FLIGHT International

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

THURSDAY 4 APRIL 1968

Number 3082 Volume 93

In this issue

Iliffe Transport Publications Ltd, Dorset House, Stamford Street, London SE1; telephone 01-928 3333. Telegrams/Telex: Flight Iliffepres, 25137 London. Annual subscriptions: Home £7 10s. Overseas £7 10s for one year; £19 for three years. Canada and USA $19 for one year; $49 for three years. Change of address—please note that four weeks' notice is required, together with the return of a wrapper bearing the old address. Registered at the General Post Office as a newspaper. Second Class Mail privileges authorised at New York, NY.

Branch Offices: Coventry, 8-10 Corporation Street; telephone Coventry 25210. Birmingham: 401 Lynton House, Walsall Road, Birmingham 22b; telephone 021 BIRchfield 4838. Manchester, 260 Deansgate, Manchester 3; telephone Blackfriars 4412 or Deansgate 3595. Glasgow, 123 Hope Street, Glasgow C2; telephone Central 1265-6. Bristol, 11 Marsh Street, Bristol 1; telephone Bristol 21491-2.

New York, NY: Thomas Skinner & Co (Publishers) Ltd, 300 East 42nd Street, New York 10017, USA; telephone 867-3900.

The RB.211 . . .

The Eastern and TWA and Air Holdings orders for RB.211-powered Lockheed 1011s (details overleaf) are Rolls-Royce's reward for the hardest technical and commercial fight in its history. The victory was not won just by the Rolls-Royce name.

The RB.211, together with the bigger RB.207 and the smaller Trent, and no doubt future members of the three-shaft, low-noise family, could put the Derby firm ahead of Pratt & Whitney and General Electric for a civil aero-engine generation to come. It is an immense achievement. The full implications—including perhaps a twin-RB.211 aircraft—can only as yet be guessed at.

. . . and the RB.207

All the American airbus contenders are bigger than Europe's A-300. Indeed, the 747-300, as it has been designated, is more akin in size, weight and range to the long-haul behemoth of which it is a variant, being to the 747 as the 720 is to the 707. The European airbus consortium can be delighted that the A-300 is still in a class of its own.

It is designed for the short-haul operator—for routes of from, say, 200 to 900 miles. Its design is uncompromised by the geography of the USA, which has dictated the non-stop or single-stop transcontinental ability and the greater tankage, weight and power that are consequential. All the A-300 has in common with the DC-10, 1011 and 747-300 is the ten-abreast cross-section which will eventually make most six-abreasters obsolete.

Furthermore, Europe's airbus remains a twin—notwithstanding the RB.211's American victory—with the attendant advantages of lower capital and operating costs. The A-300 will replace many of the twins of today—737, DC-9, Caravelle and One-Eleven—none of which has been "unsold" by multi-jet competitors. The A-300 is the mini of the new airbus class; and the demand for it will be large if the specification—now within a few weeks of definition—is met. It will be smaller, cheaper to buy and to run, and more efficient on the shorter stages.

There are two other reasons—both industrial—why the A-300 design remains valid. The twin-engine formula offers scope in the future for development of the "2½"-engine technology whereby the APU doubles up as a thrust booster to enhance hot-and-high performance and to extend the payload-range curve. British Aircraft Corporation and Boeing and the leading engine companies are actively examining this opportunity to achieve greater powerplant efficiency. The "2½"-engined aircraft would be designed and certificated as a twin, but would have APU thrust available as an operating bonus.

Secondly, it is important that Britain and Europe should have a transport engine in the RB.207 class. Air transport is now entering the era of the really big passenger and cargo jets; and these will require big 60,000lb-plus engines.

There is no point in pretending that because the new American airbuses are so much bigger than the A-300 they are not going to steal some of its market. Of course they will; but the more swiftly and surely the A-300 and its RB.207 engine are developed the bigger their share of the market will be.

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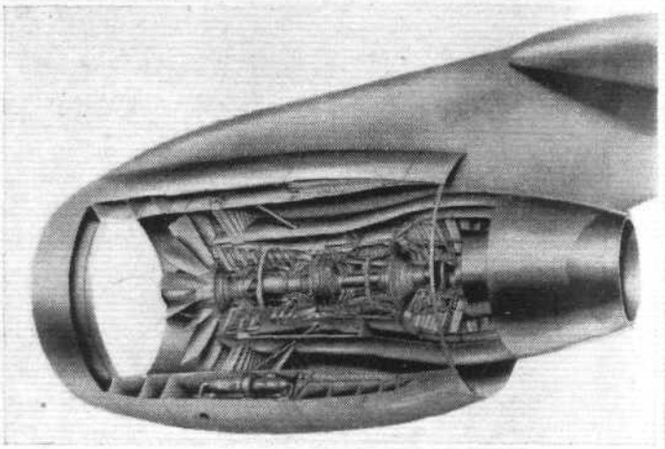
ROLLS-ROYCE WINS



Turbofan triumphant: an artist's cutaway impression of the Rolls-Royce RB.211 three-shaft turbofan selected for the Lockheed 1011

ROLLS-ROYCE'S AERO ENGINE DIVISION has won the biggest single export order ever achieved by any section of British industry with the announcement last Friday, March 29, that the RB.211 will power the Lockheed 1011.

This spectacular order, which could alone almost cure Britain's overseas balance of payments difficulties and add incalculable strength to the country's aviation technological and commercial standing over the next ten years, was announced simultaneously at hastily convened press conferences by Lockheed in New York and Rolls-Royce in London within hours of the contractual negotiations reaching a conclusion.

Lockheed's unequivocal decision to proceed with the 1011 powered exclusively by the Rolls-Royce RB.211 was taken on the strength of firm orders for 124 aircraft plus options on another 20. These crucial and unprecedentedly big launching orders came from Eastern Air Lines, for 50 aircraft; from Trans World Airlines, for 44 aircraft; and from Air Holdings of London, for 30 aircraft plus an option on a further 20.

At the London press conference Sir Denning Pearson, chief executive and deputy chairman of Rolls-Royce, said: "In order to obtain acceptance of a foreign engine in a US aircraft in the circumstances of the US balance of payments situation, the assurance of US export sales for this aircraft was considered essential. Rolls-Royce therefore approached the City of London in the person of Lord Poole of Lazard Brothers as to what they could do. The result has been that Air Holdings has placed an order for 30 aircraft with a commitment for a further 20. These aircraft are intended for all the initial sales of the Lockheed 1011 throughout the world outside the domestic USA."

Lockheed stated in New York that the value of installed propulsion equipment to be purchased from Rolls-Royce for the order from the two US operators amounted to $255 million (£98 million). If the value of the installed propulsion equipment in the aircraft ordered by Air Holdings is added, then the total of Rolls-Royce-supplied installed equipment rises to almost £150 million. As a significant proportion of the aircraft ordered by Air Holdings are likely to end up with airlines outside Britain, the great majority of the £150 million represents a direct contribution to Britain's balance of payments.

All estimates put the total worldwide potential market for jumbo - sized medium-haulers at about 1,000 aircraft by 1980. If this is realised by the Lockheed 1011 alone, it could mean business for Rolls-Royce worth, perhaps, £2,000 million when the tremendous amount of service support and spares supply business that will accrue is also taken into account.

Lockheed may not, however, have the whole market to itself. Although the 1011 orders are clearly a setback for the McDonnell Douglas DC-10 there is still the unresolved question of a substantial order for jumbo medium-haul aircraft from United Air Lines and important contracts from other significant carriers such as Braniff, National, Northeast and Continental. McDonnell Douglas still has a good chance of adding some of these to the American Airlines order for 25 DC-10s (with an option on 25 more and a declared interest in a fleet of up to 100 by 1975) and of being able to take an early go-ahead decision. Similarly, General Electric is not likely to relinquish the business without a fight and will throw everything into beating the RB.211 into the DC-10. With the prospect of an all-US book for the DC-10, and little chance of an Air Holdings-type arrangement, there will be strong political pressure favouring the CF-6. In any event, the competition to power the DC-10 will be intense. At least Rolls-Royce can now add market acceptance of the RB.211 to its price and technical advantages.

Another potential competitor in the jumbo medium-haul market is Boeing's trijet 747-300 powered by the Pratt & Whitney JT9D, and a size larger than either the DC-10 or the 1011. The failure of Boeing to halt, or even temporarily to impede, the airlines in their ordering of the 1011 and DC-10 is undoubtedly a setback to this normally influential manufacturer—it was certainly a surprise to industry observers. The 747-300 could virtually be stone dead for some while.

What does the order mean to Rolls-Royce? Commenting at the press conference, Sir Denning Pearson said: "The outcome of this hard-fought sales campaign confirms the ability of a technologically based British industry to expand its penetration of the US market. I should like to pay a tribute to all members of the company who have worked so hard over many months to win this order, and in particular to the managing director of the Aero Engine Division, Mr D. P. Huddie, who for the last six months has made his home in the US and has done nothing else but concentrate on this deal, as well as to Mr F. T. Hinkley, who has not only been involved in the long negotiations as commercial director of the company and of the Aero Engine Division, but has also had to take the responsibility for running the Division as its acting managing director. I also want to pay a

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Super-salesmen: Sir Denning Pearson, R-R chief executive and deputy chairman; Mr D. P. Huddie, managing director, Aero Engine Division; Mr F. T. Hinkley, commercial director

Yuri Gagarin

Colonel Yuri Gagarin, the Russian cosmonaut who died last week in a flying accident at the age of 34, made aviation history on April 12, 1961, when he became the first man to fly in space. His orbital flight, lasting 108 minutes, the shortest but most significant of all Soviet manned space flights, made in the Vostok 1 spacecraft, was completely successful.

On his last flight, made with Col Vladimir Seregin on Wednesday of last week, March 27, the MiG-15 trainer they were piloting crashed at Kirzhatsk, some 40 miles north of Moscow.

Although Gagarin never made a second space flight, the world-wide impact of his pioneer achievement was so great that, had he retired completely there and then, he would still have remained a world figure. But he proved an admirable ambassador for the USSR on international visits; and, through his experience and example, played an important role in training other cosmonauts. It was ironic that he should have met his death (although few details have so far been given by the Russians) on what appears to have been a routine training sortie on a well-tried type of aircraft.

In choosing Yuri Gagarin to be their first cosmonaut [writes Maurice Smith], the Russians also chose a young ambassador. When I had the pleasure of meeting him I had an immediate impression of warmth and humour. There was a complete absence of tension during his visits outside the USSR and he was both relaxed and patient when answering the innumerable questions put to him or giving his autograph to the pushing crowds. He seemed to be genuinely interested in each person who shook his hand, and his ready smile was exclusively for them—this at a time when so many of his compatriots were noted for their dour exteriors. I think a great many people everywhere will feel a personal loss, rather as they did for President Kennedy, even though they knew Gagarin only through his achievements and pictures.

F-111B all but Dead

The US Senate Armed Forces Committee voted last Thursday, March 28, against any more funds being appropriated for production of the GD F-111B for the US Navy. The decision virtually kills any further hope for the controversial variable-geometry project, which has been troubled since its first appearance with, among other difficulties, excess weight and insufficient manœuvrability.

Proponents of the F-111B now appear to have given up the fight. The DoD accepted the recommendations of the Navy Department's Analysis Section that options to develop both the F-111B and an alternative should be kept open; accordingly, it reduced its request to the Senate committee for production funds to build only eight rather than 30 F-111Bs. The money saved, it asked, should be devoted to contract-definition studies of an alternative. The committee's response was to bar any funds for F-111B and to ask DoD how much was required to define competitive proposals. The answer was $30 million (£12.5 million).

The Systems Analysis Section report reflects a change of view over the past year, for in 1967 the same team regarded the F-111B as the best solution to the problems of fleet defence in the mid-70s. Now it feels that new aircraft concepts may be preferable to the F-111Bs, even allowing for the longer delay in bringing a new aircraft into service: target date for the F-111B was early 1971. It is thought that McDonnell-Douglas, with a Phantom derivative, is currently the most favoured of the several companies bidding for the "alternative" award.

THE WORLD'S AIRLINES . . .

are the theme of next week's (April 11) big special issue of *Flight*. This annual survey covers some 850 scheduled and non-scheduled operators in brief histories, summaries of operations, fleet details and names of principal management executives. The survey will thus form a valuable work of reference for equipment exporters and others who have business dealings with airlines—and, of course, for the ordinary reader interested in the subject for its own sake. Regular news features will appear as usual.

RAF Exhibition

Gp Capt Douglas Bader opened an exhibition at the Science Museum, South Kensington, London SW7, last Monday, April 1, to commemorate "50 years of the Royal Air Force." It has been arranged by the RAF Museum and will remain open for six months.

BSE Suspensions

A new development occurred in the Government investigation of Bristol Siddeley Engines' profits on certain aero-engine overhaul contracts with last week's suspension of three employees from the company's former cost estimating department at Coventry, pending inquiries into "certain estimating irregularities."

The suspensions were announced on March 28 by the managing director of the Bristol Engine Division of Rolls-Royce, Mr Hugh Conway, who said in a statement that in view of the connection between this and the recent Wilson Committee report on BSE (*Flight*, March 7), the matter had been reported to the Ministry of Technology.

It will be recalled that after the Wilson report was published the Minister of Technology, Mr Wedgwood Benn, told the Commons (*Flight*, March 28) that he had asked Rolls-Royce, which acquired BSE in 1966, to provide a statement showing costs and profits on all other contracts by BSE with Government Departments between April 1, 1959, and March 31, 1967.

In addition, the Public Accounts Committee, which investigated BSE profits before the Wilson Committee did so,

SENSOR

Target date for the first flight of Concorde 001 is August 31. This schedule contains very little allowance for contingencies and it could well slip to the end of the year. There is nothing now between the first flight dates of the two prototypes, 001 and 002, but the odds are very much against 002 flying first, for technical as well as political reasons.

The £30 million being spent on Concorde production tooling, which will be leased to the companies at an "economic rental," will buy general machine tools which are not special to the Concorde, and which could later be used for other work. The special Concorde tooling comes out of the £500 million R&D estimate.

The £100-£125 million for Concorde production is not yet voted and is so far only the subject of enabling legislation. The Government is still trying to get BAC, Rolls-Royce and other suppliers to take a share of the Concorde financial risk, but so far without success. The firms argue that an incentive to efficiency is not secured by their taking a share of the financial risk. The incentive, they say, is that if the Concorde programme fails, the firms will fail with it.

Germany's production requirement for the new advanced combat aircraft (Anglo-German VG) is double that of Britain—400 units at least. The German industry feels that it is therefore entitled to assume industrial and design control of the programme.

Three Islanders are to be operated by Suburban Airlines of Red Bank, New Jersey, USA. The airline has Twin Otters and will use the Islanders between Red Bank and Newark Airport and perhaps later J. F. Kennedy Airport. The first aircraft will be the US demonstrator G-AVOS.

The Shuttleworth Collection's LVG C VI German 1917 scout, which last flew at the RAF Hendon display in 1937, has been re-assembled and will be on static display this year at Old Warden. It is intended to have the aircraft and its 230 h.p. Benz engine completely restored and cleared for flying by the end of this year.

WORLD NEWS . . .

has been examining one or two witnesses a second time. This re-hearing by the PAC was referred to in *Flight* for March 14 and 21.

Collaboration Reservations—1

Referring to European aviation collaboration, Sir George Edwards, managing director of British Aircraft Corporation, said last week that Britain, with a complete aerospace industry, had enormous strength in this field and should not be sold short. Collaborative projects like Concorde and Jaguar were sensible, but we must not be made to give up our unilateral ability, which had taken 50 years to build up.

Speaking to the Liverpool branch of the Institute of Directors on March 26, Sir George said it was the great hope of the design team at BAC Preston division —"the best military design team in the world"—that they would be allowed to go after the worldwide market for a new strike aircraft, one which could repay tenfold and more the research and development investment in it. Britain was looking for a partner in this venture. That was sensible. What was not sensible was the corollary that, if we did not find one, we would not build the aeroplane.

Collaboration Reservations—2

Doubts about the value of European collaboration in aircraft manufacture have been expressed by Air Cdre F. R. Banks, who retired at the end of last month from Hawker Siddeley Aviation (see picture, this page) in his Chadwick Memorial lecture on *Fifty Years of Engineering Learning*, published in the March issue of *The Aeronautical Journal*.

He expressed the view that such collaboration could demand a degree of compromise too great to meet the very tough competition in civil aviation, in both the aircraft and airline industries. A single integrated manufacturer would inevitably design, develop and build a machine more quickly than an international group financed by governments.

Air Cdre Banks said that though he was well aware that considerable design and manufacture was already sub-contracted to prime manufacturers in the US and Europe, the "primes" were still responsible for financing, controlling and creating the project; and this could not be so expeditiously done where, say, three governments were providing the funds and were therefore in control. But even in international collaboration, it was vital to progress that one company in the consortium was made leader of the whole project.

He believed Britain to be capable of financing much of its own design and manufacture of aircraft and engines and other aerospace equipment.

Air Cdre Banks also expressed doubts about company mergers. It was said that they avoided possible duplication and could lead to rationalisation; but, conversely, they tended to cut out competition, which was an unhealthy state to get into. Would Britain, he asked, have had the two distinct forms of direct-lift engine, the Rolls-Royce lightweight type and Bristol Siddeley's vectored thrust, had these two companies merged ten years ago?

Hawker Siddeley's Sir Arnold Hall recalled last week that in 1953, but for Rod Banks, Britain would have gone for small engines in clusters instead of for big engines.

Retirement presentation *to Air Cdre Rodwell Banks of HSA, seen receiving a caricature of himself by Chris Wren, signed by Fleet Street air correspondents, from Derek Wood of Interavia at a Café Royal lunch. (See also news-item, this page)*

London Air Centre

The Duke of Edinburgh has consented to be first president of a trust to establish an air centre in London which would house various voluntary organisations concerned with British aviation. This scheme has become possible through the generosity of Mr Geoffrey Edwards, who has established a trust with an initial capital of £100,000 for the purchase or endowment of an air centre in which the two primary occupants would be the Guild of Air Pilots and Air Navigators and the Air League. A council of trustees has been set up under the chairmanship of Dr K. G. Bergin, a former Master of the Guild and formerly vice-chairman of the Air League.

Parliament

A matter of concern to central Londoners in particular, and to other citizens living near major airports, was ventilated in the Commons last Friday morning when MPs discussed the Aircraft Noise Bill, on its second reading, for just over two hours until the sitting was adjourned.

Main sponsors of this measure—Mr James Johnson (Lab; Kingston-upon-Hull, West) and Mr Hugh Jenkins (Lab; Putney)—both spoke in the debate, which ranged over the commercial, operating and social problems involved.

Mr Johnson said this was "a fitting week" for it, with the Minister of Transport announcing her intention to introduce a Bill fixing maximum noise levels for road vehicles and the Minister of State for Technology opening an exhibition "about this monster plane, the Concorde." Heathrow was a main centre of London's noise activity; he had been told that the BoT Civil Aviation Department checked aircraft to ensure that their noise did not exceed 110db by day and 102db by night on take-off. "Both these figures are above 100db," said Mr Johnson, "which puts them in the deafening category." If this legislation came into force, he would expect manufacturers to feel compelled to construct less noisy aircraft.

One of the London MPs, Mr Marcus Worsley (Con; Chelsea) wondered whether airliners could approach on a steeper glidepath than the present three degree one, quoting a report about experiments at Dulles Airport, Washington, on a six-degree one. Mr Jenkins, however, emphasised that nothing proposed in the Bill was intended in any way to put people at risk when travelling: to steepen the glide-angle to any considerable degree would involve an unacceptable risk. Their argument was that the balance between the citizen on the ground and in the air was wrongly drawn; for the past 15 or 20 years it had been gradually tipping against the latter, whose lot had become harder. The Bill sought to restore freedom to pursue action against aircraft owners and operators for nuisance by noise and vibration.

The two other speakers, Mr Geoffrey Johnson Smith (Con; East Grinstead) and Mr John Rankin (Lab; Glasgow, Govan) both spoke from first-hand experience, Mr Smith because many of his constituents live near Gatwick and Mr Rankin from personal knowledge of Prestwick. Mr Smith said that the bill placed a restriction five years from now on aircraft with a noise level of about 90PNdb. Only one real breakthrough would alleviate the problem, an improvement in aero-engine design so that less noise resulted. Referring to this possibility, Mr Rankin said technologists had told him that it was possible, but the Government and operators must be prepared to pay the price, commenting: "we cannot do it under present conditions; the price would be very, very high indeed."

AIR TRANSPORT

Concorde Delay: The Background

AS LONG AGO as October or November 1967 it was becoming clear that Concorde 001 was not going to meet the extensively publicised first flight date of February 28, 1968. But the target was retained as an incentive; and at the time of the Toulouse roll-out ceremony on December 11 the likely delay was reckoned to be three or four months—not too serious. It was largely due to known delays in the delivery of equipment, mainly the Boulton Paul flying controls, of which more in a moment.

There is now no doubt that the delay to 001 is serious, and that it is due to more than late deliveries of equipment and components, British and French; but a hundred of the top engineers concerned were to stop work and conduct a post mortem they would probably not agree on the precise reasons. In any case, such an exercise would be futile.

Up to December Sud were well on schedule, with the major Pert-chart milestones checked-off, and with the systems-integration and functioning-work programme clearly defined on the network-analysis charts. Sud have not previously tackled a programme of such immense complexity. Nor have BAC; but the British company did suggest some months ago that network analysis, whereby event A must precede event B, was not a tablet of stone and should be more flexible. It was hard to controvert the French answer that they had kept to schedule so far, and why they should suddenly fall behind?

Bristol's greater experience of complex aircraft prompted their own more tactical approach rather than a too-lavish adherence to the charts which can lead deeper into the wood. There came a point where Sud was persuaded to take a new and more flexible approach. They agreed, and this augured well for the future of Anglo-French co-operation. The French took British advice, which they have not always seemed able to do. In fairness to Sud, the lateness of the flying controls—which are such a key component—has not exactly helped, and there are at least as many people in Britain as there are in France who are putting pressure on Boulton Paul. This company would argue that it started late, through no fault of its own, because of the competition for the contract with Dassault, whose price was £1½ million more, and that the delays have been aggravated by specification changes called for by Sud and by that company's procedure (which incidentally delights the ARB) of always taking everything to bits and reassembling and testing it to their own satisfaction before installation and functioning.

Clearly, the recriminations and arguments could go on for ever, but they would lead nowhere. In any case the arguments are no more acrimonious than those between different divisions of the same company working together on a difficult job. And of course 002 is benefiting greatly from the hard lessons learned by Sud.

The Concorde flight-clearance programme differs from conventional practice whereby the contractor decides when the prototype is ready for flight. Now three organisations—the committee of officials and the two national certification authorities, ARB and SGAC—are setting the standards. These are very much more exacting than anything known in the past.

Neither Sud nor BAC will publicly commit themselves to anything more precise than "late summer" for the first flight of 001. There is no doubt that 002 is now very close behind—as Dr Russell of BAC made clear last week (see page 476). The revised first-flight schedules are not being published, but there is an atmosphere of intense but friendly competition between Toulouse and Filton. This can only improve the efficiency of the whole programme. Naturally there is a determination among BAC workers to get 002 flying in time for the SBAC display at Farnborough in September, but there will be extremely strong political pressures to keep 002 behind 001. There is also the operational point that Toulouse is the more prudent airfield for the first flight of such an advanced new aircraft. As soon as 002 flies from Filton it will go straight to Fairford where the BAC trials programme will be based.

There are still a number of items of equipment that could run into trouble. Rig-testing of the power controls is still not completed; there is no reason to expect any grievously nasty setback to these components, or indeed to any other British or French components, but unscheduled failures must be anticipated in such an advanced programme. Some equipment deficiencies could be tolerated more than others. If, for example, the cabin air system were to run into trouble it would always be possible temporarily to limit cabin differential pressure while still exploring large areas of the flight-test envelope. The flying controls are, of course, typical of equipment which must be spot-on right from the maiden lift-off.

As those closest to the programme are well aware, there could still be some reverses in store. All the same, there is cause for controlled delight at the results of the very critical first engine runs.

Concorde Power Two of the Concorde 001's four engines were run up to full power with reheat during the recent ground running tests, as briefly reported last week, and no serious problems were encountered. Vibration tests were also satisfactory. Although much work has yet to be done, everyone concerned seems quietly jubilant that no nasty snags were encountered, and that the complex nozzle and variable-intake systems worked. Much integration with the rest of the systems

The oversize operator's name gives the DC-8-63F—taking off from Long Beach on March 21 for its first 4hr 20min flight—an unreal, almost model-like appearance. Seaboard has ordered 12 of these convertibles with the first due for delivery in June; 33 more have been ordered by eight other carriers

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remains to be fulfilled, but as Sir George Edwards of BAC said last week: "We have got to the stage where we have made the engines work. If the remaining programme goes as well we are likely to produce an aircraft that will do what we said it would do."

A total of 15 engine runs on 001, amounting to 15hr 28min on No 1 engine and 17hr 49m on No 2 engine, have now been completed at the Toulouse-Blagnac establishment of Sud Aviation. The tests so far have been on two of the four Olympus engines delivered. The purpose of these tests and their results are described as follows:

(1) A general check on the operation of the engines and associated equipment—in particular, the gas turbine starter and electrical generating system (alternators 1 and 2).

(2) The ventilation and cooling of the engines. Very comprehensive tests have been carried out covering the whole range of engine operation. These were conducted with nacelle doors open and closed; with variations in the geometry of the nacelle doors; with gas-turbine starter in operation, and not in operation; with dry and humid ventilation; with ventilation before and after operation of the engines, and after operation of reheat; with engine thrust varying between ground idling and maximum, etc.

(3) Characteristics of operation of the engines. These checks included: operation up to maximum thrust dry; check of characteristic parameters—in particular, turbine entry temperature; a study of engine accelerations and decelerations for all rates of movement of throttle lever; behaviour of the two engines operating simultaneously in symmetric and asymmetric conditions; measurements of stress on the engines from slow speed to full throttle, and adjustment of engine slow-running.

(4) Operation of reheat. Reheat was cut in initially for 20sec at full throttle and then operated for one minute on each engine. The simultaneous operation of the two engines at full throttle and with reheat was satisfactory.

(5) Operation of thrust reversers. These tests were carried out initially at slow speed for periods of 30sec. Thrust reversal was then increased to the maximum possible under test conditions.

(6) Operation of silencers. Tests were carried out up to full throttle, with reheat. Measurements of external noise (1,500ft away from the aircraft) were carried out in four different configurations, with and without reheat and with and without silencers.

(7) Compatibility and effectiveness of ground-based silencing equipment. Measurements were carried out to check the effect of the ground silencing equipment on the characteristic parameters of the engines, and to check the effectiveness of the silencers.

From the point of view of quality, says the Anglo-French development team, the tests were completely satisfactory, particularly with regard to ventilation and behaviour of the propulsion units. Quantitative analysis is now in progress.

Which Concorde First? A request for clarification from France last week followed a statement by Dr A. E. Russell, chairman of the Filton Division of BAC, that the British-built Concorde prototype 002 might be ready to fly before the French-built 001. Dr Russell, who was addressing a meeting of Concorde contractors, said in answer to a question about the progress of 002: "The French prototype has slipped off schedule by approximately six months and instead of flying by the end of February is now likely to fly near the end of August. The BAC aircraft is on schedule and it is now touch-and-go which of these aircraft is ready to fly first. There will be undoubted French pressure to ensure that they have this honour but it will be interesting to see what the situation is at the end of August."

Dr Russell was apparently intending only to comment lightheartedly on the obvious fact that, with 002 on schedule and 001 some six months behind schedule, the first two flights may take place within a very short interval of each other. As 001 is first in line for the supply of equipment, it should be ready first; and the fact that experience so far with 001 has been available to the team building 002 has undoubtedly helped to keep the latter on schedule.

BAC hastened to stress last week that it was not a question of a neck-and-neck race to get the first aircraft into the air but simply an all-out effort to get on with the programme as a whole.

IS THE IATA TICKET USELESS?

THE Supreme Court of the USA (in a judgment handed down on March 25) evidently believes that the IATA-type interline ticket used by Alitalia in 1960 is useless in giving adequate notice of liability to passengers. Hence Alitalia will be subject to absolute and unlimited liability—subject only to proof of the applicable amount of damages. The judgments of the original and the Appeal Court use "affirmed by an equally divided [Supreme] Court" (4/4). This itself is unusual because there are nine Justices of the Supreme Court—but in this case one took no part as a judge because he had participated in the case when he was Solicitor General.

The Federal Court of Appeals' judgment of December 16, 1966, was fully described in *Flight* for May 11, 1967 (pages 754-755), in "The Case of the Invisible Ticket." Many people think that the judgment really hinges about "fine print" because most of the judges criticised the size and legibility of printing. This, however, is a secondary issue: the real novelty is that the US courts have invented a doctrine which was specifically excluded by those who drafted the Warsaw Convention and only appears in the Hague Protocol to which the USA has refused to become a party. The US courts have now confirmed that in their view the passenger must be given adequate notice of liability limits in sufficient time to take "self-protective" measures, such as deciding not to fly, buying additional personal-accident insurance, or trying to agree a *higher* limit of liability with the air carrier.

It can be argued that the decision only affects old cases and that modern carriers will be quite safe if they give notice to passengers in the form approved by the CAB (Inter-carrier Agreement No 18900) referring to limits of US $75,000/$58,000 in not less than 10-point modern type. Unfortunately the CAB itself has destroyed this theory in a document submitted to the Court in the present case (*Lisi v. Alitalia*). In commenting on the Board's reasons for prescribing, in 1963, a minimum size for notices to passengers about liability limits ". . . the Board was *not* endeavouring to determine the requirements of the Warsaw Convention." In any event, a carrier who relied solely upon notices prescribed or approved by the CAB would always be exposed to the risk of unlimited liability in respect of registered baggage. The very serious risk from now on is that of unlimited liability in cases of passenger death, injury, or delay, for those airlines who can be sued in the USA.

Alitalia have until April 19, 1968, to petition the Supreme Court for a re-hearing. If they are unsuccessful, then there is little doubt that the airline world would be better off if the USA finally withdrew from the Warsaw Convention.

TURBOPROP DC-7C PLANS

CONVERSION of DC-7Cs to turboprop power, using Allison 501 engines, is being offered by Aviation Traders, Southend, at a price of £150,000 per aircraft for an initial batch of at least ten aircraft. This price assumes that the customer provides the airframe, engines and propellers. Interest in the conversion is being shown by Trans Meridian (see the news story on page 478). According to Mr J. R. Batt, a director of Aviation Traders, initial certification of the modification could be completed within 18 months of receipt of an order, and the firm would be able to offer conversions at short notice thereafter.

Aviation Traders at one time considered re-engining the Carvair (itself an Aviation Traders DC-4 conversion) with Rolls-Royce Darts, but this was dropped when it became apparent that a conversion cost of £80,000 would not be reflected either in higher speed or in a cruising altitude suitable for a turboprop engine. The Dart was also considered in the context of the DC-6B and DC-7C, but even in its latest development was found to be marginal on power.

The Allison 501, which powers the Electra, is a more attractive proposition for the DC-7C. It is fairly readily obtainable, develops 3,750 e.h.p., and has an overhaul life of 5,000-

The new styling on Lufthansa's Boeing 737s—in which the formalised crane emblem is on a yellow disc against a blue background on the fin—will be applied to all the airline's fleet during the coming year

6,000hr. Aviation Traders were encouraged by the fact that Douglas had already completed some engineering studies for such a conversion, and the firm believes that the finished product, having pressurisation and a cruising speed at least as high as that of the Britannia, will prove economical to operate on cargo services. An added spur is given by the fact that the progressive withdrawal of 115/145-octane Avgas from many areas is likely to prove an embarrassment to some DC-7C operators; the type can use 100/130-octane fuel, but with a restriction on full power which in turn limits the gross weight.

SAFEST YEAR

FIGURES just issued by ICAO for the 1967 scheduled airline passenger-fatality rate confirm the provisional ones published by *Flight* in the issue of January 11, pages 45-46. With an average of 0.39 deaths per 100 million passenger-miles on services operated by the airlines of the 116 ICAO member states, the year was, statistically at least, the safest one yet for air transport. The organisation records that 674 passengers were killed (*Flight* gave a figure of 672) for 171,000 million passenger-miles flown—which represents a 20 per cent increase on the traffic for 1966. The average that year was 0.65 fatalities, and for 1965 was 0.56—the previous lowest figure.

ICAO comments that "the long-period downward trend in the passenger fatality rate, which had shown signs of flattening out, or even rising slightly, between 1955 and 1960, has been falling about 15 per cent per year since then and seems likely to continue to fall although probably not at so high a rate. In the past five years this steady decrease in the passenger-fatality rate has been sufficient to offset the expansion of scheduled operations, so that the number of passenger fatalities has not increased (apart from the exceptional year 1966) although the number of fatal accidents has remained about constant and the average number of passengers on each aircraft has increased . . ."

ANOTHER MIXED-TRAFFIC COLLISION

NO injuries were sustained aboard an Ozark Air Lines DC-9 which collided with a Cessna 150 on March 27 when both were approaching St Louis Airport, Missouri. The 150 was on a training flight; the two occupants, an instructor and student, were killed, and the aircraft destroyed. Impact, at a height of 1,500ft a.g.l., was on the starboard wing of the DC-9, but it landed safely with fuel streaming from a ruptured tank. Aboard were 44 passengers and five crew.

This was the sixth "public transport" collision in US airspace within the last 30 months. Of these, five were between light aircraft and transport aircraft, involving 114 fatalities. Details are set out in the table. Since the "Grand Canyon" collision in June 1956 there have been a total of 16 mid-air collisions in the USA. The last such accident which occurred in UK airspace was in 1949, when a BEA DC-3 collided with an RAF Anson over Coventry.

The ratio between mid-air collisions and "near-misses" is in the region of 900:1, which means that there can be expected to be some 25 near-misses in the USA every week. This again applies only to incidents involving public-transport aircraft.

MID-AIR COLLISIONS IN USA: 1965-68

Date	Aircraft Involved		Location	Total occupants		Fatalities		Circumstances
10.9.65	DC-3	Cessna 150	Louisville, Kentucky	2	1	0	1	VFR, 1,800a.g.l., DC-3 climbing out
4.12.65	B-707	L-1049	New York	58	38	0	4	1,000ft; 707 approaching JFK and 1049 approaching Newark
16.6.66	C-46	Piper	Columbia, Ind	2	1	2	1	?
9.3.67	DC-9	Beech Baron	Urbana, Ohio	25	1	25	1	On approach
19.7.67	B-727	Cessna 310	Henderson-ville, NC	79	3	79	3	4,000ft; 727 climbing, Cessna letting down
27.3.68	DC-9	Cessna 150	St Louis	49	2	0	2	1,500ft; on approach

More -320Cs for Sabena An order for three additional Boeing 707-320Cs, with delivery in June, July and December next year, has been placed by Sabena, bringing to 19 the number of Boeing jets in service with, or on order by, the airline.

Personnel Post About-turn Air Cdre P. E. Warcup, for four years general secretary of BALPA, has been appointed to the post of personnel manager for British United Airways. Mr A. F. Sherman has been made BALPA's acting general secretary.

Another F.27-500 Order Sterling Airways, the Copenhagen-based non-scheduled operator, has ordered a Fokker F.27 Mk 500, the long-fuselage variant, for delivery in May. So far, 25 Mk 500s have now been ordered by four operators—including the French Government (12) for the domestic night mail service.

Airport Fees Following threats by airlines using Heathrow that they would not pay increased landing fee charges which came into effect on April 1, the British Airports Authority has sent a "stiffly worded" warning that legal action would be taken against defaulters. The BAA has the right to impound aircraft of airlines who do not meet their dues.

PAL Retires DC-3s Since March 15 Philippine Air Lines has been operating an all-turbine fleet, BAC One-Elevens and HS.748s, on domestic services. The DC-3s were finally withdrawn on March 14 and replaced on most routes by HS.748s—with six in service, four more on order and ten on option. Flights to those centres which cannot be served by 748 will be suspended until the airports have been improved.

Another 990 for Modern A fifth Convair 990A has been obtained by Modern Air Transport from American Airlines. It is at present being modified with seating for 139 and will later be based in Berlin to operate charters for two major travel agencies. One of Modern's 990s is already positioned at Tegel Airport, Berlin.

All-turbine Lufthansa By mid-year Lufthansa expects to be operating an all-jet fleet apart from the eight turboprop Viscount 814Ds, which are to be retired within two years. The airline's six Convair 340/440s will be withdrawn by June this year. Eleven Boeing 737s are now available for service and 15 out of the 24 on order will be in service by mid-August, when the jet fleet will consist, in addition, of 19 707s, including 14 -330B/Cs, and 22 727s.

A new look is being given to the 21-strong Qantas 707 fleet during block overhauls at Heathrow London. As can be seen from this picture of VH-EBR "City of Wollongong," the main change is to the airline name logo; the words "Australia's Overseas Airline" have also been replaced by the single word "Australia"

AIR TRANSPORT...

TRANS MERIDIAN REORGANISES

IN a major reorganisation of the British independent airline Trans Meridian, Mr T. D. Keegan becomes chairman, and Mr George Batchelor of the US aircraft brokers International Aerodyne Inc joins him on the board. Capt Reg Stokes replaces Capt A. H. Benson as managing director. The airline, full name of which is now Trans Meridian (London) Ltd, has moved its operating base from Luton to Cambridge, and has opened a London office. The fleet is composed of three all-cargo DC-7CFs, and the company intends to concentrate on all-cargo operations.

Trans Meridian, since its foundation in 1962, has been owned 50 per cent by Mr Keegan through a subsidiary company; the other 50 per cent, previously held by Mr John Gaul, has now been acquired by Mr Batchelor. The airline has appointed Clarkair Ltd, a London-based broker, as its agent, and intends to delegate to it a major part of the marketing activity.

Among plans for the near future is the acquisition of ten of the Beverleys which the RAF is offering for sale. Conclusion of the sale is expected shortly, and Trans Meridian hopes to be able to put the first into operation within a matter of months. As the Beverley has not seen civilian service hitherto, a certificate of airworthiness has yet to be obtained. Trans Meridian hopes to use the type in specialised cargo operations, particularly in areas lacking developed airports, and for the transport of bulky equipment. Oil companies working in South America are understood to be showing considerable interest in the Beverley for the transport of drilling equipment.

Another project under consideration by Trans Meridian is the conversion of its DC-7CFs to turboprop power, using the Allison 501. Conversion would be performed by Aviation Traders, Southend. According to Mr Keegan, a prospect of sales for only ten such converted aircraft (including the three of Trans Meridian) would be enough to warrant the go-ahead. The Allison engine was at one time considered by Douglas as a powerplant for the DC-7C, and as a result the technical problems of the conversion are understood to be relatively slight.

As Europe's only all-cargo airline, Trans Meridian plans to expand its cargo charter activities and will take a decision shortly on whether to apply for scheduled services, particularly on the North Atlantic and Far East routes; the question-mark here is the view which the Edwards Committee takes on the role of the independents, and such an application may be deferred until the committee has reported.

BOAC's TRANSATLANTIC SHARE

THE table opposite, giving passenger traffic, market shares and load factors of the 17 carriers now operating over the North Atlantic to and from US points, shows that BOAC still retained third place in 1967. The British airline also slightly improved its share of the market. However, Lufthansa, which overtook Air France by a small margin in 1966, is seen to have crept up on BOAC—though at a considerable cost in unfilled seats. During 1967 the German carrier increased the number of seats offered by about 30 per cent, whereas BOAC, with its shortage of available capacity, showed an increase of only 4.6 per cent—with the consequent wide difference in the load factors of the two airlines (51.4 versus 66.6 per cent).

BOAC's was the highest load factor in 1967 apart from that of Irish International (70.3 per cent); four other airlines, KLM, Swissair, El Al and Qantas exceeded the 60 per cent level which is generally considered to be about the highest factor consistent with effective passenger service in terms of seat availability. The Irish airline's load factor has been in the very high 60s for three years—69.4, 68.4 and 70.3 per cent respectively—whereas BOAC's was 61.3 per cent in 1965, rising to 68.1 in 1966 and dropping slightly to 66.6 per cent last year. The British carrier's share of the market, which fell from 11.1 per cent in 1965 to about 9.3 per cent in 1966, increased last year to 9.42 per cent, by comparison with Lufthansa's 8.12 per cent and Air France's 7.76 per cent.

UK/EUROPE-USA SCHEDULED TRAFFIC COMPARISON, 1967

Rank	Airline	Passengers	Market share (%)	Seats offered	Load factor (%)
1	Pan American	981,403	22.72	1,744,762	56.2
2	Trans World	838,344	19.41	1,538,982	54.5
3	BOAC	406,992	9.42	611,492	66.6
4	Lufthansa	350,515	8.12	682,401	51.4
5	Air France	335,092	7.76	638,626	52.5
6	KLM	228,822	5.30	369,158	62.0
7	Alitalia	228,792	5.30	437,634	52.3
8	SAS	219,391	5.08	387,234	56.7
9	Swissair	164,390	3.81	273,484	60.1
10	Irish	156,733	3.63	222,839	70.3
11	El Al	105,272	2.44	169,886	62.0
12	Sabena	103,227	2.39	172,994	59.7
13	Olympic	64,665	1.50	127,455	50.7
14	Iberia	60,406	1.40	114,608	52.7
15	Air-India	42,063	0.97	85,014	49.5
16	Qantas	25,828	0.60	40,744	63.4
17	JAL	6,476	0.15	21,613	30.0
	Total	4,318,411	100.00	7,638,926	56.5

Source: IATA as recorded in "Air Transport World," March 1968. Excludes flights to and from Canada only.

SKYVAN FOR SURVEY WORK

THE Canadian Federal Department of Energy, Mines and Resources is to use a Short Skyvan, supplied by Remmert-Werner, the US distributors, for geological survey work. The main factors governing the choice of the Skyvan, in the face of strong competition, were the ease of loading, the hold volume and the fact that there are no fuel tanks or other equipment in the floor to interfere with the installation of survey instruments. Another point is that the rear door can be opened in flight to give a rear view to an instrument or "bird" operator. Easy loading is essential because equipment for different experiments will be mounted on separate pallets for rapid change.

Transglobe at the CAB

THE REPORT ON Transglobe Airways presented on March 5 by an examiner of the US Civil Aeronautics Board, as part of the proceedings on an application for amendment of the airline's foreign air carrier permit, throws additional light on the company's structure and operations. The examiner's recommendations, which was adopted by the CAB, was to the effect that Transglobe should be issued wih an amended permit authorising, for a five-year period passenger charter flights between Britain and the USA; planeload cargo charters and planeload single-entity passenger charters between any British territory and the USA, each limited to ten flights in any year; UK-USA inclusive tours; UK-USA circle tours taking in any third country; and charters to the USA originating in specific European countries.

The CAB examiner finds that all the shares of Transglobe are held by British nationals; Mr Stanley Wilson, managing director, and Mrs Wilson hold, directly or through their wholly owned company Wilson's Garage, just over 56 per cent of the shares. The company's charter activities have yielded increasing profits during each of the past five years. The balance sheet and profit and loss statement for the financial year ended September 30, 1966 (the most recent available at the time of the hearing), reflect a substantial excess of current assets over current liabilities, gross chartering revenues equivalent to about $4,480,000, and a net profit of almost $800,000. In that year, Transglobe's passenger-miles exceeded 257 million, a 73 per cent increase over the preceding year. Since the acquisition of Air Couriers Ltd, the airline has become the largest facility in the London area exclusively devoted to customer aircraft overhaul and maintenance. The company has 37 administrative and sales employees, 131 aircrew and cabin staff, and a ground engineering staff of 32. Main headquarters are at Gatwick, and other offices are located in Toronto and Hong Kong.

The airline's fleet, says the CAB examiner, is being expanded. Three Britannias are operated (one owned and two leased from Canadian Pacific); six Canadair CL-44s are to be received under a lease agreement from Seaboard World Airlines.

During the last seven months of 1966, after the receipt of its foreign carrier permit, Transglobe operated seven pro-rata charters carrying social groups between Britain and the USA, from which it derived a total revenue of $63,600. During 1967, the airline operated 20 one-way pro-rata charter flights between London and the USA, and derived from them revenue of a little more than $248,000.

The company plans to open offices in Europe (probably in Frankfurt) and in New York, and to appoint sales representatives in Italy, France and Scandinavia. The utilisation planned for the six CL-44s is 65 hours a week. Peak season rates for transatlantic group charters will be equivalent to about $195 per passenger for those originating in the USA and $165 for those originating in the UK.

The CAB examiner says that no question is raised as to Transglobe's fitness, willingness or ability to exercise the rights applied for. Its case for additional authority affording it "equal competitive access to US markets in order to assure equal competitive access by US carriers to foreign markets" is in part supported by decisions concerning Caledonian Airways, Transavia Holland and British Eagle. The Board's policy, which the examiner points out is an evolving one, embodies restraints and safeguards dictated by public interest factors. The award of authority to Transglobe to operate charters, including split charters, between Britain and the USA is supported by comity and reciprocity.

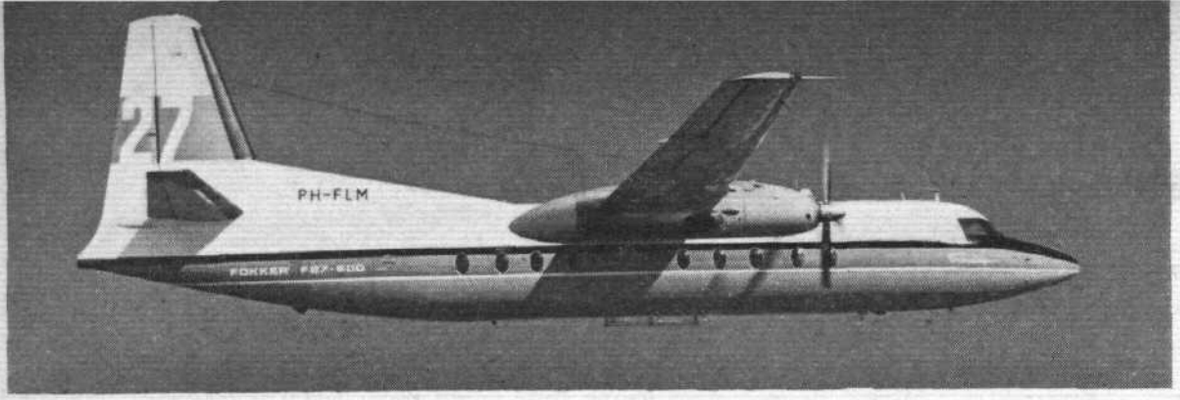
On the subject of Transglobe's application for cargo charter authority, the CAB examiner points out that except for trans-Pacific flights the Board has consistently limited authority to ten flights, with a restriction against fifth-freedom traffic, an uplift ratio, and a prohibition of operations for air freight forwarders. Transglobe requested wider authority than this, and freedom from these restrictions, which have been imposed on Caledonian Airways; the reason for this request is Transglobe's desire for the greatest operational freedom, a reason which the examiner finds unpersuasive with regard to transatlantic cargo operations, which still lie beyond any authority that the CAB has granted to US supplemental carriers.

On the subject of inclusive tours, Pan American, urging that no such authority should be granted, pointed to an opinion of the US Court of Appeals for the Second Circuit (awaiting review by the Supreme Court) to the effect that the CAB lacked statutory authority to authorise international inclusive tours by supplemental air carriers. But in the present case, the CAB examiner says, the question turns on the interpretation of a section of the Civil Aviation Act which governs the board's powers to grant authority to US supplemental carriers, but which do not govern its powers under section 402 (authorisation of foreign carriers). The examiner reviews the question as to whether grant of authority to a foreign carrier, when the Board lacks power to act similarly in favour of a US carrier, accords with comity and reciprocity; he points out the benefit to US balance of payments from foreign tourists, and cites an award of IT rights to Transavia Holland which he considers to reflect a CAB policy favouring IT authority.

Transglobe declined, says the examiner, to commit itself to the CAB agreement for a passenger liability limit of $75,000, although it conceded that limits higher than its normal £6,000 maximum had been arranged for some flights to the USA. The examiner recommends the usual condition for participation in the CAB agreement.

The CAB's recommendation for authorisation of Transglobe has still to be ratified by the President of the USA.

One of the most functionally handsome terminals is that recently opened at Doha International in the Arabian Gulf State of Qatar. Below the terminal is seen from the apron; above is the concourse. International Aeradio, associated with Qatar since 1956, is responsible to the Government for management and operations, including ATC and fire services



Test flying of the stretched Fokker F.27 Mk 500 has now been completed and certification is expected this month. This is the first aircraft off the production line (PH-FLM); it will be delivered to Sterling Airways as a 56-seater

AIR TRANSPORT...

ONE-ELEVEN 500 TRIALS

THE BAC One-Eleven 500 prototype, G-ASYD, recently completed an intensive series of performance trials in Spain over a period of five weeks. During this time the prototype logged 76hr 5min flying time in 77 flights. The object of the trials was to verify the performance with the new Rolls-Royce Spey 25 Mk 512 engines and to obtain British ARB type certification. The flights were made from Torrejon, near Madrid, and from Valencia on the Mediterranean coast.

Data-reduction teams and equipment from BAC accompanied the aircraft so as to provide the results of individual investigations within hours of the completion of the flights. On-the-spot interpretations of the hundreds of parameters recorded in the air and on the ground enabled the flight test engineers to obtain a complete picture of the performances. Thus, when G-ASYD returned to England, BAC already knew that the 500 series had met or exceeded its guarantees in all areas investigated.

TAA'S TWIN OTTERS

BECAUSE of the delivery dates, Trans-Australia Airlines will bring its five Twin Otters into service in two stages, Mr R. W. Swartz, Australian Minister for Civil Aviation, said in Canberra on March 20. The Twin Otters will be used by TAA to replace four DC-3s and two Beech Queen Airs on its routes within Queensland. The first stage would involve the positioning of two Twin Otters at Mackay to serve the Barrier Reef Islands. Under the second stage the other three Twin Otters would be stationed at Brisbane and Mt Isa to serve the Channel and Gulf country, the Darling Downs and the Northern Territory.

On the Darling Downs route, TAA expected to provide four Brisbane-Toowoomba services a week, and five a week in the opposite direction. Toowoomba Airport is an example of an airfield being developed under the Department of Civil Aviation's local-ownership plan, in which the Federal Government is sharing equally with the local authority the cost of building a runway, a terminal building and other facilities.

CONVAIR 580 CRASH CAUSE

THE failure of the starboard propeller because of a manufacturing omission is given as the probable cause of the accident to the Lake Central Convair 580 (Allison-engined 340 conversion) on March 5, 1967, near Marseilles, Ohio, USA. All four blades of the propeller separated in flight and one blade entered the fuselage. All 35 passengers and three crew were killed when the aircraft crashed after breaking up. The manufacturers' quality control department failed to detect the omission of the nitriding process for a torque piston. The National Transportation Safety Board says that the helical splines of the piston on No 3 blade-change unit were worn away because of the lack of nitriding and the torque cylinder failed because of fatigue. A number of changes in quality control and manufacturing procedures, and modifications to the propeller itself, have since been made.

It was not determined why ten torque pistons had missed the nitriding process at Allison's factory. It is possible that the batch missed out because the same ten pistons which were subsequently found not to have been nitrided were moved from the production flow to the laboratory in connection with a statistical study. Why the omission was not detected in the subsequent inspection stage was not determined.

The speed at which Allison's worked when something was found to be amiss, however, deserves recognition. On February 27, 1967, a propeller from an Allegheny Airlines Convair was received at Allison with the complaint that it failed to go into reverse pitch. On March 3, after disassembly, metallurgical examination revealed that the splines on both torque pistons had not been nitrided. Extensive research on the same day into the times at which the pistons were originally processed established a group which were suspected to have the same fault. It was then determined in which propellers the pistons were installed and which operators were using them. The operators were contacted on March 3—the day on which the trouble was first detected—and asked to check oil in the hubs of all the suspect propellers for signs of metal contamination which, it was thought, would be an indication of trouble. An oil check was performed on the propeller involved in the Lake Central accident on March 4, but proved negative. As recorded above, the accident happened on March 5.

JAL PLANS FARE REDUCTIONS

ACTING under the guidance of Japan's Transportation Ministry, Japan Air Lines plan to make major reductions in passenger fares and cargo rates, both overseas and domestic, during the six years from FY 1968 (mid-1968-69). Fares on domestic routes will be reduced by 20 per cent over the five years starting in FY 1969. More difficult, with other IATA airlines to be considered, are the proposals to reduce by FY 1973 international fares by 50 per cent and cargo rates by 30 per cent. JAL has six Boeing 747s on order.

Air Canada European Sales Mr G. G. Gauvreau has been appointed passenger sales promotion manager for Air Canada's European region. He was previously based in Montreal.

American Flyers Changes Mr Ben G. Nelms has been appointed director of flight operations and Mr Gordon Gardow director of ground operations for American Flyers Airline.

Frontier Sales Mr Lawrence C. Sills has been appointed to the new position of general manager, sales and marketing, for Frontier Airlines. He has been director of sales for the regional carrier during the past four years.

World Passenger Service Mr E. Bailey Ranes has been appointed vice-president of ground operations and passenger services for World Airways, based in Oakland, California. He was previously vice-president, Far East—a post which is to be taken by Captain W. L. Keating, the carrier's chief pilot.

PIA UK/Ireland Manager Col M. Yusuf has been appointed manager of Pakistan International Airlines for the UK and Ireland. He replaces Mr M. Naseer who returns to Pakistan as manager, Rawalpindi. Col Yusuf, who was commissioned in the British Army in 1934 and later joined the British administration in India, served in the Civil Service of Pakistan from partition in 1947 until retirement, when he joined PIA in 1966 and was the airline's manager in Italy.

EUROPEAN CO-OPERATION

THREE European airlines which already co-operate in engineering and overhaul work—Swissair, SAS and KLM—have agreed to standardise the flight-deck and cabin layouts, and the capacity, of seven Boeing 747s. This means that the three carriers will be able to share the use of the 747s, of which KLM has three, SAS two and Swissair two on order. They will also submit modification requirements to Boeing only after changes have been mutually agreed.

SAS and Swissair co-operated on DC-8s and Caravelles from 1958, KLM coming in on DC-9s from 1958. In the USA, Eastern and TWA have reached a similar arrangement for their 747s and co-operation will be extended later to their BAC/Sud Concordes.

WEATHER SHIPS TO STAY

THE ICAO-administered network of nine weather stations in the North Atlantic will remain in being for another five years. The decision was reached at a meeting last month in Paris which considered the usefulness of the ships and their possible replacement by anchored floating platforms or satellites.

It was agreed that the search and rescue and radio navigation guidance facilities of weather ships had become ancillaries in the present air transport environment, but that the weather reporting services remained essential. The vessels will be retained until at least June 30, 1973; the World Meteorological Organisation will be asked to study the most economical way of obtaining weather data after that date. A total of 21 ships man the stations.

ROLLS-ROYCE WINS

(continued from page 472)

particular tribute to the many back-room boys in the company, who in recent months have devoted all their working hours and most of their evenings and weekends to the RB.211 sales drive without being involved in the excitement of actually meeting potential customers. There has been national interest in the RB.211 sales drive and Rolls-Royce has had the greatest help and co-operation from all who could assist and, in particular, from the British Government."

It will cost around £50 million to carry the RB.211 through development and certification to full production. The British Government has promised aid up to the full amount if necessary—with a levy on sales. The Government's faith in the project has been amply demonstrated by their provision of half the £3 million or more spent so far on design and promotion of the engine. This is in addition to the substantial contributions to R-R research into advanced-technology engines dating back more than six years and including the RB.178 demonstrator engine, leading to powerplant submissions for the Boeing 747, and the successful promotion of the RB.203 Trent for the Fairchild 228.

Winning the RB.211 contract was fundamentally important to Rolls-Royce. Without it, the company could have been short of work within three years. Military Spey production is at a peak this year, and will rapidly tail off next year. The company has many smaller engines coming along, but to stay in the big league it needed a big order for an engine the size of the RB.211. Although the even bigger RB.207 is being built for the European A-300 Airbus, it is likely to be many months before that politically vulnerable project matures into substantial commercial production contracts.

For these reasons, the RB.211 fits well into the company's production plans, and will not call for any significant increase in employment or factory space. Machining capacity was being increased anyway to cope with the RB.207, and this will be accelerated. R-R has already invested over £4 million on capital equipment for its new family of large-diameter engines. Sir Denning said at the press conference that the company had been very closely cross-examined by Lockheed, McDonnell Douglas and Sud-Aviation for assurance that capacity existed to do both the RB.207 and 211. He said the answer was an unhesitating "yes." R-R is tooling up to make the RB.211 at a rate equal to the most optimistic needs of the market. This is expected to include anything McDonnell Douglas may want if the engine is selected for the DC-10.

Rolls-Royce is to supply the complete powerplant pack to Lockheed. It will include intake, reverser, silencer nozzle, pod and pylon. The intake, pods and pylons have been sub-contracted to Shorts, for whom this will be most valuable long-term business.

The entire powerplant is to be built in Britain and there is no question of sub-contract work to American companies. An overhaul facility may be established in the US for those airlines who do not do their own maintenance. A significant feature of the Eastern/TWA order for the 1011 is that both airlines already have a mutual arrangement covering the aircraft, engine, spares and overhauls for the airlines' new fleets of Boeing 747s and BAC/Sud Concordes. This will undoubtedly stretch to the 1011 and the RB.211.

RB.211-22 Details

R-R studies into the new generation of subsonic engines date back to 1961. The first detail design began in 1966. RB.211 design began in July 1967, and the programme, including manufacture, is fully under way. The first flight-engines will be despatched to Lockheed in the "second half of 1970." The exact day is spelt out in the contract, but this is not being announced yet because of the competitive situation involving Lockheed, McDonnell Douglas and Boeing. All the engines in the initial orders placed to date are to be delivered from R-R within 18 months of the start of production deliveries.

The RB.211-22 performance, according to aircraft requirements is for a take-off static thrust at sea level of from 37,020lb to 40,600lb. There is planned thrust-growth to 50,000lb without any increase in overall diameter—simply by redistributing more air through the gas-generator section from the by-pass. The initial overall compression ratio is 27:1 and the by-pass ratio is 5:1. At the maximum cruise thrust rating at 35,000ft, ISA and Mach 0.85, the thrust is from 8,665lb to 9,267lb and the equivalent specific fuel consumptions are 0.615 to 0.628lb/lb/hr. All figures are for the bare engine and do not include losses due to installation and associated equipment.

The RB.211 go-ahead is the most important endorsement yet of the Rolls-Royce three-spool philosophy, which had gained a measure of support with the RB.203 Trent and the RB.207 but will now have a chance to show its true worth against the two-spool high-by-pass engines of P&W (in the Boeing 747) and GE (in the C-5A). R-R claims that three spools are best because an engine of given pressure ratio is smaller (compressors and turbines are running under nearer optimum conditions), is simpler (it has no moving stators), has lower noise levels on the approach because of front fan speed control, and has more thrust-growth potential because of three-spool flexibility.

One of the most significant areas of engineering experience behind the RB.211 and its stablemates is the R-R work on lightweight lift engines. This has produced the Hyfil fan blade of composite carbon-fibre construction (for lightness, low cost and stiffness, with no need for noise-generating mid-span shrouds) and the smaller-diameter glass-composite l-p compressor blades. Of probably equal importance is R-R's unique experience of turbine blade cooling in civilian service—14 million hours with blade lives now up to 16,000hr. The RB.211 is said to require only modest advances in blade-cooling technique to cope with the higher temperatures used.

The new system of sub-assembly modules means that all rotating parts can be removed from the engine if necessary without disturbing the main accessory area in the middle section. Each of the five modules (l-p fan and casing, i-p compressor, inter-compressor casing and gearbox, h-p system compressor/combustion/turbine, and the i-p and l-p turbines) have their own maintenance schedule and will be capable of on-wing replacement. Engine casing target lives of 20,000hr mean that the complete engine will not normally be removed from the aircraft for several years. This maintenance plan promises great savings in engineering costs.

continued overleaf

ROLLS-ROYCE WINS

How the Order was Won

First indication that Rolls-Royce had won its battle for acceptance came last Friday morning, when Mr David Huddie, who has been leading the R-R sales effort, received a telephone call from Trans World Airlines to the effect that they would follow the order for the L-1011 already placed by Eastern Air Lines, and would buy the British engine.

From the early days of the Dart engine, but more particularly from the days, some ten years ago, when the powerplant competition for the Boeing 727 was at its height, R-R has been fighting for a major entry of this nature into the American market. The 727 competition was lost to Pratt & Whitney in 1960 (as a result of Eastern choosing the US engine). This was in fact to prove the starting-gun for the biggest race of all: 1961 saw the beginning of the research and development effort which has resulted in the RB.207 and RB.211 engines.

The costs of this programme could not have been borne by Rolls-Royce alone, and within two years the Government had stepped in with an offer of funds for the initial design study and early testing. This was followed by an offer to share half-and-half with Rolls-Royce the cost of prototype production.

During the last two years the sales campaign has hotted up, with a steady stream of Rolls-Royce salesmen flying back and forth across the Atlantic. It was in April 1966 that American Airlines put out to manufacturers a statement of its future airbus needs, and from that time on the men from Derby became well known to the US manufacturers and leading airlines. The campaign was to cost the best part of £400,000, with nearly £100,000 going in air fares and expenses alone.

In the autumn of 1967, Lockheed, first after Europe to launch an airbus, announced the three-engine configuration of its L-1011.

In a move which caught imaginations on both sides of the Atlantic, Mr Huddie, weary of commuting from one side to the other, set up not only shop but home as well in New York. As managing director of the Rolls-Royce Aero Engine Division, his determined and permanent appearance on the battle-front had a powerful psychological effect.

The American economic situation at the close of last year was far from being conducive to a massive powerplant order to be placed abroad. The US balance of payments situation was worsening, and pressures for buying American were building up rapidly.

Lockheed, which favoured the RB.211 over its General Electric rival, began manœuvres to smooth its entry to the USA. The company's chairman, Mr Daniel Haughton, had visited the Ministry of Technology late in 1967 and suggested to Mr Stonehouse that a withdrawal from the European airbus project by Britain would enable Lockheed to buy British. Lockheed could then have answered critics at home with the hope of increased sales in Europe. Mr Stonehouse was anxious to help in any way possible, but could not countenance anything that would prejudice the future of the European airbus.

Mr Haughton returned to Mintech in January, and put his proposals for an offset sale arrangement to balance the outflow of dollars that would result from buying Rolls-Royce. This time he dropped his suggestion for the abondonment of the European airbus.

In February, Lockheed put its offset sale proposal to officials of the US State Department and Treasury, and obtained their blessing, which was subsequently to prove sufficient to stifle the protectionist voices in Congress. The prospect of a full-scale public row had been worrying the airlines, but these worries were now lifted. Political difficulties had also been avoided, in this case by an understanding between the British and US Governments that the contract should be decided on commercial grounds alone.

Part and parcel of the offset deal was the arrangement under which the Air Holdings Group stepped in with an order for 30 L-1011s, and a commitment for 20 more at a later stage. The moving spirit behind this vital component of the deal was Lord Poole who, as well as being chairman of Lazards, the merchant bankers, also controls, through a related company Broadminster Nominees, important interests in the Air Holdings Group.

Rejoicing in Derby was understandably matched by some disappointment in the US. Senator Robert Taft, main antagonist of a foreign engine, said: "With the prior assurance of the Secretary of Transportation, I presume that no government interference was responsible for the decision. The order is, of course, only a fraction of the airbus field and I feel confident that American manufacturers will gain a portion of the market."

On the Stock Exchange, Rolls-Royce shares jumped 9s 3d to 54s as the order was announced. This raised the company's valuation by some £25 million.

The turning of Rolls-Royce fortunes in the USA is regarded as only a beginning. The DC-10 is still very much at large—although, unlike the L-1011, not yet under starter's orders. Most important is the fact that Rolls-Royce has established a precedent for privately negotiated offset aviation sales which could set the trend for a long time to come.

The Lockheed 1011

At long last Lockheed has realised its ambition to return to the airliner manufacturing business. It was a great name in the post-war piston-engine days, but failed to get into the jet age because of excessive preoccupation with the development of the Super Constellation formula, and then with the turboprop medium-haul Electra. It is a happy coincidence that TWA is again in at the start of this new era in Lockheed airliner building—the airline sired the first Constellation.

The definitive 1011 which has won this biggest bag of initial orders ever recorded for a new airliner still on the drawing board—their value is a record $2,160 million— is closely akin to the one shown to airlines last autumn and fully detailed in the November 2, 1967, issue of *Flight*. The version ordered will seat from 227 passengers in a mixed-class layout or 300 all-economy. With 227 seats, the 1011 has a US coast-to-cost payload-range capability with a cabin-capacity load. It will also carry maximum payload out of La Guardia for Chicago on a hot day.

Stretch is designed into the 1011 from the outset and this is matched by the RB.211 engine which is expected to be capable of 50,000lb thrust. The 1011 could well have transatlantic range potential with extra tankage in the centre-section and the fin. Alternatively, for very short ranges, the fuselage is capable of a 40ft stretch to give over 400-seat all-economy-class capacity. Other development possibilities include a cut-down twin-engined version (with the centre engine removed) that could rival the European A-300 Airbus on short ranges.

Eastern Air Lines and TWA will get their first 1011s in late 1971 and delivery of the first 25 to each airline will continue into 1973. The remainder of the initial orders for these carriers will be delivered in late 1973 through into 1975. Air Holdings will receive the first in late 1973.

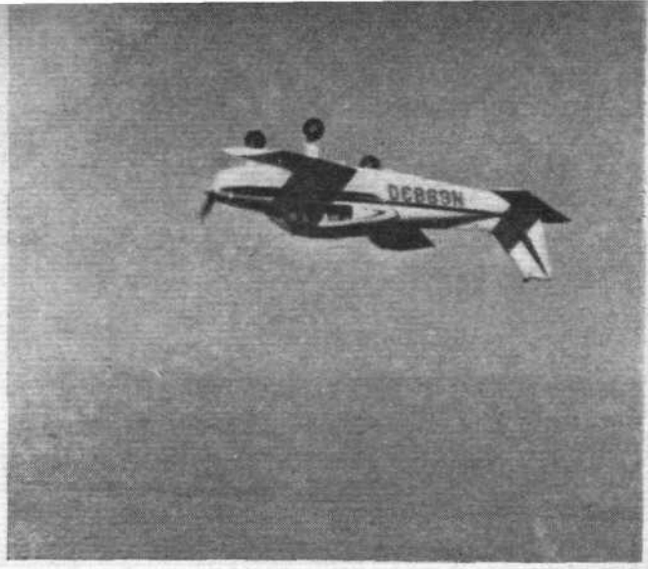
Air Holdings and the Lockheed 1011

The order by Air Holdings, backed by the capital-raising abilities of Lazard Brothers, in the City of London and overseas, for 30 Lockheed 1011s and an option on a further 20 was inspired by the need to make the choice of the Rolls-Royce RB.211 to power the aircraft a politically acceptable decision in the USA.

Air Holdings first began serious evaluation of the 1011 in January this year. In addition to its own marketing surveys, the company has been encouraged by the favourable views of other British operators. The Air Holdings press release announcing the order contained statements emanating from its deadliest rivals in the airline operating business—one from BOAC and one from British Eagle.

BOAC is quoted as seeing "a possible need in the future for an aircraft smaller than the 747 to operate on routes which do not have the traffic density to justify the use of an aircraft of this size." Also that "BOAC is examining thoroughly the application of the American tri-jet aircraft type and their possible future developments for this purpose. There is good reason to believe that developments of these aircraft would meet this requirement." British Eagle talks of "a possible need in the 1973-75 period for an aircraft of the US tri-jet type."

SPORT AND BUSINESS



The Beechcraft Musketeer Sport III is now approved to perform all positive-g aerobatics and limited inverted flight. There was no need to change the basic airframe or the 150 h.p. Lycoming engine—the differences are limited to the provision of shoulder harnesses and a quick-release door

Setting the Standard

IT IS A PRIME OBJECTIVE of the British Light Aviation Centre to inspire a higher overall standard of proficiency in private flying. (A point, incidentally, which was well stressed by leaders of the Centre in their interviews with *Flight* that appeared in our Private and Executive Flying number on March 21.) Apart from the obvious incentive of improved safety, it is on the success of this drive that a great deal of hope for the future development of British general aviation must lie. For it is only by orderly development and proven competence that private flying will gain a sympathetic hearing when the inevitable expansion of activity raises truly complex problems of airspace and the like.

A key element in the BLAC effort is the setting of a proper level and the standardisation of private pilot training. This reconditioning process is being spearheaded by an overhaul of the BLAC Panel of Examiners—for it is that group of 19 or so highly experienced instructors which is alone responsible for examining every new private flying instructor and which re-examines every instructor once a year. An important practical step in getting the panel's own house in order* was an Examiners' Seminar which took place over several days during mid-March at the Royal Air Force Central Flying School at Little Rissington. The seminar was conceived and put into effect by the energetic chairman of the panel, Mr Rex Smith, and was aided by a substantial catalytic grant of cash by the Board of Trade. Most of the panel members were at Little Rissington to fly the intensive programme of mock-instructional sorties in various typical light aircraft, and to take part in a series of ground-school lectures. All this, together with bar-side discussions long into the night, gave a never-before chance to standardise. Afterwards, it was widely remarked by panel members that the degree of standardisation was already higher than many had dared hope, but, above all, that the seminar had provided much-needed confidence in the system. *Flight* was privileged to be an observer during the final debriefing.

The BLAC Panel of Examiners is the largest and most widely experienced top-instructor group ever assembled in Britain for the purpose of checking private flying instructors. Its 19 members† come from all over the country, but the non-testing chairman, Rex Smith, is a former instructor and a proven administrator in the flying school industry.

The panel is now doing some 500 tests a year—an average of about one a fortnight for each member. This work is entirely voluntary and is performed in addition to the normal duties of the members (some, though not all, are connected with commercial and private schools). It is remarkable that so vitally important a task is not hampered by the kind of limitations that afflict most areas of voluntary service. The panel's success is surely due largely to the quite remarkable enthusiasm and dedication of the members. One wonders how long this important task can be left unrewarded.

The number of panel members may well continue to increase to match the increasing demand for instructor check-outs. The latest recruit is Mr Peter Phillips, the well known display-aerobatics pilot and ex-CFS instructor. A large proportion of panel members are, in fact, ex-CFS and the spread of experience now includes a former BOAC captain and Board of Trade examiners from the CAFU at Stansted.

With the renewed confidence of the Panel of Examiners in the standard of private pilot training to be promoted, the next step is to subject the instructor-training business to an equally rigorous reappraisal of its standards and procedure. At present there are some 75 instructors throughout the country approved to teach pilots the art of instructing. A form of seminar along the lines of the one at CFS might be instituted for them, and a certain level of performance might become a mandatory part of the process for renewing flying-instructor course (FIC) approval. This would, of course, be costly, raising the obvious question of who would pay. A measure of Government help is probable, but the FIC instructors may be asked to contribute towards the expenses. There are surely not many "professional" instructors in the country that would deny the logic and general advantage of these plans and who would not be prepared to support their realisation.

Although the demand for new instructors has always far exceeded the supply, it is likely that, in the interests of maintaining standards, instructor-training establishments will be asked to be more selective in allowing people to embark on such courses—with emphasis on the suitability of prospective student instructor's experience, aptitude and personal qualities.

The revitalised Panel of Examiners is clearly shaping up to a determined and sensible bid to ginger up private pilot instructing in Britain, and it deserves to succeed. The measures are tough, and an impression of the likely response should be gained at the instructors' teach-in to be held at Oxford Airport on April 22. It is the biggest, strongest and most widely experienced panel yet, and all its members are dedicated people with an intimate understanding of the conditions in the field.

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*It was only last October that the private-pilot instructor Panel of Examiners came under the BLAC banner (commercial pilot instructors are checked by a Board of Trade panel of CAFU examiners). Both the private and commercial pilot instructors were previously rated by a Guild of Air Pilots and Air Navigators panel—see *Flight*, October 5, 1967).

†BLAC Examiners Panel members: Mr W. G. Beadle, Oxford Air Training School; Mr A. E. Bramson, Tiger Club; Capt H. M. Buxton, London School of Flying; Mr R. D. Campbell, Bedfordshire Air Centre; Mr C. C. H. Dash, Ulster Flying Club; Capt F. V. Davico, Northern Air Schools; Capt D. F. Greenland, London School of Flying; Mr A. J. Harris, Oxford Air Training School; Mr R. J. D. Hamilton, Plymouth Airport; Mr P. Harrison, Rochester; Mr F. Kirk, Nottingham; Wg Cdr J. B. Pearse, Exeter Airport; Mr P. J. C. Phillips, Goodwood Airfield; Capt L. Rackham, Yorkshire; Capt C. W. Sweetman, Air Service Training, Perth; Mr F. C. H. Taylor, Nottingham; Capt J. D. Varley, Airways Flying Club; Capt R. O. Whitehead, Board of Trade CAFU; Capt W. A. Wooden, Board of Trade CAFU.

Recent demonstrations of the Mosquito Gyroplane Mk II are said to have produced orders for several aircraft. Mr Ernie Brooks, of Brookland Garage, Spennymoor, Co Durham, is now providing plans of the Gyroplane for amateur builders. Powered by a 1,600 c.c. VW engine, the complete aircraft is priced at £940

SPORT AND BUSINESS

The 1968 World Gliding Championships Eight nations have entered for the OSTIV design competition, the prize for which will be awarded, as usual, to the best Standard Class (15m span) sailplane entered. The judging will take place during the World Gliding Championships at Leszno, Poland, in June. Britain will not enter the design competition, having won the prize in 1965 with the Slingsby Dart.

British team preparations for the championships are well under way, and the first sailplane—a Slingsby Dart 15 with Wortman wing—was delivered on March 21. The team consists of the following pilots: Captain H. C. N. Goodhart, RN (HP.14), Mr George Burton (HP.14), Flt Lt David Innes (Dart 15) and Flt Lt John Williamson (Dart 15). Generous help has already been received from the SBAC, the Department of Education and Science, Irving Air Chute, the Ever Ready Co, the British Gliding Association (proceeds of a raffle) and many individuals; but the team is still short of just over £1,000 and would also welcome the loan of three airborne radios.

The Dukes are coming: Beechcraft's new pressurised six/eight-seater (awarded an airworthiness certificate in February) is beginning to appear off the Wichita production line. Output is to reach four aircraft a week by the end of this year

Massive Helicopter Sub-contract Bell has awarded Beech Aircraft a contract worth some $75 million (£31 million) for the manufacture of some 4,000 Jet Ranger airframes over the next five years. This is the largest sub-contract in the history of Bell and includes airframes, options and spares. It is additional to the current contract worth $2.6 million (£1.1 million) under which Beech is already delivering Jet Ranger airframes.

Fuji FA-200 for Australia This month the Mitsubishi four-seat single-engined training/tourer known as the Fuji FA-200 is to be put before the Australian DCA for airworthiness approval in preparation for an all-out bid to get the aircraft well established in that most lucrative market. This is the first stage in the export marketing of the new Japanese light aircraft; the US and Europe are the next areas to be entered.

Cherokees in Jordan Two Piper Cherokee 140s have been ordered by the Royal Jordanian Aero Club; delivery by the Piper distributor in Beirut, Khalil S. Salibi, was expected at the end of March.

Seething Rally The Waveney Flying Group will hold its annual rally and flying display on May 26, at Seething Airfield, near Norwich.

Belgium Trade Show The second Salon International de l'Aviation Générale on the Charleroi-Gosselies Airport, Belgium, is due to be held on September 3-8 this year.

Rally to the Midnight Twilight The fourth Swedish International West Coast Air Rally is to be held on June 21-23 and will be centred on the Aero Clubs of Gothenbourg and Halmstad. Further details and entry forms from the RAeC Competitions Department, 75 Victoria Street, London SW1.

Fly-In to Cognac M Michell Martell of the world-renowned brandy family, and his partners, are to be host to members of the Royal Aero Club on April 20-21. The rally to Cognac is being organised by the Royal Aero Club, and is called the Martell Medallion Air Rally.

The List of Light Aircraft manufacturers and agents given in our March 21 issue omitted to include the Nipper Aircraft company, though the Nipper Mk 3 single-seat aerobatic aircraft was included in the tabulated data. Nipper Aircraft Ltd are based at the East Midlands Airport, Castle Donington, Derby, and their telephone number is Castle Donington 779.

It has also been pointed out by the Piper CSE Aviation distributors, that Aviation Communications of Biggin Hill have ceased to be Piper dealers.

Air Touring Services Ltd of Biggin Hill, Kent, are now the sole distributors in the UK for all light aircraft built by Sud-Aviation and marketed by Socata. The sub-agents of Air Touring dealing with the Rallye range are Gilbert Aeroservices of Horsham St Faith Aerodrome, Norwich, Norfolk. Sub-agents for the Horizon family are the Norfolk and Norwich Aero Club, of Swanton Morley Aerodrome, East Dereham, Norfolk.

In the BLAC-supplied list of schools and clubs the telephone number of the Cinque Ports Flying Club of Lympne should have been Hythe 68241. Also, the operating base of Player's Flying Club is Tollerton Airport.

Two New Flying Films Two new films were shown in preview last week by W. D. & H. O. Wills and are now available for hire. The first is *Glider in the Sky*, while the second, *Fourpence to Fly*, describes the Wills flying scheme for light aircraft.

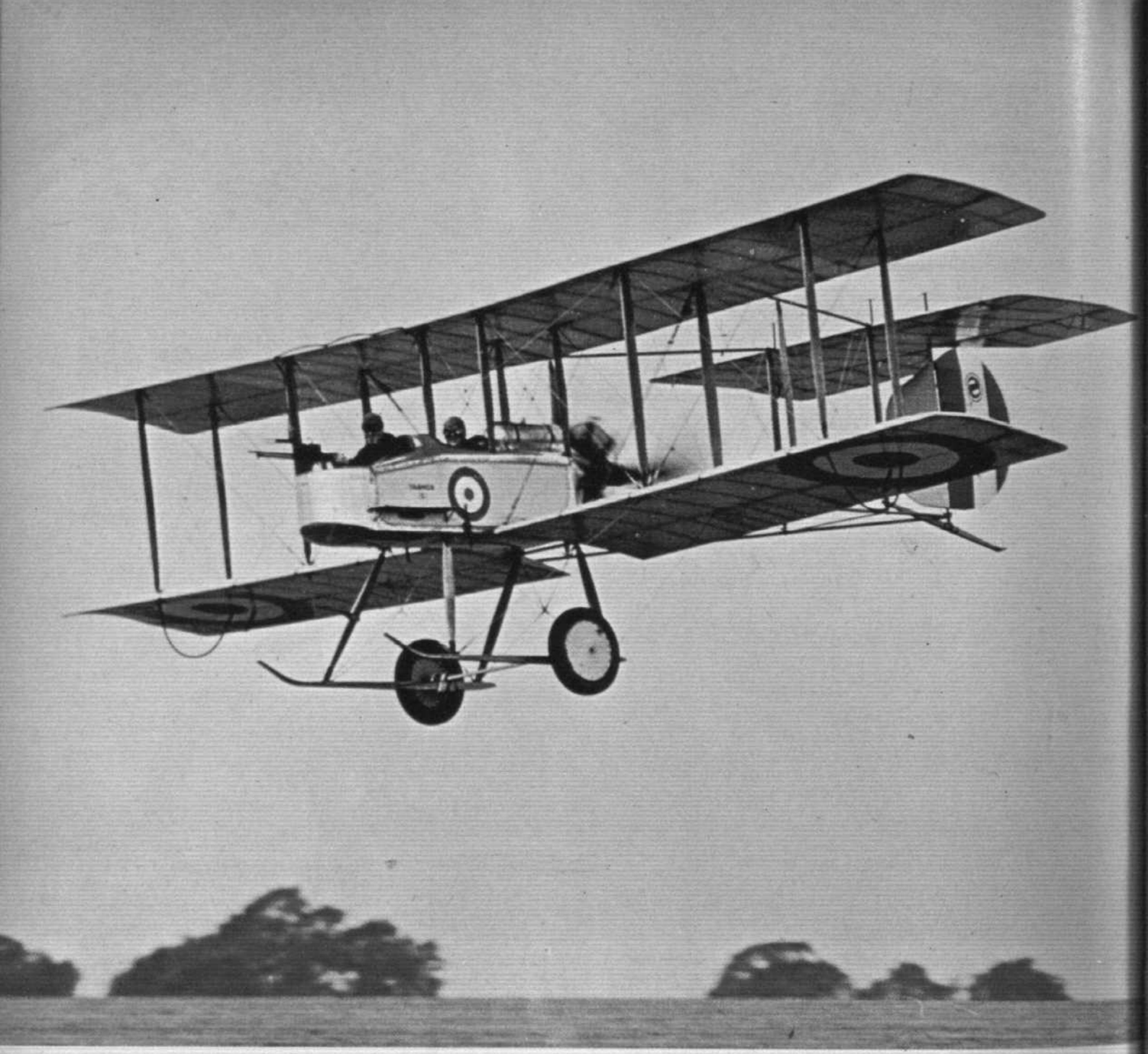
Made in co-operation with the British Gliding Association and well produced in colour, *Glider in the Sky* has as its theme an out-and-return flight from Lasham to Nympsfield in a Slingsby T.49 two-seat glider. The commentary puts over the incidents in the flight in language which is both understandable to the non-gliding layman and convincing to the sailplane pilot. One of the fascinations of gliding is that of looking at the ground and at other sailplanes sharing one's own thermal. The film has plenty of such scenes, including a field landing by another glider as seen from the air. It concludes with an exciting "scrape" as the camera glider barely clears the trees on the final approach to the airfield. The film is 16mm, lasts 22min and is available for loan, free of charge

Continued on page 485

FLIGHT COLOUR 9

Phantom

With the demise of the F-111 and AFVG, the Phantom will become the RAF's heavy striking force when the last of the V-bombers is phased out in the mid-1970s. The Phantom has the intangible characteristics of other highly successful aircraft; it is more than the sum of its parts. Designed to a USN requirement in 1953, the first F-4B flew almost exactly a decade ago, on May 27, 1958. Adopted also by the USMC, the outstanding potentialities of this carrier fighter were recognised by the USAF, which has ordered the type in quantity. Some 2,000 aircraft are on order or have been built, although Britain is so far the only country outside America to order the type.



FLIGHT COLOUR 10

Vickers F.B.5 Gun Bus

Designed as a fighter, the two-seat Vickers F.B.5 Gun Bus stemmed from the earlier F.B.4 of 1914. The first F.B.5s arrived in France in February 1915 to equip Nos. 5 and 16 Squadrons, RFC; and although slow, they soon earned healthy respect from their adversaries. Withdrawn from active service in late 1916, the Gun Bus was relegated to the training role after having seen service with six squadrons. Powered by the 100 h.p. Gnome Monosoupape engine, it had a speed of 70 m.p.h. at 5,000 ft and an endurance of four hours. The photograph is of the replica built at BAC Weybridge, mainly by the company's apprentices.

SPORT AND BUSINESS

(within the United Kingdom), from United Motion Pictures, Merton Park, London SW20.

Fourpence to Fly derives its title from the cost of the stamp needed to apply for an application form to enter the W. D. & H. O. Wills flying training scheme. This very successful plan has been run now for three years; and the scenes, filmed in colour at a number of flying clubs throughout Britain, show the progress of pupils engaged on these training courses. After opening sequences showing the selection of candidates for training, pupils are seen in a variety of aircraft, learning to fly and being taught the subsidiary "lore" which goes to make the good pilot. This film will give the prospective pupil a very good understanding of what flying is all about, and give him an idea of the skills which have to be developed before the tyro takes his aircraft solo for the first time. Like *Glider in the Sky*, the film is 16mm; it lasts for 13min and is available for hire, free of charge from the same distributors.

Low-cost ILS Development of a precision landing system for private and small municipal airports, requiring no change to aircraft instruments and costing 90 per cent less than present devices, has been announced by Waddell Dynamics, a subsidiary of Cubic Corporation, of 9233 Balboa Avenue, San Diego, California 92123, USA. Designated Vorloc II, the electronic instrument landing aid gives lateral alignment with the runway.

Operational at four airports in New England, Vorloc II uses a phase-comparison technique with a ground-based transmitting station comprising two dipole antennas mounted on a 12ft-high permanent support structure.

In operation, the ground station beams a signal on a frequency compatible with that of the standard localiser receiver and positioning indicator in the cockpit.

Made of solid-state components, Vorloc II requires limited maintenance and has no moving parts or vacuum tubes. Designed for all-weather operation, it is said to be unaffected by humidity or temperature changes. In addition, the antenna system incorporates de-icing heaters and clearance lights. All circuitry is housed in a self-contained weatherproof container mounted on the support structure with the antenna system. In the event of a primary power failure, Vorloc II automatically continues operating on a stand-by 12V battery. A 50Ah car battery provides more than four hours of operation during an emergency. Fail-safe features include a built-in monitor. The equipment is now undergoing certification testing by the Federal Aviation Agency.

Little Hope for Cheaper Radio Hopes that prices of radio equipment for light aircraft could be eased, either by Government sponsorship of the manufacture of British equipment, or by a relaxation of the 17½ per cent import duty on foreign equipment, have been dampened by the Board of Trade. Answering a question by Mr Hector Monro, MP, Mr J. P. W. Mallalieu, Minister of State, said recently that the limited market would preclude sponsorship; furthermore, it would be wrong to subsidise the purchase of American equipment, because, apart from the possibility of undermining opportunities for British manufacturers, "in general, the users of light aircraft with a real need to go into controlled areas, e.g., business flyers, should be able and willing to pay for the necessary equipment."

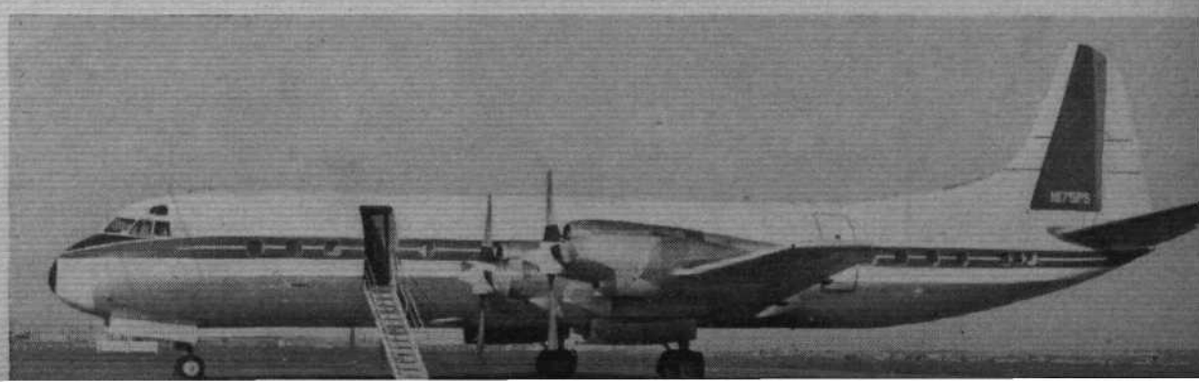
Main elements of the low-cost precision landing aid developed by Waddell Dynamics of California (see item on this page)

Since 1965 some cheaper American equipment had become available, and the limited market and high development costs meant that it was impossible to produce competitive British equipment. On a brighter note, Mr Mallalieu pointed out that relief from import duty was available in certain cases if the use of the radio was for purposes of sport or the advancement of learning, and was non-commercial. There was also the prospect that import duty would be reduced from 17½ to 15 per cent over the next three years.

It seems almost unbelievable that the Board of Trade, which in its survey estimated a market for less than 250 lightweight multi-channel VHF sets, should entirely ignore both the export potential of such equipment and the possibilities opened up by production plans for the Beagle Pup, itself supported by public funds. Some 100 Pups are scheduled to be built this year, and several times that number in the years to come.

Parachute Safety Device Omnipol, the Czechoslovak foreign trade organisation, has released details of its KAP 3P combined parachute releaser for the automatic deployment of main and reserve parachutes. Designed primarily for use in training, it meets the requirements of the Czechoslovak Aeronautical Organisation, which has made the use of such a device mandatory in training and has recommended it for all sporting parachuting. The device incorporates a barometric pressure sensing device which causes the release mechanism to operate at any preselected height between 500m and 4,000m (the ground-level pressure for the landing area is set in advance).

Weekend for Enthusiasts Applications to attend the Light Aircraft Enthusiasts' Weekend on April 19-21, are sufficient to ensure the success of the event, say the organisers, the Department of Transport Technology at Loughborough University of Technology. There are still vacancies on this short course, which is sponsored jointly with the Royal Aeronautical Society. It is expected that there will be strong participation by the industry and by light aircraft operators. The programme opens on April 19 with lectures by university staff on light aircraft design, aimed at the ultra-light aircraft enthusiast. There are demonstrations of aircraft at Rearsby on the Saturday afternoon, and two colloquia on April 21 (Sunday) on design and operation. The fee for the weekend is £5. Further details are obtainable from Mr F. G. Maccabee at Loughborough University of Technology, Loughborough, Leics (telephone: Loughborough 3171).



Believed to be the largest private aircraft ever to visit London Airport is this Lockheed Electra; formerly belonging to Pacific Southwest Airlines, it is now used by the King Investment Company

Letters

Keeping Variable Sweep Symmetrical

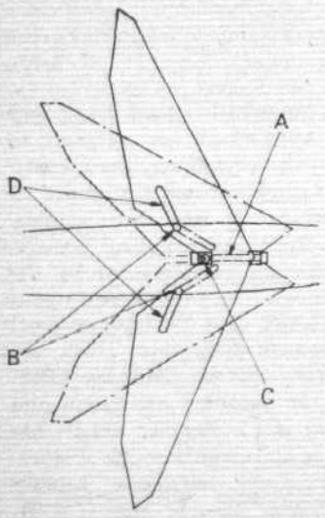
SIR,—"Variable-geometry aircraft" (or variable-sweep aeroplanes as I prefer to call them—I like my definitions to be definitive!) certainly seem to be growing in popularity, but I have yet to see one whose wing geometry appeals to me. They all seem to adopt the system of having two separate wings each hinged independently at opposite ends of a very strong centre section, symmetry being maintained by means of the sweep mechanism.

This system has some obvious disadvantages and I am surprised that nobody has hit on the scheme which was evolved by my colleagues and myself at Saunders-Roe in 1950. The disadvantages of the current popular scheme can be put very simply:—

(1) On a variable-sweep aeroplane one wants the centre of pressure to be in the right place in relation to the centre of gravity, whether the aeroplane has its wings swept or unswept and whether it is flying supersonically or subsonically. Although there is a position at which a single hinge point will produce this effect it is quite a long way out from the centre line of the aircraft, and terribly near the leading edge of the wing.

(2) In a wing system which is kept symmetrical only by the control mechanism, Murphy's Law states quite clearly that one day some unfortunate pilot will find himself flying—or attempting to fly—an aircraft with asymmetric sweep.

In the scheme which we worked out at Saunders-Roe the wing was a continuous bending structure from tip to tip and had one hinge point slap on the centre line. This hinge point was attached to a block which ran on a fore-and-aft slide firmly embedded in the top of the fuselage. Some way aft of this two strong pintles or spigots were firmly attached to the fuselage, one either side of the centre line and projecting upwards; these registered with two slots or slides, one in each wing somewhere near the rear spar.



A, fore-and-aft slide firmly fixed to fuselage; B, two pintles; C, wing hinge sliding on A; D, slides firmly fixed to wing on which pintles B slide

With this arrangement one finds that the centre of pressure moves in the right way in relation to the centre of gravity of the aeroplane; what is more, at no time can the wing system become asymmetric. The worst that can happen if the operating mechanism fails is that the pilot will be stuck with the angle of sweep at which he is currently flying.

To operate this system, of course, all one has to do is to put a hydraulic ram or electric screw-jack or some other kind of actuator on the centre line to push the wing pivot point (C) forward and backwards along (A).

Holywood, Co Down F. H. ROBERTSON

V-bomber Escape

SIR,—The interpretation of the V-bomber accident figures by your contributor M.W. (page 389, March 14) is worthy of Roger Bacon's Ministry of Planes.

From his analysis of the fact that in 16 fatal accidents involving 71 deaths 72 per cent of the dead had no ejector seats and not, as he had expected, 60 per cent (or 67 per cent in the case of six-crew operation), he seems to deduce that it is only 12 per cent (or 5 per cent) less safe to sit in the back with no ejector seat.

The total crew on the 16 fatal flights would have been 32 forward crew and 48 rear crew, assuming a ration of 2:3. However, they were killed in the ratio 21:50. This indicates to me that 34 per cent of the forward crew got out and probably none of the rear crew.

Two of the accidents were caused by the aircraft striking high ground; if it is assumed that escape was impossible for all concerned in these cases, then in the remaining accidents 39 per cent of the forward crews escaped and none of the rear crews.

Surely this is not what M.W. regards as "all chances equal"? I know where I would rather sit.

London SW3 TOM STOREY

More Airways Space?

SIR,—In view of the limited number of aircraft allowed on an airway at one time would not the following be a practical proposition?

For example, if the airway such as Red One was doubled in width, and navaids (VORs) placed at both Clacton and Brookmans Park, then there could be aircraft at the same heights going along the airway in opposite directions at the same time. Alternatively, if it was a one-way airway, there could be dual take-offs or landings on parallel runways and then parallel airways flights from or to London.

Has this idea been thought of previously, or is it in use elsewhere?

Stansted, Essex L. RICHARDS

Metrication

SIR,—The Government, through its various branches, nudges British industry along the difficult road to metrication, the changeover to the metric system which it hopes to achieve by 1975.

This has prompted me to make the most searching enquiries I could into what is happening in aviation, bearing in mind the industry's traditional position—particularly regarding instrumentation.

The British Standards Institution, which appears to have been charged with the "nudging," considered that aviation was a special case and thought that this sector could well be behind the others because of the preponderance of American/British construction. But, the BSI added hastily, the position would change radically if the Americans decided overnight, as they might, to go metric.

Next, to IATA. There I was told the world organisation had established a standard for metric measurements based on the *Systeme Internationale* with, for instance, a scale of metres per second for vertical calibration. Yet, although there was continuing pressure from the "metric" countries, and more recently from those of South America, IATA had back-pedalled a bit and introduced an interim "Blue" table with most of the controversial calibrations in feet—which, it was admitted, makes nonsense of any determined move towards metrication. Both BOAC and BEA, as well as the majority of the world's airlines, had now decided that the "Blue" table, and not all-out metrication, was what they wanted.

Their attitude was quite straightforward. There is a safety connotation, and the whole thing could not be achieved at once. BOAC mentioned that they had started measuring fuel weights in kilogrammes as far back as 1950, but flight calibration was another matter.

This brought me to enquire about the systems used by airlines flying between metric and non-metric countries. In Russia, for instance, I was told that wind

LETTERS...

speeds are given in metres per second, which must be then converted to miles per hour. Not a difficult conversion and one which did not appear to worry those pilots flying to Soviet airports.

Two instrument makers, Smiths and Elliott-Automation, told me there would be no problem whatever about producing instruments with metric measurements; they already do so anyway.

The current position is that three main systems exist—British/American, American, and metric. It seems paradoxical to me that such a revolutionary industry, one that has changed the world and the habits and outlooks of its peoples, can complacently accept a *status quo ante* about metrication.

Surely the answer is not to wait for the Americans to jump, but to agree in time to effect a careful and planned changeover to the metric system to keep this marvellous and remarkable aviation industry in line with changes in more mundane spheres—our demented coinage, for instance.

London SW13 C. P. O'BRIEN

Answer in the Double Negative?

SIR,—As BAC's advertising agents we were responsible for what you describe on page 364 of your March 14 issue as a "convincing photo-montage" of the One-Eleven 500 in BUA colours. Perhaps the production of a long series of such impressions of One-Elevens, VC10s, Concordes, Jaguars, etc., has made us over-sensitive, but we wondered if there was a note of uneasiness in your caption-writer's remark about BAC not being "quite so fast off the mark" as the picture suggested.

Neither BAC nor we have any desire, of course, to delude people that aircraft have flown when they haven't. We simply believe that an accurate, realistic "photograph" of an aircraft gives a better impression of how it will look when it eventually takes to the air than the conventional "artist's impression."

We appreciate the compliment you pay us in using the word "convincing." We are immodest enough, though, to say that we have had even more flattering compliments. We recall, for instance, one experienced BAC photographer declaring gloomily before a genuine air-to-air photographic session: "I don't know why we bother—we never get anything as good as the 'fakes.'" (The poor chap has to rely on what weather Mother Nature cares to hand out!) Even more flattering is the fact that some of BAC's airline customers have continued to use our "fakes" after they had genuine air-to-air photographs of the real thing.

Honesty, though, compels us to admit that there has been at least one occasion when BAC had a new customer's One-Eleven in the air before we could do an impression of it. We still did one—but we had to use the actual take-off shot as our reference for the livery details!

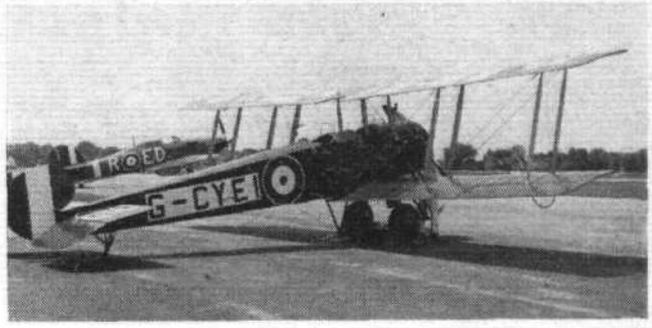
London EC4 GIBSON, GILBERT, WHITE LTD.
S. J. Edwards

Museum Pieces

SIR,—Readers interested in aircraft preservation will be glad to hear that in addition to the ex-RCAF Bolingbroke 1, Serial 9001 (first production model), No 71 MU at Bicester also has the ex-Smithsonian Museum Typhoon 1B MN235 for the RAF Hendon Museum; and this unit's team is also hard at work on the ex-Afghanistan Hind at Abingdon.

Fleet Air Museum visitors will be pleased to see two additions this year, Seahawk Mk 6 WV856 and Buccaneer S.1 XK488.

Those able to get to Canada (and isn't it time we made up a charter party with BUA?) will see many additions, including the two restored Avro 504Ks G-CYCK and G-CYEI, photographed here with Hurricane 2B serial 42012 CF-SMI, last seen at Henlow and



The Avro 504K and Hurricane referred to by Mr Hunt

possibly returning this year. Can anyone clarify the coding R-ED, perhaps the owner's initials? I cannot find a fighter squadron with this code.

Leigh-on-Sea, Essex LESLIE HUNT

The Gold Rush

SIR,—According to a recent news story in the *Daily Telegraph*, a "plane load of gold worth £150 million was flown in from Fort Knox."

If £1=$2.40, and gold is valued at $35 per ounce, then I calculate a payload of around 300 tons.

Have the Americans now got an aircraft that could take a Galaxy in its hold, or are my mathematics out?

Newbury, Berks D. B. HOBSON

Gipsy Major Spares Costs

SIR,—It is to be hoped that the recently announced change in the name of Bristol Siddeley Small Engines Division to Rolls-Royce Small Engines Division will not have the same catastrophic effect on the price of de Havilland Gipsy Major (or should it be Bristol Siddeley Gipsy Major or Rolls-Royce Gipsy Major?) spares as did the last company name-change.

At that time the price of two half-shells of a Major engine bearing went up in price from £2 10s to £12 5s, a mere 500 per cent. Thus, for re-bearing an engine four big-ends and five mains now cost £112 10s in bearings alone instead of £22 10s. Imagine the effect on overhaul prices!

Other items come to mind, such as a varnished carburettor float at the give-away price of £8 2s, float chamber needle valve £4 10s and needle seating £5. But the best buy of all is surely the fabricated tin inlet manifold, pre-war price £8 15s, which has risen during the last five years from a too-costly £85 to an incredible £220.

If you feel, Sir, that successive British governments are doing their best to kill private flying, just take a look at the fine job the aircraft industry is doing. Bear in mind that a large percentage of the privately owned light aircraft on the British register are still powered by Gipsy Major engines.

The same story goes for Gipsy Major propellers. Manufacture of the fixed-pitch metal variety is vested in the Fairey division of Westland Helicopters Ltd, while the only manufacturer of the wooden ones is Airscrew-Weyroc Ltd. The cost of a new Fairey-Reed propeller is now in the £200 bracket; good value, perhaps, compared with the aforementioned inlet manifold, but still too much—almost twice the price of an American-made imported metal airscrew including freight and duty. Also, possession of a monopoly enables Fairey to apply stringent conditions, for example, payment for propeller overhaul must be made before the work is put in hand and on the understanding that if the prop is scrapped there is no recompense.

One's love of flying would enable one to bear this kind of thing with patience if the whole situation were not so sad in the national sense. In the present economic climate it is wrong for the military-orientated firms with their 850 per cent overheads to be producing goods for

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private individuals. Surely both Rolls-Royce and Westland would welcome the setting up of a small private-enterprise firm staffed by a small but wise and knowledgeable management and a goodly number of nimble-fingered workers imbued with the ideal of looking after these existing old engines. The firm would manufacture spares at economic prices, take over the ancient machinery on which Reed propellers are manufactured, and start giving a service to private aviation at a reasonable cost. Preservation of the past would not be the sole object; ultimately this firm could branch out into manufacture, supplying propellers to all those European (and British) constructors who install the Rolls-Royce Car Division's aircraft piston engines and who currently import American propellers. There is a big market here that we as a country are missing out completely because the established aircraft industry has acquired such ridiculous overheads along with its "holier than thou" fixation and cannot compete.

While the propeller market was being tackled the engine side of "my" firm would be quietly working away on the design of a really modern light aircraft piston engine. This should be no problem at all, because all the piston engines currently in use stem from pre-war designs and are basically out of date and, in England, we have at the present time the best piston engine designers in the world, as any constructor of Grand Prix motor-cars will tell you. Moreover, I know that the best of them is all set to have a go at an aircraft motor, given the slightest encouragement.

This principle of hiving out to a company with lower overheads is not new. Grumman, I think, did it with their COIN design because they realised that even the US Government would not countenance the application of jet-age overheads to the price of a simple aeroplane. Obviously, Hawker Siddeley and Westland don't want to be bothered to service antique equipment—to be fair, they have a case: if private customers insist on using old-fashioned goods they've just got to pay. This does not alter the fact that there is still business to be done and a service to be rendered by manufacturing engines and propellers and in servicing those already in existence. But it should be done by a *new*, separate company prepared to look hard at the post-war management history of the British aircraft industry and of its accounting and apply all the lessons learnt.

With wise management such a company could be truly competitive in the light-aircraft field, which is more than can ever happen by manufacturing American designs under licence with all the attendant restrictions on marketing. Why can't we get rid of our inhibitions, go to where Geoffrey de Havilland started, and inject some simplicity and common sense back into this aircraft business?

Coventry, Warwicks EDWARD EVES

Better View at Farnborough

SIR,—As a regular visitor to the Farnborough Air Display, may I appeal to the SBAC—who no doubt are now tackling the big job of arranging this year's show—to find new positions for the large marquees allocated to the Show President and the Press, and sited now at the edge of the main runway at the foot of the slope leading to the exhibition building? These largely prevent a view of the take-offs and landings for a very large number of spectators who assemble in the vicinity, and should never have been sited there in the first place.

Bristol A. P. JENKINS

[Invited to comment, the SBAC says: "We have anticipated the point made by Mr Jenkins, in that the decision was taken earlier this year to move the Prseident's Tent to the terrace adjoining the West end of the exhibition building. This will release an additional 15,000 sq ft of viewing area to the public."]

Transport and General Worker?

SIR,—I was amused by Roger Bacon's comments in Straight and Level (*Flight*, March 14) on the composition, union-wise, of the National Joint Council.

During my time as a licensed aircraft maintenance engineer I have often wondered whether the Air Registration Board have fully considered who they issued their licences to. As a matter of interest, when I was in charge of RB's gaffer's Lancaster at Dunholme Lodge (Wg Cdr M. A. Smith, No 619 Sqn) as a sergeant fitter II I was also painter, decorator, plumber and, occasionally, furniture remover, guard commander, etc; so it's not surprising.

Dinas Powis, Glam GEORGE ALLEN

IN BRIEF

Sqn Ldr T. A. Dicks (8 Amersham Hill Gardens, High Wycombe, Bucks), hon sec of Port Said and Alexandria No 269 Sqn Old Comrades Association, writes to say that the 46th annual reunion is being held on Saturday, April 27, at the Griffin Grill, Villiers Street, London WC2.

From HQ Bomber Command Association of Officers comes news that their 23rd annual reunion is being held at HQ Strike Command, RAF High Wycombe, Bucks, on Saturday, June 8. Gp Capt R. C. Haine, the hon secretary, can send details to any member who has not already received them.

No 83 Sqn is to hold a reunion to mark the 50th anniversary of the winning of six DFCs by the squadron for a vital night reconnaissance in the Cambrai area on the night of June 14, 1918—a feat commemorated by the six-pointed antler in the unit's crest. The reunion will be held in the officers' mess at Scampton on Friday, June 7. Tickets (£2 10s) and further details from the Adjutant, 83 Sqn, RAF Scampton, Lincs.

Mr F. H. Muirhead is working on a history of RAF Transport Command and particularly requires information on squadrons and aircraft, together with photographs where possible. He would also appreciate information on the ATA and the aircraft it handled. Mr Muirhead, whose address is 3 Haremore Cottages, Faringdon, Berks, states that all letters will be acknowledged and postage refunded.

DIARY

Apr 4	RAeS: Main Lecture: "Digital Control of Gas Turbine Powerplants," by W. G. E. Lewis and G. E. Munns; 4 Hamilton Place, London W1, 6 p.m.
Apr 4	RAeS Hatfield Branch: Film show, HSA Senior Staff Restaurant, 5.30 p.m.
Apr 4	RAeS Isle of Wight Branch: Annual general meeting and film show, Clubhouse, BHC Sports Club, East Cowes, 6 p.m.
Apr 5	RAeS: 21st Louis Bleriot Lecture: "Some Thoughts about the Future of European Aeronatuics," by Handel Davies; Paris.
Apr 5	RAF Benevolent Fund anniversary concert, Royal Festival Hall, London.
Apr 5-7	Aslib Aeronautical and Transport Groups: 17th annual conference, College of Aeronautics, Cranfield.
Apr 6	Society of Aeronautical Weight Engineers (European Chapter): Second a.g.m., Mayfair Hotel, London.
Apr 8	RAeS Bedford Branch: "Ground effect Machines," by R. A. Shaw; Bridge Hotel, Bedford, 7.45 p.m.
Apr 8	RAeS: Fourth Reynolds-Prandtl Lecture: "Aerodynamic Design," by Dr D. K. Küchemann; Cologne, Germany.
Apr 9	RAeS London Airport Branch: "The HP Jetstream," by C. J. Joy; Senior Mess, Technical Block A, BOAC, London Heathrow Airport, 6.15 p.m.
Apr 9	RAeS Historical Group: "The First Fifty Years of the RAF," by Air Marshal Sir Victor Goddard; 4 Hamilton Place, London W1, 7 p.m.
Apr 9	RAeS Luton and Stevenage Branch: "A Study in Aero Engine Noise," by H. Dawson; Senior Staff Mess, English Electric Co Ltd, Luton Airport, 5.30 for 6 p.m.
Apr 9	RAeS Prestwick Branch: Annual general meeting, Golden Eagle Hotel, Main Street, Prestwick, 7.45 p.m.
Apr 10	RAeS Bristol Branch: Annual general meeting, BSE Sales Lounge, Patchway, 6 p.m.
Apr 10	RAeS Brough Branch: Annual general meeting, Royal Station Hotel, Hull, 7.30 p.m.
Apr 10	RAeS Chester Branch: "Aircraft Operations in the Antarctic," by a USAF representative; Lecture Theatre, Grosvenor Museum, 7.30 p.m.
Apr 10	RAeS Preston Branch: Annual general meeting and film evening, Queen's Hotel, Lytham, 7.30 p.m.
	SBAC Farnborough Show: September 16-22

INDUSTRY International

Products

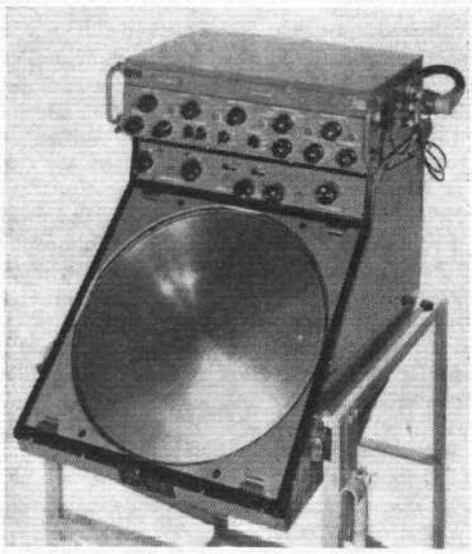
Company News

Midas Recorder Production The Aircraft Supplies Group, 506 Wallisdown Road, Bournemouth, Hants, has taken over the full production, maintenance, servicing, repair and information playback of the well-known Midas CMM3/RB accident data recording system. Mr Travers C. Downard, until recently sales manager of Royston Instruments Ltd, has been appointed technical director of Aircraft Supplies Ltd. Mr J. D. Damper has been appointed chief engineer and Mr F. A. Woodyer becomes production manager of the Midas division, which is now established at Bournemouth.

Burndept Acquisition The Ever Ready Co (Great Britain) Ltd has acquired from the Receiver of Royston Industries Ltd the factory at Erith and assets relating to the telecommunications section of Burndept Electronics Ltd. The business will be carried on under the name of Burndept Electronics (E.R.) Ltd; manufacture of the well-known Sarbe beacon and other recently developed telecommunications equipment will continue.

Helicopter Radar What is claimed to be the first radar system specifically designed for helicopter operation has been introduced by Ekco Electronics Ltd, in association with Mintech, to meet the Royal Navy's requirement for all-weather anti-submarine helicopter operations.

A helicopter equipped with the complete Ekco system forms the control centre for the whole ASW operation, the radar display acting as an operational plotting board. Information displayed includes primary radar echoes from other aircraft, vessels and terrain, up to a range of 50 n.m. together with coded SSR responses from suitably equipped aircraft, helicopters or surface vessels. This secondary radar facility provides positive information and permits low-altitude helicopters to be plotted at much increased ranges in the presence of sea clutter. Both primary and secondary radar can be displayed separately or together. The range and bearing of sonar contacts are also indicated. The operator has the choice of three modes of presentation, conventional PPI, ground-stabilised, or ground-stabilised with offset.



Ekco's helicopter tactical radar display and control panel which is being supplied for the Wessex and SH3D (see item above)

Thus the radar, in addition to providing the normal facilities associated with search and navigation, displays sonar information so that it is readily intelligible and can be integrated into the overall tactical information situation. It gives positive identification of sister helicopters or ships so that there can be no confusion of identity during a co-ordinated attack.

Extensive use is made of nylon nets for cargo-lashing, as in this picture of a pallet of four Europak 88 containers going aboard a BEA Argosy. The 4in-mesh net, with adjustable tensioners, is made from braided ICI nylon and is designed for a pallet load of up to 8,000lb at a restraint of 4g. The manufacturers, Bridport-Gundry Ltd, of Bridport, Dorset, produce similar types of net from ICI nylon for pallet loads of up to 10,000lb and 9g restraint

A Fokker Friendship simulator leaving Redifon's Aylesbury works for delivery to Philippine Air Lines, Manila. The simulator, worth more than £100,000, has a three-axis motion system

IN BRIEF

A delegation from **Dornier GmbH**, led by Herr Silvius Dornier, is visiting Brazil for final consultations with the government on the establishment of a company, to be known as Dornier do Brasil, for the manufacture of the Do27, Do28 and Skyservant.

BOAC have ordered a procedures trainer from **Miles Electronics** of Shoreham, Sussex. It will be used for initial training of Boeing 707 and VC10 pilots; instrumentation includes the Bendix 100 flight director system.

Honnor Marketing Associates, of 868B High Road, N Finchley, London N12, have been appointed to handle the world marketing of the aircraft galley equipment manufactured by the Irish Aluminium Co of Nenagh, Co Tipperary, Eire.

APT Electronic Industries Ltd has acquired an additional 20,000 sq ft of factory space adjacent to the Path Engineering works in Ferndale Road, Ascot, Berks. Path Engineering is a subsidiary of APT specialising in precision mechanical engineering, including parts for the Concorde.

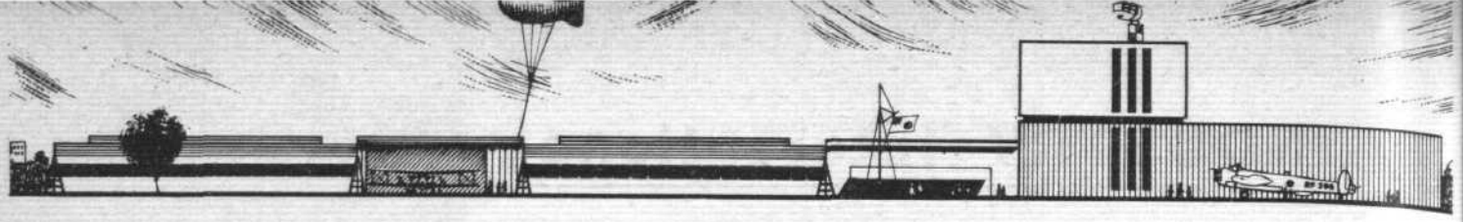
PEOPLE AND POSTS

Mr H. J. Bird has been appointed director of military requirements, Piasecki Aircraft Corp.

Mr Robert W. Duncan, MA, BSc, has been appointed technical director of Bryans Ltd, a member of the Seltronic Group.

Maj Gen J. Desmond Smith and Mr R. W. Fox have been appointed directors of Hants & Sussex Aviation Ltd, following its acquisition by Pillar Holdings. Mr A. G. D'Auvergne, Miss D. Loader and Mr A. W. Lloyd have been appointed to the board of Air Engine Services Ltd.

Air Cdre Tom Wharton, CBE, CEng, AFRAeS, MBIM, at present Director of Mechanical Engineering (2) (RAF) in the Ministry of Defence (Air Force Department) will take up an appointment as quality manager at Westland Helicopters Ltd, Yeovil, on his retirement from the RAF at the end of May.



HENDON PAGEANT, 1971

The museum project takes shape

AT LAST THE RAF is to have its own museum, dedicated solely to the history of the Service and established in the historic setting of Hendon, the ex-airfield lying only ten miles or so from London's centre.

For many years there has been a need for a central museum to bring together collections and exhibits which are at present stored, and to satisfy an increasingly veteran-aircraft-minded public. Although the Science Museum and the Imperial War Museum both provide some coverage of RAF history, they are necessarily multi-faceted and their representation of military aviation is accordingly circumscribed.

Partly because of the lack of suitable facilities for storage and exhibition, and partly through missed opportunities, many famous aircraft type-names are now perpetuated only in pictures and models, and not by actual aircraft. There is, for example, no Whitley, no Hampden and no Halifax known to survive anywhere in the world. In America, by contrast, the existence of the Wright Patterson Museum at Dayton, Ohio, has ensured that very complete documentation of USAF history has been preserved.

The need for such a British military air museum was originally foreseen by the first Lord Rothermere, who in 1917 had the foresight to realise that aerial warfare was opening a new chapter in the world's history. By virtue of his position as first Secretary of State for Air he decreed that one example of each type of Service aircraft should be preserved for posterity; and, as a result, the richest collection of early aircraft ever assembled existed for a period after the First World War, housed in the Agricultural Hall at Islington, London. Owing to difficulties concerning funds, staff and space, this collection was tragically dispersed and eventually largely destroyed. Such veteran British military aircraft as now exist have mainly had to be stored in areas inaccessible to the general public, because of security restrictions concerned with modern operations.

It was not until about four years ago that a fresh attempt was made to provide the RAF with a central museum. Early plans were initiated by an Historical Committee chaired by Sir Dermot Boyle. After considerable discussion Hendon was selected as being the best site, both in view of its historical association—the name has been synonymous with flying since the very early days—and, more importantly, because it offers very easy access both from London (by car, bus and underground) and from the Midlands and North, situated as it is adjacent to the A1 and to the M1 motorway. Ten acres of land have been set aside for the museum and existing buildings provide a basis for the large exhibition hall which is planned. The old Grahame-White factory building will be used as a workshop and a store.

The museum is directed by Dr J. Tanner; and the board of trustees, appointed by the Secretary of State for Defence, numbers among its members Sir Dermot Boyle, Sir Geoffrey de Freitas, Air Chief Marshal Sir David Lee and Air Marshal Sir Denis Spotswood. Its stated aims are to preserve and display to the public relics of interest and significance; to provide a factual presentation of the development of various aspects of military aviation; and to provide material for research within its specialist field. There will be a staff of 40 when the museum is commissioned. The running costs will be met by the Treasury and there is to be a £3,000 purchasing grant in the first year to cover the cost of acquiring exhibits; but the total capital cost is estimated to be £1 million, and this will have to be raised privately.

The Aircraft Exhibits

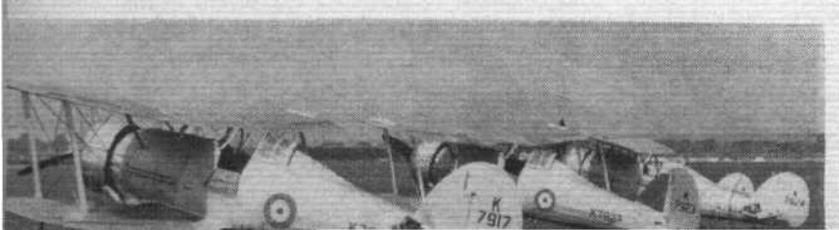
Pride of place will, of course, go to the aircraft themselves. Some 50 specimens are already in existence, stored in various locations up and down the country and these will be brought together to make probably the largest collection of historic military aircraft in Britain when the museum is completed. Many other exhibits also at present in storage will be shown in rotation as space and resources permit. The largest at present on the books is a Beverley, due to be flown into Hendon very shortly. Other famous aircraft include Avro 504K, Camel, Gladiator, Blériots XI and XXVII, S.E.5a, Sopwith Triplane, Tiger Moth, Gunbus, Beaufighter, Lancaster, Lincoln, Wellington, Lysander, Mosquito, Dakota, Spitfires, Hurricanes, Typhoon (the only remaining example, presented by the Smithsonian Institution), Canberra, Meteor, Lightning, Comet and Hind (ex-Afghanistan).

The complement of aircraft is backed up by an already very comprehensive collection of other exhibits, including a collection of 1/48th-scale models of the 300-odd aircraft types which have seen service with the RAF, RFC and RNAS. Many of these will be shown in dioramas, representing airfields in all parts of the world. Other collections already in existence include uniforms, technical equipment, armament, medals and decorations, paintings, drawings and films. Outstanding among collections of personal possessions is that of Lord Trenchard, father of the RAF.

The library and archives will be of the greatest value to the researcher and historian; they include the important collection of Brabazon papers, which range over the entire period of practical powered flight from its inception until their owners' death in 1964. The archives department will include original drawings from many well-known aircraft manufacturers.

If there is a satisfactory response to the appeal, which is being launched today, the museum will open in 1971. It is gratifying to record that over £250,000 has already been received or promised.

"Flight" photographs



Two of the aircraft types destined for the museum at Hendon. Above, a Hurricane IIB of 402 Sqn at a wartime dispersal; below, Gladiators standing on Hendon Aerodrome during RAF Pageant rehearsals in July 1937

Heinkel He111s (Spanish CASA 2.111s) and a Junkers Ju52 at Tablada airfield during the filming of "an inspection by Feldmarschall Erhard Milch." The staff cars are Mercedes—except for the last one, which appears to be a Fiat. Except for the deep-chinned Merlin engines, an impressive re-enactment

IT'S 1940 AGAIN

"We are using advanced techniques in practical filming that have never been used before. I predict that the visual impact of the 40 minutes of flying sequences in 'The Battle of Britain' will be unlike anything else ever filmed."

Thus does film producer Harry Saltzman express his confidence in the new United Artists film now in production in Britain and on location in Spain. Following an uncertain start early last year, the £5 million production got the go-ahead last June with the announcement that filming would begin in March this year for a première in September 1969. The first shooting is now in progress at Tablada airfield, near Seville, where between 20 and 30 obsolete Spanish Air Force Heinkel He111s have been assembled to represent a 1940 Luftwaffe bomber group, while some two dozen Hispano HA.1112s, the Spanish-built derivative of the Messerschmitt Bf109, are being used to simulate a fighter squadron. For the opening sequences director Guy Hamilton has chosen the Dunkirk operation, and these shots should be in the can next month.

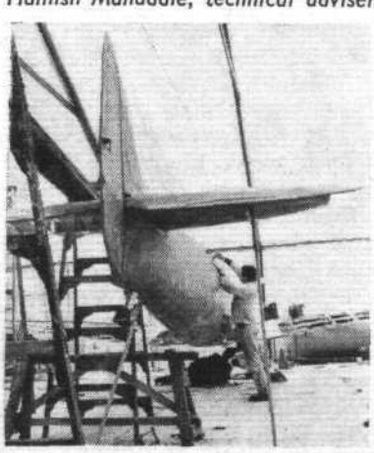
Airspace over Norfolk and Suffolk has been allotted for the aerial battle sequences, and the BoT will in due course issue a Notam for the edification of any en route pilots who might otherwise find themselves wondering if and why they had suddenly slipped back 28 years in time.

The aerial scenes will be filmed for the most part from a specially modified B-25 Mitchell bomber acquired from Euramericair of Florida. From an astrodome replacing the mid-upper gun turret the aerial director will be in contact with all aircraft through radio and with his cameras by closed-circuit TV. The cameras will occupy nose, tail and waist positions; and another mounted on a retractable double-jointed arm in the bomb-bay will give a 360° view below the aircraft.

Instrumental in obtaining such aircraft as Spitfires, Hurricanes and Bf109s has been Gp Capt Hamish Mahaddie, ex-bomber pilot and technical adviser for the film; for three years he has been travelling round Europe in search of aircraft and equipment.

Well-known stars have yet to be named; but, says Saltzman, "Let us make no mistake. In this picture there is no horrible Hun and no handsome hero, but at the same time it is not—repeat not—a documentary." To put this into perspective, co-producer Benjamin Fisz, Polish ex-Spitfire pilot, says: "I think the nearest equivalent was Howard Hughes's *Hell's Angels* and there they only had 54 planes. Our number goes into three figures."

Left, to dress some of the British airfields wooden mock-ups of Spitfires and Hurricanes have been built at Pinewood studios; here a Spitfire is under construction. Right, Air Cdre James Wallace, (standing), publicity executive for Spitfire Productions, and Gp Capt Hamish Mahaddie, technical adviser, with the B-25 camera platform



Hispano HA-1112s simulating the original Messerschmitt Bf109s, but equipped with the engine that shot the latter out of the sky—the Rolls-Royce Merlin. For the film they will be flown by Spanish Air Force pilots. The tailplane struts were specially added

Spaceflight

European Space Proposals

The Advisory Committee's Report

RECOMMENDATIONS FOR FUTURE EUROPEAN SPACE ACTIVITIES are made in a Report, recently published, by the Advisory Committee on Programmes set up by the European Space Conference during its meeting in Rome in July 1967. Its recommendations are at present being considered by member governments of the conference and are due to be discussed at the next European Space Conference, which is being held in Bonn early in July.

The Committee was asked to investigate the aims that the countries which are members of the European Space Conference could most usefully set for their co-operative activities in space, both in the scientific research and practical applications areas, and to frame proposals for the establishment of a European space policy on the following lines: projects which would cover several years and be harmoniously divided between scientific and technical research activities on the one hand, and practical applications on the other, together with the construction of the launchers required for such projects. Main directions of these projects should be: the building of improved communications satellites; and the elaboration of a meaningful scientific programme concentrated on few activities, but activities opening-up new prospects in the research area. The proposals should also establish priorities between different programmes.

Functions of the committee were purely advisory; it was to take into consideration current or completed studies and programmes conducted on the initiative of the European Space Conference or the European space bodies. It was entitled to consult national administrations of countries qualified to participate in the European Space Conference and to receive from them any suggestions they might see fit to make.

The Committee consisted of a Chairman designated by the European Space Conference: M Jean-Pierre Causse (France); a Technical Sub-Committee of experts appointed by the Committee of Alternates: Prof B. Bolin (Sweden), Prof N. Cacciapuoti (Italy), Mr J. G. Lewis (United Kingdom), Herr A. Spaeth (Federal Republic of Germany); an Economic Sub-Committee, appointed by the countries taking part in the European Space Conference: Prof H. Koelle (Federal Republic of Germany), Mr J. Defay (Belgium), Mr A. Brandstrup (Denmark), Mr A. Escribano (Spain), M J. Bonnet (France), Sr M. Rodino (Italy), Dr J. Cramer (Netherlands), Mr L. Pliatzky (United Kingdom), Mr H. Ernst (Switzerland) and Mr B. Aler (Sweden). (Australia, the Vatican City and Norway did not appoint members); plus an adviser from each of the organisations that constitute the European Space Conference—Dr A. Dattner (ESRO), Col K. Davies (ELDO) and Dr N. Simmons (CETS).

In the House of Commons on March 18, the Minister of Technology, Mr Wedgwood Benn, when announcing that the report had been published, was asked what the British Government's attitude was likely to be towards it at the Bonn conference. He replied:—

"The issues raised by this report are very important issues. The Government are now considering them. There is little time before the Bonn conference takes place. We shall reach our conclusions about them as soon as we possibly can. I cannot undertake that there will be a debate in this House, but as soon as we reach a view, we shall be in a position to let it be known."

He was asked by Mr David Price (Con; Eastleigh) whether he did not agree that for Britain to co-operate effectively with European projects it was necessary to maintain a minimum threshold of space capability at home, and whether he did not also agree that there was some doubt as to whether we had the balance right at the moment between the national effort and the European co-operative effort. Mr Benn said that those were some of the factors the Government was looking at, adding: "Of course, there is the Black Arrow project at home."

The Advisory Committee's report, which is a kind of Ployden Report on the future of the European space industry, but considerably more constructive, considers in detail all the possible permutations of European space activity, both short-term and long-term. It makes a clear differentiation between a scientific research and an applications programme, and in the context of the former, sets out three different options. The first is based on the LAS (large astronomical satellite) programme, with a timetable and financing plan proposed by ESRO. The committee considers that this could be undertaken, although it is at the limit of Europe's present technical and financial resources. Its report comments:

"One of the declared aims of ESRO has always been to undertake a project of a magnitude beyond the reach of the member states individually, and one that would be on a comparable level with what was being done in the same field in the United States or the Soviet Union. It is well known that at the outset of the Organisation's existence the decision was taken, in this connection, to construct a large satellite devoted to space astronomy. In the course of definition of the project, a scientific experiment devoted to high-resolution spectrophotometry in the ultra-violet was chosen. A succession of studies was carried out, and the state of definition and technical preparation of the project considered by the Committee was very satisfactory, and certainly much superior to that of most of the other projects submitted to it. In fact, a properly founded decision can be taken today, and the work start without further delay.

"The very complexity of the project and the desire to emulate equivalent American developments led to the LAS project being on a scale that was not originally fully appreciated, and the cost of which turns out to be very high—several times higher than the figures provided for in the ESRO budget. Those in charge of the project have shown how its financial impact could be rendered more acceptable by writing-off the technical developments—and thus the investment—over a series of several satellites of a single family. Thus, they have envisaged the launching of four satellites at two-yearly intervals, starting in 1973. In practice, this means giving astronomy a leading role to play in the ESRO programme over a ten-year period. The figure currently put forward by ESRO is close to 900 MF (at 1967 prices roughly 180 MMU), excluding the cost of the planned ELDO launchers and the cost of the experiment beyond the first satellite, but taking very fully into account all foreseeable types of expenditure, including the exploitation costs of each satellite."

The second option is for the idea of LAS to be abandoned and a minimal scientific programme of two satellites per year carried out, expenditure during the first phase being appreciably lower than in Option 1. Option 3 differs from 2 in that a meteorological satellite is introduced, starting a year after the Eurovision satellite, thus giving European meteorologists a chance of taking part in the World Weather Watch programme in 1973 with a satellite of European construction.

The Committee says that if Option 1 is approved, it means that ESRO would proceed with the LAS but that firm decisions on the smaller projects could be taken progressively over a period of time in the ESRO council. It adds:—

"If the decision is against the LAS, a choice remains to be

taken in principle between Option 2, with the higher scientific research content, and the smaller Option 3—with the implication of a larger complementary programme of applications satellites, including meteorological satellites."

As to the applications programme, the report says that the essential decision now required is on the proposal for an experimental TV relay satellite. It would be implicit in this that Governments had set themselves the objective of an operational Eurovision satellite, if the experimental project were successful; but no specific decision was required on this further stage at present. However, it adds that if European meteorologists are to be given the possibility of participating in the World Weather Watch in 1973 by means of construction of a European meteorological satellite (as mentioned above), "a decision is required in 1968 (which could best be taken at the Ministerial Conference in Bonn) to carry out a feasibility study for this project."

In its references to the technical thresholds in communications satellites, the report mentions direct TV broadcasting from a satellite, in the following terms:—

"Switching to the other end of the size-scale of the ground receiver stations, we come to the case where the satellite broadcast can be picked up directly by the ordinary domestic receiver, subject to certain minimal and inexpensive modifications, requiring essentially the use of an antenna that must be oriented towards the satellite. This is what is known as 'direct television broadcasting.'

"The essential point is that direct television broadcasting by satellite today appears technically possible and that it is almost certain that within ten years it will be a reality."

On meteorological satellites, the report says:—

"The meteorological field is in a similar situation to that of communications: space techniques have revolutionised it, and there is every reason for thinking that the future will produce even more radical changes. Operational satellites already exist in the United States and the USSR, and a number of meteorological offices (including European ones) use some of their observations in making forecasts. Their importance and their role no longer call for proof.

"In order to specify what the European contribution might be in this field, the Committee called together a group of experts including the directors of the European meteorological services as well as distinguished research workers specialising in study of the atmosphere. This group summarised the viewpoints emerging from discussion in an important document that is produced in Annex 4 of this report. It is considered appropriate to emphasise the very wide degree of agreement that manifested itself on this occasion."

In its comments on the European launcher programme the report says that as regards existing launcher development programmes for Europa 1 and 2, no new decisions are required so long as ELDO is operating within the financial limits previously approved, except that a decision on the proposed TV relay satellite entails a minor modification to Europa 2 at a cost of about 5 MMU (million monetary units, equivalent to million US dollars) if this is to be used as the launcher. It adds that acceptance of the ELDO launchers for the proposed programme for scientific and applications satellites requires a decision to undertake the manufacture of the necessary launchers. It emphasises that to meet the proposed time-scale, a decision in principle is necessary in 1968 and financial provision will be required in 1969, and adds: "No commitment is required yet on the proposed further launcher development programme for Europa 3, but, if this option is to be kept open and continuity of development secured, a decision is required on the proposal to finance certain work on the liquid hydrogen motor, estimated to cost 11 MMU, and to undertake the necessary definition studies on the launcher."

The other main recommendation by the committee is on European Space Organisation. It says that decisions taken by the Conference on proposed programmes set out above "will necessarily entail further decisions on the forms of the existing space organisations to carry them out. Thus a decision is required on the setting-up of a working group to study the further organisational framework of European space research and development. In view of the urgency of working-out detailed proposals concerning such an organisation, the work should start immediately. . . ."

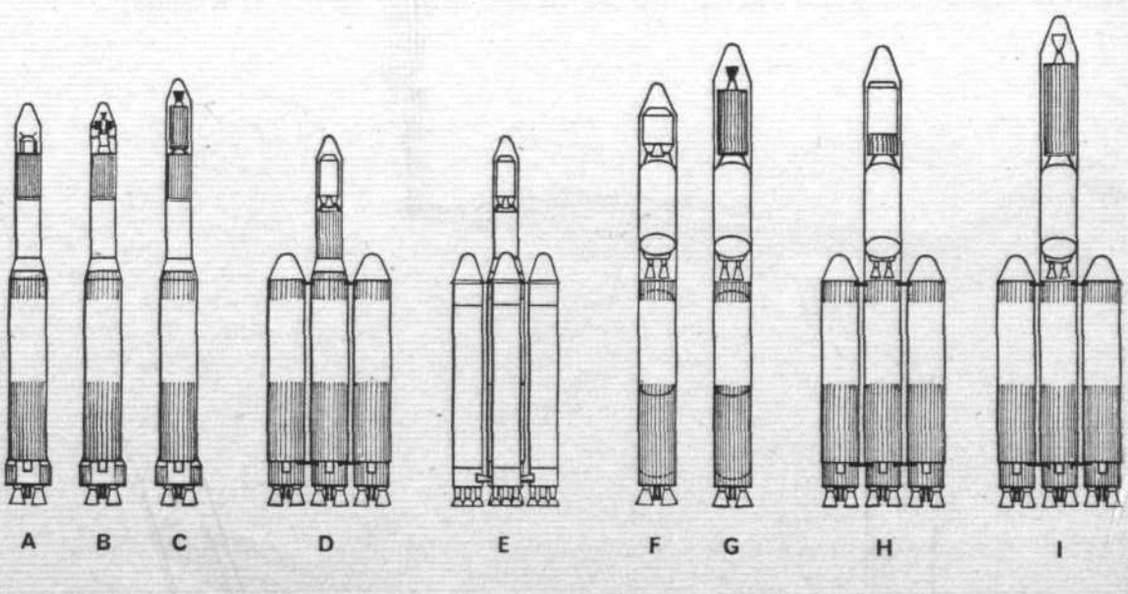
Also necessary are studies of the organisational problems of commercial utilisation of space, as well as of assigning priorities to various types of space activities in general and of applications projects in particular.

Summarising European space objectives, the Report says:—

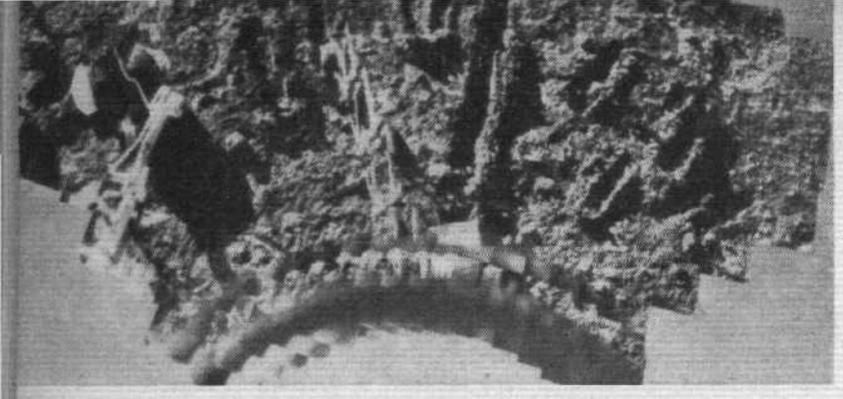
"European activity in space should be oriented towards direct objectives, namely increased knowledge and worthwhile applications. Rather than seek the 'power' objective that has characterised other space policies, Europe should above all demonstrate her determination to be independent. Rather than indulge in illusory competition, she should seek to practise the closest collaboration with the other space powers and to join with them in the execution of major international undertakings, provided always that she can at the same time safeguard her design results, and ensure that she secures technological benefits commensurate with her efforts."

As to the overall cost of the proposals advocated, the report says that "the programmes put forward by the Technical Sub-Committee are designed to produce a balanced programme, with scientific research projects and applications projects complementing one another, so as to take maximum advantage of the available facilities. These proposals rest on two assumptions: (1) the objective of a minimum independent European capacity in both satellites and launchers; and (2) a 10 per cent annual increase in expenditure on European space programmes.

Elsewhere, the report says that these programmes "would involve an estimated annual cost rising from the present level of about 150 MMU . . . to a figure in the range 185-190 MMU by 1970 and an annual expenditure of about 240 MMU in the mid-1970s."



These are proposed vehicle configurations (reproduced from the Report of the Advisory Committee on Programmes, referred to on these pages) for future European launch vehicles. Variants are as follows: (A) Europa 1; (B) Europa 2; (C) Europa 1 with electric propulsion; (D) Blue Streak with two large liquid boosters; (E) Blue Streak with four Carole boosters; (F) Europa 3 with liquid hydrogen upper stage; (G) Europa 4 with electric propulsion; (H) Europa 4 with boosters; (I) Europa 4 with boosters and electric propulsion



Mosaic of narrow-angle pictures taken by the TV camera of Surveyor 7 on January 21, assembled to show the spacecraft's surface sampler digging a trench. Later, the sampler moved the sensor head of the alpha scattering instrument (upper left) onto a pile of soil scooped from two parallel trenches, in order to analyse its chemical make-up

Spaceflight

ESTEC INAUGURATION

The European Space Technology Centre at Noordwijk, Netherlands, main technical establishment of ESRO (European Space Research Organisation), was to be officially inaugurated by HRH Princess Beatrix and Prince Klaus of the Netherlands yesterday, April 3. Primary function of the centre is the study and development of rocket payloads, satellites and payloads, and their related technology.

EXPLORER 1 DECADE

Oldest US spacecraft (launched on February 1, 1958), Explorer 1 recently passed its tenth year in orbit and is expected to continue flying silently round the Earth until late 1968. Its radio transmitters sent back scientific data for the first 16 weeks after launch, information received including confirmation of the existence of the Van Allen radiation belt named after Dr James Van Allen, who had designed the experimental instrument package for the satellite. According to the National Geographic Society, Explorer 1 has travelled more than 1 billion miles (2,100 million km).

WEATHER SATELLITE CAPABILITY

Understandably, American scientific feathers have been ruffled by some of the unfavourable comparisons of the ESSA satellites with the Soviet Meteor system recently made by Professor Ivan Andronov in a *Pravda* article (*Flight* last week, page 427), particularly his claim that the Russian satellites used cameras able to take more detailed photographs.

In 1962 the US and USSR agreed to exchange satellite-collected weather information, but the latter did not start sending any data to the USA on a regular basis until 1966. The agreement calls for transmission within six hours of pictures and analysis, but the Americans say that Soviet photographs arrive later than this and that their quality "hasn't been too good."

Prof Andronov pointed out that the Cosmos weather satellites used infra-red rays to take day and night pictures of Earth's cloud cover and record average temperatures, while the Americans' Tiros took only daytime photographs. In reply to this, American scientists say that the US had not judged it practicable to equip its weather satellites with infra-red equipment for night photography.

CNES SATELLITE CONFERENCE

An international conference on the theme *Attitude Changes and Stabilisation of Satellites* is being organised by CNES (Centre National d'Etudes Spatiales) and will be held in Paris from May 28 to 31. Papers are being given on the following main subjects: natural motions, attitude reconstitution, active and passive stabilisation. The motion in space of sounding rocket payloads and working rocket motors will also be covered. Simultaneous translation facilities are being provided.

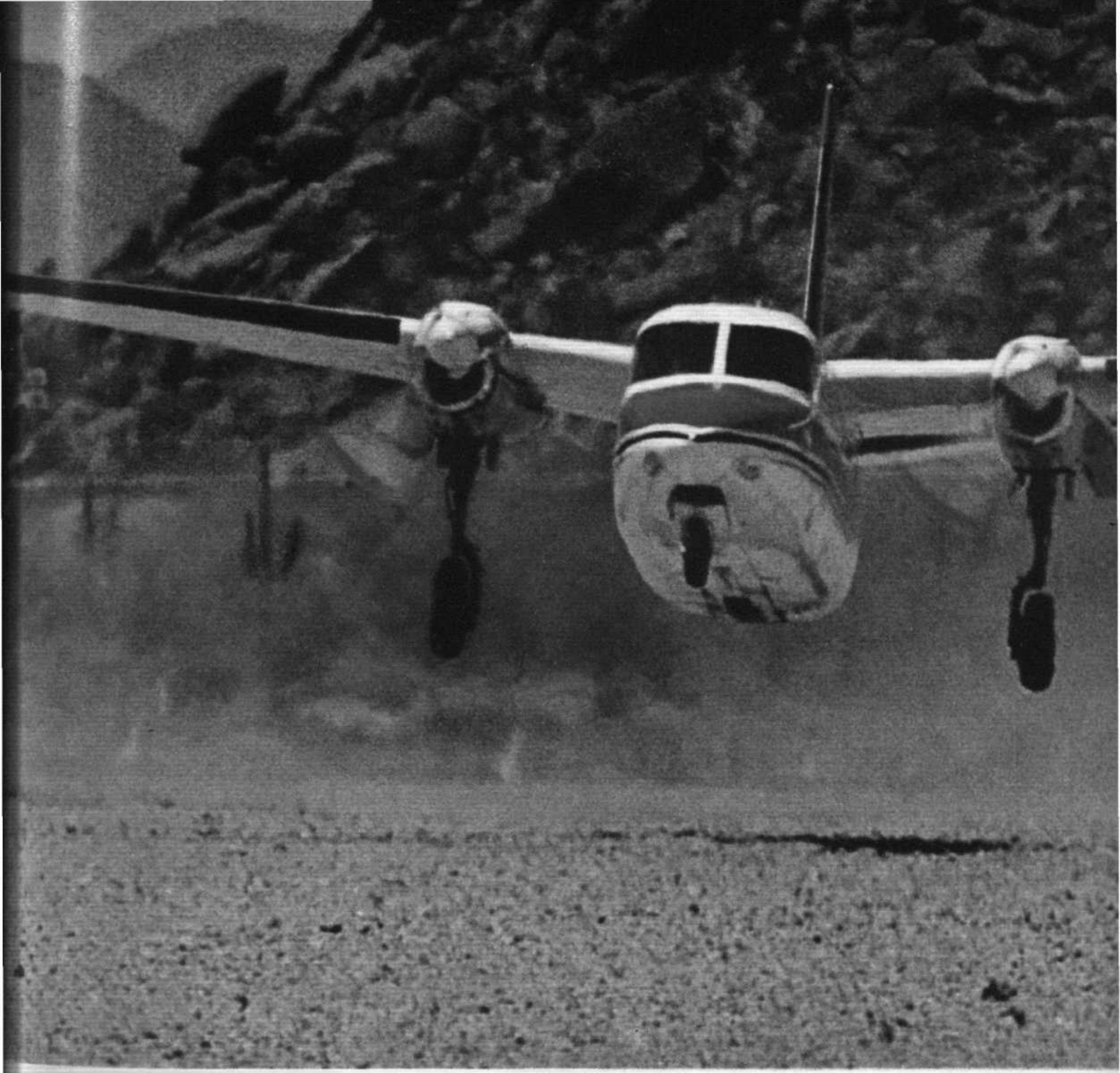
Venue of the conference will be Centre National de la Recherche Scientifique, 15 Quai Anatole France, Paris 7e. Those wishing to attend should contact Centre National d'Etudes Spatiales, Direction des Relations Exterieures, 129 Rue de l'Université, Paris 7e, and participants intending to present a paper should register as soon as possible.

ARIEL 3 SYMPOSIUM

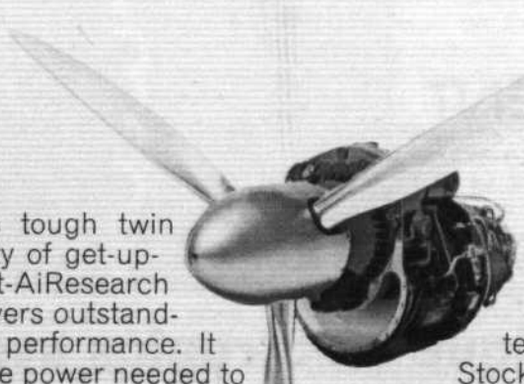
The British National Committee on Space Research has arranged a discussion meeting, under the leadership of Sir Harrie Massey, FRS, on *Scientific Results Obtained by the Ariel 3 Satellite*. This was launched on May 5 last year by NASA Scout vehicle from the Western Test Range, Calif. The meeting is being held at The Royal Society, 6 Carlton House Terrace, London SW1, on Wednesday, April 24, starting at 10.30 a.m. and going on until 6 p.m.

It will include a presentation on the project, by the Space Research Management Unit of the Science Research Council (Mr A. C. Ladd); a description of the satellite, by Mintech (Mr H. J. H. Sketch of RAE); and papers on: anomalous features of the electron density distribution in the topside ionosphere, by the University of Birmingham (Prof J. Sayers, Dr J. W. G. Wilson and Miss B. Loftus); observations of the radio sky brightness at 4 MHz, by the University of Manchester (Prof F. G. Smith and Mr P. Gregory); determination of terrestrial radio noise, and of the attitude of Ariel 3, by the Radio and Space Research Station (Mr F. Horner and Dr R. B. Bent, and Dr R. B. Bent, respectively); measurements of VLF radiation, by the University of Sheffield (Prof T. R. Kaiser); and measurements of molecular oxygen in the upper atmosphere, by the Meteorological Office (Prof K. H. Stewart and Dr P. J. L. Wildman).

NASA's HL-10 wingless lifting body (right) making a 220 m.p.h. landing on the dry lake at Edwards AFB, Calif, with an F-104 chase aircraft in close attendance. Launched at 45,000ft and gliding to earth in 4½ min, the HL-10 is being studied for possible use as a future spacecraft capable of manœuvring in flight to a ground landing



Our turboprops are tough engines for tough birds.



Turbo II, Aero Commander's tough twin executive turboprop, has plenty of get-up-and-go. Powered by Garrett-AiResearch TPE 331 engines, Turbo II delivers outstanding takeoff, climb, and cruise performance. It also has the kind of manageable power needed to fly into and out of small, unimproved airstrips. Our turboprops give instant response, and are simple to service. And wherever Turbo IIs fly, Garrett-AiResearch world-wide field service is nearby. Fly an Aero Commander Turbo II soon, and find out first-hand what AiResearch turboprops can do for your kind of flying.

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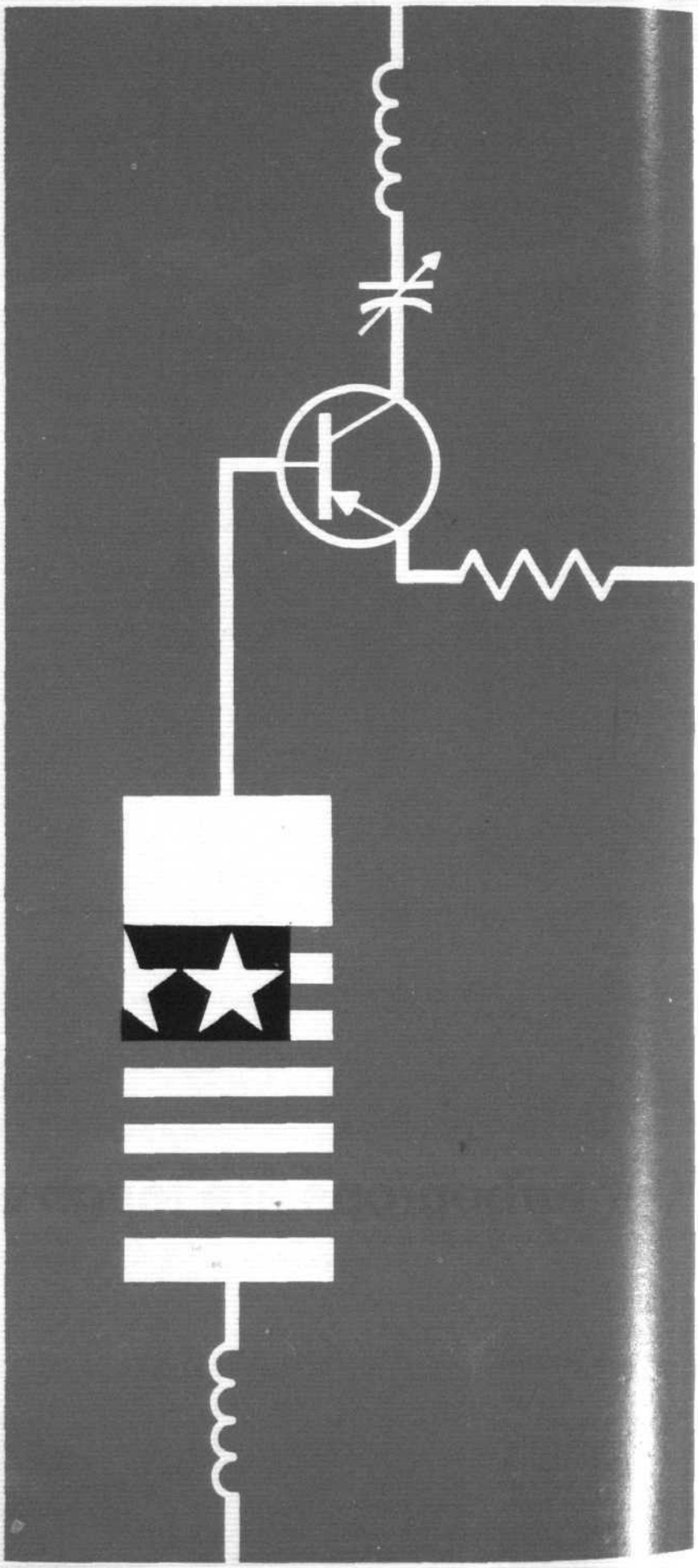
SPERRY RAND



The Ford Instrument Division recently delivered a completely integrated, digital fire-control system to the U.S. Navy. The system is now operational.

Significantly, the system was originally designed and manufactured in the Netherlands. And was manufactured, under license, by Ford for delivery to the U.S. Navy. It was the *first* Europe-to-U.S. military licensing agreement between *commercial* organizations, an agreement approved by both governments involved.

If you manufacture an electronics system—for example, in avionics, ordnance, navigation or power control—which does not exist in the United States, why not contact us.

We may be able to work together to expand the market for your system. For we have the ability to manufacture sophisticated systems to U.S. military specifications. To cooperatively develop modifications, if necessary. And to present your product to the appropriate military audience for review and evaluation.

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Spaceflight

COMSAT'S FIVE YEARS

In its annual report for 1967 the Communications Satellite Corporation has looked at the events of the past year against a background of five years' activities and prospects for "the reasonably definable future:" subtitle of the report is *Perspective at Five Years.*

A letter to shareholders from Mr Joseph V. Charyk, the president, and Mr James McCormack, chairman and chief executive officer, recalls that at the time of Comsat's initial stock offering in June 1964, the public and communications carriers immediately oversubscribed the authorised shares. Later that year, the major communicating nations of the world joined with the US in the Intelsat consortium to develop satellite technology for international commercial communications; then when the first Intelsat satellite, Early Bird, began commercial operations in June 1965 "our venture was on its way."

The president and chairman say that it now seems clear that the global system postulated by Congress in 1962 will be ready sooner, and at much lower cost, than initially projected. Two operating satellites in the Atlantic and Pacific Ocean areas, each with a nominal capacity equivalent to 240 voice circuits, are now virtually fully loaded with voice, data and TV traffic.

The next generation of communications satellites, Intelsat 3, scheduled for launch beginning in the second half of this year, are designed each to provide 1,200 voice circuits. Studies are under way on an improved version, which could provide about 2,000-circuit capacity in 1969; and design studies are complete for a satellite of at least 5,000 circuits, projected for 1970. As to ground terminals, new US Earth stations in California, West Virginia and Puerto Rico are being added this year to the present ones in Maine, Washington and Hawaii.

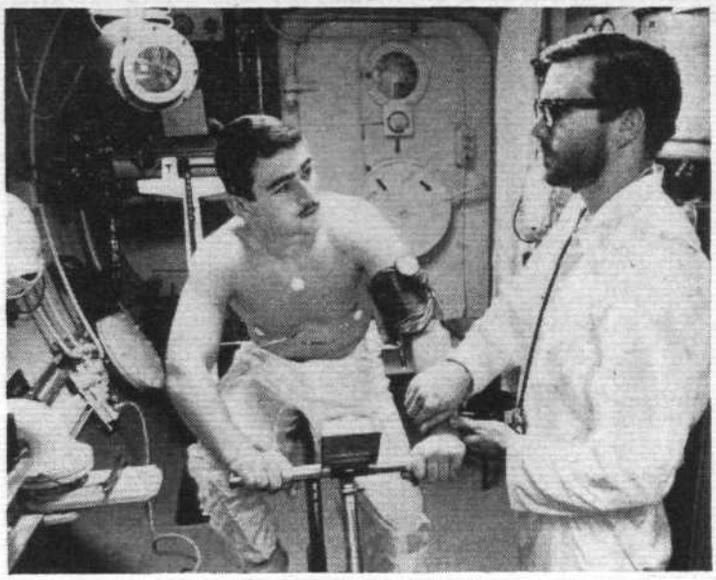
Looking to the future, the letter to shareholders comments: "The satellites now operational have all been undertaken at considerable risk. We have been fortunate that in five attempts we have had only one failure to place a satellite properly in orbit, and that those in orbit have performed satisfactorily. New uncertainties lie ahead of us. We have had, and will continue to have, our share of the more familiar sorts of delays and other disappointments. But looking back over five years, the net accomplishment is satisfying. And looking forward a similar distance, we expect to see the world in possession of a communications system more versatile, reliable, commodious and economical than anything which could have been foreseen by those who put the business together at the beginning."

EUROPEAN PROPOSALS: UK VIEWS

Some indication of the British Government's attitude towards the European space programme proposals to be discussed at Bonn in July (see pages 493-494) was given by Mr Goronwy Roberts, Minister of State, the Foreign Office, in a written Parliamentary answer on March 25.

He had been asked by Mr Rafton Pounder (UU; Belfast S) what the Government policy was towards Recommendation No 507 on European space policy and satellite applications, adopted by the Consultative Assembly of the Council of Europe on January 29; and if he would instruct the UK Permanent Representative in the Committee of Ministers of the Council of Europe to vote in favour of the proposals contained in the recommendation. This referred to the urgency of agreeing on a common European posture with regard to Intelsat, and to the importance of the World Weather Watch.

Mr Roberts said in reply that the recommendation would be taken into account in preparing for the forthcoming Space Ministers' Conference. He added that the Government was seeking, through the European Conference on Satellite Communications, a common European policy on definitive arrangements for a global commercial communications satellite system. He said further that the Government fully supported the concept of a World Weather Watch and intended to play a full part in its implementation, and that the Postmaster-General welcomed the idea of periodic meetings of European Ministers responsible for telecommunications.



Episode during long-duration scientific experiment, testing water and oxygen recovery systems required for extended manned space missions, which began at McDonnell Douglas Missile & Space Systems Division on February 19 and is continuing for up to 60 days from that date: space cabin crewman Jack G. Angaran (left) pedals a bicycle ergometer as fellow crewman Denis Giroux takes his pulse. They perform a daily regimen of exercises while the cabin's other two occupants, Guy H. King and Robert B. Zeuschner, refrain from planned physical activity in order to provide a basis for comparison

WOOMERA'S FUTURE

The future of the Woomera rocket range, according to a correspondent writing from Sydney, depends on a report being prepared for the British Government by a team of technologists and defence experts. The team has just completed a ground inspection of joint projects at Woomera, and has held talks in Canberra with Australian officials. There have also been discussions with the British High Commissioner, Sir Charles Johnston, and his advisers. The team has now gone back to Britain to prepare a report on which the Minister of Technology, Mr Wedgwood Benn, will decide Britain's attitude, when negotiations open in June on reviewing the present joint-project agreement.

This expired last June, but was extended for a year by mutual consent. It involved Britain in a half-share of the costs of research and development and weapons-testing, estimated to cost the UK about $A15 million during the current financial year. The British visit, although officially described as "routine," has left a new cloud of gloom and doubt among Australian officials. A spokesman for the Department of Supply said it was feared that in the savage mood of tough economy, Britain might pull out altogether. "But we are optimistic," he added. "We hope the worst that will happen will be a reduction of commitment, and that perhaps we might make more use of the facilities and ranges for our own armed forces." The official said that Woomera had been in a doubtful state for a long time and employees were now used to living with an uncertain future.

A drastic reduction in British interest would probably herald a slashing of the Black Arrow rocket development. This would probably coincide with the final launching by the European Launcher Development Organisation. Future ELDO launchings would be made at the French equatorial range in Guyana.

With these two projects gone and the US Defence Department's Sparta space re-entry programme already at an end, the effects would be felt not only on the range but also at the Weapons Research Establishment at Salisbury, South Australia.

Little hope is now held for anything fruitful emerging from the discussions with Japan on the use of the range facilities and the future may rest on expanded Australian armed-service operations or on a new American interest.

The British team's report is expected to be followed by official exchanges of views and talks in London and Canberra. It is also likely that the British and Australian Ministers will meet again to finalise the outcome of the negotiations. Eventual signing may take place in Canberra.

DEFENCE

A 737 Sqn Wessex HAS.3 makes a cross-deck landing for a running turnround on the two-spot flight deck of the new RFA "Engadine," the first purpose-built helicopter support ship in Royal Navy service

"Flight" photographs

HELICOPTER SCHOOL AFLOAT

Specialist vessel for ASW training

A BRAND NEW, SPLENDIDLY EQUIPPED and specially built fleet auxiliary is now in Royal Navy service to support the training of ASW helicopter crews. The RFA *Engadine* is the Navy's first specialist helicopter support ship and replaces in service a hastily converted LST, HMS *Lofoten*, which had a short service career in the role following conversion in 1964.

The need for *Engadine* is largely an offshoot of advances in ASW helicopter technology, embodied in the highly capable Westland Wessex HAS.3 which, though superficially little altered from the earlier HAS.1, represents a great jump in submarine detection and destruction abilities. The Wessex 3, and the forthcoming Sea King replacement, have medium-depth sonars, as opposed to the shallow depth sonars of the earlier helicopter. To take helicopter crews to deep waters during their operational conversion training, the *Engadine* was specified with the additional duties of providing sea time for operational squadrons when they are ashore during their vessels' refits.

Because *Engadine* is operating in the auxiliary role and not as a warship, she has been built as an RFA to Merchant Navy standards, is manned by an RFA crew of 69 officers and ratings, plus a small permanent RN contingent and the larger training contingent aboard. Laid down in 1965, the vessel was accepted into service on December 15, 1967. Under the management of the Director of Fuel, Movements and Transport (Navy), the *Engadine* is attached to the Western Fleet and will normally be based on Portland, where ASW helicopter operational training is also based.

The 8,000-ton deadweight *Engadine* has a service speed of 16kt and is diesel powered. Her flight deck has two landing spots and forward of this is the hangar, which is capable of housing up to four Wessexes and two Wasps at the same time, with everything tightly folded and the Wasps stowed athwartships at the for'ard end. The hangar will house two Sea Kings when operating in support of that type. Above the hangar deck is the Flyco cabin, at the end of a large clear deck which is designed for the operation of pilotless target drones. There are permanent tubular frameworks fitted for awning hangars, and deck strongpoints for the attachment of drone launching rails.

Apart from the permanent RFA ship's company there is a permanent naval liaison officer, a lieutenant commander, part of whose duties are analoguous to those of "Little F" in a carrier—he presides in Flyco. An RN doctor, two petty officers and ten junior ratings are also

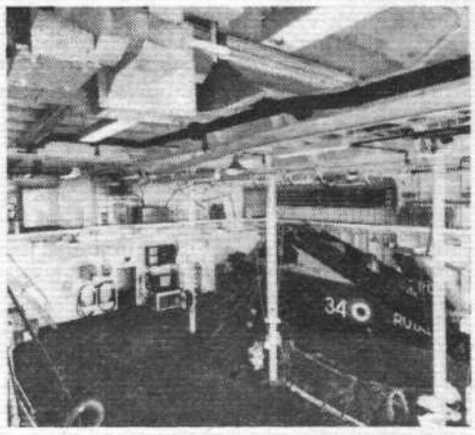
The permanent naval liaison officer aboard mans the Flyco position during operations. Flyco faces aft and is mounted above the hangars on an open deck designed for launching pilotless target drones

permanent members of the ship. Training contingents from the squadrons bring their own aircraft, some specialist stores, and maintenance personnel aboard, and accommodation, of a generally very high standard, is provided for up to 29 transient officers and 84 ratings. Normal spells aboard *Engadine* for the training contingents are only a week or so in each case, though staff instructors of the training squadrons—737 Sqn, the second-line Wessex 3 operational training unit from RNAS Portland, was embarked when the

Built by Henry Robb of Leith, "Engadine" is 420ft long, 58ft in the beam and has a deadweight of about 8,000 tons. The five-cylinder, two-stroke, turbo-charged Sulzer diesel engine develops 4,400 s.h.p. at 130 r.p.m., giving a service speed of 16kt. It is the only RFA with stabilisers, and full bridge control of the engine room is installed

No 737 Sqn Wessex HAS.3s exercise aboard "Engadine" when she lay at anchor in the Solent last week

"Flight" photographs



Left: behind the bridge and entirely Navy staffed is a small operations room with ground-stabilised radar and plotting table. Squadron observers qualified as aircraft direction officers man it. Right: highest-density packing of the hangar can get two Wasps and four Wessexes inside it. The hangar will accommodate two of the forthcoming Sea King ASW helicopters

"Engadine" helidunk: a Wessex HAS.3 lowers the body of its Mk 195 sonar. Datum hovering height during the dunking phase is 40ft with an automatic "inching" facility to maintain at least 25ft separation between the aircraft and the wave crests. The Wessex 3 is claimed to have detection capabilities equivalent to those of a frigate

Press was received aboard at anchor in the Solent last week—make frequent short voyages aboard.

Flying exercises with two Wessexes were underway during the visit, though all four Wessexes the ship can carry can be operated simultaneously, with staggered recoveries for refuelling. The two landing spots are ranged fore and aft and normally approaches are made from the port quarter (the Wessex pilot being seated to starboard), with the ship's head 20° off the wind to port. In cross-wind conditions cross-deck landings are made. In strong winds when it might be necessary for the ship to steam down-wind, aft-facing landings can be made. Deck aids comprise red floodlights, flush lights which outline the landing-spot "boxes," twin glide-slope indicators set up beneath Flyco (one aligned for Wessexes and one for Wasps, the two types making approaches at different slope angles) and a horizon datum of lights mounted across the tops of the hangar door openings. There is a magnetic-loop system for Flyco to speak to flight-deck crews.

Spacious workshops lie in the hangar hinterland and a store of about 7,000 naval air items is maintained, to reduce to a minimum the amount of equipment that training contingents need to fly aboard with them. There is a small operations room behind the bridge, with a back-projection plotting table, and two displays taken from the ship's main ground-stabilised true-motion radar, one of which is fitted with an optical plotting attachments. There is an underwater telephone for talking to the submarines involved with the ship in training exercises. Squadron aircrew qualified as aircraft direction officers man the operations room.

Emphasis of the training squadrons, when they get aboard, is on intensive flying, with a minimum of classroom work which, it is reasoned, is better done ashore. The 30-seat cinema is, therefore, more of a recreational facility than an operational necessity. There is an aircrew briefing room and the usual annexes for flying clothing and safety equipment.

Saab Wins Danish Order on Price

THE ROYAL DANISH AIR FORCE ORDER for Saab Draken 35XDs (page 432 last week), is for 20 single-seat fighter-bombers and three trainers. The contract was signed in Copenhagen last Friday. Deliveries to Denmark are scheduled to begin in 1970 (the RSAF having offered to train Danish pilots) and production for the RDAF will extend the Draken run at Saab's Linköping factory well beyond 1971, at which production for the RSAF is due to end. The Danish Parliament has been asked to approve a second order, also for 23 aircraft, and a firm decision on this is expected later this year.

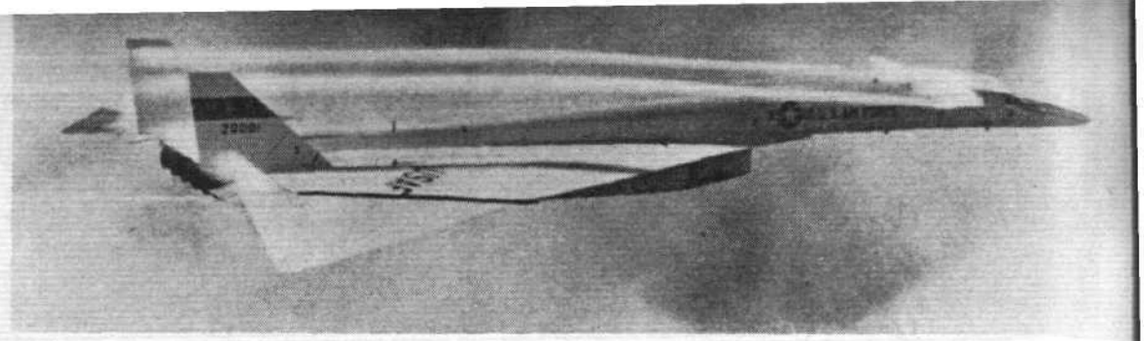
The order is Saab's biggest export success and the contract for the first 23 will be worth DK250 million (£13.8 million) to which further equipment worth DK25 million £1.38 million) will be added. Quoted price of the second batch will be only DK200 million (£11.12 million) if the contract is signed before July 1.

The Danish Defence Minister, Mr Erik Ninn-Hansen, has said that the Draken was chosen on technical merit over its competitors, the Dassault Mirage 5 and the Northrop F.5. Nevertheless, Saab's was the lowest bid, and was further sweetened by credit terms and offset purchases. Prices for two-batch purchases of these aircraft were DK254 million and DK243 million; and DK292 million and DK222 million respectively.

Saab will place orders with Danish industry worth half the total price, but the major part of these offset orders will be for components and machinery to support Saab car production. Very favourable 20-year credit financing, with no repayments for the first ten years, has been arranged by Saab. The French response, in the closing stages of the sales battle, was an offer of large offset orders to Danish industry and also to assist in financing the proposed new international airport at Copenhagen.

The Draken 35XD is a long-range fighter-bomber and reconnaissance aircraft developed from the J35F intercepter in current use by the RSAF. It will replace F-100s (first batch) and RF-84Fs (second batch) in RDAF service.

DEFENCE



The one remaining North American XB-70A, now devoted wholly to SST researches, makes a striking sight as it flies at high altitude, streaming contrails off its canard foreplane. In 116 flights the XB-70A has been supersonic on 96, at speeds ranging up to the design maximum of Mach 3

Two F-111As Lost on Ops

TWO OF THE FIRST SIX USAF F-111As to be deployed to SE Asia were lost within five days of beginning operations on Monday of last week, eight days after arriving from the United States. The other four aircraft, at Takhli air base in Thailand, were grounded for investigations by a flight safety team from the US as we closed for press.

The first aircraft failed to return from a raid against targets in North Vietnam's long southern "panhandle" last Thursday, March 28, and it was believed to be down in North Vietnam or Laos, with the fate of the crew unknown. The Pentagon simply said the aircraft was overdue; Hanoi claimed that it was shot down over North Vietnam near the Laotian border about ten miles north of the DMZ.

The second aircraft was lost on Saturday, March 30. Us sources claimed that this was following an "in-flight emergency" en route to its target, and that the crew were rescued, but it declined to give the location, though informed sources said this was in Thailand. Again the North Vietnamese claimed that this aircraft had been shot down, in a spot SW from Hanoi and close the capital.

("F-111B all but dead": see page 473)

Canadian Neptunes to Retire

CANADA'S medium-range Lockheed P2V-7 Neptune anti-submarine patrol aircraft will be phased out of service by the end June. Twenty Neptunes, 12 at CFB Summerside, PEI, and eight at CFB Comox, BC, are now in service with Maritime Command.

The Neptune phase-out will result in annual savings of approximately $8 million in personnel, maintenance and operating costs, said Minister of National Defence, the Hon Leo Cadieux.

Maritime Command's longer-range Canadair Argus aircraft will be redeployed to meet the Command's air operational commitments and will cover the Pacific for the first time. There are presently three Argus squadrons, two at CFB Greenwood, NS, and one at CFB Summerside, each equipped with eight aircraft. In addition there is an Argus conversion unit at Greenwood.

In the new deployment there will be four operational Argus squadrons; two at Greenwood, one at Summerside and one at Comox. Each squadron will have six aircraft. The conversion unit at Greenwood will become the Argus operational training and evaluation squadron for the command, with six Argus.

Because the Argus has a much greater range than the Neptune, the replacement of eight Neptunes by six Argus at Comox will increase the maritime operational capability on Canada's west coast, it is claimed.

More Caribous for the RMAF?

THE ROYAL MALAYSIAN AIR FORCE is to buy nine DHC Caribous, according to diplomatic sources in Ottawa. Cost of the purchase is said to be £3.28 million, exclusive of spares. No confirmation has been given by DHC of the Canadian Export Credits Corp, which is said to have arranged financing for the sale. The RMAF has a small flight of Caribous already which were donated by Canada under the Colombo Plan.

CF-5 OTU Formed

FORMED TO SPEARHEAD the introduction of the Canadair CF-5 tactical fighter into Canadian Armed Forces' service later this year is 434 Operational Training Sqn, which was established at CFB Cold Lake, Alta, earlier this month. The unit, with a strength of 180 officers and men, will operate 24 CF-5 aircraft. The first of these aircraft, CF-5Bs with two seats, will be delivered to the squadron in October. The first CF-5 off the Canadair line was handed over to the Canadian Minister of National Defence, M Leo Cadieux, on February 6, as we recorded pictorially on February 22.

The first Bell Iroquois for the CAF's Mobile Command was handed over on March 6 at CFB Uplands, Ont, to the commander of Mobile Command, Lt Gen W. A. B. Anderson. The aircraft was the first of ten for 403 Helicopter Operational Training Sqn of CFB Petawawa.

Galaxy Stations Named

LOCATIONS of the first three Lockheed C-5A Galaxy mammoth transport squadrons have been named by the USAF. They are Charleston AFB, S.C., Travis AFB, Calif, and Dover AFB, Del. The Charleston squadron will form between October and December next year, that at Travis between January and March 1970 and the Dover squadron in October-December 1970.

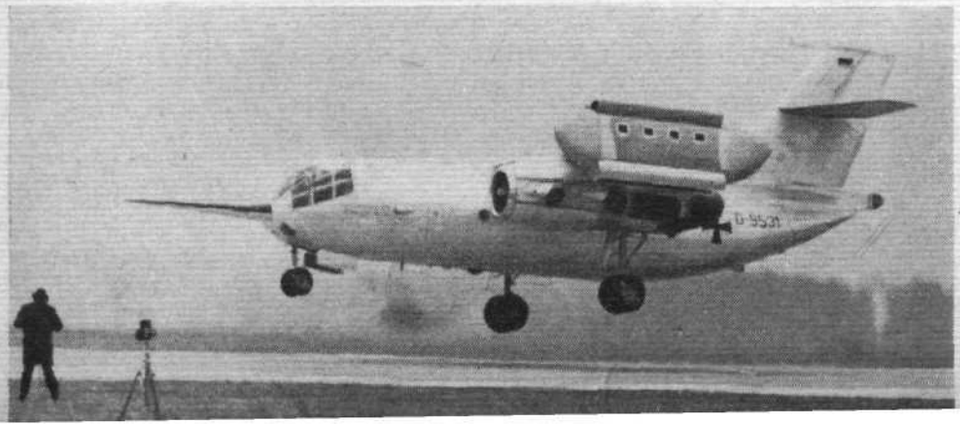
The first C-5As to be delivered will equip a Military Airlift Command training unit at Altus AFB, Okla, and crew training will begin in June 1969.

Under present plans there are to be six D-5A squadrons of 16 aircraft each.

RAAF C-130s in Casevac Role

HERCULES TRANSPORTS of 37 Sqn RAAF, have been provided with three modifications units costing a total of $A72,000 to facilitate the evacuation of wounded troops from Vietnam. The first of the Hercules equipped with one of the new units was shown in Sydney on March 7. A spokesman said: "These easily removable units mean that the Hercules can give the same service as a civil aircraft." Each converted C-130 will now have 24 stretchers, plus a special stretcher for persons with spinal injuries. The first newly equipped aircraft went into operation on March 10 on casualty evacuation flights from Vietnam. The Hercules transports were widely criticised last year as unsuitable for the movement of wounded men, being described by one medical authority as a nightmare for a sick or wounded man.

The Dornier Do31-E3 experimental V/STOL transport made its first transition flight last month at Oberpfaffenhofen, near Munich, the first conventional flight being on December 19 last, with the first vertical flight following on December 21. The Do31-E3 has two R-R Pegasus 5 vectored-thrust engines and eight RB.162 lift engines in the wing-tip pods. The German Defence Ministry has agreed to finance trials until the end of 1968, reversing last year's decision to end the programme after transition was achieved

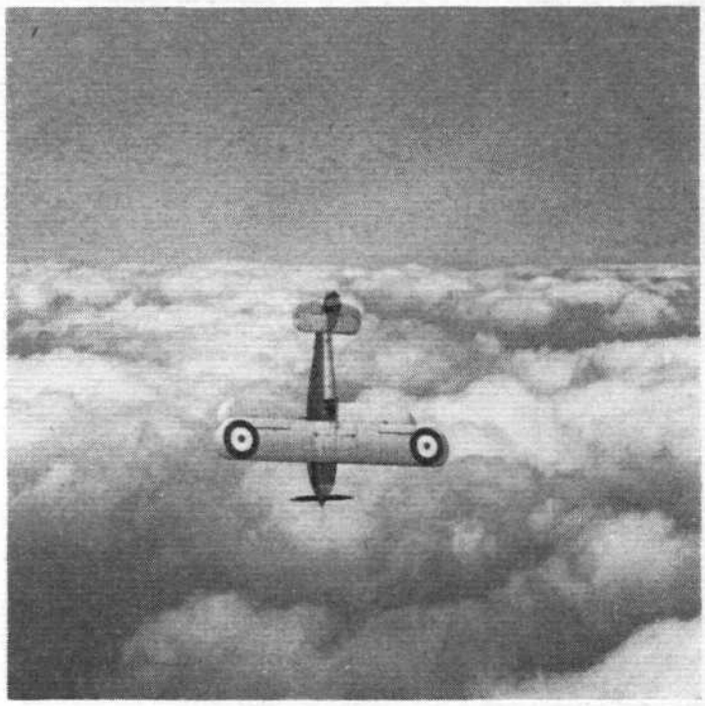


Straight and Level

SUPPOSE Rolls-Royce hadn't got the order? You cannot have a national aero engine industry—or any competitive national technology—without an airframe industry *in the long term*. That is still true.

● How nice to see Lockheed back in the airliner business. And what's this? The City of London putting money into planemaking? All we want now is for the City to back a combined industry operation to launch a mini F-111. The City of Whitehall isn't going to back it. If it's European partners we want, they'll be climbing over the main gate at Warton if only we would GET ON WITH IT.

If they do this 36 years later with a Nimrod it certainly won't be over Brooklands



Graveney who got an OBE.

The same award went to actress Sheila Scott, who spent a large part of last year flying solo around the world in a light plane.

From the "Montreal Star," January 2, 1968

Thursday 23 May (at **4.30 p.m.**)

Characteristics of the defocused spherical Fabry-Pérot interferometer as a quasi-linear dispersion instrument for high resolution spectroscopy of pulsed laser sources

From the Royal Society's lecture programme

Monastery of Meetings
Horseradish Avenue
London W1

My dear Roggie,

Just a note to let you know that Sir Kneddy Chairborne, who has been Permanent Secretary here for the last 20 minutes, has been awarded a bar to his knighthood with Tealeaf Cluster for his services to British aviation.

Sir Kneddy has asked me to snatch a few moments off from my full-time job of promoting British meetings to let you know that he wishes to be known henceforth as Sir² Kneddy Chairborne.

Yours aye,
Julian Washbrain

● Asked in the House of Commons to list the firm orders placed for the Beagle Pup, the Minister of Technology, Mr Wedgwood Benn, replied: "A number of firm orders, backed by deposits, have been received; but it would not be in the commercial interests of the company for me to disclose the exact state of their order book."

Ask Cessna or Piper or Beech or Rollasons how many firm orders they have and they will give you a list. But when a member of Parliament wants the same information about an aircraft—a very promising aircraft—built by a publicly owned company financed by public money, that's the sort of answer which he gets fobbed off with.

The funny thing is that Mr Benn, before he became a Minister, used to get exasperated with this kind of thing. I wonder what happens to these chaps when they become Ministers. Perhaps it's something the neddies put in their tea.

● "As in planting potatoes or courting, the Moon determines the best time for certain enterprises in space."

How's that for an opening sentence? It's got everything—Mother Earth, food, sex, man's conquest of space. It comes from a United Press story.

● That great character Dr R. S. Stafford, who retires soon as Handley Page's technical director, tells the story of how they forgot to lower the undercarriage of the prototype Hampden bomber in 1936. He was the flight observer, and his "abiding recollection of that landing is the strong smell of grass coming through the floor of the aircraft."

Roger Bacon

Sacré plume de ma tante! Nous avons oublié le Camping Gaz