has been made for weather radar and autopilot. As might be expected, everything is based on traditional US practice.

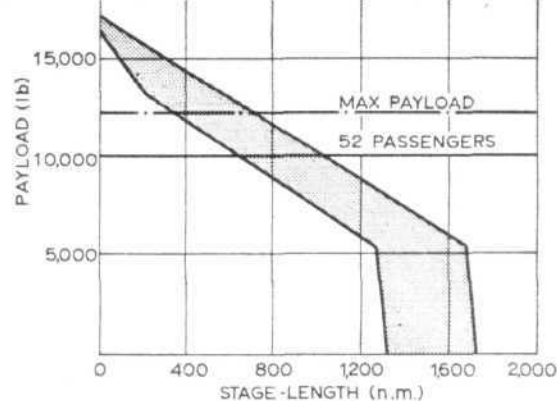
YS-11 fuselage on the production line. It is circular in section except where it blends into the flight-deck forward of the passenger door





Left, operating costs (SBAC method). Take-off weight 50,265 lb; ISA; cruise, 20,000 ft

Right, payload/range performance with and without fuel reserves, conditions as above. Fuel reserve allows 45 min stand-off at 5,000 ft, 200 n.m. diversion, plus 5 per cent of total fuel



Flying controls are manual. Hydraulics at 3,000 lb/sq in actuate the flaps, undercarriage, nosewheel steering, wheel brakes, propeller brake and windshield wipers. In line with this orthodox approach is the electrical system, which is basically 28V d.c. provided by engine-driven generators and batteries. Inverters provide a.c. for the autopilot, instruments and electronics.

The landing gear retracts forwards and the mainwheels have anti-skid brakes. Tyre pressure is restricted to 68 lb/sq in on the mainwheels and 52 lb/sq in on the nosewheels. Other design points dictated by the roughness of likely airfields are adequate track—28 ft 3 in—and safe propeller clearance; the first is ample, but propeller clearance is only 20 in, surely a minimum for this type of aircraft.

What is the potential market for the YS-11? The Japanese Air Self-Defence Force has ordered ten to be used for troop carrying, freight transport and electronic training. In addition to this military order (which will doubtless be substantially increased), All Nippon Airways have some 13 DC-3 and four CV-440 aircraft which could be retired as soon as the YS-11 becomes available. It is also conceivable that this airline may order the YS-11 to replace the ten Friendships and six Viscounts at present in service or on order. Economically this would not be justified, but the airline may decide to equip itself entirely with the home-grown vehicle, and the routes it operates would not make this impossible.

Japan Air Lines are also potential buyers. They have ten DC-4, five DC-6B and four DC-7C or F aircraft, some of the duties of which could be performed by the YS-11.

The Nihon Aeroplane Manufacturing Co is reluctant to mention its association with firms like Mitsubishi, Kawasaki and Fuji, probably because it is anxious to establish a single corporate identity, which may be the first step to a true merger. But at present the separate companies must be mentioned when describing YS-11 manufacture. Mitsubishi are making the fuselage and under-

taking final assembly. Shin Meiwa are making the rear fuselage, and Fuji are making the tailplane. Kawasaki are responsible for the engine nacelles and the wings, and Nihon Hikoki are making the flaps and ailerons. Lastly, Showa Hikoki are producing structural components, notably those involving honeycomb.

Just how successful NAMC and the YS-11 will be remains to be seen. In general, it is the aircraft which is swiftly conceived and produced, and which is successfully introduced into large-scale domestic service, that sells best in the world market. The YS-11 is likely to fulfil these requirements, and it must be considered a serious contender in the market for a DC-3 supplement.

NAMC YS-11

(Two Rolls-Royce Dart RDa.10/1 turboprops of 2,775 s.h.p. each with water-methanol injection, driving 14 ft 6 in Dowty-Rotol propellers.)

Dimensions: Span, 105 ft; length, 86 ft 3 in; height, 30 ft; wing area, 1,020 sq ft; wing aspect ratio, 10.8; wheelbase, 30 ft 11 in; track, 28 ft 3 in.

Weights: Empty equipped weight, 30,093 lb; max take-off weight, 50,265 lb; max landing, 48,047 lb; max payload, 12,130 lb; max weight of fuel, 7,386 lb.

Performance (estimated): Max cruise at 14,200 r.p.m. at 20,000 ft ISA, 48,047 lb, 257 kt; take-off to 35 ft at max weight, 20° flap, water-methanol, ISA, sea-level, 2,130 ft; ISA + 23°C, 2,360 ft; landing field length, one engine inoperative, 48,047 lb, 40° flap, sea-level, 3,790 ft; stall, landing configuration, 40° flap, 48,047 lb, 73 kt; range with max payload, 330 n.m.; range with 52 passengers, 580 n.m.; range with max fuel, 5,400 lb payload, 1,290 n.m.; fuel consumption at max cruise, 0.15 n.m./lb.

Payload accommodation: Cabin volume, 2,125 cu ft; length, 44 ft 1 in; max width, 8 ft 10 in; width at floor, 7 ft 9 in; max height, 6 ft 6 in; cabin floor to ground, 7 ft 6 in; baggage and freight volume, 390 cu ft; dimensions of largest door, 66 in x 33 in; max seats, 60 at 34 in pitch.

Fuel capacity: 1,550 Imp gal.

AUSTRALIA'S AERIAL AGRICULTURE TODAY

AT the fourth annual symposium of the Australian Aerial Agricultural Association, held at Ballarat last month, South Australia and Queensland States Associations attended for the first time as official members, but Western Australia announced its withdrawal. (There is no Tasmanian Association.) The Federal Association now represents about 40 operators in the four States.

Main questions discussed at the symposium were safety, the Tiger Moth, and training. The decision taken at the Wagga Symposium last year to found a training school for agricultural flying had been abandoned during the year owing to lack of funds, and the same reason was behind the dropping of the idea of forming a central secretariat in Melbourne on a permanent basis.

However, the 1960 decision to licence operators and pilots was continued. The Department of Civil Aviation has issued an order on the subject and within the past few months all pilots in the industry have been examined. An operations manual has been issued, and it has been decided that all pilots must take written tests after March 1. DCA examiners have reported that the practical standard in the industry is higher than had been expected.

The DCA would still like to see a central school formed and had suggested that the former RAAF base at Ballarat should be used. As the idea has been dropped, however, several operators have stated they will form their own small schools to train their own people. The largest of these operators—the biggest in the Commonwealth—is Aerial Agriculture Pty Ltd, of Bankstown, NSW, which operates 11 Beavers. This firm's flying hours in the present year will approach 10,000. No other in Australia's agricultural aviation industry has so much capital invested—about £A450,000.

It seems apparent from the tenor of the symposium (writes Stanley Brogden) that the bigger operators, such as Aerial Agriculture in NSW and Super Spread in Victoria, will quickly take over most of the other operators in their States. This will give the

industry stabilization both in prices and operational quality, and permit quicker introduction of new equipment. The industry's curse is under-capitalization. Banks will not advance money on aircraft and the rates of hire-purchase firms are too high. State and Federal governments consistently refuse to advance cheap capital, make no taxation concessions, and grant no subsidies. The New Zealand industry is more fortunate in its situation.

The Tiger Moth problem is basic. In Western Australia, South Australia and Queensland, spraying is the greater part of the business. Only in NSW is phosphate spreading the major part (the 1960-61 total there was 188,000 tons, and this is expected to rise to 220,000 tons this year). The Tiger is still the best spraying machine, partly because the operators must base aircraft over a wide area (500 miles wide in South Australia) to cope with rush orders. They are often on stand-by, and only the Tiger is cheap enough for this. Last year the Department almost decided to withdraw the vintage type entirely, owing to the accident rate, but protests from operators caused a postponement. The DCA decision will be taken soon, but the facts are that the operators have cut the Tiger Moth crash-rate to a fraction, though the overall crash-rate has stayed the same. One aspect is that it is apparently difficult for an agricultural pilot to kill himself in a Tiger: nearly all the deaths occur on other types.

Operators say they like the idea of the Grumman Ag-Cat, but none has yet been seen in Australia or NZ. They do not care for the Fletcher, as they say it cannot be used above 1,000 ft, despite the NZ liking for it. NZ is believed to have another 25 Fletchers on order. The Piper Pawnee has not been selling widely. Australian operators say they would like an aircraft with a ratio of 150 lb payload to each £A1,000 capital cost. This may be a rather different formula from that used by the designers, but it seems to make a considerable amount of economic sense.

Anti-gravity

A PHILOSOPHER'S STONE FOR MODERN PHYSICISTS

By ROBERT L. FORWARD*

IN Einstein's General Theory of Relativity¹ there are at least three different ways to generate non-Newtonian gravitational forces.

All of these methods could theoretically be used to counteract the gravitational field of the earth and thus are a form of anti-gravity. All of the known methods, however, are quite impractical. It would require impossibly large systems to obtain even a measurable amount of acceleration, much less practical anti-gravity.

The three methods of obtaining non-Newtonian gravitational fields which are outlined below were probably known by Einstein before he published his paper on the principle of general relativity in 1916,¹ they were first specifically derived by Thirring² in 1918 and they have been contained in every text on general relativity since then.^{3, 4, 5} These forces are well known to theorists in general relativity, but are little known to those outside of this field. The purpose of this paper is to point out that these forces exist, and to estimate the requirements which would be imposed on any physical system which intends to utilize these forces to obtain anti-gravity.

The forces all arise from the application of the principle of general relativity to systems of moving masses. The moving masses give rise to forces on a test body which are similar to the usual centrifugal and coriolis forces, although much smaller. The accelerations given to the test body are independent of the mass of the test body, and therefore are, in a local region, indistinguishable from gravity.

Rotating Masses and Stationary Bodies When a rotating system of masses is investigated, using Einstein's General Theory of Relativity, it can be shown that, besides the usual Newtonian term, the gravitational scalar potential contains terms which arise from the rotation of the body. One of the shapes which has been investigated is the rotating massive ring.³

For a massive ring rotating in the x-y plane, the acceleration on a stationary test body near the origin is approximately:

$$\begin{aligned}\ddot{x} &= \frac{MG\omega^2}{2c^2R} x \\ \ddot{y} &= \frac{MG\omega^2}{2c^2R} y \\ \ddot{z} &= -\frac{MG\omega^2}{c^2R} z\end{aligned}$$

Where M and R are the mass and radius of the ring, ω is the angular velocity, $G = 6.67 \times 10^{-8} \text{ cm}^3/\text{gm sec}^2$ is the Newtonian gravitational constant, c is the speed of light and x, y, z are the coordinates of the test body with respect to the origin of the rotating mass.

From these equations we see that not only does the rotating mass force the test body away from the axis in an imitation of centrifugal force, but it also forces it into the plane of rotation. The equations are independent of the mass of the test body and therefore indicate that these forces are indistinguishable from a gravitational force.

Rotating Masses and Moving Masses In the previous section it was pointed out that a rotating mass will exert forces on a stationary test body which act like the usual centrifugal force. In addition, if the test body is moving at some constant velocity $\vec{v}$, then it will experience an additional force which is proportional to the cross product of the angular velocity of the rotating mass and the linear velocity of the test body. This particular force has two analogies. From a mechanical point of view, it acts like a very weak coriolis force. From an electromagnetic point of view⁶ it acts like the gravitational equivalent of the Lorentz force on a charged particle moving through a magnetic field. One of the shapes which has been investigated is the rotating massive spherical shell. The acceleration on a test body moving with a velocity $\vec{v}$ inside the shell is approximately:⁴

$$\begin{aligned}\ddot{x} &= \frac{GM}{3c^2R} \left[\frac{4}{5}\omega^2x - 8\omega V_y \right] \\ \ddot{y} &= \frac{GM}{3c^2R} \left[\frac{4}{5}\omega^2y + 8\omega V_x \right] \\ \ddot{z} &= -\frac{8GM\omega^2Z}{15c^2R}\end{aligned}$$

where V_x and V_y are the x and y components of the velocity of the test body, M and R are the mass and radius of the spherical shell, and the other quantities were defined in the previous section.

The first term in each expression is the centrifugal type force on a stationary test body that was described in the previous section. The second term in the x and y components of the acceleration are seen to depend upon the velocity of the test body. They again are independent of the mass of the test body.

With these examples of non-Newtonian gravitation, one could envision large rotating masses nullifying gravity or shooting objects out into space. But as a practical method of counteracting gravitation, they have absolutely no value. To get some idea of what would be required, let us look at the acceleration given to a test body inside a rotating massive sphere.

The angular velocity of the sphere can be written as $\omega = V/R$ for a point on the equator. The mass of the spherical shell will certainly be less than the mass of a sphere of the same radius, so that:

$$M \leq \frac{4}{3}\pi R^3 \rho \text{ where } \rho \text{ is the density of the shell. Also, by definition,}$$

the position of the test body has the limit $z < R$. When we make these substitutions, we find an upper limit to the acceleration that can be given to a stationary test body of:

$$Z \leq -2G\rho R \left(\frac{V}{c} \right)^2$$

A practical upper limit to the surface velocity of any rotating system has been found by Beams⁷ to be $V_0 \approx 10^5 \text{ cm/sec}$, or $(V_0/c)^2 = 10^{-11}$, but let us suppose we could make $V/c = .01$. Even with this liberal assumption, in order to obtain an acceleration approaching that due to the earth's gravity, the density and radius of the sphere have to satisfy the inequality

$$\rho R \geq 10^{14} \frac{\text{gm}}{\text{cm}^2}$$

This means that with normal density materials ($\rho \approx 10 \text{ gm/cm}^3$) we will need a sphere of radius $R \geq 10^8 \text{ km}$, which is about the orbit of Mercury. If it were possible to make, contain and rotate very degenerate matter such as is found in dwarf stars, with $\rho \approx 10^9 \text{ gm/cm}^3$, then our sphere would still have to have a radius greater than 10km.

Accelerated Masses and Stationary Test Bodies When we investigate the effect of a large accelerated mass on a small test body using Einstein's theory, we find that the accelerated body drags the test body along with it. The forces applied to the test body are proportional to and in the direction of the acceleration of the large mass. Two examples which have been investigated are a test body inside a linearly accelerated massive spherical shell and a test body outside a linearly accelerated massive sphere.⁴

The initial acceleration of a test body momentarily at rest inside an accelerated massive shell is approximately:

$$\ddot{x} = \frac{4GM}{c^2R} a$$

The initial acceleration of a test body momentarily at rest outside a linearly accelerated massive sphere is approximately:

$$\ddot{x} = \frac{4GM}{c^2r} a$$

where M, R and a are the mass, radius and acceleration of the shell or sphere, r is the distance from the test body to the sphere and G and c were defined previously.

Again, if we make the assumptions that:

$$M \leq \frac{4}{3}\pi R^3 \rho \text{ and } r \approx R$$

where ρ is the density of the sphere or shell, then the accelerations for both cases have the upper limit of:

$$\ddot{x} \leq \frac{16GR^2\rho}{c^2} a \approx \rho R^2 a \times 10^{-27} \text{ cm/gm}$$

If we plan on using materials with normal densities, then $\rho \approx 10 \text{ gm/cm}^3$ and if we plan on dimensions for the driving mass that are

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ANTI-GRAVITY . . .

merely unfeasible, not impossible, say $R = 10\text{km} = 10^6\text{cm}$, then for an acceleration of the test body of $1g$, we would need to give the sphere or shell an acceleration of:

$$a \geq \frac{\ddot{x}}{\rho R^2} \times 10^{27} \text{ gm/cm} = 10^{17} \text{ cm/sec}^2$$

We could of course only obtain this anti-gravity for about a micro-second since the sphere or shell would soon reach the speed of light at this rate of acceleration. If we could obtain our dwarf star material with a density of $\rho = 10^8 \text{ gm/cm}^3$ or so, then we would only need to give the 10km sphere an acceleration of $a = 10^{10} \text{ cm/sec}^2$ and at this rate we could have anti-gravity for a whole second.

Other Devices There are probably other types of devices for obtaining non-Newtonian gravitational forces which use Einstein's General Theory of Relativity, but they have not been fully investigated in a rigorous manner. One particular class of these devices are readily visualized by using the known analogies between the gravitational fields of moving masses and the electric and magnetic

fields of moving charges.^{3, 4, 6} For instance, two rotating gyroscopes should repel each other if oriented properly, two pipes with massive liquid flowing through them should exhibit a pinch effect, etc. However, the tentative equations describing these effects all have the same constant (G/c^2) in front of them and therefore there is little hope that any such device will result in practical anti-gravity.

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HUNTER OF THE SNOWS

A seasonable study of a Hunter T.8 from RNAS Lossiemouth, where these two-seaters are used in training the Navy's day-fighter pilots before their graduation to Scimitars. ("Flight" photograph by Ian Macdonald)





Straight and Level



I AM sorry that Mr Peter Brooks is leaving BEA, although I am sure that air transport's loss will be general aviation's gain. Soon he will be taking up his new appointment as Mr Peter Masefield's deputy at Beagle.

One reason why BEA is a successful airline, I believe, is that it has been fortunate enough to enjoy, for half a generation now, the services of a team (an overworked word, but exactly right in this context) of enthusiasts and professionals like Mr Brooks.

One thing that all the members of this team appear to have in common is a real regard for the man who has run the show since 1949. An explanation of this remarkable situation is, I think, to be found in the "personal note" struck by Lord Douglas at the end of a recent lecture, and which is summarized on page 1000 of this issue.

● "There is too great a tendency to think of mergers as cure-alls. Two sick men don't necessarily make one well man."—Mr Charles Tillinghast, president of TWA.

● The manufacturers of automatic landing systems admit that one of their main problems is to convince pilots that they can and should use them. But the "climate of pilot opinion," rightly or wrongly, could not be less favourable. Ask any airline pilot whether he uses his approach coupler: the answer you get on the great majority of occasions is downright unfavourable.

Coupled approach, which involves considerable automation, but relatively little risk compared with actual automatic landing, is almost universally disliked, distrusted, ignored, or just wired off. Not only British couplers,

There you are, I told you—there's your trouble, Ted. Just hand me your No 4 grelving fredder, would you? Thanks. Now mind your backs, everyone... Mmm, that's funny. Let's try the No 5, Ted. Right—stand clear everybody. Oh, crikey. Oh dear, oh dear. Better get the Scruggs rep, Howard. Sorry about your grelving fredder, Ted

but the latest American systems, too, come in for sharp comment.

Whatever the truth about coupled approach, it has earned itself a bad name. It isn't going to be easy to persuade airline crews with this experience to trust the new automatic landing systems, however carefully and scientifically they have been designed and tested.

Plummet Slashes Fares

● London, Eng, Dec 19. What airline fares experts hail as "a brilliant new concept, a tool to prise open the mass air travel markets" was revealed today by Plummet Airlines, Britain's foremost airline. A 5 per cent reduction will be available on all Plummet routes, whenever the full moon falls on a Friday the 13th, Sagittarius is at the time in conjunction with Virgo, and Tottenham Hotspurs are playing the Harlequins.

"The limited validity," said a Plummet spokesman, "is so as not to undermine the established IATA fare structure. This new really creative fare is also subject to Government approval."

● Britain's two leading aircraft groups, BAC and HSA, are said to be wondering when the Minister is going to let them eat the merger-encouraging carrot that his predecessor dangled before them two years ago. You remember—"no more Government orders unless you merge, you naughty heterogeneous donkeys."

But the carrot has not been entirely withheld. The Government is contributing, in one way or another, to civil aircraft like the VC10, Trident, Argosy, Herald, Avro 748, BAC One-Eleven, and to other civil products. The precise sums of money—which overall are not small—have never been revealed. Why not?

MPs who have been nose enough to ask have been told, in so many words, to mind their own business. So how can Parliament and the public judge whether the industry is right to complain—if this is indeed what it is doing—that there has been a breach of promise?

Why can't we be told, for example,



how much public money is being invested in the Trident or VC10, and their engines, and on what terms? Or how much money the Viscount, on the other side of the coin, has earned for the Government? These are civil projects, so there can be no "national defence" hedge to hide behind.

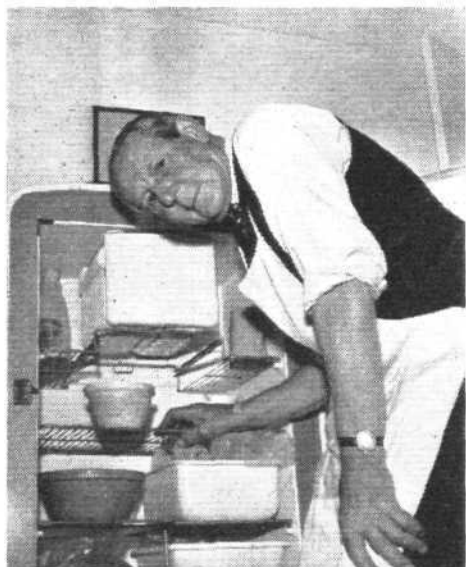
The answer is that the whole thing is secret. Why, you may ask, is it secret? That, I am afraid, is a secret, too.

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Air Chief Marshal Sir Philip Joubert, gallant airman and great planner, is extending his gallantry and planning into the kitchen. He loves cooking, and for some years has been doing a time-and-motion study to help reduce the housewife's work. He has embodied his research into a book to be published next year

● Mr J. T. Lidbury, chairman of Hawker Aircraft: "Today we make feasibility studies of feasibility studies to see if they are feasible."

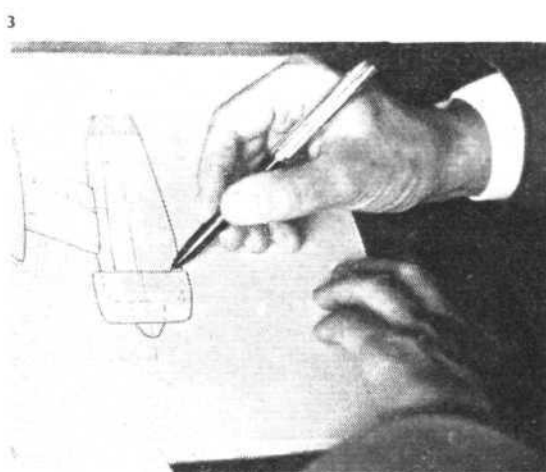
ROGER BACON



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OLEG ANTONOV

Man of Many Parts

THE TEXT accompanying these newly received pictures reads: "Oleg Antonov, one of the Soviet Union's famous aircraft designers, is also a well-known public figure, athlete, architect, painter and critic. He is now 55 years of age, but when you see him going upstairs three at a time, playing tennis, piloting a glider, or at the wheel of a racing car, you realize that when Antonov describes his design team as 'young from top to bottom' he is quite justified in including himself." The pictures show: (1) Three An-24 turboprop feederliners, two of them with revised nacelles and ventral fins. (2) Mr Antonov with a member of his family at home—relaxing in aircraft-type chairs. (3) Designing—but what? (4) Watching an air test. (5) An An-12 (centre) glimpsed distantly with two twin-engined freighters (An-8s?). (6) An An-14 seven-passenger STOL aircraft.



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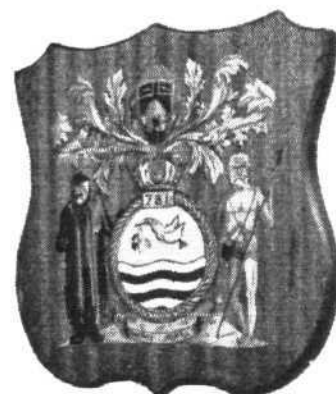
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781 Squadron's new equipment: one of its ex-Jersey Airlines' Herons landing at Lee-on-Solent. At right, a "squadron badge" which hangs in the office of the staff officer, Mr T. J. Cooper. Its appropriately matching motifs depict a taxi-driver and Neptune, and the motto—"Dominie dirige nos"—is a pun on the Dominie aircraft which 781 used to operate



THE NAVY'S AIRLINE

Two ex-Jersey Duchesses Join 781 Squadron

By HUMPHREY WYNN

WRAPPED in an impenetrable blanket of cumulus, the Royal Navy Heron XR442 flew south down Amber One at 6,000ft. Through the cabin windows there was nothing to be seen but the slender wing scything its way through the cloud, and the nacelles of the Gipsy Queens as the engines steadily performed their job. In the occasional rough air there was a sudden disconcerting lack of lift, the Sea Heron fishtailing nautically. The 13 passengers, Naval and civilian, smoked or read or dozed-off their lunch at Sydenham. This was the last leg of a south-bound Clipper flight: the aircraft had left Lossiemouth that morning at just after 9 o'clock and was due in to Lee-on-Solent at 1545.

Until this final leg, the weather had been good. The half-hour trip from Lossiemouth to Arbroath meant flying south over the snow-covered Grampian Highlands in the clear air of a sparkling day; but from Arbroath to Abbotsinch, with the hills of Perthshire and of Stirlingshire mounting into cloud on our starboard quarter, it was comforting to know we had the guidance of Renfrew radar for the straight-in approach to Abbotsinch with its surrounding shipyard cranes on Clydebank. At Abbotsinch, where we refuelled, the original passenger complement of seven had increased to ten; before take-off the captain of the aircraft, Lt Cdr E. Ashfield, explained over the public address system (a feature of the Herons which the Navy did not possess in their Sea Doves) that there might be some delay because of the Scottish Control Zone; but at 1035 we took off to begin our climb-out westwards under Scottish Airways radar. Our destination was Ballykelly, the RAF airfield in Northern Ireland where the Royal Navy co-operate in running the Joint Anti-submarine School. With the famous flat-topped hill in

the background that Fleet Air Arm men know as "Ben Twitch" (officially Bineyenagh) we sat waiting for a passenger who did not materialize; then, at 1207, took off after a Shackleton had landed—our next stop Belfast, which was hiding itself under industrial stratus when we made our approach to Sydenham, the Short Brothers and Harland airfield which is so improbably situated in the middle of a shipyard.

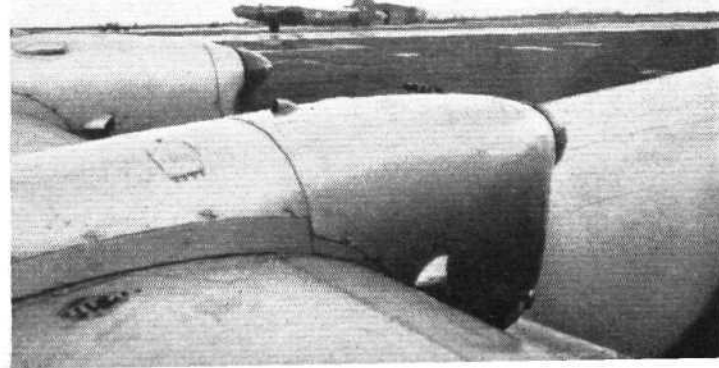
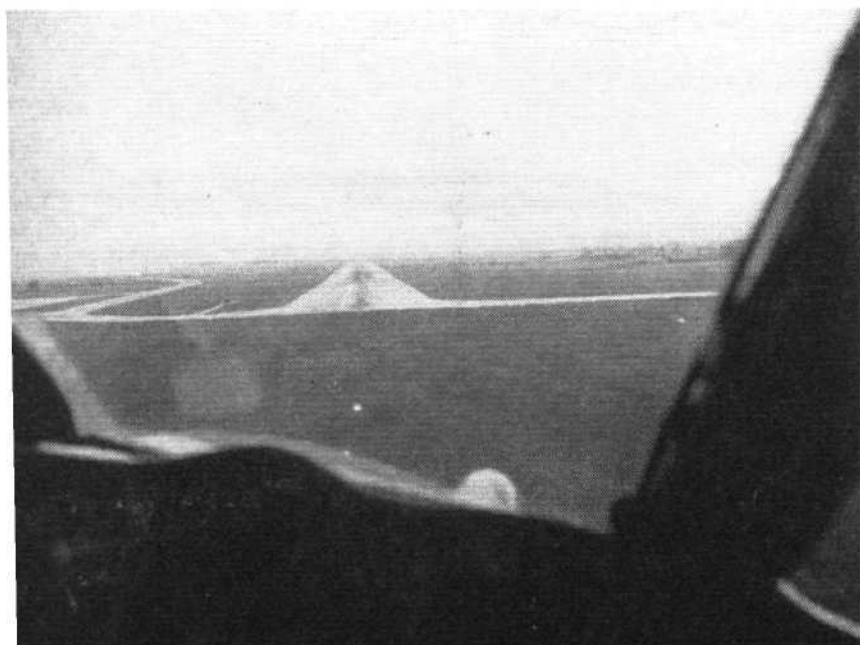
So far, so good; and when we took off from Sydenham just after half-past one it looked as though we were in for a comfortable post-prandial ride to Lee. But the weather determined otherwise: for the passengers, it meant 2½ hr of non-visibility, not knowing whether they were over the Irish Sea or Cheshire or the Midlands; for Lt Cdr Ashfield, continuous IF (the Herons do not have an automatic pilot); and for his observer, CPO A. Donaldson, airways' navigation with the aircraft's ADF and Decca.

We had crossed the Irish Sea on Green Two to the Wallsey beacon, turned via Whitegate onto Red Three, and proceeded to the junction with Amber One at Lichfield. At Daventry we left the airway, to fly direct to Lee-on-Solent under the jurisdiction of Heathrow radar; but beyond a lowering of the starboard wing as we altered course, this fact was not obvious to the passengers. There was nothing to be seen until, at about twenty minutes to four, we broke cloud over a stormy-looking Solent and went into a port turn: ahead was Lee, lights already on in buildings around the airfield on this dark afternoon; after a circuit at low level (cloudbase was 350/400ft) we landed smoothly into a gusty 25/30kt wind: another "clipper" run had been successfully completed.

Lt Cdr Ashfield and his observer had contacted Lee when about

On finals at Abbotsinch. Entry to and exit from this airfield, which is to become the civil airport for Glasgow, is controlled by Scottish Airways

Four engines in the RAF, four engines in the Navy: a Coastal Command Shackleton seen from a 781 Sqn Heron at Ballykelly



25 miles north, then using CR/DF had made their let-down to about a mile south of the airfield, in the safety lane over the water between Cowes and Fawley. Conditions on this flight had been typical of those encountered in running an all-the-year-round service to Naval air stations in the United Kingdom: never predictable, and sometimes very much worse, especially when icing occurs. At the Heron's cruising level (between 5,000 and 10,000ft) the worst of this hazard may be encountered; and pilots have the unenviable choice of pressing on, keeping a wary eye on the boot de-icers and the boost gauges, or turning back to the detriment of punctilious time-keeping on route schedules.

Lt Cdr Ashfield, CPO Donaldson and Heron XR442 belong to 781 Sqn, the Royal Navy's communications squadron, which is based at Lee-on-Solent and in addition to its "clipper" service provides VIP transport for Naval officers and NATO officials to conference destinations in Europe and in the Mediterranean area.

Two important things have recently happened to the squadron: early last year, it was awarded the Boyd Trophy, premier Fleet Air Arm award, presented annually in recognition of "the year's finest feat of aviation in the Royal Navy"; and this year, it has acquired two de Havilland Herons, the squadron's first four-engined aircraft. Award of the Boyd Trophy to the Navy's smallest squadron was in recognition of their flying during 1959 a total of 4,200hr by day and 50hr by night, in all weathers, carrying 2,720 passengers and 100,000lb of freight "without incident and to a meticulous timetable." Since that award, the squadron—which is commanded by Lt Cdr R. C. Stock—has continued to maintain a similarly conscientious service, both on scheduled and non-scheduled operations; and its carrying capacity and versatility have been increased by the addition of the two Herons.

Formerly owned by Jersey Airlines (as the *Duchess of Brittany* and *Duchess of Normandy*), these Herons are operated in a 14- or 13-seater configuration, based on a passenger weight of 160lb. Both the aircraft are Decca-equipped and can be translated to a freight configuration when required. The Royal Navy eventually is to have three Herons: two will be based overseas, in Malta, and the third held in reserve at Lossiemouth.

ILLUSTRATED MAINLY WITH "FLIGHT" PHOTOGRAPHS

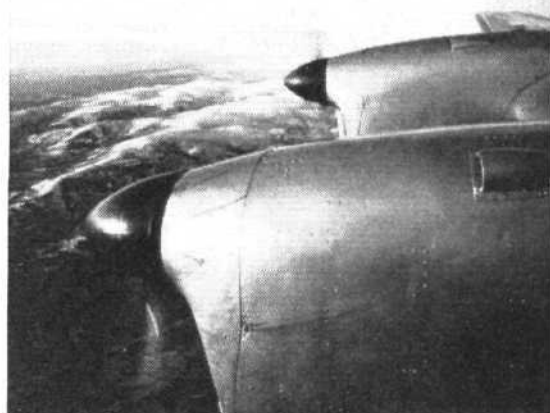
The Herons of 781 head a mixed fleet of aircraft operated by the squadron. There are three Devons which up till now have borne the brunt of the Clipper services: one of these is used as an admiral's barge; it is furnished as a seven-seater, but can alternatively be equipped with two tables for senior officers wishing to work *en route*. Another is used for the light twin-engined conversion course (SMAC 4) given at Lee-on-Solent. The unit's other aircraft are the famous Swordfish (one of only two remaining) which took part in the film *Sink the Bismarck* and is drawn up to the wardroom door on Taranto nights at Lee and flown to other Naval stations for "at home" displays; a Sea Hawk used as an admiral's aeroplane for fast transport purposes; a Sea Vampire similarly employed (Lee-on-Solent is the nearest airfield for Wykeham Hall, headquarters of the Flag Officer Air (Home)); a Whirlwind helicopter for VIP or casevac duties; and a Tiger Moth for glider towing.

In addition to Lt Cdr Stock the squadron has four pilots who regularly fly the schedules and special services operated by 781. Lt Cdr Ashfield (already mentioned) is the Senior Pilot and the others are Lts J. F. Barber, D. C. Springall and M. V. Maina. (It was Lt Barber who flew *Flight* staff members up to Lossiemouth on recent visits, once by Devon and once by Heron, from Northolt. The former trip, with five passengers aboard, involved landing at Linton-on-Ouse to refuel.) Lt J. Winslow, a qualified flying instructor, takes the light twin-engined conversion course. Lt Barber holds a commercial pilot's licence and Lt Springall is a qualified

(concluded on page 993)



The two Herons of 781 Sqn, XR441 and XR442, seen together on one of the rare occasions when they were not away from Lee-on-Solent on VIP or Clipper duties. This photograph was taken by the squadron



781 Sqn en route: the snow-covered Grampians seen from the cabin window between Lossiemouth and Arbroath



"Can we manage to undertake this trip?" The squadron staff officer, Mr T. H. Cooper, confers with the Senior Pilot, Lt Cdr E. Ashfield

Training in emergency procedures is constantly undertaken by the squadron: here one of the Devons is seen making an asymmetric landing at Lee



AVIACO



Instrumental in the revival of Aviaco's fortunes has been the acquisition of a small fleet of Convair 440 Metropolitans which concentrate on the medium-haul routes

A Spanish Airline's New Lease of Life

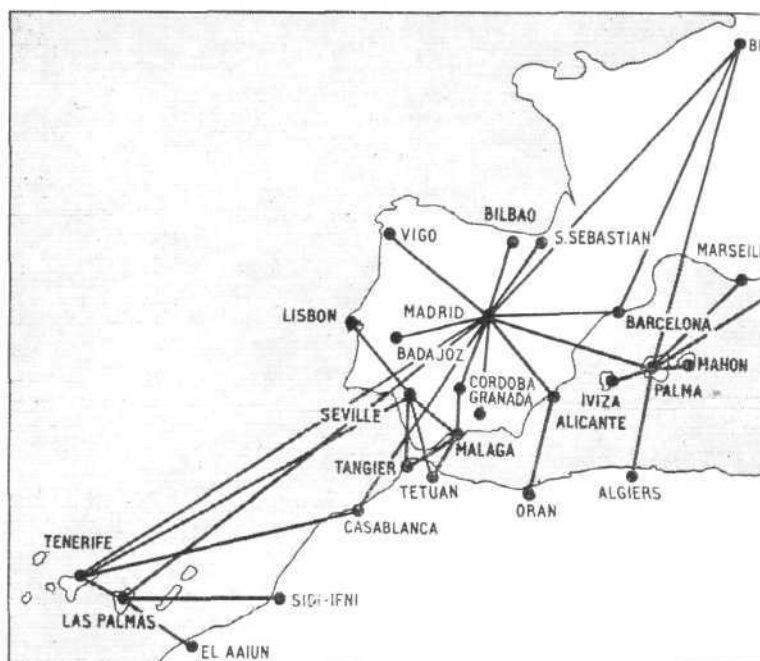
ONE of the most remarkable, and yet untold, stories of contemporary air transport has been the resuscitation of Spain's second airline, Aviacion y Comercio—or, as it is now simply known, Aviaco. In 1959 this company nearly celebrated the start of its second decade by going out of business; but by the end of the following year there had been a complete recovery, and now the airline is once again set on a course of expansion supported by a modern fleet of aircraft and the confidence of its backers, its staff and the travelling public.

To appreciate the situation which so nearly led to Aviaco's downfall it is necessary to go right back to 1948, when the company was founded in Bilbao by a group of enthusiastic local businessmen for the joint purpose of putting the city on the airline map and of exploiting the apparently promising field of air freight. With the help of local bankers, finance was obtained to purchase a spanking new fleet of six Bristol 170s—a type which seemed ideal for the varied operations which the promoters had in mind. In those early days, freight charters were the mainstay of the business, with two particular items—grapes from Almeria and apricots from Murcia—providing a substantial flow of traffic for carriage to northern Europe. However, the freight business proved to be highly seasonal and able to stand only the lowest rates. Return loads were also difficult to come by. So it came about that the directors turned their attention increasingly to possible passenger services.

Back in 1940 Iberia had been given a twenty-year monopoly franchise to operate all Spain's important domestic and international routes. Aviaco—in those days known as AYC—was thus restricted to the fringe routes. The first and obvious choice was a network of services from Bilbao, which had hitherto been neglected by the national carrier. Regular passenger operations therefore started with regular services from Bilbao to Spain's two major cities, Madrid and Barcelona: one the focus of government and administration, the other the industrial centre. The next step was to find an international route which lay outside Iberia's sphere of influence, and a suitable operation was found in the form of a service Algiers - Palma - Marseilles. Shortly afterwards, further opportunities were opened up by the development of services based on the Canary Islands. But the first really big break came in 1954 with the award of the Madrid - Barcelona airmail contract.

With this expanding business there came a demand for increased capacity; and it was here, perhaps, that the airline made its first step

The company's name has become increasingly well known abroad through the operations of a 72-seat DC-6B chartered from Sabena

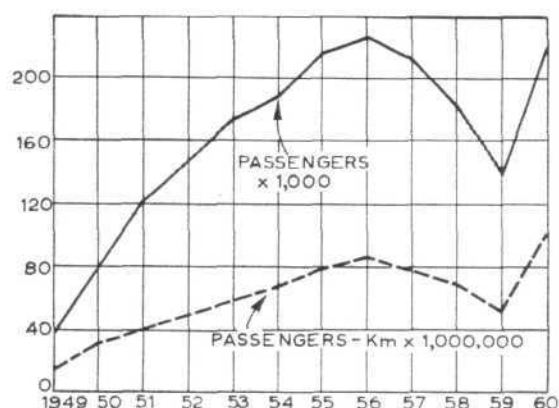


in the wrong direction, for the aircraft chosen were secondhand Air France Languedocs. By 1955 a fleet of nine of these aircraft had been acquired. But although they had been cheaply bought, they were to prove far from cheap to operate, and an apparently inherent unreliability was to result in their failure to be accepted by the public. But in 1955 the writing was yet to appear on the wall. The finances of the company were in good shape—in 1955, for instance, an operating profit of 8m Pesetas was achieved on revenues of Ps87m—and the Instituto Nacional de Industria had been persuaded to take up a majority of the airline's capital. Aviaco's headquarters were transferred from Bilbao to Madrid and plans were laid to develop an extensive network of feeder services within Spain. And it was here that the second error appears to have occurred, when a decision was taken to order six Herons for these feeder operations. Admirable as the small British aircraft turned out to be in other respects, its economics just did not permit of profitable operation at the low fares which are necessary to attract domestic Spanish traffic.

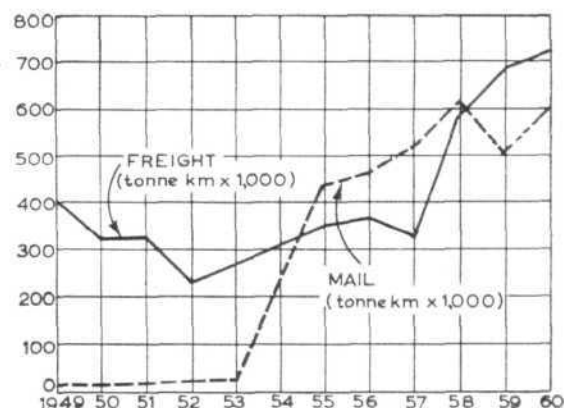
Although Aviaco's traffic continued to rise through 1957 it was in 1956 that the turn of the tide was first evident when the accounts showed, for the first time, an operating loss. This was followed in 1957 by a series of unfortunate incidents, two of which involved loss of life; they quickly reflected in a diminution in business. Another accident in December 1958 resulted in further loss of public confidence. Over this uncertain period, revenue rates had been rising, but much of the benefit has been stolen by inflation. Meanwhile costs had been rising even more sharply—between 1956 and 1958 the level of unit costs rose by over 50 per cent—as the Languedoc and Heron fleets took over from the Bristol 170s as the main source of capacity.

It became obvious in 1959 that something drastic must be done or the airline would go out of existence. Although international traffic had continued to grow, these services were uneconomic as





Nothing illustrates the Avico's recession, and recent recovery, more clearly than the graph (left) showing the development of its passenger traffic. The other graph illustrates cargo results



they averaged only one-third full; and in any case they comprised but a small share of Avico's total activities. The more important domestic traffic had by 1959 collapsed to half the peak 1956 level.

The first drastic step was to halve the issued capital of the airline from Ps100m to Ps50m, the management recognizing the extent to which accumulated losses had eroded the value of the enterprise. Next, Iberia came in and invested Ps100m in the recapitalized venture, giving the national airline a controlling two-thirds share in Avico, the balance being shared between INI and the original shareholders. Although this gave Iberia, through its majority control, the opportunity of acquiring complete control, the transaction was predicated on the assumption that Avico would be allowed to continue independently with its own separate and distinct personality.

With the active support and encouragement of Iberia, Avico's fortunes quickly began to mend. With cash in the kitty, it now became possible to modernize the fleet, this process being started by the purchase of three Convair 440s from Sabena, and the withdrawal from service of the Languedoc fleet. As the Convairs were identical with those already operated by Iberia, it was possible to rationalize the engineering activities of the two companies. And, of course, the Metropolitan happens to be ideal for the denser routes operated by Avico. Appropriately, a Metropolitan is shown on the cover of Avico's 1960 report, for this aircraft was largely responsible for restoring the public's faith in the airline. This was shown by a doubling of domestic traffic in 1960 as compared with 1959, in a single year restoring the volume of business to the peak 1957 level. Further proof is provided by the enthusiasm shown by Avico staff for the Convair, and the ordering of subsequent aircraft.

Another invaluable form of aid from Iberia was the strengthening of the sales position which resulted from the fact that Iberia now had an incentive to sell Avico services through its many sales outlets. This allowed the name of Avico to be brought before an infinitely wider audience than had previously been possible.

During the initial period of modernization, Avico has depended largely on chartered aircraft. Its Palma network is now operated entirely by three Iberia Bristol 170s, Avico's own Bristol fleet having been transferred down to the Spanish Sahara for charter operations in conjunction with prospecting for oil. Similarly, the charter of Iberia's DC-3s has enabled a decision to be taken to withdraw the uneconomic Heron fleet from service. The other party from which Avico charts capacity is the Belgian national airline, Sabena, which operates Brussels-Barcelona and Brussels-Madrid-Canary Islands on behalf of Avico, using a 72-seat DC-6B in the colours of the Spanish airline. Sabena also operate their own services out of Brussels, the revenue from the joint operation being pooled between the two partners.

Had it not been for the accord reached between Avico and Iberia, there might well have been difficulties when Iberia's route charter became due for re-consideration last year; as it was, a compromise was found which suited both parties and gave Avico an assured place in Spanish civil aviation, alongside Iberia. This opened up the way for several new routes—such as Madrid/Brussels and Palma/Nice—which will further strengthen the basis of Avico's economy. Finally the airline has been encouraged to enter the charter market and in 1960, for the first time, Avico cornered a substantial share of the UK inclusive-tour market. This share continued to expand last summer, and is certain to develop even more substantially next year because of the failure of British travel agents to conclude satisfactory arrangements with some of their own country's independents.

These developments resulted in an increase in traffic and revenues in 1960 of some 70 per cent compared with 1959, accompanied by a dramatic transformation from heavy loss in 1959 to slight profit in 1960. Although this improvement shows no sign of slackening, Avico remains still a relatively small airline by international standards with current revenues running at a level just below £2m a year. But the fact that really matters is that it is now efficient and thriving, and a proud and worthy bearer of the Spanish flag.

THE NAVY'S AIRLINE (continued from page 991)

helicopter pilot. The squadron's Herons and Doves are flown with a two-man crew, the second member being an aircrewman (rating observer) who has responsibility for navigation and also for seeing that passengers and freight are manifested. The five aircrewmen on 781 are CPOs A. Donaldson, S. Lock, M. Dwane, G. Wilks, and PO P. McCarthy. With squadron aircrew away on flying duties most of the time it was found essential for continuity to have someone in the office who could deal with requests for air transport and also provide a continuous ground link for squadron members absent from their home base. This role has been efficiently filled for the past 11 years by the civilian Staff Officer, Mr Tom J. Cooper, whose aplomb in answering requests for transport never varies, whether he is engaged in dealing with an admiral or commander or CPO. The squadron's engineering officer is Sub Lt D. Barrow and the maintenance (since March 16, 1959) has been carried out by civilians, apart from five Naval ratings who are responsible for the Whirlwind, Sea Hawk and Vampire. Maintenance of the "Admiral's barge" Devon is the special responsibility of CPO Gaitch. The squadron's respect for their civilian maintenance personnel cannot be too highly emphasized, for the aircraft are always ready when required for their duties and there is a high rate of usage—320hr flying in October being typical, while in summertime the squadron is even busier. Average monthly flying time for the pilots is 50hr, though on occasions it may be much higher. The record is held by Lt L. A. Cox, who during the Suez operations did 92 hours' flying in a month.

RNAS Lee-on-Solent, most historic of Fleet Air Arm airfields, provides the squadron with a base airfield which has three runways

—short by jet standards (1,430, 1,000 and 1,100yd) but adequate for Dove and Heron operations—and CR/DF facilities. The Solent at the edge of the airfield provides a natural safety lane in poor weather conditions. The airfield is run by Airwork Services Ltd, with Mr H. H. Simpson (an ex-lieutenant commander in the Fleet Air Arm) as airfield manager. Navy Works are responsible for the surfaces.

The ship's name for Lee is HMS *Ariel*, which is the centre for Naval air electrical training and the home of a varied collection of units. These include MARTSU (Mobile Air Repair, Towing and Salvage Unit); Fleetlands aircraft repair unit and its associated test flight; AIU (Accident Investigation Unit); EHU (Engine Holding Unit); NARIU (National Air Radio Installation Unit) and NAMDU (Naval Air Maintenance Development Unit)—a formidable display, for the uninitiated, of Naval hieroglyphics. Lee also recently became the headquarters of the new Inter-Service Hovercraft Development Unit.

781 Sqn operated in East Africa during the war, as a Fleet Requirements Unit; its association with Lee-on-Solent began in 1945. At that time, and for some years subsequently, it was mainly a training unit; only since 1954 has it been almost entirely engaged on communications duties. Even now, with the Herons, its carrying capacity is somewhat limited: when a rugby team was taken from Culdrose to Lossiemouth recently, to play in the Fleet Air Arm final, two of the members had to travel up by train. But 781's work is a specialized form of air transport; and the squadron has established a fine reputation for the reliability, punctuality and versatility of its services.

Mechanized Air Dropping

DETAILS OF THE BLACKBURN DELIVERY SYSTEM

IN theory, bombing and supply-dropping are identical pursuits—except for the important fact that parachuted stores are intended to remain intact. The actual moment of arrival, therefore, marks the point at which the two operations should begin to differ. Up to the moment of arrival, the procedures have this common purpose: to collect stores at a base and deliver them to a remote point with speed and accuracy, irrespective of whether the stores are bombs or bloaters. One might reasonably expect the techniques employed to be similar in detail; but, until very recently, most of the world's supply-dropping has been done using techniques that fall far short of the science of bombing.

Object of the Blackburn Air Delivery System is to eliminate delays, inaccuracies and risks inherent in manual handling and despatch. Its most significant contribution is an automatic despatching gear, which has at last permitted the development of a dropping technique comparable to bombing.

One of the most important requirements of supply dropping is that all the material dropped shall reach the recipient for whom it is intended. Waste of precious equipment is bad enough, but making a present of it to an enemy is even more unacceptable, and this has happened often enough to emphasize the need for accurate dropping and tight grouping of the loads. Manual release of a succession of individual loads not only increases dispersion, but also inevitably exposes the despatcher to some risk. By contrast, the Blackburn equipment permits close spacing of dropped loads and entire absence of risk, because a succession of loads can be dropped in a "stick" at the pull of a lever, and there is no despatcher. From the moment that the supply-dropping officer operates his selector lever, the process is fully automatic.

The complete system is made up from three main constituents: roller tracks, side guidance rails and an automatic release mechanism for each load. The roller tracks allow rapid loading of the aircraft, and form a low-friction floor for dropping. The side guidance rails ensure that the loads leave the aircraft freely, and at the same time form part of the load-restraining system. The automatic release mechanism is the kernel of the whole process of sequential despatch.

Installing the System

Installation in an aircraft is remarkably simple. First, sets of short transverse members are mounted on the freight floor. These are secured by quick-release attachments, and locate the roller tracks and guidance rails. The roller tracks are divided into 5ft lengths, each carrying fixed pegs at one end and sprung pegs at the other, so that it can be fitted between the transverse members in a second or two. The track sections do not depend upon the roller mountings for structural rigidity, but are braced by tubular struts. This allows the roller ball-races to be mounted in simple trunnions, so that a damaged roller can be removed and replaced without dismantling its section of track.

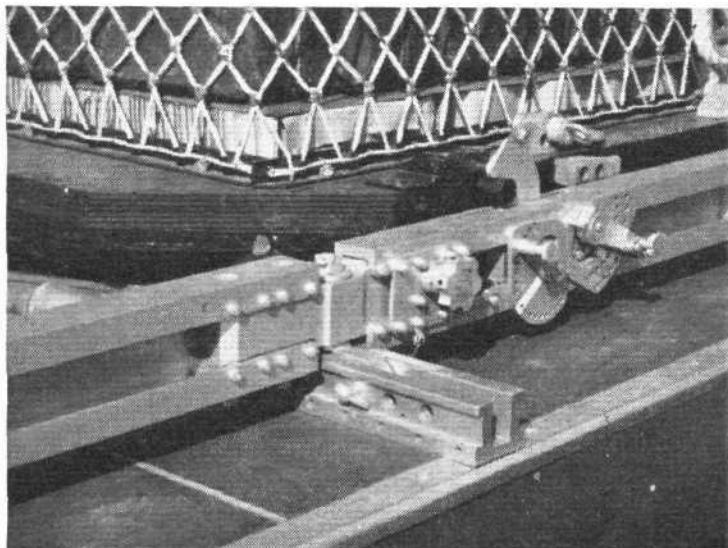
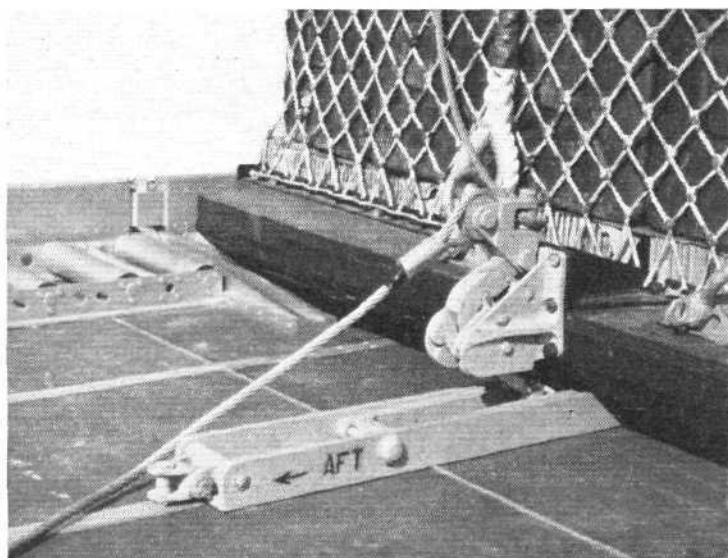
The guidance rails are also made in sections. These dove-tail together and are fixed to the same transverse members by quick-release pins; several rails can remain locked together and be handled as a unit. The transverse members, to which track sections and guidance rails are fitted, have two rows of locating holes to enable the system to cater for a wide variation of load widths.

Aft-facing hooks on the guidance rails engage with spigots on the load platforms and prevent forward or upward movement of the latter. Each hook is controlled by a pair of adjusting levers mounted on the outboard side of the rail, which move the hooks horizontally and vertically so that they can grip the spigots tightly even if the platform has been slightly distorted. When the platform moves aft, its spigots strike the backs of any hooks in their path and depress them into slots in the guidance rails, where they are automatically retained by pawls. The rails are thus left unobstructed for subsequent releases and for loading-up, and adjustment of the hooks during loading takes less than 1min for each platform. The guidance rails are also fitted with retractable spigots, which can be made to engage with holes in the sides of freight pallets which are not to be air-dropped.

Since the clearance between a load platform and the guidance rails is only about 0.25in, the latter not only ensure a clean exit from the aircraft, but also provide restraint against sideways movement in flight. The rails prevent the load from moving upwards, forwards or sideways. Movement aft is prevented by links between the floor and the automatic release mechanisms mounted centrally on the aft faces of the load platforms. Each link consists of a short rod, one end of which is attached by trunnion to a channel-section member on the cargo floor and the other end is formed into a 1in ball which is grasped by the release mechanism. When the connection has been made, the guidance-rail hooks are so adjusted as to leave no fore-and-aft play. Once the platforms have been loaded and secured, the necessary cables are attached to the release units and the loads are then ready. The air-drop sequence may be described by starting at the rear of the aircraft and assuming that only two loaded platforms are to be dropped.

Two extractor parachutes are mounted at the extreme aft end of the cargo hold, one to port, and the other to starboard; in the case of the Blackburn Beverley they are on the vertical face of the cargo-floor sill. It is standard practice for the port parachute to control the first (i.e., rearmost) load to be dropped. These extractor parachutes are released by two selector levers under the control of the dropping officer, who occupies a position near the nose of the aircraft from which he has a clear view of the approach to the dropping zone.

To release the starboard parachute (forward load) with the aft load still in the aircraft would be a painfully unprofitable procedure against which the aircraft and its crew must be protected. The two selector levers are therefore mechanically inter-



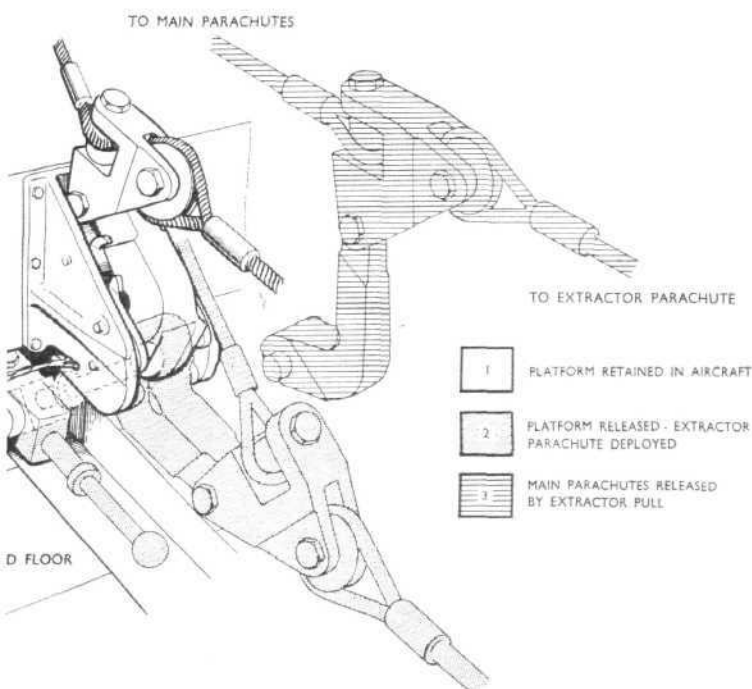
The automatic release mechanism (upper picture) is also illustrated in a drawing opposite. On the right is a close-up of the guidance rails, hooks and adjusting levers described in the text above

locked in such a way that the starboard parachute cannot be selected unless the port lever is fully in the "release" position.

Another possible hazard is the chance that, perhaps through enemy action, an extractor parachute might carry away of its own accord. The extractor-parachute cable is therefore broken, and joined by a safety link attached to the cargo-floor sill by a shear wire which will fail at the load imposed by a deployed parachute. The cable from the parachute is attached to this safety link by means of a spool normally held in place only by shear wires not even able to carry the load imposed by the falling away of an unopened parachute pack. The accidental release of an extractor parachute will not, therefore, initiate the dropping sequence. When the dropping officer makes a selection, however, the first movement of his selector lever inserts a strong pin through the safety link and the spool carrying the extractor-parachute cable. This pin, which will bear the load of a deployed parachute, remains as part of the safety link when the latter breaks its main shear wire and leaves the cargo-floor sill. If the dropping officer should decide to cancel the drop, he can return his selector lever to "safe," which will withdraw the spool pin and again protect the load from accidental release.

During an air drop, the automatic sequence begins when the officer operates the correct selector lever (he cannot operate the wrong one). The spool in the extractor-parachute cable safety link is "armed" with its load-carrying pin, and the parachute is released from its sill stowage. The parachute deploys, and its pull withdraws the safety link from its stowage on the sill. The link now becomes an integral part of the extractor-parachute cable, which is attached to the automatic release mechanism on the load platform.

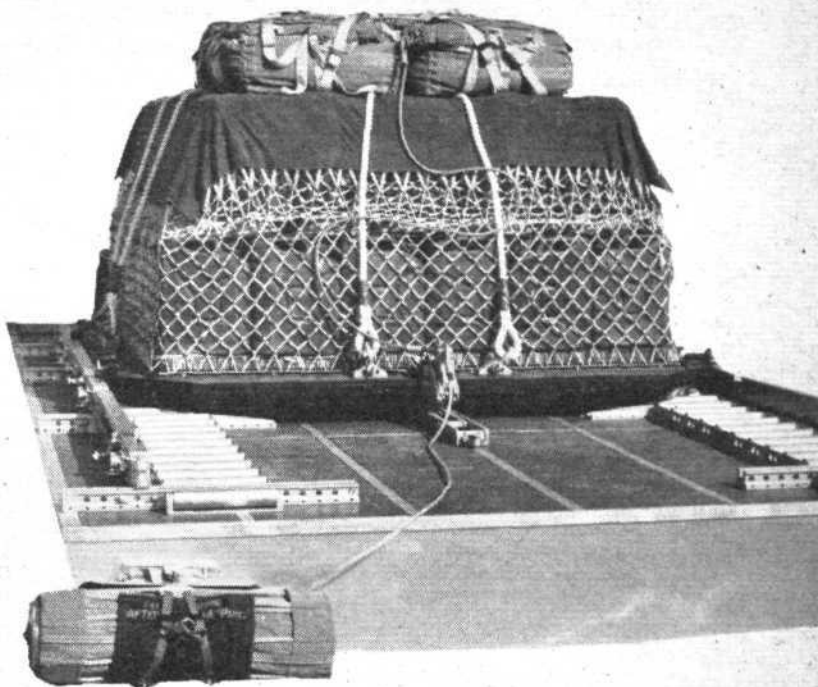
The point of attachment is the upper end of a vertical pivoted



Operation of the automatic release mechanism, described on this page, is clarified by this diagram. An actual example—one of many used in trials—is illustrated on the facing page

arm, normally held in position by a shear wire. The lower end of this arm is trunnion-mounted in a pair of jaws (part of the release unit) which are locked in the closed position until after the load platform has departed. The pull of the extractor cable breaks the shear wire and moves the arm down towards the horizontal. The lower part of the arm forms part of the housing which attaches the release unit to the ball-ended rod securing the release unit (and hence the platform) to the cargo floor. When the extractor cable rotates the arm to the bottom of its travel, the ball-ended rod is released and drops into the channel-section beam to which it is attached. The platform is now free to move aft under the pull of the extractor parachute, because the guidance-rail hooks impose no restraint in this direction.

The complete platform and main-parachute pack now travels along the roller track and leaves the aircraft cleanly. At this stage the pivoted arm to which the extractor parachute is attached is still firmly held in the jaws of the automatic release unit. But these jaws are controlled by a trigger within the unit itself. When the platform is secured in the aircraft, the looped end of a cable is passed over this trigger, the other end of the cable being attached to a strong-point on the floor, near the centre-line. The length of cable is such that it will operate the trigger only when the platform



A complete section of roller system, guide rails, air-drop load and platform, parachute packs and automatic release unit connecting the extractor-parachute pack prominent in the left foreground

is well clear of the aircraft. When the platform tightens the cable, the trigger is pulled and the looped end of the cable falls away from the unit.

Pulling the trigger allows the jaws in the release unit to open, and the released pivoted arm is pulled away from the unit by the extractor parachute. There is now no connection between the load and the aircraft. The extractor parachute and freed pivoted arm have one more task. A cable runs from the pivoted arm to the top of the main parachute pack surmounting the load, and, now that the arm has been released from the platform, the pull of the extractor cable is transferred to it from the release unit. The cable releases the parachute pack from the harness which holds it in place, and pulls the pack away from the load. When the pack is as far away as the shroud-lines allow, the continuing pull of the extractor parachute removes the bag from the main canopy, which is thus free to deploy and support the loaded platform. The extractor parachute, cable and pivoted arm now float away free; if recovered, they may be used again.

Put in a nutshell, the automatic release sequence is:—

- (1) Dropping officer selects "drop."
- (2) Extractor-parachute safety link armed, extractor parachute released.
- (3) Extractor-parachute drag unlocks load platform from restraint.
- (4) Load platform is withdrawn from aircraft.
- (5) Extractor-parachute pull is transferred to main pack.
- (6) Main pack is released from load.
- (7) Main parachute deploys, extractor parachute and cable float away free.

The procedure for dropping the second load is exactly similar, except that the starboard-mounted extractor parachute is used.

Safety Devices

Two main safety features have already been described—the extractor-cable safety link, and the load-selector interlock. A third is inherent in the automatic sequence of operations. Few things are less welcome in a supply-drop than an accidentally released main canopy foaming all over the cargo, and the Blackburn system makes such an event as impossible as could be wished. The main parachute cannot begin to deploy until its bag is removed; the bag cannot be removed until the harness holding it to the load is released; the harness cannot be released until the relevant cable is pulled; and the far end of the cable is locked to the load platform until the platform is well clear of the aircraft. Only then can the pivoted arm (to which the cable is attached) be released from the automatic release unit.

Once the system has been installed in the aircraft, the loading process is straightforward. Loaded platforms are brought up to the aft door on ramps or on vehicles equipped with roller tracks similar to those on the cargo floor. The load platforms are then moved into the cargo hold. Four platforms, together carrying

MECHANIZED AIR DROPPING...

some 15 tons of equipment can be loaded, secured, and connected in 25min; and if the aircraft has been used for some other purpose (e.g., paratrooping), the empty cargo floor can also be completely equipped with all the necessary fittings in the same time.

So far, the dropping of two separate loads has been considered to show how the Blackburn system increases both accuracy and crew safety—quite apart from speeding up the overall loading process. But a major advantage is its ability to drop a succession of loads, like a stick of bombs, at the touch of a single lever.

Basically, operation when dropping a stick is the same as for single loads. In fact, until the first load has gone, there is no difference in the sequence of events. But whereas the first load's sequence is initiated by the release of an extractor parachute stowed on the rear face of the cargo-floor sill, the sequence for the second load is initiated by an extractor parachute mounted on the rear of the first load and carried out of the aircraft with it. When this second extractor deploys, it begins to withdraw the second load, and from this point onwards the sequence is exactly similar to that for the first. If, therefore, four loads are to be dropped in a stick, the first is extracted by a parachute stowed on the floor sill and released by the dropping officer, whilst loads 2, 3 and 4 are extracted by parachutes carried by and released from loads 1, 2 and 3 (this technique is now well known as the "daisy-chain" system). As there are two extractor-parachute stowages on the sill, and two selectors under the control of the dropping officer, a set of four loads could be dropped in any one of four combinations: 1, 2+3+4; 1+2, 3+4; 1+2+3, 4; or 1+2+3+4; the first three combinations require two separate selections, and the last only one.

At the time of writing, the Blackburn Air Delivery System, as installed in the Beverley C.1, is being used with three main types of dropping equipment: up to four 11,000lb loaded platforms, dropped either in two groups or in a single daisy-chain stick; two medium vehicle platforms of up to 14,000lb; or one heavy vehicle platform, now under test at A&AEE, of 30,000lb. The 30,000lb

load can be withdrawn only by twin heavy extractor parachutes. These cannot be mounted on the floor sill in the normal way, but are stowed on the cargo floor and interposed between the normal extractor-parachute safety link and the automatic release unit on the platform. The first stages of this very-heavy-load operation are therefore:—

- (1) Dropping officer selects "drop."
- (2) Extractor-parachute safety link armed, extractor parachute released.
- (3) Extractor parachute withdraws twin heavy extractors from aircraft.
- (4) Drag of twin heavy extractors unlocks load platform from restraint. From this point onwards, the sequence is the same as for normal loads.

The British fighting Services appreciate the advantages of this system, and many successful trials have been carried out by AATDC and A&AEE. The equipment is equally applicable to the Armstrong Whitworth Argosy C.1, and the Lockheed C-130. As a result of the trials with the Beverley, the equipment was given MoA approval; the Ministry have placed an order for 56 sets of equipment for Argosies of Transport Command and the system is specified for the Short Belfast. The Canadian and Australian Services are also considering adopting the system, and the equipment is attracting world-wide attention.

Blackburn are no newcomers to supply-dropping. For some eight years the company has been engaged in the development of supply-dropping systems, freight pallets, air-drop platforms, and—in close co-operation with the MoA (and its predecessors), the AATDC, and the GQ Parachute Co Ltd—with the development of parachutes and suspension systems in general. Blackburn are unique amongst manufacturers of this type of equipment in that, in conjunction with MoA, they design, develop and test the systems, using their own parachute packers and load riggers, and operate their own private dropping zone. The company are now developing methods of dropping loads with high rates of descent, and of protecting loads from damage on impact; but that is another story.

THE INDUSTRY

Rockets at Radlett

THOUGH still in production with its ramjet instructional test rigs, the firm of A. Hilton & Co, of Sydneyville House, New Road, Radlett, Herts, has extended its activities to the rocket propulsion field. The company is offering a complete rocket test plant in which all the fundamentals of this type of propulsion can be demonstrated.

A cartridge is fired electrically in the motor and the resulting impulse and pressure generated is recorded on a chart. By weighing the motor before and after firing, and measuring the area under the thrust trace, total impulse and average specific impulse can be determined.

Falling into the same explosives category as shotgun ammunition, a slow-burning cordite cartridge manufactured by ICI is normally used. Pyrotechnic and line-throwing rockets may also be fired on the rig and a general study of the flow of gases through nozzles may be undertaken.

New Bolt Standard

A NEW British Standard (A.212) for aircraft components provides for a range (55 to 65 tons) of forged steel bolts completely free from decarburization. Their metallurgical quality is governed by a DTD specification for bolts primarily intended for use in Class 1 locations. Full title of the standard is *Cadmium-*

Designed to demonstrate the fundamental principles of rocket propulsion, this solid-propellant rocket test-rig has been designed by P. A. Hilton & Co. (See first "Industry" news-item above)



plated steel bolts of high metallurgical quality (Unified hexagons, Unified threads and close-tolerance shanks) for aircraft. Copies may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W1, price 5s (postage extra to non-subscribers).

IN BRIEF

Mr R. Broadbent, a director of the British Thermostat Co, parent company of the Teddington group, has joined the main board of Teddington Aircraft Controls Ltd.

Mr J. A. Enwright has been appointed a director of the Wayne Kerr Engineering Co Ltd, and Mr G. L. Ball, BENG, AMIEE, has been appointed sales director of the Wayne Kerr Laboratories Ltd.

C. F. Taylor & Co Ltd point out that the platform-height ranges of their airliner steps, referred to in our Airport Equipment review (December 14), should have been quoted as 7ft 6in to 11ft 6in for one of the two models and 8ft 6in to 12ft 6in for the other.

Mr R. W. Bailey has joined K.D.G. Instruments Ltd as assistant chief designer in the pressure element department. He was formerly (from 1955) chief development engineer of the diaphragm and capsule section at Kelvin & Hughes Ltd.

Mr Joseph Samuels, for six years a member of the board of Winston Electronics Ltd, has been appointed managing director. Mr W. Allan Bridges continues as chairman, relinquishing the managing directorship he assumed in August this year.

From the beginning of next year the address of the Dowty Rotol service department will be Cheltenham Road, Gloucester (Gloucester 24431; telex 4346/7). The Dowty Fuel Systems Ltd service department will continue to operate from Arle Court, Cheltenham.

An Electrolux 33 light industrial suction cleaner is being regularly used by Britten-Norman Ltd to keep the CC-2 Cushioncraft cooling system free from obstructions. Previously this had been found a very time-consuming process, especially during trials over newly cut grassland.

Mr A. E. Thornton, AMET, AFRAES, special director and foundry general manager of Firth-Vickers Stainless Steels Ltd, is retiring from the company on December 31—on medical advice and at his own request—after 45 years with Firth-Vickers and its parent company, Thos Firth & John Brown Ltd.

Ketay Ltd, a member company of the Plessey group, have announced the appointment of Mr K. J. Coleman, BSC (ENG), AMIMECHE, AMIEE, AFRAES, as chief engineer. He was previously head of control and instrumentation at the atomic energy department of Babcock and Wilcox Ltd and earlier was with de Havilland Propellers Ltd as senior development engineer and head of the alternator development department.

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.

Forty Years On

THE recent announcement that Vickers Viscounts are to be sold to the People's Republic of China brings to mind the fact that the combination of Vickers airframes and Rolls-Royce aero-engines was known to China at least 40 years ago.

Ironically, as it happens, past events are publicized in the fascinating house journal of Civil Air Transport, *CAT Bulletin*, published in Formosa. The issue for July/August 1961 (p 31) illustrates the new \$10 air mail stamp commemorating the 40th anniversary of the civil air service. The stamp features the latest CAT acquisition, the Convair 880M, and a dubious biplane. However, the balance is corrected by a photograph of a RR-powered Vickers Vimy Commercial. The caption reads: "This is the biplane which was in flight service from Pieping (Peking) to Tsinan (Lacheng or Chinan) early in July 1921, signifying the beginning of civil air service."

London W14

CHARLES W. CAIN,
Hon PRO, Air-Britain

Private Pilots and London Control

I FOLLOWED the case of Mr Alan Heber-Percy from the time it was first reported in the Press until he was fined £140 at Middlesex Quarter Sessions. I have not met Mr Heber-Percy, but I have until recently been flying my own aircraft over the route he was trying to follow. I hasten to add that I am too elderly and frightened to fly in bad visibility but I do know that when flying up from Lympe to Fair Oaks or Oxford into the setting sun, even a light haze can be disconcerting—and he seems to have done the best he could by landing at White Waltham.

It is therefore quite clear to me and some of my friends that this case, coupled with another case last year, indicates to all private pilots that we are not wanted anywhere near London Airport. The private pilot who wanders off course into the London Control Zone is chased by the authorities and given a public "telling off" in court. Official policy is bound to win in the end as no one is going to risk this sort of treatment.

The authorities can chalk up one more success in driving private pilots out of their way—as, having owned a Messenger, Gemini and Tri-Pacer and had immense fun and pleasure from them, I am now calling it a day and returning to sailing.

London W1

R. D. McCULLOUGH

[Mr Heber-Percy was fined £40 for flying into the London Control Zone without having submitted a flight plan to Air Traffic Control; £40 for acting as a pilot without having a licence which included instrument rating; and £60 for acting in a manner likely to endanger an aircraft entering the London Control Zone. He was found not guilty of flying in such proximity to another aircraft as to create the danger of a collision. He had pleaded not guilty to all four charges.—Ed.]

B-17s at Bovingdon

I WAS more than pleased when I heard of the arrival in the UK of the three veteran B-17s which are currently on location at Bovingdon, and look forward to the release of the film *The War Lover*. The photos you published in the November 30 issue of *Flight* could well have been taken at Bovingdon during World War 2, as this airfield saw much of the "Flying Fort," as it was locally known.

The United States Army Air Corps connections with Bovingdon airfield date back to the year 1942, when in the month of August the ground personnel of the 92nd Bomb Group, USAAC, arrived after disembarking at Liverpool from the SS *West Point*. The 92nd was activated at McDill Field in the USA with Boeing B-17E Flying Fortress aircraft, and these arrived at Bovingdon a few days after the ground personnel.

World War 2 was in its third year and the additional striking power of the newly arrived United States 8th Air Force in the UK was soon to be felt on the other side of the North Sea. The 92nd was now settled in at Bovingdon, and the Group was made up of the 325th, 326th and 327th Sqns along with the 407th Maintenance Sqn. Between August and December 1942 the 92nd became operational under its commanding officer, Col Sutton, and did at least three operational bombing missions.

However, at this time the 8th Air Force decided that it needed a training and replacement centre for its B-17 crews as they arrived from the USA. So in early 1943 the 92nd Bomb Group was divided: Col Sutton took half to Bassingbourn airfield near Cambridge to remain as the 92nd, while the remaining half formed the Combat Crew and Replacement Unit under Col Dwyer, with Col Smith as Base Commander.

Being the nearest USAAC airfield to London, Bovingdon saw the arrival and departure of many well-known VIPs, and No 1 hangar was kept for the sole purpose of housing VIP aircraft, among them the personal B-17 used by Gen "Ike" Eisenhower, who at that time had his HQ at Bushey Park. A familiar figure on the airfield was Maj "Larry" Hensen, who was the general's personal pilot throughout World War 2. Other well-known personages stationed at Bovingdon included Jimmy Roosevelt, son of the then President, and Clark Gable, James Stewart and William Holden—just to name three who were famous film stars. The late Glenn Miller with his band of the AEF was also a familiar sight at the many concerts and dances held at the base.

The Combat Crew Replacement Unit remained at Bovingdon until September 1944, when it disbanded and the personnel transferred to Germany.

Merioneth, North Wales

A. PEARCY JR

[Mr Percy, an air historian, is engaged in writing a history of Bovingdon airfield and would be glad to hear from anyone having relevant information. His full address is Cartrefle, 3 Ystad-y-Wenallt, Llanbedr, Merioneth, North Wales.—Ed.]

Airworthy Mosquito Preservation

FOR the last few months I have been endeavouring to make arrangements for a Mosquito to be preserved in flying condition, but so far without much success. Unfortunately the de Havilland Aircraft Co cannot help at the present time, despite the fact that the manufacturers of the Hurricane and Spitfire manage to show sufficient imagination and sentiment to keep examples of their products in excellent shape.

There can be no type more worthy of permanent preservation than the Mosquito. I am aware that the prototype still stands for all to see at Salisbury Hall, and that is better than nothing, but anyone with any true appreciation knows that there is no comparison between a "live" and a "dead" aeroplane. Even the smell, so much a part of any aircraft, is only the right one when a machine is in active use!

The main difficulty does not appear to be one of expense, for a wooden aeroplane is of very low scrap value and therefore a machine probably could be purchased from Air Ministry for a very modest sum. The big setback is the fact that the type would need to go through a prohibitively expensive routine in order to obtain a C of A, even if this could be obtained at all; and only the manufacturers of a type are permitted to operate specimens of their own products on restricted demonstration permits, at the same time being allowed to maintain such machines in their appropriate Service markings.

The last few airworthy Mosquitoes, TT.35s, are earning their petrol, oil and coolant towing drogues from Exeter, therefore giving Devon an added attraction as a holiday area. However, these stalwarts are about to be replaced by Meteors (in 1962!), so unless a plan is made and action taken soon the last Mossies will be cut up and burnt.

If any reader in the industry, or even out of it for that matter, has any useful and constructive suggestions for overcoming the problems involved, I shall be pleased to hear them. I am prepared to open and manage a preservation fund, or help form a committee, if there is a likelihood of success, but primarily it is essential to know how the aircraft can be operated (even if only for a few demonstration flights each year) on a legitimate and practical basis.

Elstree, Herts

D. F. OGILVY

IN BRIEF

We are unable to trace the owner of two books of Leica negatives which are in our possession and which may be treasured by somebody. Clues are Sao Paulo and Jauari, Crew No 68 and 70, Aconcagua from 23,000ft and pictures of Mr Twitchin and Christopher.

FORTHCOMING EVENTS

- | | | |
|-----|----|---|
| Jan | 1 | Institute of Transport (Metropolitan Section): "Development of an Airport," by Maurice G. Housego. |
| Jan | 4 | RAeS: Young People's Lecture, "Airliners of the Future," by Godfrey H. Lee. |
| Jan | 4 | London Society of Air-Britain: Film, "Hell's Angels." |
| Jan | 5 | RAeS Rotorcraft Section: "Rotating Aerofoils and Flaps," by Dr S. Neumark. |
| Jan | 10 | Guild of Air Pilots and Air Navigators: Livery Dinner. |
| Jan | 11 | Northampton College of Advanced Technology: "Vickers Aircraft," by H. H. Gardner. |
| Jan | 15 | RAeS Historical Group: "R.101 and Other Airships," by Sir Harold Roxbee Cox. |
| Jan | 16 | RAeS Astronautics and Guided Flight Section: "Development of Seals," by C. Bayly and A. Lightbody. |
| Jan | 17 | BritIRE (Computer Group): "VERDAN—a Miniature Computer for Airborne Use," by B. B. Rayner and S. Morleigh. |
| Jan | 20 | Aircraft Recognition Society: All-England Competition. |
| Jan | 24 | RAeS Graduates' and Students' Section: "The New Bluebird," by K. W. Norris. |
| Jan | 26 | RAeS Man-powered Aircraft Group: "Design Philosophy of Man-powered Aircraft," by J. J. Spillman. |
| Jan | 29 | RAeS: Joint discussion with Institution of Electrical Engineers. |
| Jan | 30 | Institute of Transport (West Middlesex Group): "The Work of IATA and the Clearing House," by A. J. Quin-Harkin. |
| Feb | 2 | RAeS Rotorcraft Section: "Rotor Flow Visualization," by Prof J. Valensi. |

AIR COMMERCE

All Nippon Airways operate three Fokker Friendship 200s and are due to take delivery of a further seven during 1962. This is the first aircraft, which entered service on July 10 last

Japan's Domestic Traffic Booms

THOSE who may have raised their eyebrows at the decision of All Nippon Airways, reported in *Flight's* November 23 issue, to adopt a medium jet such as the Trident or Boeing 727 for their domestic services would probably be surprised at the startling rate of growth of post-war Japanese domestic air transport. Last year, more than ten times as many passengers were carried domestically as in 1952, the first full year of post-war operations.

Japan Air Lines began the first domestic services in October 1951, using Martin 2-0-2s and DC-4s leased from and crewed by Northwest Orient Airlines. Traffic growth since then has been extremely healthy, and the load factors in the table below serve to underline the shortage of capacity that has probably been felt at peak periods.

TABLE 1: GROWTH OF JAPANESE DOMESTIC AIR TRANSPORT

Year	Passengers carried	Pass-km × 1,000	Available seat-km × 1,000	Passenger load factor (%)
1952	98,735	—	—	—
1953	211,501	134,461	190,591	71
1954	273,061	173,917	230,853	75
1955	316,111	207,794	295,150	70
1956	451,096	276,997	370,796	75
1957	555,415	334,016	460,684	73
1958	568,857	360,402	563,503	64
1959	745,199	440,899	642,919	69
1960	1,082,392	—	—	—

Sources: Aireview magazine, Tokyo, and ICAO Digest of Statistics

All Nippon Airways is making itself felt as a competitive force against Japan Air Lines; in August 1960 JAL put DC-7Cs on its domestic trunk routes when All Nippon introduced two Viscount 744s leased from Vickers on the Tokyo - Sapporo route; and a year later ANA's Viscount 828s (of which six are on order) and Friendship 200s (of which ten are on order) were introduced.

All Nippon has already announced its intention of purchasing more than 25 NAMCO YS-11s, and will thus become the first customer for Japan's twin-Dart transport, which is due to fly next March and is likely to present a stiff challenge to the three European twin-Dart transports in Asian markets. All Nippon is the biggest operator concentrating on domestic services only, and was established in March 1958 through the merger of Far East Airlines and Japan Helicopter Air Transport. Its piston-engined fleet consists of five Convair 440s, four Doves, nine DC-3s, three Herons (leased from JAL), five Bell 47s, one Tri-Pacer and one Autocar.

The Ministry of Transportation has divided Japan into seven areas to prevent excessive competition among the Japanese local service carriers, of whom there are six at present (excluding All Nippon). The largest in terms of type of equipment used is North Japan Koku KK of Sapporo, with a fleet of four Convair 240s, three DC-3s and a Cessna 170B.

It is interesting to see from Table 2 how closely traffic figures for the more important Japanese domestic routes in 1960 (14 years after the first year of post-war air transport) compare with those of similar US domestic routes for the year ended June 30, 1948—14 years after the US Post Office air mail route awards in the autumn of 1934, which can be regarded as the foundation of present-day US domestic air transport. In the USA, of course, air transport was operating continuously during those 14 years, while in Japan it ceased with the end of the war in 1945 and was not resumed until six years later. So the fact that 1960's Tokyo - Osaka traffic came close to that on the plum New York - Boston route in 1948 (at that time the latter was consistently ranking first among US domestic routes in passengers carried) is more significant than might be

thought, indicating as it does a more rapid rate of traffic growth. Again, the number of passengers carried in 1960 on the Tokyo - Fukuoka route was very similar to the number (93,817) carried between London and Rome that year.

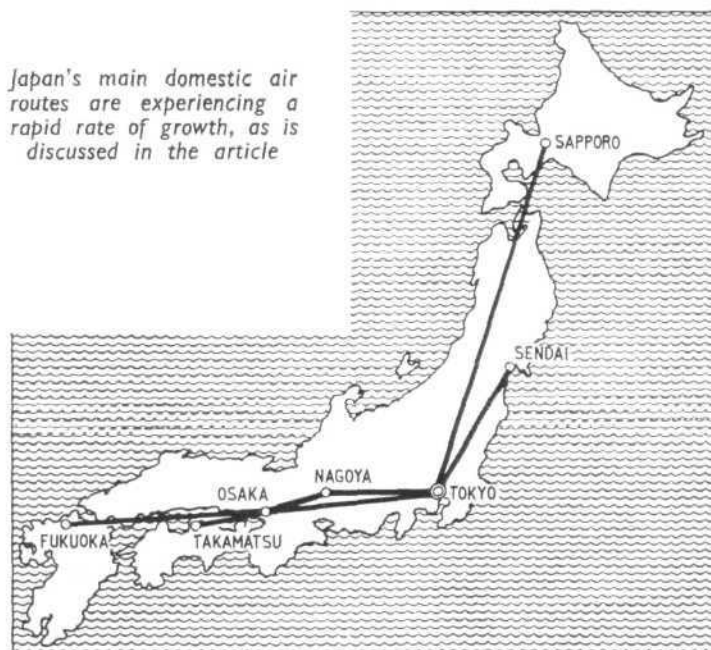
And just as the US domestic airlines had to meet fierce competition from the railways on such routes as New York - Boston and New York - Chicago, so JAL and All Nippon are meeting—and apparently beating—railway competition, especially on such routes as Tokyo - Sapporo. This is perhaps the more surprising in view of America's higher living standards; the Japanese might, therefore, have preferred to go by train rather than to fly. The current Anglo-Japanese talks in progress on a renewal of the trade agreement between the two countries and on a longer-term Treaty of Commerce and Navigation seem to offer a good psychological moment for British aircraft manufacturers to intensify their sales efforts in Japanese markets.

TABLE 2: 1960 TRAFFIC ON IMPORTANT DOMESTIC ROUTES

Route	Distance (st. miles)	Passengers carried			Japanese National Railways
		JAL	All Nippon	Total	
Tokyo-Osaka	c400	375,628	65,145	440,773	674,383
(New York-Boston)*	184	—	—	(501,078)	—
Tokyo-Sapporo	648	177,851	45,606	223,457	24,210
(New York-Chicago)*	724	—	—	(242,298)	—
Tokyo-Fukuoka	c700	92,501	—	92,501	39,565
(New York-Detroit)*	511	—	—	(102,144)	—
Osaka-Fukuoka	c430	—	74,372	74,372	25,867
(New York-Cleveland)	418	—	—	(66,354)	—
Tokyo-Nagoya	c200	—	67,285	67,285	239,929
(Chicago-St Louis)*	251	—	—	(69,558)	—
Osaka-Takamatsu	c100	—	30,179	30,179	21,856
(Miami-Tampa)	204	—	—	(35,082)	—
Nagoya-Osaka	c210	—	9,864	9,864	93,493
Tokyo-Sendai	255	—	9,835	9,835	77,748

Sources: Aireview magazine, Tokyo; Airline Competition (Gill & Bates).
* Year ended June 30, 1948 (estimated totals).

Japan's main domestic air routes are experiencing a rapid rate of growth, as is discussed in the article



Last week BEA and Lufthansa were due to sign an agreement for the joint operation, as from January 2, of all-cargo Argosy services between London-Düsseldorf and Frankfurt on six nights a week. BEA's three Argosies, one of which is seen here being unloaded at London Heathrow, are now operating scheduled services to Milan, Paris and Jersey, and are due to take over the corporation's all-cargo services to Manchester, Glasgow and Copenhagen next month

SUPER BROUSSARD PROGRESS

THE first production Max Holste MH-260 Super Broussard is nearing completion at Nord's Bourges factory and is due to fly at the end of the month, or very early in the new year. A batch of ten will be built in 1962, with first deliveries to a customer in the second quarter; and the first pressurized MH-262 is due to make its first flight next September, followed by the first production MH-262 in November.

During 1963 the production rate will be increased from one to four per month and 42 aircraft of both versions (30 MH-262s and 12 MH-260s) will have been built by the end of 1963; the production rate could be increased to eight a month if orders justify it.

The Super Broussard is already arousing keen interest among airlines, and the first MH-260 will make a one-month sales and demonstration tour in the former French territories in Africa early next year. At the end of the winter, it is understood, it will be evaluated on the night airmail service of Postale de Nuit, an Air France subsidiary, and one or more aircraft will fly on Air Inter routes in June or July.

Nord is responsible for marketing and sales as well as for production. The production effort is divided according to man-hours and the number of people working as follows: 30 per cent at Bourges, forward and centre fuselage, final assembly and flight test; 30 per cent at Méaulte, inner and outer wing construction; 10 per cent at Les Mureaux, making engine cowlings, mountings and glued panels; 30 per cent to Max Holste at Rheims who are making the rear fuselage, tail surfaces, flaps, ailerons, undercarriage fairings and engine nacelles.

The pressurized MH-262 will have accommodation for 26 passengers and eventually 32, and the Bastan IV turboprops will have an initial overhaul life of 1,000 hours. The MH-260 with "indispensable equipment" will sell for NF1.4m (£101,000) without tax and the MH-262 will cost NF1.6m (£115,000).

CAA's MYSTERIOUS PROFITS

MYSTERIOUS is the only word which adequately describes those ruined walls which lie not far away from Fort Victoria. The same word appropriately describes the financial results of Central African Airways, for the most diligent examination of the latest report and accounts provides only a few possibly controversial suggestions as to the source of the airline's unexpected profits in the year ended March 31, 1961.

Until recently, CAA was one of those unfortunate airlines which just could not operate profitably, this apparently being due to the need to operate non-commercial services. But, over the past two years, the airline has become one of the more lucrative organizations in the Federation. Although the layout and content of the annual report has improved beyond recognition, no meaningful analysis is given to explain this remarkable transformation.

The most striking feature of the CAA economy is that, unlike most other airlines, it has not been based upon a steady growth of traffic. The volume of business actually reached a peak in 1957 and has been declining gradually ever since. This has resulted partly from the economic and political uncertainties which have bedevilled the Federation. But the main reason has been the voluntary transfer of the operation of its UK services to BOAC. During the years, while CAA was paring down its staff to fit its somewhat reduced scale of operation, it was obviously difficult to break even. But by 1960-61 a stable position appears to have been reached, and the prospect is now one of renewed growth.

The next striking feature of CAA is its extraordinarily high cost level. In 1960-61 this worked out at 46 pence per c.t.m.; for an airline which is primarily a Viscount operator, and is achieving good utilization rates, this figure is almost alarming. No explanation of the cost level is given in the report, but close examination of the accounts suggests that the blame must be attached to prohibitive fuel costs on the one hand, and to high labour costs on the other. The former item probably derives from the airline's relatively inaccessible location in central Africa; this must add considerably to fuel distribution costs. The high labour charge is undoubtedly the inevitable price which has to be paid if good staff are to be retained in central Africa, but it could also be a sign that the labour force of 1,182 is either under-utilized or engaged on activities other than CAA's own operations.

Even more remarkable than the high cost level is CAA's ability to become profitable and subsidy-free in the face of unusual adversity. Not only did costs rise in 1960-61, but load factor fell sharply from 66 to 62 per cent, and the grounding of the Viscount fleet



—due to the discovery of stress corrosion cracks in the upper spars—led to a heavy loss of business. As a result, operating expenditure in 1960-61 rose fractionally to £2.8m (output was virtually unchanged at 14.5m c.t.m.) while traffic revenue fell 5 per cent to £2.3m. The year's budget showed a loss. Yet the year ended with a best-ever profit of £127,000.

The clue to this paradox—profits improving when traffic revenues are being outstripped by costs—is to be found in an item described as "other revenue." This rose from just over £1m in 1959-60 to almost £1m in 1960-61. Although no reference to this vital item is contained in the report, it is possible to dig out some of the facts which appear to have contributed to CAA's profit. In the first place, the airline now conducts an extensive handling business, largely for its pool partners. Secondly, it is now doing a substantial amount of selling for other airlines. This is apparent from the balance sheet which shows that at the year-end CAA owed other airlines £1m in advance bookings and sales—a figure which suggests that the airline's staff sell more accommodation on other airlines than on their own. In the third place, CAA is still receiving payments from BOAC in return for having in 1957 handed the operation of UK services to the corporation. (In the BOAC accounts this charge, £1½m over 10 years, is submerged under the title *commission paid*.) Fourthly, there is the possibility that any benefits accruing to CAA under the quadripartite BOAC/SAA/EAA/CAA pool might be included in this item "other revenue." And finally, CAA must have received substantial interest payments on its investments, which are now valued at a considerably higher figure than its entire fleet.

FOR LORD DOUGLAS'S WASTEPAPER BASKET

DESCRIBING criticisms of BEA in the recently issued Toothill Report on the Scottish economy as "a resounding slap in the face," Lord Douglas makes a vigorous reply in the *BEA Magazine*. Having previously said that, so far as he is concerned, the best place for the Toothill Report is his wastepaper basket, BEA's chairman now declares:—

"In point of fact, I think that BEA has served Scotland extremely well over the past 15 years and in support of this view the following facts speak for themselves:—

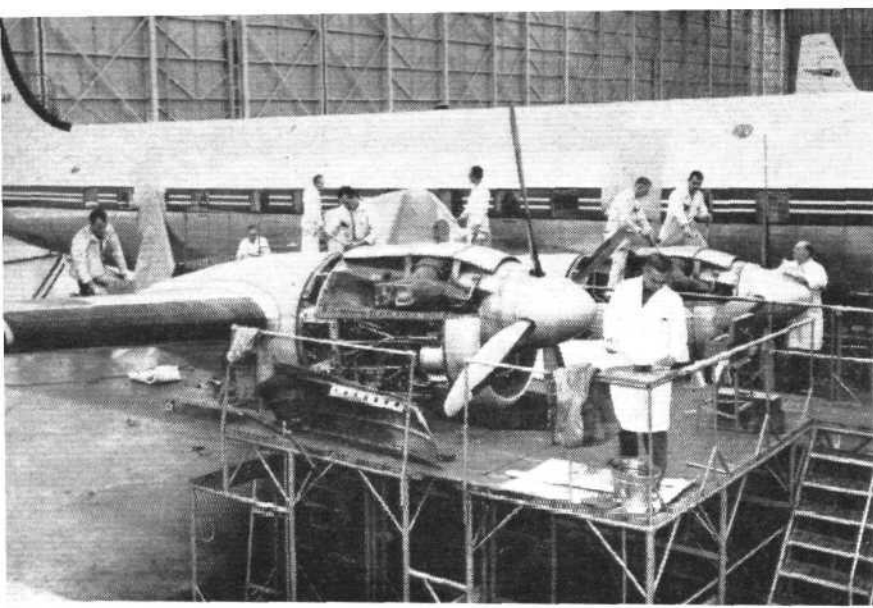
- (1) In the process of developing the trunk routes between London and Scotland into a profitable state, BEA lost nearly £3m. In addition, we have lost over £3m in providing a network of internal air services in Scotland.
- (2) BEA serves 13 points in Scotland, with a population of 5m, compared with 7 in England and Wales, with a population of 46m.
- (3) The number of seats provided by BEA between London and Scotland has increased nearly three-fold during the past five years.
- (4) The cheapest air fare in the world is offered by BEA on its London-Scotland routes.

Dealing with criticism in the Report that, "it is clear that tourism has been favoured at the expense of business" on the Scottish trunk routes, Lord Douglas goes on:—

"While it is true that a great deal of BEA's effort has been directed towards implementing our policy of lower fares, thus bringing the price of air travel within the reach of more and more people, the first-class business traveller has by no means been overlooked.

"During the past summer, for example, BEA provided 510,000 seats between London and Scotland, of which 93,000 were first-class. Of these, 360,000 were sold, including 69,000 first-class. The passenger load factor was therefore 71 per cent, which means that we were left with 150,000 unsold seats on our hands, including 24,000 first-class.

"On the 'businessmen's' morning and evening services, 129,000 seats were provided including 46,000 first-class, 95,500 seats were sold, including 37,000 first-class, which means that 26 per cent of all seats provided on these services were not filled. These figures hardly square with the Toothill Report's complaints of lack of capacity, especially first-class."



TCA has now disposed of all its 21 DC-4M North Stars. Here is the last one being prepared at Montreal for delivery to World-Wide Airways Inc of Montreal. Four have been sold to World-Wide; eleven to Mr John Gaul of London (via Overseas Aviation); five to Lausa, Mexico City; and one to International Air Freighters of Edmonton

AIR COMMERCE...

YOUR AIRPORT CAN BE PROFITABLE

ONE reason for the profitable state of American airports is the readiness to make use of specialized knowledge in airport planning. The pioneer firm of airport consultants, Leigh Fisher Associates Inc, has established an international reputation since its formation in 1946, and offers a wide range of services to airport managements and civic authorities.

These are broadly of three types: market studies including air traffic forecasts and general airport development programmes; airport planning; finance and operations management, including airport rate analyses, capital and revenue financing, lease and contract reviews, concession development and similar services. Although most of Leigh Fisher's 150-odd clients are in the US, the firm has advised the Swedish Government on Stockholm's Arlanda airport and has prepared a management and financial programme for the airport of Wellington, New Zealand. Among the "firsts" claimed by Leigh Fisher include the first uniform airport cost accounting system.

BOAC's DC-7Cs

CAPT HENRY KERBY (Cons, Arundel and Shoreham) asked the Minister of Aviation on December 15 if he was aware that, despite an assurance given to Parliament in March 1955 that the ten DC-7Cs ordered by BOAC would be sold for dollars when Britannias were delivered, these aircraft remain unsold; and, in view of this undertaking and the importance of dollars to the exchange reserves of the United Kingdom, if he will consult with the corporation to ascertain the present situation regarding such sales while there is still a demand for such second-hand aircraft in the USA.

Mr Thorneycroft in a written answer said that the aircraft have not been sold so far because the Government decided in 1958, when Parliament was informed, and on a further review in 1960, that the "balance of advantage to the British aviation industry" lay in allowing BOAC to keep them in revenue-earning service. With the exception of the two converted for all-freight work, the aircraft were now being withdrawn from service altogether and would be sold by the corporation "to the best advantage."

It is not clear why the "balance of advantage to the British aviation industry" should be served by retaining in service American aircraft in a corporation already afflicted with acute over-capacity. Two other European carriers, SAS and Swissair, have already sold their DC-7Cs to Riddle, as has Northwest Orient, which has also sold or leased a DC-7C to President Airlines. Riddle has been negotiating for ten more aircraft of this type. The corporation's 7Cs have been used intensively on charter work in recent months, and it may well be that the reason why they have not been sold is that the group charter market has now become so competitive.

FOKKER F.28—FIRST OFFICIAL DETAILS

PLANS are in hand for a 44- to 55-seat, small twin-jet airliner to be ready for service in 1965 or 1966. *Flight* is told by Mr Frits Diepen, commercial director of Fokker. The company is at present testing selected airlines for customer-reaction to the aircraft, designated F.28, which will have a gross weight of about 45,000lb, two rear-mounted Bristol-Siddeley or Rolls-Royce turbofans of about 7,000lb thrust each, a cruising speed of 415kt and stage lengths of 200 miles with 55 passengers or 600 miles with 44.

Fokker feel that the F.28 is a new class of airliner which will fall mid-way between the BAC One-Eleven weighing 70,000lb, and "the D.H.126 at 30,000lb." (The latter project has not officially been revealed, and is believed to have been shelved.) The F.28 is intended mainly as a passenger carrier on routes where competition warrants an aircraft of this type. It would be able to use "85 per cent of the runways now used by the Friendship," although it is not intended as a Friendship replacement. Civil engines in the correct thrust brackets are also not expected from American manufacturers.

Although Fokker's capacity is stretched to the limit with present projects, Mr Diepen says that they would take any steps necessary to acquire the capacity for the F.28, if the design was firmly launched. Licence agreements with non-Dutch companies were apparently not excluded. Mr Diepen added that he would not like to take the risk of launching, but would fully support an even smaller 25-seat jet airliner, because he was convinced that a market for such a type would materialize over the coming years.

Meanwhile, Friendship production continues and orders are still coming in. Fokker are preparing to send the fuselage jigs to Breguet at Biarritz, where Friendship fuselages are now to be made under licence. About 30 aircraft workers have been recruited under one-year contracts from Britain. The competitive position in relation to the Avro 748 and Handley Page Herald is felt to be strong.

A CHAIRMAN AND HIS PHILOSOPHY

AT the end of his recent lecture (*Flight*, November 23 and 30) on the progress of European air transport, BEA's chairman, Lord Douglas of Kirtleside, struck a personal note. "I am sometimes asked," he said, "what I think has been my own personal contribution to BEA in the 13 years that I have been its chairman."

"First of all I have tried to put into practice my belief that the chairman should deal with major policy and should delegate the day-to-day running of the airline to his executive officers. But I have been equally firm in my belief that the chairman should be really responsible for policy-making, and this means that he must play a continuous part in the formulation of policy, not just rubber-stamping recommendations which get worked out at executive level. A full debate is, I believe, an essential ingredient of the process of policy-making and I have always insisted in BEA that I should personally hear all the arguments for and against particular lines of policy."

"Once a policy decision has been made I will agree to change it only when the arguments for a change are quite conclusive. This, it seems to me, is essential for stability of purpose. Many policy decisions in the airline business are based on a very fine balance of arguments, and it is really quite easy to vacillate from one conclusion to another. This is why it is very important that the chairman should give the impression that he has no doubts about the correctness of currently agreed policies."

"But behind this front the chairman must have an open mind. To hold too firmly to established policies can easily lead to inflexibility, which would be fatal in the rapidly changing air transport business."

"I have tried in BEA to encourage the innovators, the men



G-AHEL, one of the original L.049 Constellations ordered by BOAC in 1946, and sold to Capital in 1954, has now been owned by Trans-European Airways for nearly a year. The Gatwick-based independent now operates three Constellations

This unusual picture taken recently in Hong Kong shows Japan Air Lines' first Convair 880, which in its early hours shed part of its insignia due to a fault in the priming paint. JAL's 880s and also Swissair's aircraft are serviced in the colony by The Hong Kong Aircraft Engineering Co. Cathay Pacific, the Hong Kong airline, will soon have a Convair 880



receptive to new ideas. I like the story about Earl Mountbatten who, when asked the secret of the success of his wartime Combined Operations, said: 'What I have done is to take ordinary Service material, and make them more afraid to reject a new idea than to accept it.' The record which I have outlined earlier in this lecture demonstrates, I think, that the innovators have been the pace setters in BEA.

"While encouraging the innovators there are two types that I have tried positively to discourage. These I call the 'pontificators' and the 'non-possumus' types. One of the first things that I learned about air transport is that there are no ready-made answers to the constantly changing problems which present themselves to management. The 'pontificators' are those who think that there are. The 'non-possumus' chaps are those who always have ten good reasons why a new proposal will not work and isn't worth trying. You will find pontificators and non-possumus types in any large organization. But I think I can claim that they have been severely discouraged in BEA."

MR RYLANDS ON BAHAMAS AIRWAYS

In *Flight* for November 9 there appeared an article "Bahamas Airways Revitalized" by the Air Transport Editor. It reviewed what has been described as the "extraordinary circumstances" in which BOAC Associated Companies sold Bahamas Airways in April 1959 to private enterprise and then had to buy it back again less than two years later to prevent the airline from going bankrupt.

Very little has been published about the circumstances of the transaction, and whether or not the British taxpayer, through BOAC, was the sole loser. The article concerned recorded that one of the two parties concerned, Mr David Brown, did not in fact lose any money, but that it was not known whether Mr Eric Rylands, his partner, did so. In fact, Mr Rylands tells us, his companies lost more than £50,000 on the Bahamas project.

After the article had been published, Mr Rylands informed *Flight* that he was concerned because it contained inaccuracies, and that certain comments in it were not justified. He said (see *Flight*, November 23, page 796) that he was preparing a statement of the facts governing his association with Bahamas Airways and that he would be submitting this statement to the chairman of BOAC "during the next week or so"; as soon as the facts had been laid before Sir Matthew Slattery, Mr Rylands promised to let *Flight* have a similar statement. At the same time he would correct the alleged inaccuracies.

Mr Rylands tells us that his report for Sir Matthew will not now be completed for some little time. He also now feels that there was some misunderstanding about his undertaking to let *Flight* have a copy of this report.

The inaccuracies in our article were two in number. The Hermes were provided by Skyways Limited to Bahamas Airways for £50 per hour each and not £200 per hour. Of this £50 £14 went towards depreciation, and the remaining £36 included: (1) free supply of engines, propellers and all other components except "consumable" items; (2) one free round trip per year to the UK for a check 4; and (3) the cost of the check 4. This costing was based on that made by Skyways (as audited by the Air Ministry) during their trooping contracts. It was also agreed with BOAC.

The second inaccuracy was our statement that Mr Rylands made

no changes in Bahamas Airways' management. The deaths of two of Mr Rylands' executives made it impossible to reorganize the Bahamas management from Skyways personnel as quickly as had been hoped. The post of general manager was offered to two people, and later advertised in the technical press. In the event Mr James Vick was appointed a few months before BOAC repossessed the airline in December 1960. In addition Skyways supplied a new company secretary and chief accountant, Mr M. Ballamy; a new chief pilot and operations manager, Capt J. S. Morgan of Skyways; and also a cost accountant, a chief storekeeper and several other officials.

Mr Rylands says that his report to Sir Matthew will be concerned with the Tymms report which was commissioned by BOAC Associated Companies to enquire into the circumstances that led to BOAC's having to repossess Bahamas Airways. This report, by Sir Frederick Tymms and Mr Stephen Wheatcroft, was made at the suggestion of Mr Rylands (though BOAC appointed the two people concerned). It was received by Mr Rylands during the third week in September. He considers it to be an excellent report though he proposes to correct points which he considers to be inaccurate and to add points which he thinks are pertinent. Asked whether he would agree to the publication of the Tymms report provided BOAC agreed, Mr Rylands says: "I would have no objection provided my comments were published also, but I must emphasize that any decision in this connection must rest with Sir Matthew."

In our article we pointed out that, last year, Bahamas Airways lost £400,000 on revenues of £800,000. Mr Rylands considers it fairer to take the two-year period of his control, during which a loss of £460,000 was made on revenues of £1,263,000, compared with £203,000 on £490,000 during the preceding two years.

Although the participation in Bahamas Airways was shared by Mr Rylands and Mr David Brown 50-50, the losses—said by Mr Rylands to be more than £50,000—are entirely his companies'.

The DC-3s sold by Messrs Rylands and Brown to Bahamas Airways for £35,000 each had been reconditioned by Skyways Engineering Ltd at below cost. The modifications were extensive, including 32 new Payloader seats, a new light honeycomb floor, a new door; duplicated HF/RT and VOR/ILS; a passenger address system, and all the modifications up to UK standards required by the ARB. BOAC were given complete details of the modifications, which were agreed by their chief standards engineer. Samlesbury's labour rates were less than 15s an hour and the work was done below cost. "You may ask," says Mr Rylands, "why we did this work at below cost. The answer is that we really believed in BAL and wanted to get it on its feet."

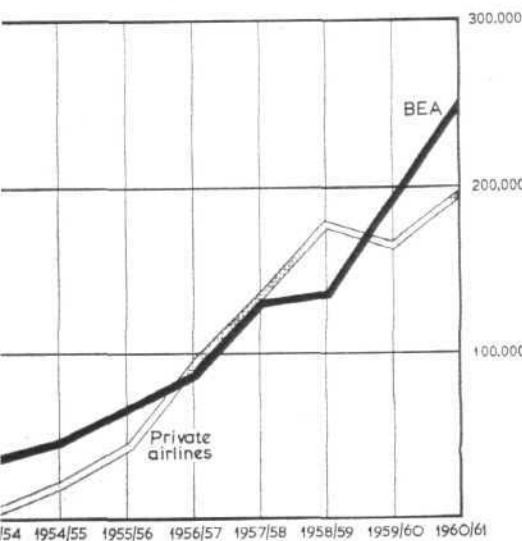
INTRODUCING EURAVIA

EURAVIA is the name of a new British independent airline which has just been formed with the financial support—believed to be very large—of UK travel agent interests. The managing director is Mr J. E. D. Williams, the well-known authority on international air transport operations and economics. His co-director is Capt J. C. Harrington, formerly with BOAC and subsequently with Bristol Aircraft. Operations are due to start with Constellations next April, and the airlines will be based at an airport, as yet undecided, "in the London area." Business will be devoted almost exclusively to the inclusive-tour market and contracts with a number of leading travel agents have already been arranged.

Euravia will operate three Constellations, all bought from El Al, two L.049s and one L.149. These are at present being refurbished at Tel Aviv and delivery will be made before the spring.

The company has not yet applied for an Air Operator's Certificate, although discussions with the Ministry of Aviation are understood to have been encouraging. Likewise, though the Air Transport Licensing Board has not yet issued licences for the proposed operations, applications are in the process of being made.

Euravia's company secretary is Mr P. J. Ward, and the registered office is 150 Southampton Row, London WC1, telephone number Terminus 6152.





Since this picture was taken in the Fokker factory the first of Sudan Airways' three Friendship 200s has started its production flight tests, and is due to be delivered in the new year...

AIR COMMERCE...

THE UK SAFETY RECORD IN 1960

THE Ministry of Aviation's past leisureliness in the publication of its annual accident surveys seems to be improving. The latest survey* of this kind to be published, for the year 1960, appeared on December 20, 1961, whereas that for 1959 appeared 18 months later and that for 1958 two years later.

Of the 20 accidents to aircraft engaged on public transport in 1960, 12 occurred on scheduled passenger services, six on non-scheduled passenger services, one on a scheduled freight flight and another on a non-scheduled freight flight. This compares with 19 accidents to aircraft engaged in public transport during 1959. Apart from the loss of three crew members in a Don Everall Viking on a non-scheduled freight flight off Crete, the year 1960 was free of fatalities, although seven passengers and one crew member were seriously injured when a BEA Viscount 701 dived to avoid a PanAm Boeing 707 over Rome on August 11, 1960.

One comment made by the survey is that one accident in 1960 and two in 1959 might have been contributed to by an attempt by the pilot to unfeather a propeller at too low an airspeed. The resulting drag increase as the blades turn from the feathered to the unfeathered position can, if the airspeed is low, result in the aircraft stalling.

The circumstances and causes of accidents are described, in the case of aircraft engaged in public transport, with the operator's name. Recommendations for future avoidance are not included, although reference is made to accident reports where these have been published. The chief purpose of these surveys still seems to be to provide a historical record rather than to share the experience gained from the accidents recorded.

TAA IN 1960-61

TRANS-AUSTRALIA AIRLINES has always prided itself on being The Friendly Airline. Yet if a single mood characterizes the TAA annual report for 1960-61 it is unfriendliness—unfriendliness towards an organization variously described as The Company or The Competitor. Superficially this hostility might appear unjustified, for TAA enjoyed a record year: revenue up to £17m, profits up to £3m, the number of passengers over one million, and traffic up 5 per cent at a time when the Australian economy was being held in check by a stringent dose of credit control.

But on closer inspection the reason for TAA's concern becomes more apparent. Taking traffic growth, TAA's increase was entirely the result of having taken over Qantas' New Guinea network. If account is taken only of mainland traffic, then TAA suffered a 3 per cent fall in business. Even worse, this was at a time when the national total fell by only 1 per cent—the difference being primarily because Ansett-ANA narrowly ousted TAA as the main carrier on competitive trunk routes. As if this were not enough, Ansett-ANA were also approved on the two main New Guinea routes (Sydney-Port Moresby and Port Moresby-Lae); this intrusion turned the New Guinea network, which had been profitable in the Qantas days, into an unprofitable operation for TAA. The final turn of the screw came when Ansett-ANA was also admitted to the two important routes from Darwin to Alice Springs and Mount Isa.

TAA claims that the working of the government's rationalization programme has also helped to boost the Ansett-ANA share of traffic. This is because the Cross-Charter Agreement, which came into full effect in 1960-61, goes further than the earlier Airlines Equipment Act⁷ (which stipulated a 50 : 50 share of mainline capacity) and ties the 50 : 50 share to a 68 per cent load factor for each carrier. To achieve this, both carriers had to cut back their capacity. In the case of TAA this appears to have pushed their load factors

(already rather higher than those of Ansett-ANA) up to a point where traffic allegedly diverted to the rival operator.

Despite these difficulties, TAA's balance sheet shows considerable improvement, the main feature being a timely reduction in the extent to which the airline depends on short-term borrowing. Less favourable is the slow rate at which the aircraft appear to be depreciated (this feature was the subject of adverse comment in this column last year). In this connection, the report notes that "the Commission will make a general depreciation policy review in 1961-62 having in mind the impact of new light jet aircraft."

Perhaps the most remarkable financial changes were the increases experienced during the year in regard to unit costs and unit revenues—up 11 and 12 per cent respectively. As no reference is made to these quite amazing results in the report, it is necessary to hazard an explanation. Costs must have been inflated by a higher payroll as the number of staff rose to 4,848 and increased pay scales came into effect. At the same time, the full benefit was enjoyed of substantial fare increases which had been introduced towards the end of the previous year. A further factor which has probably contributed towards these weird results is TAA's accounting procedure for dealing with charter of aircraft to other operators (notably three Viscounts to Ansett-ANA). It appears that the revenue from these charters is lumped in with passenger revenue on TAA's own services, while no distinction is made between the costs of providing the chartered aircraft and the cost of operating TAA's own services. Exclusion of the ton-mile figures for capacity and traffic on these charters from the total for TAA's operations would alone account for most of the increases in TAA's unit cost and revenue rates.

SCHIPHOL SHIPSHAPE

A DUTCH housewife, out walking in the attractive public park that lies adjacent to Schiphol airport, remarked as an aircraft passed low overhead: "There goes one of our DC-8s." This close sense of identity with the Dutch national airline is perhaps the keynote of the glossy annual report for N.V. Luchthaven Schiphol.

Except for the Port of New York Authority, no other airport produces such an extensive and detailed account of its activities. Traffic statistics are comprehensive, figures not only being given for Schiphol but also for other major European airports. The number of passengers in 1960 rose to a record 1.4m, an all-time daily record being reached one day in early September of 6,289 passengers. As usual in Europe, the traffic flow showed a remarkable degree of seasonal variation, ranging from 7,000 passengers in February to 17,000 passengers in July. Freight traffic also rose sharply to over 46,000 tons, the peak falling in the immediate pre-Christmas months. But whereas intercontinental services accounted for only one-quarter of passenger traffic, in the case of freight this proportion was as high as one-third.

This increased activity brought an unprecedented number of visitors to the airport. Indeed with a total of 1½m paying sightseers in 1960, Schiphol had the unusual distinction of catering for more visitors than passengers. These visitors did not only come to see airliners and to enjoy the bustle, but also to visit the aviation museum, which was opened in May, or to learn something about the model farm which helps defray the costs of running the airport.

Another index of growing activity was a rise in numbers employed on the airport to 15,000. The biggest employer, with a staff of 3,000, was Fokker. In comparison, the airport authority itself only employed 322 staff. Yet another sign of growth was a substantial rise in revenues to just over Fl 11m (almost £1m) of which just under half came from landing and parking fees. Expenses stood at just under Fl 11m, the main items being depreciation and payroll (Fl 4m and 3m respectively). Although the accounts thus showed a small profit, this does not allow for interest on capital, nor apparently for the cost of providing technical services. Still, not many airports are yet able to show a profit, even if only on paper.

THE CHINA TRADE

ALTHOUGH Handley Page can make no comment, it is believed that the Chinese Government is interested in the Herald, and that the purchase of a small number is being considered. All that can be said for certain is that the Chinese delegation which visited Farnborough last September visited Handley Page and inspected the Herald. Meanwhile the British Aircraft Corporation has now confirmed that an order has been placed by the Chinese for a number of Viscounts, although the precise

*Survey of the accidents to aircraft of the United Kingdom, in the year ended December 31, 1960, HMSO, 4s 6d.

... Meanwhile the Viscount 833 flown for Sudan Airways by British United continues to operate the successful "Blue Nile" weekly service between the Sudan and London Gatwick

quantity is not revealed. As already recorded, it is believed that the Chinese have bought six Viscounts with an option on six more. Talks that led to the order are believed to have started last January, and officials of both BAC and Rolls-Royce have been to Peking a number of times.

The Chinese have now asked the British Petroleum Co to supply aviation fuel, presumably for the Viscounts. Since Russia is believed to have a surplus of oil this development lends credence to suggestions, made at the time of the Viscount deal, that there are serious shortcomings—technical or political, or both—in the arrangements whereby Russian technical aid and exports has been provided for China. According to one report the Il-18s operated by the Chinese state airline (it is believed that three have been in service) have been withdrawn because of technical trouble.

Technical troubles alone, however, are unlikely to have prompted the Chinese to turn to the West to fulfil its civil aircraft needs. Whatever the reasons—whether they arise from the ideological differences now cleaving the two main Communist bloc countries, or from anything else—the fact remains that a new market for British aircraft has opened up.

A domestic airline serving a potential market of 600m people is obviously an aircraft salesman's dream, even though it may still be at an early stage of development. But entry at this early stage through a door that has hitherto been firmly closed may well justify cautious optimism about the future. The order for six Viscounts may be multiplied many times, as may a possible order for Heralds; and looking further ahead the British Aircraft Corporation could follow up its Viscounts with BAC One-Elevens, and might even succeed in finding a new market for the VC10. It has been unofficially reported that the big Vickers jet has, indeed, been the subject of talks with the Chinese.

Meanwhile the Americans, as already reported, are not happy that their major western ally should be exporting what it considers to be capital goods to Red China. The Americans tried very hard to dissuade Britain from selling Viscounts and their Rolls-Royce Darts to the Chinese. The following is an extract from the recent evidence before a Congress select committee, when Mr Leonard G. Lipscomb (Republican, Calif) said it was "about time the US took the leadership in stopping this foolish trade with the Soviet bloc."



Dr Jack Behrman, Assistant Secretary of International Affairs, said: "I can tell you from personal experience that we tried very hard to stop [the Viscount sale]." Mr Lipscomb asked: "Does this mean that we should be looking at our own picture and seeing whether we should sell Lockheed transports to Red China?" Dr Behrman replied: "It does not mean we are going to, and I can tell you that..." "We had better not," interrupted Mr Lipscomb. Dr Behrman said that the US was trying to set an example, "but we are not in authority over these nations." (See also brevity in column 1 below.)

The position is that the Viscount and its engines are not on the list of strategic equipment which are embargoed for export to the Communist bloc by the British Government. Nor is the ILS/VOR airborne equipment (Standard Telephones) which has already been exported to Russia, Poland and Czechoslovakia. It remains to be seen whether Ekco weather warning radar will be supplied with the Viscounts, if indeed it has been specified. According to one report the Chinese are interested in ground ILS stations and have closely examined the Pye system which has already been sold to East Germany, Czechoslovakia, Poland, Hungary and Rumania. It is not yet clear whether China will adopt ground VOR beacons.

The Viscount order may be merely a transitory gesture of defiance to Moscow, but nevertheless hopes are high that the Viscount sale could lead to China's becoming a major purchaser of British aircraft engines and equipment.

BREVITIES

Alitalia's training centre at Leonardo da Vinci Airport, Rome, is training seven Aerolineas Argentinas Caravelle pilots.

British United Airways has been granted full passenger and freight rights between London and the Canary Islands by the Spanish authorities.

BOAC has moved its Manchester cargo section from the city office to Ringway airport; telephone number of the section is now Mercury 5262.

KLM is reported to have asked the Netherlands Government for a subsidy. In view of the heavy losses sustained during the current year, the airline estimates that the loss for 1961-62 may be as high as £7.8m.

The French domestic carrier Air Inter, which has leased Viscounts from Air France for some months, is now to buy five of these aircraft outright from the French national carrier.

SAS lost Kr89.6m (about £6m) last year, according to Mr Curt Nicolin, managing director of SAS, who said there would be further staff cuts and "heavy rationalization."

Qantas will begin operating two return services a week from Perth, Western Australia, to London via Singapore on February 1. Boeing 707s would take only 27hr 20 min to cover the 10,249 miles.

Air Safaris was stated to be "as solvent as it could be" by Mr Heyman, counsel for Alkit Ltd, who petitioned successfully for its compulsory winding up. Esso Petroleum were creditors for £105,000 and Alkit for £1,050.

The Convair 990 was awarded its airworthiness certificate by the FAA on December 18. Since the start of the flight test programme early this year, six Convair 990s have accumulated almost 1,000 hours flight time.

The Ministry of Aviation says it is considering Government financial aid towards the development of Yeading Airport following discussions in London recently with representatives of the Leeds-Bradford airport joint committee.

Seven former US airline pilots retired from service under the FAA's "age 60 rule" have joined the agency as safety inspectors. Of the 52 pilots who have retired under the 60-year age limit, eleven applied to the FAA for jobs as safety inspectors.

The sale of Viscounts to Communist China could "wreck Allied co-operation in trade in strategic materials" and was "immoral," said Republican Senator Kenneth B. Keating in Berlin on December 14. Mr Dean Rusk, US Secretary of State, has also said he is "not happy" with the sale.

Lufthansa is to start a twice-weekly Frankfurt-Johannesburg service in May, using 106-passenger Boeing 720Bs. Stops will be made at Salisbury, Nairobi and Khartoum, subject to government approval, with Rome a possible additional stop. Lufthansa will also begin services to Accra and Lagos in the spring.

Spartan Air Service of Ottawa, Tennessee Valley Authority and the Port of New York Authority are to be presented in Dallas on January 23 with the Lawrence D. Bell Helicopter Pioneer Award. The award is made in memory of the late aviation pioneer and goes to organizations engaged in civil helicopter operations for ten years or more.

BOAC announces what it describes as a "major face lift" for the interiors of the corporation's Comet 4 fleet. New interior designs are being planned also for the corporation's Boeing 707s and Britannias. BOAC has appointed Mr Robin Day, the international industrial designer, as the corporation's consultant on aircraft interiors, and his first job is the design of the VC10 interior.

According to a report in the *Financial Times*, Austrian Airlines is to undergo a financial reorganization. New share capital will reach Sch.150m (£2.06m), and two-thirds of the equity is likely to be held by the Government and provincial governing bodies. Meanwhile AUA is planning to purchase "several jet airliners" for service in 1963 or 1964. According to another source these are likely to be Caravelles.

Because the characteristics and commercial application of hovercraft have not yet been established, Mr C. M. Woodhouse, Parliamentary Secretary to the Ministry of Aviation told the House recently, the regulation of their operation is still under consideration. Meanwhile the Minister, in consultation with the Minister of Transport, "will continue to issue permits to fly under the Air Navigation Order, which will enable development work and operation trials to proceed under proper safety conditions."

Riddle Airlines has asked the CAB for a permit to serve the routes operated by Mackey Airlines. Riddle has also asked the Board to grant it rights for direct Miami-Nassau services and has requested unlimited charter rights between the West Indies and the US. The airline has applied also for the following routes: (1) Tampa/St Petersburg-West Palm Beach-Fort Lauderdale-Miami; (2) Jacksonville-Tampa/St Petersburg-West Palm Beach-Fort Lauderdale-Miami and points in the Bahamas; (3) West Palm Beach-Fort Lauderdale-Havana-Nassau.



King Hussein of Jordan, visiting Wattisham on December 15 (see below), inspects a guard of honour. Escort officer is Flt Lt L. Marsh, and behind are the station commander, Gp Capt B. P. T. Horsley, and the Air Adviser to the Royal Jordanian Air Force, Wg Cdr E. P. Bennett

SERVICE AVIATION

Air Force, Naval and Army Flying News

Wattisham's Royal Visitor

AT Wattisham on December 15 King Hussein of Jordan inspected a guard of honour (see picture above) then in the control tower scrambled aircraft of the station's fighter wing—four Javelin FAW.8s of 41 Sqn and eight Lightnings, four from 56 and four from 111 Sqn. The first aircraft was airborne 35 seconds after the alarm had been given and the eight Lightnings which followed climbed vertically with rehear. Before recovery of the wing a display of individual aerobatics in a Lightning was given by Flt Lt L. Swart, a flight commander with 56 Sqn and a former member of the aerobatic team of 111 Sqn. The king, who was met by the AOC No 12 Group, AVM R. N. Bateson, had a 40-minute flight after lunch in a Javelin T.3 with Sqn Ldr J. Hodgson, a flight commander with 41 Sqn. In the evening King Hussein, who was accompanied by the Air Adviser to the Royal Jordanian Air Force, Wg Cdr E. P. Bennett, dined with the Secretary of State for Air, Mr Julian Amery, and members of the Air Council.

Area Bombing

IN a recent lecture to members of the Royal United Service Institution, the co-author of *The Strategic Air Offensive Against Germany*, Dr A. Nobel Frankland, said that in his view the subject of area bombing of Germany was the most controversial and perhaps the least understood aspect of Bomber Command's offensive. "Some people seem to think that area bombing is a question of indiscriminate attack or the so-called 'terror attack' in which bombs were scattered at random. This is a malicious travesty. Area bombing is achieving the greatest possible accuracy against selected targets with a view to disrupting German war production—I think a legitimate aim in war."

Dr Frankland, who is director of the Imperial War Museum, said that Air Chief Marshal Sir Arthur Harris, wartime C-in-C

of Bomber Command, was not responsible for the decision to carry out mass bombing of Germany. It was a "popular myth" that the decision was taken and sustained by Sir Arthur and there was a new myth—which he believed was created by Sir Charles Snow—that the responsibility rested on Lord Cherwell. In fact the decision to undertake this kind of bombing was reached by the War Cabinet and thrust upon a somewhat reluctant Air Staff which was surprisingly slow to accept the facts of life about the future of precision bombing.

Busy ASR Year

THIS has been a busy year for the search and rescue squadrons and units of the Royal Air Force. During the summer, detachments of Whirlwinds from 22 and 228 Squadrons (commanded respectively by Sqn Ldrs G. L. Verran and J. Badeni), operating from eight strategically placed bases round the coast of Britain, were at times called out almost daily. Between September 1, 1960, and September 30 this year the Whirlwinds were called out 213 times—including 40 false alarms—and rescued 74 persons, of whom 60 were civilians. The Whirlwinds also carried out 62 casualty evacuations.

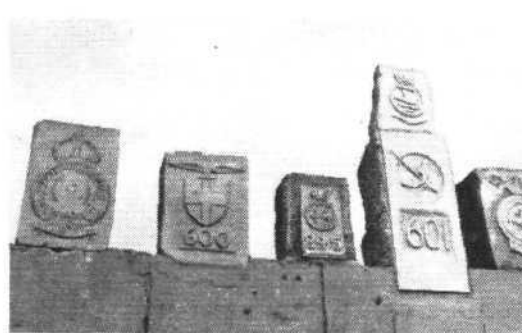
During the summer, there was a redeployment of rescue helicopters, Whirlwinds ceasing to operate from Felixstowe and resuming operations from Tangmere and Manston. At Manston, the Whirlwinds were called out 18 times in one week. This year's "finest hour" for 228 Sqn came when the seven-man crew of the boom defence vessel HMS *Barmouth* were rescued in raging seas off the Yorkshire coast (*Flight*, Nov 2).

China Sea Search

TWO crews of a Shackleton squadron, No 205, operating from RAF Changi, Singapore, flew through monsoon rains and tropical thunderstorms to assist in rescuing six survivors of a Panamanian freighter which had sunk in ten minutes in the South China Sea. Five of the men they located were subsequently rescued; 29 of the crew of the freighter, *Combine One*, are presumed to have lost their lives.

The aircraft, captained by Wg Cdr A. E. Harkness (who commands 205 Sqn) and Flt Lt F. Maycock, flew during two days and nights in conditions which were described as "the worst for years": the area was thick with cu-nim down to 1,500ft while torrential monsoon rains reduced visibility for long periods to 500yd. Winds were of 40 m.p.h. strength. After reaching the reported position of *Combine One*, Harkness' aircraft found no trace of the

ship. He then made normal search procedure and 60 miles from the given position sighted three men on a lifeboat and three on liferafts. The aircraft homed the British tanker *Calix Auckland* and the American tanker *Tritain* on to the survivors, five of whom were picked up. When Harkness made for Saigon, Maycock's aircraft took over the search. He later followed a report from the survivors that 14 of the *Combine One* crew had safely launched a lifeboat and got away from the sinking ship; he located a waterlogged lifeboat but found no survivors.



"Flight" photograph

Squadron badges in the dispersals at Takali, carved in soft yellow Malta stone. They commemorate training detachments on the island by RAF and RN squadrons and from left to right can be discerned the badges of 56, 600, 845, 824 (above) and 601 (below) and 111 Sqn.

First to be placed there was 601's in 1956

IN BRIEF

Lady Bowhill, widow of Air Chief Marshal Sir Frederick Bowhill, wartime C-in-C of Atlantic Ferry Command and later of Coastal Command, presented a portrait of her late husband to the Royal Air Force Club on December 13.

No 5004 Airfield Construction Sqn, based at RAF Khormaksar, Aden, are appealing for a stuffed beaver or beaver's head to display in the crew room at their headquarters. The squadron's badge, sanctioned by the Queen in January 1959, depicts a beaver's head.

The RAF has vacancies in May next year for 350 aircraft apprentices, 50 administrative apprentices and 1,100 boy entrants. Nomination forms for apprenticeship applicants must reach Air Ministry (M.6c), London WC1, not later than January 14; and boy entrant forms the Inspector of Recruiting, RAF, Victory House, Kingsway, London WC2, by February 1.

A history of 213 Sqn, which was recently awarded a standard in recognition of twenty-five years' service, is being compiled and the squadron would be glad to hear from any ex-members who have relevant information, photographs or reminiscences. Those who could help in any way should get in touch with Fg Off F. M. Leeson, No 213 Sqn, Royal Air Force, Bruggen, BFPO 42.

Presentation of a badge of 3 Sqn, RAAF, to Brig-Gen Pedro Q. Molina, commanding general of the Philippine Air Force, after last month's Manila Air Show. Making the presentation are Gp Capt I. F. Rose, OC 78 Fighter Wing, (right), and Wg Cdr R. H. Glassop, OC 3 Sqn

