

FLIGHT

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Front cover: a McDonnell Douglas F-4K Phantom of the Royal Navy gets airborne from RNAS Yeovilton on the reheat power of its two Rolls-Royce Spey 25Rs. Both the RAF and Navy Phantoms—which differ only in minor respects—are now fully operational.

... mais ce n'est pas l'Europe

The time has come to stop betraying Britain's technological birthright to appease General de Gaulle. The time has also come to speak frankly to our French friends if the great prizes which can still stem from sensible European collaboration are to be won.

The British aircraft industry is still 2½ times bigger than that of France and, more important, it makes not only pretty airframes. It possesses the only complete aviation technology outside the USA and Russia. Representing 60 continuous years of investment and invention, it is too vital a British asset to be transferred without returns.

The truth is that the well of British goodwill and self-effacement has been drawn dry. Britain was prepared to forgo some of her technological advantage in return for large and stable markets. The policy was sound: Britain would be freed from the bondage of expensive aeroplanes launched on the basis of 12-off for the RAF or 15-off for BEA; and France would gain the bigger market—plus knowhow, experience and skills which she lacked, especially in systems and equipment and in civil marketing and support. Other European air powers—notably Holland, Germany and Italy—would join in and a united European industry would at last be able to exploit its 3:1 man-hour-cost advantage over the USA.

But, sadly, France's definition of Europe begins and ends with France. General de Gaulle's highly sophisticated and technically minded civil servants saw and seized a golden opportunity. Their aim was simple: to transfer to France Britain's aircraft leadership, and to secure, inside a decade, a complete reversal of the existing situation. Who can blame them? As near as a touch, aided by well intentioned but technically illiterate civil servants and politicians in Whitehall, they have ensured that this will, by 1975, be the actual state of affairs.

With airframe leadership in France,

and with nationalised Snecma as licensee to Pratt & Whitney, what new engine development will Rolls-Royce get from Sud and Dassault? There is reason to believe that Rolls-Royce have not missed the point.

Technical leadership of Concorde, with its British aerodynamics and power, were given to Sud, whose jet transport experience began and ended with the Caravelle. Design leadership of the Jaguar was given to Breguet, who had never built a supersonic aeroplane. The swing-wing AFVG was then proposed. Dassault, backed by a Government which believes in aviation, built and flew their swing-wing Mirage and insisted on AFVG leadership. At this stage the British Government, prodded by the industry and the Press, began to be a little less suppliant. France promptly withdrew from the AFVG, pleading cost as the reason (later announcing, contrary to a French undertaking to Mr Healey, a go-it-alone combat development). Dassault's F-1 Mirage was later ordered into production, threatening the Jaguar's market. The latest French action is an all-out campaign in Bonn to shoot down MRCA—the multi-role combat aircraft which Britain is proposing to build with Germany—in favour of the Mirage 3G.

Sud was given leadership of the A-300 in return for French agreement to fit Rolls-Royce instead of American engines. In the event the major design, project and specification work and decisions fell to HSA. The A-300 project and consortium are now politically paralysed. They probably would not be if HSA—or BAC—had been in control, or if the aircraft were now based on standard RB.211 engines.

The best chance for the European airbus—and for a more sensible and balanced European industry—is a British-led project. This would require acknowledgement by France that leadership on every aircraft, for good technical and business reasons, should not always be French.



WORLD NEWS

Service Flying Accidents

Results of a Government review of its policy not to publish regular statistics on Service flying accidents are to be announced in the near future. This was stated by the Minister of Defence for Equipment, Mr John Morris, at the end of the Air Estimates debate on March 19 (see *Parliament*, page 464). His statement, in answer to a question from Mr Cranley Onslow (Con, Woking), was as follows:—

"The practice of not publishing regular statistics of accidents involving Service aircraft is of long standing; but we have been carrying out a review of this policy, the results of which will be announced in the near future. All useful information about Service aircraft accidents which have a bearing on flight safety is already released to the Board of Trade and others directly responsible for flight safety, as well as to the Ministry of Technology and the aviation companies, on a confidential basis.

"From the point of view of improving flight safety, the publication of accident statistics is of less value than the lesson to be learned from the circumstances of individual accidents. Each accident is the subject of detailed investigation and searching analysis, and the results of each case are discussed fully with the Board of Trade and the Ministry of Technology. The Board of Trade makes full use of this knowledge in discharging its responsibility to civil aviation."

Waiting for Britain

The attitude that Britain should either make up her mind quickly on the A-300B or get out of the project altogether was hardening on the Continent last week. M Jean Chamant, French Minister of Transport, is reported to have said: "We are not going to go on begging the British any more.

"Even if Britain does take part," he added, "I am not sure we will take the RB.211 engine that Britain was insisting on. We may find it cheaper, easier and

better for sales purposes to use Pratt & Whitney JT9D engines." Sub-contracts would be offered to Italian, Dutch, Belgian, and Swedish firms, and they might be invited to share the project if Britain withdrew.

M Chamant expressed doubt as to whether the BAC Three-Eleven, if built, would be a profitable venture. But A-300B sales would, he said, reach 800, 400 of which would be in the USA alone.

More Thrust from JT9D

A new version of the JT9D turbofan is being offered by Pratt & Whitney, producing 48,000lb thrust (2,500lb more than the JT9D-7 and JT9D-15), achieved by increasing fan airflow capacity. Designated JT9D-17, it should be available for delivery to aircraft companies in the summer of 1972, according to *Interavia Air Letter*. The engine is being offered to France as an alternative powerplant for the A-300 should Britain withdraw from the European Airbus project. P&W would give technical assistance and parts to Snecma to enable them to produce the JT9D.

Increasing turbine inlet temperatures will give the new version a potential 51,000lb thrust, and P&W claims that the low fuel consumption of earlier versions will be retained. Other data on the JT9D-17 include a bypass ratio of 5.1 and compression ratio of 22. On the climb at Mach 0.9 at 35,000ft the engine will be rated at 11,500lb and will have a fuel consumption of 0.662lb/lb thrust/hr. The cruise rating at the same altitude and speed is 11,000lb at 0.658lb/lb thrust/hr. Weight is 8,700lb, little more than that of earlier JT9Ds.

BOAC's Pay Proposals

In a letter sent direct to pilots last weekend BOAC's flight operations director, Captain Frank Walton, detailed the new pay structure which has caused a rift in the BALPA/BOAC talks on pay

and productivity (*Flight* last week, page 432a).

BOAC's proposals essentially put off the implementation of a bidline system (which BALPA wants) for three years while such a system was worked out. The interim flat-rate system proposed would give senior captains now earning £5,880 an immediate rise to £6,700, to £7,500 in January 1970 and in stages to £8,600 by April 1972. By that time the pay of other ranks would also rise proportionately.

Subject to pilot acceptance of productivity measures, BOAC's proposals include a no-redundancy provision and the acceptance of the principle that all pay will be pensionable.

Last week Captain Roy Merrifield resigned as chairman of BALPA. His responsibilities have been temporarily assumed by Captain L. Taylor.

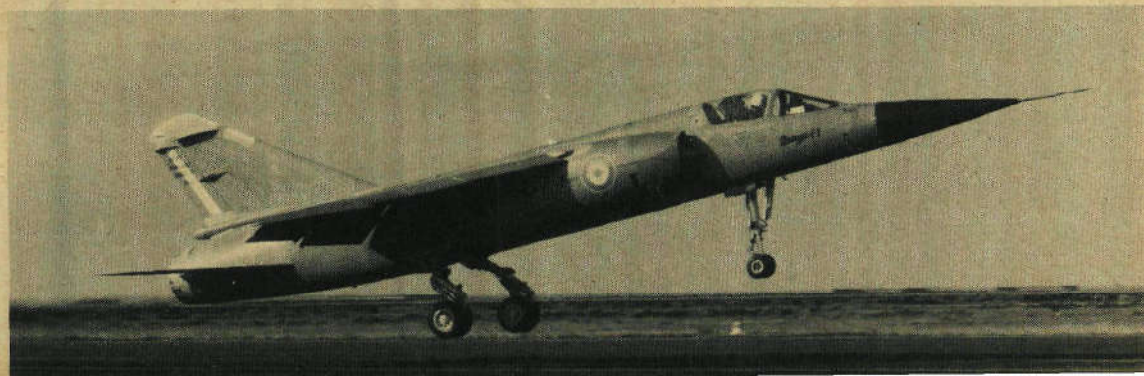
Cheyenne Lost

A Lockheed AH-56A Cheyenne rigid-rotor compound helicopter crashed off the coast of California while on a test flight on March 12. The pilot and sole occupant, Mr David Beil, was killed. The Cheyenne was in high-speed flight at about 3,000ft when it went out of control and broke up before hitting the water about 1,000yd offshore. The AH-56A has encountered a number of problems during its development, and the effect of this crash will not be known until the committee of enquiry has examined wreckage which is now being salvaged. All Cheyennes have meanwhile been grounded.

F. J. V. Holmes

British aviation owes much to the devoted band of joy-riding pilots who after World War One went round the countryside, mostly with war-surplus Avro 504s, giving people their first taste of flying. Among them was Fred Holmes, whose death occurred recently at the age of 73. With A. J. Cobham (later

F.I's Mach 1 The second development Dassault Mirage F.I reached Mach 1.15 on its first supersonic flight, a 50min sortie (seen here) from the test airfield at Istres last Thursday, March 20. It took off in 1,400ft (450 metres), landing in a slightly shorter distance. The first F.I was lost, together with its pilot, in May last year. A hundred of these interceptor/strike fighters are on order for the French Air Force, to replace Mirage 3Es





Another for Biggles A fortnight ago we published a picture of the Camel replica built by Slingsby sailplanes for the forthcoming film "Biggles Sweeps the Skies", based on the character created by the late Capt W. E. Johns. Now comes this B.E.2c replica, commissioned from Mr Charles Boddington (who made the first test flight) and built in only ten weeks in Brooklands Aviation's workshops under the supervision of Mr Frank Golding from design drawings by Mr Boddington's brother David. It includes some Tiger Moth components, and the engine is a 142 h.p. Gipsy 10 Series 1 modified to run upright

to be famous as Sir Alan) and O. P. Jones (later to become best-known of the airline pilots) he founded Berkshire Aviation Tours. In 1919 the three of them carried 10,000 passengers. His two partners left early on, but he went on until 1936.

In 1936 Mr Holmes joined Airports Ltd, to become works and service manager of the new airport at Gatwick, where he stayed until 1947. In the following year he joined Tiltman Langley Ltd, newly set up to do research and development. He stayed until his retirement from executive responsibility in 1963.

Fred Holmes's career had begun in 1911 when he joined A. V. Roe as one of the famous band of Avro apprentices whose numbers are now sadly diminished.

Sir Denning Honoured

Sir Denning Pearson, chairman and chief executive of Rolls-Royce, received an Honorary Fellowship of the University of Manchester Institute of Science and Technology from the president, Sir Peter Allen, at a ceremony on March 18.

Propulsion Prospects

Any insuperable barrier to the development of second- and third-generation advanced-technology fan engines is unlikely; but for small engines, particularly in the matter of pressure-ratio development potential, the outlook is less clear. This is the view of Mr R. H. Weir, Director of the National Gas Turbine Establishment, as expressed recently in the 16th Barnwell Memorial Lecture to members of the Bristol Branch of the Royal Aeronautical Society. Mr Weir went on to say that the variable-stagger (or variable-pitch) fan appeared to offer a number of advantages, while another contender for future design consideration was the Rostat aft-fan engine, despite its formidable mechanical problems.

The lecturer spoke of the separate installation of fan and gas producer, a layout which could be a step towards complete integration of engine and airframe, with engine-controlled airframe aerodynamics. Thoughts of geared-fan

engines, with bypass ratios as high as 12 and pressure ratios of 40, linked with a variable-stagger fan suggested that the turboprop might be worthy of re-evaluation. He advocated, too, the use of the small digital computer for powerplant control.

The paper gave a glimpse of the spectacular advances which painstaking research could yield in the future, as seen through the eyes of a lecturer who could hardly be better qualified to make it. Not unexpectedly, Mr Weir dealt with many of the current research projects which the NGTE is conducting, including the stowed rotor and its possibilities for inter-city VTOL. We hope to deal more exhaustively in an early issue with some of the advanced concepts which Mr Weir described to his audience.

Canadian Air Show

The 1969 Abbotsford International Air Show is being held at Abbotsford International Airport, British Columbia, between August 8 and 10. Full details are available from Mr R. C. Thornber, vice-president, Commercial Displays, Abbotsford International Air Show Society, PO Box 361, Abbotsford, BC, Canada.

Denmark's Diamond Jubilee Display

Celebrating the 60th year of the Royal Danish Aeroclub, a big air display is to be held at the Karup, near Aarhus, base of the RDAF on Sunday, June 1. Both civil and military aircraft will take part, with a strong emphasis on history. "Massive participation" is promised from Norway, Sweden, England, Germany and the United States, say the organisers.

Air Museum for Ireland

An aviation museum is to be set up at Dublin Airport by Aer Lingus, which is issuing an appeal for exhibits. Captain J. C. Kelly-Rogers, pioneer transatlantic captain with Imperial Airways and BOAC, and former deputy general manager and now a director of the airline, has been appointed curator of the museum. He has made a lifetime study of aviation history, particularly relating

SENSOR

Jaguar flight test results are showing only minor deviations from estimated performance and handling qualities. All handling characteristics after about 50 flights and 50 hours are exactly as predicted, though engine handling needs some further tuning. The first French A-type tactical single seater is to fly this week.

The Malaysian Air Force is considering the purchase of Saab Viggen and 105s.

SAS is now considering the purchase of Short Skyvans, having recently been examining Twin Otters.

The RAF is considering the possibility of fitting Viper 20s to its Jet Provost 5s in place of the Viper 11s from the Mark 4s now being retired for fatigue reasons. The Viper 20 confers substantial performance gains, including halved time to 35,000ft, 250 n.m. radius of action with 3,000lb of stores or 500 n.m. with 1,000lb.

The defence research report by the Commons' Select Committee on Science and Technology is to be published in mid-April, soon after the House returns (on April 14) from its Easter recess.

The present restrictive STOL policy in Australia is to be changed. A small committee of DCA and airline officials is to go abroad soon to study developments both in aircraft and airports, following the realisation that STOL operations must be taken into account in the next round of Australian airport development in the early 1970s.

It is unlikely that Britain will ever again consider building, either in isolation or collaboration, a combat aircraft of over 40,000lb gross weight. The "limited-war" strategy, combined with foreseen advances in propulsion and avionics, is considered to have overtaken the need for aircraft larger than this.

The first Black Arrow utilisation satellite X4 is to be modified in concept to carry sensors at present under development for weather satellites. The large solar-cell flexible array planned for this satellite may be cut down in size, leaving the definitive array to be flown for the first time on X5.

Recent talks between BOAC and Caledonian on dry-leasing a 707 may result in closer liaison between the two companies. The next round of ATLB licensing hearings on the Atlantic routes may reveal that BOAC will use Caledonian as a non-scheduled subsidiary, taking advantage of the Scottish company's options on two further 707s.

WORLD NEWS...

to Ireland. One of the first exhibits for the museum will be the 1933-vintage DH.84 Dragon, already housed at Dublin Airport, sister aircraft to that with which Aer Lingus started operations in May 1936.

Old Warden Cancellation

Old Warden Airfield has been water-logged for several weeks past, and the Shuttleworth Collection has accordingly been forced to cancel its flying day scheduled for next Sunday, March 30. (The diary entry on page 482 of this issue had gone to press before the cancellation was announced.)

Aslib Aeronautical Conference

The Aslib Aeronautical Group is holding its 18th annual congress at the College of Aeronautics, Cranfield, during the weekend April 11-13. ("Aslib" is the acronym for the organisation originally known as the Association for Special Libraries and Information Bureaux.)

Beginning with a film show on the Friday evening, the conference will continue on the Saturday with lectures—*Product Information Services*, by Mr D.

Kennington, *English Electric; Documentation Services of ESRO*, by Mr A. H. Holloway, MoD (Navy); and *Compiling "Jane's All the World's Aircraft"*, by Mr J. W. R. Taylor. In the evening a reception and dinner will take place.

On the Sunday there will be three more lectures: *A Historian's View of Aviation History*, by Mr J. M. Bruce of

the RAF Museum; *Counter-aided Design*, by Mr R. J. N. Offer, Rolls-Royce; and *Evaluating Information-handling Systems*, by Mr J. Martyn (or Mr A. Gilchrist) on Aslib.

Membership application forms and full details are obtainable from the conference secretary, Mr E. J. MacAdam, 74 Stancliffe Road, Bristol.



Twenty-one-year teamsters Pilot Dick Chandler (left) and navigator Bill Crooks (right) have been flying together for 21 years, and Hawker Siddeley at Brough recently celebrated the occasion by presenting them with tankards. They started together on Army co-operation work in a Rapide of North Sea Air Transport, based at Brough, and now they fly HSA's communications Dove. Centre is Mr Jack White, executive director and manager, Brough, and in the right background is Mr Mike Byrne, sales and publicity manager

Parliament

Two of the topics raised by Opposition MPs during the Air Estimates debate on March 19 were the multi-role combat aircraft and protection of shipping when the Fleet Air Arm no longer exists in its present form. When the Minister of Defence for Equipment, Mr John Morris, summed up he referred at some length to the MRCA but not to shipping protection, apart from a brief allusion to the possibility of seaborne Harriers.

It was the Opposition's aviation spokesman, Mr Frederick Corfield (Con, Gloucestershire, South), who expressed doubts about some aspects of the European multi-role combat aircraft project. He thought that the concept of co-operation was sound, but there were difficulties. West Germany, "occupying the potential battlefield," could hardly be expected to share Mr Healey's enthusiasm for a graduated response as opposed to a willingness on NATO's part to "go nuclear" immediately.

He also stressed the difference in outlook between Britain and West Germany. Whereas the Germans were interested in their own theatre only, Britain's geographical position and dependence on seaborne communications had committed her not only to the central European front but also to the flanks of NATO. In these circumstances, he considered that

an Anglo-German project would inevitably be something of a compromise. He thought that reports that the French were exerting pressure on West Germany to abandon the MRCA and take the Mirage G were not a happy augury. He hoped the Minister would assure the House that if RAF requirements for "a genuine all-weather multi-role aircraft" could not be filled by co-operation it would be provided by Britain.

When he came to reply, Mr Morris said that collaboration was not easy at any stage, but couldn't get off the ground without basic agreement on operational requirements. "This, in turn, inevitably involves compromises amongst air forces; for instance, approaching operational problems from differing national standpoints. This is exactly what is happening with the MRCA, the project for a future NATO combat aircraft which we are discussing with the German, Dutch and Italian Governments. We are now in the final stages of a feasibility study aimed at meeting the aircraft needs of all the participating countries from one basic aircraft design, and it is very worth while spending a good deal of time and effort on this vital initial stage.

"It is now very likely that this can be achieved with a degree of commonality amounting to some 80 per cent. It is, however, a feature of the project that it will be able to accommodate each country's particular requirements with regard—particularly in the case of the RAF—to avionics, terrain-following radar and all-weather capability. Our hopes in this field are now concentrated on the MRCA project."

Two other Opposition MPs, Rear

Admiral Morgan Giles (Con, Winchester) and Mr Patrick Wall (Con, Haltemprice), were particularly concerned about shipping protection. Admiral Giles said that the taking-over by the RAF of entire responsibility for air defence and air support of the fleet and Merchant Navy, except for the helicopter element of this task, and the Navy taking over the strategic deterrent role from the RAF, were major changes, representing a watershed in British maritime history.

He drew from this the conclusion that the RAF must take really seriously its new responsibility of flying from ships. Secondly, the Navy must accept the new state of affairs. It must not lament the demise of the Fleet Air Arm (see *Defence*, pages 491 and 492) and it must work with the RAF to produce really effective air support and air defence both for the Fleet and for Britain's seaborne trade worldwide.

Mr Wall was specifically concerned with the Indian Ocean area. While it was clear that in the Mediterranean the RAF could operate from land bases, this could not happen in the Indian Ocean. He said we had Gan, Diego Garcia and Masirah; that was about all. Therefore it was essential for aircraft, probably VTOL types, to be provided for operations from ships. What measures were the Government taking for training the RAF for such operations? This caused a great deal of controversy in the 1920s and 1930s and wartime experience showed the need for specially trained pilots to operate from ships. What plans did the Minister have for training RAF crews for this task? Unfortunately there was no reply to this question from the Government at the end of the debate.



AIR TRANSPORT

FREQUENCY INCREASE FOR BUA

AT first sight it appears that the Board of Trade, which last week granted BUA an increase in domestic-service frequencies, has not only overturned an Air Transport Licensing Board decision, a heinous crime at any time, but has in doing so overturned its own stated policy—that BEA should not have to compete with any more independent frequencies on domestic routes.

But has the Board of Trade, which was endorsing the recommendation of its Appeals Commissioner, Sir Algernon Rumbold, given BUA a genuine frequency increase on the London-Glasgow route? The airline will be allowed 25 flights a week on this route from April 1 next year, compared with 17 at present. But BUA has an additional six a week which it took over by a temporary exemption when British Eagle, which had 12 a week (from Heathrow) on the route, folded last November. It has applied for all 12 on a permanent basis, and the application is before the ATLB at the moment.

LONDON-GLASGOW PASSENGER TRAFFIC, 1961-68

Year	BEA	BUA	British Eagle	Total	% growth over previous year
1961	324,328	—	—	324,328	—
1962	400,636	—	—	400,636	+24
1963	476,950	—	1,860	478,810	+20
1964	542,224	—	25,023	567,247	+18
1965	590,427	—	19,404	609,831	+8
1966	566,269	45,825	35,944	648,038	+6
1967	589,452	53,670	48,989	692,111	+7
Jan-Oct:					
1967	511,548	46,217	42,401	600,166	—
1968	477,160	50,919	37,181*	565,260	-6

* Estimated

The Commissioner recommended that, if BUA is successful in obtaining a permanent licence for these services, they should not be additional to the eight extra services now being granted. If the BoT follows the recommendation, which seems likely, BUA will not get more than 29 services a week, and the independent sector on London-Glasgow will be no better off than it was when British Eagle closed down.

The Board of Trade, on the Commissioner's recommendation, rejected an application by Channel Airways for domestic trunk-route authorisation centred on Stansted, on the ground that the diversion of traffic from Heathrow which would occur will not be justified until overall traffic is growing again and the economic situation is improved.

BUA has been granted an increase in frequency from 10 to 17 a week on its Gatwick-Edinburgh service, and from 12 to 17 on its Gatwick-Belfast service.

One of the most remarkable aspects of Sir Algernon's report is that it expresses concern at the fall-off in traffic on these domestic routes, yet makes no mention of the massive fare increases (37 per cent in the last five years) which have taken place.

MINIMA ANOMALY TO END?

PROPOSALS to include foreign-registered aircraft in the ban on approaches when the RVR (Runway Visual Range) value falls below 600 metres, have been made by the BoT. This limit has applied to British aircraft since 1966. Exemptions are made for aircraft fitted with the appropriate equipment for Cat 2 and Cat 3 operations. A ban on approaches when the RVR is below the operator's minimum is also proposed.

IATA and the foreign airlines using British airports have

been informed, so that representations can be made. This was stated in the House of Commons by Mr William Rodgers, Minister of State, Board of Trade, on March 18.

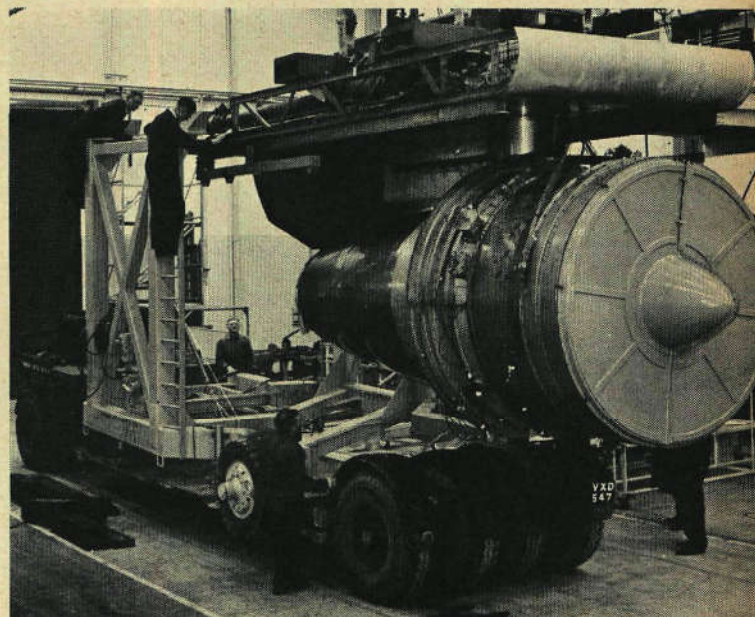
The timing of the proposal presumably stems from the approach accident at Gatwick London to an Ariana Boeing 727 on January 5, but the proposal itself has been under consideration for some time. The 600-metre RVR limitation has applied to British-registered aircraft since 1966 following investigations into fog conditions which showed that (as pilots have known for a very long time) visual references can be lost at low altitudes in RVRs below this figure, even though visibility on the initial approach appears to be adequate. The prohibition of approaches when the RVR is below the operator's minimum has applied to British airlines since 1952, when RVR measurements were available only in the UK; these have since come into general use.

ANTI-COLLISION TESTS

AIRBORNE tests of a collision-avoidance system built to meet a 13-year-old airline specification are to be conducted in the USA by the Federal Aviation Administration and the Air Transport Association. The FAA will provide range control, tracking and other services at the National Aviation Facilities Experimental Center, Atlantic City. The conduct of the tests and evaluation will be the responsibility of Martin-Marietta, under a \$1.5 million (£625,000) contract from the ATA.

The CAS equipment to be tested has been developed by McDonnell-Douglas, Bendix, Sierra Research and Wilcox Electric. The test programme is expected to last until December.

A Rolls-Royce RB.211 being prepared for its journey to Pystock, Hants, where it will undergo simulated altitude tests in the National Gas Turbine Establishment test facility which is being modified to accommodate the engine. Flight testing, starting early next year, will be done in a modified VC10 in which a single RB.211 will replace two Conways



AIR TRANSPORT...

OBSCOLESCENCE AND THE 747

THE Boeing 747 was going to make older jet aircraft absolutely obsolete, said Mr Harold Gray, chairman and chief executive of Pan American, in Washington recently. This would be true even if there were no increase in total traffic, he added—such was the efficiency and economy of the new aircraft. It would be cheaper for Pan American to replace some of its other aircraft with 747s, even if this meant the utilisation of the older types dropped to zero.

Mr Gray also reaffirmed the big carriers' assertion that ten-abreast seating would be a mistake. The utilisation of the extra seats over nine-abreast layout would be low, he said, and the quality of service might suffer.

Airport terminals that could now handle two 707s within a quarter of an hour could equally well handle a 747, he thought. The big problem facing airport managements was not meeting the demands of the 747 so much as meeting the normal 12-15 per cent annual traffic growth.

PROBLEMS FOR THIRD AIRPORT

PLANS for developing a third London Airport seem likely to run into difficulties even after a decision on a suitable site has been taken. The major snag is that there is likely to be an acute shortage of gravel for construction purposes during the next few years because of a sudden spurt in the motorway programme. The Ministry of Transport's engineers are worried about the lack of gravel, and also that the civil engineering industry will be short of capacity during the same period.

Obviously, not only the third London airport, but its motorway access and any plans for extending the runways at Gatwick would be affected by this situation. Plans for starting work on London's Motorway Box in the early 1970s will also extend the difficult period for a few more years.

Another problem is that of providing the fast rail access which is considered vital for the success of any third London airport. All regions of British Railways are desperately short of capital for modernisation, and are unlikely to contribute towards the cost of a rail link, at £1 million per mile of double track, or of trains, at £100,000 per four-car self-propelled electric unit. Even if the British Airports Authority pays for these items, it will have to contend with an acute staff shortage on the railways.

Rail access to two of the four sites on the short list, Cublington and Thurleigh, would not impose any problems other than those already mentioned. At Nuthampstead,

however, there is the difficulty of access from an extremely slow, mainly diesel-operated, line to Cambridge. Access to Foulness involves that from heavily used commuter lines, with Liverpool Street, a terminal used to capacity at present, as the London terminus.

If the most extravagant of the Foulness plans, that for a combined motorway/monorail link, were to be adopted, there would be an abundance of difficulties including shortage of raw materials and civil engineering capacity, and public opposition to the motorway, which might take ten years to build. In addition, the speeds of 150 m.p.h. expected from the monorail would not be acceptable because monorails become unstable at more than 100 m.p.h.

D.W.W.

Tridents for Cyprus? An order for two HS Trident 2Es is expected to be signed shortly by Cyprus Airways.

European 747 Club Air France, Alitalia, Lufthansa and Sabena signed on March 14 an agreement for the joint maintenance of their fleets of Boeing 747s. Lufthansa will install a flight simulator at Frankfurt for use by all four airlines.

KSS Change to 747Bs KLM, SAS and Swissair, who have recently agreed on technical co-operation with their Boeing 747s, have together changed their previous orders to ones for the heavier, longer-range "B" version. Seven aircraft are involved—three for KLM and two each for SAS and Swissair.

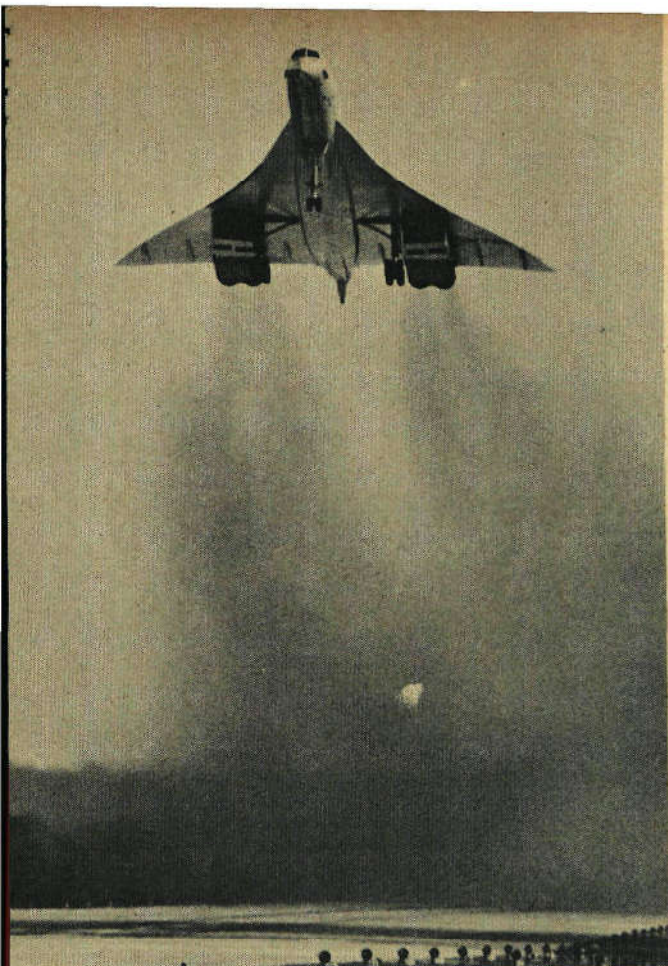
BOAC's 747 Needs BOAC may need up to 20 747s eventually, said the airline's engineering director, Mr Charles Abell, in Seattle recently. It has 12 on order and four on option at present. He added that none of the 12 on order would be changed to the longer-range 747B, but that the configuration of the four options, scheduled for delivery in 1973, was still under discussion.

More Carvairs for BAF A fleet of six ATL Carvairs will be in service with British Air Ferries at Southend during this summer season. One of the five previously used, G-ASKG, was delivered early this month to Compagnie Air Transport at Le Touquet. This is being replaced by one of three which have been stored at Lydd for the past two years. The sixth Carvair, now delivered, was actually the 17th to be built. This has been lying at Stansted for several years in an unequipped state; it has now been finished and registered G-AXAI.



The first of two BAC One-Eleven jets for Dan-Air Services was delivered to Gatwick on March 14. Lease-purchased from American Airlines, it is seen here with temporary livery and still carrying its US registration, N5041, before being flown to Dan-Air's engineering base at Lasham, Hants, where it will be repainted and prepared for use on European holiday flights this summer. Dan-Air expects its second American Airlines One-Eleven to arrive before the end of this month.

Concorde 001 made its fifth flight last Friday, March 21, with Mr Brian Trubshaw of BAC acting as second pilot with M Andre Turcat. He handled the aircraft during most of the 1½ hr flight, including the take-off and landing. These pictures were taken on the first flight and show the Concorde from new angles



UPDATED JT9D

PRATT & WHITNEY is offering a new version of the JT9D turbofan engine to produce 48,000lb of take-off thrust for application to advanced versions of large-capacity passenger and cargo aircraft. This important new development was announced by Mr James S. Lee, the company's vice-president (marketing) on March 19 (*Sensor Flight*, October 3, 1968). The new engine, the JT9D-17, will provide substantially more thrust than the JT9D versions already selected to power Boeing 747 and McDonnell Douglas DC-10-20 transports currently in production and it will be available for delivery to aircraft manufacturers from July 1972. The JT9D-3, which powers initial versions of the 747, delivers 43,500lb of thrust, while the JT9D-7 and JT9D-15, selected for advanced 747s and the DC-10-20, are rated at 45,500lb.

Mr Lee said that the increased thrust in the new engine will be obtained by increasing fan airflow, and maximum commonality with the JT9D-7/15 will be retained. Early availability of the engine is possible because there will be no extensive changes in the gas generator. The basic JT9D configuration has a capacity for growth to 51,000lb take-off thrust through the use of increased turbine inlet temperatures with further development.

PRESSURES IN BMA-INVICTA

RIPPLES last week on the surface of BMA-Invicta, the airline recently formed by the merger of British Midland and Invicta (see *Flight* for February 13, page 237), were the only visible sign of turbulence underneath. The chairman-designate, Mr Peter Cannon, had stepped down in favour of Mr James Hodgson, a colleague at Minster Assets, the merchant bank which is major shareholder and the constructor of the merger. A spate of rumours followed to the effect that disenchantment with its investment had set in at Minster. There was speculation that Minster was considering selling the airline, possibly to British Air Services, the BEA-controlled company.

Speculation increased when neither Mr R. R. Paine nor Mr Hugh Kennard, joint vice-chairmen of the merged airline and founders of its two constituent parts, appeared for a board meeting on March 20. At this meeting, two directors were appointed from within the company—Mr Michael Bishop (general manager) and Capt David Fenton (operations director). The meeting also confirmed the appointment of an accountant, Mr H. Free, to the board.

The question of a sale of BMA-Invicta can now be ruled out. The truth of the matter appears to be that the presence of Minster Assets has suddenly hit the airline like a bomb. Minster has over a period ploughed something over half a million pounds into the airline, and it is now applying very severe pressure to protect its investment and to make sure that the airline realises the potential for success which Minster believes it has. Neither BMA nor Invicta was profitable before the merger, and BMA faced possible closure when Minster intervened last year.

The urgency with which Minster is moving has caused considerable stress at top levels, but the merchant bank is evidently demanding that nothing should stand in the way of the immediate action which it believes necessary to make the airline profitable. Part of this action is the segregation of the Viscount and DC-4 elements in the former Invicta fleet for closer financial control. The former British Midland operation is felt by Minster to be in need of a new approach, especially with regard to forward planning. Its present projections do not, it is understood, offer the chance of sufficient profit to attract the investment necessary for expansion in the long term.

If the hard commercial impact of Minster has proved a shock for those concerned, relationships may yet bend rather than break, and the BMA-Invicta management may re-emerge in much the same form as at present. At any rate it is clear that Minster not only sees an opportunity for the airline to get well and truly into the black; it also sees every chance that its present approach will build a viable unit deserving of further investment and expansion.

AIR TRANSPORT...

Is QNH the answer?

IN A CONTRIBUTION which was over-long for our Letters pages, Captain Howard G. Easton makes some useful and pertinent comments on the QFE versus QNH controversy. Referring to the letter from Captain H. A. Hopkins in the issue of February 13, pages 259-260, he says that the point that he, Captain Easton, made in his earlier letter (see the issue for December 26, page 1062) was that, when QNH was standardised in the USA, QFE was in effect cancelled for all but visual circuits and landings. He adds that Captain Hopkins, in his preamble, stated that the basic issue was hidden by secondary ones. This is true, but the discussion was then clouded in "a mass of secondary issues . . . and some irrelevances, too." Let us, Captain Easton continues, look again at some of these:—

(1) An altimeter that cannot be set to QFE at high levels has a distinct *efficiency*—it rules out QFE setting-error accidents.

(2) Values of QFE/QNH are both subject to error, but definitely not equally. The "altitude" errors due to capsule displacement and instrument mechanics double as one rises above sea level while maintaining a QFE setting, apart from other error variations. Try, before every take-off, checking your promulgated QFE against "zero" and QNH against the particular threshold level. Keep it up for a year or so to make sure a certain setting isn't suffering a run of bad luck.

The use of QFE and QNH gives two opportunities for blunder. The chance of one blunder is quite enough. Those countries which have seen the light and standardised on QNH raise the transition level to a good height, well clear of the danger levels, and standardise it (FL 180 in the USA), so that it becomes a regular habit to knob-twiddle at that level. Like putting on trousers when we dress, it is rarely forgotten, and therefore the "altimeter" terrain-collision incidents are almost completely ruled out.

(3) I am pleased to see that we are all agreed about radio altimeters. They take over at low levels where the accuracy of pressure altimeters is inadequate, regardless of the setting in use.

(4) I hope they never *do* print QFE heights in the bold print used for QNH.

(5) The terrain-collision rate of US operators using QNH does not demonstrate a superior record over that of QFE users, says Capt Hopkins. Regardless of statistical interpretation, this statement is irrelevant to the discussion. The vital fact is that by cancelling QFE they improved their statistics. By cancelling QFE we would similarly improve ours.

Capt Hopkins goes on to say that there is nothing more to the QFE/QNH wrangle than a question of datum. . . . I believe he could not be further from the truth—the QFE/QNH wrangle is based simply upon personal preferences. It is a

fact that with QFE set, and using correct QFE references you can make a safe, accurate approach. It is also a fact that with QNH set and using correct QNH references, you can make an equally accurate and safe approach—and to the same minima.

Whether you think that one is easier than the other is again a matter of personal preference. The majority of British pilots use QFE, some have experience of both; the majority of pilots abroad use QNH; none have any "approach" problems. The sad thing is that we allow matters of personal preference to lead us away from the interests of aviation safety.

The real point of the discussion must surely be about the question: "Why do experienced pilots miss a vital part of their particular practice, drill and checklist?" I believe the answer is disorientation. Manoeuvring to the final position on the glidescope often involves much turning. Bending forward twiddling knobs in a turn is the first stage in the classic in-flight demonstration of disorientation; stages two and three result from a commanding distraction elsewhere in the cockpit; and stage four, to put it politely, is not knowing whether you are on your back or your elbow. Even a mild disorientation associated with a mild "problem" would be enough to cause this check-list "jump" and its awful consequences.

It is suggested that QFE might be set earlier. I have often wondered whether the crew of the aircraft which hit the summit of Mont Blanc had been too hasty with the Geneva (1,000ft-plus) QFE. That is the sort of thing that *can* happen if you set QFE earlier rather than later. It is bad practice to dispense with a true terrain comparator until beyond doubt established on the final approach track and slope, with its special track and slope aids and fixes.

There will soon be many comparatively inexperienced private pilots flying around with IMC ratings. Reading this discussion they must be alarmed. Let us print the first golden rule of instrument flying to reassure them.

Settle yourself comfortably before instrument flight and then avoid any head or body movement. Scan with eye movement only. You know it is good practice to keep the ball of your needle and ball in the centre. You also know how easily it moves. The liquid in the balance channels in your ears moves just as easily. It is the displacement of your "ball" associated with aircraft motion that produces disorientation. Keep your ball "in the centre" too, and you will be quite all right and enjoy your instrument flying. In any essential head and body movement which may be necessary, ensure that the movement is *slow* and careful, with the aircraft kept laterally level.

Finally, I say again, we climb, cruise (below certain levels) and descend safely on QNH. Turning in to pick up our finals

Recently repainted for BKS's Bloodstock and Cargo Division, this Ambassador, G-ALZR, is one of the few still remaining on the ARB register after some 15 years of service. It was photographed at Birmingham Airport on March 16 after bringing in racehorses for delivery to Cheltenham





we bend forward to set QFE, experience a little distraction and associated disorientation, which we cope with, but then do that awful check-list "jump." The flight is now distinctly dangerous. Get back on to QNH reference, scrub QFE references off those approach charts and thereby permanently improve the safety situation.

EAGLE PENSION UNFROZEN

EFFORTS to obtain the consent of the UK Inland Revenue authorities to an early distribution of British Eagle pension funds to former employees of the liquidated airline—the company's contributions as well as their own—have been successful. Officials are relieved that the Government has permitted the necessary change in the rules.

The trustees of the fund are offering its members a number of alternative courses, one of which involves a cash payment in lieu of the frozen pension. Without a concession by the Inland Revenue, ex-employees would have had to wait until normal retiring age.

QUANDARY FOR AUSTRALIA

APPLICATIONS for the importing of larger aircraft into Australia have suddenly increased to a point at which the Director General of Civil Aviation has decided that no decision can be made before he has a Federal Government direction on policy. He believes that many of these applications directly conflict with the two-airline policy. For example, the Melbourne-based air-freight company, Brain and Brown Air Freight, now operating DC-3s to Tasmania, has asked for an import permit for two or three Britannia 300s.

The Department of Civil Aviation likes this company and knows very well that under present management the aircraft would never be used for passenger operations. But it cannot be certain that some economic factor may not compel a later change of ownership. The Government cannot stop any licensed operator from starting an inter-state operation, with cargo or passengers, if he has the aircraft. The difficulty of the two-airline policy is that the only real control is through the Department of Customs, which is advised on air policy by the DCA. The second aspect of this application is that the two major airlines, Ansett Airlines of Australia (Ansett-ANA that was) and TAA must regard the introduction of large cargo aircraft by a third operator as a threat to the freight side of the two-airline policy.

Among the other applications are two for small jet aircraft. Mr R. R. Walker, the former Ansett executive who two years ago began executive operations with a Dassault Fan Jet Falcon, mainly for the growing mineral industry, has asked for a second—though this one would be leased from the manufacturers. He has told the DCA that his operation is not economic with one aircraft. A complication is that Mr Rupert Murdoch (known in England for his *News of the World* bid) recently bought a strong interest in Mr Walker's company, Executive Jets. Mr Murdoch bought out the holdings of some Sydney shareholders who were worried about progress and he also took up a big new issue at par. Mr Murdoch's own News Ltd also has a charter/training aircraft subsidiary, Nationwide. This operation is being linked to Executive Jets, which is Melbourne-based.

Seen at Prestwick earlier this month after a diversion from Shannon, this Flying Tiger DC-8-63F, N864FT, is a pure freighter with blanked-off windows. The tail and broken cheatline are blue, with the airline's name in red.

In Perth, a local operator, Murchison Air Charter, which is operating considerable small-aircraft charters for the mining firms of the north-west, has been fighting to get a permit to import an HS.125, secondhand, either by purchase or, more likely, on lease from Hawker de Havilland. Should the DCA allow this company to have its HS.125 and deny Mr Walker has second Falcon? Could Mr Walker survive with either one or two aircraft, with competition from an HS.125?

To what extent the two operations would compete with the existing MacRobertson Miller operation in the west has to be decided by the Federal Cabinet.

S.B.

Accident Date The date of the accident to a C-130, 9J-RCV, of Zambian Air Cargoes was January 20 and not, as stated in *Flight* for March 13 (page 398), February 20.

Accident in Yemen A DC-3 of Yemen Airlines crashed on a test flight on March 19 about six miles from the airport at Taiz. The four crew, the only occupants, were killed: one was the airline's chief pilot.

The Ringway Accident The two pilots and one of two stewardesses, the only occupants, were killed when a British Midland Viscount crashed during a training flight from Ringway Airport, Manchester, on March 20. The aircraft rolled to starboard after take-off, cartwheeled on to its back and caught fire.

Il-18 Crash in Egypt A United Arab Il-18D, carrying pilgrims from Mecca, crashed and burned in the early morning of March 20 on the approach to Aswan Airport, upper Egypt, in darkness after a flight from Jeddah. It struck the ground about a kilometre short of the runway threshold. Of the 94 passengers, 14 survived, some badly injured; the seven crew members were killed. Before the accident the captain had said that he had difficulty in seeing the runway and had asked for increased lighting.

The Venezuelan Disaster The death toll in the VIASA DC-9 accident at Maracaibo has turned out to be very much bigger than was reported when we went to press with last week's issue (page 431). In addition to the 74 passengers and crew of ten in the DC-9, all of whom died, 70 persons were killed on the ground or died later in the village into which the aircraft crashed, and about the same number gravely injured. The DC-9 lost height after take-off and apparently hit high tension cables. Local authorities later blamed the comparative shortness of the runway, which was closed to jet traffic from last weekend. An extension by 800 metres is being put in hand immediately.



AIR TRANSPORT...

PART ONE

"Unknowns" into "knowns"

IN JULY, 1967, there was a collision near Hendersonville, North Carolina, between a Piedmont Boeing 727 and a Cessna—both on IFR flight plans and under air traffic control. The inquiry found that the Cessna pilot, although fully qualified with instrument rating, had strayed into the 727's airspace; the report then went on to say:—

"The Board feels that controllers in their communications tend to use the same standards for airline and general aviation pilots. . . . All available information with respect to clearances should be given to pilots, particularly non-airline ones, and the practice of reading back clearances should be encouraged."*

I find this to be a surprising recommendation and wonder whether the Board had really thought through all the implications. The suggestion clearly is that the controller should seek to form an assessment of the pilot's skill and experience in coping with instrument flight under air traffic control and should offer special consideration to general aviation traffic. Now if this means anything, it means offering the pilot a larger airspace cushion or more communications time (extra vectors, readbacks, etc.). Now the Board should be told that it just cannot have this—not if the existing level of safety or of airport acceptance rates is to be maintained. The controller will certainly bend over backwards to help the odd non-instrument-rated pilot who inadvertently strays into the airways or TMA, but this is quite a different matter from asking him to distinguish, as part of his daily routine, between two levels of skill in respect of two pilots operating to a tight radar-approach sequencing or over cloud on IFR flight plans.

Besides, manipulative skill and instrument rating may have little to do with the matter; at root it may be a question of crew complement rather than crew competence. In the recent FAA review of the New York congestion problem it was originally recommended that, at high-density terminals, only aircraft with certain levels of communication and navigational equipment, and with a minimum of two crew, should be admitted. The FAA later got cold feet about entering the crew complement field in the operational, as distinct from the airworthiness certification terrain, but nevertheless the line of thought, clearly quite valid, implied that in high-density terminals one man just cannot cope alone—this regardless

of his instrument skill.† So, logically adding the FAA (high-density area) initial suggestion, that the total number of hands, eyes and ears must come to a minimum of seven, to the CAB recommendation that the air traffic controller should try to make allowances in relation to a certain class of traffic for a below-par level of crew competence, one fetches up with a somewhat strange concept of what air traffic control really is. For, in fact, the controller just cannot make these distinctions. The concept is not practical. Some kind of "General Aviation" tag on the flight-progress strip would, in any except the most relaxed situation, mean nothing to the controller as far as separation standards or degree of attention are concerned. In the general situation today, during instrument meteorological conditions (IMC), the controller *must* be able to rely on a high level of competency in respect of *all* pilots at the other end of his communications and vectors—public transport, general aviation and military alike.

The qualification "in instrument meteorological conditions" is important since it admits the thought that one may have pilots flying in controlled airspace, but who do not, at a particular time, need instrument skill. At present that is in fact the case and in many parts of the world we do have the VFR pilot flying in VMC on the airways among IFR traffic; however, it is now widely recognised that VFR (i.e. "unknown") traffic simply does not mix safely with controlled traffic and the practice of mixed (controlled) IFR and (uncontrolled) VFR traffic in controlled airspace is rapidly disappearing—and has already disappeared in the UK and in certain "positive control" areas in the USA.

But what if one can somehow make the VFR traffic "known" instead of "unknown"—that is, require the pilot to file a flight plan, keep to it, and report at the standard check-points? This is in fact one of the leading questions now before ICAO, namely the concept of Controlled Visual Flight, for which a new name and a new proficiency rating (CVFR) is being contemplated.

This will be dealt with in the next part of this article.

†Incidentally (though this is a matter of economics rather than pure safety), the same FAA meeting preferred to ignore the comment of a very experienced controller that the acceptance rate at an airport is in major part influenced by the experience of the airman.

* The AOPA Pilot, December 1968.

Irish Viscount Sales Drive . . . A Viscount 808 freighter, EI-AJK, has been sold by Aer Lingus to SA Transport Aérien of Geneva. It will be delivered in November, but a Viscount 803, EI-AOE, will be leased to them from the end of March until -AJK is delivered. Four SATA crew are now doing conversion training with Aer Lingus at Dublin and will shortly be followed by another four. Recently, two Viscount sales teams have visited South and Central America and although no sales were reported it is believed that some serious inquiries were received. A sales team is at present visiting Asia and another one is being organised for Africa.

. . . and Re-equipment Programme Irish International will take delivery of its two new Boeing 707s from Flying Tiger on March 28 and April 2. The aircraft, EI-ASN and -ASO, will then go to Brussels where they will be overhauled and

refurbished to company standards by Sabena and will return to Dublin on April 27 and May 5. Aer Lingus has also announced delivery dates of its Boeing 737s. The first two will be handed over at Seattle on March 31 and April 15 and will leave the following day via Winnipeg and Gander for Dublin. The next three (737QCs) will be delivered in September, October and November, and the final three in December, March and April 1970, bringing the total to eight.

Beirut Improvements Government approval has been given for improvements of Beirut International Airport which include a new 3,600m (11,800ft) runway, strengthening of the existing runways and expansion of the terminal. This work is due for completion by 1971. Construction of a new terminal and another new runway is planned. Finance will be provided from a French loan to the Lebanon.

MAY START FOR AIR MELITA?

THE new Maltese airline, Air Melita, which is to operate scheduled flights from Malta to points in Europe, is reported to be starting operations in May, when two leased Boeing 737-200s should have been delivered (see *Flight* for March 13, page 392). Conversion training on the 737 for 18 of the airline's pilots is understood to have started.

Air Melita has applied to operate Malta-Europe services and a letter of intent of approval by the Government has been issued. A licensing board of inquiry has approved in principle the proposal to operate services to Athens, Beirut, Lisbon, Zurich, Stockholm, Brussels, Amsterdam, Copenhagen, Cologne, Paris, Tunis, Nice and Oslo. Operations will start with services to Stockholm via Zurich, but this still requires agreement between Malta and the Governments of Switzerland and Sweden—though steps have already been initiated by the Malta Government. The airline, which expects to operate at a loss for the first two years, calculates it will be necessary to average 30 passengers per flight for their entire route network in order to break even. The company expect to step up the initial number of 20,000 passengers in 1969 to 250,000 a year by 1974, increasing meanwhile their flights and number of aircraft. To achieve this target Air Melita is to spend some £400,000 in advertising during its first year of operation.

A majority (60 per cent) of the Air Melita shares are owned by Maltese citizens, the remainder being held by a US Corporation. A total capital of £2.5 million is required.

TRANS MERIDIAN POOL

A POOL agreement has been concluded by Mr T. D. Keegan, chairman of the all-freight Trans Meridian (London) Ltd, with African Safari Airways, the Nairobi-based company registered in East Africa and operating inclusive tours from Europe to East Africa. According to the agreement Trans Meridian will provide technical services for African Safari Airways as well as cargo capacity to East Africa on their CL-44s.

As well as operating inclusive tours, African Safari Airways operate hotels and Safari tour organisations, especially at Malindi where they have a 500-room hotel on the coast. The company intends to expand inclusive-tour traffic to Africa (presently operating mainly from the Continent) to include UK and USA departures, and is now investigating increasing Britannia operations. The company is engaged on a study of various jet aircraft with a view to further expanding their capacity to East Africa. Mr Keegan is now a director of African Safari Airways.

This DC-8-62 F-BOLG, on the apron at Le Bourget, Paris, was recently delivered to Union de Transports Aériens and is operated on long-haul services to the Far East, Australia and Pacific, replacing, on passenger flights, some of the airline's DC-8s, one of which, F-BJLB, is now operating all-cargo flights. In the background is an Aeroflot An-12, right, and a military C-130

FULLY AUTOMATIC DEMONSTRATION

FOLLOWING the Arinc Autopilot Sub-committee Meeting in London (March 11-13), 30 members were given a demonstration of Smiths Industries autoland equipment in Trident 2E G-AVFA at RAE Bedford. Two flights were made, each consisting of three full-stop autolandings and one overshoot. The demonstration included automatic roll-out, roll-out guidance and the use of ground-speed and distance equipment which makes up the Cat 3B package. On landing the captain, Hawker Siddeley test pilot Mr Jimmy Phillips, although fully screened from external visual guidance, brought the aircraft to a standstill on the runway centreline. The demonstrations of automatic overshoot were made from below 12ft with a simulated single engine failure.

Smiths autoland equipment at triplex level is specified for the entire BEA Trident fleet and was certificated last September by the ARB for use in Cat 2 conditions.

CENTENARY OF A PIONEER

NEXT Monday, March 31, is the hundredth anniversary of the birth of a man who did more than most to give British air transport a start. Mr George Holt Thomas not only founded in 1919 one of the first airlines—Aircraft Transport and Travel—but had much earlier formed the Aircraft Manufacturing Co., builders of the original de Havilland types, and afterwards provided financial support for Airco's successor, the de Havilland Aircraft Co. Son of the founder of the *Graphic* and *Daily Graphic*, Mr Holt Thomas took a strong and early interest in aviation when general manager of the publishing group, which offered £1,000 for the first flight of a mile. He visited France to look at progress there and organised the early flying meeting at Blackpool and demonstration flights at Brooklands. He died in France on the first day of 1929.

Itavia to Switzerland New Services between Milan and Basle-Mulhouse (six times a week with HP, Heralds) and between Turin and Geneva (five a week eventually with F.28s) are planned by Itavia. The services are due to begin on April 21.

Commonwealth SST Discussions The implications of the introduction of SSTs will be the main talking point of the next meeting of the Commonwealth Air Transport Council in London on June 3-13. The council, formed in 1945, meets occasionally to discuss matters of common interest to Commonwealth Governments.

Arctic Jet Service On March 19 Nordair of Montreal inaugurated the first scheduled jet service inside the Arctic Circle when once-weekly flights were started to Resolute Bay on Cornwallis Island using Boeing 737-200s operated in passenger/cargo configuration on the 2,300-mile route from Montreal. Flights leave Montreal each Wednesday morning and arrive back in the late evening. The 737, which has been fitted with special nosewheel deflectors to permit landings on the northern gravel strips, lands at Frobisher Bay in both directions.



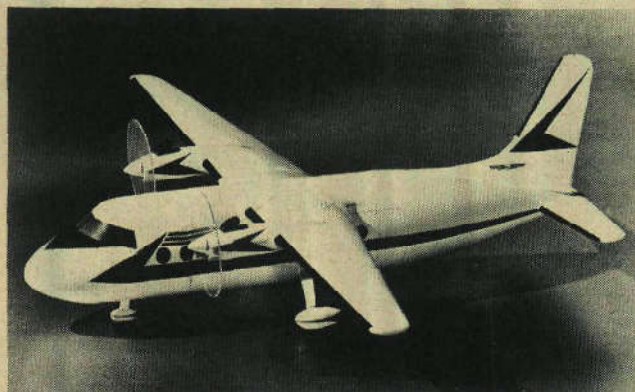
AIR TRANSPORT...

LIGHT COMMERCIAL & BUSINESS

Bells all the Way An order worth more than \$1 million (£417,000) has been placed by Petroleum Helicopters Inc with Bell for ten JetRangers and four Model 47G-4As. PHI will have more than 25 five-seat turbine-powered 206As when these are delivered, and its fleet will include about 125 Bell helicopters of various models.

It was in May last year that Bell produced its 10,000th helicopter—25 years from entering the business. This week the 12,000th was completed—a Hueycobra for the US Army, but civil production continues to take a large share of the output. Another 1,000 Bell helicopters will be made this year.

Merlin IIB Cleared for Icing Swearingen has successfully completed in-flight icing tests on the Merlin IIB in accordance with FAR 25 standards.



Commercial Helicopter Student Tony Gerlings, a young Dutchman with a degree in agriculture, is studying at the Oxford Air Training School for a commercial helicopter licence. It is expected that he will be the first man in Britain to obtain his helicopter Commercial Pilot Licence under the scheme which allows 75hr on fixed-wing aircraft and 75hr in helicopters. After conclusion of the course he will, if successful, possess a PPL for fixed-wing and a CPL for helicopters.

Engine TBO rise for Skyvan The FAA and the ARB have authorised an immediate increase in TBO from 1,500hr to 2,000hr for the Garrett AiResearch TPE331-2-201 turboprops fitted to the Short Skyvan. The aircraft and its engines have now been in service for nine months, and the rise in TBO will save operators 15 per cent in maintenance costs, it is claimed.

PAC-1 Tentative Go-ahead The Pacific Airmotive Corporation's Aircraft and Engineering Division of Los Angeles has announced a tentative schedule for building a prototype of an entirely new third-level airliner to be known as the PAC-1 Commuter Airliner (see also this page). Construction is to begin this month; the first flight is expected early in 1971 with certification and deliveries a year later.

The PAC-1 is a 28-seat twin-turboprop powered by 680 s.h.p. P&W PT6A-27s and with a gross weight of less than 12,500lb for certification in normal category CAR Part 3. To take advantage of any relaxation in the weight limit on the simplified rules, the PAC-1 will have stretch potential for up to 40-seat capacity. A low price is a key feature of the basic PAC-1 and to achieve this the airframe and systems are being kept relatively simple (the undercarriage is fixed). The target price is \$450,000 (£190,000) ex-works; the estimated direct operating costs are \$111 (£46) per hour and 2 cents (2d) per seat-mile.

The layout is designed for both all-passenger and freight or ready conversion between the two roles; there is a large side door and a capacious baggage space (360 cu ft). To comply with the latest FAA safety requirements there are to be four emergency exits in the cabin area and there will not be any fuel tanks under the cabin floor.

PAC-1 Basic Data

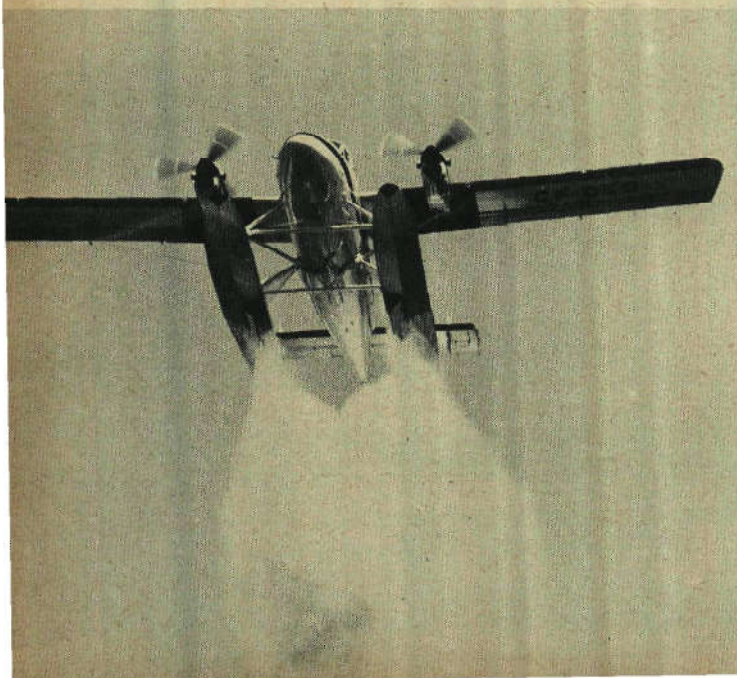
Powerplant 2×680 s.h.p. P & W PT6A-27s.

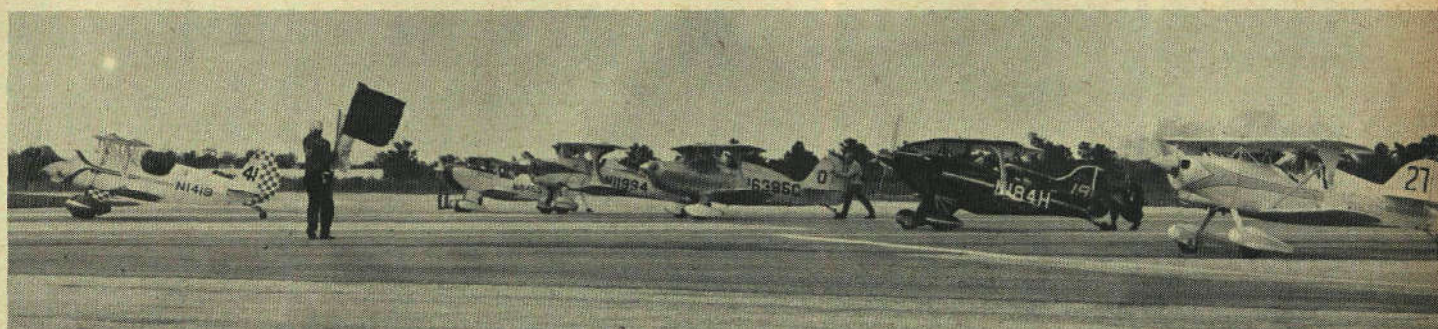
Dimensions Span, 65ft; length, 53ft 4in; height, 20ft 1in.

Performance Speed: max, 234 m.p.h. at 2,500ft, 248 m.p.h. at 10,000ft; 206 m.p.h. at 60 per cent power; service ceiling, 30,000ft; stalling speed, 76 m.p.h. (45° flap); take-off distance over 50ft, 1,636ft; landing distance over 50ft, 2,120ft; max payload/range, 5,250lb over 400 miles; max tanks payload/range, 4,260lb over 1,115 miles.

Left upper, a model of the proposed 28-seat PAC-1; see also this page. Left lower, Athabaska Airways of Prince Albert, Saskatchewan, is the first commercial operator to order the DHC Twin Otter for water bombing; the aircraft will be on hire from the beginning of the 1969 forest fire season. Single-drop capacity is 4,600lb of water; Dial-o-Matic load control gives automatic water up-lift of predetermined quantities as the aircraft skims the surface of suitable lakes or rivers.

Wright Airlines, a third-level operator in the Detroit area, has a small fleet of Lycoming-engined Herons. One of these aircraft recently force-landed due to fuel starvation.





Florida Pylon Races

By DON BERLINER

WARM, SUNNY Southern Florida is supposed to be something akin to heaven, at least in the dead of winter when most of the US is covered with ice and snow. It was for this, among other reasons, that swinging, social Fort Lauderdale was chosen for the opening event in what promises to be an unusually busy American air racing season.

The sight of swaying palm trees in February is usually quite rejuvenating to anyone slowed almost to a halt by the depressing effects of a long winter. Seeing lush greenery in the context of a major air meet should be conclusive evidence that springtime is near.

But the palm trees were bent low by strong winds and, occasionally, whipped by driving rain that threatened to wash the airfield into the nearby Atlantic. Travel posters notwithstanding, Florida proved an uncongenial host for what had been planned as the first of an annual series of National Air Races. Atlantic Coast Air Races Inc. the organiser, is not expected to survive. Once again a major American air race proved an artistic success but a financial disaster.

Friendly Executive Airport, north of Fort Lauderdale, was not an ideal site, being somewhat difficult for tourists to find, and none too well laid out for such an elaborate event. But few American airfields can offer the required facilities and proximity to populated centres, yet be so relatively free of scheduled traffic.

The last two pylon racing seasons have attracted a growing number of able contestants and so it was that this Florida first-time effort (first major air meet in the south-eastern US for almost 20 years) attracted an entry list exceeded only by the most recent of the long string of Reno Races. Among the 54 entries were 16 Formula One midjets, 13 sport biplanes, ten women's stock-planes, eight AT-6s and seven Unlimited cross-country racers.

As usual the first meeting after a busy winter of modifying and re-working produced almost a full set of new records—

Top, at the Ft Lauderdale Air Races, Fla., the winner of the ladies' race for standard production aircraft was Mrs Berni Stevenson in an SIAI Marchetti SF.260. Above, line-up for the Sports Biplane race; just off is an EAA Biplane with, on the line 1 to r, a Pitts Special, a Little Toot, a Starduster, another Pitts Special and a Mong Sport

aided in no small part by a well-designed three-mile oval course laid out over perfectly flat terrain. Bill Falck, the nearly unbeatable Formula One champion, took advantage of a beautifully re-finished wing to boost his qualifying record from 225 to 231.26 m.p.h., surprising even himself. In the Sport Biplane Class, a pilot who is becoming almost as consistent as Falck, Dallas Christian, increased his record from 179 to 183 m.p.h., thanks to new upturned wingtips and a super-slick paint job. Christian later said only the rough air kept him from trying for 200 m.p.h.

In the women's Stock Plane Class, open to production, four-seat, retractable-undercarriage aircraft of not more than 300 h.p., Mrs Berni Stevenson traded her faithful Mooney Executive 21 for the first SIAI Marchetti SF.260 (or Waco Meteor, if you prefer) to be imported into the US. It was a wise choice as she led a highly competitive field with a record 195.65 m.p.h. Only the AT-6s, of the four pylon classes, failed to produce a record, but modifications are prohibited and the appeal is close competition rather than improvement of the breed.

Throughout the day of time trials, winds had been around 20kt. and they continued so for the first of the three days of heat races. The second racing day was worse in the morning and deteriorated steadily until mid-afternoon, when the field was hit by a tropical storm with winds of at least 50kt. The



programme was washed out with only one of seven races completed, and two pylons were toppled.

In the midst of the storm, with ceiling and visibility near zero, the first finisher in the 900-mile cross-country race roared into earshot. The distinctive sound of a Merlin was of little identification value, however, as all six starters flew P-51 Mustangs. Ed Bowlin, in a P-51D owned by ex-Indianapolis 500 race driver Mickey Rupp, was the winner at 310.81 m.p.h., despite heavy weather for most of the route. Second place went to veteran Dick Kestle, also in a P-51D, at 294 m.p.h., and third to rookie Bill Hogan at 276 m.p.h. in the first P-51H to be raced in the US. Only one of the six starters failed to finish, in the worst weather for a cross-country contest since the 1947 Bendix Race.

Morning and early afternoon of the final day were taken up with re-building and re-covering pylons, while the pilots and an estimated 20,000 spectators fidgeted nervously. When the course was finally opened for competition, the most intensive programme of pylon racing yet seen in the US was begun—between 1.30 and 6 p.m., 12 races were run off. The last of 13 scheduled heats would have been completed, had not the AT-6 championship race been concluded with a classically precise wheels-up landing which rendered the runway temporarily unusable.

The Sport Biplane championship race was easily the most exciting. Top qualifier Dallas Christian, who had yet to be properly tested, was pitted against National Airlines chief pilot L. J. "Skeeter" Royall, whose modified Pitts Special sported a 125 h.p. Lycoming boosted to a rumoured 200 h.p. Royall had clocked the best heat speeds, of 166 and 164 m.p.h., but it was obvious that both he and Christian had been taking it easy.

The race began with Christian swinging wide around the

scatter pylon, apparently to give the others a break—he was so confident. Seeing that Royall had charged into a commanding lead, he immediately set off in pursuit. By the time Christian was up to speed, he was several hundred yards back, though travelling at about 185 to Royall's 180 m.p.h. By lap four of the six-lap race, the gap had been closed to less than 100ft, but in his haste to catch up, 1968 National Champion Christian cut a pylon. He was the apparent winner by almost three seconds—180.96 m.p.h. to 179.95 m.p.h.—but the trophy and \$1,000 first prize went to Royall on the penalty. Both topped Christian's old national record of 177 m.p.h.

The Formula One race, expected to be an interesting battle between Bill Falck, Bob Downey (Professional Race Pilots Association president), and dark horse Nick Jones in a brand-new and surprisingly fast modified Cassut Racer, was settled in a conference room instead of on the course, Darkness having prevented this final race of the day from being run, the seven eligible pilots agreed to the awarding of placings and prize money on the basis of previous performance, in preference to postponing the race until the following day, as that would have entailed considerable effort for just ten minutes' racing. Falck was declared the winner, Downey second and Jones third.

The Women's Race, as expected, was an easy one for Berni Stevenson and the swift little Italian import; 1966-67 National Champion Judy Wagner was second in an aerobatic Bonanza, 1968 National Champion Dot Etheridge third in a Meyers 200. The winning speed, 198.10 m.p.h. was only 0.1 m.p.h. below the record. Had competition been tougher, it is probable that 200 m.p.h. would have been exceeded for the first time.

The AT-6 race offered close, noisy competition, if not individuality. The championship race, won by airline pilot John Trainor in an SNJ-4, saw the first four aircraft cross the finishing line separated by less than four seconds.

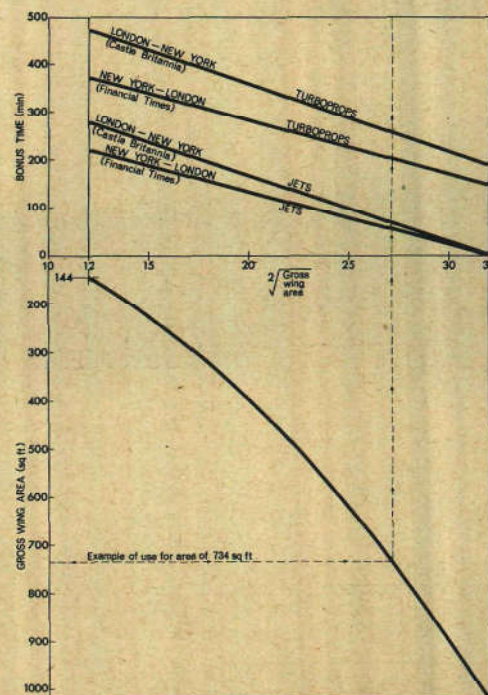
While South Florida gave few indications that it was a potential winter home for the air races, other parts of the country readied plans for summer racing season to stretch from May through to late September. With more than 100 racing aeroplanes registered with the National Aeronautic Association and its racing affiliates, future growth of the sport appears to be assured.

Atlantic Air Race Handicapping In two categories of entry for the *Daily Mail* transatlantic air race—those for jet/turboprop private/business aircraft—a handicapping system is being introduced, based on a formula devised by the Royal Aero Club. One of these categories is for the shortest time London-New York, for a £2,500 prize offered by the Castle Britannia Group of Unit Trusts, the other for the shortest time New York-London, for a similar prize put up by the *Financial Times*. Both concerns have agreed to the introduction of a time bonus.

The formula is based on gross wing area and is depicted for the two categories in the graph reproduced on this page. To read it, draw off the gross wing area from the left-hand column (as in the example shown) until the line reaches the curve, then take a vertical from that point up to the class and direction of aircraft. Examples of different types and their bonus times are as follows:—

Aircraft	Gross Wing Area (sq ft)	Bonus Times	
		New York— London	London— New York
		(min)	
TURBOJETS:—			
HS.125	353	145	185
Jetstar	542	96	122
DC-9	1,000	4	5
BAC One-eleven	980	7	9
TURBOPROPS:—			
Jetstream	270	321	408
Gulfstream I	610	230	292

Entrants in these categories will not be eligible for a time bonus if more than one fixed-wing aircraft is used in their attempt, or if their aircraft is equipped with temporary fuel capacity additional to that specified by the manufacturers as standard or optional.





Sigma—design of a super-glider

By NICHOLAS GOODHART*

SIGMA, THE SUPER-GLIDER PROJECT, has now been going just under three years and, but for the fire at Slingsby Aircraft, would be getting close to first flight. Among other projects seen by the Duke of Edinburgh on his visit to Slingsby Aircraft on February 6 was the new post-fire prototype of Sigma which is just beginning to take shape. For this visit a good deal of information about the project was displayed and, as this data makes little sense without some understanding of the basic philosophy, this appreciation is written to fill-in round the bare facts of "span 21m," "weight 1,250lb-1,300lb" and "fitted with an area- and camber-changing flap."

Sigma is designed to provide the British entry at the 1970 World Championships at Marfa, Texas, with an Open Class sailplane having the highest probability of winning the Championships. At this point everyone always says that, of course, winning a championship is not all performance; there are many other important aspects such as comfort, rig-ability, good handling, ease of repair, etc. There is no doubt that is true but, and it is a very big but, no amount of these virtues will compensate for an inadequate performance. So this article is about the development of Sigma as a high performance glider. We have had to think, too, about the other virtues but we shall not know whether enough attention has been paid to them until the flight trials start, hopefully next October.

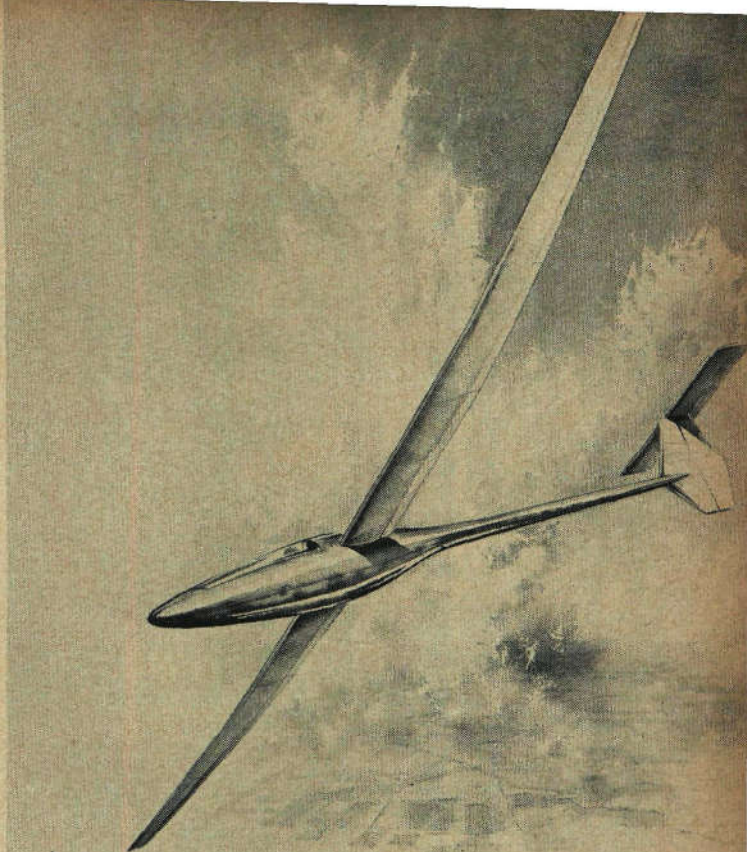
Sigma's genesis really lies in the basic analysis of cross-country thermal flying. The work of Dick Scorer, Betsy Woodward and others demonstrated that thermals were not simply patches of rising air but had an internal structure which caused the lift to increase as one got nearer the centre. This factor immediately puts a high premium on low circling speed and explains the fact (now so obvious) that gliders with high circling speeds, however low their minimum sink may be, fly in the weaker, outer parts of thermals and are consequently poor climbers.

The first requirement for Sigma is therefore a low circling speed and a reasonably low minimum sink to go with it. Only in this way can one be sure of competing successfully on the bad days or climbing out of the inevitable hole that crops up all too often in competition flying. With this in mind, we set as the lowest acceptable standard the minimum sink performance of a Skylark 3, i.e. 1.2kt sink at 37.5kt EAS.

The second part of the thermal cross-country technique is the straight glide between thermals. The overall average speed achieved depends on the speed at which the glide is made and the height lost in the process. The requirement therefore is the best possible glide ratio at the highest possible speed.

One can summarise what is involved in meeting the requirements of these two cases as follows:— climb: high lift coefficient, large wing area, low weight, and low drag; cruise: low lift coefficient, low wing area, high weight, and low drag.

Low drag is a requirement in both cases (surprise! surprise!) and becomes the main consideration for the fuselage and tail



This "Flight" impression of Sigma is the first illustration to show the configuration of the new sailplane, and was prepared from models and drawings displayed by Slingsby Aircraft during the Duke of Edinburgh's visit to the firm last February. Sigma represents probably the ultimate in the present line of thought on sailplane design, and (provided the aircraft can be delivered to the British team in time to allow adequate development and practice time) could well lead the field at Marfa next year. Prospects for commercial production are naturally uncertain at this stage, but it is hardly likely that a glider with such a performance promise would lack for buyers, particularly in America. A "cooked" Sigma, with slightly reduced span, could probably be built for between £5,000 and £10,000, assuming an order for 10-20 aircraft.

surfaces. Weight, on the other hand, needs to be high for cruise and low for climb; we did not have any bright ideas for solving this problem. We were therefore left with the problem of developing a wing giving a high lift coefficient and having a large area for climbing but capable of the maximum possible reduction of area for cruise at low lift coefficients. In both configurations drag had to be very low, i.e. extensive laminar flow was needed.

Fortunately Dr F. X. Wortmann, the aerofoil specialist, was extremely interested in the concept of a wing capable of operating in these two modes and undertook to design a wing section, or rather a pair of wing sections, for Sigma. It remained for John Sellars as chief designer of Sigma to engineer a flap system to combine the two profiles. That, in a nutshell, is what Sigma is all about. The wing section can operate with greatly reduced area (i.e. flap in) with a good low drag "bucket" in the range of cruising $C_{L,s}$ (say 0.1 to 0.8) but is also capable of operating at very high lift coefficients with extra area (flap out) for circling. Having got the basic concept sorted out, the next step was to do a study of the major parameters—wing span, wing area, weight—in order to find the effect of varying these items on the calculated performance. This study was done at Hawker Siddeley Aviation, Brough, who very kindly provided both computer time and an aerodynamicist, Neville Beckett, for the study. Mr Beckett has in fact been responsible to John Sellars for the aerodynamic aspects of the design from the parametric studies onwards.

The results of the parametric study showed that wing

* Sigma project manager.

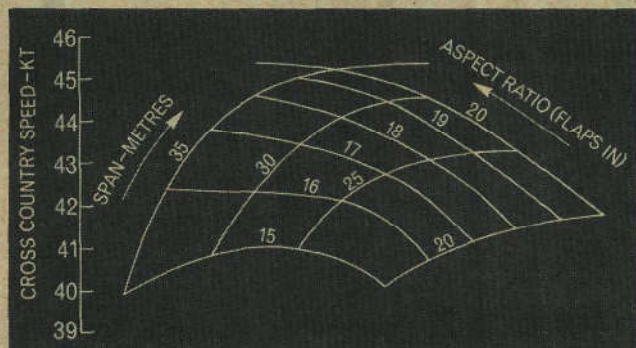


loadings needed to be very high by gliding standards—of the order of 10lb/sq ft (flap in), that weight should be high—1,200-1,600lb, depending on thermal strength—and that wing span should be as large as possible.

The design of Sigma that has emerged is therefore one of large span (21m) and considerable weight (flying weight 1,250lb-1,300lb). Calculated performance shows that we have held to our basic requirement of circling performance better than that of the Skylark 3 with a minimum sink of 1.07kt at 37.5kt. But the really exciting part of the performance is achieved in the cruise configuration. Our calculations show 50:1 glide ratio at 56kt and 32:1 at 100kt. Perhaps it should be added that the method of calculation we use gives, when applied to existing gliders, performance figures which appear to correspond closely with their real performance. In other words we like to think it is not too starry-eyed.

Having settled on the basic parameters, we found that many of the main features then followed almost automatically. The first item was the wing material. With the large span and high

This carpet showing variation of cross-country speed with span and aspect ratio is generally applicable to all gliders, and illustrates the reason for the slender wing shapes universally adopted. These particular curves assume a thermal having a core strength of 4.6kt and a square-law distribution giving zero lift at 600ft radius. The key to Sigma's performance lies in the wing, with its area- and camber-increasing flap, the function of which is to enable efficient circling at low speeds in thermals without compromising the high-speed cruise



Know your Engine-out Decision Height A recent Board of Trade *Aeronautical Information Circular** highlights certain critical factors that affect the correct choice of a decision height for a successful overshoot following an engine-out approach-to-land. The advice was prompted by an accident report recently published concerning a fatal accident which occurred when an instructor in a light-twin, which had made a partial single-engine circuit with the port propeller feathered, unfeathered the propeller on baseleg and instructed the cadet pilot to overshoot from the point of flare. The overshoot was not successful.

The circular notes that whilst the level of performance available on one engine had little bearing on this accident, the owners and pilots of twin-engined aircraft with a limited single-engine rate of climb would be well advised to make

explicit instructions with regard to what single-engine practices may be carried out, and at what height and airspeed. These instructions, it is recommended, should take account of such factors as slower undercarriage retraction when the "failed" engine is the sole source of hydraulic power. Further, it is particularly important that before an actual or simulated single-engine approach is carried out a decision height should have been determined and that if the aircraft descends below this height on one engine it must land. An overshoot on one engine must not be attempted from below the decision height. Group C performance aircraft at weight, altitude and temperature limiting conditions can show a single-engine rate of climb as low as 50ft/min with flaps and undercarriage retracted. The height loss incurred below the decision height whilst flaps and undercarriage are being retracted and the recommended single-engine climb speed established can be in the order of 200ft to 300ft. A decision height not lower than 500ft is, therefore, recommended. Further important recommendations on engine-out handling and training are contained in the circular.

The next point of interest is the height of the fuselage off the ground with the wheel down. With such a large span there is a problem in ensuring that the wing-tips have satisfactory ground clearance for safe field landings. If the static dihedral is sufficiently large to overcome this problem, the flight dihedral can be excessive due to the amount of wing bending between the two cases. We therefore went for a long undercarriage extension. Incidentally the undercarriage (main and tail) has been built and donated by Dowty-Rotol Ltd. Due to the effective change of wing incidence when the flap is out, the fuselage attitude on landing and take-off is almost the same as in cruising flight. This means that the tailwheel has to be some feet below the rear end of the fuselage, and so the fin extends a considerable distance below the fuselage, where it provides a convenient mounting for the retractable tailwheel.

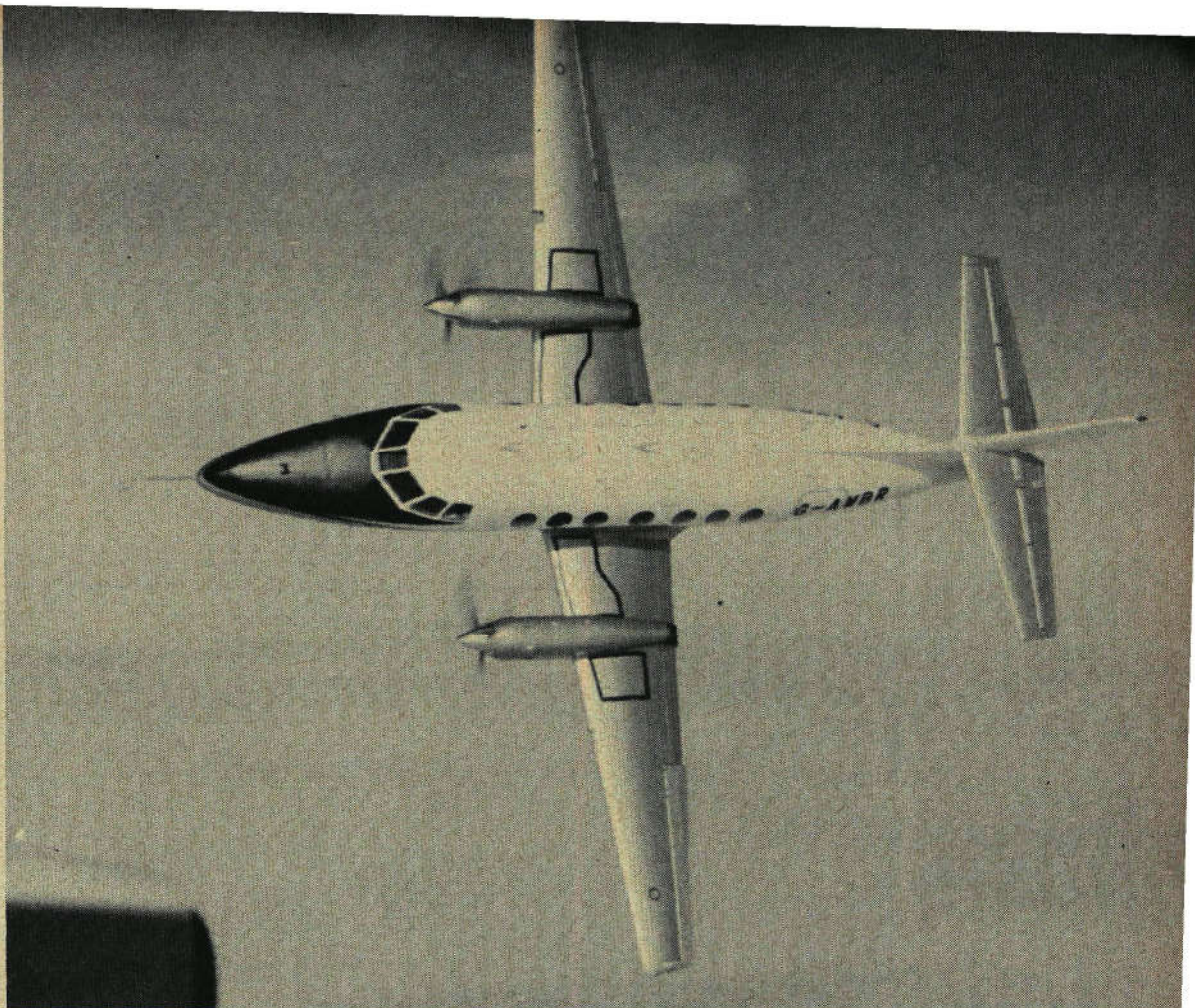
That, then, is an outline of what Sigma is going to be and, but for the Slingsby fire, we would have been able to show the Duke of Edinburgh a nearly completed first prototype. Instead, we were only able to show him the beginnings of the new fuselage and the rest of the features of the design had to be displayed in model form. However, re-design and re-build are now getting going strongly and we hope to have the aircraft operational in good time.

Many other fascinating aspects of Sigma arise through its very advanced performance. For example, there is the question of how much change in technique will be involved in flying the aircraft, bearing in mind that cruising speeds will be in the 120kt bracket (flaps in). Another point is that minimum sink with flaps in is almost exactly the same as that with flaps out; the difference lies in the speeds for minimum sink which are 53kt and 37.5kt respectively. Thus the flaps serve only for the essential purpose of reducing the turn radius for thermalling.

As can be guessed, the development of a glider of the size, complexity and sophistication of Sigma is far from cheap though, unlike some aviation projects, the estimated cost of building one prototype still remains within the figure (£30,000 at 1966 prices) put forward when the project was started. Due to the splendid support given by the aviation industry and others, in particular W. D. & H. O. Wills, sufficient finance is now available for building one prototype. But it has been decided that a strong case exists for building a second prototype and fund-raising continues in order to provide for this. At present, we estimate that a further £9,000 is required.

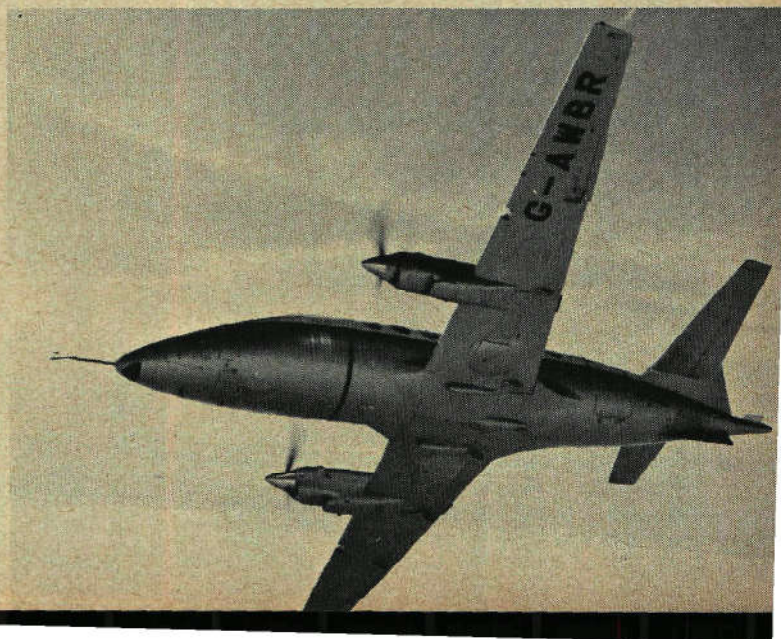
*Aeronautical Information Circular No 12/1969, obtainable free of charge from Aeronautical Information Service, Tolcarne Drive, Pinner, Middx.

explicit instructions with regard to what single-engine practices may be carried out, and at what height and airspeed. These instructions, it is recommended, should take account of such factors as slower undercarriage retraction when the "failed" engine is the sole source of hydraulic power. Further, it is particularly important that before an actual or simulated single-engine approach is carried out a decision height should have been determined and that if the aircraft descends below this height on one engine it must land. An overshoot on one engine must not be attempted from below the decision height. Group C performance aircraft at weight, altitude and temperature limiting conditions can show a single-engine rate of climb as low as 50ft/min with flaps and undercarriage retracted. The height loss incurred below the decision height whilst flaps and undercarriage are being retracted and the recommended single-engine climb speed established can be in the order of 200ft to 300ft. A decision height not lower than 500ft is, therefore, recommended. Further important recommendations on engine-out handling and training are contained in the circular.

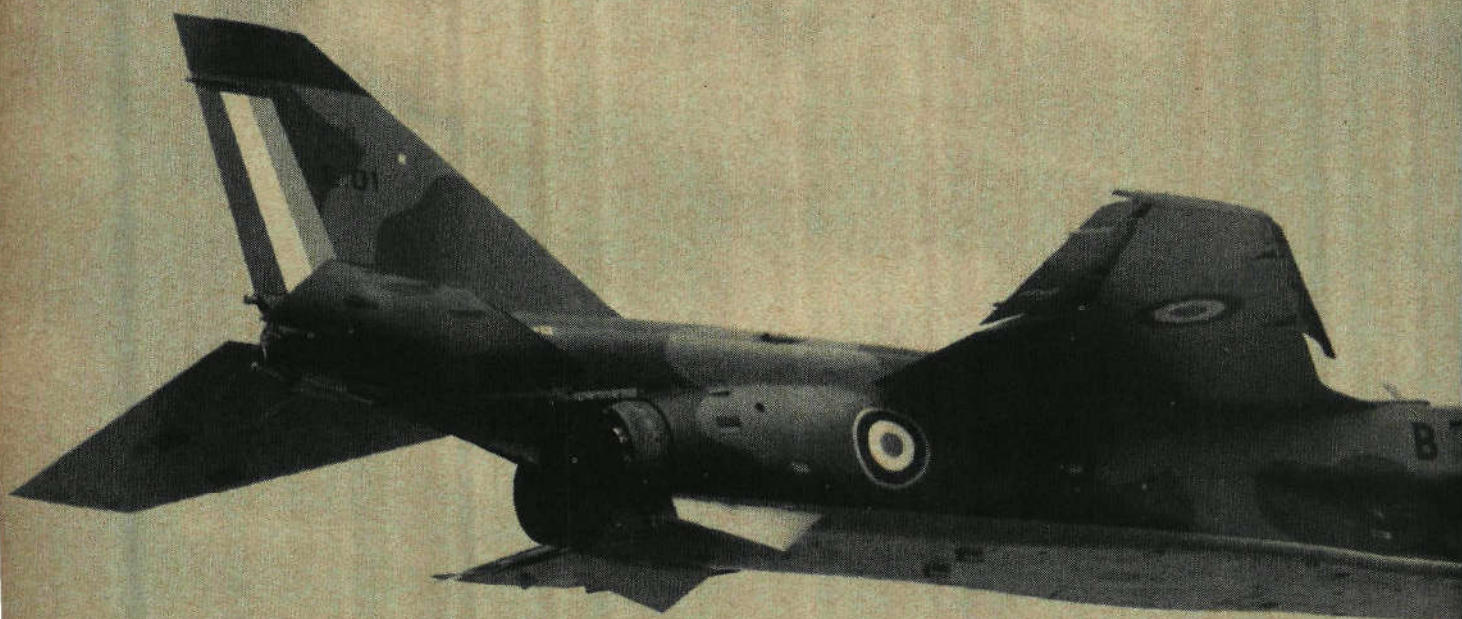
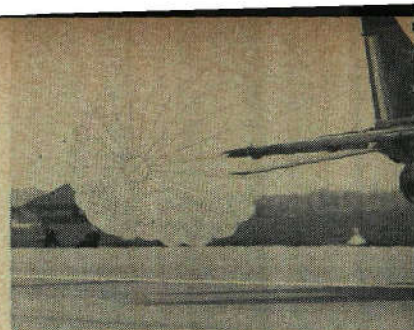


Jetstream Jeep

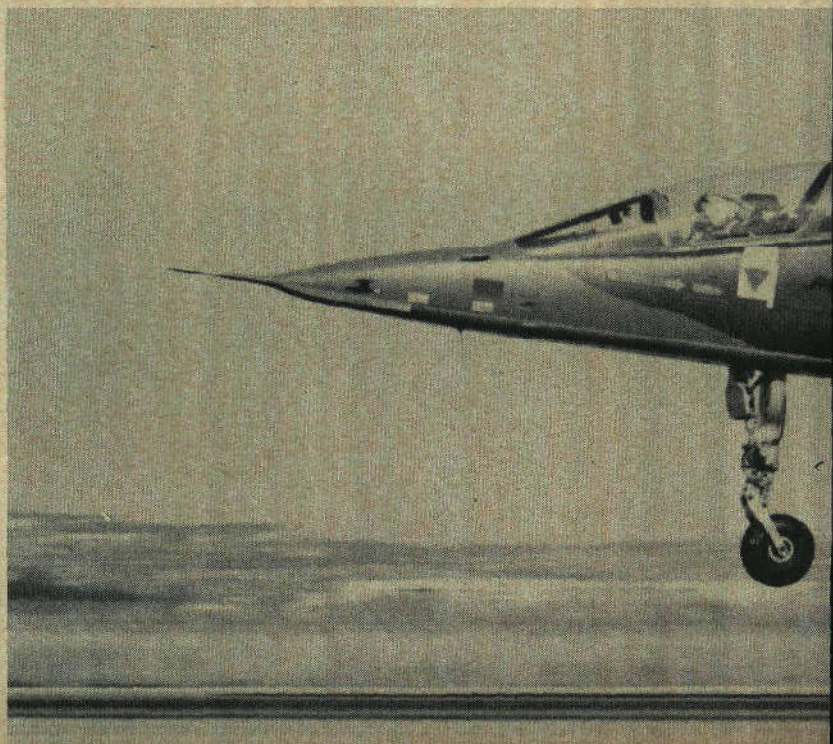
The USAF will soon receive eleven special Handley Page Jetstream 3Ms (designated C-10A) for communications/navigation/training/aero-medical duties. This Garrett-powered version of the businessman's barouche (Rolls-Royce Turbomeca Astazou) is advanced in development and performing up to expectations. In the hands of display/test-pilot-extraordinary Neil Williams, the handling is clearly more than lively enough. Distinguishable new features are the faired mainwheels, the ventral fin (final shape has yet to be defined), tailcone extension housing jettisonable crash recorder, and British registration on the otherwise USAF markings

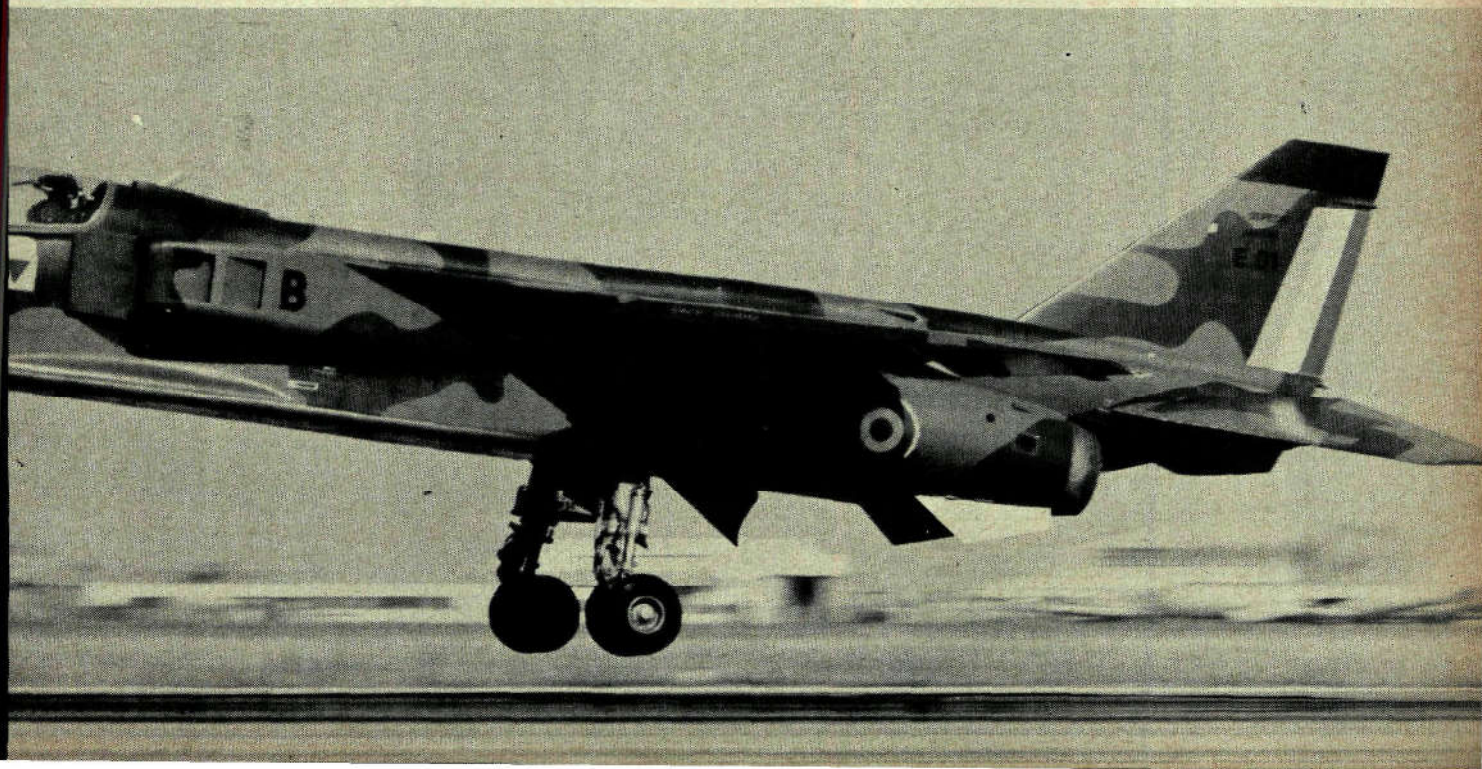
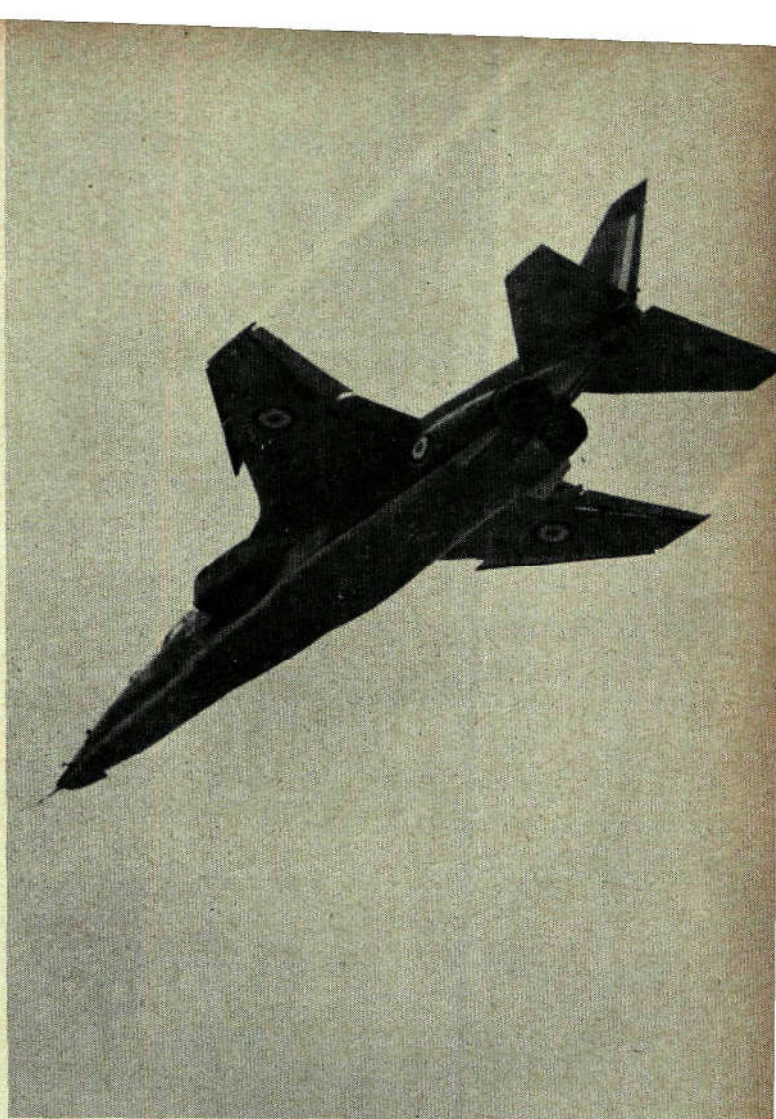
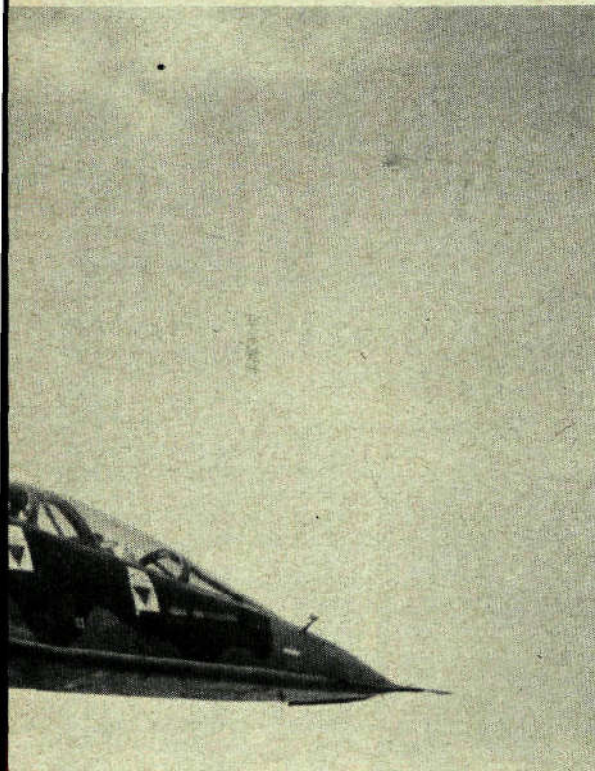
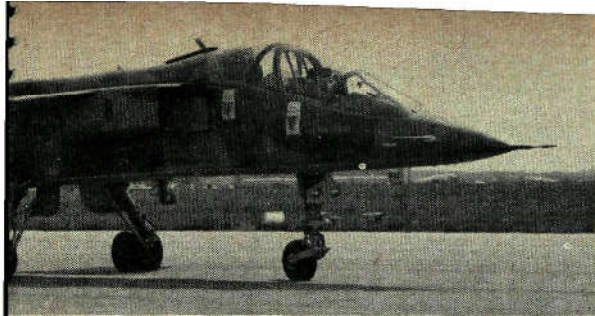


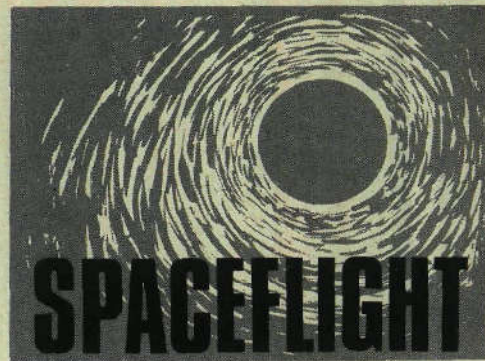
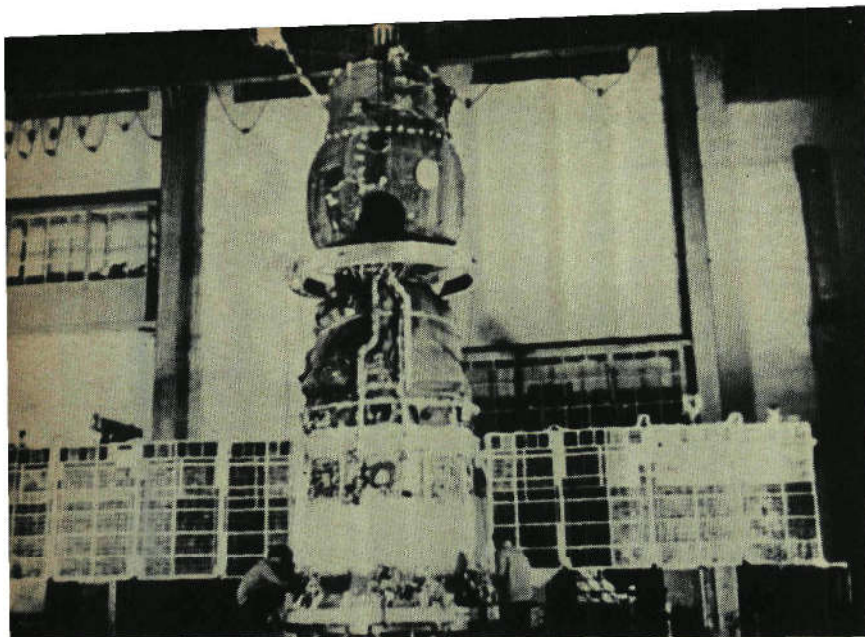
WILDCAT STRIKER



The Anglo-French Jaguar close-support strike-trainer is now well into its development programme, with two prototypes flying at the Centre d'Essais en Vol at Istres. A number of representative points have been established in the flight envelope, and the aircraft has already been flown with stores on board. The next stage will flutter trials. The first two aircraft (two-seaters) will be retained by the French Air Force, as will two further single-seaters which will fly later this year. The first of the RAF's aircraft will fly towards the end of the year and by 1970 there will be seven prototypes flying in Britain and France. No less than five versions of Jaguar will be built, three based on the single-seat version and two on the two-seater. The former includes a deck-landing aircraft for the French navy. In addition the joint Anglo-French project-management organisation Sepecat has announced the development of a reconnaissance version. While Europe struggles with another collaborative project, MRCA, it could therefore be said that Jaguar is already a multi-role aeroplane in its own right.







NAS AND UTILISATION SATELLITES

Satellites "can be applied in a variety of ways that will contribute to the welfare of mankind and to the amelioration of certain of the world's problems." However, "an extensive, coherent and selective programme will be required to achieve these benefits."

These are the main conclusions of a two-year study by the US National Academy of Sciences issued on February 8, made by 200 specialists from industry and the universities under the chairmanship of W. Deming Lewis, President of Lehigh University.

"Satellites are our newest national resource," the report says. "The benefits from space application are expected to be large—larger than most of the study participants had originally believed, and certainly larger than the cost of achieving them."

The report suggests practical satellites can be employed in a direct attack on basic world problems—such as hunger, illiteracy, poverty—as well as a host of problems common to the developing and developed world, for example, air pollution. And, it says, these worthwhile things can be done with a return on the investment, at a saving.

To realise the potential, the report urges a doubling or tripling to "200-300 million dollars a year" of NASA's space applications programme, "a level that is in the best interest of the United States." The present programme, it says, "is too small by a factor of two or three, if we measure it in the light of the substantial opportunities that can be pursued effectively only if financial support is increased." In this context the 1970 fiscal year budget before Congress asks \$135.8 million for space agency financing of space applications programmes, with most of the money earmarked for advanced Nimbus weather satellites, applications technology satellites, and a first Earth resources satellite to be flown in 1971. President Nixon and Congress have not yet acted on the request.

Noting that weather and communications satellites "have already entered solidly into the area of economic usefulness," the study asks immediate high priority development of satellites that broadcast television directly to homes.

"Two [direct television broadcast satellites] seem so easy

technically, so reasonable economically, and so potentially desirable," the report says. "One is a multi-channel distribution system for the use of network television transmission for both the private and public sectors of the industry. The other is a multi-channel system of the 'Teleclub' type for educational, instructional, and informational television for developing countries."

One section of the report notes: "What is certain is that space technology can be exploited for human good, specific practical objectives can be identified and intensified policy planning for space applications—nationally and internationally—can begin."

Of international aspects it says further: "The uses of Earth-oriented satellites have inevitable international implications. They appear to have uniquely pervasive effects upon international problems of environmental and resource management. It is thus noteworthy that the United States may be able to develop satellite applications in such ways as to ease international tensions and offer solutions to world problems."

NASA's 1969-1970 BUDGET

NASA has requested \$3,880 million for the fiscal year 1970 (July 1, 1969, to June 30, 1970), some \$200 million less than that requested for the current year, but equal to the sum which was finally voted by Congress. The most significant change is a decrease of almost \$260 million in the R&D figure, the 1970 request being for \$3,050 million. Following the rundown of the Apollo programme, more attention is to be given to the practical applications of spaceflight to Earth resources and to implementing unmanned planetary explorations. Of the specific programmes involved \$44.2 million has been requested for applications technology satellites F and G, to be launched respectively in 1972 and 1973. \$50 million has been requested for a synchronous weather satellite.

It is hoped to spend \$40 million next year on the 1973 Viking Mars lander project, for which approval was given last year and for which \$8.1 million has already been voted. Also in 1973 is the planned single Mariner flyby of Venus and Mercury, for which \$3 million has been requested (the total programme cost for this is estimated at \$87 million). Another new feature of the 1970 budget is a plan to fly five small (and presumably spin-stabilised) spacecraft to Venus and Mars in the next five years. The project of greatest complexity appears to be the much-publicised planetary "grand tour" planned for 1977-78. NASA hopes this year to obtain approval for this programme which will probably cost over \$1 thousand million.

With American Apollo flight now running on a 10-week cycle, the next stage in Russian manned missions is eagerly awaited. Following the successful flights of Soyuz 4 and 5 last January, this photograph of an actual Soyuz spacecraft has been released, from which the size of the spacecraft is seen to be close to that estimated in "Flight" for November 28 last year

Letters

London's Third Airport

SIR,—It is regrettable that the Roskill Commission omitted a few other seaside sites suitable for a third London airport. Apart from Foulness, Sheppey and Shoreham-on-Sea Airport could be considered also, especially Shoreham as the fourth London Airport.

It is quite futile in this jet age to plan for this overcrowded island anything of this kind inland. The protests from Cublington, Nuthampstead and Thurleigh will blow it skyhigh—and rightly so, because it's Stansted all over again: the same first-class agricultural area and so on.

In the jet age we not only have to cope with jet noise but also with jet air pollution, which is soon bound to be colossal. All this speaks highly in favour of seaside airports with miles of open space for stacking aircraft and dissipating noise and air pollution.

Take Foulness. We shall see in the next decade all the towns from Bexley to Southend expand and weld together almost into one, Southend becoming the East End of London. Therefore, Foulness and Sheppey will become the best airport sites from all points of view—even that of Mr Masfield, who advocates an airport as near to the city boundary as possible.

Last but not least, an airport in the Thames Estuary will suck in London's expansion along the Thames wasteland eastwards and thus spare the countryside.

London NW3

GEORGE K. DE MOERS

SIR,—Why don't we fill in the Wash and site London's third airport there. High-speed monorail services could be built to London, the Midlands and the North with reasonable ease.

London W1

P. F. TRAVERS-WAKEFORD

SIR,—Perhaps Mr Peter Masfield does often say "airports are for people." But which people? Those using the airport or those living around it? "Who actually wants to go to Foulness anyway?" Why, the very people who would want to use the SSTs and Jumbo jets and yet not want to have up to 4 million pounds of thrust battering them into the mad-house during the other 23 hours of any day!

Luton, Beds

K. J. SIBLEY

The Corporations Apart

SIR,—In answer to the letter from Mr Roger C. Young in your issue of February 13, surely the overriding factor in this instance is the completely different functions of the two corporations and not hypothetical arguments relating to aircraft that a merged corporation might or might not have. One can only take the facts as they stand, and these are plain for everyone to see.

BEA has an extensive high-frequency route network far in excess of that of any short-haul division of any European airline; and, because the routes are primarily short-haul, the financial return rests on high aircraft utilisation and a sound business acumen—let there be no doubting that. BOAC is purely long-haul, and the financial benefits of this are also plain to see.

To become one airline the two corporations with a rationalised fleet would require very sophisticated aircraft

indeed to cater for these two distinct functions, unless operations are also to be trimmed to suit. After all, an airline is a public service, a fact which economists and theorists tend to forget; and if separately the two corporations are providing a unique and extensive transport system unmatched in any Continental country, and not costing the British public millions of pounds in so doing, why the change? Surely not for change's sake.

Hillingdon Heath, Middx

B. ROGERS

Travel Agency Failures

SIR,—The failure of travel agencies is surely too frequent and in need of serious investigation to avoid repetition.

Explanations given seem feasible enough, but the point at issue is that the calamity is avoidable if checked in time. The public suffer the loss of their money, of a holiday or of a chance to return to their homeland. Some shocking instances have been known where savings have been irretrievably lost.

Perhaps it is too easy these days to show an interest in acquiring permission to hire aircraft without adequate financial backing to offset misadventure. Undoubtedly, competition must be fierce for the privilege of obtaining air flying space and the financial risk too great for small businesses.

Birmingham 5

FRANCIS B. WILLMOTT

[As Mr Willmott may have seen from the Parliament column in our issue of February 27 (since his letter was written), a move is afoot to give the ATLB full statutory rights over such operations.—Ed]

Flying by the Book

SIR,—Born in Hoxton in the early twenties, I have an accent that gets no table in exclusive restaurants. During the war my offers to pilot fighters or bombers met with disdain and I was eventually relegated to the real fighting in the Parachute Regiment (which used indifferent aeroplanes that set us anywhere except on the DZ).

Nevertheless, I have never, over the years, lost my burning desire to fly and eventually own some kind of single-seat banger. In fact I already have 1hr 40min instruction and am waiting for my youngest to leave school so I may get in even another hour (at £7 per hour... plus £5 club fees... plus fares).

However, my 2s 6d for *Flight* and the use of every library in North London has made me such an exceptional pilot that I have no doubt whatsoever that I could solo within the next ten minutes of my next hour's instruction.

As a lorry driver with a STOL eight-wheeler I am at present set with QFE (neither up nor down) and at the age of 46 am concerned with my own C of A before flying for the masses becomes reality.

Are there any flying scholarships for the middle-aged? If not, why not?

London N16

GUS GOWER

Private Flying

SIR,—Oh, the sweet nostalgia of private flying in pre-war days, when one could use an aeroplane as one would use a private car! Just say, "Oh, what a lovely day" and go. Yes, but where to? The answer was anywhere your fancy might take you—the aerodrome of your choice to meet aviation friends, or to have friends meet you to take you to their home for a meal or a night; or to a farmer in his own field, taking your dog and gun for a day's sport.

Those were the days when almost every aerodrome would welcome you at any time of day or night; that horrid restriction PPO (prior permission only) had not been thought of. I well remember a dark and dirty night when the aircraft lights failed—so no compass, no instruments. I found an RAF aerodrome, buzzed the hangars, throttled back to call out to the first bod to appear: "SOS, switch on the landing lights!" And lo, it happened. We were well entertained in the officers' mess until my wife came to collect us. Many a time when a long journey could not be completed I have put up at an

LETTERS for these columns should be addressed to the Editor, "Flight," Dorset House, Stamford Street, London SE1, and must bear the sender's name and address, though the address will not be printed in full unless the writer specially requests it. Use of a *nom de plume* is acceptable only in exceptional circumstances. Brief letters will stand a better chance of publication.

LETTERS...

RAF aerodrome for the night, often with a game of bridge or other entertainment thrown in.

What have we now? Radio, flight plans, nearly every aerodrome PPO and restrictive regulations with fantastic fines for the breaking of same. The attitude of the commercial pilots is that they own the air, and the fewer private aircraft the better. If a commercial pilot can read the number of a small aircraft, then he can file a "near miss" report, and its poor pilot is hauled up in front of a beak who looks upon him as the silly goose with unlimited golden eggs to hatch. Every hand is against him.

What possible justification can a grass aerodrome like Portsmouth have for making itself PPO? There must be many others in the country like it. Why should it be necessary for a private pilot to have to suffer the inconvenience and inefficiency of the GPO in making a telephone call to ask for permission to land? Surely it is officialdom for officialdom's sake.

Would that the spirit of Tommy Rose, Campbell Black, Harry Mitchell and a host of others could rise from their graves or obscurity and shout for some freedom of the air so that flying could be fun without fear once more, as it is in France and many other countries.

Gosport, Hants

H. R. DIMOCK

Hawker Siddeley Jets

SIR,—I have been reading (rather belatedly) Roger Bacon's page in your issue of February 20. His first paragraph refers to the number of jet aircraft built by the companies which now are incorporated in HSA.

Roger should be reminded that there are some HSA companies north of a line from the Wash to the Severn. If he had remembered their existence he might have included such aircraft as the Buccaneer, Vulcan and Nimrod in his list, not to mention experimental types such as the Tudor 8, Ashton, Avro 707 and AW.52.

Stockport, Ches

W. G. HEATH,

Chief Structural Engineer,
HSA Woodford

Aerosols at Altitude

SIR,—I write with reference to Mr S. R. Hancock's letter (February 27) about aerosol sprays in aircraft.

I work in the passenger handling section at RAF Lyneham. All passengers, before arriving for a flight, are sent a set of reporting instructions, and among them is a list of articles prohibited on Air Support Command passenger flights—such things as non-safety matches, butane-gas refills and portable radios with batteries still fitted; and aerosol sprays are on this list. If passengers do report with any of these articles in their baggage, they are politely but firmly asked to remove them and hand them over.

An aerosol "bomb" left on a window-sill on a sunny day is quite capable of devastating the average kitchen, so it does not take much imagination to realise what could happen in an unpressurised aircraft baggage hold.

By the grace of God, and a lot of hard work, Air Support Command has a good safety record. It is checks of the above kind that help to keep it the way it is.

RAF Lyneham,

C. J. WEBB,

Wilts

Cpl

Portuguese Pioneering

SIR,—These two memorials were observed recently, while on a visit to Portugal.

The street sign, in the fascinating old Alfama district of Lisbon, commemorates a very early European pioneer of aeronautics whose interesting practical experiments in 1709—with a glider and a hot-air balloon—are described in C. H. Gibbs-Smith's *A History of Flying*—a Batsford publication now, unfortunately, out of print. At least, I assume it must be the same Gusmão, although the



Portuguese aviation memorials, in Lisbon (left) and Cascais (see letter below from Mr Geoffrey Scott)

author, who post-dates his birth by one year, refers to this Portuguese Jesuit Father as *Laurenço de Gusmão*.

I wonder if any reader can fill in the background to the other monument, a creeper-covered stone cairn surmounted by an eagle, which overlooks the harbour at Cascais. According to the plaque, it commemorates a flight from Lisbon to Rio de Janeiro by two Portuguese airmen, Gago Coutinho and Sacadura Cabral. It would be interesting to know the type of aircraft used for this early South Atlantic flight. It took from March 30 to June 17, 1922, and was presumably the first aerial link-up between Portugal and her former Colony, Brazil, where, incidentally, Gusmão was born.

Harpenden, Herts

GEOFFREY SCOTT

[These determined aviators made their flight in not-so-easy stages. They started in a modified Fairey IIIc seaplane (Rolls-Royce Eagle): it was replaced by another; and they finished the flight in a third machine of the same basic type.—Ed]

Irish Sea Pioneer Crossings

SIR,—A letter from Mr J. C. Oakes in your issue of March 6 mentions that there is a plaque in his village school in Wales stating that Capt Vivian Hewitt was the first man to fly the Irish Sea from Holyhead to Dublin on April 26, 1912, but that *Flight* gives the honour to someone else who flew on April 22. Hewitt was certainly the first person to fly from Holyhead to Dublin, where he landed in Phoenix Park, but the honour of being the first person to fly a powered aircraft non-stop across the Irish Sea goes to Denys Corbett Wilson. This he did by flying from Fishguard to Crane, near Enniscorthy, Co Wexford, on April 22, 1912. *Flight* for July 11, 1968, refers to this crossing.

Portmarnock,
Co Dublin

J. C. KELLY-ROGERS,
Captain

DIARY

- Mar 29 Aviation Society of London: Air Day, including All-England Recognition Contest, CEBG Conference Hall, Sudbury House, 15 Newgate Street, London SW1. (Admission by ticket, 8s 6d, from Paul Davis, 31 Mervyn Road, London W13; a few tickets may be available at door from 10.40 a.m. onwards.)
- Mar 30 Shuttleworth Collection: Open day with flying demonstrations; Old Warden Aerodrome, Biggleswade, Beds.
- Apr 1 RAeS Specialist Lecture: "High Lift," by D. McRae, Dr L. F. Crabtree and D. N. Foster; 4 Hamilton Place, London W1, 6 p.m.
- Apr 2 RAeS Bristol Branch: Annual general meeting, Sales Presentation Theatre, Rolls-Royce (Bristol Engine Division), 6 p.m.
- Apr 6 British Air Ferries: Air display, Lydd, Kent.
- Paris Show: May 29–June 8.
- "Flight" Light Aviation Show, Cranfield, Beds: July 20–27.



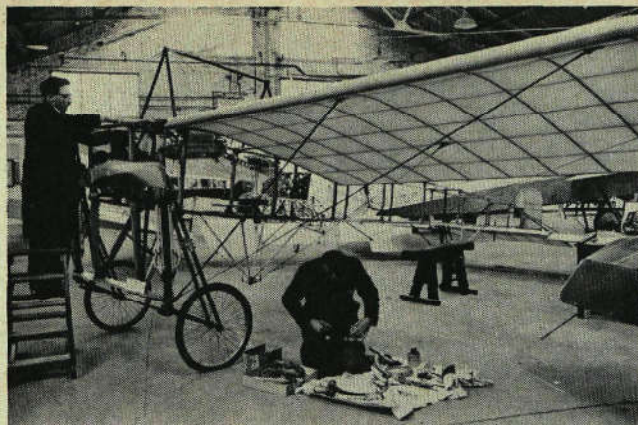
FLIGHT COLOUR

23

Fairey Swordfish

Although obsolescent at the beginning of the Second World War, the Swordfish torpedo-spotter-reconnaissance aircraft, or "Stringbag" as it was affectionately known, remained in service until after VE-day, gaining for itself and the Fleet Air Arm a record second to none in operations against the enemy. Originating from the Fairey TSR 1, the Swordfish Mk I first flew in April 1934, followed in November by the seaplane conversion. Appearing almost ten years later in 1943, the Mk II and Mk III respectively featured a strengthened mainplane—for operating the new rocket projectile—and an ASV scanner. Flying offensively during the setbacks of the early war-years, the "Stringbag" earned its laurels at Taranto by disabling part of the Italian battle fleet for the loss of only two aircraft. Other notable actions included the Battle of Cape Matapan in 1941 and the gallant attack by six aircraft on the German battleships *Scharnhorst*, *Gneisenau* and *Prinz Eugen* in the English Channel in 1942, for which the leader, Lt Cdr Esmonde, was awarded a posthumous VC. A total of 2,391 Swordfish were built, powered by either a 690 or 750 h.p. Bristol Pegasus. Maximum speed, 139 m.p.h. at 4,750ft. Service ceiling, 10,700ft. This particular example is kept in flying trim by the Fleet Air Arm.

Flight, London SE1, 1969



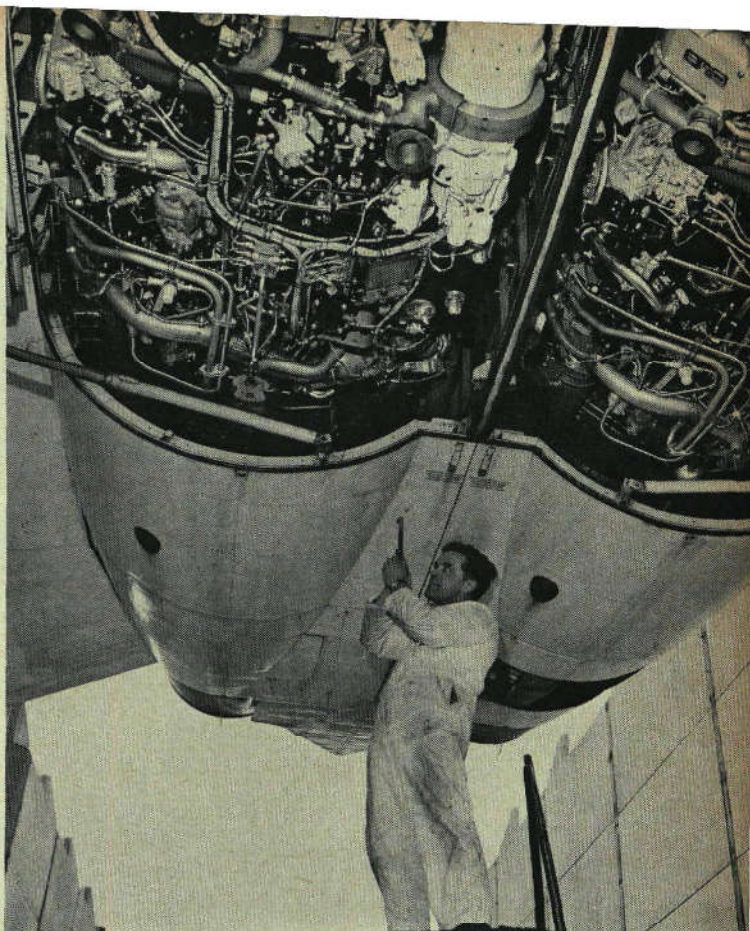
A "FLIGHT" REVIEW

Aircraft overhaul and repair

AIRCRAFT OWNERS WILL ALWAYS have a home base where regular overhauls and repairs can be effected, but it may well be of value to have a ready source of reference to the facilities available in other areas. In this review we have departed from some previous directories published in *Flight* and the companies have been placed in broad regional divisions, instead of being listed in purely alphabetical order. In a geographical area as small as the British Isles it was obviously unnecessary to make these divisions too small or too numerous, so the first and largest division includes London, the Home Counties, South East and much of Southern England. The second division embraces the Midlands and East Anglia, and the third Wales, South West England and the Channel Islands. Northern England lies between the Scottish border and the Midlands and the final division embraces both Scotland and the whole of Ireland.

Within the geographical framework we have tried to further break the directory down into the categories of work that the companies perform. First, there are the firms which deal mainly with the larger transport type of aircraft, and these are followed by the organisations which specialise mainly in light aircraft. Helicopter overhaul forms a third section, and engine overhaul is broken down, like the aircraft, into the larger and lighter types of engine. Components cover a very broad field, but some companies which specialise particularly in the instrument, radio and electronics and electrical fields are listed separately under those headings. Finally, there are the companies which specialise in aircraft furnishing and the installation of cabin floor and wall coverings.

Lack of space has prevented the inclusion of a company under more than one category of work, so owners will find it useful to check under allied trades to see if a particular organisation can provide the service required. We have tried to place the entries under the headings corresponding to their major activity. Where companies have contacted us we have been able to include the latest information on their services, addresses and telephone numbers. The directory is not intended



Overhaul with a difference—a vintage Bleriot aircraft (above, left) being rebuilt at the Shuttleworth Aircraft Museum at Old Warden by Warden Aviation & Engineering Co., specialists in this field. Above, an engineer checks the Rolls-Royce Conways of a VC10

to list companies who sell equipment for overhaul or repair work, but only those who can provide a service to the aircraft owner by actually working on his machine or its components. Even so some of the entries have specified certain sales facilities and stock which are available.

Separate manufacturing activities have generally been excluded, and the overhaul by the bigger airlines of their own aircraft is not normally included although the very topical picture of the completion of the roof of BOAC's Boeing 747 overhaul hangar shows the current trend towards larger and more costly facilities. No mention is made here either of the widespread factory after-sales support facilities provided by the manufacturers of many British aviation products.

Addresses are reduced to the minimum for space reasons and include the telephone number but not the exchange, unless its name or code differs from that of the town. In general we have steered away from STD codes at present and leave the reader to check with his own dialling instruction booklet. The word "London" has not been included in London postal district addresses, only district references being shown.

The current list brings up to date the directory in *Flight* of October 17, 1968, in so far as that issue covered aircraft maintenance as opposed to sales.

Most of the companies are to be found at airports and airfields throughout the country, but some of the component overhaulers have their works away from flying activities. In general, however, these will have close associations and contact with one or more airfields, and arrangements are usually available for the transport of equipment.



AIRCRAFT OVERHAUL AND REPAIR...

WHERE AND WHAT

London area and the South

LARGE AIRCRAFT

Airwork Services Ltd, Bournemouth (Hurn) Airport (0201 62271) Civil and military maintenance contractors—UK and abroad: light aircraft and radio overhauls; aircraft and parts sales; consultants. Sales and service agent: ARC: King Radio: Narco.

Aviation Traders (Engineering) Ltd, Southend Airport (0702 49471); also at Stansted, Lydd and West Croydon. Overhaul: all types of civil aircraft, airframe and systems components; aircraft conversions including the design, manufacture and installation of freight doors and holds. Non-destructive testing and aircraft weighing service. Avio-landa, extending passenger walkways, Western Gear manufacturing licences.

BKS Engineering Ltd, Seymour Mews, London W1 (486 9744) Aircraft overhaul at Southend (48474); maintenance facilities at Newcastle (869707) and Leeds/Bradford.

British United Airways, Gatwick Airport (0293 27890) Overhaul all types of aircraft.

British United Island Airways Ltd, Gatwick Airport (Crawley 31177) Aircraft and component overhauls.

Dan-Air Engineering Ltd, Hangar 83, Lasham Airfield, Alton, Hants (0256 83282) Used-aircraft dealer; general parts stockist: overhaul all aircraft up to 160,000lb.

Field Aircraft Services Ltd, No 2 Maintenance Area, Heathrow Airport (759 2141) Business jet total contract maintenance and handling facilities; airline maintenance: aircraft brokerage; licensee for Boeing rain-repellent system; worldwide sales agent for Hunslet Air-Tug.

Aircraft Division, East Midlands Airport, Derby (Derby 31821) Overhaul of all types of aircraft up to Boeing 707/DC-8 size:

working parties worldwide; structural modifications; interior conversions complete service; component overhauls.

Engine and Instrument Divisions, Imperial Way, Croydon, CR9 4LE (688 7777) New factory. Overhaul of R-R Dart and P&W radial engines up to R-2000: Hamilton Standard, Dowty Rotol, Hartzell and McCauley propellers; engine accessories: systems components: electrics: instruments and autopilots: United Control flight recorders (including playback), Bendix service agency.

Laker Airways Ltd, Gatwick Airport (01-668 2471) International Jet Centre due for completion in summer 1969, maintenance and service for all types of aircraft from 1970.

LIGHT AIRCRAFT

Aeromart, 38 Monmouth Street, WC2 (240 1902); Blackbushe Airport (Yateley 3753) Used-aircraft dealer; clothing: equipment and literature stockist: light aircraft maintenance: airport restaurant proprietors.

Air Couriers Ltd, Gatwick Airport (0293 23292) Light aircraft and equipment supply, repair, overhaul and installation: instrument, autopilot and radio stockist: radio overhauls. Bayside: Becker Flugfunkwerk: Brittain Industries: Dare: Florida Aircraft Radio & Marine: Gables Engineering: Narco.

Air Touring Services Ltd, Biggin Hill Airport (Biggin Hill 3652) Sole distributor: Sud-Aviation (SOCATA) light aircraft range: parts stockist. Overhaul light aircraft up to 12,000lb: SOCATA aircraft and component overhauls and electrical, instrument and radio installations: aircraft administration and operation.

Aviation Communications Ltd, Biggin Hill Airport (0959 42233) Overhaul aircraft up to 12,500lb: component and radio overhauls: parts stockist: Narco agent: used-aircraft dealer.

A British United Airways VC10 (left) in the airline's big maintenance hangar at Gatwick Airport, is an example of one of the larger types of aircraft which can be overhauled there

Aviation & General Sales Facilities, Biggin Hill Airport (Biggin Hill 2163) Messerschmitt/Bolkow distributor—parts and service. Flaravia Flying Club—stockist of flying equipment.

BCH Aviation, Cranleigh (814) Light and executive aircraft maintenance: C of A renewals: checks: engine overhaul.

Business Air Travel Ltd, Lympne Airport (0303 68241) Beechcraft dealer: light aircraft and engine maintenance.

Eagle Aircraft Services Ltd, Light Aircraft Division, Leavesden Airport, Watford (Garston 75233) Beech Aircraft distributor: engine and component stockist exchange and service. RCA dealer: Latham Aerotractor distributor: Rolls-Royce parts and service centre: used-aircraft dealer: light aircraft overhaul, including pressurised. Design facilities: installation of all avionics equipment.

Express Aviation Services Ltd, Biggin Hill Airport (0959 42233) Light aircraft and radio overhaul: radio installations: Narco agent: King Radio, Flite-Tronics, Garwin and Delco-Remy dealer: used-aircraft dealer: engine exchanges on request.

Farm Aviation Ltd, Rush Green, Hitchin (Stevenage 55051) Specialist in maintenance and overhaul of agricultural aircraft.

Gregory Air Engineering Ltd, Denham Aerodrome, near Uxbridge (0895 832496) Cessna and Piper parts stockist: used-aircraft dealer: light aircraft overhauls.

Hants & Sussex Aviation Ltd, Portsmouth Airport (0705 62304) Enlarged premises. Overhaul all types of piston engine up to 500 b.h.p.—R-R (GQ 70 exchange service). Continental, Franklin (approved dealer) and Lycoming (factory approval)—and associated engine accessories, propellers (Dowty Rotol, HSD, Hamilton Standard, Hartzell, McCauley (approved service centre) and Sensenich) and governors. Extensions planned to include turbine work. Light aircraft overhauls. Comprehensive parts and exchange facilities: Borg-Warner, Garwin and Stewart Warner (Southwind) service. Used-aircraft dealer. Responsible for Auster aircraft spares and technical support. Associated with Air Engine Services and West London Aero Services.

Leavesden Air Servicing Ltd, Leavesden Airport, Watford (Garston 75266) Overhaul, modifications, repair and maintenance facilities for business, executive and light aircraft. Contract maintenance undertaken. Applications of modern fluid de-icing systems. Overhaul of airframe components and cylinder heads for Gipsy Queen 70 and Gipsy Major. Special installations executed to customer requirement.

Lightplane Maintenance Services Ltd, Elstree Aerodrome, Boreham Wood (953 3586) Light aircraft overhaul.

London Aviation, The London School of Flying Ltd, The Aerodrome, Elstree (953 4411) UK full line Piper aircraft dealer: Lycoming engines: King and Narco radios: used-aircraft dealer.

Mann Aviation Ltd, Fair Oaks Aerodrome, Chobham (7441) Light aircraft overhaul.

Personal Plane Services Ltd, Wycombe Air Park, Marlow (High Wycombe 29432) ARB approved for C of A and overhaul on aircraft up to 7,000lb. Agent: Hoffmann, Legere and Regy propellers: Richter equipment and Badin instruments. Aero Shop: general parts: materials for home builder. Specialists in sales and overhaul of French light aircraft; and in building replica aircraft, film work, etc.

Rollason Aircraft & Engines Ltd, Croydon Airport (688 5151); Redhill Aerodrome (Nutfield Ridge 2212) Agent: SAN, Jodel. Production: Condor, Turbulent and Beta aircraft and Ardern 1500 engines. Service and parts. Remanufacture and conversion of Tiger Moths and Stamperes. Materials for home builder. Used-aircraft dealer. Overhaul: light aircraft: Gipsy, Continental, Lycoming and Ardern engines up to 200 b.h.p. (exchanges): associated accessories and wooden propellers. Permali (Hordern Richmond) agent.

Rudds Aviation Ltd, No 3 Hangar, Ford Aerodrome, Littlehampton (1681) Aircraft maintenance and servicing and special installations.

Shoreham Aviation Services Ltd, East Hangar, Shoreham Airport (Shoreham-by-Sea 5181) Light and executive aircraft maintenance: C of A renewals: checks: engine overhaul.

Simpsons Aeroservices Ltd, Elstree Aerodrome, Boreham Wood (953 2692) Light aircraft overhaul.

Skywork Ltd, Building 48, Stansted Airport (0279 73613) Light aircraft overhaul: used-aircraft dealer.

Southdown Aero Services Ltd, Lasham Airfield, Alton, Hants (Herriard 359) Slingsby Aircraft agent: used-aircraft dealer; glider repairs—construction to order; stockist of P.Z.L. flight instruments and equipment: approved repair organisation for all Polish-built sailplanes: glider shop.

Southern Sailplanes, Thruxton Airport, Andover (Weyhill 373) Glider and light aircraft maintenance and repairs: prototype construction: manufacturer-approved repairer of all glass fibre sailplanes: stockist of materials, spares and glider instruments.

Thurston Aviation Ltd; Thurston Avionics Ltd; Thurston Engineering Ltd, Stapleford Aerodrome, Romford (Stapleford 341); Standon Road, Ongar (2135) Light aircraft, engine, component and radio overhauls: Gipsy and Cirrus engine exchanges: Narco representatives.

Universal Flying Services Ltd, Fair Oaks Aerodrome, Chobham (8075); Rochester Airport (0634 61378) Light aircraft and engine overhaul.

Vendair (London) Ltd., Biggin Hill Airport (0959 42251) Champion Aircraft dealer: used-aircraft dealer: importers and exporters: all types of aircraft parts and ground equipment stocked: light aircraft overhauls.

West London Aero Services Ltd, White Waltham Airfield, Maidenhead (Littlewick Green 3272) Overhaul of light aircraft: factory approved overhaul base for Auster aircraft and spares stockist: appointed Beagle Pup overhaul base and spares stockist: reconditioned exchange service in association with Hants & Sussex Aviation for Gipsy, Cirrus, Lycoming and Continental engines: Hartzell and McCauley propeller overhauls.

Whittemore (Aeradio) Ltd, A. J., Biggin Hill Airport (0959 42211) Narco agent: light aircraft overhauls.

HELICOPTERS

Bristow Helicopters Ltd, Redhill Aerodrome (Nutfield Ridge 2353) Helicopter and light aircraft overhauls.

Campbell Aircraft Ltd, Membury Airfield, Lambourn (770) Bensen Gyrocopter and Gyroglider licence manufacture, kits, parts and service: McCulloch engine parts and service.

Major inspection in progress on a Dan-Air Comet 4. Dan-Air Engineering is approved for the overhaul of all types of aircraft up to 160,000lb at its Lasham base

Twyford Moors Helicopters Ltd, Southampton Heliport (Southampton 23915) Repair and servicing of helicopters: full training and charter facilities available.

LARGE ENGINES

Air Engine Services Ltd, Blindley Heath, Lingfield (2646) Specialist in Pratt & Whitney radial engine and accessory overhauls: current development into Rolls-Royce Dart. Associated with Hants and Sussex Aviation.

Aviation Engineering, High Road, Byfleet (45427) Used-aircraft and engine dealer: light aircraft maintenance: component overhauls: engine top-overhaul—Merlin and light engine specialist.

LIGHT ENGINES

BMG Ltd, 352 High Road, Ilford (590 9436) Velocette agent: engines for ultra-light aircraft and hovercraft: overhauls.

Phoenix Aircraft Ltd, Cranleigh (Lucks Green 3323) Distributor: Agusta and Aeronca JAP engines. Agent: Avions Jodel: Bensen: Nova Star: Rollason: Rolls-Royce Continental, Luton Minor and Major plans and kits. Light engine and instrument overhauls.

Rolls-Royce Ltd, Small Engine Division, Leavesden, Watford (Garston 74000) Sales and support for Allison Division General Motors Corporation Allison Model 250 series engines in many countries throughout the world apart from North America.

COMPONENTS

Airtech Ltd, Haddenham, Bucks (442) Aircraft component, electricals, radio and radar overhauls.

Aviation Activities Overhaul Services Ltd, Willow Lane, Mitcham (648 7080) Fuel, ignition, electrical, hydraulics and pneumatics systems component overhauls and parts stockists.

Aviation Engineering & Maintenance Co Ltd, Ramsgate Airport (0843 51381) Overhaul: fuel injectors and pumps: Dowty Rotol gearboxes: electrical, hydraulic and pneumatic components: instruments and auto-pilots (air-driven gyro only). Parts stockist. Small-part salvage, repair and manufacture to customers' drawings. Manufacturing and marketing rights: cowlings fasteners ex Aero Controls: Amal fuel valves.

Canford Engineers Ltd, Stansted Airport (Bishop's Stortford 3441) Overhaul of

hydraulics, electricals, powerplants, fuel tanks, aerofolds, radio, autopilots, safety equipment, galley equipment and aircraft seats. Associate company, Canford Aircraft Equipment Ltd, is concerned with freight equipment, galleys and bar boxes.

Delaney Gallay Ltd, Edgware Road, NW2 (452 6491 Ext 217) Overhaul all types of oil cooler and heat exchanger.

FPT Industries Ltd, Portsmouth Airport (0705 62391) Flexible fuel tank overhauls.

Hawker Siddeley Dynamics Ltd, Hatfield, Herts (62300) Overhaul facilities for HSD products, e.g., propellers, governors, propeller electronics, rotation indicators, electrical fuel controls, and air conditioning and anti-icing equipment, can be extended to similar products of other manufacture; details on request.

Kearsley Airways Ltd, Stansted Airport (0279 712132) British and American component overhaul: electrical, hydraulics and pneumatics equipment.

Sandall Precision Co Ltd, Bletchley (3456) Overhaul: hydraulic servo equipment and electro-hydraulic valves.

Saywell Ltd, R.F., Gatwick Airport South (0293 29595) General aircraft component overhauls, stockist and exchanges. Used-aircraft dealer.

Staravia Ltd, King's Ride, Ascot (23422) General parts and equipment stockist: component, instrument and radio overhauls.

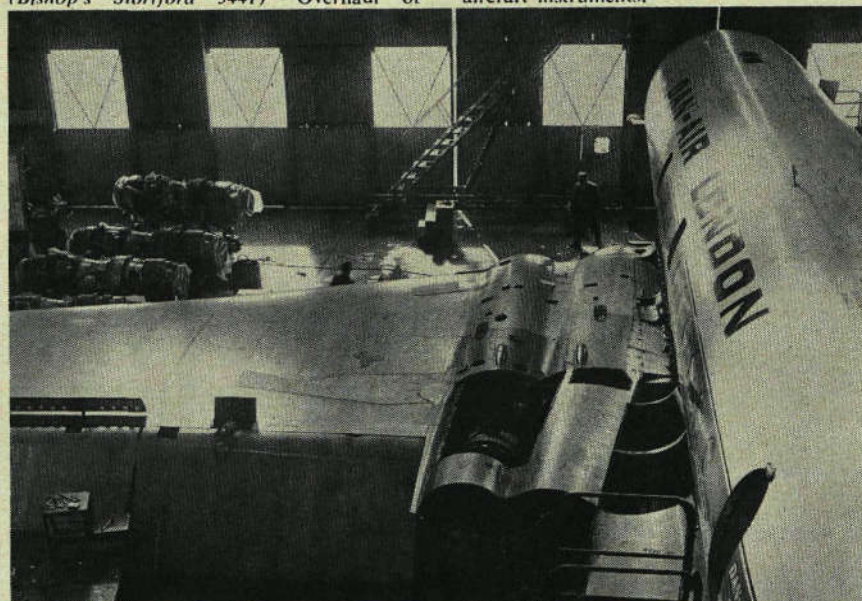
Trans Global Aviation Supply Co Ltd, 338 Kilburn High Road, NW6 (624 6815) Used-aircraft dealer: general components and parts stockist: engine and component overhauls.

INSTRUMENTS

Aeronautical & Commercial Instrumentation Ltd, Chesham (6161) Instrument and autopilot stockist. Overhaul: instruments, autopilots and oxygen breathing equipment.

Aircraft Supplies Ltd, Wallisdown Road, Bournemouth (52511) Manufacture of Midas CMM/3R/B2. Overhaul of all flight instruments, electrical components, gyro, compasses and Midas flight recorder systems.

Airline Instruments Ltd, Elstree Aerodrome, Boreham Wood (953 4912) Instrument and autopilot overhaul: specialist in US light aircraft instruments.



AIRCRAFT OVERHAUL AND REPAIR...

Aviation Instruments Ltd, Gatwick Airport (0293 22922) Instruments, autopilots and general airframe parts stockist; instrument and autopilot overhauls.

Camerer Cuss & Co, 54 New Oxford Street, WC1 (636 4861) Clocks, with and without coded output; watches, time of day and stop; supply, repair, overhaul, and parts.

Fenns (Farnborough) Ltd, Farnborough, Hants (41221) Instrument and autopilot overhauls.

Kollsman Instrument Ltd, Southampton Airport, SO9 3FR (0421 262731) Distributor and stockist: Kollsman Instrument, Kollsman Motor, Kollsman System Technik and Filotechnica Salmoiraghi. Pressurisation equipment and instrument overhauls.

Litco Flight Aids, Corner Hall, Hemel Hempstead (56574) Stockist: electrical components, instruments and autopilots; instrument and autopilot overhauls.

Pandect Instrument Laboratories Ltd, High Wycombe (26301) Overhaul instruments, compasses, autopilots and flight systems. AIM agent and warranty repairs.

Technivision Services, 812 Western Road, Slough (29091) Instrument overhauls.

RADIO

Aeronautical Radio Services Ltd, Camberley (4341) Radio and radar overhaul.

Aircraft & Commercial Reinforced Plastics Ltd, Gresham Road, Staines (51235) Manufacture and overhaul radomes; v.s.w.r. checks; furnishings in g.r.p. made to order; radomes for Viscount weather radar modification kit.

Designed for two BOAC Boeing 747s on overhaul side-by-side, the new hangar is rapidly taking shape at Heathrow Airport—London; it covers about 3½ acres. On March 17 Mr Keith Granville BOAC deputy chairman and managing director (light coat) and Mr Geoffrey Rippon, chairman of Holland & Hannen and Cubitts Ltd, the contractors, tightened the last roof bolt

Airmec Instruments Ltd, High Wycombe (17448) Overhaul and installation: radio and navigation aids. Narco dealers; Kett distributors; low cost ADF.

Collins Radio Co of England Ltd, Heathrow House, Cranford (759 9911) Collins Radio parts and service.

Eagle Aircraft Services Ltd, Commercial Aircraft Division, Heathrow Airport (759 3611 Ext 212) Aviation consultants and international brokers; specialists in commercial aircraft sales and leasing. Consultants and advisers on airline and airfield management techniques. Manufacturer of Ekco E.190 weather radar modification kits for all types of Viscount aircraft.

FieldTech Ltd, Heathrow Airport (759 2811) Distributor: Bendix International; SunAir Electronics; Electronic Equipment Engineering Inc.; Aerocom; Schwiene Engineering; Fritz Hartmann. Agent: Spilsbury & Tindall; Sunbeam Electronics; Rockbestos; United Control Corporation. Parts and service. Radio and radar overhaul—specialise in US products.

RCA Ltd, Sunbury-on-Thames (85511) RCA commercial aviation products sales and service.

ELECTRICS

Aircraft Electrical Services Ltd, Potten End, Berkhamsted (2694) Electrical component overhaul and supply.

Aviation Electrical & Radio Co Ltd, Moons Lane, Horsham (60206) Electrical, electronics and radio overhauls; specialist in connectors and cable assemblies. Stockist: Amphenol; Cannon; Grimes Manufacturing; Plessey Connectors; Thorn Bendix.

Eastern Aero Electrical Services Ltd, Sales: Heathrow Airport (North) (759 1314); Service: Priory Street, Colchester (6173) Electrical equipment exchange and overhaul. Stockist: British Lighting Industries; Hoffmann Manufacturing; International Rectifier; Triplex Safety Glass.

Methodical Engineers Ltd, Thundersley (South Benfleet 2681) Electrical equipment overhaul for all types of aircraft.

Repairstock Ltd, Cranleigh (1071) Electrical and instrument overhauls and parts.

Tomkins Ltd, Marvin, 127 Shirland Road, W9 (286 3022) General aircraft component stockist; new and used aircraft engine dealer; electrical overhauls.

FURNISHING

Beake Ltd, J. A., Kingston Road, Leatherhead (5594) Interior furnishing specialist; on-site working parties.

Benson (AIF) Ltd, J. J., Southend Airport (0702 544605) Interior furnishing specialist.

Crawley Upholstery, Aviation Division, Dolphin House, 183 Rusper Road, Ifield, Crawley, Sussex (0293 22655) Interior refurbishing and re-upholstery; business aircraft interior; fireproofing of upholstery to ARB requirements.

Fliteform Ltd, Heathrow Airport (759 1205) Interior furnishing specialist.

Latex Upholstery Ltd, Lonsdale Road, W11 (229 6262) Cabin and seat retrim; escape chute maintenance.

Mulliner, H. J., Park Ward Ltd, 473 High Road, NW10 (459 6591) Luxury interiors.

Rumbold Ltd, L. A., Old Oak Common Lane, NW10 (965 4802) Interior retrimming and refurbishing specialist—working parties.

Midlands and East Anglia

LARGE AIRCRAFT

Airline Engineering Ltd, Luton Airport (0582 25435) Round-the-clock services from wheel change to complete refurbishing of aircraft up to largest size; sub-assembly manufacture; parts stockist.

Autair International Airways Ltd, Luton Airport (0582 26104) Overhaul piston and turbine-engined aircraft up to One-Eleven size; parts for resale for One-Eleven, Herald, HS.125, HS.748 and Ambassador.

Bott Aviation Services Ltd, Eric, Birmingham Airport (021 SHE 4272, Ex 111) New and used-aircraft, engine and parts dealer; B-licence overhaul aircraft groups 5-1 and 5-2; engine top overhaul 6-1 and 6-2; propeller overhaul by arrangement; on-site inspection, certification and advisory services provided.

Britannia Airways Ltd, Luton Airport (0582 21461) Aircraft overhaul—approved for Boeing 737 and Britannia.

British Midland Airways Ltd, East Midlands Airport (Castle Donington 741) Contract overhaul and maintenance; used-aircraft dealer; parts stockist.

Marshall of Cambridge (Engineering) Ltd, Aircraft Division, Cambridge (56291) Extensive facilities for overhaul of all types of aircraft, systems components and radio; major conversions; interior furnishing; design; machine shops; manufacturing facilities, Grumman Gulfstream service and parts; Lockheed C-130 service centre.

LIGHT AIRCRAFT

Agricultural Aviation & Engineering Ltd, No 3 Hangar, Norwich Airport, NOR 60N (0603 44681) Light aircraft maintenance; ARB approval pending for overhaul up to 7,000lb; engine top-overhaul groups 6-1, 6-2.

Brooklands Aviation Ltd, Civil Repair Service, Sywell Aerodrome, Northampton (43113) Light aircraft, component and radio overhauls.

CSE (Aircraft Services) Ltd, Oxford Airport (0096 53931); Halfpenny Green Airfield, Bobbington (0384 88340); Newcastle Airport, Woolsington (0632 860418). Distributor and stockist: engines, all light aircraft components and equipment. Aircraft and engine overhauls and maintenance—groups 5.1, 5.2 and 5.3 and Jetstream; radio and radar overhaul; Piper Aircraft assembly and validation for CSE Aviation. Manufacturers represented: Agavenco; Alcor; Bendix; Collins; Delco-Remy; Hartzell; King; Lycoming; Narco; Prestolite; RCA; REA; Scott; Sensenich; Stewart Warner.

Executive Air Engineering Ltd, Coventry Airport (023 312439) Light aircraft overhaul including HS.125; conversions and special installations; radio workshops; parts stockist; exchanges; aircraft handling; King Radio agent.

Gilbert Aeroservices, Norwich Airport, Norwich, NOR S2A (45846) Sud-Aviation (SOCATA) agent; used-aircraft dealer; light aircraft overhauls.

Gliderwork, Husbards Bosworth Airfield, near Rugby (0645 82375) Glider overhauls; barograph calibration.

Gregory Engineering Ltd, Birmingham Airport (021-743 8124) New and used-aircraft dealer; light aircraft overhauls; radio installations.

Hall & Co, H. J., Leicester East Aerodrome (Great Glen 2175); Tollerton Aerodrome (0602 89692) Light aircraft overhauls.



AIRCRAFT OVERHAUL AND REPAIR...

Luton Flying Club Ltd, Luton Airport (0582 24426) Light aircraft overhaul; used-aircraft dealer; Airtour Shop airfield agent.

McAlpine Aviation, Sir Robert McAlpine & Sons Ltd, Aviation Division, Luton Airport (0582 24182) Piper Twin Line dealer, Rinaldo Piaggio and Helio Aircraft distributor—service and parts including engine exchanges. Private and business aircraft overhaul specialists: radio overhaul and installations.

Nipper Aircraft Ltd, East Midlands Airport (Castle Donington 779) Nipper design, manufacture and sales rights: light aircraft radio. Agent: Nelson engines (48 b.h.p., 4-cylinder two-stroke). Light aircraft maintenance.

Norfolk & Norwich Aero Club, Swanton Morley Aerodrome, East Dereham (Swanton Morley 274). Light aircraft overhauls: radio installation.

Rogers Aviation Ltd, Great Barford, Bedford (62441); No 1 Hangar, Cranfield Aerodrome (0230 45661) Sole full-line Cessna Aircraft dealer. Dealer: R-R Continental engines (exchanges); ARC, Bendix, King, Narco, RCA radios and radar; ARC, Brittain, Cessna, Honeywell autopilots; McCauley propellers. Service and parts. Used-aircraft dealer. Overhaul: light aircraft instruments, autopilots, radio, radar, and top overhaul.

Truman Aviation Ltd, Nottingham Airport, Tollerton, Nottingham (52881) Beagle Aircraft distributor; Piper Aircraft regional agent; Lycoming and Hartzell service under concession arrangement with H. J. Hall & Co and Executive Air Engineering for airframe/engine and radio services respectively. Sales agent for Lycoming, Hartzell, King, Narco and Bendix.

Warden Aviation & Engineering Co, Old Warden Aerodrome, Biggleswade (Northill 288) Specialists in restoration and servicing of veteran and vintage aircraft: skilled aircraft woodworkers; C of A work on Tiger Moths and comparable types undertaken.

HELICOPTERS

Autair Helicopter Services Ltd, Luton Airport (Luton 22661) ARB approved for all helicopter overhaul including damage repairs: specialise in Bell JetRanger after-sales service.

British Executive Air Services Ltd, Oxford Airport (0096 54151) Brantly Helicopter distributor—parts and service: helicopter overhauls.

Management Aviation Ltd, Bourn, Cambridge (Madingley 314) Light helicopter overhauls: spray-gear specialist; Hiller service and parts.

LARGE ENGINES

Alvis Ltd, Coventry (25501); Flight Department, Coventry Airport (0203 312311) Lycoming piston engine overhaul, exchange, parts and service; Daughter Design Authority for Lycoming, P&W and other US piston engines in UK. Service support: Bendix ignition and fuel equipment; AiResearch turbochargers and control equipment; Marvel-Schebler carburetors; Rover Gas Turbines. Light aircraft and helicopter overhaul.

LIGHT ENGINES

Rolls-Royce Ltd, Motor Car Division, Crewe (0270 55155) Continental light aircraft engines sales, service, parts outside the Americas and Japan: overhauls and exchanges.

Specialised work on helicopters is undertaken at the Redhill base of Bristow Helicopters Ltd. Here piston-powered Whirlwinds are being converted to Gnome Whirlwinds for civil use



COMPONENTS

Goodyear Tyre & Rubber Co (GB) Ltd, The, Wolverhampton (22321); Heathrow Airport (759 1922) Service and replacements for US Goodyear tyres, wheels and brakes.

Hulme, John, Bottisham Cambridge (0220 28323) Glider components, instruments and repairs; hire service of two-seater training gliders.

Lucas Gas Turbine Equipment Ltd, Birmingham 28 (021 SPR 3232) Lear/Romec fuel pumps licensee and service agent.

FURNISHING

Stemp & Co Ltd, E.F., 154 Bromsgrove Street, Birmingham 5 (021 643 0959) Interior furnishing specialists.

Wales, S.W. England and the Channel Islands

LARGE AIRCRAFT

Western Airways Ltd, Weston-super-Mare Airport (28151). Aircraft overhaul: component manufacture.

LIGHT AIRCRAFT

Breeze, F., Airport, Dunkeswell, Honiton (350) Glider construction, sales and overhaul; used-aircraft dealer: light aircraft overhaul; instrument calibration.

Channel Islands Aero Services Ltd, Jersey Airport (Central 42373) Cessna dealer: used-aircraft dealer: light aircraft maintenance and overhaul, engine top overhauls, Cessna 150/172 spares.

Glos Air Ltd, Staverton Airport, Cheltenham (0452 713385) Aero Engine Services (NZ) distributor—construction of Glos-Airtourer 115, parts and service; King Radio and Narco dealer; most current light aircraft parts and standard parts stocked; used-aircraft dealer: light aircraft overhauls.

Plymouth Airport Ltd (Plymouth Aero Club), Crownhill, Plymouth (72752) Limited light aircraft overhauls.

Shobdon Aviation Co Ltd, Shobdon Aerodrome, near Leominster (Kingsland 452) Light aircraft overhaul: parts stockist: used-aircraft dealer.

South West Aviation Co Ltd, Exeter Airport (0392 66584); Bristol (Lulsgate) Airport (Lulsgate 444); Swansea Light aircraft maintenance; Tiger Moth parts.

Westcountry Aircraft Servicing Ltd, Exeter Airport (0392 68166 Ex 5). Light aircraft overhauls: maintenance on Skyvan 3.

LARGE ENGINES

BOAC Engine Overhaul Ltd, Treforest Industrial Estate (Treforest 2041) Overhaul: R-R Avon, Conway 508, 540/550; P&W JT3D-3B and JT9D; Lucas Gas Turbine fuel control systems; Lucas and Hamilton Standard fuel pumps.

LIGHT ENGINES

Aviation Jersey Ltd, La Haule, St Brelade, Jersey (Central 25301) Plans to erect new factory on Rue de Prés trading estate for manufacture of engine parts and overhaul of aero engines.

COMPONENTS

Flight Refuelling Ltd, Wimborne (2121); Tarrant Rushton Airfield, Blandford (Blandford 2501) Overhaul: aircraft: gas turbine engines; systems components: instruments; autopilots: radio and radar: safety equipment.

Permal Ltd, (incorporating Horden-Richmond Ltd), Gloucester (28282) Design, manufacture and repair of helicopter rotor blades and propellers for light aircraft and hovercraft.

RADIO

Nautair Ltd, Jersey Airport Radio servicing.

ELECTRICS

Wynn (Aircraft) Ltd, E.D., Staverton Airport, Cheltenham (0452 713264) Electrical and instrument overhauls and stockist.

Northern England

LARGE AIRCRAFT

Servisair Ltd, Manchester Airport (061 MER 1372); Leeds/Bradford Airport (Rawdon 3251); Belfast (Aldergrove) Airport (Crumlin 701) Full line maintenance and/or maintenance back-up facilities for scheduled and charter operators, for all types of aircraft.

LIGHT AIRCRAFT

Air Navigation & Trading Co Ltd, Blackpool Airport (Blackpool 45396) Used-aircraft dealer: light aircraft overhauls: radio installations, general maintenance and parts.

Cumberland Aviation Services Ltd (Casair), Carlisle Airport (Crosby-on-Eden 641) Beagle Aircraft and Airtour Products dealer and stockist; used-aircraft dealer: light aircraft overhaul.

Darchem Aero Ltd, Aircraft Maintenance Service, Tees-side Airport, near Darlington (Dinsdale 332) Private and business aircraft overhauls.

AIRCRAFT OVERHAUL AND REPAIR...

Northair Aviation Ltd; Northair Electronics Ltd, PO Box 42, Leeds/Bradford Airport (0973 72251) Dealer: Cessna Aircraft; ARC; Jeppesen; Narco; RCA—service and parts. Distributors for King Radio and Brittain autopilot systems. Used-aircraft dealer. Light aircraft, propellers, components and radio overhauls; maintenance facilities also at South Yorks Airport, Doncaster.

Slingsby Aircraft Co Ltd, Kirbymoorside (751) Glider and light aircraft overhauls.

Westair Flying Services Ltd, Blackpool Airport (42660) Cessna Aircraft single-engine dealer; Rolls-Royce Continental, McCauley and Weston-Garwin dealer; ARC, Brittain Industries and King Radio distributor; used-aircraft dealer. Light aircraft, electrical, instruments and radio overhauls.

Yorkshire Light Aircraft Ltd, Leeds/Bradford Airport (0973 73133) Rolls-Royce Continental service centre—parts and exchange accessories. Narco radio warranty service dealer. Light and executive aircraft overhauls and repairs.

COMPONENTS

Avia Engineering Ltd, Hangar 88, Liverpool Airport (051 GAR 4141) Electrics and hydraulics overhauls; DC-3, DC-4, DC-6 parts stockist.

Burnley Aircraft Products Ltd, Repair Division, Burnley (7681) Overhaul: gas turbine combustion components.

RADIO

Park Air Electronics, Stamford, Lincs (2187) Manufacturers of ground to air communications equipment. Manufacturers of headsets, boom microphones and carbon microphone matching amplifiers; intercoms; audio units. Limited overhaul and maintenance facilities for Class III aircraft radio. Full overhaul and spares for own products including Nipper radio.

ELECTRICS

Carlux Electrical Services Ltd, Victoria Road, Chester (21202) Electrical and instrument overhauls.

Scotland and Ireland

LARGE AIRCRAFT

Scottish Aviation Ltd, Prestwick Airport (0292 79888) SALchek service covering all types of aircraft; major conversions including Viscount freighter and Dart-Convair. Hamilton Standard propeller (23E50), airframe component, instrument and radio overhauls. Design; manufacture; testing; airport handling service.

Short Brothers & Harland Ltd, Belfast 3 (58444) Flying Services Division's maintenance services provided for various Government and civil operators.

LIGHT AIRCRAFT

Air Service Training, Perth Aerodrome (OPE8 51122) Cessna Aircraft dealer—150, 172, 310—parts and service; Rolls-Royce Service Centre—Continental 0-200 and IO-470 engine and carburettor overhaul and parts; Gipsy, Lycoming and Franklin top overhaul; light aircraft, radio, and Southwind and Janitrol cabin heater overhaul; used-aircraft dealer; general parts stockist.

Headfort Aviation, Kells, Co Meath, Ireland (Ceanannus Mor 3) Lake LA-4 distributor; used-aircraft dealer; light aircraft overhauls.

Loganair, Hangar 10, Glasgow Airport (041 TAN 1549) Agent: Piper Aircraft, Messerschmitt-Bölkow. Light aircraft maintenance.

Strathair, Auchterarder (2545) Major maintenance, overhaul and C of A on American and British light aircraft up to Aztec or Dove size; maintenance and top overhaul of light aero engines.

LARGE ENGINES

Scottish Air Engine Services, Prestwick Airport (Prestwick 79888) Overhaul and repair: P&W R.1830 and R.2000 and associated accessories, parts, supply and exchange scheme operating—Avco Lycoming overhaul projected.

COMPONENTS

A.G.T. Precision Engineering Ltd, Spiersbridge Terrace, Thornliebank, Glasgow S2 (041-638 2265) Engine and airframe accessory and electrical component overhauls and parts; ignition specialist and stockist of magnetos and components; overhaul of air conditioning and heating equipment and fuel heaters.

INDUSTRY International

Rolls-Royce/Lockheed Agreement A technical collaboration agreement on carbon fibre reinforced composite materials has been signed between Rolls-Royce Ltd and the Lockheed Aircraft Corporation, under which Rolls-Royce will make available to Lockheed on agreed financial terms and on a non-exclusive basis its carbon fibre process technology for application to Lockheed products. In return, Lockheed will provide a feedback on carbon fibre process technology improvements covering the treatment and impregnation of carbon fibres, and will make available certain manufacturing techniques relevant to gas turbine and associated technologies. The joint licensing agreement was negotiated by Rolls-Royce on behalf of the National Research Development Corporation and the company wishes to acknowledge the full co-operation and support it has received from the NRDC.

To Avoid Cost Escalation Although completed as long ago as December 1966 the report of the Steering Group on Development Cost Estimating was only published last week and the main recommendations it makes are now seen to be grouped under the following headings. First, it asked for improved staffing for management of projects including the

setting up of the nucleus of a project team at an early stage, and secondly, improving the ability of the staff of Mintech to evaluate effectively the programmes planned by contractors and their cost estimates.

For major projects the Steering Group's third suggestion was the introduction of a project definition stage of longer duration and greater depth than the kind of project study recommended in the Zuckerman report. They said that a well-founded decision on full development needed to be taken at a point further along the road than had been the case in the past, and that this would not mean any lengthening of overall time scales. Finally the Group looked for improvement in the method used in industry for programming, estimating, and control of development projects.

In order to examine the methods used in industry for estimating the cost of developing and producing defence equipment and the methods used both in industry and the ministries for controlling costs against estimates, the Steering Group was formed with senior administrative and technical officials, and it employed the services of consultants from Associated Industrial Consultants Ltd. and P.A. Management Consultants Ltd. During 1967 and 1968 the report

was studied by the then Ministry of Aviation and later the Ministry of Defence, and then went to the Electronic Engineering Association and the Society of British Aerospace Companies for discussion.

The Government has accepted all the recommendations made in the report and action has already been taken on most of them. The report has been published because of its interest to all those concerned with estimating and monitoring advanced technological projects. Published by Her Majesty's Stationery Office, the report comes in two volumes. Volume 1 at 10s 0d and Volume 2, which is a handbook of procedures based on the best current practice in the defence field, at 15s 0d.

Pye Research Moon Samples Two British scientists, Dr G. Eglinton and Mr J. R. Maxwell of Bristol University, will use a Pye Series 104 Model 64 Chromatograph in their analysis of a sample of the surface of the Moon due to be brought back by the astronauts who will set foot on the Moon's surface in the course of the forthcoming Apollo 11 mission in July. Moon surface material is to be sealed in sterile canisters and NASA is to issue small pieces to some of the world's leading scientists.



Continued from page 480

Post-Apollo manned programmes have been put forward for consideration, although the scale of spending will be considerably reduced from that of Apollo. NASA has requested \$2 thousand million for 1970 for manned space flight, of which \$1.6 thousand million is earmarked for Apollo and \$345 million for the Apollo Applications programme. The first of only two AAP flights will now almost certainly slip to 1972.

Another advanced programme for which Congress is expected to approve more money next year is Nerva, the nuclear engine for rocket vehicle application. NASA has asked for \$27.5 million to carry through its share of the work, in association with the Atomic Energy Commission, to develop the 75,000lb-thrust flight-rated engine already approved (\$22.1 million was voted for Nerva in fiscal 1969). As the upper stage on a Saturn V, Nerva could add 60-70 per cent to the payload for a lunar landing, or could double the payload for deep-space work (see news item below).

ORBITER SATELLITE FOR GRAND TOUR?

For some time NASA has been examining a most ambitious unmanned flight to the outer planets in 1977-1978. Recently it has been suggested that the spacecraft would carry a pick-a-back satellite which could be placed in orbit around one of the planets during the journey. The "grand tour," as it is known in NASA, is based on the favourable configuration of the outer planets Jupiter, Saturn, Uranus and Neptune, which would enable a reasonably fast journey to be made (using the gravitational field of each planet to generate the velocity required to fly-by the next planet) without the necessity for developing new rockets.

Such a programme would have to overcome a number of substantial technical hurdles: power generation, communications and reliability, for example, pose problems which have not yet had to be faced. Using a Titan 3D-Centaur launch vehicle (the same combination as that which will launch the 1973 Viking Mars-landing spacecraft) the cost of the project is estimated at between \$100 million and \$200 million. The payload could be increased by using a Saturn V with a nuclear-powered upper stage, making possible the addition of a satellite which could be detached from the spacecraft and placed in orbit around a selected planet. The critical lead-time item would be the propulsion system; about \$1.2 thousand million has already been spent on nuclear propulsion work, according to Dr Milton Klein, manager of the NASA-Atomic Energy Commission Space Nuclear Propulsion Office, and a further \$1.1 thousand million would be needed to develop a flight-rated system. At present a 75,000lb-thrust Nerva (nuclear engine for rocket vehicle application) stage is being developed for use with Saturn V for planetary missions, and would approximately double the payload of the proposed Saturn-Centaur Vehicle. For a Jupiter fly-by, the Saturn-Nerva combination would, apparently, allow a payload of about 70,000lb.

Assuming that the target date of 1976 for the first Nerva flight is met, the "grand tour" could be the first application of nuclear propulsion to spaceflight.

SPACE SHUTTLE STUDIES

Two contracts, each worth \$300,000, have been awarded by NASA-Marshall Space Flight Centre to Lockheed and General Dynamics for six-month studies of low-cost manned space-shuttle systems. Two similar study contracts have been given to North American Rockwell and McDonnell Douglas by the Manned Spacecraft Centre and Langley Research Centre respectively. The contract for ILRV (integral launch and

re-entry vehicle) studies will be concerned with different aspects of these vehicles, and a joint review group from the three NASA establishments will co-ordinate the work of the four firms.

A re-usable transportation system for the post-1974 period is considered to be essential for the support of proposed future space stations. The Lockheed proposal will emphasise a 1½-stage configuration, in which one or more expendable propellant tanks are attached to a central spacecraft. The GD study will compare fly-back and simple expendable lower-stage configurations. In the fly-back concept the lower vehicle stages would return to Earth after exhausting their propellants.

RUSSIAN WEATHER SATELLITES

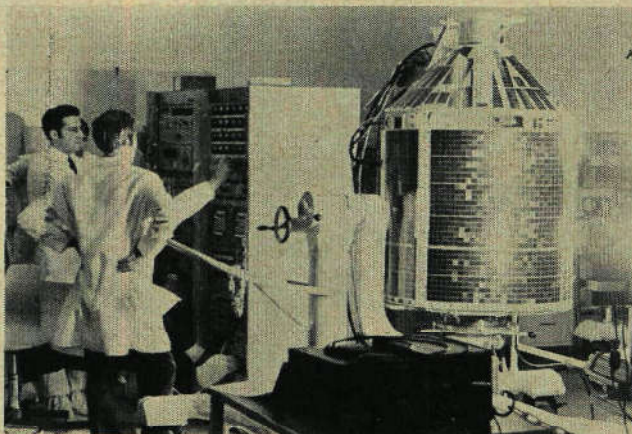
One of the main applications of the Soviet Meteor system of meteorological satellites is the detection and tracking of ice formations, notably in the Antarctic. Writing in *Izvestia* recently, Victor Bugayev, head of the Russian meteorological service, has made some pertinent comments on the value of the system. Cosmos 226 (launched on June 12 last year into a 403×374 miles, 81.2° orbit) is currently transmitting daily observations and photographs of the sea ahead of the 14th Antarctic Expedition.

A complete map of the Antarctic coast and ice packs around the continent was compiled for the first time last December using weather satellites. The first such satellite, according to Bugayev, was Cosmos 144 which, launched on February 28, 1967, transmitted data until March last year; presumably this comment refers to the operational system, since a previous metsat (Cosmos 122) was given some publicity since its launch on June 25, 1966, was witnessed by President de Gaulle. Last year the Russian meteorological organisation was served by Cosmos 184 and Cosmos 206, and over 11,000 cloud charts were compiled and broadcast under the international exchange scheme. Data is transmitted by wire to Novosibirsk, Tashkent, Khabarovsk, Prague, Warsaw, Sofia and Washington; 1,550 advisory telegrams were sent to Cairo and New Delhi.

Cloud formations on the day side of the Earth are photographed by conventional TV cameras, on the night side by infra-red equipment.

Gp Capt Edward Fennessy, managing director of Plessey Electronics Group, has been appointed chairman for 1969 of the National Industrial Space Committee. He will head that organisation (sponsored by the SBAC, the Electronic Engineering Association and the Telecommunication Engineering and Manufacturing Association) in representing to the British Government the views of the aerospace, electronics and telecommunications industries in space matters.

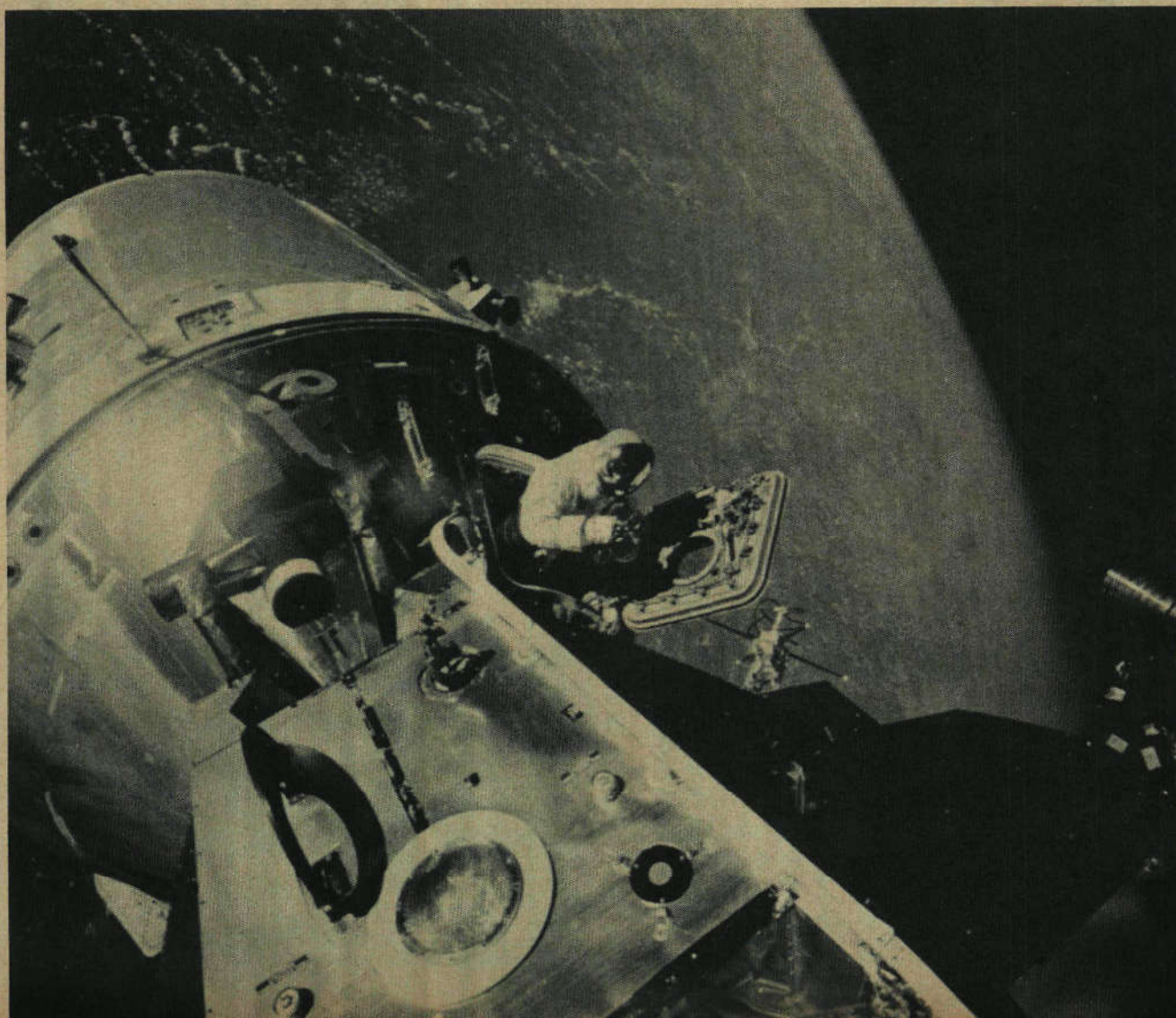
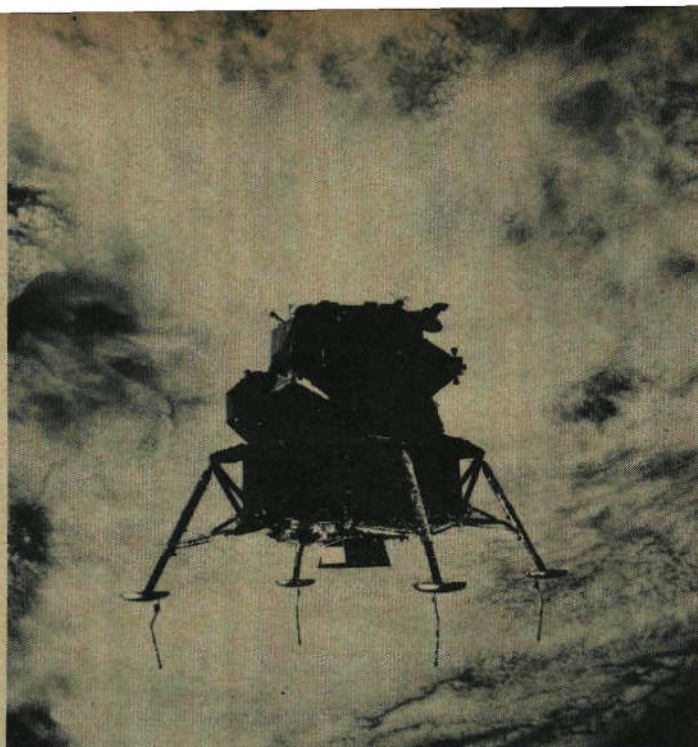
The first West German satellite, Azur, is now under construction at Bölkow. This scientific satellite contains seven experiments, weighs 172lb and will be launched by NASA Scout rocket from the Western Test Range next October. The satellite is seen undergoing its first solar-cell test, in which it is exposed to artificial sunlight





Apollo 9's big day

Right, Apollo 9 lunar module in its natural environment on March 7, shortly after separation from the command module. The vehicle was upside-down in relation to the Earth at that time. Below, this view of the CM was taken from the LM on the previous day. David Scott is seen retrieving samples from the CM skin.





Overlooked by the Omega badge on the fin of the first Phantom F-4K of 892 Sqn, probably the last FAA fixed-wing squadron to be commissioned (see story below): the CO, Lt Cdr Brian Davies (right), and Senior Observer, Lt Cdr Peter Goddard, at RNAS Yeovilton



892 Commissioning: end of an era?

NEXT MONDAY, MARCH 31, No 892 Sqn with its McDonnell Douglas Phantom F-4Ks is being commissioned at RNAS Yeovilton. Unless there is a dramatic change in British defence policy, it will be the last fixed-wing squadron in the Fleet Air Arm—a Greek Omega (Ω), last letter in the alphabet, has been chosen as its badge; so March 31, 1969, is a watershed date for British Naval aviation. Significantly, it is the day before April 1, foundation date of the Royal Air Force.

For the fixed-wing element of the FAA, however, the writing has been on the wall ever since the 1966 Defence Review. Yet, judging from the high morale its personnel have sustained, it is hard to believe that it is now only a matter of 2½ years before the Government phases out the aircraft carriers and the subsequent hand-over of the Naval Buccaneers and Phantoms to the RAF takes place.

Analysing the factors which have kept morale so high, one must first look to the leadership: admirals and commanding officers, rather than raising false hopes, have used the theme "we have a job to do, let's get on with it" for all communications. Although this has not alleviated any of the fears which inevitable redundancies will bring, it has acted as a reminder that whatever the future holds there is work to do right up to the last day.

The greatest mistake which can be made in putting up arguments for the retention of any military force is to bring out the past. The Fleet Air Arm is some 55 years old as far as history books are concerned. During the First World War it proved its worth with the skill and devotion of its aviators. It was believed then that everyone had been convinced of the effectiveness of Naval air power. Second World War honours, highlighted by the Swordfish attack on the Italian battle fleet at Taranto, revolutionised

Naval tactics. The Navy ended the war with a front-line strength of 1,300 aircraft and 70,000 officers and men. But all this does not provide an argument for existence in an era which demands cost-effectiveness from its forces.

Main consideration must be the development of aircraft carriers in post-war years, for example *Ark Royal*, on which £30 million has been spent to refit it for 18 months' operation.

Commissioning of 892 Sqn marks the beginning of the final phase. If those who decide defence policy have not referred to the past in their decisions, they certainly cannot help history repeating itself. So once more Naval air forces are run down, and no one can be more aware of the repercussions than Naval airmen; yet it reflects their quality that they should continue to be so keen to achieve such high standards, in a profession which describes flying from a

carrier as the peak of airmanship. There is little doubt that even if the Phantom is the last aircraft the Navy will teach itself to operate, the type will bring out the best from its aviators.

The Navy has approached the task of introducing the Phantom into the Fleet methodically, starting in May 1968 with 700 Sqn, the Intensive Flying Trials Unit. Although the aircraft presented a proven airframe, data on the Rolls-Royce Spey had to be collated and weapon system and performance evaluated.

In January this year, with the trials almost complete, the first training squadron, 767, was formed. Its task is not only to train RN pilots and observers but ironically to train the RAF crews destined to fly the fighter version of the Phantom going into service with the RAF (the remainder of the aircraft originally ordered for the Navy).

While the trials and pilot training have progressed, the Naval Test Squadron at Boscombe Down has been engaged in preparing the aircraft for the decks of *Ark Royal*. Recently the first touch-and-

Czechoslovakian jet trainer, the L-39, powered by a Walter Titan (Ivchenko AI-25W) turbofan of 3,307lb s.t. It has been designed to meet the requirements of a Soviet specification for an L-29 Delfin successor as a standard Warsaw Pact basic trainer





Straight and Level



By 1970 BOAC will have seven Boeing 707-320Cs, of which five will be passenger aircraft. Do you remember BOAC's estimates in 1964, when they cancelled all those Super VC10s, that by 1970 they would need only two 707-320Cs? It seems they cancelled at least five too many Super VC10s.

Who checked their estimates? Nameless officials. All right, who was responsible? The then Minister, Mr Julian Amery. Where is he now?

Writing articles in the newspapers and saying that someone in the Government ought to be "impeached" for something or other.

● "EASTERN AIRLINES SIGNS FOR ATARS," proclaimed the Eastern press release headline.

For one ghastly moment I thought that their 50 Lockheed 1011 TriStars, were not going to have Rolls-Royce engines after all.

ATAR turns out to be an Automated Travel Agent Reservations system.

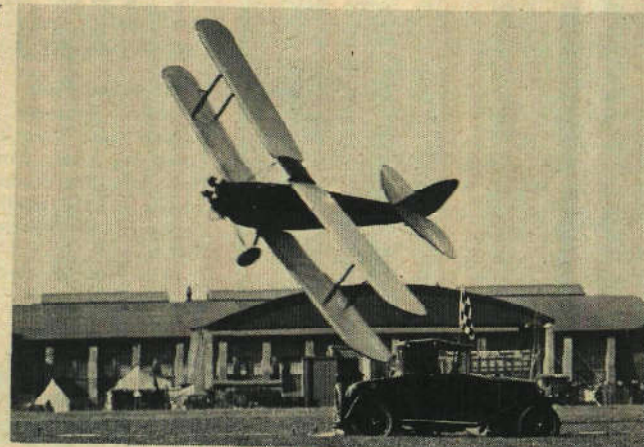
I wonder if automated travel agents get invited on all those "inaugurals."

The modifications, including the replacement of a spare broom would take several weeks, said a corporation spokesman.

From a news item about NAC Viscount modifications in the "Wellington Evening Post," March 2, 1969



There's quite a lot of traffic congestion on the roads these days... (Cessna 172 after a forced landing near Raleigh, North Carolina)...



... not to mention on the airfields... (D.H. 60 Genet Moth at Lympne in the 20s)

● United Air Lines is conducting special courses for staff "to develop a sensitivity to the individual needs and feelings of passengers." The programme is designed, we are told, "to teach employees empathy—the ability to project oneself into the other fellow's shoes."

Sounds pretty corny.

● "Total intra-mural expenditure in the United Kingdom on Concorde is now estimated at £40 million," said Mr J. P. W. Mallalieu, Minterch Minister of State, in a recent written answer to a Commons question.

That is £10 million more than the last published cost of Concorde work being done in Ministry establishments. Mr Mallalieu did not say that it was £10 million more. I can only suppose he didn't know. It seems a funny way to account for such a non-paltry sum.

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Overlooked by the Omega badge on the fin of the first Phantom F-4K of 892 Sqn, probably the last FAA fixed-wing squadron to be commissioned (see story below): the CO, Lt Cdr Brian Davies (right), and Senior Observer, Lt Cdr Peter Goddard, at RNAS Yeovilton



892 Commissioning: end of an era?

NEXT MONDAY, MARCH 31, No 892 Sqn with its McDonnell Douglas Phantom F-4Ks is being commissioned at RNAS Yeovilton. Unless there is a dramatic change in British defence policy, it will be the last fixed-wing squadron in the Fleet Air Arm—a Greek Omega (Ω), last letter in the alphabet, has been chosen as its badge; so March 31, 1969, is a watershed date for British Naval aviation. Significantly, it is the day before April 1, foundation date of the Royal Air Force.

For the fixed-wing element of the FAA, however, the writing has been on the wall ever since the 1966 Defence Review. Yet, judging from the high morale its personnel have sustained, it is hard to believe that it is now only a matter of 2½ years before the Government phases out the aircraft carriers and the subsequent hand-over of the Naval Buccaneers and Phantoms to the RAF takes place.

Analysing the factors which have kept morale so high, one must first look to the leadership: admirals and commanding officers, rather than raising false hopes, have used the theme "we have a job to do, let's get on with it" for all communications. Although this has not alleviated any of the fears which inevitable redundancies will bring, it has acted as a reminder that whatever the future holds there is work to do right up to the last day.

The greatest mistake which can be made in putting up arguments for the retention of any military force is to bring out the past. The Fleet Air Arm is some 55 years old as far as history books are concerned. During the First World War it proved its worth with the skill and devotion of its aviators. It was believed then that everyone had been convinced of the effectiveness of Naval air power. Second World War honours, highlighted by the Swordfish attack on the Italian battle fleet at Taranto, revolutionised

Naval tactics. The Navy ended the war with a front-line strength of 1,300 aircraft and 70,000 officers and men. But all this does not provide an argument for existence in an era which demands cost-effectiveness from its forces.

Main consideration must be the development of aircraft carriers in post-war years, for example *Ark Royal*, on which £30 million has been spent to refit it for 18 months' operation.

Commissioning of 892 Sqn marks the beginning of the final phase. If those who decide defence policy have not referred to the past in their decisions, they certainly cannot help history repeating itself. So once more Naval air forces are run down, and no one can be more aware of the repercussions than Naval airmen; yet it reflects their quality that they should continue to be so keen to achieve such high standards, in a profession which describes flying from a

carrier as the peak of airmanship. There is little doubt that even if the Phantom is the last aircraft the Navy will teach itself to operate, the type will bring out the best from its aviators.

The Navy has approached the task of introducing the Phantom into the Fleet methodically, starting in May 1968 with 700 Sqn, the Intensive Flying Trials Unit. Although the aircraft presented a proven airframe, data on the Rolls-Royce Spey had to be collated and weapon system and performance evaluated.

In January this year, with the trials almost complete, the first training squadron, 767, was formed. Its task is not only to train RN pilots and observers but ironically to train the RAF crews destined to fly the fighter version of the Phantom going into service with the RAF (the remainder of the aircraft originally ordered for the Navy).

While the trials and pilot training have progressed, the Naval Test Squadron at Boscombe Down has been engaged in preparing the aircraft for the decks of *Ark Royal*. Recently the first touch-and-

Czechoslovakian jet trainer, the L-39, powered by a Walter Titan (Ivchenko AI-25W) turbofan of 3,307lb s.t. It has been designed to meet the requirements of a Soviet specification for an L-29 Delfin successor as a standard Warsaw Pact basic trainer





go landings were made on *Eagle* and the first arrested landings are expected to be carried out in June.

Commissioning of 892 Sqn is therefore just another step in the methodical plan which culminates when the squadron embarks in *Ark Royal* next year. As a tangible reminder that this is the last fixed-wing FAA squadron to form, the insignia on the tail fin of 892's aircraft will be a black Omega, the last letter in the Greek alphabet denoting the end, the black, suggestive of mourning.

892 was first formed with American aircraft, the Grumman Wildcat, in 1942: its history typifies that of any other Fleet Air Arm squadron—operating during the war in defence of Atlantic convoys and in the post-war period at almost every sphere of operational activity: flying from *Eagle* at Suez, from *Centaur* during the Indonesian confrontation, the Radfan fighting and the Dar-es-Salaam crisis. More recently equipped with Sea Vixens, 892 embarked in *Hermes* and was present at the last phase of the Aden withdrawal. In February last year it returned to the UK to form an outstanding aerobatic team—Simon's Circus.

In its new commission, 892 will be commanded by Lt Cdr Brian Davies, AFC,

who is 35, but whose team will be a young one, mostly converted from Sea Vixen squadrons with flying experience in Phantoms gained in 767 Sqn. No doubt with his experience gained test flying Phantoms in the US and then as Senior Pilot of 700P Trials Unit, Lt Cdr Davies will mould them into traditional Fleet Air Arm shape. *Ark Royal*, the carrier his team will embark in, is looked upon as the ideal fighting unit—a mobile airfield with Buccaneers capable of striking a wide variety of targets, Sea King helicopters for AS operations, and Gannets, still the only British AEW aircraft: and where the Phantom can be used not only for air cover but in a subsidiary ground attack role.

The last days of this carrier will be depressing for those who believe history will repeat itself. Already there is talk (*Flight*, March 13, pages 422-423) of taking the Harrier to sea with an uprated Pegasus, and with RAF aircrew.

Admiral Horacio Rivero, USN, NATO Commander-in-Chief South, said recently when talking about the Soviet fleet in the Mediterranean that surface ships operated at a very great disadvantage when they did not have the air power required for any Navy to survive, and that a ship operating in an area where the enemy has control of the air does not survive very long. At least such a possibility, as far as the Royal Navy is concerned, is safeguarded against in the next 2½ years.

Marine Corps Harriers

PLANS FOR THE United States Marine Corps to order Hawker Siddeley Harriers were announced on Wednesday of last week, March 19, by the US Secretary of Defence, Mr Melvin Laird. This initial order is understood to be for 12 aircraft, but may subsequently be increased to 100 (see *Flight* for December 19, 1968), though doubts have been expressed (*Flight*, January 30) about the Marine Corps getting budgetary approval for a big Harrier purchase.

In the Air Estimates debate in the Commons on March 19, when United States orders were discussed Mr Robert Howarth (Lab, Bolton, East) commented that USMC interest in the Harrier, "though it went out at one stage, has now reappeared in a modest way and, we hope, will go ahead."

Malaysian Mission

AN EVALUATION TEAM from the Royal Malaysian Air Force, headed by the Chief of the Air Staff, Air Cdre Sulaiman bin Sujak, was visiting Britain this week to "see and discuss the aircraft which might meet their needs."

This was stated in the Air Estimates debate in the Commons on March 19 by the Minister of Defence for Equipment, Mr John Morris, who said he would be having talks with the team and assured the Commons that the MoD, Mintech and the companies concerned would give the visitors all the help and advice they could. He expressed the hope that, as a result of these efforts, the Malaysian Government would buy British aircraft.

The RMAF team, which left Kuala Lumpur on March 6, was arriving in London last Sunday, March 23, from the Netherlands and after its visit going on to Canada. In the UK, the Malaysians were to look at aircraft and radar equipment and were having discussions with Hawker Siddeley, British Aircraft Corporation, Marconi and Plessey.

Before mentioning the Malaysian mission, Mr Morris referred to the question of "a return to Labuan by the RAF and the supply generally of fighter aircraft to Malaysia linked with the proposal for this return." He added:—

"The Government have considered very carefully the question whether we should be justified in stationing RAF aircraft permanently in East Malaysia again, but we do not believe there is at present any threat which would warrant the return of the RAF to Labuan."

US Israeli F-4 Training

ISRAELI AIR FORCE pilots and technicians are to receive training on the F-4 Phantom in the United States as part of the package deal under which Israel is to receive 50 of these aircraft (*Flight*, January 16), according to newspaper reports in Israel. There has been no official confirmation of these reports, but a contract of this kind for the supply of a type of aircraft new to an air force would almost automatically include the training of personnel and provision of spares.



Dassault Mirage 5 (see news item below) armed with an AS.30 air-to-ground missile, two rocket pods and two Sidewinder air-to-air missiles

More Belgian Mirages

AN OPTION ON A FURTHER 18 Dassault Mirage 5Bs, in addition to the 88 contracted for last year (*Flight*, September 19, 1968), is being taken up by the Belgian Ministry of Defence. This brings to 106 the total number of these aircraft ordered for the Belgian Air Force to replace F-84Fs and RF-84Fs.

SABCA (Société Anonyme Belge de Constructions Aéronautiques) is preparing to lay down an assembly line for the 106 Mirage 5Bs. The Belgian company is already making wing main spars and

airbrakes for this version, as well as components for the Mirage 3. It is studying the possibility of series production of the fin and tailplane of the Mirage F1 and is building prototype components for this aircraft. SABCA is producing type record calculations for the prototype fin of the Mirage G4 as well as planning a series of structural tests. For the future the company hopes to put the Mirage F1 fin and tailplane into production and to build the Mirage G4 fin, as well as producing powered controls for both types.



Royal Wessex, first of two Mk 4s which are being prepared at Yeovil by Westland Helicopters for the Queen's Flight of the Royal Air Force

Airborne to Anguilla

A TOTAL OF 16 Air Support Command aircraft were involved in Operation Sheepskin, last week's "invasion" of the Caribbean island of Anguilla to counter a UDI by Mr Ronald Webster and his supporters. Four VC10s, seven Hercules, three Andovers, one Britannia and a Comet were involved.

One of the Hercules started the airlift when it took off from Lyneham at 0235hr on Tuesday, March 18, followed by three or four from the same airfield and others from Fairford. Three VC10s took off from Brize Norton on the same day between 0700 and 1015hr while two Andovers flew from Abingdon, joining another which was already in the Caribbean area on a training exercise. The third VC10 left Brize Norton on the 19th and the Britannia went out from Lyneham on the same day.

ASC carried two companies of the 2nd Parachute Battalion, nine Land Rovers, six trailers and an Army Signals installation, and two of the Hercules did an air drop on the Anguilla airstrip, each putting down two Land Rovers and two trailers. Subsequently one of the Andovers landed on the strip.

The VC10s flew direct to Antigua, a distance of 4,160 n.m., in about 8hr; the Hercules made one stop at Gander and the Andovers were routed via Keflavik, Gander and Bermuda.

Two other aircraft used in the operation were Royal Navy Wasps from the frigates *Minerva* and *Rothsay*. They dropped leaflets and landed personnel.

707s for RAAF?

A PURCHASE OF surplus Qantas Boeing 707s is being considered by the Royal Australian Air Force. The airline has six of their older and smaller aircraft for sale; the air force has a need for aircraft of the Boeing type able to fly 3,500 miles non-stop for transport and freight work. The RAAF has for some time shown interest in the Boeing 707-338C, which is able to carry a far larger pay-

load than the aircraft being offered by Qantas. Qantas has now standardised on this larger version. There are many merits in the RAAF and Qantas using the same type. In a defence emergency there are big advantages if the air force can use its own crews to fly Qantas aircraft and if it can call on the company's spares pool and maintenance experience.

B-52 Minus Four

A USAF Strategic Air Command B-52 which "lost" four engines—two of them breaking away from the aircraft—after take-off from Wurtsmith AFB, Michigan, made a safe landing there after being airborne for nearly six hours to burn off fuel.

The aircraft, with a crew of seven,

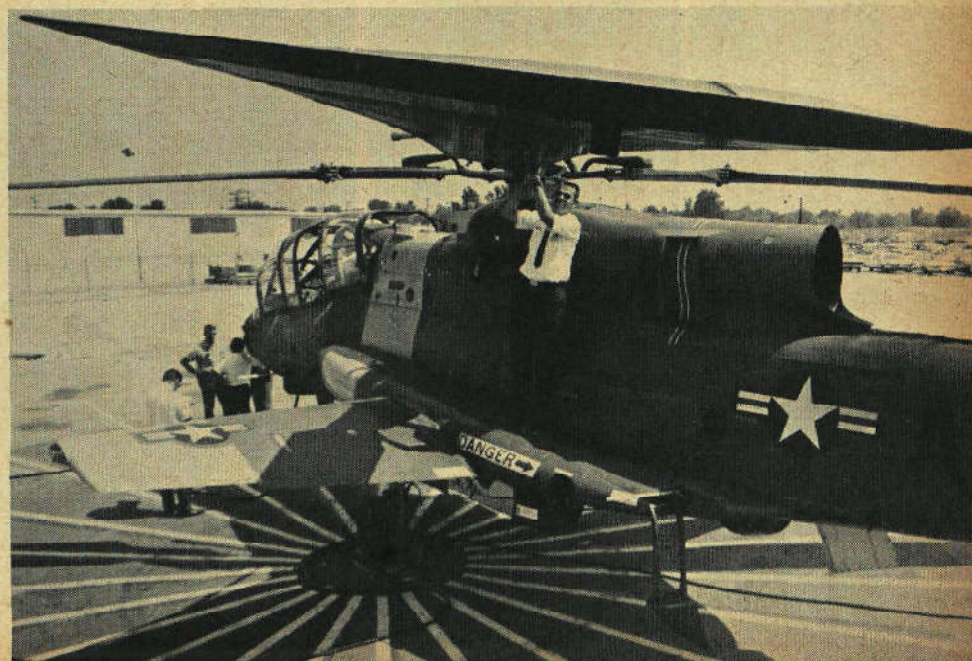
lost its Nos 5 and 6 engines shortly after take-off from the base on a training sortie. It had reached an altitude of 8,000ft when, according to the captain, Maj Robert Winn, one of the engines on the starboard side "caught on fire and took another engine with it right out of the aircraft." He added: "It felt like we hit a brick wall."

The two starboard pods which fell off the B-52 were the inboard ones, and with this pair gone, Maj Winn said he had no control over nos 7 and 8 engines. At that point the crew might have been justified in abandoning or ditching the aircraft; instead, as the captain put it, "after we started circling"—off Oscoda, Michigan, about half way up the Michigan shore of Lake Huron—"things got under control." The B-52 was carrying non-nuclear bombs.

After consultation with his base, which in turn consulted with Boeing test pilots at Wichita, Winn decided to starve the outer starboard engines of fuel. Then, for upwards of six hours, with SAC's commanding general being kept informed of the situation and hundreds of "spectators" clustering on the coastline below, the B-52 circled round Lake Huron waiting for 200,000lb of fuel to burn up. Meanwhile an emergency rescue operation was mounted, with three Coast Guard helicopters and an amphibian, plus a USN aircraft from Gross Ile Naval Air Station, Detroit, which happened to be passing through the area.

When it eventually had only 81,000lb of fuel left, the B-52 descended and made a "normal" landing at Wurtsmith on its four port engines. Maj Winn's subsequent reported comment was: "after we got on the ground, I found out that this had never happened before in the history of the B-52."

Twisted, tapered and cambered rotor blades on a US Army Cheyenne at Lockheed-California, Van Nuys, Calif. Twisting along the 25ft blade is only 5°; tapering is in thickness from root to tip; and cambering is a special curvature of the blade's cross-section with a leading-edge "droop." These refinements, Lockheed state, improve lift capability at low speeds and help to distribute the aircraft's structural load more evenly in high-speed flight





Straight and Level



BY 1970 BOAC will have seven Boeing 707-320Cs, of which five will be passenger aircraft. Do you remember BOAC's estimates in 1964, when they cancelled all those Super VC10s, that by 1970 they would need only two 707-320Cs? It seems they cancelled at least five too many Super VC10s.

Who checked their estimates? Nameless officials. All right, who was responsible? The then Minister, Mr Julian Amery. Where is he now?

Writing articles in the newspapers and saying that someone in the Government ought to be "impeached" for something or other.

● "EASTERN AIRLINES SIGNS FOR ATARS," proclaimed the Eastern press release headline.

For one ghastly moment I thought that their 50 Lockheed 1011 TriStars were not going to have Rolls-Royce engines after all.

ATAR turns out to be an Automated Travel Agent Reservations system.

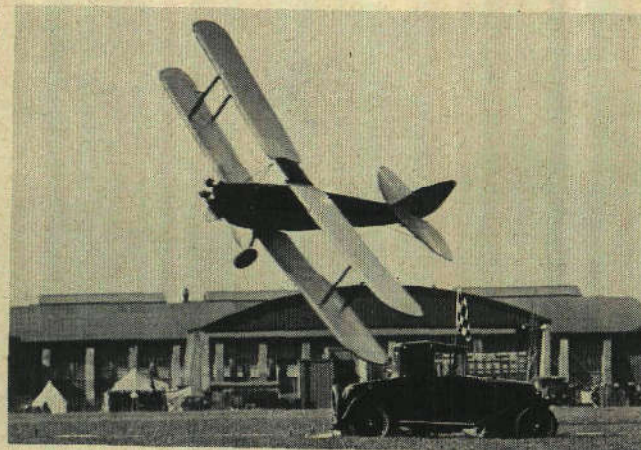
I wonder if automated travel agents get invited on all those "inaugurals."

The modifications, including the replacement of a spare broom would take several weeks, said a corporation spokesman.

From a news item about NAC Viscount modifications in the "Wellington Evening Post," March 2, 1969



There's quite a lot of traffic congestion on the roads these days... (Cessna 172 after a forced landing near Raleigh, North Carolina) ...



... not to mention on the airfields... (D.H. 60 Genet Moth at Lympne in the 20s)

● United Air Lines is conducting special courses for staff "to develop a sensitivity to the individual needs and feelings of passengers." The programme is designed, we are told, "to teach employees empathy—the ability to project oneself into the other fellow's shoes."

Sounds pretty corny.

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