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Waiting for Edwards

An appeal is bound to follow the Air Transport Licensing Board's decisions in the great North Atlantic case. Indeed, whatever the Board's decisions may be, at least one of the three parties—BOAC, British Eagle and Caledonian—will lodge the automatic protest with the President of the Board of Trade. The familiar ritual of a lengthy and costly repetition of the case heard by the expert body will then ensue before a single non-expert commissioner appointed by the Minister.

The appeal hearing *could* be under way before the end of this month, and the commissioner's report could conceivably be with Mr Crosland's advisers before the end of next month. The President's decision could be out before the August holiday; and British Eagle or Caledonian—or both—could be in business next season. There is, however, little likelihood of such unseemly haste.

There is the Edwards Committee to wait upon; and Sir Ronald is not likely to risk his reputation with any hurriedly prepared report. He will certainly not be finished before next March. Giving Mr Crosland and his officials time for study, the airline industry and the public cannot reasonably expect to see the report much before this time next year. Assuming that legislative changes are recommended and accepted, Britain's airlines will be well into 1971 operations and into detailed planning for 1972 before they really know where they are. The 1971 General Election may also add to the uncertainty.

What of reports that the Government wants to see BOAC and BEA merged, route-licensing administered by the Board of Trade, and the Licensing Board scrapped? There have been indications, as there so often are when Government departments subcontract their work to committees, that the Board of Trade would not be at all displeased with the Edwards Committee if it were to recommend certain changes. It is quite possible that some officials in the BoT would like to see a merged BOAC and BEA. It would certainly be easier to administer. There may even be some who believe that, since all major route-licensing cases come to the BoT anyway on appeal, it would save everyone a lot of bother if the department were to handle the whole thing itself and wrap up the Air Transport Licensing Board.

We are not quite sure how or when the BOAC-BEA merger and scrap-the-ATLB hares were started, but they seemed to gain momentum from some of Lord Beswick's comments last month from the Government benches of the House of Lords, and from Mr Crosland's announcement of only interim terms of office for the chairmen of the three public bodies concerned.

Sir Anthony Milward's "bunkum" comment on the merger rumours was about the best that could be made (though "irrelevant bunkum" might have been even more to the point). There may well be a need for the two corporations to have their overheads banged together occasionally, but this can be done without a merger, which would only lower efficiency (BEA might as well merge with Pan American for all the problems a merger with BOAC would solve).

As for the Air Transport Licensing Board, the greatest need is for British air transport—which means its licensing authority—to be made more, not less, independent of the Civil Service and of politicians. The question of whether there should be more private competition for BOAC and BEA—to which the commonsense answer is yes—should be left to a powerful, independent licensing authority to decide. The present licensing board is now deciding the North Atlantic case, which is a microcosm of the wider British civil aviation problem. The system is very nearly right: all that is needed is more national competition, and a truly independent authority to regulate it.

WORLD NEWS

Concorde and the Crisis

One effect of the crisis in France will be an increase in the total cost of the Concorde and in its price to customers. Speaking last Saturday, Mr John Stonehouse, Minister of State, Technology, said that Concorde, despite setbacks, might have a lead of six years over the American SST; but he added that "the present troubles in France are holding back the programme. The increases in French wages, and the other costs, are also bound to have an adverse effect."

Financing the Jetstream

Handley Page are seeking to increase their authorised share capital of £3,200,000 by the creation of 2,800,000 ordinary shares of five shillings each. This decision has been taken to support Jetstream production, the company stating in a letter to shareholders that although the original USAF order was for a modest number of aircraft the contract contains options for a large quantity; and that negotiations with this and other air forces have progressed sufficiently to justify the board undertaking the special design, development, research and tooling costs necessitated by the contract. To date, 176 Jetstreams have been ordered.

The company announces a profit for 1967 of £333,000, a little below the average (£343,000) for the previous four years. The chairman, Sir Walter Dawson, says in his review that profits for 1968 will be "very considerably lower than this figure" owing to a large increase in expenditure to achieve maximum expansion of Jetstream production, and to a deferred programme of Government work.

UK Air Exports Increase

"Exports of Britain's aerospace industry so far this year are running at a level 50 per cent up on the same period last year and are consistently setting new records for any previous period in the industry's history."

This is stated by the Society of British Aerospace Companies in their June 6 *News Letter*. SBAC say that by the end of April, according to the latest Board of Trade returns, the 1968 export total stood at £90,922,000 compared with £60,685,000 for the first four months of 1967, itself a near-record export year. With guided-weapon exports of £1,787,000 so far this year, the overall total is £92,709,000.

The January/April figure was made up as follows: aircraft and parts, £40,948,000; engines and parts, £47,973,000; instruments, £1,572,000; tyres, £429,000. Sales of guided weapons during the period amounted to £1,787,000.

Britain's largest customer during the period was the United States, buying £8,214,000 worth of aircraft and parts and £24,011,000 worth of engines and parts.

The April export total, £19,023,000, was £3½ million up on the corresponding figure for April 1967 (£15,478,000) and the USA was again Britain's biggest customer, spending over £2½ million on aircraft and parts and nearly £6 million on engines and parts.

USMC Buys Hueycobra

The US Marine Corps has followed the US Army in adopting the Bell AH-1J Hueycobra, the sleek two-seat "gunship" development of the Iroquois helicopter. An initial $15·5 million contract for 49 Hueycobras for the Marines was announced by Bell on May 29. The -J is the Marine configuration of the type; 838 AH-1Gs for the US Army are in production under earlier contracts.

Display Time

Two large-scale flying displays are taking place in Southern England next Saturday, June 15.

One is the RAF 50th anniversary display and exhibition at RAF Abingdon, Berks, a repetition of the events staged on the previous day for the Queen and members of the Royal Family. Both in the display and in the static exhibition the theme will be the evolution and development of the Service over half a century. The airfield is a few miles south of Oxford, and routes will be signposted. Gates open at 10.30 a.m. and the flying display is from 2.45 p.m. until about 4 p.m. Admission charges are: coaches with occupants, £5; cars with up to five occupants, £1; motor cycles, 2s 6d; pedestrians free. Souvenir programmes will be on sale in aid of Service charities and the RAF Museum.

The second big display on Saturday is at the BAC airfield at Filton, Bristol, organised by the Royal Air Forces Association and sponsored by the *Daily Express*. Again, history will be the theme, and early aircraft will include the replica Bristol Box-kite and the Shuttleworth Trust's Bristol Fighter. Times: gates open, 10.30 a.m.; flying begins 2.30 p.m. Prices: cars with occupants, £1; motor cycles, 10s; pedestrians, 5s (children 2s 6d).

On the following Saturday, June 22, the RAFA is organising an anniversary display at Staverton Airport, between Cheltenham and Gloucester.

Dr Lippisch Rejoins Dornier

The veteran aerodynamicist Dr Alexander Lippisch has been appointed to act as a consultant to the Dornier company, with which he was first associated 50 years ago, when he was closely involved in setting up their aerodynamics department. In the inter-war years he designed some very advanced sailplanes and light aircraft, including successful tailless types, and this work eventually led to the development of the rocket-propelled Me163. After the war Dr Lippisch worked in the USA, where he continued his work on tailless—and, indeed, wingless—aircraft.

What the Queen will see tomorrow
Part of the impressive line-up of aircraft, and missiles, depicting famous RAF types in service since 1918, which Her Majesty, Prince Philip and other members of the Royal family will see at Abingdon tomorrow, Friday, June 14, on a visit to mark the founding of the Royal Air Force. There will be a flying display and indoor exhibitions and the station is open to the public on Saturday, June 15, when the display is being repeated. (See "Display Time," this page)

SENSOR

BEA's compensation for buying Trident 3Bs and One-Eleven 500s instead of Boeing 727-200s and 737-200s is likely to be between £20 million and £25 million and to cover a period of seven years only. The attitude in the Treasury is that BOAC were over-compensated in 1964, and that this is not going to be allowed to happen in BEA's case. Payment is expected to be in the form of a lump sum rather than annual payments. The question of a change in BEA's capital structure to bring it in line with that of BOAC will be raised as soon as the compensation question is settled.

Delivery date of the Trident 3B is now slipping as a result of the Government's delay over the compensation issue, and BEA may now miss the 1971 summer season. The delay will increase the cost of the 3B and the amount of compensation required by BEA for lost revenue. Trident 3B basic price will now be at least £2.3 million. So far HSA has spent more than £2 million of its own money on the programme but cannot spend more without a BEA contract.

Concorde is now unlikely to be seen over Farnborough. First flight date is now well towards the end of the year for both 001 and 002.

There are no indications that the very top levels of the BoT favour a BOAC-BEA merger.

Orders for the Lockheed L-500 (civil C-5A freighter) from Pan American and Trans World are expected soon, probably for ten aircraft each. PAA—and other 747C customers—have decided against the use of the Boeing 747 for all-cargo operations and for competitive reasons Qantas is now also a potential customer for the L-500. Two teams from Lockheed have recently been briefing the Australian airline.

The French domestic crisis, and Ministerial changes, have created further confusion in the ELDO situation. At present the other members of the organisation, already faced with the British decision not to participate after 1971, do not know what France's attitude towards it will now be.

Decca Navigator Italiana is being formed to promote the Decca hyperbolic navigation system in Italy. A five-chain coverage of the country is proposed. Operators who could make particularly good use of the system include the civil police and military helicopter units, and coastal shipping.

The short list of contenders to meet Japan's F-X requirement includes the F-111, F-4, Lockheed CL-1010 (project), Northrop F-5 and N-530, Mirage, Saab 37, Lightning and Jaguar. F-X will be a replacement for 200 F-104Js in the air intercepter role, and service introduction is planned for 1971. Favoured candidates are the F-4 and Lockheed CL-1010.

BEA pilots have amassed a £50,000 strike fund, growing at £5,000 per month, to back their claim for salaries up to £6,800 p.a. for two-crew One-Eleven operations.

Shorts and the MoD/Mintech defence sales organisation are now heavily engaged in assessing the commercial possibilities of the Short Blowpipe infantryman's SAM around the world, before putting the missile into full production for the British Army. Blowpipe, originally a company PV, is now receiving Mintech financial support.

A new subsonic, high-Reynolds-number wind tunnel is to be built at RAE Bedford. Working section will be approximately 13ft by 10ft and RN will be 6 million. The tunnel should be operational by 1971 and will be used largely for improving the efficiency of subsonic transport aircraft aerodynamic design.

Knighthood for Barnes Wallis

Seldom can an honour have been more deserved than that which has been conferred on Dr Barnes Wallis, knighted in the Queen's birthday honours last Saturday. A young 80 years of age, and still BAC's chief of aeronautical research and development, he has been responsible for designs and inventions that have included the R.100 airship, geodetic airframe construction, the bomb that breached the German dams, other special-purpose bombs, and the pioneering Swallow swing-wing project.

Another knighthood—"for services to export"—goes to Mr D. P. Huddie, who played a major part in landing the Rolls-Royce RB.211 order last March.

A Minister who has been very much in the aviation picture during the past year is made a Privy Councillor: Mr John Stonehouse, Minister of State, Mintech.

Two chief test pilots are honoured, Denis Tayler of Short Bros and H. C. Rogers of Rolls-Royce, both of whom are appointed OBE; and a well-deserved OBE comes the way of Mrs Ann Welch, who has done so much for British gliding.

Aviation names in the civil sections of the various Orders include the following:

Privy Councillors G. W. Reynolds, MP, Minister of Defence (Admin); John Stonehouse, MP, Minister of State, Ministry of Technology.

Knighthoods D. P. Huddie, managing director, Aero Engine Division, Rolls-Royce (for services to export); B. N. Wallis, chief of aeronautical research and development, British Aircraft Corporation.

Dr Barnes Wallis

Mr D. P. Huddie

CBE S. D. Davies, technical director, Dowty-Rotol; T. R. Grieve, vice-chairman and managing director, Shell-Mex and BP; F. Nixon, consulting engineer (quality and reliability), Rolls-Royce; Cdr H. Pasley-Taylor, director, Elliott-Automation.

OBE Cdr A. W. Beeton, chairman, Northern Region, Air Training Corps; Mrs A. G. Caldwell, Point Piper, NSW (for services to aviation in Australia); J. Dent, lately director and chief engineer, Hawker Siddeley Dynamics, Whitley, Coventry; F. A. Gillibrand, regional general manager, Germany, BEA; G. E. King, chief project engineer, British Aircraft Corporation, Stevenage.

G. A. Nicholls, New Zealand (for services to the transport industry and aviation); H. C. Rogers, chief test pilot, Rolls-Royce; Wg Cdr W. H. N. Shakespeare, dep. chmn., RAFA; F. G. Tarrant, Assistant Director, Guided Weapons (Eng), Ministry of Technology; D. G. W. Tayler, chief test pilot, Short Bros and Harland; Capt R. F. Uren, chief pilot, Qantas Airways (for services to aviation); Mrs Ann C. Welch (for services to gliding); R. H. Woodall, director and chief executive, Rotax. **Continued overleaf**

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MBE H. G. Adams, secretary, South-East Area, RAFA; A. F. Arnold, superintendent, turboprop engine test department, Rolls-Royce; E. G. Bass, senior production engineer, Hawker Siddeley Aviation, Herts; G. W. Brown, welfare officer, No 4 Welfare Area, RAF Cheadle Hulme.

H. G. Davis, reservation systems manager, BEA; T. G. Deegan, Territory of Papua and New Guinea (for services to aviation); F. L. C. Firmin, sales manager, Radar Division, Marconi; D. A. E. Hunter, establishment manager, Fife factories, Elliott-Automation; J. M. Johnson, group leader, missile design, Armaments Division, Hawker Siddeley Dynamics, Coventry; Miss S. M. Keene, superintendent of typists, NGTE, Pyestock.

W. S. MacDonald, lately Group Commandant, No 29 Group ROC; S. J. Menko, managing director, Flexello Castors (Export) (for services to export); W. P. Robinson, senior navigation superintendent, BOAC; C. E. Tuttenden, former senior examiner of airmen, Department of Civil Aviation, Australia; J. D. Woodhead, service manager, Stevenage, Guided Weapons Division, BAC.

BEM G. W. Bennett, head clerk, RAF College, Cranwell; S. O. Elliott, lately observer, ROC; W. J. S. Hammond, chief flying instructor, No 617 Gliding School, Air Training Corps, Hendon; J. H. Langton, craftsman, Aeronautical Inspection Directorate Laboratory, Harefield; J. S. W. T. Llewellyn, R and D craftsman, NGTE, Pyestock; Miss E. Millhouse, senior National Accounting Machine operator, Rolls-Royce Aero Engine Division; J. Newton, civilian instructor, No 367 (South Sheffield) Sqn, Air Training Corps; E. J. Peachey, chargehand, Central Flying School, Little Rissington; G. Robertson, chief observer, ROC; W. D. Williams, foreman, mechanical assembly of air weapons and aircraft equipment, Hawker Siddeley Dynamics.

RAF Museum Contributions

Two aircraft, a Hawker Hind and a Vickers Gunbus, were presented to the Royal Air Force Museum at RAF Abingdon last Monday, June 10. The Hind, which had previously been given to the RAF by the Royal Afghan Air Force, was handed over by Col Khan, Chief of Staff to the C-in-C; and the Gunbus, built by the Vintage Aircraft Flying Association, was handed over by its chairman, Mr D. G. Addicott. The aircraft were received by Marshal of the RAF Sir Dermot Boyle, chairman of the museum's board of trustees.

To date, in response to its appeal for £1 million, the museum has received (or been promised) £450,000. Contributions may be sent to the appeal director, Gp Capt E. D. Levien, RAF Museum, 84/86 Regent Street, London W1.

New Deputy MD at Weybridge

Mr John Ferguson Smith, FCA, has been appointed deputy managing director of British Aircraft Corporation, Weybridge Division. Since 1965 he has been director and general manager of the division, with special responsibilities for the export-winning One-Eleven programme and for the Hurn (Bournemouth) factory where these aircraft are assembled. Mr Ferguson Smith came from Vickers Ltd in 1958 to join the Weybridge company — then Vickers-Armstrongs (Aircraft) Ltd—as commercial manager.

Aerobatic Dinner

To support the British team competing in the fifth World Aerobatic Championships at Magdeburg, Germany, in August, the Royal Aero Club is holding a dinner on Friday, July 12, in co-operation with the British Light Aviation Centre.

Application for tickets (50s each, exclusive of wines) should be made to the Competitions Department, Royal Aero Club, Artillery Mansions, 75 Victoria Street, London SW1, and the dinner will be at the Royal Aero Club, 9 Fitzmaurice Place, London W1, at 7.30 for 8 p.m. on July 12.

An RAeC announcement stresses that the importance of the occasion, and private-enterprise support (a group which includes four members of the 1966 British team has raised enough money to buy a Zlin Akrobat 526, and John Player and Sons have bought a two-seater Zlin for training) "make it essential that the Royal Aero Club should be seen to be supporting the team to the utmost."

Salisbury Hall D.H. Reunion

All former members of the de Havilland Technical School and design staff who worked at Salisbury Hall, London Colney, have been invited by Mr W. Goldsmith, the present owner, to revisit the recently restored Elizabethan manor and grounds—where the prototype Mosquito W4050 is on show—next Saturday, June 15, from 2.30 p.m. Families welcome, tea and buns at modest prices.

"AIR-CUSHION VEHICLES" : A VACANCY

With the impending launching of *Air-Cushion Vehicles* as a separate journal in its own right, a vacancy exists in the editorial department for a junior journalist or editorial trainee to play a very active part in this exciting new stage of the journal's development. Though the successful applicant's primary responsibilities will be towards *Air-Cushion Vehicles*, he will also be expected, and encouraged, to undertake *Flight* assignments from time to time.

The appointment will appeal to young men looking for an entry into exciting fields of specialist journalism. Though previous journalistic experience is not essential, applicants will be asked to prove some aptitude for the work. Experience in relevant industries will be an advantage; a close interest in things aeronautical and marine, and an A-level standard of education, are essential. Applications are invited from men aged 19 to 22, though these age limits are not inflexible.

Paris reprise *Dominating the aircraft park at the Turin show was the "circus" of Russian giants reminiscent of that at last year's Paris Show. In the photograph, reading in a clockwise direction, are a Tu-134, Il-62, An-22, USAF C-130, Alitalia DC-9-30, DC-9-30F, Mi-8, Mi-6, and Mi-10. A preliminary report on the show appears on page 905*

The first Il-62 to be seen in Britain was operated not by Aeroflot but by Ceskoslovenske Aerolinie, who are using it on their Saturday services into Heathrow London. The Il-62 (CCCP-86666) is on lease for purposes of evaluation to CSA, who are possible customers for the Super VC10

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Making Aircraft Safer

IN TWO PAPERS presented at the annual Technical Conference of Beirut's Civil Aviation Safety Centre last week Mr J. E. Nichols of Boeing described current American thinking on how future transport aircraft design will make it easier for passengers to survive aircraft accidents. Mr Nichols, payload systems product development manager at Boeing, concentrated on the 747 in one paper, but in a second revealed what the American Aerospace Industries Association committee on crashworthiness is likely to recommend to the FAA next month. New crashworthiness regulations are expected to be issued by the FAA in December this year for implementation on aircraft coming off the production line in mid-1970.

The AIA working party tackled a four-point programme, investigating the possibilities of improving the fire-resistance of materials used in aircraft cabins; aircraft evacuation systems; fire suppression systems in aircraft; and emergency lighting systems. Fuel containment, ground rescue equipment and crash location beacons were not dealt with. It was assumed by the working party that an accident had occurred on take-off or landing in or near an airport and that the accident itself was "survivable."

In tests on materials used in aircraft interiors—seat covers, cabin wall and ceiling panels—the working party burned mock-up aircraft of different types and sizes and tested the materials in a 25ft wind tunnel as well as performing the standard bunsen burner and radiant panel tests. Materials were checked for self-extinguishing properties, smoke generation and the production of noxious fumes.

In all cases it was found that the critical area of a cabin fire was above the level of the seats; lower down the fire had less effect and in many cases the mock-up cabin carpets were undamaged, except by soot which had dropped from the ceiling. New materials tested by the AIA, apart from seat-cushion foam, were shown to have a self-extinguishing time of zero, against five seconds for decorative panels and no self-extinguishing properties for carpets in current use. Seat-cushion foam with a self-extinguishing time of four seconds was also tested. The use of the new materials, it was said, would considerably lengthen the time available for passengers to leave the aircraft before being overcome by heat or fumes. A method of insulating fuselages from outside fires was also tested and found to be very effective, although it would involve a considerable weight penalty.

Before considering evacuation systems in detail the AIA working party analysed the performance of current systems from details contained in accident reports. It found that current systems work well, and that aisle and exit widths do not limit the flow of passengers, which is dependent on the number of people who are able to use a slide in a given time. Between 1954 and 1966 evacuation times had decreased by 25 per cent and the time between "unfasten seat belts" and the use of a slide had been reduced by 35 per cent. Of the malfunctions in evacuation equipment the misplacement of a slide and failure to inflate had been the two major faults, although malfunctions as a whole had decreased by 56 per cent in the twelve-year period.

The team found that in real accidents there was generally no panic among passengers, often the reverse, as people hung around looking for hats, shoes, presents and belongings. A good passenger briefing was considered to be essential to a successful evacuation and the working party placed cabin staff training high on the lists of safety priorities.

On the practical side the working party evaluated two kinds of evacuation method—slides (inflatable) and stairs (mechanical). Inflatable stairs were looked at, but they were found to be too heavy and cumbersome to stow in the aircraft. Another practical problem was the "trampoline" effect which could be set up when several people descended the inflatable stairs at one time.

A fold-away mechanical staircase was evaluated which packed, from an extended length of 16ft, into a volume of 2ft × 1ft × 9in. It weighed 30lb. Even so, the working party felt that the flow-rate down a slide was inherently better than that down stairs. Double-lane slides were tested (and are to be fitted to the Boeing 747), with automatic inflation and placement systems which give a maximum time between door opening and slide usage of ten seconds. To guard against the slides collapsing under load conditions a "bolster" is fitted midway down, underneath the slide, and another bolster is incorporated at the bottom so that the inflatable structure is stabilised laterally. The bottom cushion also prevents evacuees being injured by hard contact with the ground.

To safeguard people who leave by an over-wing exit the working party recommends the use of double-width exits which lead on to an inflatable ramp so that people can walk out on to the wing with relative ease. Work is also being done on adding a further inflatable section to the ramp so that, once on the wing, passengers can slide off it easily without injury. Such injury often occurs on current equipment even when people use the flaps as a slide. If the flaps are up, or if they jump off the leading edge, leg and ankle injuries are common.

In the area of fire-suppression the working party had found little to offer in the way of suggested improvements apart from better interior materials and the use of a medium which could insulate a fuselage against damage from external fires. Fire-curtains hung across aisles (similar to the fire-proof bulkheads in ships) would contain a fire to some extent, but it had been found that passengers were unwilling to pass through them, thinking they were solid partitions. The provision of smoke helmets was considered, and nine prototype helmets were evaluated.

Lighting systems, internal and external, were evaluated, as were the slides, by sending 1,250 people on trial evacuations from various mock-up fuselages in all lighting conditions. Some of the participants, who ranged through the age brackets

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of five- to 65-year-olds, did several evacuations, and the working party had a total of 3,600 individual evacuations to study by the end of the tests. It was found that an even level of (low intensity) lighting along the cabin was better than having relatively bright lights spaced at long intervals. External lights should illuminate the slides or over-wing exit paths and the ground below. The working party will recommend to the FAA that operators should use floodlight-type lamps integral with the fuselage rather than attempt to illuminate a slide by built-in electro-luminescent systems or by fluorescent tubes.

The working party also recommends that "exit" signs should be more uniformly lit so that they had be read easily. A considerable amount of work was done on ways to indicate the location of exits in darkness or smoke. Aural systems (a recorded "exit here") and tactile systems (a cardboard arrow on each seat-back) were tested. Both systems had disadvantages and the working party concluded that the best way of indicating the nearest exit to a passenger was by means of a placard on the seat-back or on the service panel in the overhead rack.

Much of the working party's work reads directly across to the 747, although McDonnell Douglas had as great a contribution to the AIA team as had Boeing. In particular the 747 will be equipped with double-width inflatable slides which will be capable of use within ten seconds of emergency door opening. Lighting will be improved, and the use of flame-resistant interior materials will be widespread. When an evacuation is signalled by the flight crew (via an emergency alert system) the cabin crew will operate each of the ten exit doors manually, aided by a power boost system. When a door is opened in emergency conditions, the slide, which is stowed on the lower interior surface of the door, is inflated and automatically deployed. Passengers will be encouraged to "step and sit" on the slide, rather than to sit on the door sill before pushing off. Cabin staff training, says Boeing, is vitally important, in order to overcome passenger hesitation so that the maximum flow of evacuees can be maintained.

INTERVIEW WITH SIR ANTHONY

"I AM not signing the contract for Trident 3Bs until the terms of compensation have been settled with the Board of Trade." This was said by Sir Anthony Milward, chairman of BEA, in answer to questions at a press conference at Madrid Airport last Thursday. The occasion was the inauguration of a Trident 2 London-Madrid service. The type has been in *ad hoc* service for two months and entered regular service on June 1. Compared with the Trident 1, whose range can be marginal on London-Madrid, the Trident 2 has double the range—"We could have turned and flown back today without re-fuelling," said Sir Anthony. Three Trident 2s have been delivered, all ahead of schedule. Twelve more are to come this year and next.

The question of compensation for the Trident 3B was now "red hot," said Sir Anthony. He expected to have the matter settled by the end of June. Half the compensation required—and he did not demur from somebody's suggestion that BEA were asking for about £40 million—was due to the revenue lost. "June 1 was the first anniversary of our application to buy Boeings, which would have been in service by now." The rest of the compensation was, he said, due to the fact that the Trident 3B and the One-Eleven 500 were smaller than the Boeings. "Put this in—I know of no reason why the Boeing 727-200 should be any more popular than the Trident. It's an economic problem, not a popularity problem. I am sure it will be a jolly good aircraft—but a 148 seater is too small. I want bigger aircraft."

Asked whether it would be fair to say that he had "done a Guthrie" to the Trident, Sir Anthony replied: "We've been through all that. We still want the Two-Eleven—that is the aircraft that we should have built in Britain and sold. Now that the entire cost of the RB.211 engine is paid for we should have put it in a 200-seater and we would have had a world winner. But we have been told to buy something else and we are going to make the most of it. Hawker Siddeley will be in in very difficult position if the order is not settled soon."

Asked whether BEA would order the A-300 by the July deadline, Sir Anthony replied that there was "not the remotest chance." He thought it would be the end of the year before there would be a definitive aircraft and a definitive price. "We have bent over backwards, we have a permanent committee working with the manufacturers, but they haven't even settled the width of the fuselage. We don't know whether it is going to be eight-abreast or nine abreast. Until they have settled little things like that there can be no specification and no price tag. I have told Hawker Siddeley that we are not interested in any more presentations until we have a specification and a price."

Was he worried about the delay? "No, we can look around—at the 1011 and the DC-10. We shall not need an airbus until about 1974." He thought, guessing, he would want ten airbuses for a start, but nothing like 25—not until the end of the seventies.

Were Lufthansa and BEA "egging each other on" in opposition to the airbus? he was asked. "No, that is wide of the mark. We are not against the airbus. We shall, in due course, want a limited number of 300-seaters, but if it isn't right we don't want it and we shan't buy it. Lufthansa have always bought Boeing and they will take a hell of a lot of shifting from that."

Would he or his successor be under pressure to buy the A-300, just as he was under pressure to buy the Trident 3B? "There is no law that can compel BEA to put its name to a contract which it doesn't want to sign. It would need an Act of Parliament. If they want us to buy what we don't want to buy, they can buy it as a Government responsibility, or pass an Act of Parliament."

Other points made by Sir Anthony were that BEA are going to launch an all-out charter effort, both under their own name and that of their subsidiary British Air Services, which owns Cambrian and BKS. Spain was going to be the first major effort. He was going to have talks the next day with the chairman of Iberia about expansion, and BEA were thinking of building an hotel in Spain. BEA had no intention of quitting domestic trunk routes—"no intention whatever." These routes were BEA's territory, and 80 per cent of their domestic business. For "some inexplicable reason" they were doing very badly this year, showing a negative rate of growth. There was no intention of putting up fares for a long time. There was a possibility of hiving off or taking on some of the shorter domestic routes through BAS, but that was a separate matter.

Sir Anthony did not think that the SST was BEA's business. "SSTs as at present known are not in BEA's thinking," he said. How had he managed to persuade the French to allow BEA, after all these years, to use Orly? Replied Sir Anthony: "By tremendous brilliance and by using some arguments not unconnected with Gatwick."

This DC-9-30F (I-DIKF), recently delivered to Alitalia and on display at the Turin Show (see page 905), is very much an all-cargo version, with cabin-window transparencies deleted and skinned over . . . "Flight" photograph

CHANGES FOR AIR CANADA?

THE previously forecast changes in the organisation and financial structure of Air Canada are hinted at in a statement made by the board of directors in announcing the retirement of Mr G. R. McGregor on May 31 after 20 years as president of the airline. His successor—Mr N. J. MacMillan, chairman and president of Canadian National Railways, which owns all the stock of the airline on behalf of the Government—has been appointed in an acting capacity only and the board emphasises that the appointment is of a "temporary nature." The name of the future president, and possibly also the changes being made in the organisation and financing of Air Canada, may be announced after the Federal election on June 25. Mr H. W. Seagrim, executive vice-president of the airline, has long been the expected successor to Mr McGregor—who said as much in an interview with *The Montreal Star* of May 31, adding that Mr Seagrim had been specially selected for the position with the approval of the board. Mr McGregor also said that he had now severed all his ties with Air Canada.

In the statement, the directors of AC and CNR say that they "consider that it is essential that each organisation maintain its individual management, but recognise that the suitability of present relationships, taking account of Air Canada's long-term financing requirements for growth and expansion, as well as areas of possible co-ordination and integration, require further review. The reviews under way by the Government and by the boards of directors will take some weeks to complete and from these could emerge variations of the existing corporate structure, or possibly a new corporate entity designed for more orderly long-range planning and development which would better serve not only the national interest but the interests of both corporations."

Mr McGregor, who studied engineering at McGill University, learned to fly in 1932 and won the Webster Trophy, presented annually to the best amateur pilot, in 1936 and 1938. After joining an auxiliary squadron in the RCAF in 1938 he served in the Battle of Britain and was awarded the DFC. He commanded the Nos 1 and 2 Canadian Fighter Squadrons and became Director of Air Staff, RCAF HQ, Overseas, later commanding No 14 Fighter Squadron in the Aleutians. He was awarded the OBE in 1944. He joined Trans-Canada as general traffic manager after the war and was later elected a member of IATA's executive committee. He was appointed president of the airline on February 1, 1948, succeeding Mr H. J. Symington. In 1967 he received the C. D. Howe Award of the Canadian Aeronuatics and Space Institute for "achievement in the field of planning, policy-making and leadership in aeronautics and space."

Near Disaster On June 3 a TWA Boeing 727 struck a pier and landing lights at New York La Guardia while on final approach after a flight from Cincinnati. The captain took overshoot action and, because of undercarriage and other damage, asked to be allowed to land at NY Kennedy with its longer runways. The landing gear collapsed and the 727 skidded on its belly for 5,000ft. Of the 95 passengers and seven crew aboard, 14 passengers were slightly hurt.

Sir Giles Guthrie (left) who, as reported in last week's issue, pages 849-50, relinquishes his chairmanship of BOAC at the end of the year. With him (centre) is Mr Charles Hardie, who is to be part-time chairman for the year 1969, and Mr Keith Granville, who will be managing director and will retain his position as full-time deputy chairman

Retiring 404s Piedmont Airlines will retire their fleet of Martin 404s this year, after the deliveries of YS-11s and Boeing 737s are complete. The carrier's options on six 737s and ten YS-11s will probably be exercised by late summer.

All-jet Eastern Transition to all-jet operation has been begun by Eastern Airlines. The carrier's fleet of Super Constellations was retired earlier this year; four Electras and seven Convair 440s have now been released for sale with deliveries beginning last month. The airline has 39 Electras and 20 Convairs.

More 748s for LIAT Last month Leeward Islands Air Transport (LIAT) took delivery of a third HS.748—ex-Channel Airways (see *Flight* for May 30, page 823). A fourth is expected this month for introduction into service on July 15. Previously LIAT had leased one of Autair's 748s (G-ATMI, operated in the Caribbean as VP-LIU).

Irish 747s to be Leased Trans Caribbean Airways is to lease Irish International's two Boeing 747s in the five winter months of each year from 1970-71 to 1974-75 handling peak Caribbean traffic during the period when North Atlantic traffic will not demand the available capacity of the 747s. The Irish airline is due to receive the first 747 in November 1970 and the second in March 1971.

A Hundred More Twin Otters Miami Aviation Corporation, the main US distributor for de Havilland Canada, signed an agreement on June 7 to buy 100 Twin Otter 20s mainly to meet the expected growth in the number and requirements of commuter airlines. The corporation has already bought 30 Twin Otters for deliveries before the end of this year; the additional 100 will be delivered during 1969 and 1970. Before this recent agreement, de Havilland Canada had sold 200 Twin Otters in 26 countries—more than half of them in North America.

. . . By contrast, this 94-seater Caravelle (I-DABT) is one of four being acquired by SAM from Alitalia, all of them to be in service by April next year. It was used on June 1 by SAM, the Alitalia charter subsidiary, to operate their first commercial jet service, and the first by any Italian carrier, into Elmdon Airport, Birmingham

AIR TRANSPORT...

MOSCOW-NEW YORK SOON?

THE award of a foreign air carrier permit to Aeroflot for scheduled and non-scheduled flights between Moscow and New York was recommended on June 3 by a CAB examiner under the terms of the revised US/USSR air transport agreement. This permits Pan American and Aeroflot to select one of four intermediate stops—Montreal (which has been selected by Aeroflot), London, Copenhagen, or Stockholm. Aeroflot's representative said at the hearings that Il-62s would be used with about 140 seats, some 30 of which will be for first-class passengers. In his recommendation the examiner said that an intermediate stop would give each carrier greater operational flexibility and would provide additional traffic support to improve the economics of the operation.

TRAFFIC UP, PROFITS DOWN

DESPITE record US airline traffic and revenues during 1967, profits declined. Passenger traffic increased by 21 per cent in passenger-miles, and cargo, in ton-miles, was up 15 per cent by comparison with 1966. But, although operating revenues increased by nearly 20 per cent, expenses went up by 24 per cent; so there was a drop of nearly 9 per cent in net income and of 3 per cent in net profit. These are some of the highlights in the annual report, *Facts and Figures*, of the Air Transport Association of America.

The report says that "the reasons for the profit lag are many, but centre on the inability of the airlines to reduce operating costs per unit of traffic to the same extent as unit revenues. The airlines have, since 1962, steadily lowered the average revenue per revenue ton-mile, or yield, while the cost of doing business, as measured by the cost of the revenue ton-mile, has also gone down. In 1967, however, for the first time since 1963, the unit cost failed to decrease significantly while the yield continued to decrease at the same rate.

PERFORMANCE OF THE UK INDEPENDENTS IN 1967

Airline	Passengers carried §	Scheduled services				Non-scheduled services		
		Load pass-miles (000's)	Load short ton-miles (000's)	Capacity short ton-miles (000's)	Overall load factor (%)	Capacity short ton-miles (000's)	No of flights	Hours flown
Air Ferry	195,760	—	—	—	—	17,534	3,076	8,534
Autair Int'l	159,178	12,564	1,236	2,699	45.8	6,179	2,915	7,039
BKS	561,162	120,812	11,209	16,827	66.6	7,614	1,026	3,147
Britannia	310,836	—	—	—	—	33,438	3,346	10,287
British Eagle *	699,969	107,487	10,672	21,584	49.5	167,665	12,523	48,405
British Midland	244,764	43,402	4,279	8,074	53.0	5,065	1,372	3,420
BUA†	1,652,383	416,099	61,286	121,934	56.6	93,636	13,300	29,358
Caledonian	139,725	—	—	—	—	50,435	2,929	13,676
Cambrian	464,719	83,041	8,817	14,079	62.6	7,042	3,315	5,792
Channel	621,810	44,830	4,347	8,711	49.9	18,119	4,854	10,448
Dan-Air	233,595	9,843	897	2,193	40.9	18,038	3,304	8,635
Emerald	27,423	3,041	275	539	51.0	8	13	17
Invicta	193,276	—	—	—	—	6,957	4,141	6,223
Laker	101,793	—	—	—	—	23,013	2,611	7,079
Lloyd Int'l	26,909	—	—	—	—	19,307	1,178	5,554
Loganair	1,945	—	—	—	—	38	1,036	487
Skyways	211,173	22,709	—	3,269	66.3	1,170	1,305	1,631
Strathallan	143	—	—	—	—	369	427	465
Transglobe	141,467	—	—	—	—	31,236	1,803	8,342
Trans Meridian	—	—	—	—	—	7,653	325	1,961

* Includes British Eagle International Airlines and British Eagle (Liverpool). † Includes British United Airways, BUA(CI), British Air Ferries, BU(Manx)A and Morton Air Services. § Total passengers carried on scheduled services, inclusive tours and separate-fare charters.

Airline	Fleet at Dec 31, 1967		Average annual utilisation (hr)	Airline	Fleet at Dec 31, 1967		Average annual utilisation (hr)
	No	Type			No	Type	
Air Ferry	2	DC-6/6B	2,055	Cambrian	11	Viscount 700	1,731
	2	DC-4	2,164		5	DC-3	1,073
Autair Int'l	2	Ambassador	1,659	Channel	1	Dove	338
	3	Herald	1,609		1	HS.748	1,885
	1	HS.748	2,081		1	DC-4	403
	1	Viking	946		2	Viscount 700	728
					5	Viscount 700D/800/810	1,900
BKS	1	Ambassador	1,118				
	3	Viscount 700D/800/810	1,930	Dan-Air	3	DC-3	812
	3	Britannia 100	1,381		6	Ambassador	918
					1	DC-7F	777
Britannia	7	Britannia 100	1,829		3	Comet 4	1,527
British Air Ferries	11	B.170	843	Invicta	2	Viking	466
	6	Carvair	1,095		2	DC-4	1,557
British Eagle	4	Viscount 700	729	Laker	3	One-Eleven 300/400	2,275
	3	One-Eleven 300/400	2,265		2	Britannia 100	1,078
	13	Britannia 300	2,890				
				Lloyd	2	Britannia 300	3,016
British Midland	2	DC-3	654				
	1	Viscount 700	1,631	Loganair	1	Islander	332
	4	Viscount 700D/800/810	1,889		1	Aztec	415
BUA (CI)	1	B.170	52	Morton	4	Heron	534
	4	Herald	1,470		2	Dove	324
	1	Viscount 700D/800/810	1,891		5	DC-3	986
BUA	10	One-Eleven 200	2,291	Skyways	2	HS.748	1,637
	3	Britannia 300	2,591		3	DC-3	380
	3	VC10	3,577				
				Transglobe	3	Britannia 300	2,279
BU (Manx)A	1	Herald	1,320				
				Trans Meridian	1	DC-7/7B/7C	1,285
Caledonian	6	Britannia 300	2,492				

BASED on information released by the Board of Trade, the tables (left) show the performance and aircraft utilisation in 1967 of the British independent airlines. Included are those airlines holding licences in classes A, B, C, D, and type 1 of class E—in other words those licensed for scheduled and separate-fare charter operations.

The figures for non-scheduled operations include separate-fare charters, single-entity charters, charters to Government departments, charters to other operators, and fifth-freedom and cargo charters. Separate-fare charters are those in which the charterer re-sells part or all of the capacity of the aircraft; the term comprises inclusive tours, which are those charters in which the cost to the passenger includes the cost of accommodation.

The recorded number of flights refers to stage flights—the part of the journey between two consecutive stopping-places. Hours flown refers to revenue hours, figures for non-revenue hours being supplied only by the two corporations. One of the airlines shown—Trans Meridian—is all-cargo. Another, Emerald Airways, ceased operations in November of the year.

The fleets of the airlines are those at the end of 1967, and only the aircraft types used during the year for the types of operation under consideration are shown. The utilisation figures have been adjusted to allow for the fact that some aircraft were not in use for the whole year.

The average annual utilisation for all the 321 aircraft in service with all British airlines at the end of 1967 was 2,003hr. At the top of the list was BOAC's Super VC10s with 3,966hr. The total number of passengers carried on air transport operations was 15,764,880, and the total of passenger-miles was 12,576,233,000. By far the greatest part of the passenger traffic was on scheduled services—12,318,369 passengers, carried a little over 700 miles each. Less than 10 per cent of the passenger-miles—865,934,000—were performed by the independent airlines.

The completion of the office block at Gatwick Airport, London—seen here from the south pier—marks the conclusion of three stages of construction, the first of which was opened in June 1958. The top floor of the new five-storey office building houses the terminal control room, radio equipment and plant rooms

IATA TO COINTRIN

THE location of the IATA offices which are being moved to Geneva is to be the top floor of the new terminal building at Cointrin Airport. The move to Geneva (see *Flight* for December 14, 1967, page 982) represents the consolidation of a number of IATA offices at present in New York, Montreal and London, and the three traffic conferences (now in New York, Paris and Singapore). Computer services, resolution drafting, compliance, the technical office for Europe and the Middle East, the clearing house, and the chief economist's office will also move. The director general, Mr Knut Hammarskjöld, will have an office in Geneva, and the temporary head of administration there will be Mr Alan Black.

STILL MORE FOR EDWARDS

IN an addition to earlier evidence given on March 1 to the Edwards Committee, the Civil Air Transport Industry Training Board stresses the desirability of predicting long-term manpower needs. The original evidence from the board explained its purposes and objects. The addendum says that "training for many of the occupations in civil air transport is abnormally expensive; thus, the industry devotes a far higher proportion of its resources to training than do most other industries.

"Unfortunately, the specialist nature of the knowledge and skills required for many occupations is of a nature that recruitment of trained personnel from outside the industry is difficult and the period of training which has to be borne by the industry is often a matter of years. Furthermore, such knowledge and skills once acquired can often be used only in civil air transport activities and, should there be a surplus of trained personnel, their redeployment is often a national loss as much as it is industrial. Thus, in the civil air transport industry, accurate manpower planning is essential if there is not to be a waste of expensive human resources with the attendant economic and socially undesirable consequences. To train too many personnel in relation to the long-term needs of the industry would be wasteful; to train too few could be damaging to growth and our competitiveness internationally.

"It is difficult to predict long-term manpower needs and to lay plans for effective training unless there is some assurance of stability in the future structure of the civil air transport industry. With such an assurance, it would then be possible for the industry to explore the means by which the training resources existing in the industry and elsewhere could be used in a manner likely to lead to maximum cost-effectiveness. Closer co-operation with the military side of air transport on manpower-planning and training matters could make a significant contribution to achieving such cost-effectiveness. However, a prerequisite to any such co-operation is a knowledge of long-term requirements.

"This board is anxious to do all in its power to assist the industry in its long-term manpower planning and in gaining the maximum return on the investment which it makes in training. Since this is a matter of national as well as industrial importance, this board hopes that your committee will recommend ways in which the stability necessary for the long-term planning of training can be achieved in the civil air transport industry."

Eagle Sales Mr Philip G. Tasker has been appointed sales manager, scheduled services, for British Eagle. He joined the airline in 1965 after previous service with BEA and Icelandair.

Selling Cargo Charters A major air cargo marketing campaign has been launched by Caledonian Airways to promote split-charter cargo services, permissible under the airline's present licences where there are not more than four consignor/charterers and no individual consignments of less than 1,000kg.

New Chairman for Northeast Mr George Storer has been appointed chairman of Northeast Airlines in succession to Mr James W. Austin, who had been with the airline since 1957 when he was appointed president. Mr Storer's former position of executive committee chairman will not be filled and Mr F. C. Wiser, president of the airline, will continue as chief executive officer.

New ATLB Member Mr J. M. Drummond has been appointed as a part-time member of the Air Transport Licensing Board for an 18-month period to December 31, 1969. Mr Drummond (63) is an incorporated accountant and was, from 1961 to 1966, financial adviser to the Electricity Council. Since the death of Mr C. P. Harvey, QC, last January the ATLB has had only seven members.

Eastern Appointments Mr Henry J. Aneiro has been appointed vice-president, marketing research and development, for Eastern Airlines. He joined the airline in April 1964 and was previously director, special programmes. Other new Eastern appointments are those of Mr Rolf S. Andresen as manager, operating budgets and financial analysis, marketing, and of Mr George A. Rowe as director, product development—described as a "unique" appointment in the airline industry, involving the development of strategies and programmes in customer service.

Three ex-Philippine Air Lines Viscount 784s are operated by Falconair, the Swedish non-scheduled carrier formed early last year. The Viscounts are frequent visitors to Southend, where this picture was taken

AIR TRANSPORT...

FUJI'S MOUNTAIN WAVE

IN the report of the investigation into the break-up of BOAC's Boeing 707, G-APFE, near Mt Fuji on March 5, 1966 (see *Flight* for June 29, 1967, page 1043), it was stated that of 100 crews questioned, 79 had reported turbulence, but only four had encountered severe turbulence in the area on that day. These four were in cases where the aircraft were flying within about 30 miles of the mountain and on its eastern side, where the 707 broke up, but this relatively small number of reports of severe turbulence may well have left some people (and crews in particular) with lingering doubts about whether extreme turbulence in a postulated powerful mountain wave was the sole cause of the disaster.

Any such doubts would probably have been dispelled if the experience of one US Navy pilot, now flying with United Air Lines, could have been recounted at the time. In this carrier's flight operations magazine, *The Cockpit*, for March/April 1968, the pilot writes:—

"March 5, 1966, was a beautiful, sunny, cloudless day, with a brisk north wind blowing. I was preparing to take off during the early afternoon from NAS Atsugi (30 miles from Tokyo) on a routine test flight from the Navy overhaul and repair facility there, when Atsugi tower asked if I would investigate a report of a crash south of Mount Fuji. I took off, and from 30 miles away could see a plume of dense black smoke rising, perhaps to 8,000ft. My aircraft, an A-4C [Douglas Skyhawk] was fully loaded with fuel (gross weight 22,000lb), but nevertheless was highly manœuvrable.

"As I neared the crash site, I descended from 11,000ft MSL to 5,000ft AGL and immediately—like running into a brick wall—was tossed about so violently that I was unable to read any instruments and had my hands completely full trying to keep my airplane upright. One fitting of my oxygen mask was shaken loose and, as my head was banging back and forth off the canopy, the brilliant thought entered my head that I should get the h—— outta there. Somehow I managed to keep the nose pointed more up than down and eventually climbed to 16,000ft MSL, all the time being batted around by the turbulence in the lee of Mount Fuji. From the comparative calm of that altitude, I directed the rescue helicopter towards the crash, but the turbulence was too great even for him to get within five miles of the scene."

The final altitude of the A-4C, 16,000ft, was approximately that (4,900 metres) at which the 707 was estimated to have been flying when first meeting heavy turbulence. Accelerometer readings in excess of +9g and −3g were, the United pilot says, recorded by the A-4C.

ACCIDENTS AND INCIDENTS: APRIL/MAY

FATAL ACCIDENTS

Date	Carrier	Aircraft	Location	Fatalities Pass	Fatalities Crew	Total Occupants Pass	Total Occupants Crew	Circumstances
Apr 20	SAA *	Boeing 707 (ZS-EUW)	Windhoek, SW Africa	127	12	132	12	Crash-landed after t.o. following possible engine fire.
May 3	Braniff	Electra (N9707C)	Dawson, Texas	79	5	79	5	Mid-air break-up in turbulence.
22	Los Angeles Airways	S-61L (N303Y)	Paramount City, Cal	20	3	20	3	Rotor failure during cruise: broke up.
28	Garuda	Coronado (PK-GJA)	Bombay	15	14	15	14	Crashed after take-off.

* Further information on previously reported accident.

NON-FATAL INCIDENTS

Date	Carrier	Aircraft	Location	Injuries Pass	Injuries Crew	Total Occupants Pass	Total Occupants Crew	Circumstances
Mar 23	Eastern	DC-8 (N878OR)	J F Kennedy, NY	0	0	64	7	U/c collapsed on landing.
Apr 28	Capitol	DC-8 (N1802)	Atlantic City, NJ	—	4	0	4	Crashed on landing on training flight. Destroyed.
May 1	MEA *	Boeing 707 (VR-BCP)	Beirut	—	—	—	—	Jack pierced tail-section during lifting in hangar.
4	Channel Airways	Viscount (G-APPU)	Southend	20	4	80	4	Over-ran runway after landing in rain.
9	Skyways Coach Air	HS748 (G-ASPL)	Manston	0	0	26	4	Emergency landing after nose-wheel retraction trouble.
15	Polaris Air Transport	Convair 240 (LN-KAP)	Fornebu, Oslo	0	0	?	?	Collided with LN-KAT (below) while taxying.
15	Einar Riis Flyrederi	DC-4 (LN-KAT)	Fornebu, Oslo	0	0	?	?	See above.

* On lease from British Eagle.

Looking at Research in Holland

DURING the meeting of the ICAO Airworthiness Committee in Amsterdam arrangements were made for the participants to visit research establishments of the National Aerospace Laboratories (NLR), the Royal Netherlands Aircraft Factory of Fokker, and Schiphol Airport.

At the main NLR laboratories near Schiphol, the committee were welcomed by the director, Mr Marx, who outlined some of the work being undertaken by the establishment on behalf of Fokker, KLM, the Netherlands Aircraft Development Board, and other state authorities including those responsible for the vast land reclamation and hydrodynamic projects of the nation. The establishment employs 600 staff, of whom approximately 140 are graduates, and a further 140 hold other high technical qualifications. Almost all of Fokker's aerodynamic work, and some of the structural work, is done at NLR. Aircraft prototype flight testing, operational research for the RNAF, and for civil aviation have all been the subject of recent effort.

The wind tunnel facilities provide a range of performance from transonic, through M1.3-M4.0, to M6.0. Work has been performed for ELDO, and studies made of guidance systems and rocket propulsion and combustion. Most of the Fokker F.28 flight test instrumentation was designed by NLR, with Fokker designing the remainder. The establishment began to use digital recording on flight tests ten years ago and the complete package for the F.28 includes a 50-channel digital recorder, a photo-panel observer, a wire recorder and a VGH crash recorder.

In the aircraft operational research programmes, two distinctly different methods have been used. In one, an ex-Army precision tracking radar was used to establish the flight path envelopes for ILS approaches in poor visibility on DC-8, DC-9, Caravelle and Electra aircraft. Some 5,000 approaches have been observed, and it was arranged to record separately the meteorological conditions, and to de-brief the crews on the flight techniques which had been in use. The other programme used a camera mounted in aircraft to photograph runway lights during take-offs and landings. The addition of accelerometers to the aircraft equipment and the provision of ground photo-theodolites enabled the following data to be obtained to a high degree of accuracy: aircraft position, pitch and bank attitude, drift angle, height, lateral displacement, ground and air distances, and accelerations due to the use of wheel brakes and thrust. Some 600hr have been flown with the system and all the data reduction has been done by Fokker.

In collaboration with RAE Farnborough some work has been performed for the North Atlantic Systems Planning Group, and a report will soon be made on the possibility of reducing aircraft lateral separation standards. A flight test programme to investigate the accuracy of the trailing cone method of checking aircraft static pressure systems has been flown with a two-seat Hunter aircraft.

One most interesting task undertaken for KLM has aimed at establishing the possible advantages of vertical scale engine instruments as opposed to the conventional circular scale and pointer instruments. KLM, Swissair and SAS have a joint procurement agreement for the Boeing 747 aircraft, and had requested a report on this instrument evaluation by mid-May 1968. The instruments being compared are the Bendix vertical scales and a new General Electric circular instrument which also provides a large-scale digital read-out of the parameters. The test subjects sit at a DC-8 type aircraft cockpit centre-pedestal complete with engine controls and the instrument display can be instantly changed from vertical to circular scales as required.

The subjects have been captains, co-pilots and flight engineers in equal numbers. Half of each group have used the two different displays in turn in a different order. In addition to establishing the achieved ease and accuracy of readings the subjects were given an additional simultaneous test where the work load can be gradually increased to eventually unacceptable limits. The additional task undertaken is a non-familiar predictive test. (This and other similar tests, have shown that it is possible to so overload subjects as to cause their handwriting to become as illegible as that of a subject deprived of oxygen.)

Many airlines will welcome the report of the test programme when it becomes available, for the time is long overdue for rational and scientific evaluations such as these, to replace the prejudicial and subjective opinion of a "chief pilot," no matter how experienced.

F.28 structural testing

At a second NLR establishment situated in the newly reclaimed North West polder of the former Zuyder Zee, the Committee were the guests of the head of the establishment, Professor Schijve. This is where structural and fatigue testing of the Fokker F.28 wing (built by Shorts) is under way. The static tests were completed in mid-April and the fatigue tests are now proceeding. The object is to test for an equivalent of 60,000 flights of 30min duration, each of which takes only 90sec on the rig.

At the Fokker plant on a separate occasion, Mr J. H. Greidanus, the chief designer, was host to the Committee, which saw the F.28 production assembly line, and full-scale test specimens being tortured in the water tanks. Some of the Committee members and their advisers are pilots with levels of experience ranging from senior FAA test pilot (USA), CEV test pilot (France), airline pilots (IFALPA) and private pilots. All were offered test flights on the F.28 and accepted. Mr A. P. Moll, chief test pilot, demonstrated the aircraft, and in particular its manœuvrability in the approach and landing configuration. No one who flew the aircraft is likely to disagree with previous assessments of its flying qualities—they are excellent!

This latest product of the Netherlands is a good example of the most competent and confident way in which a small nation can compete in the big league—if it has the will and the research and design facilities to back an undoubted talent for selecting a section of the aircraft market which has need for a high-quality product. L.T.

BUA COMPANIES TO MERGE

FROM November 1 British United Airways (CI) and British United (Manx) Airways will operate jointly under the name of CIMAS—Channel Islands and Manx Air Services. To overcome the situation which has involved substantial losses for the two airlines during the past four years there will be a fundamental reorganisation of their route patterns and a rationalisation of the fleet. CIMAS will operate with a fleet of HP Heralds and will centralise maintenance in Jersey. Viscounts surplus to requirements will be transferred to BUA at Gatwick.

Following the acquisition of the two airlines from Air Holdings by British and Commonwealth Shipping and others (see *Flight* for May 23, page 775) the boards of the two companies will each have the Hon Anthony Cayzer as chairman and Mr Alan Bristow as deputy chairman. Other board members of BUA(CI) are Capt Geoffrey Thomas (general manager), Mr J. A. Thomson, Gen L. de Vic Carey, Mr H. F. Popham, Maj J. R. Riley and Mr T. L. Vondy. Those of BU(Manx)A are Mr Vondy (managing director), Mr Thomson, Capt Thomas, Mr G. S. Hankinson and Sir Henry Sugden.

AIR TRANSPORT . . .

How Much Compensation for BEA?

WHEN BEA WAS DIRECTED to buy British aircraft the Government gave an undertaking that the corporation would be "compensated" for any extra costs it incurred. The amount is being negotiated by the airline and the Board of Trade, and the bargaining is not yet completed. In the meantime the figure of £75 million which was published in *The Times* has given rise to shocked Parliamentary questions.

In this article we have attempted to estimate a fair figure, using the basic data published in our survey of March 16, 1967, with revisions to take into account the results of devaluation and rises in the prices of the aircraft involved.

Our 1967 estimate was that the extra cost of the British aircraft would be £61,560,000, less some £10 million for the cost of converting BEA to American aircraft—training, certification (of aircraft and their US blind-landing equipment), complete rejigging of operations and maintenance organisations, separate spares holdings, and other costs.

The total included a £25 million contribution by the taxpayer for manufacturers' development costs. Though Trident 3B development costs are estimated at £17 million now, the further orders for the One-Eleven 500 will yield a contribution towards the £10 million expenditure anticipated. Both manufacturers will receive this money directly from the Government and not via BEA.

The seating capacity of the Trident 3B is 147 (against the figure of 140 used in the original calculations), which is only 10 per cent less than the 164 seats in the equivalent Boeing 727-200. This means that 23 of the American machines now produce the same number of seat-miles as 26 Tridents, and the capital cost of either fleet appears to be very similar (Table 1). The price of each aircraft has risen, in addition to the 16.7 per cent surcharge on the Boeings, because of devaluation. Air France has revealed recently that it paid $55 million for ten 727-200s, including spares, which is £400,000 each less than estimated in March 1967. The current estimate is $8.2 million per aircraft, duty paid, against $7.4 million for each Trident 3B. This illustrates the penalties for ordering late—and also the impact of duty on an industry in which prices are going to be increasingly determined by international competition. Though these calculations are based purely on the current British situation, looked at in isolation, BEA might argue that in 1966 they could have secured the necessary larger aircraft for about £45 million plus duty, much of which would have been paid before devaluation: and that their competitors' costs are not inflated by duty payments.

A similar argument can be applied to the 737: but the current price of a fleet of 15 is little different from that of the 18 BAC One-Eleven 500s ordered. We conclude from Table 1 that a payment of about £2.5 million would compensate for the differences in capital cost.

TABLE 1: COMPARISON OF CAPITAL COSTS

	British Aircraft (£m)	US Aircraft (£m)
26 Trident 3Bs	80	
23 Boeing 727-200s @ $6m + 20% spares + 14% duty ...		78.66
18 BAC One-Eleven 500s	32	
15 Boeing 737-200s + £1.5 m + 20% spares + 14% duty		30.78
	112	109.44
Extra capital cost of British aircraft	£2.56 million	

Table 2 is a revised summary of operating costs to allow for the greater passenger capacity of the Trident 3B, and the increased cost of the US-made spares. The engineering costs have been increased by 10 per cent and 12 per cent respectively for the 737 and 727, giving hourly cruising costs of £139.5 and £200 per hour. The corresponding figure for the BAC One-Eleven is £122 and for the Trident 3B £181 5s. These estimates have not been altered from those used in March 1967, on the basis that other variations would affect all the aircraft to approximately the same extent.

TABLE 2: SUMMARY OF OPERATING COSTS

	Cost/hr (£)	Hours flown	Cost (£)	Landings	Landing fees*	Cost (£)
BAC One-Eleven 500	122	36,000	4,392,000	46,400	42.1	1,953,440
Boeing 737-200 ...	139.5	30,000	4,185,000	40,000	44.9	1,796,000
Difference			207,000			157,440
Trident 3B	181.5	52,000	9,438,000	46,000	70.5	3,243,000
Boeing 727-200 ...	200	45,200	9,040,000	42,600	79.8	3,399,480
Difference			398,000			−156,480
Total Difference						605,960

* Estimated increase 12½ per cent 1967-68

The greater capacity of the Trident 3B has raised the equivalent number of landings for the 727, so that the latter would now pay *higher* aggregate landing fees. The estimated average landing fees for each aircraft has been increased by 12½ per cent to allow for extra charges at Heathrow and for devaluation, balanced to some extent by "no change" in domestic fees.

The estimate of the greater operating cost of the British aircraft is now £600,000 p.a., against £1,820,000 originally. This would be equivalent to a lump sum compensation, over a 12-year-aircraft life, of £5.65 million, using a 5 per cent interest rate, which is near to BEA's average rate of 5.2 per cent. (The answer is not £7.2 million because a pound available now is worth more than one received in 1980, quite apart from the effects of any further inflation, because it can earn interest in the meanwhile. The upside-down compound interest sums involved have been christened "discounted cash flow.")

So it is estimated that the *current* extra cost to BEA of the British aircraft is about £8 million, which is less than the "conversion cost" of some £10 million. Additionally, the manufacturers' development costs will total between £20 million and £25 million.

However, it is clear also that Air France and Lufthansa have acquired Boeing 727s and 737s at much lower capital cost per seat than BEA will pay; and this will be reflected in their costs. Depreciation and interest make up about 35 per cent of BEA's "aircraft type costs" for the Trident 1. By excluding the 14 per cent duty, BEA could point to extra capital costs of up to £45 million to start the bargaining. Nevertheless, if it is true that there is now no significant difference in the current operating costs of the two pairs of aircraft, the decision of the Board of Trade should be relatively straightforward. They have to decide what capital burden BEA can bear and still keep on a level footing with its competitors. A downward adjustment should be made to allow for the fact that BEA operates on all ten of Europe's busiest air routes, and also that nearly all its international routes attract extra high fares because they are over water. The present traffic slump can be expected to last until 1970 at least, undermining any argument based on a shortage of capacity. A comparison with the lower operating costs of the BAC Two-Eleven would be answered by taking in the extra development costs of around £50 million.

On this broader basis, compensation in the region of £20,000,000 might be anticipated. But we repeat that on the basis of operating costs there is probably now no justification for any compensation at all. In no circumstances could a figure of £75,000,000 be justified.

HAWKER SIDDELEY NIMROD MR.1

By MICHAEL WILSON

"WE SEARCH AND STRIKE." The one-time unofficial motto of Coastal Command is nowhere more applicable than in the field of anti-submarine warfare. It is probably not too much to say that the implementation of an effective ASW system is the greatest problem which military aviation technology faces today. It is also one to which Britain, dependent as she is upon maritime trade routes, must give unremitting attention. The bitter experiences of the Atlantic war in 1941 and 1942 must never be allowed to recur.

Such considerations as these have led to the development of the Hawker Siddeley 801 Nimrod MR.1, the world's first pure-jet ASW aeroplane. Its equipment for detecting, tracking and killing submarines is as comprehensive and advanced as any known to be flying today. It is also the fastest, if not the largest, aircraft to be designed for these duties. Transit time and endurance on station are the basic prerequisites of maritime reconnaissance aircraft, coupled with good load-carrying ability. In all these respects (and particularly in that of transit time) the Nimrod will be superior to anything flying now or planned for the immediate future. Compared with the Tracker S.2 or similar aeroplane, for example, one Nimrod operating at short range is equivalent to two or three smaller aeroplanes at the same range. As the distance to the search area increases, the increasing divergence of transit times and endurance on station for the two aircraft requires probably five or six S.2s or equivalent. Eventually, after about 700 miles, the smaller aircraft runs out of range entirely and there is thus no equivalent.

The basic mission of the Nimrod, whether in peace or war, remains the same: the security of ships. The flight out to the target is initiated either as part of a regular patrol or in response to a signal from a vessel at sea that has detected the presence of a submarine. In the latter case a quick reaction time is essential. In round figures the difference of 100kt-odd between Nimrod and its fastest piston or turboprop predecessors over 500 n.m. reduces by 20 per cent the time to reach the search area, and this can cut down the search area (in which the submarine is known to be) by nearly 40 per cent. With nuclear submarines travelling at between 35kt and 40kt underwater, the benefits of high-speed cruise are obvious.

The origin of Nimrod goes back a decade. In 1958 the Air Staff began to formulate Air Staff Requirement 381 for a Shackleton replacement to undertake the following tasks: to detect, fix and destroy surfaced and submerged submarines, both conventional and nuclear; to detect and shadow enemy surface units and forces; to conduct wide-area surveillance; to make limited air-to-surface strikes against individual vessels; to perform search and rescue; and to undertake emergency trooping. The Nimrod will, incidentally, replace only the Shackleton 2s. The -3s, with supplementary Viper 11s in the outboard nacelles, will continue in service until about 1978.

A close and continuing study of a number of projects was undertaken by the British Government. These included both new projects and modification of existing aircraft and design proposals included ASW versions of Vanguard and VC10 from BAC and Trident and Comet from Hawker Siddeley. Evaluation of projects was made over a long period and it was not until 1964, when serious discussion on costs got under way, that the Comet derivative began to emerge as the likely contender.

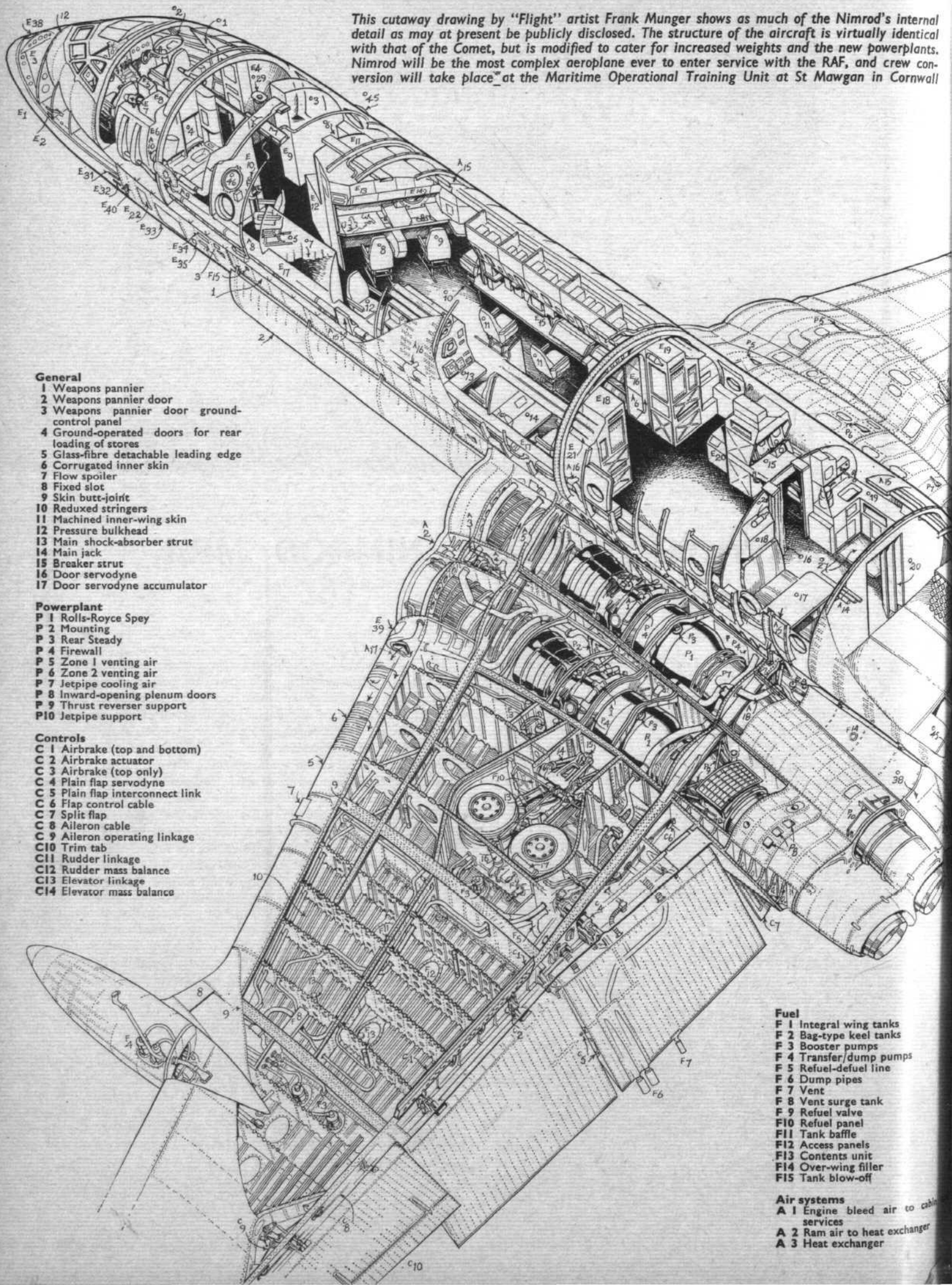
Whereas in 1958 development of a brand new aircraft might have been expected to absorb a fair amount of money, the long period of indecision over a Shackleton replacement saw a gradual tightening of Treasury purse-strings and it became increasingly clear that the sum of money likely to be made available would not buy a completely new airframe design as well as a weapon system.

Of the design submissions made by the various firms, the Comet emerged as the most cost-effective solution: all the R&D work on the airframe was valid (except in a few cases described later) the jigs existed for the most part, the airframe

Continued on page 890, after cutaway drawing of Nimrod

HAWKER SIDDELEY NIMROD MR.1 . . .

This cutaway drawing by "Flight" artist Frank Munger shows as much of the Nimrod's internal detail as may at present be publicly disclosed. The structure of the aircraft is virtually identical with that of the Comet, but is modified to cater for increased weights and the new powerplants. Nimrod will be the most complex aeroplane ever to enter service with the RAF, and crew conversion will take place at the Maritime Operational Training Unit at St Mawgan in Cornwall



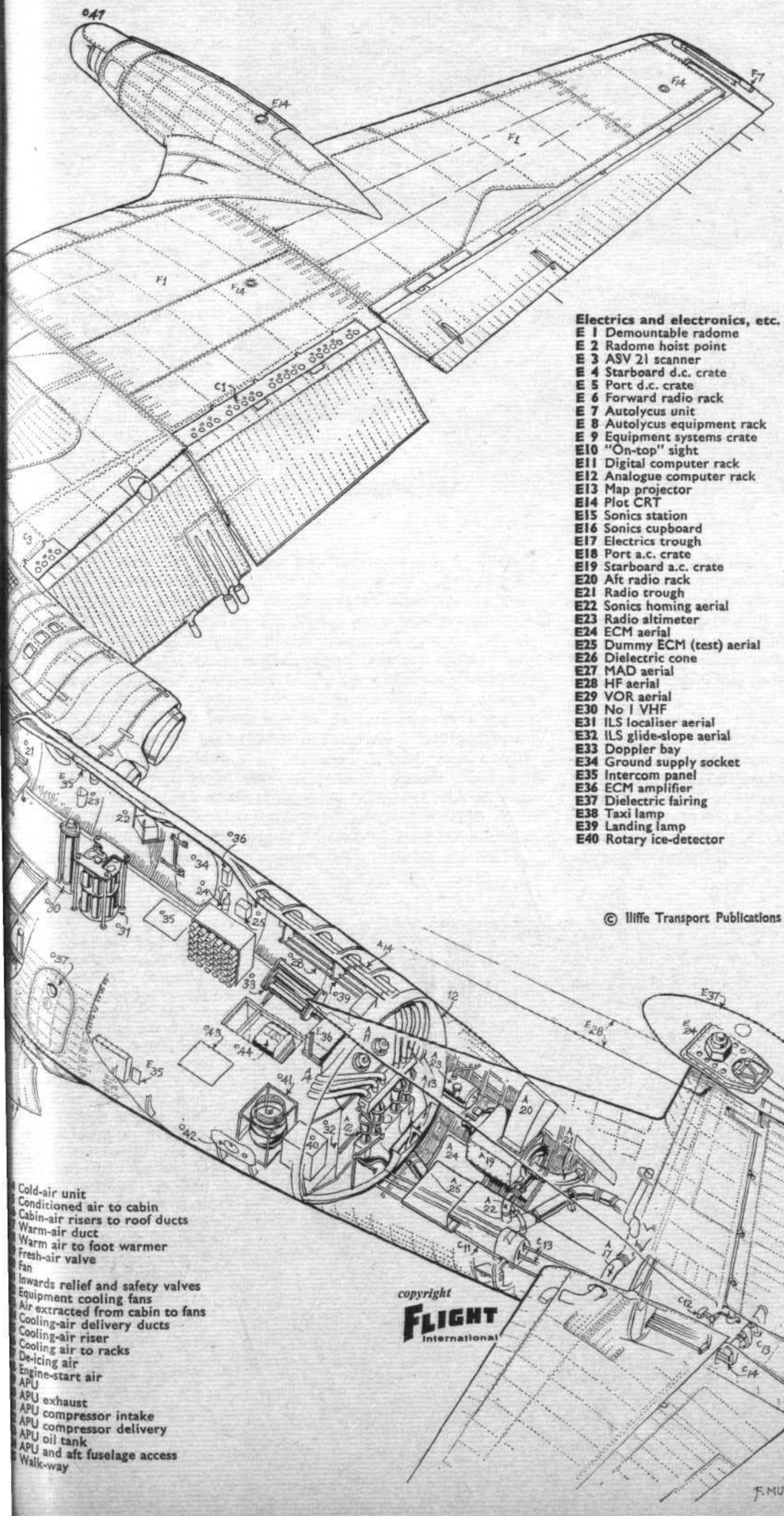
General
1 Weapons pannier
2 Weapons pannier door
3 Weapons pannier door ground-control panel
4 Ground-operated doors for rear loading of stores
5 Glass-fibre detachable leading edge
6 Corrugated inner skin
7 Flow spoiler
8 Fixed slot
9 Skin butt-joint
10 Reduxed stringers
11 Machined inner-wing skin
12 Pressure bulkhead
13 Main shock-absorber strut
14 Main jack
15 Breaker strut
16 Door servodyne
17 Door servodyne accumulator

Powerplant
P 1 Rolls-Royce Spey
P 2 Mounting
P 3 Rear Steady
P 4 Firewall
P 5 Zone 1 venting air
P 6 Zone 2 venting air
P 7 Jetpipe cooling air
P 8 Inward-opening plenum doors
P 9 Thrust reverser support
P10 Jetpipe support

Controls
C 1 Airbrake (top and bottom)
C 2 Airbrake actuator
C 3 Airbrake (top only)
C 4 Plain flap servodyne
C 5 Plain flap interconnect link
C 6 Flap control cable
C 7 Split flap
C 8 Aileron cable
C 9 Aileron operating linkage
C10 Trim tab
C11 Rudder linkage
C12 Rudder mass balance
C13 Elevator linkage
C14 Elevator mass balance

Fuel
F 1 Integral wing tanks
F 2 Bag-type keel tanks
F 3 Booster pumps
F 4 Transfer/dump pumps
F 5 Refuel-defuel line
F 6 Dump pipes
F 7 Vent
F 8 Vent surge tank
F 9 Refuel valve
F10 Refuel panel
F11 Tank baffle
F12 Access panels
F13 Contents unit
F14 Over-wing filler
F15 Tank blow-off

Air systems
A 1 Engine bleed air to cabin services
A 2 Ram air to heat exchanger
A 3 Heat exchanger



Electrics and electronics, etc.

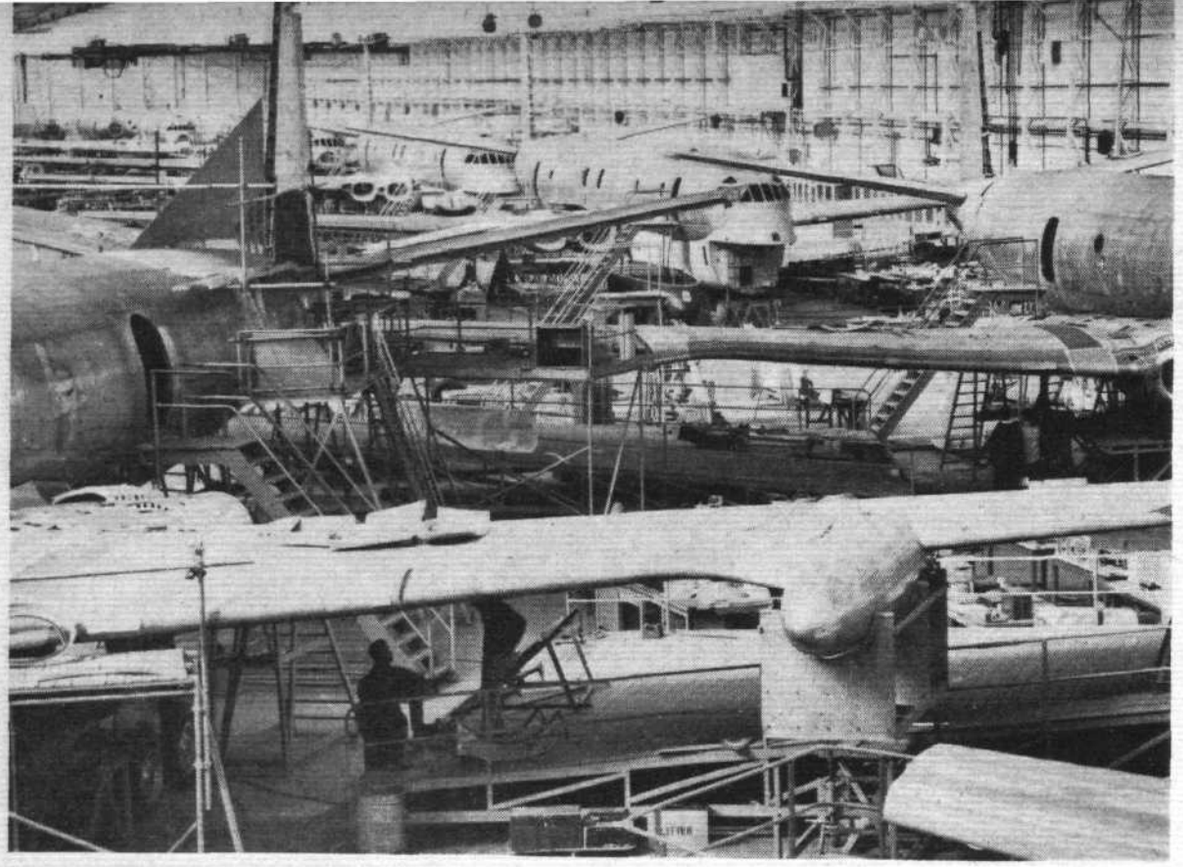
- E 1 Demountable radome
- E 2 Radome hoist point
- E 3 ASV 21 scanner
- E 4 Starboard d.c. crate
- E 5 Port d.c. crate
- E 6 Forward radio rack
- E 7 Autolycus unit
- E 8 Autolycus equipment rack
- E 9 Equipment systems crate
- E10 "On-top" sight
- E11 Digital computer rack
- E12 Analogue computer rack
- E13 Map projector
- E14 Plot CRT
- E15 Sonics station
- E16 Sonics cupboard
- E17 Electrics trough
- E18 Port a.c. crate
- E19 Starboard a.c. crate
- E20 Aft radio rack
- E21 Radio trough
- E22 Sonics homing aerial
- E23 Radio altimeter
- E24 ECM aerial
- E25 Dummy ECM (test) aerial
- E26 Dielectric cone
- E27 MAD aerial
- E28 HF aerial
- E29 VOR aerial
- E30 No 1 VHF
- E31 ILS localiser aerial
- E32 ILS glide-slope aerial
- E33 Doppler bay
- E34 Ground supply socket
- E35 Intercom panel
- E36 ECM amplifier
- E37 Dielectric fairing
- E38 Taxi lamp
- E39 Landing lamp
- E40 Rotary ice-detector

Operational equipment

- O 1 Engineer's panel
- O 2 Escape hatch
- O 3 Crew door
- O 4 Toilet
- O 5 Port beam lookout
- O 6 Starboard beam lookout
- O 7 Blackout curtain
- O 8 Routine navigator
- O 9 Tactical navigator
- O10 Tactical commander
- O11 Sonics operator
- O12 Wireless operator
- O13 ASV operator
- O14 Operator for future sensor
- O15 ECM/MAD operator
- O16 Blackout curtain
- O17 Dinette
- O18 Hot food container stowage
- O19 Fixed galley
- O20 Folding door
- O21 Look-out and stores loader (port and starboard)
- O22 Stores control panel
- O23 Ready-use oxygen stowage
- O24 Hand extinguisher
- O25 First-aid kit
- O26 Size A sonobuoy stowage
- O27 Foot-warming mat
- O28 Camera magazine stowage (under hat-rack)
- O29 Periscopic sextant
- O30 Pressurised launcher
- O31 Rotary launcher
- O32 Baggage stowage area
- O33 Retro-launcher
- O34 Emergency door
- O35 Parachute stowage
- O36 Escape rope stowage
- O37 Main door
- O38 Dinghy stowage
- O39 Hat-rack
- O40 Safe
- O41 Lox pack
- O42 Lox pack charging point
- O43 F.126 camera access
- O44 F.135 camera
- O45 Domed observation window
- O46 Hinged pressure-bearing window
- O47 Searchlight

- Cold-air unit
- Conditioned air to cabin
- Cabin-air risers to roof ducts
- Warm-air duct
- Warm air to foot warmer
- Fresh-air valve
- Fan
- Inwards relief and safety valves
- Equipment cooling fans
- Air extracted from cabin to fans
- Cooling-air delivery ducts
- Cooling-air riser
- Cooling air to racks
- De-icing air
- Engine-start air
- APU
- APU exhaust
- APU compressor intake
- APU compressor delivery
- APU oil tank
- APU and aft fuselage access
- Walk-way

F. MUNGER



A general view of the Nimrod production line at HSA's Woodford factory. The final assembly shed is possibly the largest in Europe and apart from Nimrod has an HS.748 production line, while other aircraft (Shackletons, Vulcans, and so on) also find their way here for refurbishing

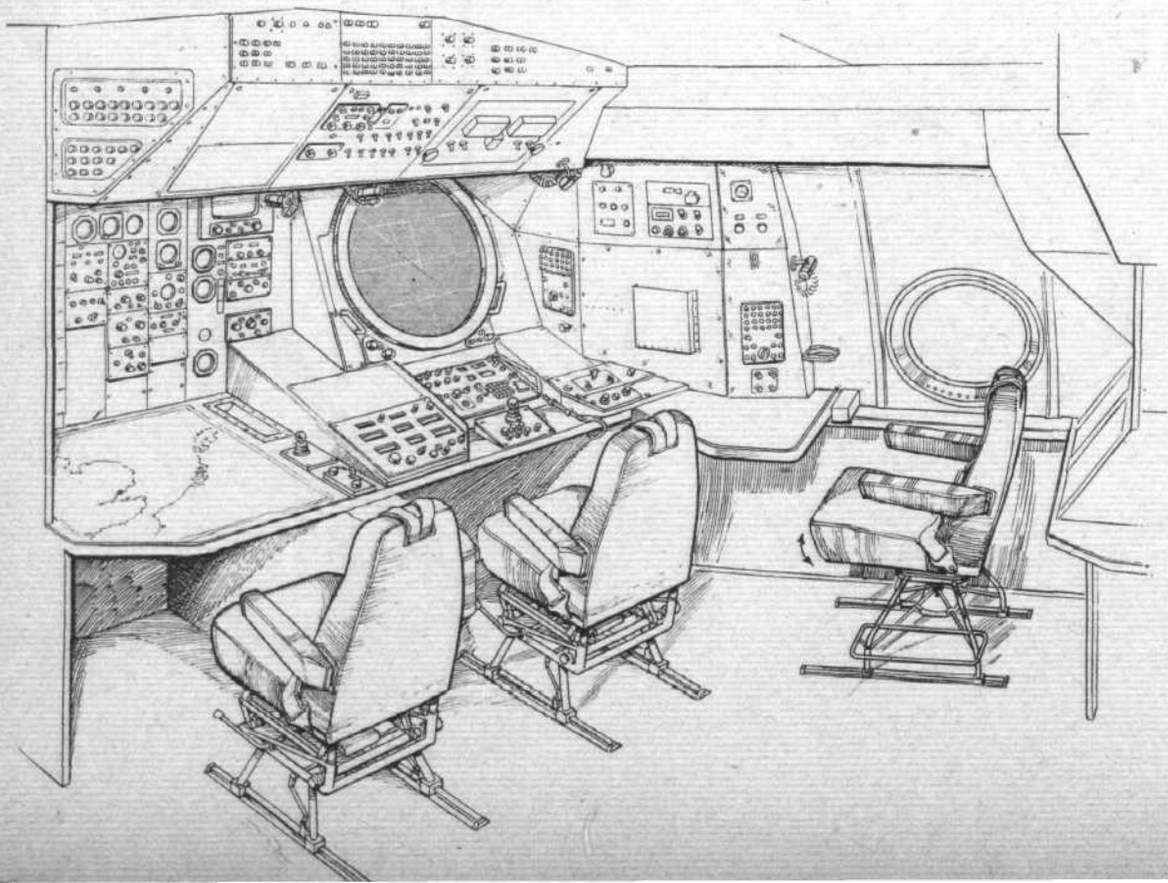
was a familiar exercise to many of the Hawker Siddeley personnel and there was spare capacity in the factories. The relatively high cost of the VC10 and the three-engined layout of the Trident militated against the two big civil jet contenders, while turboprops were considered to be too complex and to lack the necessary speed. Also, adoption of the Trident would have needed a second production line with its attendant cost.

Almost the greatest lesson which had been learned by the design team while examining progress in aircraft design since the Second World War was the impressive reduction of turbine-engine specific fuel consumption. It became clear that, even at the low altitudes and speeds required for a large part of the ASW mission, the turbofan engine was preferable to any other form of propulsion. During the flight out to the search area this engine also offered a higher cruise speed at greater height. A turbofan-powered Comet was therefore attractive. Finally, the Comet was backed by 1.5 million flying hours and fell not far short of the original operational requirements.

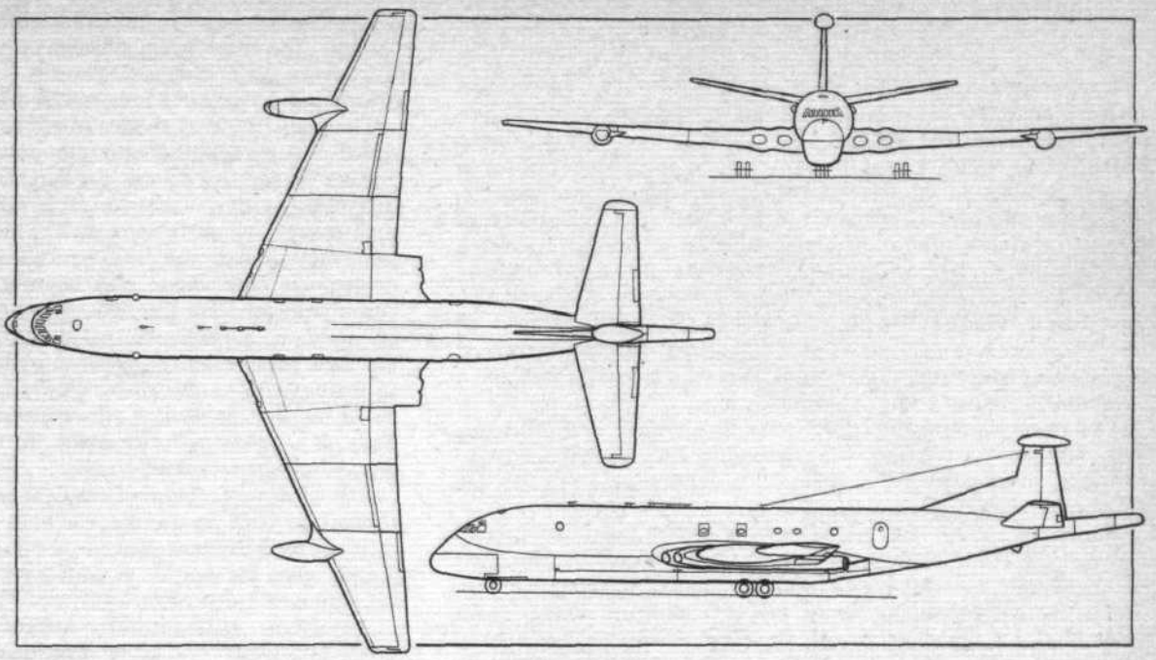
Four engines were considered to be essential. The aircraft is able to cruise on station with progressively three and then two engines (as the weight decreases) at a high power setting and consequently good s.f.c. Under these conditions the design case is a failure of one of the engines, when the remaining engine or engines must be capable of sustaining the aircraft until another is started and brought up to power. The Rolls-Royce Spey RB.168 turbofan was suitably sized for the Comet and was, therefore, adopted. The particular variant selected was the Mk 250, rated at about 11,500lb thust each.

In May 1965 approval was given for initial work to begin and the Ministry go-ahead was given in January 1966.

The translation from commercial transport to maritime



Details of the routine and tactical navigators' compartment. On the left is the routine navigator's station with charts on which may be plotted "en route" fixes from an overhead projector. On his right is the tactical navigator's station with the 24in tactical display. The toggle on the panel in front of him allows symbols to be moved over the CRT and fix positions to be inserted into the computer. The third position is that for the tactical commander, which post is now to be deleted



Although the ancestry is clear in plan view, the side elevation disguises the Nimrod's background effectively by the devices of a capacious weapon bay, a dorsal fin and the ECM fairing

Leading data

Span, 114.8ft; length, 126.75ft; height, 29.7ft; wing area, 2,121 sq ft; fuselage depth, 13.25ft; weapon bay length, 50ft approx

reconnaissance was relatively straightforward. The airframe is based on that of the Comet 4C (although the fuselage length is that of the Comet 4) and the main and obvious change is the addition of a capacious skirt attached to the underside of the fuselage in segments that they are free to move relatively to one another. By this means, structural loads in the bomb-bay are not transmitted back to the fuselage to threaten the integrity of the pressurised hull. The weapon carriers pick up at the strong points used to mount the floor and no strengthening of the basic Comet fuselage was needed.

This extensive weapons bay—most of it ahead of the c.g.—lessened the directional stability to an extent not offset by the beneficial end-plate effect of the ECM aerial fairing mounted atop the fin. Thus a rather prominent dorsal fin was added to make up the deficiency and gives the Nimrod a characteristic appearance.

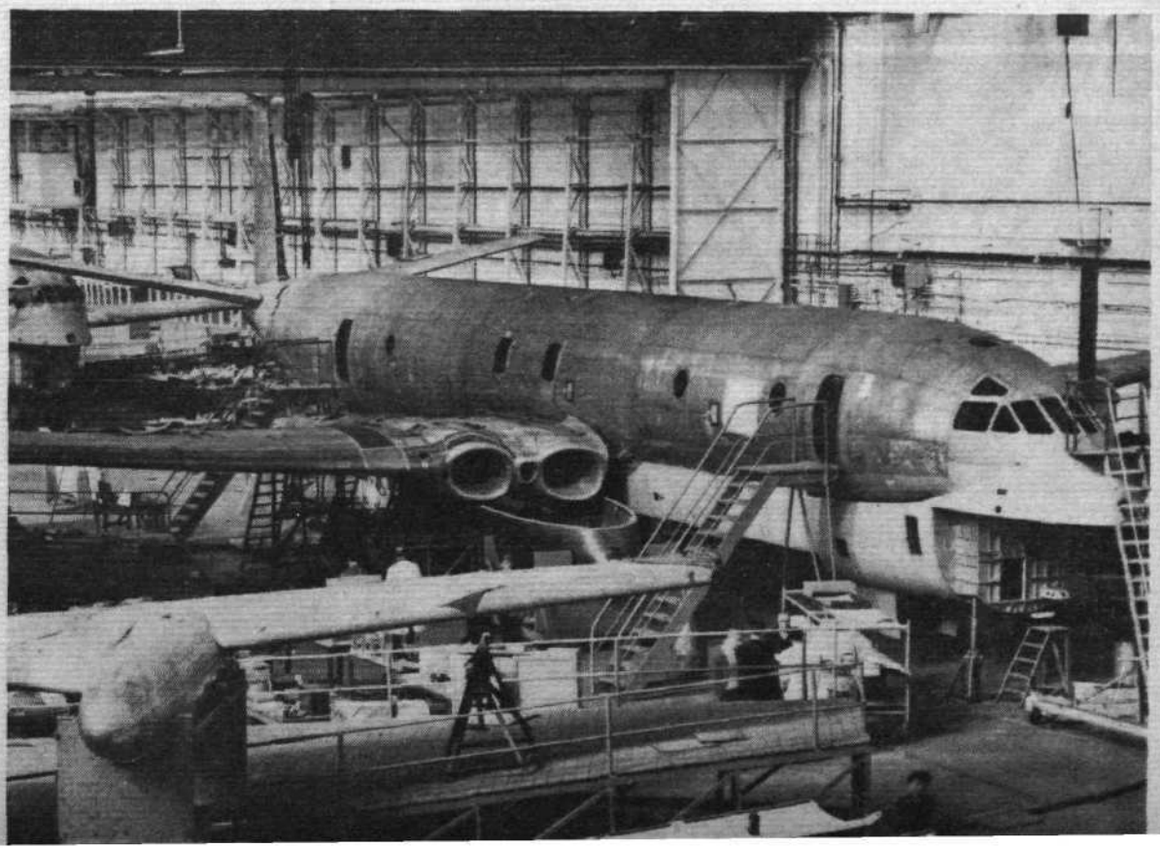
The other noticeable external difference applies to the engine intakes. The greater mass flow and diameter of the Spey engine over that of the Avon has resulted in an increase in the size of the inlets and exhausts, which has meant some redesign in the wing centre-section.

The pilots' windscreens have been deepened to confer better visibility during search, and two eyebrow windows (one each side) have been added in order to enable the crew to look into the turn when the aircraft is banked during ASW manœuvres at low altitude.

Extra fuel tanks have been fitted in the weapons bay. Other changes include the strengthening of two wing ribs to carry pylons for external stores; the installation of a searchlight in the starboard external wing tank; and strengthening of the undercarriage to cope with what is now a considerably heavier aeroplane. A Rover APU is carried to provide high-pressure air for engine starting.

Surprisingly, the fact that the flight profile is rather different from that of the Comet 4 has brought no airframe problems. Comet experience has read directly across to Nimrod and test work has been done on the aircraft only where structural changes have occurred: for example, the eyebrow window cut-outs were pressure-tested. The MoD has made an assessment of the Comet under appropriate conditions, and the handling and ride were found to be quite acceptable. In particular, no unpleasant yaw modes—a trial in some ASW

Another view of the Woodford assembly line. Sub-assemblies are built as far as possible at the HSA divisions responsible for similar assemblies on the Comets. Note the large size of the nose radome and the enlarged engine air intakes



NIMROD MR.1 . . .

aircraft—were found to exist in low-altitude turbulence.

Crew comfort has been given much thought and the improvement over that of the Shackleton is very great indeed. This factor, which has not always been given due regard as a vital adjunct to effective ASW, stems from several aspects. First, the absence of vibration and noise and the ability to fly out at high altitude, in air-conditioned comfort, removes a major source of crew fatigue while the increased cruising speed cuts down the transit period, so reducing the total airborne time. Sorties will thus be much shorter than those of the Shackleton, and the Nimrod therefore has no crew rest facilities as such (the Shackleton has two bunks) although a "dinette" provides comfort while eating.

The roomy fuselage further adds to comfort and efficiency and, because of the low wing position, the main-spar carry-through structures (quite literally a stumbling-block in the Shackleton) are under the cabin floor.

Construction of the aeroplane is distributed extensively through the Hawker Siddeley organisation, so that the divisions of the company which had built Comet sub-assemblies also build the corresponding units for the Nimrod. Only where assemblies are peculiar to 801 is construction undertaken at Chadderton. Thus, the wing centre-section is built at Chester, which is now also responsible for fuselage sections and outer wings, production of which has been transferred from Portsmouth. The tailplane and engine intakes are made at Hatfield. Final assembly takes place at Woodford, which is also the base for development flying.

The two prototypes were the last two Comet 4s on the production line and were suitably modified up to Nimrod (or, in the case of the second prototype, quasi-Nimrod) standards. The first of these is a handling and performance aircraft, powered by four Speys, and was flown for the first time on May 23 last year. The second aircraft, fitted for reasons of economy and time with Avons, flew on July 31 and will be used for the development of the ASW system.

While HSA are responsible overall for the electronics, Elliott-Automation Advanced Military Systems division have been selected as the design co-ordinators for the nav-attack systems. The ASW equipment is a logical development of the Shackleton system but the greatly increased performance and space of the Nimrod have allowed more advanced data processing to be employed. In fact, probably the greatest single difference between the two aircraft, regarded as weapons systems, is the application of computer techniques to the prediction of target data.

The crew numbers 11: two pilots, one engineer, two beam lookouts (port and starboard), a routine navigator, a tactical navigator, a radio operator, an ASV radar operator and two sonar operators.

The flight-deck layout is entirely conventional, strongly resembling its civil predecessor, and there is very little evidence of the aggressive nature of the new aeroplane. A Smiths SF.6 flight system is fitted, together with an SEP.6 autopilot. Mach trim is standard and a yaw damper makes for smoother flying when the aircraft is doing the quite violent S-turns which are a feature of ASW work. It is not really until one leaves the flight deck and walks down the cabin that the scientifically warlike aspect becomes apparent. Immediately to the rear of the flight-deck bulkhead are two hemispherical look-out blisters for visual tracking, one each side of the fuselage (a second blister is fitted on the starboard side further aft). Adjacent to these is the side-by-side station for the routine and tactical navigators—the command post of the aircraft—set obliquely against the starboard fuselage side. Further aft again, the next station is that of the radio operator, who faces his radar counterpart across their combined console looking on to the port wing.

The two sonar operators ("sonics" in the vernacular) sit side by side, looking to starboard; and bringing up the rear on the same side is the ECM/MAD (electronic countermeasures and magnetic anomaly detector) station. The last two positions along the rear left-hand cabin are reserved for future sensor equipment. Further aft, but still inside the pressure cabin, is the sonobuoy bay.

As already stated, the basic ASW equipment of the Nimrod is similar to that of the Shackleton, modified in many cases to suit the new-data processing system. It comprises the IC sonar, ASV radar, Autolycus and ECM. These are supplemented by a new long-range sonar system and MAD.

The basic tools of the trade are sonobuoys, active or passive, which are parachuted into the water in a given pattern. The passive buoy listens-out for underwater sound sources and transmits to a surface vessel or aircraft the bearing of any such source which it detects. The active buoy broadcasts low-frequency pulses underwater and any returns are processed to provide both range and bearing information to a ship or aircraft. In practice the two types are complementary and both are used in a particular search area to provide a fix. While the two passive buoys provide a fix on the target in relation to their positions the active buoy determines the range of this fix in relation to itself. One technique then is to use the active buoy as a datum for the attack, by beginning a count-down as the aircraft flies over it.

ASV (air/surface-vessel) radar may be used to detect the submarine if it is on the surface, or a periscope or snorkel if it is partially submerged although being an active device it may give the search aircraft away. ECM may also be used for submarine detection.

Autolycus, an ionisation detector or "sniffer," will reveal small concentrations of combustion products from fuel oils. It gives an indication of whether shipping is or has been present, although too long a search in the same area may result in spurious, search-aircraft-induced indications.

MAD is a very sensitive device which has not previously been fitted to British ASW aircraft. The equipment consists of a magnetometer which can detect and measure extremely small local changes of intensity of the Earth's magnetic field from the nominal value. The magnetometer is isolated as much as possible from the effect of the aircraft itself by mounting it on a long boom. Information is displayed as a flat trace representing a uniform magnetic field on a recorder. A blip appears in the trace if there is a change in field intensity such as would be caused by the presence of an iron mass of appreciable size. This aid is very local in operation and is the best method of obtaining a final and accurate fix. It has to be used in conjunction with other sensors, however, since it is non-selective and does not differentiate between, for example, a submarine and a sunken wreck.

Each sensor and its operator may be regarded as an information unit, and its data is assessed by the tactical navigator. In the Shackleton, information was transmitted by means of word or note; but in the Nimrod, co-ordinates of a fix or suspected target are transferred automatically by the sensor operator to the tactical navigator's station, where it appears on a 24in-diameter display.

The tasks of the routine and tactical navigators are complementary. The first man is responsible for the navigation of the aircraft in transit to and from the search area; the job of the second is to conduct the attack.

Sub-contracting throughout HSA means a lot of roadwork. Here a Nimrod is seen in transit to Woodford for final assembly

The primary, navigation mode uses Doppler with an inertial platform, giving Doppler ground speed and drift and inertial heading. Tactical navigation uses mixed Doppler-inertial velocities and inertial heading. Automatic reversion to inertial data occurs should Doppler fail, and this is satisfactory for short-term work. A further reversion available in the case of failure of both Doppler and the platform is the use of the air-data computer and twin-gyro compass to provide speed and heading. Besides present position data for the two navigators, latitude and longitude are also displayed to the second pilot.

The task of the routine navigator is to navigate the aircraft out to the search area and to plot radar fixes along the route. A Ferranti vertical projector displays aircraft and ship symbols on to his chart table to enable position fixes to be read off. One of four projection scales may be chosen: 2, 1, 0.5 million and 36,000 to 1, to correspond with the tactical display.

The routine navigator is not dependent upon digitally computed information, but uses instead Doppler and platform.

Sitting immediately alongside the routine navigator is the tactical navigator, whose job is to evaluate data from the information units. He may also be responsible for commanding the attack if the first pilot does not elect to do so. Information is processed by an Elliott 920B computer, the primary purposes of which are to relieve the tactical navigator of part of the task of analysing data from the "sonics," and to organise and control the tactical display. Presentation of continuously updated information to this crew member takes place on an Elliott display of 24in diameter. Five scales may be selected to give a converge between 10 n.m. and 160 n.m. The display is north-stabilised and the origin may be chosen at will; it need not represent the instantaneous position of the aeroplane but can be a surface vessel, for example. In the latter case, correlation of information and timing can enable the aircraft to make an attack by using the vessel as datum.

The computer can then feed steering information to the pilots' flight director and will begin a countdown to attack. The actual release of the weapon or weapons is not done automatically, but for safety reasons, is under the direct control of the tactical navigator.

Mounted alongside the main display is the tabular display, a smaller, square tube which is used to note down navigational information such as target and aircraft track, speed and position, sonobuoy selection, next fix point, etc., and is, in fact an *aide memoire*. This display is also driven by the computer.

Nimrod will carry the full range of ASW weapons: mines, depth charges, bombs and torpedoes. In addition, two wing pylons can carry either Martel or AS.12 missiles.

Performance may not yet be disclosed but it is known that the aircraft can conduct a useful search at 1,000 miles from base. This takes into account a 400-mile diversion on return to base (spanning, for example, the range Kinloss to St Mawgan) together with a 30min stand-off and 5 per cent reserves. Because the airframe is aerodynamically similar to that of the Comet, the speed range must be very similar.

Nimrod progress

Up to last April the two prototypes had been accumulating flight hours at the impressive rate of 25hr/month for the first aircraft and 20hr/month for the second. Progress has been very smooth, the only "flats" in the utilisation graph being due to weather or for scheduled maintenance.

The Nimrod has been surprisingly free from the political cut-and-thrust which has laid low other projects. One reason is, perhaps, that the burden of risk falls very heavily on HSA. The contract for most of the programme—design, R&D, production of two prototypes and 38 production aircraft—is worth about £100 million and was negotiated on a fixe-price basis. This means that while HSA will receive an overall maximum profit (closely auditor-scrutinised), there is, theoretically, no limit to the loss which the firm would have to bear if the final cost were greater than the estimated figure. The Nimrod will be quite the most complex aircraft ever to enter RAF service and its design development and production were clearly going to be a major programme. As the existing HSA (Manchester) chief designer, Mr Maurice Brennan, was heavily committed with other projects, the task of leading the 801 programme was given to Mr Gilbert Whitehead. The Manchester division of HSA is probably unique, therefore, in having two chief designers.

A view of the Nimrod which will become increasingly common over the years, especially at St Mawgan and Kinloss. The large bomb-bay doors are slightly open, and the dorsal fin and ECM fairing are distinctive

It is HSA's contention that Nimrod should be designed for at least 20 years' active life and a close watch has been kept at all stages of design to ensure that future improvements may be incorporated with the least possible modification work. For example, the 60 kVA constant-frequency alternators are very conservatively rated, so as to be able to cope easily with future additional loads. Future development in three areas is foreseen: new and more effective weapons, better sensors and new and even more economic engines, to all three of which Nimrod will be adaptable. Probably the greatest improvement will come in the development of powerplants such as the three-spool Rolls-Royce engines. Housing such large-diameter engines within the wings would be a problem and it is possible that podded installations would be the practical solution.

Not a few countries have shown great interest in the aircraft—Holland, Canada and Italy, for example, while South Africa's proclaimed interest in the Nimrod to replace her Shackletons was stamped on by the British Government last year.

While there is no British Operational Requirement for an AEW (airborne early warning) aircraft the Nimrod would obviously be an ideal platform for AEW equipment, since the requirements of the two missions are broadly similar. Cruising at high altitude, it could carry the large scanner essential in this role and would have satisfactory endurance.

Meanwhile, test flying continues apace to meet the in-service date of early 1969, by which time the Nimrod will have been granted an interim operational capability, although it will not yet have been cleared for tropical or arctic flying.

The first prototype has already been transferred to A&AEE at Boscombe Down for an official handling assessment; and the first production aircraft, which is due to fly in a few days' time, will be used for armament and nav/attack development. The second and third production 801s will also go to A&AEE for assessment in all aspects. Production of the present batch is scheduled for completion some time before 1971.

In conclusion, it must be emphasised that the Nimrod is not a Comet in uniform; it is an absolutely brand-new aeroplane at the very beginning of its career but with the birthright of many years' experience built in. It should be second to none in its ability to protect seaborne traffic, be it military or civil.

INDUSTRY International

Products

Company News

Automatic Tester A flexible automatic test system which carries out a wide variety of testing functions at reduced cost has been developed by the Special Products team of Honeywell, at Hemel Hempstead, Herts.

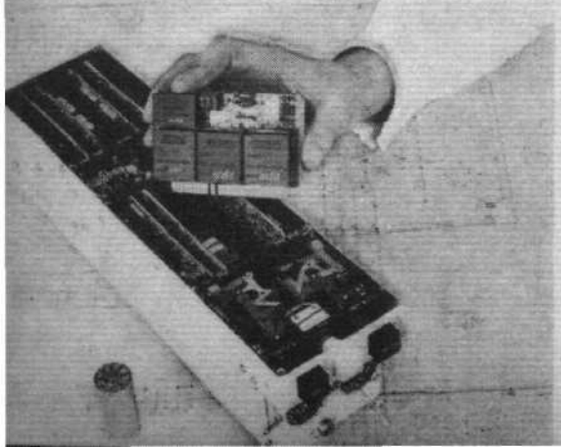
Operated from eight-hole pre-punched tape, the equipment, known as "Titan," employs standard test modules, which can be built up into a system exactly suiting a user's individual needs. This modularity allows the user rapidly to change the configuration as required, eases maintenance and keeps down production, installation and commissioning costs. A large number of optional packages are available, including those for RF testing.

Titan can be used for monitoring and maintaining large electronic systems such as flight simulators, ballistic computer systems, process control systems and analogue computers for radio receivers and transmitters, or for routine acceptance of assemblies and components. It is thus equally suitable for the mass producer, the specialist component manufacturer and the maintenance engineer.

Harrier Autostabiliser Illustrated below is the Elliott-Automation autostabiliser, first of a new range of autostabilisation and autopilot equipment for VTOL aircraft and helicopters. The unit contains built-in test circuitry, operable by pressing the two keys on the front of the box. Other systems in the range incorporate self-monitoring and failure-surviving features.

The whole system for Harrier, which includes two sub-miniature rate gyros, the computing circuitry and the power supply, are all contained in a single box weighing about 5lb, and is stated to be considerably smaller and lighter than units previously available. An example of the gyro used in the system has been included at bottom left of the picture, and a circuit card has been extracted to show the high-density electronic modules.

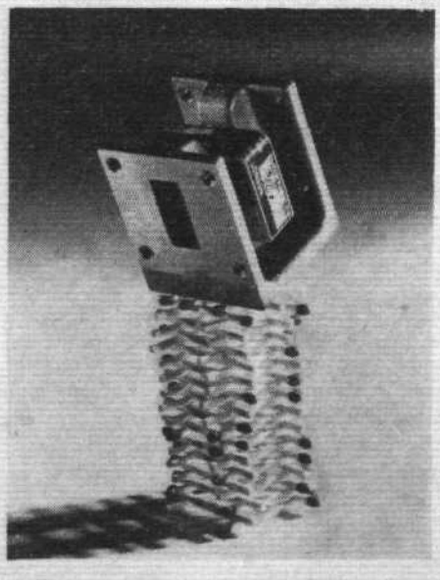
This Elliott-Autostabiliser, described above, is of particular value to the Harrier pilot at the hover and at low airspeeds



Laser Patent Reference Carrollton Press Inc, 1647 Wisconsin Avenue, Washington DC has published a collection of full text facsimiles of more than one hundred pending US and British patent applications. Known as the "LAMP" Bookfile Collection (Laser and Maser Patents-pending), it will contain complete specification, claims, and drawings, all of which will now be available months and years before they are made public as issued patents. Among its other uses, this advance information might save companies money in avoiding unprofitable duplication of previously accomplished research results.

This first-published collection of pending patent applications will contain some 2,000 pages in two looseleaf binders. This format permits subscribers to maintain the collection as a reservoir of advance patent data if they order the optional updating service. The basic collection costs $450 and the updating service sells for $175 per year plus a slight charge for all relevant applications after the first 20 received.

The new Marconi Type F1046-32 low-power waveguide circulator is claimed to be less than one-tenth the weight of previous types



Canadian Radar Air traffic controllers in Canada will be able to provide radar control for aircraft hundreds of miles away when a new $500,000 (£210,000) radar remoting system currently being developed goes into service. The new system will relay radar data over long distances economically and accurately, also providing air traffic controllers with more extensive and more clearly displayed information than now is possible.

The sonobuoy discharge system for the HSA Nimrod utilises a considerable quantity of precision stainless steel tube by Accles and Pollock Ltd. The Nimrod—subject of a feature on pages 887-893 of this issue—carries a computer-controlled dispenser which drops sonobouys in a pre-determined order

Airborne Instruments Laboratory of Long Island, New York, is developing the system as part of the Canadian Dept of Transport programme for expanding and improving ATC.

The system will process radar information on aircraft into digital form which can be carried on telephone lines to a distant ATC centre.

At the control centre, the data will be processed for display on the controllers' consoles. Special symbols will indicate each aircraft's current position and four previous positions. In addition, the aircraft's identification number and its altitude will be displayed adjacent to the current position symbol of those aircraft equipped with SSR transponders.

Photo-recce Units Ordered W. Vinten Ltd, of Western Way, Bury St Edmunds, Suffolk, has received from an overseas air force a contract for three mobile photographic processing and aerial interpretation units. Delivery of the first is scheduled for June next year, with completion of the order by 1971. These, it is stated, are the first commercially available units of the kind to be built in the United Kingdom.

Letters

BOAC's Profits

SIR,—Through your columns, notably that of Roger Bacon, you have attacked BOAC for being over-profitable. I cannot agree with you that the corporation's profit is bad under present circumstances.

BOAC had a long string of financial deficits over the years. The taxpayer waved goodbye to many millions of pounds in order to give the corporation a clean slate and rebirth into the jet age. Surely it therefore behoves the corporation to make adequate provision for the future in order that it may never again find itself in this humiliating position. Sir Giles Guthrie claims that this is where profits will be used. Any business must save money to invest if it is to expand.

I feel that *Flight's* charge should be answered on this point. What is BOAC in business for? The ordinary taxpayer's answers must surely be: (1) to make money; and (2) to provide transport. Taking these in order, I am sure that *Flight* would be the first to regret any loss made by the corporation; it must run at a profit. Secondly, only a very small proportion of UK taxpayers have yet flown by BOAC (their misfortune), but this makes it even more important that they are not expected to meet losses either now or in the future. Basic economic textbooks tell me that a business is run first to make money and that it is the object of businessmen to maximise their profits.

Why should BOAC be any different? To be sure, it is a nationalised transport undertaking and one must assume that, as Parliament nationalised BOAC, Parliament's intention was that BOAC should serve the public good.

In my view the "public good" is to provide air services so that effective demand for travel may be satisfied and to ensure that this is not to the detriment of our balance of payments. That BOAC has been unable to maintain its share of the market is bad from the national viewpoint. But which of these is to be chosen: to make money, or to provide such transport as to gain as big a share of the market as possible? I choose the former—for the reason that, if a business pursues a policy of maximum growth in the here and now, it may not be strong enough to survive the hereafter, i.e., the 747 and SST era. This means "back to the begging bowl." Thus although BOAC's share of the market has fallen and it is short of capacity (a mixture of bad luck and bad judgment), the corporation's policy of building a strong base should prove to be best for the taxpayer in the long run. If the corporation errs, it does so on the side of financial safety.

BOAC's high load factors seem to indicate two things. Either it is better at selling transport (not surprising, with the superb VC10) or it is short of capacity, or both. If this is to the national detriment then the remedy lies with the ATLB right now.

As a taxpayer I have followed BOAC's fortunes for some while, and am glad that a nationalised corporation is pursuing a policy which seems likely to ensure that it does not in future come a-begging to me. After BOAC's past hard times this seems a policy of wisdom—*reculer pour mieux sauter.*

Sunbury on Thames, Middlesex — A. M. BOSCHEINEN (MISS)

RegiSSTration

SIR,—May I propose an immediate seat on the Board of Roger Bacon's Flight Falsies Corporation for the highly paid executive who has bulldozed the diabolical liberty of the "registration" G-BSST for the Filton Concorde? (page 815, *Flight*, May 30).

Until now I have lived in truly insular belief that we British were above such low Continental tricks as messing about with the Civil Register once we had settled down to the comfortable G-AAAA to G-ZZZZ succession. Only a combination of letters designed to offend could be eschewed right along the line to Britannia G-APLL, which innocently plied its way for a time as G-ANBG before someone felt that nobloodygood was a bit much for an aeroplane that was having a certain amount of teething troubles.

Of course, we have suffered occasional harmless "fiddles" such as G-AERO for the Auster J/1, which prompted *Flight* to reply with G-AFLT, but that was good friendly publication rivalry and, anyway, both were anachronistic. But this gimmickry of "G-BSST" has all the earmarks of the sort of poster sales-promotion practised by BOAC/BEA with their artistically bodged registrations "G-BOAC" and "G-ABEA."

Let's stop the rot here, otherwise we shall live in an even more uncertain world. This messing about means that G-BSST will "live" many, many years before its rightful time, because the British Register is at present methodically alphabetting new Beagles, Boeings and Cessnas in the G-AWAA-ZZ sequence.

Finally, and inevitably, "G-BSST" will be subject to the harrowing in-argot of the Press prosers, who will happily ignore everything and refer to "Sierra Sierra Tango." If so, why don't we go the whole Hotel Oscar Golf and merely transpose the hyphen—GB-SST?

London W14 — CHARLES W. CAIN

Morale Boosting

SIR,—I was amused to read in Neil Harrison's article on the Beagle Pup (*Flight*, April 25) the sentence: "what a fantastic difference this aircraft will make to the morale and prowess of the British light flying movement." Naturally, we all wish the Pup every success. However, I cannot help thinking that morale and prowess would benefit more from such modest assistance as the old fuel rebate, cheaper hangarage, lower landing fees and navigational charges, even cheap loans—in total, a pittance compared to the vast sums that the Government seem anxious that Beagle should spend on the taxpayers' behalf.

Biggin Hill Airport, Kent — W. J. GIBBS

Who has the Worst Weather?

SIR,—One of my numerous loving admirers over here just showed me Harold Rigby's letter in your March 28 issue. I should have suspected my admirer; he was gleeful when he gave me the copy!

As a veteran, highly skilled bikini-watcher I must try to aim my pin at Harold's balloon. In discussing the heavy traffic at Van Nuys he tries to bolster his position by saying that that airport "probably" has a good weather record. He's treading dangerously. Van Nuys is within sight of Los Angeles International. The flying weather in the entire Los Angeles basin is frequently lousy. You've heard of smog; that's where it's born. Besides all that, we have the same basic rule over here that you have in the UK—when the weather's IMC the only flying that's done is by those who are IFR-qualified.

Not only that, Van Nuys is a narrow piece of real estate that no self-respecting "jet age" airport should be confined to. It has one long runway, and a shorter parallel runway hard beside it. That's all. By comparison, Heathrow is the size of Luxembourg.

This constant pounding on Britain's awful weather puzzles me. I hope Harold doesn't really believe that the British either invented bad weather or have any kind

LETTERS...

of monopoly on it. Some of our busiest airports over here are in the worst weather belt. Chicago O'Hare is in the midst of some of the most frequent IMC conditions in the US, yet it handled 643,787 movements in 1967. Oakland, California, is just across the bay from San Francisco; they have traditionally lousy flying weather a considerable amount of the year, yet Oakland handled 398,286 movements last year. And there are Pittsburg, New York, Kansas City, Detroit, Philadelphia—I could go on and on; not one of them has ever been described as a garden spot, yet they handle tremendous volumes of traffic.

If Harold won't accept that bikini, how about the purely IFR operations? O'Hare leads the pack again, with 607,095 in 1967. Los Angeles is second, Kennedy third, Washington fourth, and so on. Of course (Harold will probably say) there can be an "IFR operation" on a bright and sunny day; this is the current airline obsession for trying to lay the blame for any possible mishap on the traffic control people instead of the pilots.

So let's take true, pure instrument approaches in actual IMC. Here Los Angeles (within sight of Van Nuys, remember?) leads the pack. Next is O'Hare, then Newark, JFK, Atlanta, LaGuardia, Buffalo, and so on—all amongst the busiest airports and areas in the US.

I'm surprised at Harold's "revelation" about a country only ten minutes' time from London imposing restrictions on traffic. We've had the same thing for many years. It's called flow control over here. While it isn't the Republic of France that is hampering operations at New York, it *is* Boston, Chicago, Washington, Cleveland, and on and on. I've had to wait for an IFR clearance under such conditions for more than an hour myself. The airlines take quite a few such delays. But what's so astonishing about that? It's been part of our way of life in the airspace for years.

Washington, DC MAX KARANT,
Senior Vice-President,
Aircraft Owners and Pilots Association

Wheel and Woe

SIR,—The photograph in *Flight* for May 9 of "a wheel-shaped planetary landing craft," recalls to my mind the "Aerial Wheel" which was entered in the Military Aeroplane Trials in 1912 and actually arrived at the trials. The pilot was housed in the hub of the wheel, the idea being that, in the event of a crash, the wheel would roll until it came to rest, when the pilot could dismount.

At the last moment his courage failed him, and he was frantically rushing round offering £100 to anyone who would fly it. Though I flew in those trials with Blériot and Cody, I did not fancy the Aerial Wheel, and there were no other takers.

Kendal, Westmorland T. C. STAPLES

London-area Maintenance Facilities

SIR,—Although it is undoubtedly true (as reported in Sport and Business last week) that the southern part of the London area is short of airports with good engineering facilities, 24-hour all-weather approach and Customs, the same cannot be said for the area as a whole.

Here at Luton we can offer all these facilities—plus a 24-hour engineering service. As some clients fly their aircraft from the Near and Middle East for servicing or overhaul by McAlpine at Luton, perhaps it is not too far away from South London to provide the service the ex-Gatwick boys need.

Luton Airport, Beds J. P. B. O'NEILL,
Commercial Manager, McAlpine Aviation

The Originator of VASI

SIR,—The article "Low-cost Precision Approach," which appeared in your issue of May 2, referred to Research Engineers Ltd as the "creators of VASI" and stated that this company "did most of the basic development."

The fact is that the visual approach slope indicator was invented by my then colleague, Mr J. W. Sparke, of the Royal Aircraft Establishment, and anyone can satisfy himself on this point by reference to the patents. Furthermore, the prototypes used in the flight tests were designed at RAE. When the tests in the UK and US were satisfactorily completed, the VASI was adopted by ICAO, and various firms in Britain and abroad then produced their own commercial versions of the original RAE design. Research Engineers Ltd is one of three firms in Britain who did so under licence from the National Research Development Corporation. Subsequent development by Research Engineers Ltd was therefore confined to practical details of their own version; it was certainly not "basic."

Mr Sparke has received world-wide recognition for his work, the latest being the award of the Cumberbatch Trophy for 1966. This is all so well known in the aviation world that I would not have bothered to set the record straight were it not that similar claims have been made on behalf of this company on previous occasions. As the proverb says "When a thing is a success, everybody is its father; when it is a failure, it is an orphan." I trust that Research Engineers Ltd will now have the grace to disclaim paternity.

Camberley, Surrey E. S. CALVERT

[Mr E. S. Calvert, OBE, DSc, will be remembered as the originator of the Calvert line-and-bar approach lighting system and of other highly effective aids. His work has been recognised by the award of, *inter alia*, the Wakefield Gold Medal of the RAeS, the Laura Taber Barbour Air Safety Award and the Monsanto Safety Award—Ed.]

High-speed Piston Engines

SIR,—I read with great interest your revelation of the plans of Continental and Lycoming to produce a new generation of high-speed piston engines, running at about 4,000 r.p.m. in fixed-wing aircraft and 6,000 r.p.m. in helicopters. The fact that these engines are to be in the 250-600 h.p. bracket must pose a serious challenge to the 500 h.p. turbine of which we have been hearing for so long, but which is presumably still bogged down by economics.

The aviation piston engine has been supposed to be dying for so long that it comes as quite a shock to see that two reputable companies are prepared to sink large sums of capital in developing an entirely new range—entirely new, that is, so far as they are concerned. But is this not just one more case of something the British started years ago being brought out and sold as the latest thing in America?

I seem to remember, in the late twenties, hearing the late Harry Ricardo preaching the gospel of high rotational speeds in aero engines, and the first practical result of this formula was the Pobjoy "R" engine, developing its 75 h.p. at what was then considered the incredibly high crankshaft speed of 3,600 r.p.m. The only reason why the Pobjoy never caught on was that the aircraft to which it was fitted failed to achieve government support, and therefore there was not enough money available to pusue its development adequately.

It remained for the late Major F. B. Halford to put the high-speed aero engine conclusively on the map in the shape of the Napier Rapier, Dagger and, most

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

successful of all, Sabre. The Sabre was so revolutionary with its two crankshafts, 24 cylinders and sleeve valves that it naturally needed more development than its predecessors, and had barely reached its peak in the Typhoon when all big-engine development swung over to turbines. The Sabre was the last high-speed aero engine to go into production, with take-off r.p.m. of 3,750 and a future development potential capable of taking it to 4,000 r.p.m.

Thus, in wishing Continental and Lycoming every success with their new generation of high-speed aero engines, I hope the work of the British pioneers will not be entirely forgotten, particularly in the case of Frank Halford, who was one of the greatest and least-rewarded engineers this country has ever produced.

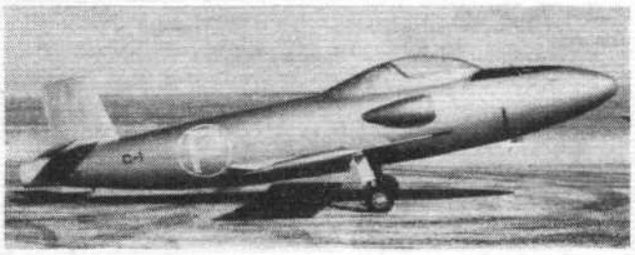
St Peter Port, Guernsey JOHN GRIERSON

Preserve that TSR.2!

SIR,—I read recently that three of the four TSR.2s which were completed are at present at the Shoeburyness Proof and Experimental Establishment, where they will be used in tests of destruction of air targets.

Would it not be possible for one of the three to be kept at the RAF Museum planned for Hendon? I realise that the TSR.2 never actually entered RAF service but in the circumstances I feel sure the public would appreciate the opportunity of seeing it along with earlier, more fortunate, British aircraft.

London SW16 D. WILSON



The manned Jindivik from Woomera now preserved at RAAF Edinburgh, South Australia (see letter from Mr Leslie Hunt)

SIR,—Your picture (page 594, April 18) of the T.188 and TSR.2 at Shoeburyness makes one wonder why the only TSR.2 to fly should have been sent there and not kept for exhibition; any of the others could surely meet Shoebury's requirement—if, in fact, it will serve any real purpose there. It seems to me that we are still missing the main chances for posterity—unlike the Australians, who have preserved one of the manned Jindiviks—C-1, from Woomera, A93-2 "Pika."

Leigh-on-Sea, Essex LESLIE HUNT

All-in Travel Service

SIR,—It was with interest that I read your news item on "Nursing the Businessman" on page 661 of your issue of May 2.

Without wishing in any way to decry the intention of the company concerned to initiate a comprehensive travel service, I would like to point out my own company realised the necessity for such a service quite some time ago, and have what I think is a *really complete* service for the businessman.

We specialise not only in long-distance international journeys by air and sea for the independent businessman or groups by scheduled or charter services, but cover every possible facet of travel and extraneous activities.

If required, one of our senior staff will personally call upon the busy executive to formulate his travel plans, give advice as to the most economical routes, cover passport and health requirements and effect all reservations whether by land, sea or air throughout the world; provide a meeting and greeting service at arrival and departure points; transfers to and from hotels; self-drive or chauffeur-driven car; guide, secretarial and interpreter service; escort service and if necessary, even for shopping expeditions in far flung parts of the globe. In addition, information can also be given if required on local amenities and facilities. Needless to say, all of these services can be provided on a 24-hour basis.

Vacational needs are also extremely well catered for by the undertaking of all types of private and group holidays, cruises and yacht hire, etc.

Further to supplement the service, we operate a special division to supply industry with "incentive promotions" to increase productivity and profitability. These schemes can cover staff, salesmen, dealers or consumers and do not merely supply the actual holidays; complete package programmes can be arranged.

London EC2 J. R. HAMPER,
Director and General Manager, Clarkson Alltravel Ltd

Whirlwind Power

SIR,—Mr K. J. Phillips, who writes (May 30 issue) regarding errors he says you made in reporting on the Biggin Hill Air Fair, has got a bit off the beam himself, in spite of having served in 705 Sqn as he says.

All Whirlwind helicopters powered by Alvis engines had the 14-cylinder Leonides Major fitted, and still do for that matter. Alvis never made a seven-cylinder aero engine; the Leonides nine-cylinder does, however, power the naval Dragonfly and its civil counterpart, the Widgeon.

The Mk 7 Whirlwind to which Mr Phillips refers are Leonides Major-powered, as also was the Mk 8, which served so well in the Queen's Flight for a number of years.

Leamington Spa, Warwicks R. E. NICOLL

SIR,—I fear that Mr K. J. Phillips's corrections are not in fact correct regarding the Scout and Wasp helicopters.

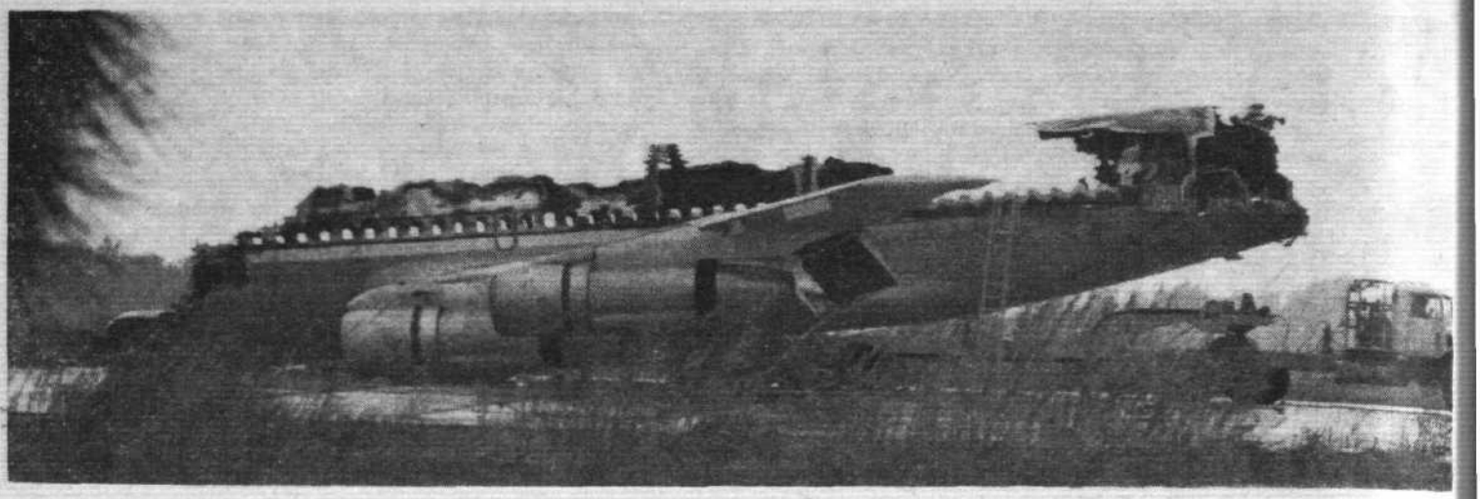
The Saunders-Roe P.531 (Sprite?) was the beginning of this series. A modified P.531 was used for very early naval trials, and called Wasp Mk 0. The Army Scout was developed from the P.531, with the definitive Naval Wasp being derived from the Scout (i.e., there is no "Sea Scout" as such).

Marlow, Bucks A. P. H. BAMFORD

[Maj R. E. Nicoll was, until his recent retirement, sales manager of Alvis Aero Division; and the writer of the second letter, Mr Bamford, describes himself as "Recent ex-Scout/Wasp flight development engineer"—Ed.]

DIARY

June 14-18	"Dawn-to-dusk" competition, Redhill Aerodrome, Surrey.
June 14	RAF 50th anniversary: HM the Queen's visit to Abingdon.
June 15	RAF 50th anniversary: public display, Abingdon.
June 15	Royal Air Forces Association: Air display, Filton, Bristol.
June 15	International Rally, Milan, Italy.
June 16	27th Air Tour of Lombardy, Italy.
June 16-29	Seventh International Ballooning Week, Mürren, Switzerland.
June 18	Third Eurospace US-European conference, Munich.
June 20-22	Dutch Air Tour 1968
June 21-22	RAeC: National Air Races, British Ninety Nines (women pilots) race, and international flying display, Goodwood.
June 21-23	International West Coast Air Rally, Gothenburg and Halmstad, Sweden.
June 21	Helicopter Club: Visit to Army Aviation Centre.
June 22-23	"Air Squadron" Aerobatic Trophy, RAF Little Rissington.
June 22	International rally, Rimini, Italy.
June 22-23	de Marta Trophy, Turin, Italy.
June 22	Royal Air Forces Association: RAF 50th and RAFA 25th anniversary—flying display, Staverton Airport, Glos, 2 p.m.
June 22	RAeS Rotorcraft Section: Helicopter rally and garden party, Dunsborough Park, Ripley, Surrey (members and guests only).
June 23	International rally, Romagna, Italy.
	SBAC Farnborough Show: September 16-22.

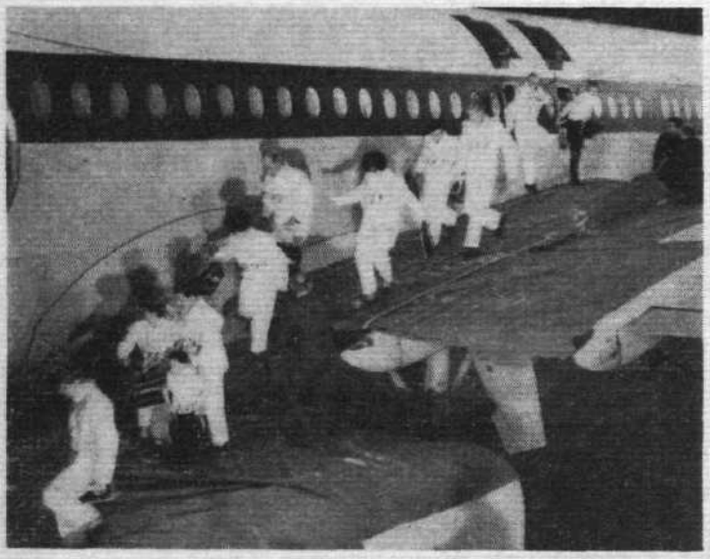


Everyone on board this aircraft, burned out in a landing accident, escaped with his life. It can be done . . .

SURVIVAL

Saving lives when an accident has happened

. . . if proper training and equipment are provided



By definition, accidents are bound to happen. In many of them lives could be saved—and "accident" revert to "incident"—if more measures were taken to ensure that airliner passengers and crew had an environment which gave them greater chance to evade the hazards of an emergency. In this survey "Flight" staff member John Bentley reviews some of the developments which will give aircraft occupants in the 1970s a better chance of surviving any accidents that may occur.

ACCIDENT REPORTS from American authorities occasionally contain the chilling phrase "This accident was non-survivable." Such a finding is inevitable when an aircraft breaks up in mid-cruise, or hits the ground at descent speed; but many accidents occur in which the question of survival—the difference between life and death—is a hairsbreadth, which becomes even narrower as the years go by. This narrowing is due to several causes—mainly because of stronger airframe construction and the provision of better safety equipment and training. But, ideally, if an accident is "survivable"—that is, if one person survives—then all the occupants should be able to survive. Although this ideal may seem remote, it is by no means impossibly so; indeed, many of the means of preventing fatalities are available now—at a price. Two lie in basic areas which need attention.

The first is a 15 per cent increase in airframe structural strength on all newly built aircraft. The effect of this on weight and payload/range considerations is unacceptable to operators but airworthiness experts believe not only that the incidence of in-flight structural failure would be reduced but that survival of all occupants in a "survivable" accident could be assured if this additional strengthening was incorporated. That this would be so is difficult to establish, but it is certainly the case that modern jets, with airframes constructed from metal machined out of solid billets, are much more "crashworthy" than the older sheet-skinned aircraft. Unfortunately, this aspect is somewhat masked by the higher speeds at which the jets tend to crash; but these speeds have virtually steadied out in the 100kt-plus region and future construction methods which produce stronger structures should prove their worth.

The second basic aspect of survival concerns fires and, in particular, fuels. Very few airlines use JP.4 nowadays; but that does not stop an awful lot of damage being done, and some hundreds of lives being lost each year, because the aircraft crashed and burned. A recent Civil Aeronautics Board study

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SURVIVAL . . .

showed that in 28 potentially survivable accidents where fire was involved more than half the fatalities were due to post-crash fire. Of the 1,161 occupants involved, 488 were killed and 673 survived. The fatalities were broken down into three sections: 166 people died from impact forces; 28 drowned during an unsuccessful ditching; and 294 deaths were directly related to fires which broke out after impact.

A great deal of work is being done in the United States to produce fuels which will not spread when the tanks burst, and on the development of crash-resistant tanks. There are strong possibilities that a combination of these two approaches will considerably reduce the fire risk in aircraft accidents within the next five years.

"Solidified" fuel can be produced in gel or emulsion form. A gel is a liquid dissolved in a solid, while an emulsion is one liquid suspended in another. The US Army, which has been doing research on what it calls "safe" fuels for some years, has concentrated its attention firmly on emulsions because gels tend to become more viscous at low temperatures and to break down at high. Emulsions, they claim, are also easier to make and break and can be reconstituted if necessary.

While this work is going on in the US Army the FAA is evaluating gelled fuel so that its own tests, plus the Army work on emulsions, will give a good indication as to which type of modified fuel is better for civil applications. (The two specifications are not exactly alike because of different military requirements.)

At the moment it seems that an emulsified fuel will suit both military and civil needs. Tests have shown that emulsified fuels are much less readily ignitable and more easily extinguished, and that if a tank is ruptured in a crash the blobs of emulsion which spatter themselves around are less easily ignited and do not flow appreciably from their post-crash position.

Although it has been proved already that turbine engines will function adequately when using either emulsified or gelled fuel, work still has to be done on ascertaining the corrosive effects on ancillary fuel system equipment—such as pumps, filters and pipes—made of various materials.

It is ironic that much of the work in the last two years on "safe" fuels has resulted directly from the Vietnam war, where fatalities in the US Army from fires following helicopter crashes are said to outnumber fatalities in helicopter crashes resulting from enemy action. It's an ill wind . . . .

Other methods of reducing post-crash fires include the provision of literally crash-proof tanks, but this still leaves pumps, connections and the fuel lines themselves vulnerable. Another method is to inert the airspace above the fuel so that the constituency necessary for an explosive mixture cannot be achieved. It would seem that a combination of all the above methods would make the difference between life and death to at least 50 per cent of the prospective fatalities in a "survivable" accident.

If the fire hazard could be eradicated there would still remain many factors which affect survival. The first of these is the ability to reduce impact damage to occupants to an absolute minimum. This could be done, for instance, by providing shoulder and leg-restraining harnesses in addition to a lap strap, in the same way as military pilots are strapped to their ejection seats. It *could* be done, but it never will be, because passenger reaction and comfort must be taken into consideration. Some kind of emergency restraint system has to be used, although those suggested so far have proved impractical. Possible methods include the use of plastic bags which, mounted on the seat-backs, inflate (one would hope) either automatically at a pre-set level of forward g force or when actuated by the crew. The concept suffers from the twin facts that 100 per cent inflation reliability could not really be expected in operational use; and, of course, the bags would have to be deflated or punctured to allow the occupants to escape. Injuries to occupants from the impact would be very greatly reduced, but evacuation would undoubtedly be delayed.

There are still people—outside the aviation industry, of course—who believe that all aircraft seats should have some sort of ejection device fitted to them; but this would obviously be impracticable, because of the extra weight involved and because in any case untrained passengers would hardly be likely to be able to use an ejector seat and parachute effectively. More likely is the possibility that some of the nervous types would have second thoughts about flying at all, and eject on the take-off run. Another suggestion, made recently, was that the co-pilot's seat in all aircraft should be of the ejection type so that he could eject in an emergency in order to act as a human flight recorder. But this, too, is hardly practicable; provided enough information channels are used, the job is done much better by an efficient electronic device.

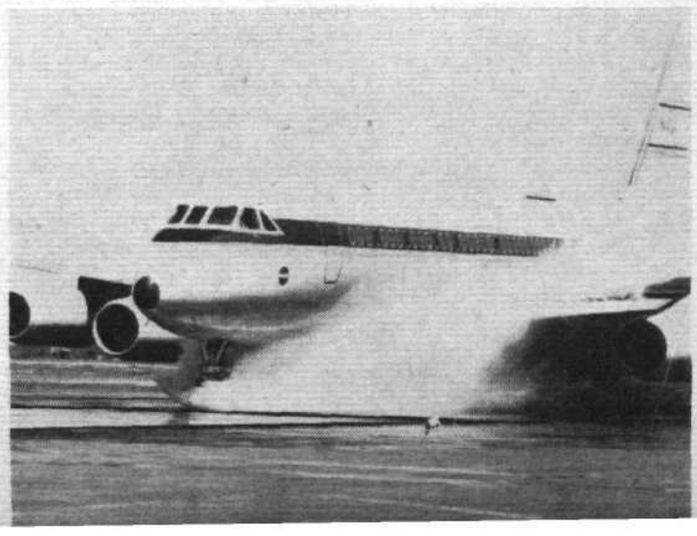
Nevertheless, the ejection seat, developed by a British company, Martin-Baker, has probably contributed more than anything else to survivability in military aircraft accidents. Developments in this field, going on all the time as military requirements become more and more stringent, have by no means been exhausted.

Probably the ultimate impact-reduction system which will evolve in passenger aircraft will involve not ejection seats but "de-lethalised" seats and restraint systems. These will be seats and lap-straps designed to reduce the effect of "flailing" limbs and trunks which inevitably occurs during a sudden deceleration. Seat-backs can be designed so that they do not split skulls which come into contact with them, and legs, too, can be cushioned. A good example of this kind of approach is found in the VC10 seat, which will be fitted as standard to all future BOAC aircraft.

Damage from loose articles lying around the passenger compartment will always be a risk, but with the trend towards stowing hand baggage in overhead cages rather than in racks at least one source of objectionable flying objects is eradicated.

Evacuation Because of the fire risk, evacuation as rapidly as possible is of absolute importance to survival. Fires have been known to consume a cabin within tens of seconds, either burning the occupants or asphyxiating them by consuming all the available oxygen. Minimum time required by the American

Survival starts before an incident happens. Here an FAA 707 is being used to check the efficiency of runway grooving as a means of reducing the aquaplaning danger



SURVIVAL...

authorities for evacuating a modern jet transport is 1min 30sec.

The two main methods of leaving the cabin in an emergency are through the emergency windows, which usually lead on to a wing, or by the doors, via a slide. Attractive as the first method would seem to a pasenger sitting near the wing, it does have disadvantages. The exits are smaller than a normal door and, once on the wing, there is usually a big drop to the ground unless the undercarriage has been wiped off or is retracted. The best way of getting off a wing, if the flaps are down, is to sit on the trailing edge and slide over the flaps. At worst one could jump off the leading edge and risk a broken ankle; but even that is better than not being able to get out at all.

There are two main schools of thought on the best method of door exit. Some airlines use inflatable slides and others the non-inflatable type. Both kinds, generally speaking, have to be deployed manually. The inflatable slides have been shown to work well, although mishandling can give rise to serious problems, and even to non-availability—for instance, if the slide is inadvertently inflated before it is removed from its cover. BOAC uses only inflatable slides and the rapid evacuation from 707 G-ARWE at Heathrow recently, in which nearly 90 passengers used one slide in just over a minute, is ample testimony to the company's faith in the system.

On the other hand, BEA uses nothing but non-inflatable slides in its aircraft. These are simply nylon-type fabric chutes which are attached to the door-sill by the cabin crew, the free end being thrown out of the doorway. They appear to suffer from the big disadvantage that two people have then to climb down the slide, using it as a rope, in order to stand at the bottom and hold out the slide so that it can be used by succeeding passengers. This means some delay, inevitably, and it takes nerve to climb down a slide. The writer did it once, in the BEA training centre, and would not look forward to doing it again. Neither would he care to stand holding the bottom of a slide while the rest of the passengers came down. The natural compulsion would be to run as fast as possible away from the crippled aircraft—particularly if there was any fire about. In fact, this is exactly what happened when a slide was used in this way some years ago. The first two men out, who climbed down the slide, simply ran off when they saw flames nearby.

Proponents of this type of slide argue that the inflatable variety can suffer from mishandling before deployment, or can fail to inflate. The non-inflatable type is mechanically foolproof, they say. At the moment, both types are capable of being burned although fire-resistant materials have been developed and may be incorporated, at a price, in future systems.

Whichever type of slide is used the passengers have to be briefed to use it, and cabin crew must be familiar enough with its operation to be able to deploy it in the dark. Two important points emerge here: are passengers sufficiently well briefed in ground evacuation techniques, and is cabin crew training taken far enough? Both BEA and BOAC have cabin-crew simulators for teaching emergency drills, and all cabin crew must be checked on each aircraft type at least once every year. Neither corporation, however, gives its instruction in smoke-filled cabin interiors, and neither of their cabin mock-ups is tiltable. KLM has just built a composite DC-8/DC-9 fuselage mock-up which can be tilted 15° and filled with smoke if necessary; this approach seems much more realistic than that used by many operators.

The costs of effective cabin crew training are inevitably high, but in many cases it is the cabin crew who alone are responsible for getting people out of the aircraft. Only five per cent of all cabin staff may need to use their knowledge in this respect, and then only once in their service life; but nobody knows which five per cent it will be or when they will have to act. This is all the more reason why they all should be properly trained in the first place and kept rigorously in trim during their flying careers. While conscientious chief stewards, pursers and flight crew usually check at least one if not all of the stewards and stewardesses on their emergency drills at the start of each trip, this is virtually a theoretical check. Anyone can learn quickly enough where the emergency-light switches or CO_2 bottles are located; getting the equipment to work properly is another matter, and one which is probably not checked often enough in practice.

It would seem prudent to make all emergency equipment as automatic as possible or, if it must be used manually, simple to operate. Training and checking could be more realistic, and recruiting standards should be kept high. Time and time again cabin staff have shown themselves capable of the highest standards of efficiency and bravery in performing their emergency duties, but they must be supported by good equipment which leaves them more time to control the outflow of passengers and to make sure that none is left behind or trampled in the usually inevitable rush.

Often forgotten is the fact that any aircraft will have its complement of old and infirm, or very young, passengers who need encouragement or physical assistance. At the other end of the scale there are some passenger types who need restraining in an emergency. The cabin crew should be of a calibre which can cope with the whole range of temperaments. (One airline is said to be training its stewardesses to shout loudly and clearly—their instructions could not be heard during an actual emergency.)

Meanwhile the flying crew generally make their own way out. The captain's job varies, but usually consists of supervising the "ground" end of escape slides and marshalling passengers at a distance from the aircraft. People tend to wander away from accidents and can reach considerable distances before being "caught" by the airline, which is naturally trying to account for the fate of all occupants. This head-counting is much simplified if one crew member has the job of marshaller until the emergency services arrive.

All of this presupposes that the accident has occurred on land, simply because the trend in "survivable" accidents these days is towards their being on land. There are very few premeditated ditchings of modern jet aircraft, and this explains in part the looseness of the legal requirements for the carriage of liferafts. For example, on a North Sea crossing, unless it is up to Norway, no such rafts are needed, although virtually all aircraft carry lifejackets. In the event of any ditching the problems of impact forces and evacuation are compounded by the unnatural surroundings and the physical hazards of cold water. Even in Pacific waters, lifejackets are no supporters of life unless warmth can be induced somehow. By far the best way is to be able to board a raft and at least partially dry out. The problem then becomes one of location by search-and-rescue craft.

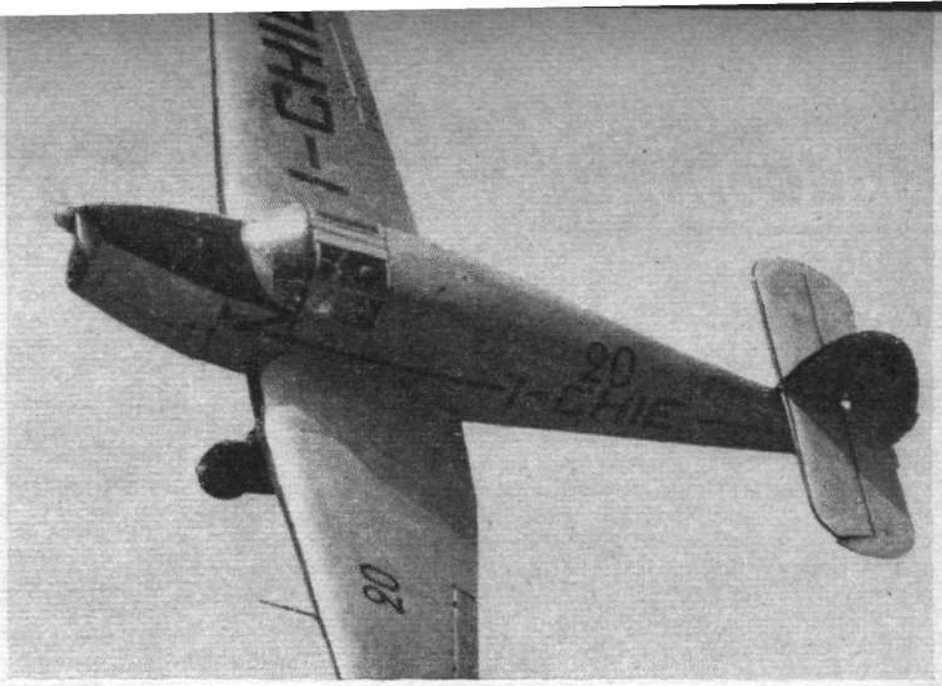
Unless emergency radio transmitters are provided, or the ditching is within sight of a populated coastline, the arrival of such craft is not always as rapid as might be imagined. In a recent maritime incident in the North Sea a passenger liner was abandoned at 6.30 a.m., but the first aircraft did not arrive overhead until 10.30 a.m. All the passengers survived their eventual six-hour wait because they had efficient liferafts.

The Future Concern is expressed regularly in Parliament and the Press about the safety aspects of the large-capacity aircraft which will be with us within the next two years. In fact the Boeing 747 will have more emergency exits per passenger than current jets, and the slides will be two-stream affairs enabling twice the number of people to be evacuated in the same time. There will be ten exits in all, five each side (two over-wing and three doors), giving two exits for each group of 75 passengers. Sill height at 15ft will be a problem—psychologically, a 20ft eye-height is disturbing—but who has time for phobias in an emergency? Seats will no doubt be designed to high impact-resistant standards, and innovations such as tape-recorded emergency briefings will be provided for.

It all points towards self-containment. However good the airport emergency services, and however well deployed, it can never be guaranteed that rescue will be available almost instantly. Aircraft must carry their own systems. With a little more refinement, and the development of "safe" fuels, there is no reason why the survival systems outlined in this article, and the cabin crews who have to operate them, should not be able to provide a much higher level of safety in any accident which can be termed "survivable."

JOHN BENTLEY

SPORT AND BUSINESS



Italy's 8th City of Bari Air Race on May 26 (see last week's issue) was won by this veteran SAIMAN 202, built in 1942 and flown by Luciano Gozzoli, of the Ravenna Aero Club. With a production life extending from 1936 to the early post-war years, the two-seat 202 was powered by a 130 h.p. Alfa-Romeo 110-1bis engine

"Flight" photograph

American Air Racing, 1968 This year's racing season in the USA will start with the Maryland National Air Races at Frederick, Md, on July 4-7; the meeting is planned as a salute to the RAF on its fiftieth anniversary and fly-pasts will include an Avro 504, a Spitfire XVI, a Vulcan, and "anything else British on the East Coast." Racing will be on a new 3¼-mile six-pylon course, and there are plans for an unlimited-class cross-country race from Florida.

The fifth annual National Championship Air Races will be held at Reno, Nevada, on September 15-22, and will be strictly a racing programme; the National Aerobatic Championships, to be held on October 18-20, have been moved to Fort Worth, Texas, where the altitude and temperature are more favourable for aerobatics. Plans for the Cleveland Air Races have not yet been announced.

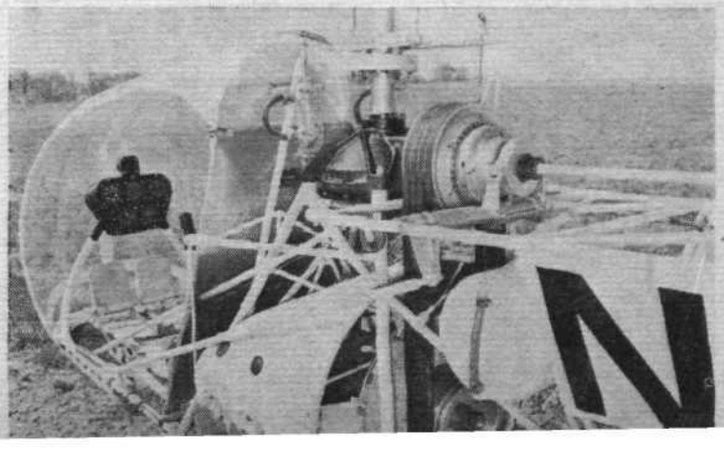
Beware the Spiral The owner of an Auster one day agreed to let a friend get in a few hours prior to the renewal of his licence. The owner had only about 200 hours' experience and no instrument flying, while his friend's experience was even less. Intending to visit France for the day, they landed at a South Coast airfield to clear Customs. Then, finding the weather unfavourable, they elected instead to visit Sandown in the Isle of Wight, where the weather was reported "wide open." They set off westward along the coast at some 500ft above the sea (strictly speaking, they should have kept the coast on their left, in accordance with the Rules of the Air). Without warning they entered a fog bank. The pilot started to make a 180° turn to the right, though the co-pilot (the owner of the aircraft) advised a left turn away from the coast. At that point the pilot lost control and the aircraft began a spiral dive. Although the co-pilot was without instrument-flight experience, he had had some time on a ground-based simulator, had grasped the significance of bank angle, and saw what was happening. He took over and was able to level the aircraft, which was by now only 50ft above the water. A straight climb to 1,000ft brought them out on top of the fog bank.

The moral of the story is that any instrument-flight training is better than none. Simulator or Link instruction is excellent value, while a training aircraft with an instructor is even better. However limited their ambitions, all PPL graduates should be encouraged to undergo basic instrument-flight training. The need to know can arise when it is least expected.

Fairoaks Aerodrome We are asked by Mr Douglas Arnold, proprietor of Fairoaks Aerodrome, to point out that, contrary to the report on page 750 of *Flight* for May 16, he has no plans to extend the airfield beyond its present bounds, nor has the acquisition of adjacent land been for the purpose of anticipating possible objections. Any improvements and expansions to the facilities at Fairoaks are still subject to negotiations with the relevant authorities and will not be started until their permission has been obtained. The area of the present hangarage was misprinted as 10,000 sq ft; it is in fact 100,000 sq ft and this will be included in the 200,000 sq ft which is planned. Proposals for a new clubhouse and restaurant have not yet been finalised.

New from Beechcraft A new light aircraft, the Model 36, is expected to be announced by Beechcraft in the near future. Although details are not yet known, it is understood to be single-engined, and probably heavier than the other singles at present in the Beechcraft range.

The XRG-165A Glaticopter is a single-seat R&D aircraft built in the USA by Galaxie Engineering to test ideas in rotor, control and drive systems. With a maximum weight of 880lb, the helicopter has glass-fibre rotor blades of 25ft 8in diameter. The transmission (right) incorporates multiple Goodyear V-belts and spiral bevel gears. The engine is a 65 h.p. Continental



Spaceflight

MARINER MARS FLIGHTS PLANNED

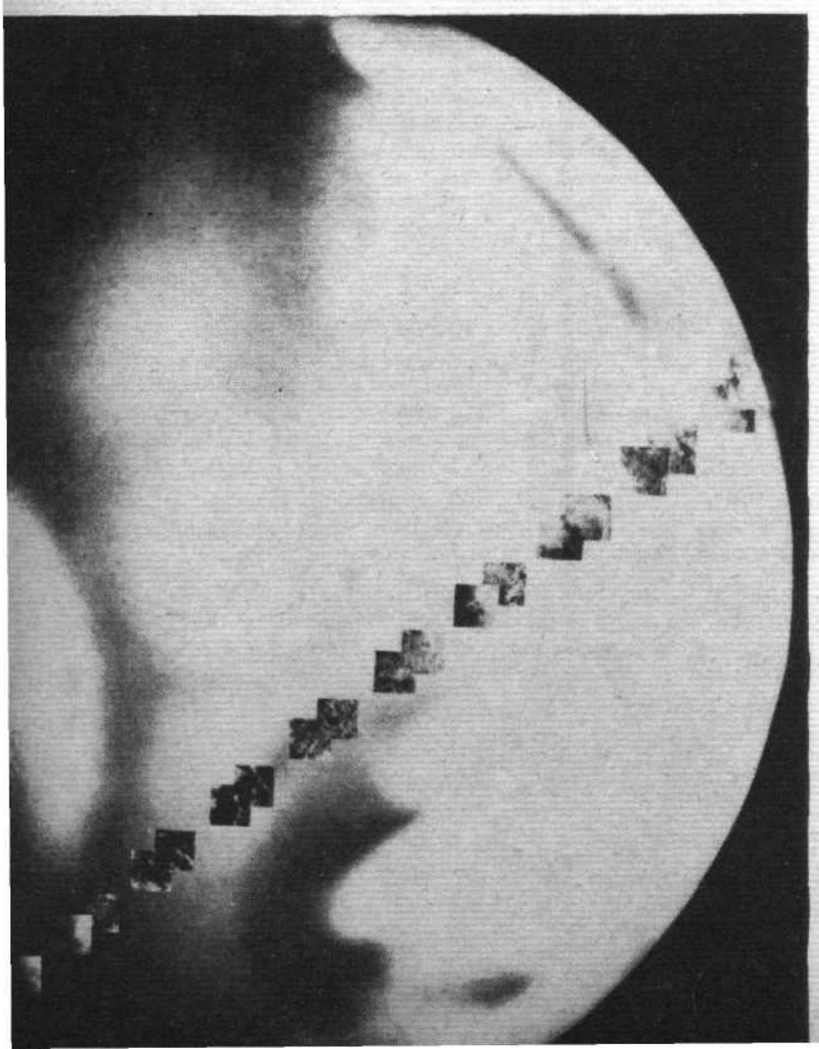
NASA plans to launch two Mariner spacecraft, F and G, on fly-by missions to Mars next year: according to *Interavia Air Letter* for May 31, launch period will be between mid-February and mid-April 1969 and the spacecraft will arrive at the planet between the end of July and the middle of August. The first Mariner will be launched as early as possible in the period, the second as late as possible; and their arrival dates will be not less than five days apart. Launch vehicle will be the Atlas/Centaur combination—the first time it has been used for planetary exploration.

These Mariners will be nearly twice as heavy as those of the Mars '64 mission—900lb (408kg) compared with 575lb (260kg). Experiments on board the spacecraft have been designed with particular emphasis on providing data on the Mars atmosphere and surface. Design trajectories of the two Mariners will take them by Mars at a closest distance of approximately 2,000 miles (3,200km) compared with a closest distance of 6,000 miles (9,650km) in the 1964 mission. This extremely close approach, which will occur when Mars is about 62,000,000 miles from Earth, includes a 30,000:1 probability that the spacecraft will not impact on and contaminate the planet.

The 1964-65 Mariner Mars project was conducted for NASA by the Jet Propulsion Laboratory following establishment of the project in late 1962 with the objects of conducting scientific observations near the planet and of returning data to Earth for study and analysis. Secondary objectives were to develop and study the equipment and techniques involved and to make certain scientific measurements of the interplanetary environment on the way to Mars. These objectives were successfully accomplished. The 1969 twin mission to Mars forms the next planned step in the US planetary programme. TV pictures from the 1969 mission will cover an area ten times as large as the previous mission with about the same resolution, and some parts of this larger area will be photographed in close-up with resolution up to ten times that provided by Mariner 4. Another aim of next year's mission is to take pictures at a range where the whole planet is in the field of view. As Mars rotates, its entire surface will be photographed.

The 1969 mission will probably be followed in 1971 by two spacecraft orbiting Mars, and in 1973 by two orbiters which will drop scientific packages on to the planet's surface to carry out soil analysis and perform other experiments.

Mars is about half the diameter of Earth and has a ninth of Earth's mass, resulting in a surface gravity 38 per cent of Earth's and an escape velocity of some 3.1 miles/sec compared with 6.9 for Earth. Martian surface pressure is probably less than Earth's pressure at 5-15-mile altitudes. Prior to its close examination by the Mariner probes, Mars had been the subject of telescopic examination by astronomers because its marked surface and thin atmosphere allowed them to measure its 24½hr day and annual change of seasons. Until the Mariner probes, and even with powerful telescopes and under the favourable atmospheric conditions, scientists could not obtain high resolution pictures of the planet.



Martian photography: 19 of the 21 pictures of the surface of Mars taken on July 14, 1965, by Mariner 4 (see "Mariner Mars Flights Planned," above) at a distance of about 6,000 miles from the planet

NEW COSMOS LAUNCHINGS

On May 30, June 1 and June 4 the Soviet Union launched three more Cosmos satellites, numbered respectively 222, 223 and 224. Orbital parameters of these latest Soviet spacecraft are as follows:—

Cosmos 222: initial period of revolution, 92.3min; apogee, 528km (nearly 328 miles); perigee, 277km (172 miles); inclination, 71°.

Cosmos 223: i.p.r., 90.1min; apogee, 374km (over 232 miles); perigee, 212km (131½ miles); inclination, 72.9°.

Cosmos 224: i.p.r., 89min; apogee, 270km (167½ miles); perigee, 200km (124 miles); inclination, 51.8°.

Both 223 and 224 are transmitting on a frequency of 19.995Mc/s.

An Associated Press report from Moscow on June 4 of the Cosmos 224 launching commented that the satellite "had the same kind of orbit as that used for tests of the Soviet man-carrying spaceships and for space link-ups."

USSR OCEAN RECOVERIES

Tests by the Soviet Union in the central Pacific of space vehicle recovery, originally announced as taking place from May 20 to June 30, ended after eight days. An official announcement on May 28 said that the tests had been successfully completed and that the two designated target areas were again free to shipping and aircraft. The landing systems being tried for ocean recovery were fired nearly 5,000 miles (8,000km) from Soviet territory into target areas near Caroline and Christmas Islands. All the Soviet manned space vehicles, and most of the unmanned ones, have so far returned to land areas.

EARTH RESOURCE SATELLITES

This is the concluding part (the preceding instalment was published last week) of a slightly condensed version of a paper called "Current Program and Considerations of the Future for Earth Resources Survey," by Mr Homer E. Newell, Associate Administrator of NASA. It was given at the Fifth Symposium on Remote Sensing of Environment at the Institute of Science and Technology, University of Michigan.

Ice intelligence from a satellite: in this case Nimbus photographic information on the ice concentrations (white areas) around the Gulf of Bothnia, in the lower centre, and other areas of the Scandinavian peninsula

IN METEOROLOGY, despite our operational satellite system, we still lack much of the data essential for worldwide long-range weather forecasting. We get good global cloud-cover pictures, cloud motion and some ocean surface temperatures. But we do not get three-dimensional fields of density, wind velocity, temperature and water vapour content within the atmosphere itself. Yet these are required before realistic weather models can be constructed and tested.

Until methods to meet these needs can be proven and made operational, high-pressure weather balloons at various altitudes may have to be used for interrogation by satellites to supply the data needed for weather prediction to provide the state parameters in the atmosphere essential for long-range weather prediction.

In geodesy, completion of the current programmes will enable us to find the relative positions of any two points on Earth with an accuracy somewhat better than that of conventional first-order triangulation. But geodetic science will not come to an end because of this. Far from it: just because space technology has so greatly increased the resources of geodesy, the imaginations of geodesists have leapt ahead to correspondingly ambitious new goals.

Key elements in new geodetic technology may be highly precise laser ranging devices, optical systems of very high resolution, atomic clocks, and a variety of sophisticated special instruments such as gravity gradiometers. Geodesists hope to use their new techniques to make direct measurements of the rates of continental drift and uplift, monitor the geometry of the ocean surfaces, keep track of the total water content of the polar ice caps and the world's glaciers, probe the interior of the Earth by exploring its gravity anomalies, and measure the tidal and other mass motions of the atmosphere.

There are three areas of oceanography where we may look for major contributions from space in the future: (1) sea surface state on all shipping lanes; (2) marine biological resources; and (3) the science of oceanography.

As for the first, we have mentioned that monitoring of ocean wave conditions and sea-ice has now been demonstrated by radar and microwave techniques from aircraft: it should be possible to extend this technique to satellites if the few technical difficulties can be overcome. Large economic benefits are predicted for the shipping industry from this programme.

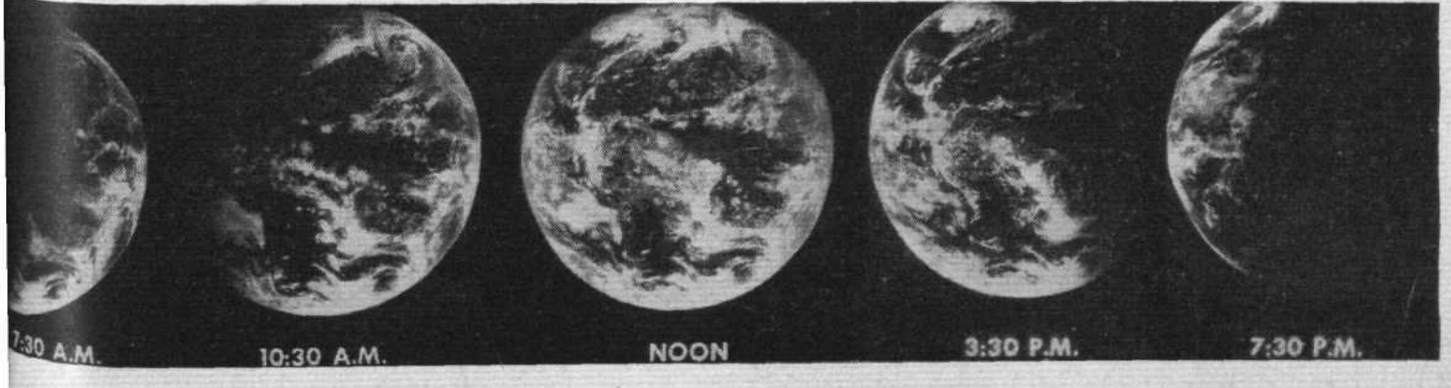
As for marine biological resources, we have not yet demonstrated any techniques of direct usefulness, except surface temperature determination and colour photography. To produce data of significance to the fishing industry we will need something like weekly global maps of surface temperature and chlorophyll concentration in gms/cm^3 by remote sensing. Colour photography or spectroscopic determination of reflected light from a satellite may be effective for measuring surface chlorophyll levels.

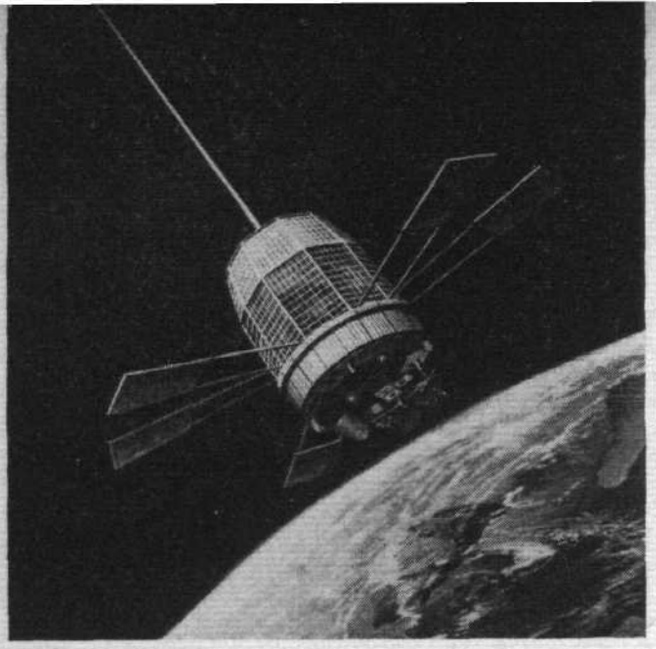
Further possible information on marine life resources may come from oil slicks appearing near schools of fish. These might either be detected by detailed colour photography, or, possibly, by absorption spectroscopy highly sensitive to fish oil vapours above the slicks.

Research is needed to find what overall contributions to the science of oceanography can be made through surface observations. Classically, oceanographers have been interested in many properties far below the surface and many of these will probably never be accessible from space. However, satellite interrogation of ocean buoys, designed to supply depth measurements of temperature, salinity and currents, may become useful.

If satellite altimeters can be developed to give accuracies of ±10cm, oceanographers can gradually determine the true shape of the geoid, and ocean height deviations from this level

"We get good global cloud-cover pictures": this sunrise-to-sunset sequence was taken by ATS 3 from its synchronous parking orbit 35,800km (22,245 miles) above Brazil. The 3.30 p.m. picture shows storms over the US and the Pacific; in the 7.30 p.m. one they are dissipating





Earth resources satellite over the Atlantic, outlining the flow of the Gulf Stream: an artist's conception of this type of vehicle, now being studied by General Electric, Valley Forge, Pa, builders of the Nimbus weather satellites

Spaceflight

will be extremely useful in determining the dynamics of ocean movement on both local and global scales.

In the long term, benefits from satellite oceanographic techniques can be expected to result in many large sectors of the economy, such as fisheries, industrial applications such as coastal engineering, and ocean transportation. A few examples cited by the Academy of Sciences Study of 1967 include world freight shipping and world fishing industries. The Academy finds it safe to assume that any small-percentage savings accruing to industries would quickly give benefits many times greater than the cost of a satellite programme.

In agriculture, forestry and geology the principal need now is for improved identification of the signature of various species. We have described recent advances showing that several techniques appear to be practical enough to be used with automated signature identification from aircraft altitudes. However, extension of this capability to satellite levels will require a great amount of basic research effort and experimentation.

In general, when we plan to move from laboratory and aircraft testing of sensors to the spacecraft level, we are faced with many serious problems. These are associated with energy absorption by the atmosphere as well as emission/scattering by the atmosphere and other sources of noise. In addition, the engineering problems should not be overlooked. Included are such requirements as much lower volume and weight for the instruments, higher reliability and lower power levels usually available. Consequently, our high-altitude aircraft project can be regarded as moving one step closer in developing an Earth resources surveying capability from space.

In summary, we have touched upon the technical progress of the past and tentative plans for the future. We have not mentioned the very great problems of providing a data handling and distribution network and of organising it into an overall workable system. Yet these must be faced before we can begin to realise the potentials of remote sensing. It is our hope that if we push on vigorously and demonstrate workable technologies, others will find ways to solve the management and organisational problems.

It is reassuring to find that the National Academy of Sciences report from last summer's study on Space Applications has endorsed the future potential of remote sensing of resources so enthusiastically. I should like to quote from the report:—

"Useful applications of space are unquestionably real, substantial, and potentially close at hand. A turning point has been reached, at which we can now describe with conviction and in some detail the many specific ways in which space vehicles and space technology will become important elements in our economic, industrial and social world. Applications that were speculative and vague only a few years ago now appear credible and attractive to the potential users. The space programme has broken the plausibility barrier."

Later it states:—

"Our first general conclusion is that the potential economic benefits to our society from space systems are enormous. They may amount to billions of dollars per year to many diverse elements of our industry and commerce and thus to the public."

The prospects are promising. We must set our sights, however, on those observations and services which can only be obtained using space, in a conclusive manner, or which can be better or more economically produced using space. Our goal is a balanced programme, which explores as rapidly as resources permit the technical possibilities, while constantly weighing the economic worth of the various uses.

EUROSPACE CONFERENCE

Next week (June 18-21) the third Eurospace US-Europe Conference is being held in Munich. Among topics due to be discussed are co-operation between the United States and Europe and the outlook for space research in the future.

Representatives of ELDO, ESRO, NASA, the BDLI (Bundesverband der Deutschen Luft- und Raumfahrtindustrie), commercial companies and space-orientated organisations are attending the conference.

Interavia Air Letter for June 6 comments that "one of the problems facing the conference . . . is the UK's withdrawal from ELDO after 1971, which will mean that Europe itself will have to develop a large booster or rely on purchasing such vehicles from the US."

NEW COMSAT LOCATION

A new building at 960 L'Enfant Plaza South, SW Washington, DC 20024, is now the headquarters of the Communications Satellite Corporation (Comsat). The Interim Communications Satellite Committee, governing body of Intelsat, is also being located there. Intelsat (International Telecommunications Satellite Consortium) now has 62 member countries; Comsat is the US representative and manager for the consortium.

KENYA EARTH STATION

In London on June 4 the East African External Telecommunications Co announced that nine companies had submitted tenders for the satellite Earth station to be sited at Mount Margaret in the Rift Valley, Kenya. A worldwide invitation to tender had been published in February this year (*Flight*, March 7), and by the closing date, May 31, technical specifications and contractual documents delivered to the Kenya High Commission in London weighed almost half a ton. The following companies have tendered: Hammond (EA) (RCA Canada); Collins Radio; The Marconi Co; R. J. Tilbury (STS Italy); Mitsui and Co (NEC Japan); ITT Africa and Middle East; GEC-AEI (Electronics); The Page Communications Engineers; and Siemens (Kenya).

Announcing the nine tenders, the general manager of EAET, Mr H. Z. E. Ramogo, said that work on evaluation of technical specifications and documents would start immediately; the order was due to be placed in early September and the company did not bind itself to accept the lowest or any tender. He added: "the overall cost of the station is expected to be about £1.5 million, of which the construction of the dish aerial and installation and supply of technical equipment is the major cost. Having broad band facilities will make available many more telephone links with overseas countries, and better quality channels than those at present carried on the radio telephone circuits.

"EAET is a registered company in East Africa with its head office in Nairobi, 60 per cent of whose shares are owned by the East African Posts and Telecommunications Corporation on behalf of the three East African Governments and 40 per cent by Cable and Wireless Ltd."

TORINO HIGHLIGHTS

The indoor part of the Turin Show is in the city-centre exhibition hall. The Soviet display fills the large annexe

"Flight" photographs

BIGGER, BETTER AND MORE INTERNATIONAL than before, but still without many visitors; these were the impressions of the opening days of the third Turin Show organised by the AIA (Associazione Industrie Aerospaziali). The long show opened on June 4, continued daily from 9 a.m. to the late hour of 11 p.m. with a two-hour lunch-time break, and is due to close today, June 13. Overshadowing all else in volume and diversity is the Russian participation. The Soviets have laid on the full Paris Show treatment, with virtually the same exhibits and very little new information or approach. Could it be that Turin was being told that although Fiat might be teaching the USSR how to build motor-car factories, only the Russians can stage the biggest air show on earth?

Apart from the predictably large turnout by the compact, capable and versatile Italian industry, there are national industry stands by Britain, France, Germany and Egypt. The US is represented by Lockheed-California, McDonnell Douglas, LTV Garrett-AiResearch, and by various Italian agents for US engine and equipment companies. At Caselle Airport, where the flying part of the show is held, the Russian display was absolutely dominant at the outset, before the addition of a small measure of European and US participation.

New at the Show All the familiar Soviet transports in production are on show with the exception of the An-24. The largest, the An-22 (CCCP-67691) jumbo turboprop freighter, is a production aircraft—the type is now in service on the heavy lifting of civil engineering equipment. The others are the Yak-40 (CCCP-19661) prototype feederjet; Mi-10 (CCCP-04105) crane helicopter; Mi-6 (CCCP-21175) large all-passenger helicopter; Mi-8 medium-sized helicopter; Il-62 (CCCP-86671) long-range jet early production model; and the Tu-134 short-range jet. Accurate information on Soviet civil aircraft progress was no easier to come by than at Paris. The Tu-144 SST prototype is still expected to fly this year. During a *Flight* interview with Tupolev technicians the impression was gained that only one prototype Tu-144 was being built, and that no production plans would be made until flight trials had begun. The 164-seat Tu-154 trijet medium-hauler will fly in the next few months and is expected to enter service in 1970. A twin-jet, smaller than the Tu-154 but larger than the Tu-134 is a Tupolev project with the type number Tu-164. The current export best-seller is the Tu-134 ($2.1 million ex-works) for which JAT is the latest customer.

Italian industry ambitions to participate in transport aircraft construction beyond the present limited collaboration ventures (Fiat makes Caravelle engine pods and tail components, and Aerfer builds DC-9 fuselage panels), are still frustrated by lack of encouragement from the Italian Government or Alitalia. Fiat would like to participate in the A-300.

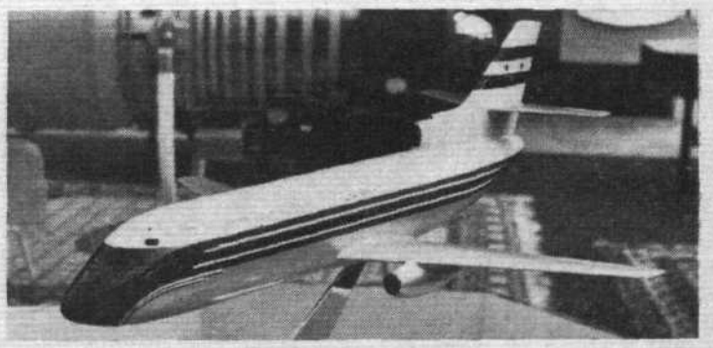
Egyptian industry is making a first appearance in an international air show. The Egyptian General Aero Organisation, whose pinnacles of achievement have been to make the 10,000lb-thrust (with re-heat) E300 turbojet and the Ha300 supersonic intercepter, is showing a model of a proposed three-engined 90-seat short-haul airliner, as yet undesignated. The design study is based on the use of the 7,000lb-thrust E 300-C.

In the military sphere, the Fiat G.91Y made a first flying appearance in public. Delivery to the official military test centre is imminent, and the prospects are good for a substantial IAF order. Switzerland and Germany are the best export possibilities. An Italian decision on the choice of a maritime reconnaissance aircraft rests between the Breguet Atlantic and the Lockheed Orion; the latter would be built by Fiat. Lockheed-Georgia arranged for the presence of a USAF C-130 and it may be assumed there is a strong lobby for this type to replace the C-119 in preference to the development of the Fiat G.222.

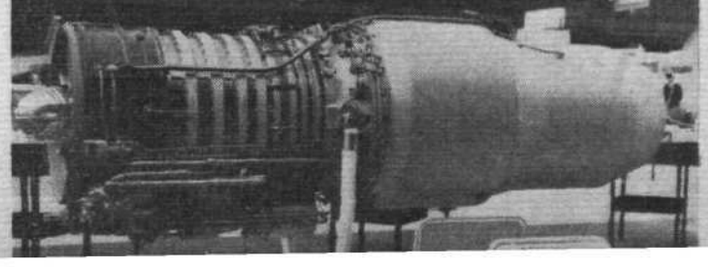
Space interest is centred on the Soviet display, which includes a model of the Venus-4 which soft-landed on the planet last autumn.

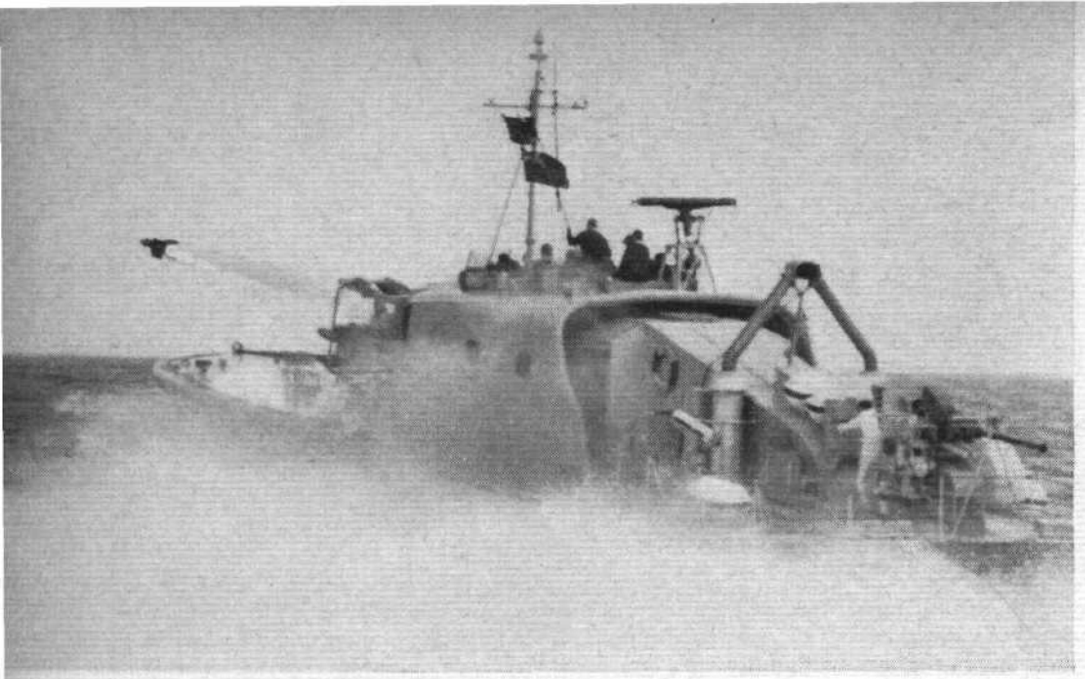
A fully illustrated report on the show will appear in next week's issue.

A Vostok on the rockery—Russia brought its massive space launcher and erected it in the gardens of the exhibition hall



Above, the Egyptian General Aero Organisation is showing this model of a 90-seat trijet airliner project. The engine would be the 7,000lb-thrust E 300°C which has already begun bench tests. An actual engine is displayed (below)





A wire-guided missile—in this case an SS-11(M)—streaks from the Royal Libyan Navy FPB "Susa" on trials in the Solent last week. Both SS-11(M)s and the improved SS-12(M)s were fired to show the capabilities of the Vosper/Nord system

"Flight" photographs

DEFENCE

FPB MISSILE SYSTEM DISPLAYED

THE FIRST FAST PATROL BOAT to be armed with the Vosper/Nord ship-to-surface wire-guided missile system (*Flight*, November 16, 1967) is now well into her pre-commissioning trials. The boat, the Royal Libyan Navy's *Susa*, was recently completed at Portsmouth by Vosper and the system was demonstrated to Service authorities, naval attachés and the Press in the Solent last week.

The system, which can be installed without difficulty in existing FPBs without reducing other armament, uses marine versions of the well-proven Nord SS-11 and SS-12 wire-guided missiles, which have now been built in tens and hundreds of thousands. While the 5,500m-range SS-12(M) can be considered the normal missile for use in anger, the shorter range, less powerful and only one-third as costly SS-11 can be used as the associated training missile, or against particularly low-value and shorter-range targets. Either missile can be slung upon the launchers—two batteries of four flanking the bridge, with storage for additional missiles in a magazine below deck—in any combination without any adaptation whatsoever.

Susa herself is a conventional FPB of the type for which Vosper has become world-renowned. With three Marine Proteus gas-turbines of 4,250 s.h.p. each (and two diesel engines for manœuvring and low-speed cruise) *Susa* has a top speed of 57kt. She is the first of three similar boats being built by Vosper for the RLN and will be delivered in September, for a long work-up in UK waters by a Libyan crew before sailing to Libya next year.

The system was fully described in the earlier article already cited, but to recap briefly, Vosper and Nord, who have developed the system as a private venture, claim that small FPBs (*Susa* is 96ft long overall) can now have the destructive punch, if not the range, of 6in naval guns. The 168lb SS-12(M) has a 63lb warhead, timed to explode 6ft after point of impact—that is, well inside a hull or superstructure—for maximum destructive effect. The missile has a maximum time of flight of 32sec, with a 1.8sec, 9g launching booster, and a 30sec solid-fuel sustainer motor. Powered until impact, the missile strikes home at 660ft/sec (about 450 m.p.h.). Maximum range is about 6,600yd (this being the length of wire on the missile spool) and maximum effective tactical range is 6,000yd. Minimum strike range, limited by the need of the aimer to "acquire" the missile in his sight after launching and bring it on

The aimer, seated in a rotating turret in the operations room, above, has a special seat to absorb the high vertical accelerations of an FPB at speed in a seaway. He has joystick control of the missiles. The turret can be initially trained to bear by the radar officer; the aimer himself trains it left and right with pedals. "Susa" has two launchers, each with four missile rails, flanking the bridge, below left. In place, below right, are two SS-12(M)s

to his line of sight to the target, is 900yd.

Last week three SS-12(M)s and two SS-11(M)s were fired by *Susa* at a 15ft ×30ft towed lattice target at ranges of up to 5,500yd. Though there was little wind there was a good swell—sea state four—running. *Susa* herself was very steady during her 50kt runs-in—the commander having to keep a very true heading, to within one or two degrees, during the initial phase to give the aimer any chance of a hit. The aimer was Nord development engineer (and crack marksman) M Malaval, seated in the turrent in the operations room below the bridge with the APX 260 sighting head projecting through the deckhead immediately forward of the open bridge. Vosper and Nord claim that any normal man with good reflexes and eyesight can be trained to operate the system—in the RLN, the first operational user, the gunnery officer will be aimer. No special staff is needed to test and maintain the missiles aboard, it is claimed, and two men, or only one in an emergency, is all that is needed to operate the system.

In last week's firing the first SS-12(M) struck and ricochetted from the water some way short of the target. The second scored a hit but the third also bounced off the water short of the target. With two SS-11s fired from shorter ranges two hits were scored, one 15ft and the second only 3ft from the centre of the bullseye. The two SS-12(M) misses were both attributed by a Nord representative to technical failures—probably wire breakages—which would be looked into. To observers watching the missiles once gathered on to the line of sight, continuing their flight to target only a few feet above the water, it seemed that wire breakage might have occurred through wave interference. Without the ×10 magnification through the sight that the aimer enjoys, it seemed that the missiles, skimming only inches and feet above the wave crests for thousands of yards, must strike the water at any moment and a random high wave must be a real hazard to the success of a firing. Against this it is fair to add that the target being used was far smaller than the targets a missile-equipped FPB would normally engage.

No price was quoted for the cost of the entire system when installed in an FPB (it is equally suitable for installation in other displacement craft and in ACVs). It is understood that the price per round is £2,400 for the SS-12(M) and £850 for the SS-11. These are prices for rounds with dummy warheads; in fully explosive fighting trim the missiles cost about £3,000 and £1,100 a round respectively.

Encouraged by the first application of a lightweight guided-missile system to FPBs, Vosper is going a stage further in its latest design for a 100ft FPB. Slightly longer than the Libyan boats, permitting the fitting of more powerful diesel cruising engines for a longer range at higher cruising speed, this vessel includes not only the 2×4 batteries of Nord weapons but also four launchers for the Contraves Italiana Sea Killer beam-riding ship-to-surface missile. This has a range of about 20km (11 n.m.). Its associated Sea Hunter fire-control and guidance system is also compatible with the Short Seacat short-range anti-aircraft missile, a triple launcher for which, it is proposed, will be mounted at the stern. The usual 20mm gun on the foc'sle is retained as a general-purpose weapon for occasions when the use of missiles would not be justified.

Vosper's contention is that a very powerful range of armament can now be carried in the fast, small, hard-to-hit and relatively inexpensive patrol boat, and now makes the FPB a valuable and potent addition to every modern fleet.

Bridge Pilot Leaving RAF

THE RAF AUTHORITIES have decided not to court martial Flt Lt Alan Pollock, 32, who on April 5 flew his Hunter FGA.9 between the two towers, the bascules and the upper span of London's Tower Bridge.

The MoD (Air) announced on May 31 that the AOC-in-C, Air Support Command, Air Marshal Sir Thomas Prickett, has decided in the light of medical opinion not to bring Flt Lt Pollock to trial by court martial. Flt Lt Pollock has recently been in Ely and Wroughton RAF hospitals with pneumonia. The statement said that medical opinion was that "if he were brought to trial it would probably have a damaging effect on his health, both immediately and in the long term."

In an unprecedented, and some might think unusual way, the statement went on to anticipate the findings of a medical board not yet convened, in adding: "When he is well enough he will come before a medical board and is expected to be invalided from the RAF."

The decision follows by some weeks that of the City of London Police to take no action against Flt Lt Pollock in the civil courts. His implied discharge on medical grounds begs many questions, in particular those concerning the level of support which his demonstration—against the failure of the Government to acknowledge reasonably the RAF's 50th anniversary—enjoys in the Service. Certainly there have been several expressions of support and sympathy for Pollock's action made to *Flight* by serving RAF officers in recent weeks.

In making this strange decision the MoD seems to impugn Flt Lt Pollock's mental health for it is highly unlikely that a court martial would have adverse medical effects upon a man simply recently recovered from pneumonia. There seems little doubt that from the authorities' point of view Flt Lt Pollock's recent illness, and a medical discharge, has provided a felicitous way of avoiding punishing Pollock for manifesting resentments widely shared throughout the Service and to the public expression of which a court martial might well have led.

Japanese F-X Short List

THE SHORT LIST of candidate aircraft to become Japan's air-defence intercepter in the 1970s (see Sensor last week) has been drawn up after consultations between the Prime Minister, Mr E. Sato, and the Director-General of the Defence Agency, Mr K. Matsuda. The three aircraft are the McDonnell Phantom F-4E, the projected Lockheed Starfighter development, the CL-1010/2, and the Dassault Mirage F.1C. A 12-member survey team, led by General K. Ogata, will travel to the USA and France this summer to make further assessments of the aircraft before a decision, expected in the early autumn.

The Japanese Government plans to order about 60 aircraft — provisionally designated F-X—during the current third defence build-up programme, which ends in 1971, in which year the selected aircraft is required to enter service. A considerably greater number will be ordered in later years.

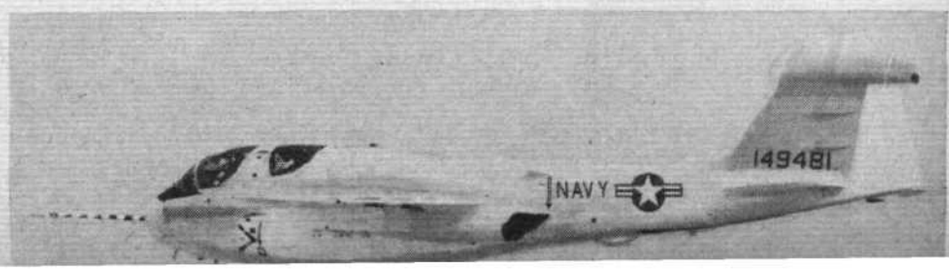
The Japanese air staff is reported to favour the McDonnell F-4E but proponents of the CL-1010 are reported to be stressing its relatively low unit price, its similarity to the present F-104J and thus lower re-training costs, and its lesser capabilities as an attack aircraft. This might be considered a shortcoming in contexts other than Japan, where its advocates argue that, as an almost wholly defensive aircraft, it will be less likely to invite domestic and foreign criticism over its relevance to Japan's "peace" constitution.

LIT Outline Revealed

STOL WAS ESSENTIAL and VTOL welcome if it could be provided without much extra cost in the USAF's projected Light Intra-theatre Transport (LIT), USAF Secretary Dr Harold Brown told Congress in testimony recently released. The LIT will replace the Caribou, C-123 Provider and some C-130 Hercules in the 1970s. Boeing, LTV and McDonnell Douglas have recently received contracts to study STOL designs for the requirement, following earlier studies of V/STOL designs.

Dr Brown said that USAF studies indicated a need for 350kt airspeed, a 250 n.m. combat radius, and a freight capacity of between 15 and 20 tons with STOL capabilities with that payload.

The four-seat EA-6B electronic-counter-measures development of the Grumman A-6A Intruder made its first flight on May 25. Seating is two by two, with a forward-fuselage stretch of the standard A-6A airframe. Ordered by the US Naval Air Systems Command, the EA-6A is designed for carrier-borne and advanced base operation alongside A-6A bombers and the earlier EA-6A two-seat ECM version



Straight and Level

AT LAST Dr Barnes Wallis has got his K. Too often after reading the latest Honours List to see if I have been knighted I have to seek solace in Chesterton's verses:

Prince Bayard would have smashed his sword
To see the sort of knights they dub.
Is that the last of them? Oh Lord!
Will someone take me to a pub?

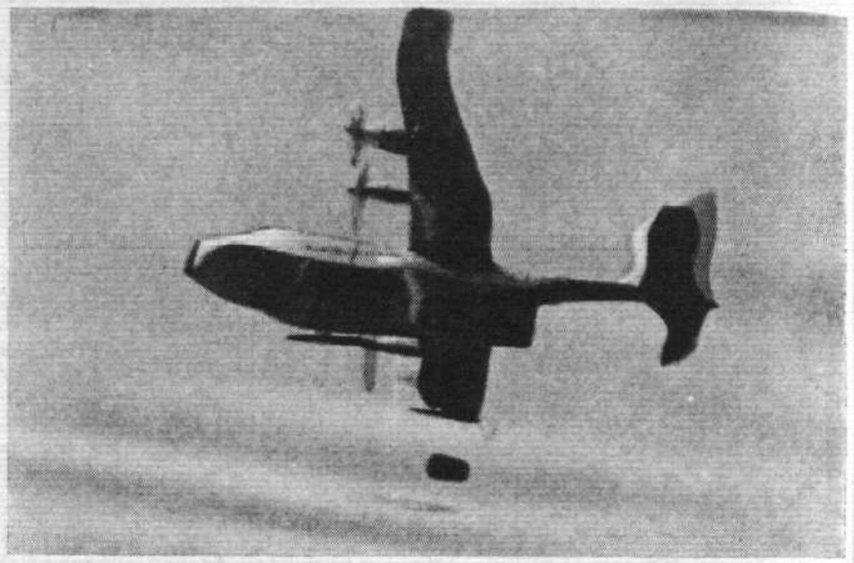
It's not like that this time. Let's go to the pub anyway.

● "America is capable today of building a Mach 3 supersonic transport." That was an American aircraft company president—Mr Shockbody J. Scratchcrunge of Megabust Aerodyne Inc—speaking not last week, but ten years ago.

Many were the doubts at that time in Britain about the wisdom of going for Mach 2 when an American Mach 3 competitor was going to be in service by 1965. I seem to remember that *Aviation Cheek* was even talking about 1963. Looking back it is easy to take for granted the coolness of the European technical judgement (=British technical judgement) that Mach 2 was right, and that anyone who went for Mach 3 would fall flat on his face.

● The British Airports Authority, says *The Economist*, estimates that Heathrow will be saturated "by approximately half the number of aircraft that comfortably pass through comparable American airports." Are the British Airports Authority seriously suggesting, asks the magazine, "that British air traffic control is only half as efficient as American? If not, what are they suggesting?"

What *The Enockemist* seems to be suggesting is that we all simply adore mid-air collisions, of which there have been six involving public transport aircraft in America in the last three years.



"Bit late on the round-out there again, Hoskins" (model of a proposed amphibious version of the C-130, with boat hull and hydroski, reflected in a Lockheed water tank)

● "If it is admitted that pools are an extension of Air Service Agreements, then there is a case for publishing their details. This might clear the air and it might also have the effect of making competition in Europe a little more lively."—Mr Clive Adams, writing in our US contemporary, *Air Transport World*, May 1968.

Join the club, Mr Adams. As BEA's general sales manager until 1966 you have views on pool agreements that should interest the Edwards Committee.

● In the past 48 hours Sir Fred Crunge has joined three different Government committees of inquiry, the nosepiece of his pince-nez, the boards of a merchant bank, an insurance company and an investment trust, the Plastic Face Flannel Dispenser Consumers Advisory Council, the Chocolate Blancmange Marketing Board, the Life Governors of the Sunset Homes for Aviation Ministers, and the pieces of a marble bust of Mr Wormwood Binge hurled at him by a plane-maker.

Busy Sir Fred has still had time to fix up a committee table with a linoleum top, and another round of European airbus meetings. Reports that he has also been gathered unto his forefathers are officially denied as "premature."

● Overheard at a BOAC cocktail party: "Well anyway, we settled the Bahamas Airways pilots' dispute. We paid them."

Roger Bacon

"If you can't get them in, Parker . . .

. . . we can always bring the Blenheim"

Left, Miles Gemini payload demonstration; right, automatically inflated dinghy, Blenheim I, Bicester, November 1938

● LONDON. – BOAC pilots will stage a global go-low starting Sunday night.

From "The Star," Hongkong, May 17, 1968