

11 MARCH 1965

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FLIGHT

International



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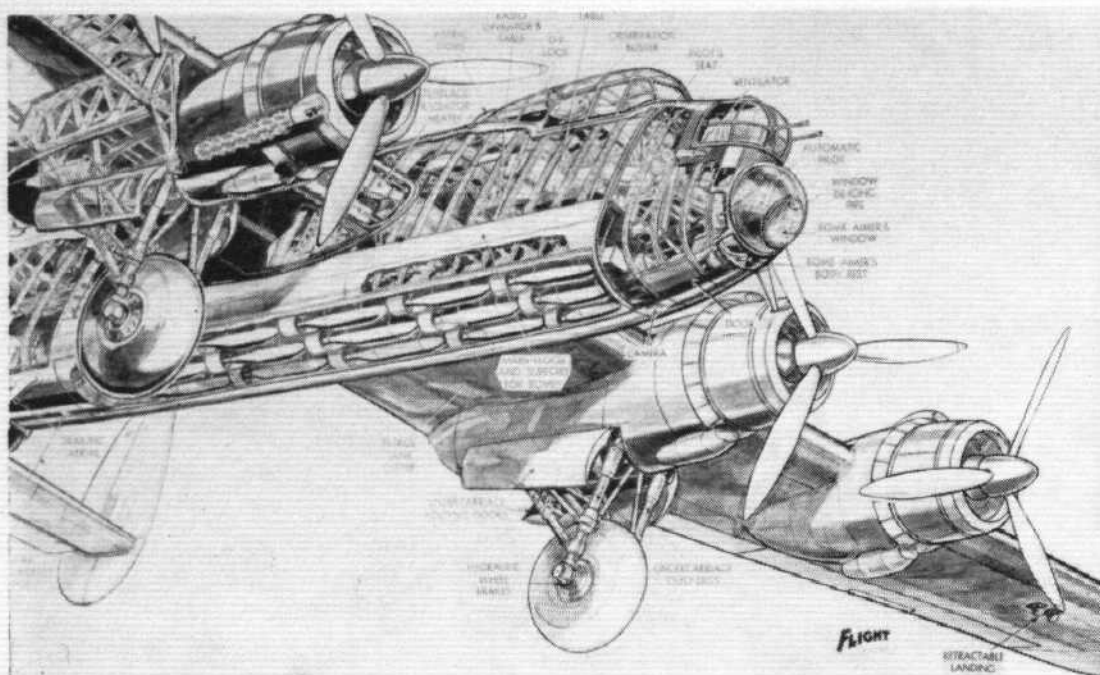
This is the judgement of the C.A.S., Royal Malaysian Air Force, now his Handley Page Herald military transports have completed several months of anti-guerilla operations in the Federation.

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"FLIGHT" CUTAWAY DRAWINGS



Avro Lancaster Mk 2 (actual size reproduction of central portion of a 10in x 8in print)

Reproductions of many of the cutaway drawings of aircraft, engines and missiles which, executed by "Flight" artists, have been one of the most admired features of the journal for many years past, can be supplied in the form of photographic copies. A list of the subjects available appears below.

AIRCRAFT

Airspeed Horsa
Airspeed Oxford
Armstrong-Whitworth AW 52
Armstrong-Whitworth AW 650
Armstrong-Whitworth AW 660
Auster 3
Auster AOP.9
Auster Agricola
Aviation Traders Accountant
Avro 748
Avro Anson
Avro Ashton
Avro Lancaster Mk 2
Avro Lincoln
Avro Shackleton
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Avro Vulcan B.1
Avro CF105 Arrow
BAC One-Eleven
Beagle B206
Beagle M218
Beagle Airedale
Blackburn Buccaneer S. Mk 1
Blackburn Firebrand
Boeing B-52
Boeing 707-120
Boeing 707-420
Boeing 727
Bristol 170
Bristol 188
Bristol Britannia 310
Canadair CL-28 Argus
Canadair CL-44D-4
Chance-Vought Crusader
Cierva C.30
Concorde
Convair F-102
de Havilland DH 125
de Havilland Comet 4
de Havilland Comet 4B
de Havilland Heron 2
de Havilland Mosquito
de Havilland Moth Minor
de Havilland Sea Vixen
de Havilland Trident
de Havilland Vampire Trainer
Dornier 215
Dornier 217E
Douglas A4D Skyhawk
Douglas C-133A Cargomaster
Douglas DC-3
Douglas DC-7C
Douglas DC-8
Edgar Percival EP9
English Electric Canberra
English Electric Lightning

Fairey FD.2
Fairey Firefly
Fairey Jindivik
Fairey Spearfish
Focke Wulf FW190
Fokker D.23
Fokker Friendship
Folland Gnat Mk 1
Folland Gnat Trainer
General Aircraft Hamilcar
Gloster Gladiator
Gloster Meteor 8
Graf Zeppelin
Handley Page Halifax
Handley Page Herald
Handley Page Hermes
Handley Page Victor
Hatfield Man-powered Aircraft Club
Puffin
Hawker P1052
Hawker Hunter F.6
Hawker Sea Fury
Hawker Sea Hawk
Hawker Tempest
Hawker Typhoon
Hawker Siddeley types—see under original de Havilland names
Hunting Percival Pembroke
Hunting Percival Jet Provost
Ilyushin Il-18
Junkers Ju87B
Lockheed P-38 Lightning
Lockheed F-104 Starfighter
Lockheed C-130A Hercules
Lockheed 1649A Constellation
Lockheed Electra
Marcel Dassault Mirage III
Mig-15
Miles Master I
Miles Merchantman
Miles Student
North American X-15
North American P-51 Mustang
North American F-86 Sabre
North American F-100A Super Sabre
Northrop N156F Freedom Fighter
Republic F-105A Thunderchief
Republic F-105D
Scottish Aviation Twin Pioneer
Short SC1
Short Belfast
Short Seamew
Short Shetland
Short Skyvan
Short Solent
Short Sperrin
Southampton Man-powered Aircraft
Sud Caravelle
Tupolev Tu-114

Vickers VC10
Vickers Super VC10
Vickers Valiant
Vickers Vanguard
Vickers Varsity
Vickers Viking
Vickers Viscount 701
Vickers Viscount 802
Vickers Supermarine Spitfire I
Westland Lysander
Westland Wyvern
Zeppelin LZ 129 Hindenburg

AIR-CUSHION VEHICLES

Bell SKMR-1 Hydroskimmer
Britten-Norman Cushioncraft CC-1
Britten-Norman Cushioncraft CC-2/001
Britten-Norman Cushioncraft CC-2/002
Britten-Norman Cushioncraft CC-4
Denny D.2 Hoverbus
Vickers VA-2
Vickers VA-3
Westland SR.N1
Westland SR.N2
Westland SR.N3
Westland SR.N5

MISSILES AND ROCKETS

Atlas ICBM
Bristol Bloodhound
de Havilland Blue Streak
de Havilland Firestreak
Diamant
Emeraude
English Electric Thunderbird
Europa I—Blue Streak
Europa I—Second Stage
Europa I—Third Stage
Europa I—The whole vehicle
Fleet Ballistic Missile Submarine
SSB(N)598 "Geo. Washington"
Minuteman
Redstone
Nike Zeus
Black Knight 2
Nord AA20
Polaris A3
Thor Mk 1
Thor missile site
USS "Ethan Allen" Polaris firing submarine
US/UK satellite Ariel
V-1

HELICOPTERS

Bristol 192
Fairey Rotodyne
Fairey Ultra-light
Hunting Percival P74
Saunders-Roe P531
Saunders-Roe Skeeter
Sikorsky S-61N
Sikorsky S-64
Sikorsky S-65
Westland Wasp
Westland Wessex AS1
Westland Westminster
Westland Widgeon

ENGINES AND MISCELLANEOUS

Allison V-12
Armstrong Siddeley Cheetah
Armstrong Siddeley Python
Armstrong Siddeley Sapphire
Armstrong Siddeley Screamer
Armstrong Siddeley Tiger
BMW801A
Blackburn Cirrus II
Blackburn Turbomeca Turbo 600
Bristol Centaurus
Bristol Olympus
Bristol Orion
Bristol Proteus
DB 601
de Havilland Gnome
de Havilland Goblin II
de Havilland Goblin test house
de Havilland Gipsy Minor
de Havilland Sprite
General Electric & Bristol Siddeley T-64
Jameson
Lycoming T55
Mikulin M209
Napier Eland
Napier Gazelle
Napier Lion X1A
Napier Nomad
Napier Oryx
Napier Sabre II
Rolls-Royce Avon
Rolls-Royce Conway
Rolls-Royce Dart
Rolls-Royce Dart installation in Herald
Rolls-Royce Derwent
Rolls-Royce Griffon 65
Rolls-Royce Kestrel Blower
Rolls-Royce Merlin
Rolls-Royce RB.162
Westland SR.N3 engine group
Elliotts Olympia 419
Peak 100
Slingsby Dart
Slingsby Eagle
Slingsby Swallow
Slingsby Sky
Slingsby T.49
HMS "Indomitable"

SIZES AND PRICES

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Note: The majority of the aircraft drawings were originally reproduced across two pages of "Flight," i.e., at approximately 14in wide. Some are annotated, while others have key numbers with corresponding lists; photo-copies of the lists can be provided at a small extra charge. All prices quoted above include packing and postage. Prices for larger sizes on application.

Obtainable only from The Photographic Department, "Flight International," Dorset House, Stamford Street, London SE1.



Component units of Hughes airborne infrared system.

HUGHES INFRARED SYSTEMS GIVE INTERCEPTOR AIRCRAFT PASSIVE SEARCH, DETECTION AND TRACK CAPABILITY

Modern interceptor attack systems must be prepared to complete their missions in a variety of hostile environments. The achievement of this flexibility requires an airborne IR search, detection and track capability which can operate either alone or in conjunction with the radar fire control system.

Hughes infrared systems utilize the most advanced field-proven technology, and

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- they are unaffected by radar jamming and deception countermeasures.
- they provide completely passive attack capability, including the firing of IR missiles without dependence upon radar.

- they are fully effective at night.
- they are compact, easily fitted to either existing or planned aircraft.
- they are in quantity production.

Hughes IR accomplishments during the past 15 years include the development of IR systems for reconnaissance, anti-tank missile control, bomber defense, ballistic missile defense, star-tracking and space vehicle instrumentation, and the manufacture of over 10,000 IR guidance heads for Falcon air-to-air homing missiles. In addition, Hughes manufactures a complete line of infrared components, including detectors, irdomes, cryostats and closed-cycle coolers. Today, Hughes facilities for research, development, and production of infrared systems and components are the most extensive in the United States.



Hughes infrared equipment shown mounted on U.S.A.F. Aircraft.

HUGHES INTERNATIONAL
HUGHES AIRCRAFT COMPANY

CULVER CITY, CALIFORNIA, U.S.A.

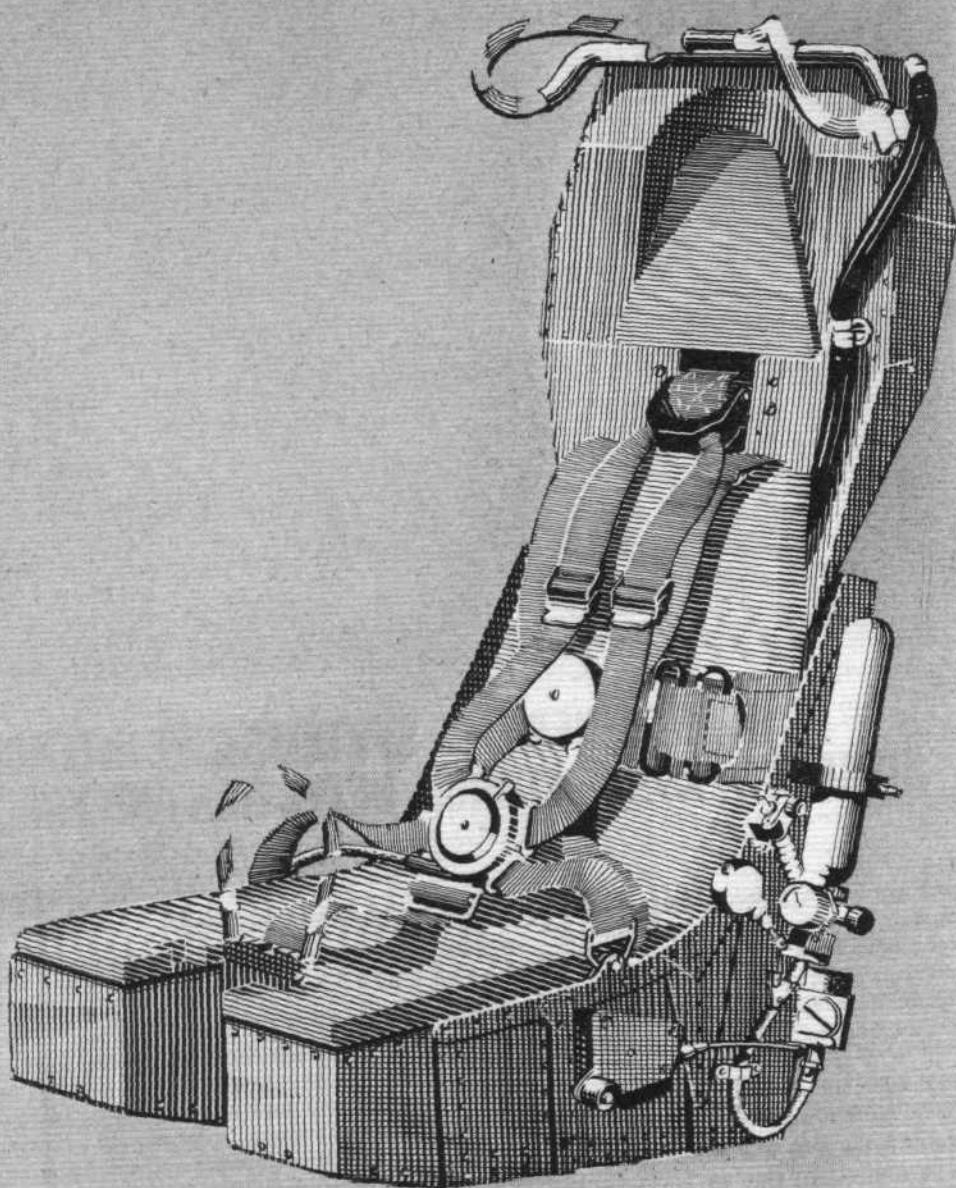
SEAT AND AIRCRAFT

LIVES

958

SAVED

The Mark GZ4 ejection seat designed for the Potez CM170 Magister is just another of the Martin-Baker range of well proven aircrew escape equipment. Manufactured specifically for this aircraft it incorporates a canopy jettison system to ensure that safe escape can be effected at speeds down to 90 knots in straight and level flight at zero altitude.



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THURSDAY 11 MARCH 1965

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Editor-in-Chief

MAURICE A. SMITH DFC

Editor

J. M. RAMSDEN

Assistant Editors

MARK LAMBERT BA

KENNETH OWEN

BSC DCA6 AFRA6S

Air Transport Editor

H. A. TAYLOR

Production Editor

ROY CASEY

Managing Director

H. N. PRIAULX MBE

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

£30 Million Feather Bed for BOAC?

PARLIAMENT is to bury the dead capital that has been lying so heavily upon BOAC. The Minister of Aviation told the Commons on March 1 that he will shortly introduce the appropriate legislation.

Encouragingly, he has not fallen for that dubious £12 millions' worth of "special provisions" with which BOAC attempted to load its £78 million accumulated deficit last year. So far as it had been defined, which was none too clearly, this was future expenditure. It was not right to try to sweep it into the deficit dustbin in the belief that it would be emptied by the obliging taxpayer.

Mr Jenkins evidently agrees. He says he will write off only the "operating deficit," as he describes it. In round figures this is £80 million. It seems rather odd, incidentally, to describe it as an operating deficit when more than half of it is capital loss, but let that pass. Dead money is dead whatever the inscription on the headstone.

The disturbing part of the Minister's statement concerns the additional £30 million with which he proposes to "establish a reserve against contingencies." Long-haul air transport, he says, is "peculiarly susceptible to trading fluctuations and to hazards both as to cost and as to revenue." He makes it sound as though he is preparing the biggest and most sumptuous feather bed in the history of British civil aviation.

What BOAC Asked For

What BOAC has long asked for is compensation if ever the Government requires it to act against its best interests. The last Government agreed to this, in a letter from the then Minister to Sir Giles Guthrie on his accession as chairman on January 1, 1964. Thus in May 1964 BOAC's board decided to cancel all 30 Super VC10s on order and to buy eight Boeing 707-320Cs instead, because it would save a large though undefined amount of capital and, to a much lesser extent, operating costs. In July the Government directed BOAC to have Super VC10s (though only 17 instead of 30). In this directive, published as Appendix V to BOAC's 1963-64 annual report, the Government agreed to compensate BOAC for operating Super VC10s. This is what part of the £30 million must be for.

Why then does the Minister represent it as a blank cheque to cover "contingencies" and "trading fluctuations"? As with the Minister's appointment of a BEA board member to look after the consumer, he seems to have some odd ideas about how to foster self-reliance.

We hope that Parliament will probe this £30 million carefully. What costs will the Minister allow BOAC to charge against it? According to our reckoning BOAC should be making some pretty healthy net profits in the years to come. It will no longer have to bear the burden of interest payments on its accumulated deficit. It will enjoy the high load factors that booming world traffic and a drastically reduced fleet of the most attractive aircraft on the routes will ensure. Indeed, BOAC's revenue in the years to come might well be adequate to cover the higher capital, introductory and operating costs of the Super VC10, contractual penalties to BAC, the £4½ million set aside last year for golden handshakes up to 1968, the £3 million liability to the BOAC/BEA joint pension scheme, and so on. But if any of these items is to be charged against the £30 million, then each should be clearly defined, so that BOAC's true commercial and financial position is never open to misrepresentation.

BOAC is already well on the way to becoming one of the most efficient airlines in the world, and not only one of the safest. We do not think that Sir Giles needs or wants a £30 million feather bed.



WORLD NEWS

FIAT'S HIGH-SPEED HELICOPTER

A novel combination of rotor, thrust propeller and aerodynamic rudder, all mechanically interconnected, is the basis of a new high-speed helicopter being designed by Fiat under the designation Fiat 7005. Basically a small three-seater with retractable undercarriage and streamlined airframe, the 7005 has an Allison 250 turbo-shaft driving both the three-blade main rotor and the four-blade thrust propeller through a single fore-and-aft shaft.

Propeller r.p.m. are so governed that, as collective rotor pitch is applied and absorbs engine power, propeller pitch is reduced to maintain constant r.p.m. Thus the greater the required lift the less the forward thrust. During cruising flight, power is progressively transferred to the thrust propeller as the power input required for rotor lift decreases.

At the same time, three rudder surfaces set between horizontal end-plates are linked with the propeller controls and the minimum propeller pitch adjusted so that torque compensation—by slipstream over the rudders—is automatically ensured for any thrust/lift combination. The pilot needs only to manipulate the conventional collective lever to achieve all these effects.

GOOD EXPORT START

Exports of British aircraft engines, components, instruments and tyres for January totalled £9,035,000—a 20 per cent increase over the 1964 monthly average of £7.5m. January was the first month since May 1964 in which the figure has exceeded £9m. Further increases can confidently be expected in the coming months, says the



The Douglas DC-9 was airborne for 2hr 15min on its first flight, though the planned duration was only 1hr 45min. Other pictures are below and on page 358

SBAC, because their recent forecast of £180m for 1965 was calculated on a basis of deliveries against firm orders now in hand.

FRENCH EXPORTS

During 1964 the French aircraft industry achieved export sales of Fr 1,424,207,778 (about £106.3m). Of this total, Sud-Aviation made the largest individual contribution with exports worth just over Fr 400m (about £30m), mainly Caravelles, Alouettes and sounding and upper atmosphere rockets.

TRANSALL PROPELLERS

Ratier Figeac in France have received a sizeable order for propellers to be made under Hawker Siddeley Dynamics licence for the Transall tactical transport, which is now entering production. Though Ratier Figeac remain prime contractors, Hawker Siddeley will do part of the production work at their Lostock, Lancs, factory, making some propellers, hydraulic control

units and synchrophasing equipment.

The HSD share is about £2m and represents the third Transall order received. HSD had already had orders worth more than £1m for development equipment and pre-production propellers. They are now working on orders worth £5m and hope that this total will increase beyond £10m following current negotiations.

SONIC BOOMS FOR MPs

In a written Parliamentary reply on March 1 the Parliamentary Secretary to the Ministry of Aviation, Mr John Stonehouse, said that the forthcoming sonic-boom demonstration for Members of Parliament and representatives of local authority associations would be made by Lightning aircraft flying between 25,000ft and 34,000ft. The demonstration would be made on Wednesday, April 21; in answer to a further question from Sir Rupert Speir (Con, Hexham) Mr Stonehouse said that the site of the demonstration would be announced as soon as it had been chosen.

BOAC'S DEFICIT WRITTEN OFF
Air Transport, page 358

PIPER REFINEMENTS
Sport and Business, page 367

ATLAS-CENTAUR 5 SETBACK
Spaceflight, page 382

EQUIPPING THE PHANTOMS
Defence, page 383

First Take-off by the DC-9 was from Long Beach Municipal Airport, with a landing later at Edwards AFB for continuation of the test programme. Orders and options now total 210—including 11 unannounced orders and 96 announced and unannounced options



Fast Fiat Artist's impression of the new Fiat high-speed helicopter project (see news item on facing page)



DEVELOPING THE P.1127

The developed P.1127 aircraft was the subject of a Parliamentary question by Mr Nigel Fisher (Con, Surbiton) on March 1. Was it the policy of the Secretary of State for Defence to redesign this aircraft, how long would this take and what would be the approximate additional cost? In a written reply Mr Healey said: "The intention is to develop the P.1127 to the minimum standard necessary to make it suitable for operation with the Royal Air Force and to complete this work in time to ensure the introduction of the aircraft as a partial replacement for the Hunter before the end of the decade. The cost and scope of the development are still the subject of detailed study, but both will be closely controlled."



Dr J. Graham Taylor
who is now in charge of
medical services for
BOAC and BEA (see
page 359)

EFFECT OF REDUNDANCIES

On March 1 the Minister of Labour was asked by Mr Quintin Hogg (Con, St Marylebone) how many qualified scientists, technologists and engineers were affected by the recent redundancies in the aircraft industry. Mr Gunter stated in a written reply: "I have information only about the

qualifications of those redundant workers who have sought my department's help in finding other employment. One hundred and thirty-five engineers and technologists have registered for employment with my Professional and Executive Register. They include 88 qualified aeronautical engineers, nine mechanical and two electrical engineers; 32 have engineering or drawing-office experience but are not professionally qualified, and four are technical authors."

FLIGHT NEXT WEEK...

... will be the annual Private and Executive Flying Number, containing—in addition to regular features—articles of especial interest to present and prospective private pilots and to users of business aircraft. There will also be data tables on British and foreign current light aircraft and engines, a guide to European light-aviation events, and a full list of British flying clubs and groups. Publication day: Thursday, March 18.

"MAGNIFICENT MEN" PREMIERE

The Duke of Edinburgh is to attend the premiere of the film *Those Magnificent Men in their Flying Machines* at the Astoria Cinema in London, on Thursday, June 3. Twentieth Century Fox Films are donating the proceeds of the performance to the Royal Air Forces Association, the RAF Benevolent Fund and the Guild of Air Pilots and Air Navigators' Benevolent Fund.

The film, a comedy set in 1910, centres on an air race from London to Paris. Some remarkable flying reconstructions of aircraft

SENSOR

General Electric may be the American engine manufacturer assigned to the joint Anglo-US development of direct-lift VTOL engines, in particular the Rolls-Royce RB.189. GE has achieved high thrust-weight ratios with its family of small turbines.

A "Plain Pilot's Guide" to the handling and performance characteristics of jet transports is to be published by the Ministry of Aviation. It will cover all the characteristics and qualities of jet transports—stalling, stick-shakers and stick-pushers, Dutch roll and yaw damping, take-off, approach and landing, Mach buffet, turbulence, and so on. Written by Mr D. P. Davies, chief test pilot of the ARB, it is likely to be a best-seller among jet pilots converting—or even fully converted—from propeller types. The book will not be ready for some months. Announcement of publication, price and how to get copies will be made as soon as possible.

By 1970 most of today's 707s and DC-8s will be ten years old and will be out of front-line long-haul service. They may be available for as little as £500,000. After rework—they will have done 30,000hr—they could be ideal equipment for busy short-haul trunk routes. These aircraft may form the strongest competition for the proposed "air bus."

Last November's lecture on the 737 and 727 by Mr J. E. Steiner of Boeing, in which he argued the case for reverting to wing-mounted engines, appears to have caused some protests from Boeing 727 operators. It is unlikely that Boeing will in future place much sales emphasis on the relative advantages of wing- or rear-mounted engines.

The RAF's helicopter strength in South Arabia and Malaysia has been impaired by the recent temporary grounding of the Belvedere following accidents caused by resonance problems. This may have given urgency to the hitherto leisurely consideration of Westland's proposals for new tactical and heavy-lift helicopters (page 384).

Certain foreign customers for new British equipment are not too happy about the Ministry of Aviation procedure of trying to encourage competitive bidding in all systems projects. This results in MoA efforts to get foreign customers to look at rival designs to those they would like to adopt.

A move to get British airlines out of party politics by denationalizing BOAC and BEA could gather momentum in the Conservative Party following Mr Neil Marten's contribution to the recent civil airlines debate. Mr Marten, Parliamentary Secretary to the Ministry of Aviation for two years until last October, said: "The whole conflict would be settled if there were no nationalized corporations." He also suggested that appeals against the ATLB should not go to the Minister, so as to get politicians "disengaged from commercial decisions." It is the first time that these ideas have been put forward by a politician.



The Crew of the DC-9
on its first flight were, left to right, Mr George R. Jansen, aircraft division chief engineering test pilot; Mr Duncan P. Walker, flight test engineer; and Mr Paul H. Patten, the test pilot associated with the DC-9 since the early design stages

WORLD NEWS . . .

of the period—they have been illustrated in the pages of *Flight* during the past year—were used in the production.

Application for tickets for the premiere, priced at 15, 10, 5, 3 and 2 gns, should be made to the General Secretary, The Royal Air Forces Association, 43 Grove Park Road, London W4 (CH15wick 8504), or to the Executive Secretary, the Guild of Air Pilots and Air Navigators, 14 South Street, Park Lane, London W1 (GR0svenor 1212).

USEFUL READING

Current and forthcoming special numbers of Iliffe journals include the following: *Autocar*—March 12, Motor Caravans; *Yachting World*, March issue (now on sale)—Fitting-out Number; *Motor Cycle*—March 11, Spring Buyers' Guide; *Motor Transport*—March 12, "C" Licences Number.



First Three Cessna Model 411s awaiting delivery to customers—who include Continental Motors Corp—at the makers' Multi-Engine Delivery Center at Wichita. Cessna introduced the new model in mid-February, and the response has already caused the production schedule to be stepped up to reach 12 aircraft per month by August

MR JENKINS ON THE SMALL SCREEN

THE MINISTER OF AVIATION, Mr Roy Jenkins, was interviewed on the BBC-2 television programme *Encounter* on February 25 by Mary Goldring and Michael Charlton. The programme confirmed previous impressions of the Minister as a cool, analytical politician with powers of expression well above the normal Westminster standard.

His handling of questions gave some insight into the thinking behind policy as announced to date, and a hint of the way in which he will approach decisions yet to be made. Here are extracts from some of his replies.

The Aircraft Industry "The Government is the biggest customer of the aircraft industry . . . It provides £1,350 each year for everyone employed . . . the aircraft industry has rather got into the mood of thinking the Government will pay for everything . . . [it] needed a few rude shocks—because although in one sense it had been feather-bedded, it had also been led along without any decision being made . . . I think that the industry in a way has welcomed a slightly more decisive policy, even though it's been a tougher policy towards them, than that which they'd previously been led to expect."

Lobbying "I thought that one would be subjected to a certain amount of lobbying; but if you ask me about this I would have expected to find the pressures more difficult to deal with . . . I've found a lot of difficulties but . . . not the feeling that I'm under terrible pressure from the aircraft industry."

Concorde "I merely thought that there were certain grave economic doubts about Concorde, but that it might well turn out to be a success, even economically . . . We're going ahead with it and . . . I'm determined to make as much a success of it as possible . . . But anyone in his right

mind, looking at the facts, would have had some doubts—I don't apologize for that at all . . . We will watch Concorde as it develops. We will keep a constant eye on the economics and try and see that it makes sense. I think that if . . . we have a perfectly viable supersonic transport, capable of flying across the Atlantic, available three years before the Americans have one, then there will be a reasonable market for it."

TSR.2 "People say the whole future of the aircraft industry depends on it. I don't quite agree, but clearly it's the biggest of any of the four projects."

Decision-making "After nearly 16 years being a back-bench MP—where one has a perfectly agreeable life, and opportunities to make speeches and to contribute in various ways, but where in fact one *does* absolutely nothing—it's a great change and a great pleasure to be able to take decisions . . . I haven't really got a technical bent of mind at all; but I think that one ought to be able to steer between a mass of technicalities, and see what the broad issues are; try and judge between the conviction with which varying courses are being urged upon one . . ."

International Collaboration "Manufacturing for a solely British market, at present research and development costs, is out. If you do this, you get into a TSR.2 position, in which you are staggering under the weight of the development costs you are carrying for a small production line. The only way to get a bigger production line, a bigger market, is to get other countries in with you from the beginning . . . But I don't want to do everything with the French and nothing with the Americans. Though I tend to believe that collaboration with the French will tend to flow more successfully (not because of any goodwill or ill-will on one side or the other, but because of the facts of the situation) . . . from a political point of

view it is on the whole easier at the moment to co-operate with Washington than to co-operate with Paris . . . On the other hand, you have the difficulty that the American aircraft industry is self-sufficient and doesn't really want much, if anything, from the British aircraft industry . . . The French and British industries are much more complementary."

The Ministry of Aviation "Whether it's the right form of organization to go on in the future with I'm not yet sure. There are quite strong arguments both ways. I don't unduly mind if someone eventually arrives at a solution which does me out of a job—does me out of *this* job."

Size of the Industry "It would be ludicrous to have an arithmetical figure and say 'I have decided that the size of the aircraft industry should be 195,000—or whatever it is . . .' Indeed, I've got the Plowden Committee, a very powerful committee, which is supposed to report on organization and size. I would think that the industry should be somewhat smaller than it is at present . . . smaller, I would say, but not down to the French size, or anything like it."

Large Short-haul Aircraft "There's been a lot of extraordinary loose talk about an aerobus . . . What the Americans mean by this, on the whole, is a vast 500- to 700-seater which they will, I think, go ahead with. They've got a military requirement for it and a civilian requirement will no doubt come along as a corollary. The number of routes on which you can fly it are extremely few, and the problems of loading and unloading people are very great indeed. What I mean by an aerobus—which I would rather like to develop—is a 'flexible' plane carrying perhaps 150 to 200 people . . . with some sort of fairly short landing and take-off capacity and flying between cities of moderate size."

parliament

KENNETH OWEN

On allotted Supply days the House of Commons turns itself into a committee to sanction expenditure on the Civil Service and the Armed Forces. In fact the Supply debates are rarely concerned with financial detail: they are general debates on Government policy on subjects chosen by the Opposition.

On Monday of last week it was a vote of £1,915,906,800 on account, including £85m for the Ministry of Aviation. For purposes of procedure Mr Angus Maude sought to reduce this £85m by £1,000. For purposes of debate the subject was the civil airlines.

The date was March 1 and Mr Maude came in like a lamb, nibbling at the Government's allegedly differential treatment of the corporations and the independents in an earnest, quiet, worried way. Under the Civil Aviation (Licensing) Act of 1960, he indicated, all British airlines were born equal—but under the present Government some were more equal than others.

Not so, declared Mr Roy Jenkins in

reply. It was hardly surprising that Conservative aviation spokesmen were hazy in their ideas, since the Leader of the Opposition determinedly refused to allow anyone with previous aviation responsibility to speak on the subject. Among those cast into outer darkness were Mr Amery, Mr Thorneycroft, Mr Marten and Mr Fraser.

The picture of the independents as rugged free enterprisers of the air, keen to meet and beat anyone on the tarmac, was also a fallacy, the Minister went on. They wanted protection as much as anyone; in no profession did poachers turn into gamekeepers with more alacrity.

Mr Maude had spoken for 50min in opening the debate. Mr Jenkins spoke for 35min, of which just 20sec was needed to announce a bill to write off BOAC's deficit and create a new reserve, cancelling a Government debt of £110m. Out of the red and into the black at the rate of over £5m per second is not bad going, even for the dynamic Mr Jenkins.

Mr Neil Marten, one of the large band of Conservative ex-Parliamentary Secretaries to the Ministry of Aviation, chatted in a reasonable, conversational manner for 28min. He deplored the conflict between the philosophies of the two main parties. With disarming directness he suggested that the conflict (in civil aviation) would disappear if we had no nationalized corporations. It was the first time this had been suggested in Parliament.

Denationalization of the corporations was an interesting idea, Mr Eric Lubbock commented; how was it omitted from the

Conservative Party's election manifesto? It was wrong, the Liberal aviation spokesman continued, for the Government to delegate political decisions to the Air Transport Licensing Board, which was a non-political body.

Among the several Scottish members who spoke in the debate, Mr Hector Monro (Conservative, Dumfries) put in a word for the private and club pilots, of whom he is one. Attacking high costs and operating restrictions, pilot Monro spoilt the effect slightly by confessing "Whenever I fly I try to do so without a radio, in order to make sure that I get 'rockets' on the ground and not when I am flying as well."

Mr Edward Heath, Tory spokesman on economics, finance and home affairs, took the Opposition out like a lion in a forceful winding-up. Mr Jenkins, he recalled, was once such a promising, persuasive, intelligent backbencher. But four months in power had taken its effect; he had become an intolerant, mentally obtuse, petulant, arrogant Minister. Strong stuff—except that Mr Heath grinned just as broadly as Mr Jenkins at this point.

The Parliamentary Secretary to the Ministry of Aviation, Mr Stonehouse, did his all-shouting, all-pointing best in reply, inviting the clatter of interventions that sure enough came down on his head. At the ten-o'clock division the Liberals voted with the Government to defeat the motion by 296 to 275. Mr Jenkins' thousand pounds was safe, after all.

(Civil aviation debate report, page 364; defence debate report, page 386).

press

DAVID HOFFMAN

Washington, March 5

Accurate, thorough, perceptive, clear. For a decade, colleagues in the American Press have applied these adjectives, at times begrudgingly, to the writing of Richard Witkin. Until February, Witkin was aerospace news editor for the *New York Times*. Now, this versatile journalist is covering New York politics—at his own request.

To close associates Witkin complained that aviation has fallen into a news rut and that daily coverage of this rut leads to boredom. In so complaining, Witkin speaks not only for the competent American journalists who specialize in aviation; worse, he speaks for his bosses.

The journalistic province of aviation includes, in America, the airline industry, the agencies that regulate the airline industry,

and the firms that manufacture aviation equipment. Never before has the Press been so dependent on airline advertising (the companies this year will spend more than \$100 million on ads alone). Never before have the agencies wielded such vast power (FAA is managing the supersonic transport programme and the once docile CAB is menacing IATA's fare structure). Never before have the manufacturers earned such fat profits from the sale of aircraft (every time Boeing and Douglas announce a new 707 or DC-8 order, their stock flicks upward). How, then, has the Press responded to the new power and prosperity of aviation?

Only two of the six big dailies in New York City employ an aviation editor, or, as the British say, an air correspondent. Two years ago, four did. In Washington, the two influential dailies are perhaps the richest papers in the land. One lacks an aviation editor, the other confers the title on a man who covers motoring and travel as well.

It would appear that three forces are at work. The first is a tribute to the industry: jet transport has become reliable, regular and routine. As a result, the Press is less concerned now with what the companies do than with what they are, their status on Wall Street. When Boeing unveiled the 737, for example, "Ho-hum, another airplane," yawned the managing editor, and the 773

went on page two of the financial section.

Secondly, the interest of reporters and their bosses is further diluted by the drama of manned space flight. Industry public relations men, who could counter this trend with imagination, still attempt to popularize aviation with stale formulae and transparent gimmicks and thus make up the third force responsible for the poor play aviation is getting in the US Press.

Examples: Suppose Company X decides to build a new aeroplane. Its specifications are leaked first to the trade Press, with "exclusives" shared on a rotating basis. Then there is a formal announcement, which the daily Press will (1) use in full; (2) ignore, because the story has already been stolen from the trades, or (3) cut drastically, because the trades had a scoop. Next comes the roll-out ceremony, the first flight celebration and the pilot reports ("airplane is stable in all flight regimes," etc). Witkin could have written all five stories *before* he saw the first Press release.

Two years ago American Airlines had a nice idea. It restored a Ford Tri-Motor and flew it across the country to dramatize aviation's progress in the past decade. But lo, there appeared behind American's Tri-Motor still another Tri-Motor, this one leased by a competing carrier. A blizzard of Tri-Motor releases swept across reporters' desks. As one reporter put it: "It's more than one needs to know about Tri-Motors."



AIR TRANSPORT

BOAC's Deficit is Written Off

THE Government is to write off the whole of BOAC's accumulated deficit of about £80m at the end of the 1963-64 financial year—excluding the "reorganization" and other "special provisions" totalling £12.4m—and is to create a reserve contingency fund for the corporation. The total sum involved in the write-off is £110m.

This was announced by Mr Roy Jenkins, the Minister of Aviation, during the civil airlines debate in the House of Commons on March 1 (see pages 364-365). He said that legislation to make this action possible would be introduced soon. His statement follows:—

"BOAC's accounts for the year ended March 31, 1964, showed an accumulated deficit of £90.5m. Of this sum, about £80m represented past operating losses.

"The causes of these losses have been analysed at length and are a matter of public record. . . . While the deficit and its associated interest payment remains as a dead-weight on the corporation, it serves only to impair morale and stultify the determination of the management and staff to put the corporation's policies and programmes on a sound basis.

"In his letter to Sir Giles Guthrie of January 1, 1964, the right hon Member for Preston, North [Mr Julian Amery] charged him to produce within a year a plan which would enable BOAC to achieve a breakeven. It was recognized that the plan would involve a review of the route network and the size of fleet needed to meet estimated traffic requirements and some tautening of the administrative and technical fabric of BOAC's international organization. This plan is now to hand. The route network has been surveyed and, apart from the excision of a service to South America, remains intact.

"The fleet now on order matches the estimated requirements and Super VC10s will come into service as needed. The last ten of these aircraft remain in suspense, but I am hopeful that they will eventually form part of the corporation's fleet. Steps have been taken to rationalize the corporation's labour force and, although their full benefit will not be realized immediately, I believe that the results achieved so far are encouraging.

"The commercial remit to Sir Giles Guthrie led, however, to considerable controversy last summer about the composition of the corporation's fleet. As a result of the compromise solution then reached, [Mr Amery] in his letter to the chairman of BOAC of July 31, 1964, which was published in the corporation's report, gave an assurance that the Government would take the necessary action to reorganize the capital and financial structure of the corporation so as to enable it to operate as a fully commercial undertaking with the fleet now on order. That pledge we have quickly honoured. It is the logical counterpart of the measures which BOAC has itself taken to set its affairs in order.

"As to the actual sums involved, it is, I think, common ground to all on both sides of the House who have considered this problem that the bare minimum must be the writing-off of the accumulated deficit on the operating account as it will be on March 31, 1965. This step is a recognition of the fact that the part of the corporation's borrowings from the Exchequer used to finance this loss cannot now be substantially repaid and that the interest on it is now a discouragement rather than an incentive to a good financial performance by the corporation.

"We propose to go a little further in order to put BOAC in a position to operate in a fully commercial fashion without obscuring its true financial result. Long-haul air transport is peculiarly susceptible to trading fluctuations and to hazards both as to cost and as to revenue. We therefore propose to establish a reserve against contingencies. The write-off of the accumulated operating deficit and the creation of an adequate reserve will, in all, entail a cancellation of government debt to the sum of £110m and I hope to introduce early legislation to this end.

"No new money or call on real resources is involved, but assistance on this scale clearly calls for appropriate safeguards for the Exchequer. The Government therefore propose to take powers to control any transfers from the reserve to revenue account, to determine the distribution of any profits earned by the corporation and to control the investment of any surplus cash which the

The prototype Douglas DC-9 made four flights totalling 6hr 13min in the six days including and following the first flight on February 25 (see last week's issue, page 312). At least four more flights from Edwards AFB, where the DC-9 is temporarily based, were due to be made by the end of last week. A coupled autopilot approach from 9,000ft was made on its second flight



A British United Airways VC10 in the airline's new hangar which is nearing completion at Gatwick. This hangar, probably the largest of its kind in Britain, is, in fact, the first of four bays in a steel cantilever building designed for BUA's VC10s. It has a clear span of 176ft, an overall height of 54ft, and a depth of 187ft



corporation may accumulate. The committee may also wish to know whether any part of the reserve would, as a result of the commercial and financial arrangements between BOAC and BOAC-Cunard, find its way to BOAC's private partner in the latter company. I assure the committee that the nature of the reconstruction to which I have referred will be such that this will not occur. I hope that the measures proposed will help the corporation to put its past troubles behind it and, in future, to match with financial success its deservedly high reputation for safety and service."

(Leading article in this issue)

AGREEMENT ON ENTERTAINMENT?

THE 17 North Atlantic airlines reached a tentative agreement, during their meeting in Paris on February 27, to discontinue in-flight entertainment. This decision depends on the expectation that the US domestic trunk airlines will take similar action. These carriers were due to meet last week to discuss the question.

The meeting was of airline chairmen and presidents and the proposed agreements have now been submitted to other IATA members for a mail vote which must be unanimous and approved by the respective governments.

TWA has so far been the only carrier providing in-flight entertainment on the North Atlantic. In a statement issued on March 1 the airline said that, in order to prevent "chaos in international air fares" after April 1, it had "expressed a willingness to forgo... movies on condition that the 16 opposing international airlines ceased their bickering over fares and came to an agreement." TWA's contract with In-Flight Motion Pictures expires in August, and the renewal date is April 27. If the fares are not approved and in effect by this date TWA says that it may extend its showing of films into 1966. The airline made it clear that it was still very much in favour of entertainment for its passengers.

LIGHTNING BLAMED FOR ELKTON ACCIDENT

THE probable cause of the accident to a Pan American Boeing 707-120 on December 8, 1963, has been given by the US Civil Aeronautics Board as the effect of a lightning strike. According to the report lightning ignited the fuel in a port wing-tip tank. This caused an "explosive disintegration of the left outer wing and loss of control." All 81 occupants were killed.

This is the first time in the USA that a lightning strike has been given as the likely cause of an accident, but the Italian authorities blamed lightning for the fire, explosion and crash of a TWA Constellation in June 1959.

NAIROBI INCIDENT INVESTIGATED

MIS-SETTING of the starboard altimeter by the first officer, who was flying the aircraft from the right-hand seat, was the primary cause of the premature touchdown of the BOAC Comet near Nairobi on the night of February 2, 1964. The Comet (G-APDL) was on approach to Nairobi's runway 06 with the landing gear down when it touched the ground in the Kitengela game conservation area about nine miles from the runway threshold. The Comet was climbed away and landed by the captain. Only minor damage

was caused. The aircraft was about 3,000ft too low; the first officer had set a QFE of 938mbs instead of 839mbs on the millibar scale.

The report—by the Accident Investigation Branch of the East African Common Services Organization—gives as a secondary cause the failure of the commander and the co-pilot "to carry out diligently all the essential checks." This failure allowed the error to pass unnoticed; the report recommends that "the operator should examine his laid-down flight-deck procedures." Although the incident was not one which required notification under East African regulations the chief inspector of accidents ordered an investigation because of the "gravity and potential" of the incident. The British MoA accepted an invitation to take part in the investigation.

ACCIDENT CAUSE QUESTIONED

DIFFERENCES over the payment of insurance following the Comet 4B take-off accident at Ankara, Turkey, on December 21, 1961, came to light in newspaper reports at the end of last month. These differences have been the subject of negotiations between underwriters since 1963 when a writ was issued on behalf of BEA against S. Smith and Sons (England), the makers of the director horizon in which a screw was alleged by the Turkish investigating authorities to have been loose, thus leading to an incorrect attitude indication immediately after take-off. In a statement Smiths say that they were fully insured against the risk and that their insurers were confidently resisting the claim. Apart from the legal issues involved, the statement continues, "there is now considerable doubt as to whether the Smiths Director Horizon... had anything to do with the accident. Since the writ was issued, technical investigations have brought to light information which was not available at the time of the official inquiries into the accident."

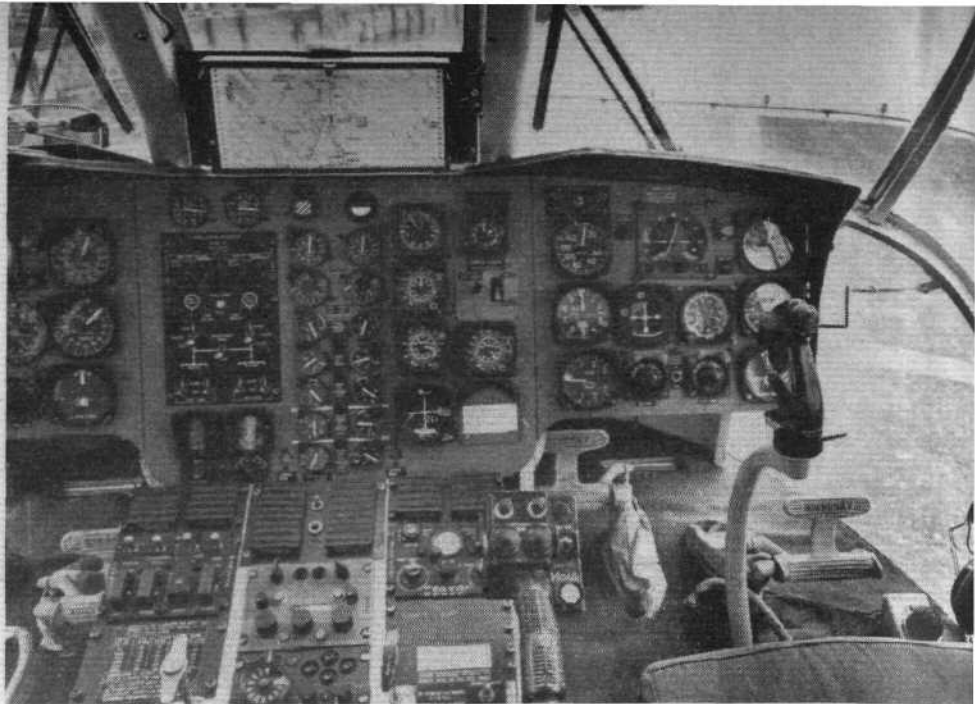
Asked about this statement a Ministry of Aviation spokesman said that no request had been made to the Ministry to approach the Turkish authorities for a review of the accident investigation. A BEA spokesman said that the airline had no reason to suppose that the original findings of the investigation did not still stand and that agreement would probably be reached without court action.

Dr J. Graham Taylor has been appointed director of medical services of BOAC and BEA and will take charge of the new organization which is to serve the two corporations. His deputy will be Dr A. S. R. Peffers.

New ARB Headquarters From March 29 the headquarters of the Air Registration Board will be at Brabazon House, Redhill, Surrey (Redhill 5971). The board's present offices in Chancery House, London WC2, will close from 6 p.m. on March 24.

Eastern's Order for 24 DC-9s (see last week's issue, page 312), is for an "advanced" model with an increase in overall dimensions, including greater wing area, and with special high-lift devices to improve the small-field performance. Certification and delivery of this developed version will be from November 1966. From March 1966, Eastern will lease a total of 15 standard models which will later be exchanged one by one as the airline's own DC-9s are delivered.

One of BEA Helicopters' S-61Ns was used on March 3 to take a party of 15 MPs from Battersea Heliport, London (picture below), to the heliport at Issy in Paris. This was the first centre-to-centre commercial helicopter operation between the two cities. The picture on the right shows the captain's instrument layout with the Decca Flight Log and, on the right of the central panel, the three decometers and lane-identification meter



AIR TRANSPORT...



West Coast Orders DC-9s Three Douglas DC-9s have been ordered by West Coast Airlines for delivery starting in July 1966. They will be 76-seaters.

Mr Brantz Mayor has been appointed vice-president, Europe, of the Boeing International Corporation. He was previously European director. In his new position he will, in addition to other duties, represent Boeing's interest in Bölkow.

A Second F.27 Mk 100 has been ordered by Flugfelag Islands (Icelandair). This is due for delivery in April next year. The first F.27 will be delivered in May this year. Including two F.27s sold to a so-far unnamed customer, the total F.27 sales by Fokker and Fairchild total 317.

First Super VC10 Flight to New York was made on March 7 in 6hr 54min and was followed by a three-day demonstration programme. There will be two more proving flights which will take in other American cities, including Washington, Boston and Chicago. The Super VC10 is laid out for 139 passengers (109 in the Standard VC10) and will enter North Atlantic service on April 1.

CAA's One-Elevens will take over all present Viscount services on the routes Salisbury - Johannesburg, Bulawayo - Johannesburg, Salisbury - Durban and Salisbury - Ndola/Blantyre - Nairobi, and will not be used, as a correspondent suggested (see *Flight* for February 25, page 283), only for supplementary services. The airline tells us that it has no intention of operating a direct Salisbury - Nairobi service.



Capt Kenneth Deadman, former BOAC senior pilot, has been appointed careers officer at the College of Air Training at Hamble.

First DC-4 for Invicta An 80-seat DC-4 has now been delivered to Invicta Airways at Manston Airport and will enter service on March 20.

Mr John Ford has been appointed chief press and information officer for Qantas in the UK and European region, based in London. Formerly deputy chief press and information officer at the Qantas headquarters in Sydney, Mr Ford will be assisted by Mrs Julia Bradbury, who is publicity officer (London).

The Hunt Trophy, awarded by The Guild of Air Traffic Control Officers for the most outstanding contribution to ATC during the previous year, has been given to the North Western Lodge of the Guild for its work in fostering and organizing training courses for prospective controllers. The first of these three-year courses started in September 1963 at Wythenshaw Technical College.

CAB Asks for All-cargo Information The CAB will, from April 5, require separate semi-annual reporting of costs, revenues and traffic for scheduled all-cargo services of US carriers other than local-service, helicopter, intra-Alaskan and intra-Hawaiian operators. This requirement, which will be operative for three years or less, is designed to provide the board with more detailed information about air freight and all-cargo services.

Formula for an Independent ATLB

THE following suggestions are made by Mr M. A. Guinane, former deputy managing director of Cunard Eagle Airways. He wants the Air Transport Licensing Board to be strengthened so that it can act in a completely independent manner and become in fact the sole authority, under the law, of British air transport and the repository of all British air transport economic expertise.

Public Interest The main charge laid on the ATLB should be that they function **IN THE PUBLIC INTEREST**—that is, in the interest of the customers as well as of the airlines.

Standard Accounting Formula Without a standard formula for the preparation and submission of airline budgets and accounts, the board cannot be expected properly to assess economic argument. Standard formulae for direct operating costs, contribution of revenue over direct costs and allocation of overheads should be defined. So as to bridge the corporation/independent gap further, all airlines should be required to publish their accounts.

Pooling The board should be empowered to approve and monitor all commercial agreements and all amendments thereto. Since such agreements are used in support of operators' cases the board should be as knowledgeable about such agreements as the operators concerned.

Government Contracts All Government contracts should be made subject to the same licensing procedure as other operations. It is ridiculous that such a large part of the British air effort should be outside the ATLB's jurisdiction. The board should act as the Government's agent—the Government department merely ensuring that the "conditions" are met.

In this way the board would be able to assess the impact on operators of their bids and be able to weigh other economic factors. This procedure would tend to eliminate the present "cheapest gets it" policy, which debases the value of British air transport. Coupled with standard costing formulae it would help to alleviate the fears of the independents that the corporations could undercut them at the public's expense.

Foreign Permits The board should have discreet power of authority over all foreign operators in concert with the relevant Government departments. In this way the board could give full consideration to foreign competition and be in a position to assess properly the

balance between protection for British airlines and the need to give full consideration to foreign operators in accordance with the accepted tenets of international reciprocity.

This proposal would also eliminate the present system whereby a travel agent, after being refused an IT licence with a British operator, can by-pass the board by going to a foreign operator.

Traffic Rights Unless the ATLB has control over traffic rights, it cannot do justice to British applications for international services or amendments thereto. It is ludicrous that such a vital sector of the airline industry should be outside the ATLB's control. This ties in with the suggestion that pools become subject to the board.

International Tariffs This is a vital sector which should be placed, like domestic tariffs, under board jurisdiction. Hearings will never be conducted or decisions thereon made properly until the board can consider and have authority over price policies in relation both to current and to future estimates.

Validity of Licences All scheduled service licences should be granted without expiry date. In this way operators would be given some security of tenure and have an opportunity for carrying out long-term planning and development forecasting. This would also benefit the British aircraft manufacturers.

Any argument against this can be demolished because the board, for financial reasons, and the Ministry, for technical reasons, can halt operations.

Control of Operations Stricter control should be exercised over the operation of licences granted. Operators should be required to apply to the board before reducing or suspending services. "Use it or lose it" is a good policy.

Appeals The present appeals procedure should be eliminated. It weakens board authority; it forces the Minister to judge between corporation and independent when he is responsible for the well-being of the corporations; it means a re-hearing by one man of a case which has already been decided by the complete board; and it lends itself to frivolous appeals. The only appeal should be to a court of law.

Summary The basic policy for the ATLB should rest on the abiding principle that the transport of people and goods from place to place should be carried out **IN THE PUBLIC INTEREST**.

ACCIDENT REPORT POSTSCRIPT

SEVERAL secondary points emerged from the investigation into the DC-8F-54 take-off accident at London Heathrow on November 6, 1963, the Ministry of Aviation report on which was summarized in last week's issue, page 313. Among them were those relating to the evacuation of the passengers.

No total time for the evacuation of the 90 passengers could be established, but the average individual time estimated by a substantial number of the passengers involved in the accident was about 3min. Fortunately the ruptured fuel tanks were in the starboard wing, whereas the post-crash fires involved only engines Nos 1 and 2, which burned for more than 20min. There were more than 16,000gal of JP-4 on board the DC-8F at the time of the accident.

As soon as the aircraft came to a stop the purser opened the main passenger door on the port side at the rear. He did not deploy the escape chute because the ground was only 3ft below the door sill and the chute might, be thought, have hindered rather than helped evacuation. He then opened the galley door on the other side. All passengers except one (who pushed the purser out) appear to have left "in an orderly manner," and most went through the two doors, though others left, after an initial delay, through one of two available emergency exits. One passenger at the forward end of the cabin was not unnaturally concerned about the slow progress of the evacuation and made his way successfully past the cargo in the forward section of the fuselage and out through the forward main door.

The investigation report comments on the limited amount of light available from the emergency system. Some passengers were unable at first to see how to release their seat belts, and failure to read the instructions on the emergency exit wasted more time. Passengers tried to push it out, though it was designed to be pulled in. The use of bold letters "PULL IN" is recommended.

Considering the question of the adequacy of the emergency

exits, the report says that the situation might well have been different if the fire had developed. A diagram in the report shows that four exits—the main and galley doors and two emergency exits—were available for the 90 passengers. As in other similar accidents, there was a wide range of reactions among the passengers. These "varied from hysterical anxiety at one extreme to concern only for their hand baggage at the other."

While passing through New York on her way from Bermuda to London the Queen Mother visited the tower at John F. Kennedy International Airport. With her, left and right, are Mr William Parenteau, the FAA tower chief at JFK, and Caesar B. Pattarini, general airport manager



AIR TRANSPORT...



V₁ V₂ AND ALL THAT

Part 9 of C.C.J.'s "V" Classifications

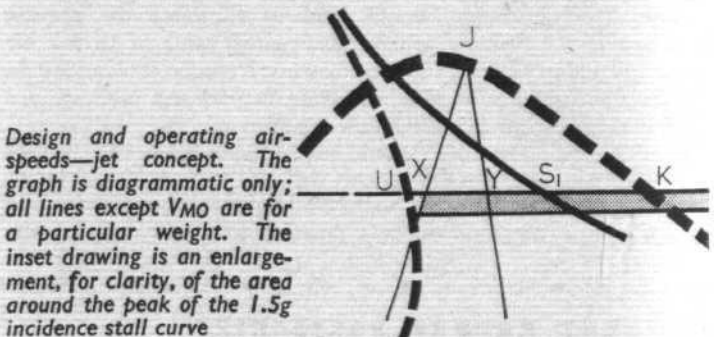
I COMMITTED myself, in the previous article in this series,* to writing something about the high-speed, high-altitude case of the rough air speed (V_{RA}) and its associates. To be candid, I do not know much about it, and the only reassurance I can give myself or the reader is that nobody else knows much about it either. I say this advisedly. Here, for example, is a quotation from the minutes relating to the October 1964 meeting of the NASA Research Advisory Committee on Operating Problems. This represented at the time all they felt able to say on the subject: "Pilots should be given the best possible training on turbulence flying and the avoidance of the stall." This, of course, is fine and dandy, but, with all due respect to that august body, the advice doesn't help us much and, when one comes to look closely at what the various training practices are, one finds a whole series of contradictions.

In relation to turbulence flying, one operator will say, "keep the autopilot in as long as possible"; another will say, "take it out immediately on entering other than slight turbulence." Again, one will say, "don't touch the trimmer or you will be mis-trimmed at the reversal of the gust"; another will say that "most of the turbulence incidents are associated with loss of airspeed, so trim if you have to in order to keep within the recommended speed range"; and yet another will say, "ignore airspeed in turbulence and concentrate entirely on attitude." None actually advocates a climb (unless, of course, the aircraft is a long way from the performance ceiling), but only one, so far as I know, says, point blank, "drop to 8,000ft below the normal operating ceiling for the weight." One operator, in an obviously conscientious effort to be fair and factual, arranged for his pilots to have two lectures on turbulence flying, one by the engineering and one by the operations staff. The

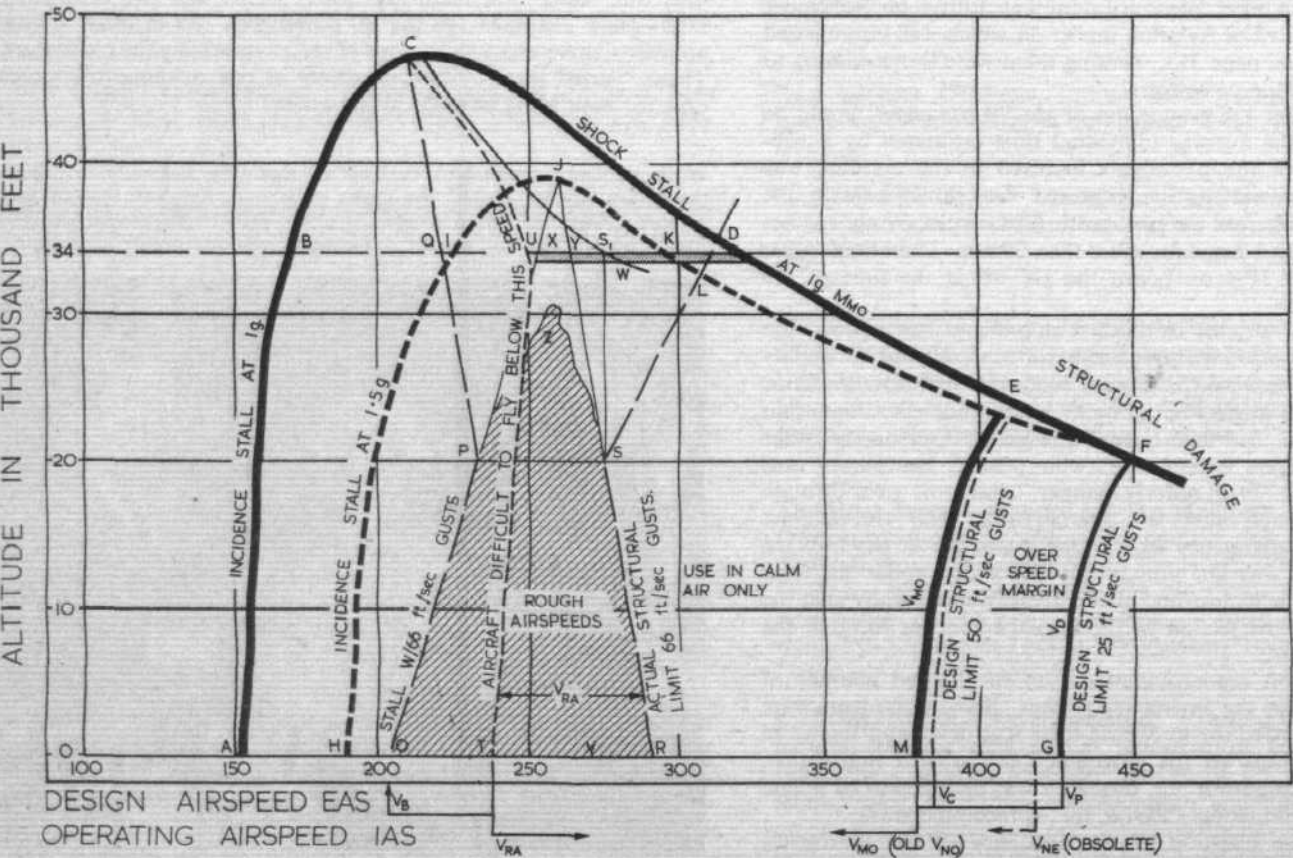
latter advocated flying at the maximum turbulence speed; the former stressed all the maintenance problems which would ensue if pilots flew at that speed.

Among the meteorologists a tendency has been noted here and there to drop the ICAO-defined expression "severe turbulence" and to write out their forecasts in terms of "moderate turbulence or more." This makes sure that, if the pilot (who is usually instructed not to fly in severe turbulence) meets trouble in flight or if he cancels out on the ground, at least everybody else is in the clear.

Among the manufacturers matters are scarcely more rational. One, concerned mainly about the stall in turbulence, overnight claps on 40kt to the recommended rough air speed; another, concerned mainly about tuck-under, modifies the pitch trim compensator and, if nose-down still occurs, recommends immediate use of reverse thrust. Of course, there is some excuse for this



* February 11, page 216.



uncertainty. The speed band represented by Mach 0.7 to 1.2 cannot be satisfactorily studied in a wind tunnel because of the choking effect of the shock-wave. However, that could be overcome by air-testing at altitude—a procedure which most manufacturers and certificating authorities are slowly coming round to, though the actual regulations are still a long way behind and, for the most part, are written in terms of controllability demonstrations at "altitude optional."*

With this background to the problem of upper-level turbulence procedures and, at the present time, with nothing in FARs, BCARs, or the ICAO Annexes in the way of recommended criteria for rough air speeds or techniques, we can scarcely hope to come up with a really satisfactory definition of V_{RA} . In fact, one might well be excused for taking the easy way out and producing a definition on these lines: "The rough air speed, V_{RA} , is a speed so selected that if, on encountering turbulence, the pilot stalls the aircraft, or it breaks up in the air, it will be the wrong speed."

However, even if we cannot come up with a watertight definition, we can, I think, outline the case more conveniently from the point of view of the pilot than has been done elsewhere. Such, then, is the object of this and of the next article of the series. It is a strictly limited objective, but, to achieve it without writing a volume, I will have to draw a line at the point where general principles cease to apply and where one enters such disputed areas as the inadequacies of individual designs in respect of elevator effectiveness, or of all designs in respect of attitude-indicating instruments.

These are certainly very much part of the subject of turbulence flying, but, as indicated earlier, I am trying not to be too controversial in this series. Mind you, I am not sure but that at the back of my mind there may well be the intention of arriving at a common language so that I can be controversial in the next. For this purpose the limitations of most elevators, trimmers and horizon indicators will certainly ensure adequate material—but, in order to bring this V_1 , V_2 series to an end, I must here eschew such digressions. I propose therefore to be reasonably conventional and drive on towards a general (i.e., high-level and low-level) description of the rough-air speed and its associates just as if the series of out-of-control-in-turbulence incidents had never happened.

I said "reasonably conventional" because the figure opposite, though fairly copybook in its framework, is somewhat unconventional in the middle (around Z). But, before explaining this or going into a detailed description of the various lines, it is desirable to point out the main differences between this figure, representing the high-speed, high-altitude case for the rough air speed, and the figure appearing with Part 8 of the series, which dealt with the low-level, old-fashioned (i.e., piston-engined) idea of V_{RA} , V_{NO} and V_{NE} .

The most easily noticed differences are, of course, the purely graphical ones—namely that altitude has been introduced as a

principal parameter and that load-factor is shown as a direct function of airspeed. Operationally, the differences are not easy to describe with clarity because, mainly, of the several unconsummated unions between V_B , the design gust speed, and V_{RA} , the rough air speed; between V_C , the design cruising speed, and V_{NO} , the normal operating limit speed; and between V_{NO} and V_{MO} , the maximum operating limit speed. Finally, speed V_{MO} has acquired an upper-level Mach associate, M_{MO} and the two are usually introduced to society as Siamese twins— V_{MO}/M_{MO} . The V_B/V_{RA} and V_C/V_{NO} unidentical twins can be understood by reference to Part 8 of this series. However, before proceeding (in the next article) with our main theme, namely the high-speed, high-altitude case of rough air speed, it would be useful to get this V_{MO}/M_{MO} business defined, since M_{MO} has an important cut-off effect on V_{RA} in the upper levels. Fortunately, V_{MO} presents no problems if it is remembered that, in effect, it is little more than a jet-age re-labelling of V_{NO} .

The margins and other safeguards prescribed in the following definition would scarcely seem to need further comment since they follow closely those described for V_{NO} in Part 8, plus extra safeguards against the additional phenomena associated with compressibility. The warning margins given in the note express the US values. The British requirements are not yet published in BCARs but, where the margin V_D/V_{MO} is small, the warning must come in at a speed not higher than $V_{MO} + 12\text{kt}$ or $M_{MO} + 0.02M$.

Definition

18. The Maximum Operating Limit Speed (V_{MO}^*/M_{MO}) is the indicated airspeed or Mach number, whichever is applicable to the altitude, which should not be exceeded in any flight regime. It is so selected that, allowing for moderate upsets, the aircraft remains free from buffet or other undesirable flying qualities associated with compressibility. V_{MO}/M_{MO} must not exceed V_C .

Note: Distinctive aural warning must be given at V_{MO} plus 6kt or M_{MO} plus 0.01M, and M_{MO} must be at least 0.05M below V_C .

FAR 191 (a) (1);

603 (k)

711 (a) & (b)

A description of the remaining lines on the diagram and further comment on the V_{RA}/V_{MO} speed group will be given in the next article (Part 10). In Part 11 I hope to tidy up the whole design air speed group by reference to V_A , the design manoeuvring speed, and to a few other left-overs. Then, finally, there is a small performance group connected with approach and landing—and the V_1 , V_2 series will (not without some relief to the author and probably the reader) come to an end.

V_{MO} must be placarded by means of a suitable display on the ASI (the "barber's pole" or "wasp needle"); some Mach meters offer a corresponding display from the speed at which Mach effects become dominant.

Toa Airways, the Japanese domestic carrier, has ordered five NAMC YS-11s—one of which is seen here in the airline's colours—for service introduction this spring



AIR TRANSPORT...

Debating Airline Policy

SHORT of quoting Hansard in full it would be impossible to deal with all the points made during the airlines debate in the House of Commons on March 1. The speeches were unusually long and each of the speakers covered a very large number of subjects. In this summary we have picked out as many as possible of the salient arguments. The details of the announcement by the Minister of Aviation about writing off BOAC's accumulated deficit are given on page 358.

Opening the innings for the Opposition, MR ANGUS MAUDE (Con, Stratford-on-Avon) took some time to warm up while running through the historical background to the airline licensing and other aspects of the situation. However, in his final comments he made a number of vigorous accusations. He said, for instance, that the Minister's policy statement, to the effect that no expansion will be permitted of existing independent frequencies on parallel routes, was "casting the Act and the Licensing Board firmly on one side."



Mr Angus Maude: "The Minister ... is, in fact, casting the Act and the Licensing Board firmly on one side"

The Minister had, in effect, said that there was no longer significance in the criteria which the ATLB had so far applied in deciding its cases. Such factors as "material diversion," the "need or demand for services" and the need to "further civil aviation" were apparently no longer relevant. The Minister was evidently deciding all cases in advance without consideration of any of them.

He said that the Conservative Party thought this policy to be so disastrous that he wanted to make it quite clear that when this party was returned to power it would restore to the independents the opportunities for expansion on scheduled services which the licensing system had intended to allow. The Minister had, he said, produced no shred of evidence or argument to show that the new policy would represent an improvement in the total position. He had not argued that the corporations had suffered "grievously and unreasonably" from the competition of the independents and he had not argued either that the total amount of traffic had been suffering.

In his historical references Mr Maude tried to show that many of the arrangements for maintaining a balance between the corporations and the independents had been similar under Labour and Conservative power. For instance, in the period before 1951 the independents were restricted entirely to charter flights, including the right to tender for trooping contracts. Until now the corporations have never been invited to tender for these contracts. The Conservative Government, after 1951, tried the experiment of permitting the independents to operate scheduled services under associate agreements with the corporations.

By 1960 it was clear that the independents and the corporations had much to offer to air transport and the Civil Aviation (Licensing) Act abolished formally the corporations' monopoly on scheduled services. All airline operators were placed on a completely equal footing before the ATLB, which decided each application on its merits with two tests—one of benefit to the passengers and the other, laid down in the Act, of furthering the development of British civil aviation. Nothing was said in the Act about favouring or furthering the interests of one sector more than another. It could not be said that the freedom given to the independents had done any serious damage to the continued growth of the corporations' traffic. Mr Maude produced figures to show that the two corpora-

tions continued to expand at exactly the same rate as that of the total British air transport effort.

The first major change in the *status quo* since 1960 was the Minister's statement on trooping policy, which he made on November 25, 1964. In this the two corporations were to be allowed to tender for trooping contracts in competition with the independents. At the time the Minister said that he thought that "independent operators are fairly well provided for" and that he did not think "that it is right to place the corporations under a special and to my mind, unfair disability in tendering for these contracts." Mr Maude asked why it was wrong to place the corporations under a special disability in respect of trooping but right now to place the independents under a disability in respect of frequencies on scheduled routes. What the Minister was now doing was to load all the special disabilities on to the independents and to relieve the corporations of nearly all of them.

When, a little later, Mr Maude discussed the restrictions on domestic services, he seemed at first to have missed the main point. He spoke of competitive disadvantages, *vis-à-vis* BEA, of limited frequencies—yet, with the departure of British Eagle from the trunk routes, this situation no longer applies. He spoke too of the Minister's warning that there would be no prospects of increased frequencies for the independents as if this were a complete restriction—yet the warning by the Minister related only to services which were then being operated in parallel with those of BEA.

Earlier he had spoken of the need for the independents to have scheduled services because inclusive-tour charters represented business for only 80 days during the year. He asked whether, if the Minister was against dual designation on overseas routes, this would apply against the two corporations when the licence for one of the independents on a particular route expired. It was obviously bad for the independents that it should be known to foreign governments that they did not have the support of the home Government.

Unless the Government really accepted the contention that competition on the domestic routes was a good thing, why was it



Mr Roy Jenkins: "Choices were not faced, incompatible objectives were simultaneously pursued ..."

that the Minister proposed to appoint to the BEA board a member whose special duties were to look after the interest of the passengers? Was it to be supposed that BEA had not so far been looking after these interests?

MR ROY JENKINS, Minister of Aviation (Lab, Stechford), denied that there had been a switch of policy away from the free competition encouraged by the previous Government. There was, he said, no air service, domestic or international, which an independent could run under his predecessor which it could not run today. It had not been by his edict that British Eagle had stopped its domestic services. It was, he said, "the free decision of Mr Bamberg, and the alacrity with which he took it suggests that he was not altogether sorry to withdraw from his commitment."

The history of the case was that British Eagle asked for unlimited frequencies. This was refused by the ATLB, which offered the airline one service a day. This was accepted. In 1963 the company asked for a big increase and, once, again, the application was

refused; but, on appeal, the then Minister of Aviation gave the airline the right to two services a day on the London-Glasgow route in place of a once-daily frequency. He did not believe that the previous Government would have done much more for British Eagle, but would have dangled a carrot in front of the company's nose and pretended that they might do more in the future. Mr Jenkins did not think that this was a right or sensible way in which to proceed. The choices had not been faced by the previous Government, which had pursued incompatible objectives. He had been asked to provide a statement of the Government's intentions and he had tried to provide this statement.

He mentioned particularly the difficulty in obtaining foreign approvals for traffic rights. These, if obtainable, were often possible only with disproportionate damage to an existing British



Mr Eric Lubbock: "...there has been struck a reasonable balance between the corporations and the independents..."

operator. Because of this, and to avoid the waste of everyone's time, he would be prepared to direct the ATLB, where necessary, to refuse applications. Where no dual designation was involved the Government would continue to press vigorously for foreign approvals. This would also apply when a renewal for the approval came up for negotiation.

Speaking of pooling agreements Mr Jenkins said they had their advantages and their disadvantages, but that it would be a mistake to think that we would escape from the disadvantages by allowing independents on the routes. They participated in pool arrangements just as much as the more established operators. The picture sometimes built up of independents as "rugged free enterprisers in the air," was to a large extent a fallacy. Once in they wanted protection as much as anybody else. This was a field in which poachers turned into gamekeepers more quickly than in some other fields. At the same time the pooling system could sometimes work against legitimate passenger interests. He was dissatisfied with the position on the London-Paris route, where fares and load factors were very high. He would like to see BEA taking the lead in pressing for a better deal.

"Threadbare" Arguments

The issue he had to face was whether or not to move in the direction of unrestricted frequencies. There were some attractions in this policy, but the advantages did not necessarily apply in the long term to air transport with its heavy capital costs. Even in the short term the arguments for competition had been made to look "pretty threadbare" with the decision by BEA to retract its request for increased fares on the main domestic trunk routes.

(Mr Jenkins then turned to the question of BOAC's financial structure and the necessary reorganization. This statement did not directly relate to the main subject of the debate and is dealt with separately on page 358.)

First to speak after the Minister of Aviation was MR ALICK BUCHANAN-SMITH (Con, Angus and Mearns). In a maiden speech he said that one of the greatest weaknesses in Scottish communications was the lack of domestic air links with Prestwick. There were nearly 70 companies of American origin in Scotland which needed easy air links with the USA, but unless one of them happened to be near Prestwick it was simpler to travel by way of London. There was also a vital need for adequate feeder services within Scotland.

MR RAPHAEL TUCK (Lab, Watford) made a special point about the need to improve the financial arrangements for selling British aircraft abroad. He referred specifically to the case of Middle East Airlines which was, he said, pro-British in attitude and wished to replace its Comets. The competitors for the order were BAC with the Super VC10 and Boeing with the 707. MEA needed about five or seven aircraft and the order would be worth £14-£15m. The

USA, he said, intended to slash the price of each 707 by £300,000 and to grant credit facilities extending over ten years. The British manufacturer was also reducing its price, but could offer only seven years' credit. This order was of major importance because MEA was a "very big trend-setter" in the Middle East, and its decision would have a marked effect on the re-equipment plans of other airlines in the area.

MR F. A. BURDEN (Con, Gillingham), who is a director of British Eagle, explained some of the background history of the airline's services on the domestic trunk routes. The Minister, he said, had talked about the London-Paris route, and how he hoped to improve it—but the point was that this route was less able to carry a second airline than that from London to Glasgow which had the densest traffic in Europe. He asked the Minister to look again at the whole matter. He did not believe that Mr Jenkins was as imbued with nationalization and public ownership as many of his colleagues.

That the Minister's attitude to the independents was perfectly proper was one of the points made by MR J. RANKIN (Lab, Govan). It would, he said, be far better for the independents to open up services in new areas than to try to make easy profits on routes that had already been developed by the State airlines.

MR NEIL MARTEN (Con, Banbury), said that one of the most revealing insights into the mind of the Minister was provided by his expression of opinion of BEA such as that presented by the appointment to its board of a member to look after the interests of the passengers. He referred to the fact that BEA had made good profit during the period in which it had competition on the domestic trunks. There was conflict between the philosophies of the two main political parties. How was this to be solved?

De-nationalize BEA?

He saw little advantage in the fact that BEA was nationalized, His view was that BEA, as a commercial airline, did not want the odium of monopoly to be put on it by the Ministry. Nor did it want Ministry officials looking over its shoulder or Ministers trying, as they had done, to interfere with its aircraft procurement policy. The Government has an investment in BEA of about £100m which was earning 5 per cent interest for the country. This money could be put to better use. Just because BEA had been nationalized for so long was no reason for thinking it should be nationalized for ever.

MR ERIC LUBBOCK (Lib, Orpington), took a middle line over the Government policy and said that the disruption of the airline industry by denationalization would be far worse than anything that had happened since the war. Liberals were, in general, in favour of competition, but unregulated competition did not benefit the airlines or the travelling public. It was much better that those who had considerable and legitimate interests at stake should know what the Government had in mind and this was why he welcomed, in principle, the Minister's statement.

It did not seem likely, in the circumstances, that a limited increase in frequency for British Eagle, had this been agreed, would have helped the airline. He said that British Eagle had not even planned to operate in the summer of 1965 all the services to which they were entitled. Nevertheless, since the airline's proposal for introduction of BAC One-Elevens would not increase by more than 10 per cent the total number of seats on the London-Glasgow route, he asked the Minister to consider a suggestion that British Eagle should go back on to the route as from the spring of 1966 and use One-Elevens. He concluded his speech by saying that, in spite of the anguished cries of some members of the Opposition, a reasonable balance had been struck between the corporations and the independents.

MR W. BAXTER (Lab, West Stirling) said that consideration must be given to British Eagle or another company to take part in some of the more important domestic services. It was not right to expect private enterprise to take the bad routes and not some of the good ones. MR HECTOR MONRO (Con, Dumfries), emphasized the importance of private and executive flying. MR JOHN TILNEY (Con, Wavertree), said that he would welcome BEA on the London-Liverpool route provided that an independent airline were to be allowed on the London-Manchester route.

MR EDWARD HEATH (Con, Bexley) was almost the only speaker in the debate to mention the statement on BOAC's finances. He said that the Opposition would expect a complete and detailed

SPORT AND BUSINESS



On February 19 Cessna flew a new single-engined agricultural aircraft called the Agwagon. Production plans will not be completed until the prototype has been tested under actual operating conditions. Meanwhile details are being withheld, but the aircraft clearly uses many Skywagon components

New Jodel From Dijon To fly in April or May and available for delivery this summer is an exciting new Centre Est Aéronautique four-seater based on the race-winning three-seat Sicile Record. Called the Quadriplace DR 250, the new 140 h.p. aircraft looks similar to the 100 h.p. Sicile Record, but has a cabin 2in bigger all round, an even cleaner external finish and, above all, much more power. The 140 h.p. Lycoming O-320 is the chosen powerplant, while either Lycoming or Rolls-Royce Continental 160 h.p. engines may be specified as alternatives later.

The Quadriplace 250, as its name implies, is a true four-seater as opposed to the two-plus-occasional-two quality of the smaller predecessor. The basic empty weight without optional equipment will be around 1,060lb, which gives a handsome disposable load of 1,065lb within the permitted gross weight of 2,025lb. The c.g. range permits up to 385lb of passengers and baggage to be carried on the rear seats and on the small baggage shelf respectively.

Performance and efficiency are the keynote of all Jodels and the Quadriplace estimates look promising. Cruising TAS on 65 per cent power at 10,000ft is expected to be 155 m.p.h., while the same speed should be achieved at sea level on 75 per cent power. Fuel consumption would be around 7 Imp gal per hour. No price has been quoted by Centre Est but it may be expected to be in the region of £4,250 if the aircraft is imported into Britain.

A Come-back for the Aircoupe Marketed in Britain by Pan Aeronautics Ltd, under the name Aircoupe 415D Club Trainer is a re-worked version of the old Aircoupe F-1A. The outstanding feature of the Club Trainer is its price—£3,450, all delivery charges and taxes paid. The two-seater is supplied with factory-new 90 h.p. Rolls-Royce Continental C90 engines, zero-time components in the all-metal airframe, full night lighting, and a new C of A.

The first Aircoupe Club Trainer should be available for demon-

stration in Britain before the end of this month. The refurbishing of the airframe is undertaken in America in those aircraft destined for European customers and the engines are fitted after arrival in Britain.

While of only modest performance, the Aircoupe has two remarkable features for its low price: an all-metal airframe and a tricycle undercarriage. Empty weight of the aircraft is some 933lb and gross weight is 1,400lb or 1,450lb according to the modification state of the rear spar. Fuel tankage is for 20 Imp gal and there is ample space for radio equipment. The non-aerobatic (claimed to be unspinnable) Aircoupe Club Trainer [will no doubt interest training establishments in this country. Pan Aeronautics Ltd is based at Panshanger Aerodrome, near Hertford, Hertfordshire.

Gliding Awards for 1964 have been announced by the British Gliding Association, as follows:—

de Havilland Cup for gain in height, J. J. Goddard, 16,500ft in a Skylark 3f from Portmoak.

Wakefield Trophy for distance, J. S. Williamson, 274 miles from Upavon to Swindon and return in an Olympia 419.

Volk Cup for declared-point out-and-return, J. S. Williamson for flight listed above.

Seager Cup for best two-seater performance, R. P. Saundby and B. Roberts for 17,750ft gain of height from Bicester in a Blanik.

Douglas Trophy for club cross-country distance (three flights), Surrey Gliding Club for flights by D. B. James, A. D. Purnell and H. V. Howitt.

California in England Trophy for women's distance, Anne Burns, 174 miles from Lasham in a Ka-6.

Frank Foster Trophy for 100km triangle speed, Anne Burns, 43.4 m.p.h. from Lasham in a Standard Austria.

Robert Perfect Trophy for club with proportionally most categorized instructors, (1) Aberdeen GC; (2) Norfolk GC; (3) Cornish GC.

Manio Cup for longest goal flight: no award.



The 140 h.p. four-seat Centre Est DR 250 Quadriplace ("New Jodel From Dijon," above) promises to be a fast and efficient newcomer from France. An interim development aircraft called the DR 200 has been flying for some months and is externally similar to the DR 250 but is powered by a 105 h.p. Potez engine

Marconi AD70 DME

The Marconi AD70 airborne distance interrogator is the only airline DME being manufactured in Europe. The AD70 is a second generation high performance equipment incorporating many new features designed to simplify pilot operation and speed up the acquisition of distance information.

RAPID SEARCH AND LOCK ON

The automatic search circuits scan distance range from 0—200 miles *in 5 seconds* and 40 miles *in 1 second*.

VELOCITY MEMORY

Velocity memory enables the AD70 to continue tracking if the reply signal is temporarily lost.

AUTOMATIC STANDBY

If no signals are received the AD70 will automatically search until a reply signal is received.

CHANNEL EXTENSION

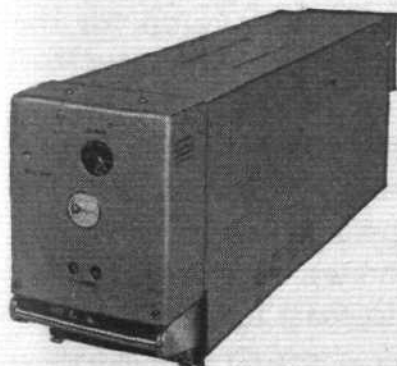
The AD70 provides 126 channels which can easily be increased to 252 channels to cater for future DME system expansion.

SELF TEST

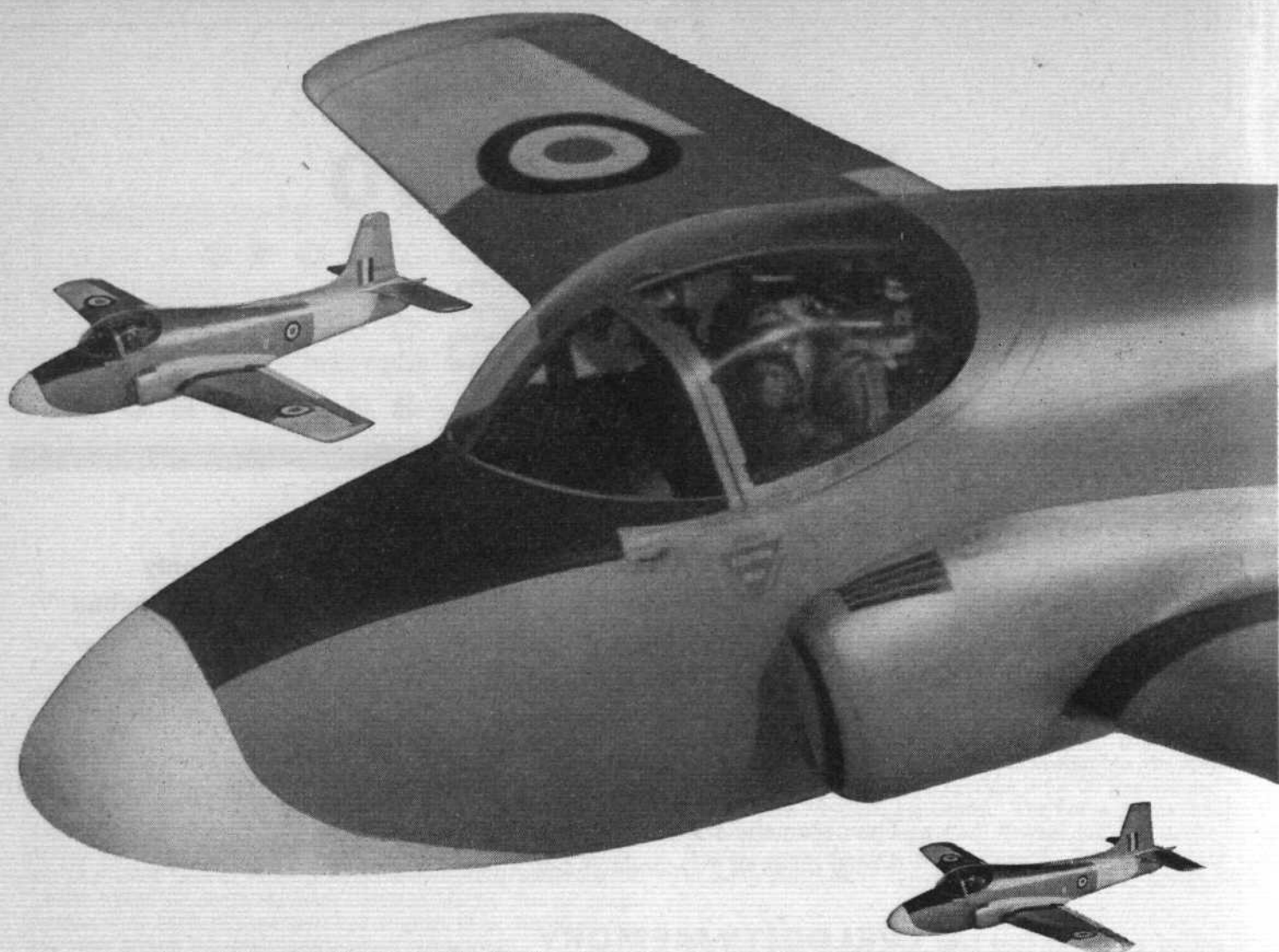
Self Test confirms correct equipment operation.

ARINC SPECIFICATION

The AD70 meets all the requirements of ARINC 521D.



Marconi airradio systems



A NEW JET TRAINER

British Aircraft Corporation has been awarded a contract to develop for the Royal Air Force a pressurised jet trainer, the BAC 145, to be known in the RAF as the Jet Provost T Mk 5.

Design of the BAC 145 is backed by the experience already gained in over 300,000 Jet Provost flying hours and in producing already more than 450 Jet Provosts for the RAF and five overseas Air Forces. Jet Provost flight experience, supplemented by exhaustive fatigue research carried out during actual flying training programmes, enables an airframe life of 15 years, assuming normal utilisation, to be confidently forecast for the BAC 145.

Versatile, and as reliable as the Jet Provost, it retains the well-proven Bristol Siddeley Viper engine and, with its pressurised cockpit will allow protracted training exercises to be carried out at high altitude in safety and comfort thus widening still more the scope of the syllabus that can be undertaken by a single aircraft type.

BRITISH AIRCRAFT CORPORATION

100 PALL MALL LONDON SW1 ENGLAND

SPORT

AND

BUSINESS

Tiger shark nacelles and numerous interior improvements, plus many new electronic options, have greatly improved the Aztec in its C version



REFINEMENTS IN THE PIPER RANGE

PIPER aircraft sold, operated and maintained in this country with great success by C.S.E. Aviation Ltd at Oxford, are steadily developing in comfort and performance. The Cherokee 140 two-seat trainer is beginning to take over from the Colt and proving both popular and able to cope with more difficult weather conditions. There is still some doubt as to whether it will actually spin or not, but it will go through realistic spinning motions though at increasing i.a.s. and at least give some idea of the condition. Formal spinning exercises are carried out in Terriers. The first Cherokee 140 at Oxford flew 496hr during its first six months. Despite higher hourly costs, students prefer them to other types. During the very high winds of January, Cherokees at Oxford were flown for 6hr each day, with pupils departing on cross-countries, when Colts were not even taken out of the hangar.

The Cherokee 180C, latest variant of this horsepower, shows considerable improvements in interior furnishing, smaller cowling, smoother engine mounting, cross-over exhaust system and a generally better feel. It is elevator-limited in the forward c.g. condition in such a way that all stalls are classic but docile, yet minimum power-off flare-out speed not seriously affected. The undercarriage provides exceptional stability with good steering and braking. Spats are now standard. The standard fixed sun-blinds may be necessary in sunny climates, because of the sharply raked wind-screen, but they rather clutter vision otherwise.

With fixed-pitch metal propeller, one occupant and half fuel, the demonstrator made 130 m.p.h. TAS at 2,500ft with 2,300 r.p.m. and 109 m.p.h. TAS at 2,000ft and 2,000 r.p.m., the latter in positively tranquil quietness. Rate of climb at light load was an indicated 1,200ft/min at full power and 80 m.p.h., making regulation circuits possible almost within the airfield boundary. The aircraft is very simple, but pleasant to fly, comfortable and capable of carrying a full complement of radio.

Similar progressive refinements in the Comanche 260 include virtually noiseless fresh-air ventilators, improved heater and fuel injection as standard, with carburettor as a special-order alternative. Most important is that these improvements have not brought price increases. The price has in fact remained constant for two years. The alternator tends to produce a slight whine through the audio system, mostly at low r.p.m. on the ground.

Future prospects for the Comanche may be supposed to lie in the direction of turbo-supercharging and pressurization, if Piper follow the lead of the Mooney Mk 22. The Comanche 400 has apparently met with disappointing response, but the Twin Comanche offers plenty of development prospects.

An excellent device now becoming standard on many Piper types is the electric tailplane trimmer, by which trim can be applied precisely and easily without removing the hand from the aileron wheel. The system is precise enough for fine trimming, acts at a suitable rate and can be immobilized in the remote case of runaway by a quite gentle restraining pressure on the trim handwheel, which remains in the trim circuit. The electric trim motor can then be isolated by pulling the related circuit-breaker. With the appropriate version of the Altimatic autopilot, the trimmer is operated automatically. The Comanche demonstrator, flying at 2,000ft with 2,400 r.p.m. and 24in, about 75 per cent power, trued 180 m.p.h. by the Piper Tru-Speed a.s.i. and the fuel-flow was set in the "75 per cent" sector to give 12.5 Imp gal/hr, or 14.4 air miles/gal.

The Aztec C demonstrator G-ASTE is a veritable electronic centre now, with Dare duplicated com/nav, ARC radio compass, Altimatic autopilot with height hold, automatic electric trimmer

and ILS localizer-only coupling. It also has the King DME, which not only indicates distance from the beacon but will think out a precise groundspeed when flying directly to or from the beacon.

The Aztec is exceptionally good value for money in terms of payload-range, together with short-field capability and good single-engined performance. Noise and vibration have been further reduced, and the electric trim greatly assists cancellation of the nose-up trim change when lowering flap, which is the Aztec's only really unfortunate characteristic. At a conservative 21in and 2,250 r.p.m. the a.s.i. gave a TAS of 170 m.p.h., and the DME a ground-speed, during this flight, of 187 m.p.h. The radio coupler has a useful "nav" mode which takes some of the hunting out of VOR flying. The Gatwick ILS localizer was successfully captured from a 45° cut and the glide-slope was followed manually simply by throttle adjustment either side of about 13in intake pressure. There are now 30 Aztecs of all types in Britain and five to come.

With the increasing British implementation of VOR and the availability of the new small combined com/nav radios, two VORs make an attractive navigation system. During the demonstration flight, the Aztec was flown on autopilot outbound from Upper Heyford VOR—with distance and groundspeed indication from Upper Heyford DME—with cross-bearings from London VOR to a fix exactly overhead Odiham for the turn into the Gatwick TMA.

Piper are now firmly committed to low-wing designs. An intriguing feature is the flexibility shown by the basic Cherokee airframe, which now ranges from the two-seat 140 to a full six-seater. Piper have stretched the Cherokee to 290 h.p. and six seats, with an extra rear door, just as Cessna have steadily expanded their high-wing range up to 285 h.p. and a full six seats.

Ready to fill another major market is the turbo-supercharged PA-31, which should form a very useful stable-mate for the Aztec. It is reported that the window shape has been changed and that the engines have been moved several inches further forward, the latter probably to improve turbosupercharger cooling.



Similar improvements have gone into the Cherokee 180C, above, and the Comanche 260, below





This one-third scale model of a generalized design for a Mach 3 transport is used in the 40ft x 80ft wind tunnel at Ames Research Center to obtain basic low-speed information. The canard model's delta wing is fitted with large flaps on both leading and trailing edges to increase lift at low speeds. Beneath the model but above the floor is a ground plane used to study ground-cushion effects

PROGRESS IN RESEARCH: AMES' WORK REVIEWED

RECENT work by NASA scientists at the Ames Research Center at Moffett Field, 35 miles south of San Francisco, has included developments in a variety of subjects from VTOL and hypersonic transport studies to the structure of the Martian atmosphere. Employing some 2,200 personnel, of whom over one-third are scientists and engineers, the establishment is one of nine major NASA centres in the USA.

Founded in 1940, the centre was named after Dr Joseph S. Ames, chairman of the National Advisory Committee on Aeronautics from 1927 to 1939. Current aeronautical and spaceflight programmes are supported by a large range of test facilities, including conventional wind tunnels, re-entry heating simulators and free-flight ballistic test ranges. Among the recent accomplishments of the centre are the following items, which were reported last month in a review of 1964 activity.

Manned Control of Large Boosters Studies using both fixed and moving cockpit simulators have shown that a pilot can fly large boosters from lift-off to orbit. The pilot successfully stabilizes the booster during initial flight through the atmosphere, and can react quickly enough to counter dangerous wind gusts effects. The pilot can also provide fine guidance outside the atmosphere to achieve the precision needed to reach required orbits.

Hypersonic Transport Studies Long-range hypersonic aircraft have been studied to define technical problems that will require future research. Studies show that an aircraft powered by hydrogen-

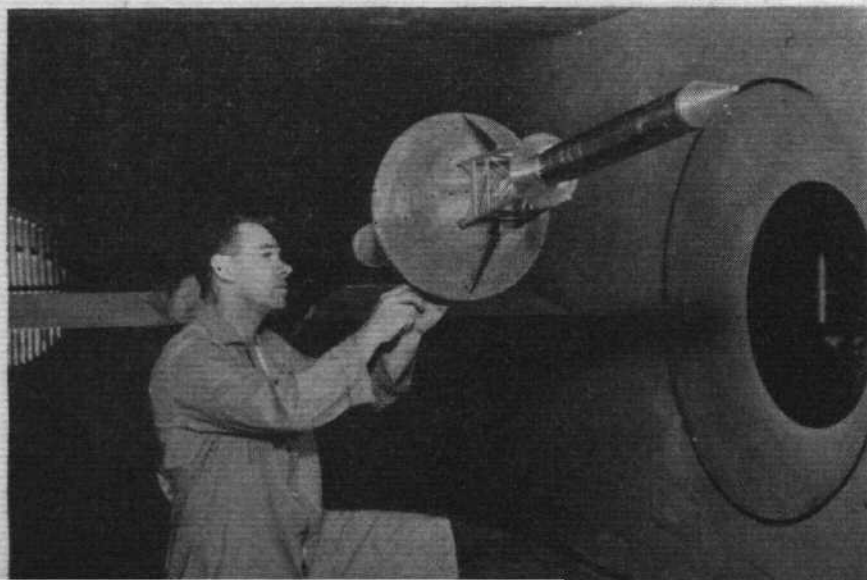
burning, air-breathing engines and travelling at Mach 4-8 has good potential for transports with transcontinental and intercontinental ranges. To achieve this, major research efforts will be needed in use of liquid hydrogen fuels, hypersonic engines, and insulated structures able to withstand external temperatures up to 2,000°F.

New Take-off and Landing Aid A new way to locate the precise position of an aircraft on the runway has been studied, and has been shown to be simple, reliable and accurate. Radioactive sources buried under the runway at intervals activate a scintillator-counter in the aircraft. This provides the pilot with precise data on the position of the aircraft on the runway regardless of rain, snow, ice, or zero-zero weather.

Probe Vehicle to Define Mars Atmosphere Planetary entry research has suggested that a small, lightweight, spherical probe be used to define the Mars atmosphere. Measurements of vehicle motion would indicate structure of the Mars atmosphere. The type of radiation from the hot gas cap at the nose of the probe would indicate what gases make up the atmosphere of the planet.

Improvement of M-2 Manœuvrable Atmosphere Entry Craft An improved design has been developed for the Ames M-2 lifting body. A piloted version called the M-2F-2 will be flown at NASA's Flight Research Center at Edwards, California, later this year. Extensive testing in a number of Ames wind tunnels has shown satisfactory performance, stability, and control characteristics for the M-2.

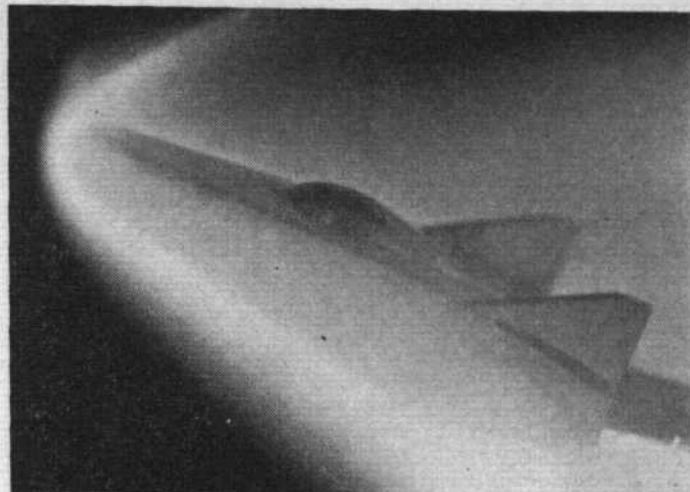
Supporting research for manned spaceflight is an important part of NASA investigations at Ames. Left, the launch escape system of the Apollo command module is readied for aerodynamic testing in the unitary wind tunnel. Right, astronauts Walter Schirra (left) and Gordon Cooper discuss the Ames five-degrees-of-freedom motion simulator with project engineer Hubert C. Vykukal during a visit to the centre



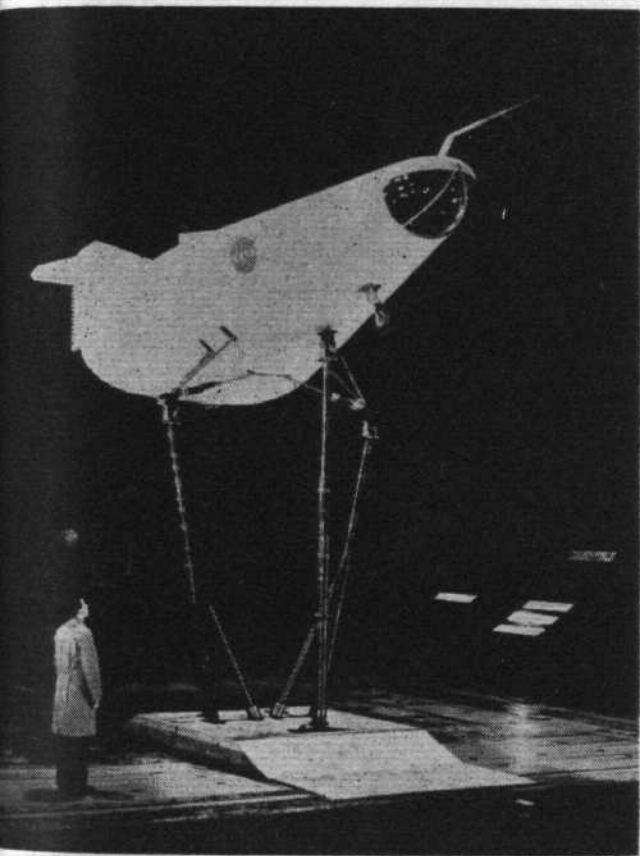
Jet Transport Pilots and Severe Air Turbulence Ames simulator studies have resulted in the following conclusions about effects of severe air turbulence on jet transport operations. Aircraft handling qualities and cockpit layout have less effect on pilot control during violent turbulence than the element of surprise. Most control problems occur when pilots are exposed to hostile flight conditions with which they have had little previous experience. Such conditions are large displacements of their aircraft from the planned flight path and severe structural vibration during gusts. A solution appears to be special simulators to train flight crews under extreme conditions.

Moon and Planet Mission Navigation by Hand-held Sextant Mid-course navigation sightings for missions to the Moon and planets, it has been shown, can be made with sufficient accuracy using a hand-held sextant. Studies were made on the Ames midcourse navigation simulator. A manned flight test of the hand-held sextant is scheduled for the 12th Gemini flight.

Certification Requirements for Supersonic Transport Take-off Ames studies show that FAA performance requirements which must be



A model of the M-2 lifting body is tested in a 1ft hypervelocity wind tunnel. The 4,000ft/sec airflow produces temperatures at the blunt nose of about 9,000°F. In this experiment the heat-transfer distribution was being measured



Flight version of the M-2 lifting-body craft prior to testing in the 40ft x 80ft wind tunnel at Ames Research Center. Conceived and developed by Ames scientists, the M-2 has been flight-tested at NASA's Flight Research Center at Edwards, California. An improved version, the M-2F-2, should fly later this year

show much greater radiative heating than for entry into air. Nitrogen and carbon dioxide (presumed to be major parts of Mars and Venus atmospheres) combine to form cyanogen, which results in about ten times as much radiative heat during entry into these gas mixtures as that during Earth entry.

Heat Shield Performance Improved techniques have been developed to predict performance of heat shields under combined convective (friction) and radiative heating during spacecraft entry into the atmosphere. Ames arc-heated tunnels have been used.

Solar Wind Measurements Ames experiments on IMP-B, launched on October 3, 1964, and OGO-1 (September 4, 1964) are investigating the free-streaming solar wind and its interaction with the Earth's magnetic field. Both satellites travel out beyond eight Earth diameters through the turbulent boundary of the Earth's magnetosphere and are sending back significant information. Determination of the source of the Van Allen radiation belts have been made by Dr John Wolfe of Ames.

New Pod for Vertical-lift Engines Wind-tunnel studies of a pod containing five jet engines mounted vertically, one behind the other, on a wing have shown that all five engines could be started and operated in any sequence, even under the extreme cross-flow conditions of airspeeds up to 170 m.p.h. Bell-mouth inlets, the simplest tested, provided the best inlet flow conditions.

In the hypervelocity ballistic range at Ames Research Center projectiles are launched at speeds up to 17,000 m.p.h. to simulate micrometeorites in outer space. The impacts of such projectiles on spacecraft and on simulated lunar surfaces are studied in detail

met to certify transport aircraft for the critical take-off phase can be derived from ground-based flight simulator tests. Comparisons of simulator and flight tests of a DC-8 aircraft have shown good correlation. It appears that the simulator can be used to determine standards for take-off certification of the supersonic transport.

Convective Heating of Spacecraft in Planet Atmospheres Analysis of spacecraft heating during wind-tunnel test in various gases has shown a simple correlation that will permit estimates of maximum heating in any gas. This allows calculation of heating in a variety of gas mixtures (such as air, or carbon dioxide and nitrogen). It avoids having to make physical tests of the many gas mixtures now being suggested for the atmospheres of the planets.

Radiative Heating in Planet Atmospheres Spacecraft entry tests into simulated planet atmospheres at speeds of 10,500-21,700 m.p.h.





The new museum will be a 784ft-long structure of textured cast granite, tinted glass and dark anodized aluminium

US AIR HISTORY UNDER ONE ROOF

ASSUMING that Congress comes forth with a requested \$40m (writes a US correspondent) a massive, ultra-modern monument to American aviation history will soon appear in the shadow of the Capitol in Washington. This new National Air and Space Museum is to be located directly across the Mall from the National Gallery of Art, and is expected to attract up to 50,000 visitors daily.

Recently unveiled plans for the long-awaited structure show a building 784ft long, 250ft wide and nearly 100ft high. Within it will be more than 300,000 sq ft of exhibition area, 100,000 sq ft for research facilities, a 1,200-car underground garage, a large cafeteria and an auditorium seating 350 people.

The exhibition halls will be as extensive as 180ft by 65ft, and as high as 110ft from the sunken floor to the skylight. About 60 major items of aircraft and spacecraft are to be displayed at one time, with some being rotated to give the public an opportunity to view as many of the museum's 200-plus historic aircraft as possible.

At present the Museum's main Air and Space Building is a small, "temporary" World War I Quonset-type hut, containing such exhibits as Wiley Post's Lockheed Vega *Winnie Mae*, the *Vin Fiz* (the Fokker F.IV that made the first US coast-to-coast flight), the Bell X-1 and smaller space items such as recoverable capsules and some of Dr Robert Goddard's later rockets. The choice items—the Wright Flyer and Lindbergh's *Spirit of St Louis*—are in the nearby Arts and Industries building of the Smithsonian Institution, along with Doolittle's 1925 Schneider Cup winner and a collection of Wright and Langley craft from the earliest days. The large modern missiles, because of their size, are simply parked outdoors.

Most of the aircraft awaiting display are stored in a warehouse complex near Washington—some in crates, some out in the weather, and still others undergoing restoration in the well-equipped shop. Here are more than 50 types of captured German and Japanese World War Two aircraft, and numerous others thought to have been lost but actually just spirited away by the thoughtful museum staff before the fates could take over.

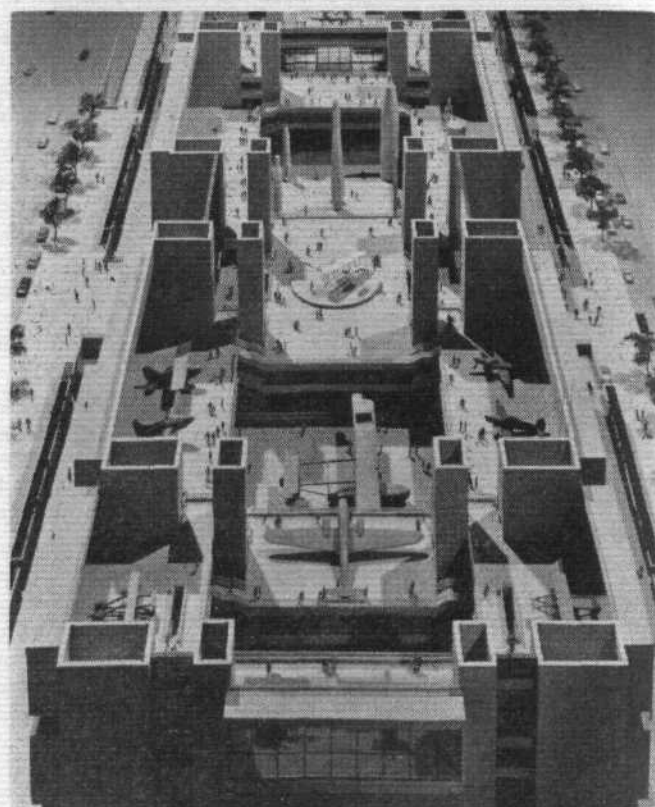
When the new building is completed, many aircraft now on loan to other museums will be brought back. Even so, limitations of space make it doubtful that anything larger than a DC-3 can be shown, thus forcing such historical types as the B-29 *Enola Gay* (first atomic bomber) to remain in storage.

In addition to aircraft and spacecraft, the building will house special exhibition areas devoted to educational displays explaining aeronautical and astronautical sciences, where development will be

traced with actual hardware, models and a variety of audio-visual devices. Above the display area will be a one-storey historical research centre, consisting of a library, document centre, conference rooms and study areas.

Assuming Congressional approval of construction funds before this year is much older, the museum could be open in 1969—to present, according to Director S. Paul Johnston, "a balanced story of where we have been, where we are, and where we are going."

This model of the interior shows how some 60 complete aircraft and spacecraft will be displayed, surrounding the Wright Flyer in simulated flight



DIARY

- Mar 11** RAF Reserves Club Ball. London Hilton Hotel, W1, 7.30 p.m. to 2 a.m.
- Mar 12** British Interplanetary Society Yorkshire Branch: "BIS Educational Programme," by Dr N. H. Langton, Hull.
- Mar 12** Institute of Navigation: Discussion, "Height Measurement in Supersonic Aircraft." Royal Geographical Society, 1 Kensington Gore, London SW7, 5.30 p.m.
- Mar 16** RAeS Leicester Branch: "Experiences as a Test Pilot," by T. P. Frost. Loughborough College of Technology, 7.30 p.m.
- Mar 17** Guild of Air Pilots and Air Navigators: Professional licence holders' meeting. Fortes Airport Hotel, 5 p.m.
- Mar 17** Kronfeld Club: "In Search of Flying," by Ian Scott-Hill; 74 Eccleston Square, London SW1, 8 p.m.
- Mar 17** RAeS Coventry Branch: "The Buccaneer," by R. D. Boot. Herbert Art Gallery, 7 p.m.
- Mar 17** RAeS Hatfield Branch: "Aviation and Agriculture," by Air Cdre A. H. Wheeler. HSA Senior Staff Restaurant, 6 p.m.
- Mar 17** RAeS Isle of Wight Branch: "Saunders-Roe—Three Decades (1929-1959)," by F. A. Kerry. Saunders-Roe Sports and Social Clubhouse, 6 p.m.
- Mar 17** RAeS Manchester Branch: Chadwick Memorial Lecture, by Dr S. G. Hooker. College of Science and Technology, 7 p.m.

- Mar 17** RAeS Preston Branch: "Man-powered Flight," by Prof T. R. F. Nonweiler. Queen's Hotel, Lytham, 7.30 p.m.
- Mar 18** RAeS: "A Systemworthiness Concept for Aircraft, Airmen and Environment," by G. Prill; 6 p.m.
- Mar 18** RAeS Cambridge Branch: "The Private Aircraft," by F. H. Robertson. University, 8.15 p.m.
- Mar 18** RAeS Gloucester and Cheltenham Branch: "Parachuting and Air Dropping of Supplies and Equipment," by Maj T. Adams and Maj J. A. Evans. Wheatstone Lecture Hall, Gloucester, 7.30 p.m.
- Mar 18** RAeS Halton Branch: "Large Aircraft Operations in the United States Navy," by Cdr J. J. McGrath. Branch HQ, 7 p.m.
- Mar 18** RAeS Yeovil Branch: a.g.m. Park School Hall, 7.30 p.m.
- Mar 19** Society of Licensed Aircraft Engineers & Technologists: "Introduction of the BAC One-Eleven," by F. A. Laker. Royal Institution of Naval Architects, 10 Upper Belgrave Square, London W1.
- Mar 19** British Interplanetary Society Western Branch and Bristol Astronomical Society: Joint meeting, "The Moon," by Patrick Moore. Bristol University, 7.30 p.m.

Note: RAeS lectures other than those given at branches take place in the Society's lecture theatre at 4 Hamilton Place, London W1.

HINDUSTAN HJT-16 KIRAN

INDIA'S PRIMARY TRAINER

NOW well advanced in its flight tests at the Bangalore division of Hindustan Aeronautics Ltd is the first wholly Indian-designed jet aircraft, the HJT-16 basic/intermediate trainer for the Indian Air Force. Production of the aircraft is now beginning, alongside that of the HF-24 Maruta fighter, and it is expected that the first HJT-16 deliveries will start to IAF training schools towards the end of next year.

The background of the HJT-16 was given in *Flight* for October 1, 1964, soon after the first flight, but to recap briefly: design began in April 1961, to an IAF operational requirement, and initially employed 15 engineers under chief designer Dr V. M. Ghatage. The team was subsequently enlarged to 35, but effort was then concentrated on the HF-24 and during the first half of 1963 work on the HJT-16 was continued only on a low priority. Design work was accelerated once again late in 1963 and construction of the prototype began in November of that year, leading to a first flight on September 4, 1964.

The Kiran is a wholly conventional, workmanlike aeroplane which displays no radical or fussy features but is well tailored to both the IAF's needs and the present capabilities of the young Indian aircraft industry. In particular, it is matched to India's climatic conditions in having full pressurization and air conditioning. In the Viper 11 of 2,500lb static thrust, the designers have chosen a well established engine from Bristol Siddeley, with which Bangalore already has close links in the licence production there of Orpheus variants for licence-built HS Gnats and for the Maruta.

The side-by-side cockpit appears spacious and is equipped with Martin-Baker Mk 4 lightweight ejection seats with a ground level/90kt survival capability. There are duplicated blind-flying panels

and a single, central, engine panel. ADF and a ten-channel VHF transceiver, with a single-channel stand-by set, are installed.

The airframe is designed for a manoeuvring load factor of 6.67g and ultimate load factor of 10g. Large plain flaps and a wing of reasonable thickness: chord ratio combine to give a low stalling speed of 70kt. Airbrakes described as being suitable for use during formation flying are fitted. Tailplane incidence is variable to give pilots experience of this type of trimming control. The forward view over the sharply tapering nose appears to be particularly good. The engine-air intakes are starkly simple, probably in the interests of simplicity and to avoid structural complications at the wing root. The cockpit transparencies are, probably for similar reasons, single curvature panels leaving a rather angular windscreen arch profile.

No mention has yet been made of arming the Kiran, in the way that most jet trainers are now being adapted as training/attack aircraft, but the Kiran affords large uncluttered underwing and lower-fuselage areas where such capability might be installed. Already built in is the ability to carry two 50gal underwing tanks to supplement the 250gal internal tankage.

HINDUSTAN AERONAUTICS HJT-16 KIRAN

Bristol Siddeley Viper 11, 2,500lb static thrust

Span, 35ft 1in; length, 34ft 9in; wing area, 204 sq ft; gross weight, 7,495lb; wing loading, 36.6lb/sq ft; fuel capacity, 251 imp gal internally, plus two 50 imp gal underwing tanks.

Performance Max speed at sea level, 420kt; diving speed, 500kt; stalling speed, full flap, 70kt; rate of climb at sea level, 4,475ft/min; take-off run, 1,215ft; landing run, 1,115ft; time to 30,000ft, 10min; service ceiling 42,000ft; maximum range and endurance at 30,000ft with full internal fuel, 520 n.m. and 2hr 40min; maximum range and endurance at 30,000ft with full internal and external fuel, 760 n.m. and 3hr 26min.

The Kiran's functional lines are well displayed in the heading photograph. On the left, below, the Indian Minister of State for Defence Production, Mr A. M. Thomas, shakes hands with Hindustan's chief test pilot, Gp Capt S. Das, after formally naming the trainer at Bangalore



Design of the intakes for the Viper 11 engine reconciles adequate performance with the benefit of a simple wing-root structure

In the Garden of Aden

Lunar landscapes—deserts, bare and rocky crags, empty wadis—are the setting of varied RAF and Army Air Corps operations based on Aden, as an uneasy peace is kept in the numerous small States of the South Arabian Federation. Like fish far from water, maritime reconnaissance Shackletons of 37 Sqn fly policing missions in addition to discharging their less arid duties over large areas of the Indian Ocean and Persian Gulf. A Shackleton MR.2c flies along the Wadi Bana (pictures 1 and 2), in the Aden Protectorate, its maritime sea-grey topsides seemingly well camouflaged for this particular overland role. Newly decked out in standard tactical drab, the first camouflaged Beverley big lifter of 84 Sqn climbs out from Khor-maksar (3). Lighter loads than those the Beverley engulfs are the concern of 78 Sqn Twin Pioneers, which fly them into forward landing strips throughout the area, in support of land forces. A Twin Pioneer climbs out of Monk's Field (4), a forward Army base near the Yemeni frontier, a dust cloud marking its departure from lunar desolation. When force is needed, the Hunter FGA.9s of 8 and 43 Sqn are called in. A pair from 8 Sqn fly past the striking and apparently impregnable mountain-top town of Al-Kara (5) and a typical intimidating rockface (6).

"Flight" photographs by Michael Barnes

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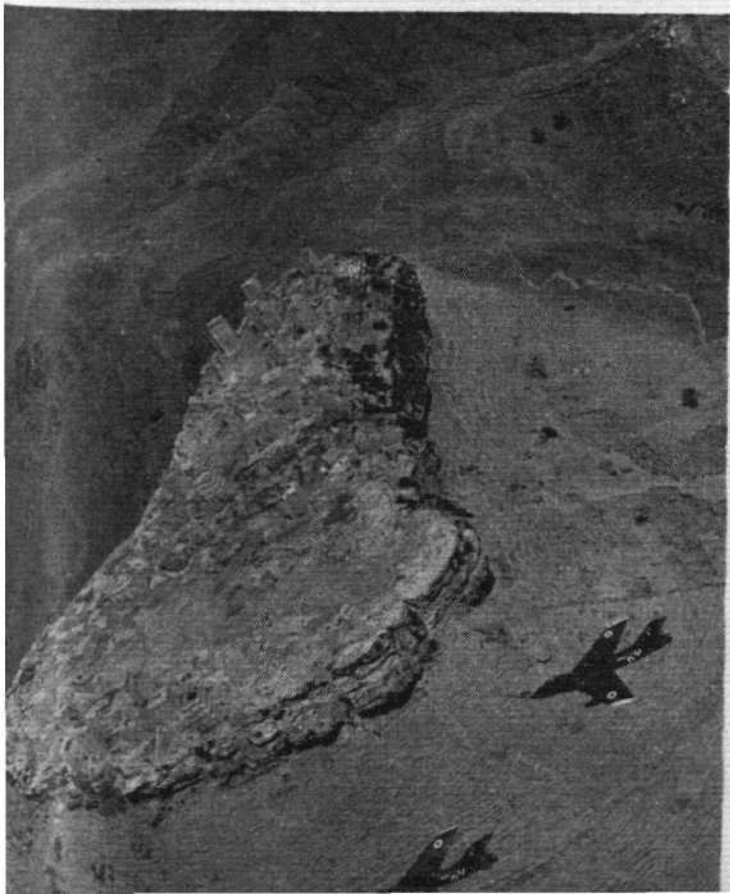


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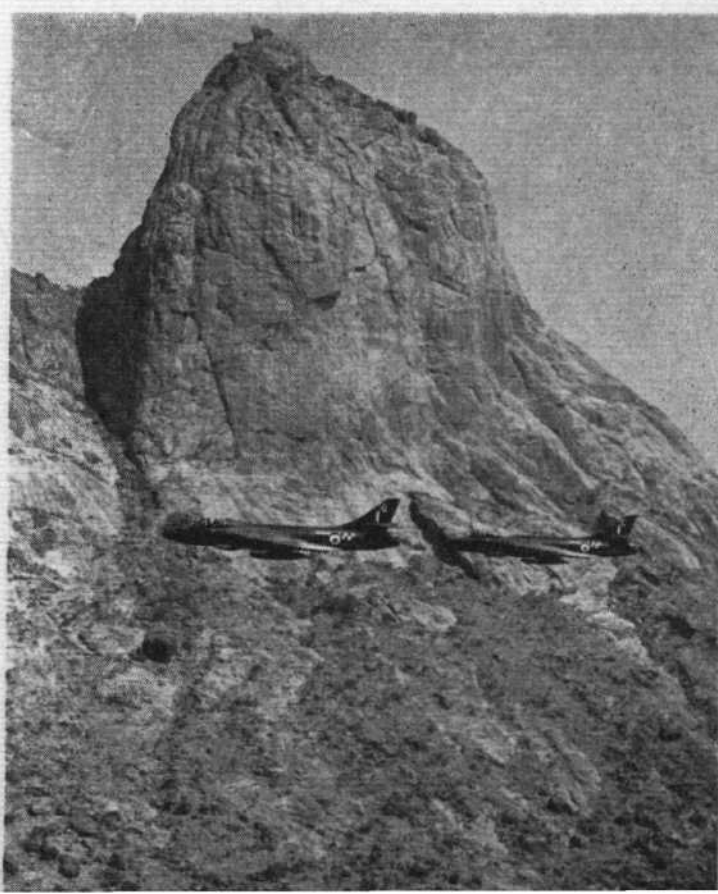


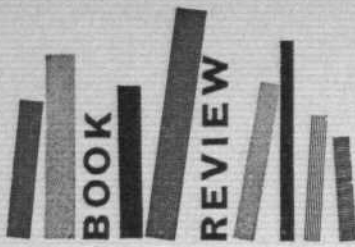
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The Pen and the Air

RECENT AVIATION LITERATURE REVIEWED BY HUMPHREY WYNN

ON the afternoon of February 23, 1909, a biplane of wood, wire and silk, with a 49ft wing span and an eight-cylinder engine with chain-driven propeller, rose from the frozen surface of Baddeck Bay, Nova Scotia, after a run of about a hundred feet. It flew for approximately half a mile at between 10ft and 30ft, then landed softly on the ice.

At the controls of *Silver Dart*, as it was called because it had a partial silver finish, was a young man of 23, J. A. D. McCurdy, a native of Baddeck; and his flight, the first in Canada, ensured him a place in Canadian history. But how many people who have heard of McCurdy know of him as treasurer and assistant engineer of the Aerial Experiment Association, and of *Silver Dart* as the Association's Aerodrome No 4? ("Aerodrome" will be explained subsequently.) How many know that the chairman of this pioneering body was Alexander Graham Bell, inventor of the telephone, and that the director of experiments was a young American, Glenn Hammond Curtiss?

Chief engineer of this talented body was F. W. (Casey) Baldwin; and the story of what they achieved in that corner of Canada is told in a worthy volume with the rather forbidding title and subtitle *Bell and Baldwin—Their Development of Aerodromes and Hydrodromes at Baddeck, Nova Scotia*. Written by Dr J. H. Parkin, who was formerly Director of the National Aeronautical Establishment, National Research Council of Canada, this describes in detail not only the Association's early experiments with "aerodromes" (Bell adopted Samuel Pierpont Langley's name for flying machines) but also later work by the Canadian Aerodrome Company and the Bell Laboratory.

Next to the great Dr Bell, whose many-sided genius ran through all the far-sighted aircraft experiments at Baddeck, Casey Baldwin is Dr Parkin's hero. He made the first public flight (March 12, 1908) in a heavier-than-air machine in America; but he was a modest, self-effacing man and this "self-abnegation has resulted in McCurdy, instead of Casey, being generally regarded as the first Canadian aviator." Dr Parkin is modest too, his excellent book being prefaced by an 18th-century type of disclaimer: "the author hopes that the drawbacks of his inexperience as a writer and his technical style and vocabulary may be somewhat mitigated by his bringing to the task some familiarity with the subject resulting from an association with aeronautics dating from the time of the Aerial Experiment Association."



Cecil Lewis is another author who brings to his task "some familiarity with the subject," dating from the time of the Royal Flying Corps. He also brings a light touch, a witty pen, a natural style; he exults in writing about flying as he exulted in the joy of it, and his essays in *Farewell to Wings* are a delight to read, as Leonard Bridgman's illustrations are a delight to the eye. For the connoisseur, here is what it felt like to fly the Maurice Farman Longhorn, Morane Parasol, Spad, Albatros, and many other types; while for the ordinary reader Lewis expresses the sheer pleasure of flying: "The earth that bore us was so far below we had not to remember it. We lived like spirits in an airy loom striking great arabesques of flight across the weft of evening."

Another man who found pleasure in flying is Col Hubert Julian, the negro "Black Eagle" whose extraordinary life story is related (by John Bulloch) in a book of that title. By occupation an international arms dealer, Col Julian was taught to fly by "Billy"

Bishop; patented a "parachuttagravepreresista"—a safety device for "lowering a disabled plane gently to the ground"; became a parachutist; planned to fly from New York to Liberia in a Boeing seaplane; took part in flying displays in the US; and became the Emperor of Ethiopia's personal pilot, making the first parachute jump in that country and being awarded the title of colonel.

These three books all hark back to earlier days of aviation, and so do two recent American publications, *LZ 129 "Hindenburg"* by Douglas H. Robinson and *The Douglas DC-3* by Len Morgan. Airships are about as far removed from modern aviation as dinosaurs from animal life, and anything written about them has its own fascination—almost like reading about the design of, and life aboard, the *Mayflower* or Nelson's *Victory*. The DC-3, however, is still with us and apparently irreplaceable; and Len Morgan's description of his first experience of flying this aircraft vividly recalls one's own first acquaintance, at the outset of what became a love affair.

Another book which links the past with the present is Bruce Robertson's *British Military Aircraft Serials 1912-1963*, a small but valuable work of reference which details by serial numbers every military aircraft produced in Great Britain over the past 50 years.



Aircraft in the news at present are chronicled in William Green's *The World's Fighting Planes*, and those wishing to know basic facts about such aeroplanes as the TSR-2, F-111, P.1127, Mirage III, Phantom and Viggen can benefit from these pages. Those in search of facts about these specialized aspects of flying—as seen from an American viewpoint—can find them in three "Modern Aircraft Series" books: *Agricultural Aviation Guide*, by Alan Hoffsommer (whose picturesque account of his introduction to the subject is backed by solid subsequent experience); *Instrument Flying Guide*, by Robert T. Smith; and *Aviation Radio for Pilots*, by Jim Holahan.

Finally, model-makers will find much to stimulate and interest them in *Aero Modeller Annual 1964-65*, which has on its cover a representation of a Concorde taking off with a muscle-powered ornithopter in the background. Does this imply subjects for modelling and, if so, how do you make the model man to power the ornithopter?

THE BOOKS REVIEWED

Bell and Baldwin. J. H. Parkin, £6, Toronto University Press; London: Oxford University Press.

Farewell to Wings. Cecil Lewis; illus, 18s, Temple Press.

Black Eagle. Col Hubert Julian (as told to John Bulloch), illus, 25s. Jarrolds (London).

British Military Aircraft Serials 1912-1963. Bruce Robertson; illus, 25s, Ian Allan (Shepperton).

LZ 129 "Hindenburg", Douglas H. Robinson; and *The Douglas DC-3*, Len Morgan. Both Famous Aircraft Series, illus, 22s 6d post free, Morgan, Dallas. (Available from W. E. Hersant Ltd, The Cholmeley Bookshop, 228 Archway Road, London N6.)

The World's Fighting Planes. William Green; illus, 30s, Macdonald (London).

Agricultural Aviation Guide, A. Hoffsommer; *Instrument Flying Guide*, Robert T. Smith; *Aviation Radio for Pilots*, Jim Holahan. Modern Aircraft Series, Crown Publishers, New York. (Available from Graham K. Scott, 2 The Broadway, Friern Barnet, London N11.)

Aero Modeller Annual 1964-65. Edited by D. J. Laidlaw-Dickson and R. G. Moulton; illus, 10s 6d. Model Aeronautical Press Ltd (Watford).

Letters

Letters for these columns are welcomed, though "Flight International" does not necessarily endorse the views expressed. Name and address should be given, not necessarily for publication in full. Brief letters will have a better chance of early publication.

Saving British Light Aviation

SIR,—Referring to the complaints of your correspondents about the lack of suitable British light aircraft, in order to put the records straight I would like to point out that our company has been producing limited numbers of single- and two-seat light aircraft for several years. One of these aircraft has been recently approved by the Air Registration Board for a full British C of A, and the other is in the process of being approved. Furthermore, we have a small but skilled team of craftsmen who will continue to develop and produce light aircraft in the future.

It is very fashionable among economists to say that to develop an export product one need not have a home market. In the case of light aircraft nothing could be further from the truth; what is needed is a missionary enthusiasm from Government departments, landlords, local authorities and airworthiness authorities to promote light aviation in this country and remove obstacles to its development.

It is very sad to note that the Ministry has failed to recognize this; by removing the petrol rebate it has destroyed a small but widespread stimulus to an infant industry; and in the absence of other alternatives, such as promotion of facilities, I fail to see how direct subsidies to manufacturers can help in the long run. How can we expect to sell light aircraft abroad if we do not fly them ourselves? Foreigners who fly in to visit us will not buy British aircraft unless they see real evidence that we have our own progressive and flourishing light aircraft movement.

I would like to make it clear that the light aircraft I am referring to are those which can be purchased by private individuals and clubs, have running costs comparable with those of motor cars, and can be used for sport, recreation, travel and family holidays with, perhaps, a bit of business flying thrown in. This type of aircraft, which has been the mainspring of the American and French light aircraft industry since the war, is completely separate from a military or professional specification.

Croydon, Surrey

D. M. J. JONES,
Sales Manager,

Rollason Aircraft & Engines Ltd

SIR,—With reference to the current correspondence on "Saving British Light Aviation," one name springs to mind—F. G. Miles, who in July 1963 started again on his own. I know of no English designer of light aeroplanes who can compare with him. One of his creations, the 1928 Miles Martlet prototype, was powered with an 80 h.p. ABC Hornet flat-four air-cooled engine. I have often wondered whether the American Franklin, Lycoming and Continental air-cooled flat-fours owed their origin to the Hornet.

Birmingham 14

MAURICE AUSTIN

SIR,—Is Mr D. E. Bianchi (Letters, February 4) talking of saving the light aviation manufacturing industry or the sport and pastime of private flying? I would venture to suggest that the survival of the former cannot guarantee the survival of the latter, but I'm convinced that the reverse would apply. I believe that the answer lies in attracting more adventure-minded youth into the sport of club flying.

Why is today's youth not taking up this sport instead of standing on street corners? Obviously, the answer is that the cost of tuition is prohibitive. To learn to fly today costs anything from £250 upwards.

But surely this could be lowered? Why not, for example, teach a pupil to fly for, say, £100 and then obtain a guarantee

from him that he would do ten hours' annual flying at, say, £5 per hour for three consecutive years in aircraft belonging to the club at which he learnt to fly?

The present centre of attraction, it would appear, is not the would-be pilot but the private owner and club member who is already able to fly.

Worle, Somerset

M. PATTENDEN

Nocturnal VTOL

SIR,—It is of historical importance to note that the photograph of the Hawker Siddeley Kestrel on page 275 of the February 25 issue of *Flight* shows, for the first time in the history of aviation, a jet V/STOL fighter, destined for operational service, flying at night.

The Kestrel took off vertically and accelerated to wing-borne flight. Shortly afterwards it returned to Dunsfold, decelerated and landed vertically. The photograph shows the aircraft just before touchdown. The only illumination, apart from the temporary lighting required to take the photograph, consisted of a few gooseneck paraffin flares.

Dunsfold, Surrey

J. CRAMPTON,

Technical Sales Manager, Hawker
Siddeley Aviation Ltd, Hawker Blackburn Division

BEA and the Passenger

SIR,—The appointment to BEA's board of a member to pay "especial attention to the interest of the domestic passenger" brings to mind a meeting of the Minister's Consultative Council (wonderful title) sitting under Alex Boyd, and with representatives of all the big interests—Sholto Douglas of BEA, Miles Thomas of BOAC, Sir Frederick Handley Page, the SBAC, the insurance companies, the Baltic Exchange, and so forth—and your humble servant, at that time representing the Joint Air Transport Committee of the London Chamber of Commerce.

Boyd suggested that perhaps the Council no longer served a useful purpose, and the State corporation chairmen of course agreed. "H.P." made an apt remark about the thickness of the paper used for the minutes; and when it came to my turn I pointed out that I was the only one present who represented the poor fare-paying passenger, and that as such I felt that the Council served a useful purpose—if only in allowing one voice to stick up for the user against the weight of Government-owned airlines and Government-controlled industry!

We survived a few more months, but were finally buried as time-wasting.

Pulborough, Sussex

J. VIVIAN HOLMAN

He Who Sups with the Devil . . .

SIR,—I hope you will not allow yourself to be goaded into irresponsible action by the crass stupidity of the opinions expressed by Mr Moroney in your issue of February 25.

There are quite enough informed commentators on the political scene, and everybody knows that only *The Times* is ever quoted in the House. Even Sir Roy Fedden fails to reach the pages of Hansard because he will write for *The Daily Telegraph*.

Let *Flight*, therefore, stick to factual reporting and not get embroiled in the sewage of politics. Does Mr Moroney really think that the present situation has arisen in 100 days?

London W1

P. TRENTHIDE

SIR,—I have always looked to your magazine for accurate and unbiased reports. It would be a pity to bring *Flight* to the degradation of political mud-slinging.

Clearly, E. H. Moroney's letter is just that—a scantily disguised attack on the Labour Government. I wonder what his reactions would be had a Tory hand swung the axe, as on so many previous occasions? At least in this case the butchered were not conceived and nurtured by the executioner.

Aircraft these days seem to have assumed an insatiable

LETTERS...

appetite for pounds sterling. I for one miss my tax deduction and object to it being wasted on a piece of unnecessary prestige machinery.

An aircraft industry is an expensive luxury for a country in such a precarious economic situation, and we must be prepared to see it run down.

Bury St Edmunds, Suffolk

P. J. "RUDDERHAM

SIR,—Re Mr E. H. Moroney's letter: please keep *Flight* as it is, an aeronautical weekly and not a political organ—whether it be for Sir Inept Clueless-Fume or Mr Harold Nil-Done. The hot air went out of aviation with the Montgolfières; let's keep it that way.

Harrow, Middx

K. SH. SAKLATVALA

International Airports

SIR,—Following Mr M. S. Nichols' letter in your issue of February 11, Liverpool Airport also was omitted from your list of international airports of the world. Regular flights operate to and from Dublin, Cork and Rotterdam. In fact, our oldest customer, Aer Lingus, have been operating into and out of Liverpool Airport since 1936.

Speke, Liverpool 24

K. A. PORTER,
Director, Liverpool Airport

[As remarked in the introduction to the tables (December 10, 1964), space considerations make it necessary to confine each year's entries to a representative selection of international airports.—Ed]

Unofficial Radio at Airports

SIR,—I do wish you journalists were a little more careful with your designations. It appears from a heading ("Amateur Radio at Airports") in your correspondence columns of February 18 that any schoolboy who happens to twiddle the knob of a one-transistor "bleeper" while in the vicinity of some aerodrome, thereby doing a bit of private ECM, is to be classified with the 10,000 or so genuine amateur radio devotees who, before they were allowed to transmit, had to pass a GPO examination which puts great stress on the causes and elimination of interference.

An allied problem is the fact that the same lad can buy himself, for a few shillings, quite a powerful radio transmitter from almost any government-surplus dealer (who doubtless "forgets" to point out that a licence to transmit is required) and can then radiate away merrily on any frequency the set will tune to, distress and emergency channels included.

Surely the least that can be done is to restrict the sale of these things to those who can produce a licence to transmit?

East Grinstead, Sussex

W. BLANCHARD

How Low Can You Get?

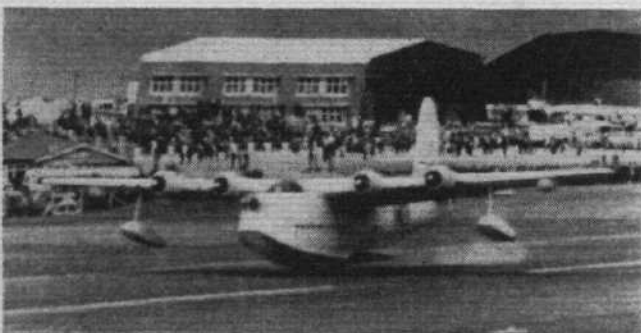
SIR,—I personally would have given the perpetrator of the Wellington boat episode the Order of the Wellington Boot.

Birmingham Airport

G. T. BEDGGOOD,

Chief Flying Instructor/Manager, Mid Fly Ltd

This was it—from Straight and Level, "Flight," February 25



Blackburn B.2—Information Wanted

SIR,—In connection with a little book I am compiling to raise funds for the Trueloves Home for Seriously Handicapped Boys, I hope to include illustrations of most types of veteran and vintage aeroplanes preserved throughout the world, with as much information as I can obtain about those who flew (and are flying) them.



Could readers help me with details of the Blackburn B.2 G-AEBJ kept—until recently, at any rate—at Brough by the Hawker Blackburn Division of Hawker Siddeley? Names of pilots and notes of any interesting flights, etc, would be enormously helpful to me.

90 Woodside,

Leigh-on-Sea, Essex

LESLIE HUNT

"Hush-hush Dakotas"

SIR,—In your issue of January 7, Mr Laing asks for information about the wartime services operated between Aberdeen (Dyce) and Stockholm by the Swedish airline, ABA.

ABA's operations, using Douglas DC-3s, started on March 27, 1942, in parallel with the services flown between Scotland and Sweden by BOAC and the Royal Norwegian Air Transport Service. Flights were made under cover of darkness, on an irregular basis depending on weather conditions and traffic needs, initially about once a week, increasing to four or five trips per week in the early part of 1943. On June 21, 1942, an aircraft was attacked on the eastward trip, but not vitally damaged; however, this caused a suspension of services until August 15. Services were again suspended during the period of short nights from May to August 1943, except for two trips.

On August 27, 1943, the DC-3 SE-BAF disappeared between Scotland and Norway with the loss of three passengers and four crew, including ABA's chief pilot, Capt K. G. Lindner; and October 22, 1943, a second machine, SE-BAG, was shot down just off the Swedish coast at Haalloe, with the loss of ten passengers and three crew. After this the service was again suspended until March 5, 1944; nine trips were made between then and April 14, when the British Government refused permission for further flights as part of the security precautions preceding the Normandy landings. ABA was allowed to resume its services in October 1944, but they then operated into Prestwick, using converted Boeing B-17s.

Photographs of the Swedish DC-3s in their wartime markings have been published quite frequently, most recently in Mr R. E. G. Davies's excellent book, *A History of the World's Airlines*.

RAE Farnborough, Hants

JOHN A. BAGLEY

Lifting-fuselage Aircraft

SIR,—In the past few years I have noticed an ever-increasing interest in the lifting-fuselage or Burnelli type of aircraft. In view of the advantages and proven virtues of these aircraft in practice, I am delving deeper into this type of design. If any reader could possibly supply me with any drawings, calculations, etc, I would be greatly appreciative.

"Elmelund," Ganlosevej 10,
Farum, Denmark

T. HOLLAND

INDUSTRY International

Products

Company News

Great Britain

G.E.C. Take Over at Stanmore The Applied Electronics Laboratories of the General Electric Co Ltd at Stanmore, Middx, until recently a Government-owned establishment, have now been taken over wholly by G.E.C. (Electronics) Ltd, thus extending the scope of work from defence to industrial and other fields.

The laboratories were established in 1950, with a nucleus of staff transferred from the then G.E.C. Research Laboratories (now the Hirst Research Centre). They were set up to develop electronic equipment for defence, initially as an agency of the MoS, and subsequently of the MoA, administered by the G.E.C. The administration was transferred to G.E.C. Electronics in 1962.

One of the principal activities of the establishment has been the development of missile guidance and allied equipment in connection with, among other weapons, the Seaslug Mk 1 and 2 and, currently, the Sea Dart. Important work has also gone into the development of a variety of airborne electronic equipment, including the design of the Sea Vixen interception and fire control radar, the digital data link for the Lightning and, more recently, sophisticated airborne digital computers using microminiature techniques resulting from earlier work on Dexan, the first British airborne digital computer. Trials of guided weapons equipment developed by G.E.C. at Stanmore and Portsmouth are conducted by the company's Applied Electronics Laboratories at Salisbury, South Australia, and at the Woomera Range of the Australian Weapons Research Establishment.

The Stanmore Laboratories are also active in other fields, being responsible, for example, for the gun control equipment on Britain's heavy tank, the Chieftain, which has just completed its trials with spectacular success.

The new status of the Stanmore Laboratories is reflected in a new management structure. The manager is Mr Peter F. Warren, who is directly responsible to the Director, Defence Projects, Brig J. Clemow. Four assistant managers have been appointed: Mr R. L. Hughes (who is also deputy manager), Mr P. Irvin, Mr A. S. Walsh and Mr G. A. Gledhill, who are respectively responsible for the main departments—Weapons, Avionics, Assessment and Techniques, and Engineering Services. Air Cdre C. A. Bell, who joined G.E.C. in 1958, has become special assistant to Brig Clemow. Mr R. D. Stirk and Mr R. C. Ashworth, recently appointed assistant managers (sales) within G.E.C. Electronics, will work closely with the manager of the laboratories.

Dowty's "Long Friendship" Order Dowty Rotol has received an export order worth nearly £500,000 from Fairchild Hiller for propellers, undercarriages and auxiliary gearboxes for the new FH-227 stretched F-27 Friendship airliner. This equipment will be fitted in the 18 FH-227 Friendships ordered in January by Mohawk Airlines.

Repeat Order for Circuit Testers The Admiralty has recently placed further orders with Elliott-Automation (34 Portland Place, London W1) for automatic circuit testers. These orders are the result of the performance of one of the first Elliott automatic circuit testers which the Admiralty bought early last year. On one programme the equipment enabled a production run of complex wiring systems to be checked in less than one-tenth of the normal time, using unskilled female labour.

The Elliott automatic circuit tester is intended to save time in production line operations. It checks automatically, rapidly and accurately circuits of from 100-1,000 lines for continuity and insulation within pre-set limits of acceptance.

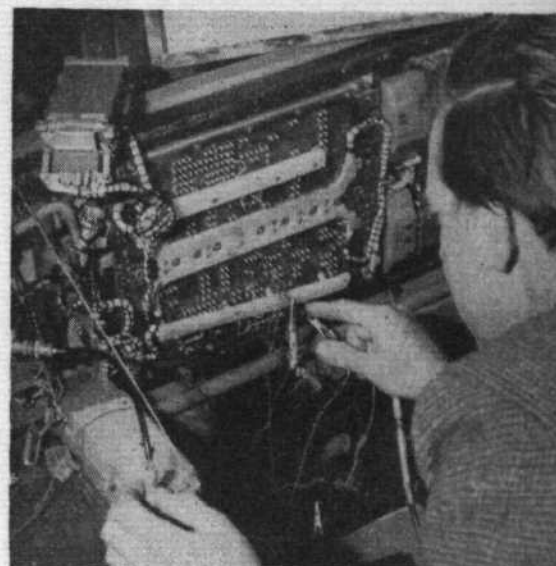
It is able to cope with printed circuit boards, and circuits containing relays and similar devices. Checking is carried out at approximately 10 tests per second. Normally a continuity test, followed by an insulation test, is applied consecutively to each circuit. A step-on pulse moves the equipment automatically to the next circuit if the results of the current pair of tests are satisfactory. When there is a fault, its location and type is clearly displayed.

Smiths take Honeywell Licence Smiths Aviation Division has signed agreements with Honeywell Inc, of Minneapolis, USA, under which Smiths acquire the right to manufacture in the UK certain advanced instrument systems and control equipment of Honeywell design.

Sales and manufacturing rights concern, first, the Honeywell servometric indicating system for aircraft instruments and, secondly, pressure ratio transducers including the widely adopted LG14 and LG80 engine pressure ratio systems.

The agreement follows a period of exchange visits and technical discussions between the two companies. Both organizations have conducted joint studies related to the US programme to evolve a control system for all-weather aircraft operation.

Servometric instruments are a new Honeywell development in instrument displays, providing vertical and circular-pointer type read-outs for aircraft and space applications. The instruments are claimed to have a high degree of immunity against shock, vibration, steady-state acceleration and temperature extremes, and offer the advantages of closed-loop feedback systems. They have only one moving part and do not utilize



The guidance receiver of a Seaslug Mk 2 missile under examination at the G.E.C. Applied Electronics Laboratories after being recovered intact from a firing to a height of over 100,000ft (see "G.E.C. Take Over at Stanmore")

gearing, slip rings or commutators. Associated lower-power solid-state circuitry is of straightforward design using standard components.

Honeywell pressure ratio transducers and systems are now in use on British and American aircraft to give the pilot an indication of power or thrust for all throttle settings. The transducer senses a pressure ratio between the engine inlet pressure and exhaust pressure and transmits it to an indicator on the flight panel.

Protective Film on Trident Line Fablon clear self-adhesive plastic film is being used for the first time to protect metal in the British aircraft industry. One of the major users in this context is HSA's de Havilland Division, which is employing Fablon in the protection of Tridents during production. The material is also being used to protect the BAC-Sud Concorde, the BAC One-Eleven and the VC10.

All exterior surfaces of the Trident are covered with Fablon in order to reduce corrosion and damage. The film was introduced into the HS factories after 18 months' laboratory tests. It proved to be unaffected by most production processes, including that in which alloy sheets go through a sulphuric bath. Two thicknesses of Fablon are used—the 0.008in for surfaces subject to heavy wear and therefore prone to scratching, and the 0.004in for standard light-alloy sheets.

Fablon is manufactured by Commercial Plastics Ltd, of Berkeley Square House, Berkeley Square, London W1.



A section of the bonded store recently established by Rogers Aviation, the Bedford business-aviation consultants, at their Cranfield engineering base. The company provides a full range of services in the business aircraft field and equips aircraft for a variety of functions in many parts of the world

INDUSTRY International...

For Safety in Study A continuous-burning rocket motor designed to operate on commercially available oxidant and fuels is produced by P. A. Hilton Ltd, of Southampton Airport. It has been developed for use in universities and engineering technical colleges for the study of applied thermodynamics.

The motor (which was described and illustrated in *Flight* for January 23, 1964) operates on gaseous oxygen and kerosene; diesel or fuel oil may be used as alternative fuels.

In a note on the simplicity of the Hilton motor, the British Oxygen Co Ltd remark that, after firing, the propellant lines are purged with nitrogen; fed into each propellant line by control valves on the test-rig instrument panel, this ensures that all combustible mixtures are completely cleared after each firing, so that stripping and examination can be carried out with complete safety. This was suggested by British Oxygen, who were consulted on the problem.

Talking Heat Treatment A four-day heat treatment conference, to be held from June 15-18, at Bingley Hall, Birmingham, will be of interest to those engaged in aircraft manufacture. A paper entitled *Heat Treatment Problems in the Aircraft Industry*, one of the features of the opening day, is to be presented by Mr C. Smith, a special director of James Booth Aluminium Ltd.

Other papers to be presented during the four days include *Plasma Arcs and Plasma Jets in Heat Treatment Operations*; *Latest Developments in Controlled Atmospheres*; *Heat Treatment Techniques of the Refractory Metals*; and *Heat Treatment Problems of some Non-Ferrous Metals*.

Programmes and registration forms for the conference may be obtained from the Conference Secretary, Business Publications (Exhibitions) Ltd., 103-119 Waterloo Road, London SE1.

Miniature Motor Designed for military applications where size, weight and high performance are the governing factors, the Globe type MC motor operates on 50/60 or 400 cycles in two-, four- or six-pole types. Hysteresis synchronous or induction rotors are used in these motors, with options of spur-gear reducers and even-odd-ratio planetary gear reducers in 129 total reductions. The MC motor is 1½in diameter by 2½in long, and gear reducers add up to 2in maximum for the largest reduction. Further details are obtainable from Globe Industries Inc (UK) Ltd, PO Box 22, Kinbex House, Wellington Street, Slough, Bucks.

Plessey Post Mr D. G. Booth, MMECH, has assumed responsibility as divisional general manager for the two Plessey-UK divisions most closely concerned with aircraft mechanical equipment. These are the Aircraft Mechanical Division, makers of the Plessey constant-speed drive starter, and the SPE Division, specialists in pumps and fuel system components. Mr Booth joined the company in 1937 as a draughtsman at Ilford.

Pressure Switches Detailed Teddington Aircraft Controls, of Merthyr Tydfil, Glam, have produced a comprehensive loose-leaf brochure giving technical data on their range of pressure switches. Operable by a variety of fluids and gases, these switches are available in forms which offer various types of mechanical response to rising, falling and differential pressures.

USA

Apollo Aerial The Dalmo Victor division of Textron Inc has been selected to develop the high-gain deep-space communications aerial system for NASA's Apollo spacecraft. The firm was selected by North American Aviation (space and information systems division), principal contractor on the Apollo command and service modules. The communications aerial system, which will initially cost an estimated \$3m, will be used for voice, video and telemetry communications once the spacecraft is away from the Earth. During near-Earth orbit, a special aerial developed by North American will be used.

Airborne Atomic Frequency Standard What is claimed to be the world's smallest fully synthesized atomic frequency standard, measuring only two-fifths of a cubic foot yet providing exceptional accuracy and long-term stability of 5×10^{-11} , has entered full-scale production at Varian Associates, of 611 Hansen Way, Palo Alto, Calif.

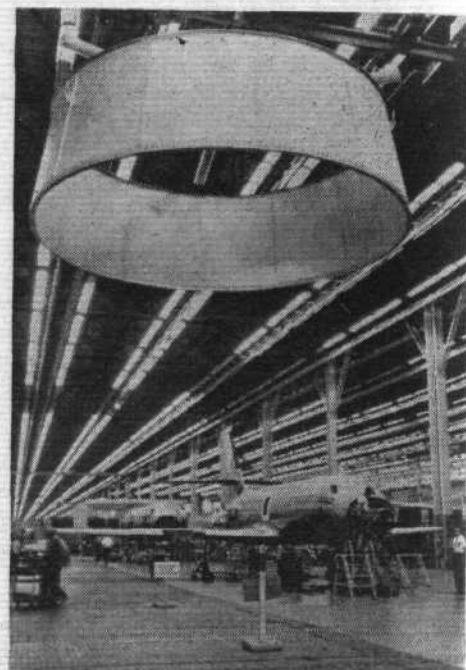
Weighing only 20lb, the Varian R-20 Rubidium Frequency Standard makes possible application of atomic frequency and stability to such uses as airborne navigation, aircraft collision avoidance systems, manned orbiting space laboratories and space tracking systems.

The R-20 rubidium frequency standard consists primarily of a servo system in which

a crystal oscillator is locked to the electron hyperfine transition frequency found in the rubidium atom. This unvarying atomic frequency provides the long-term stability reference.

Light enough for airborne systems and designed to fit in standard aircraft electronics racks, the R-20 can provide a precise time reference for such navigation systems as the Loran-C and Omega. In aircraft collision-avoidance systems the Varian instrument can be used in the transmission and reception of very precisely timed signals by two or more aircraft to indicate the distance and closing, or opening, speeds.

Douglas in the Lebanon Establishment by Douglas Aircraft Co of a corporate international marketing office in Beirut, Lebanon, has been announced. Mr Charles W. Hostler, named manager of international marketing for the Middle East, will direct operations at the new office. He was formerly assistant manager of the Douglas office in Paris.

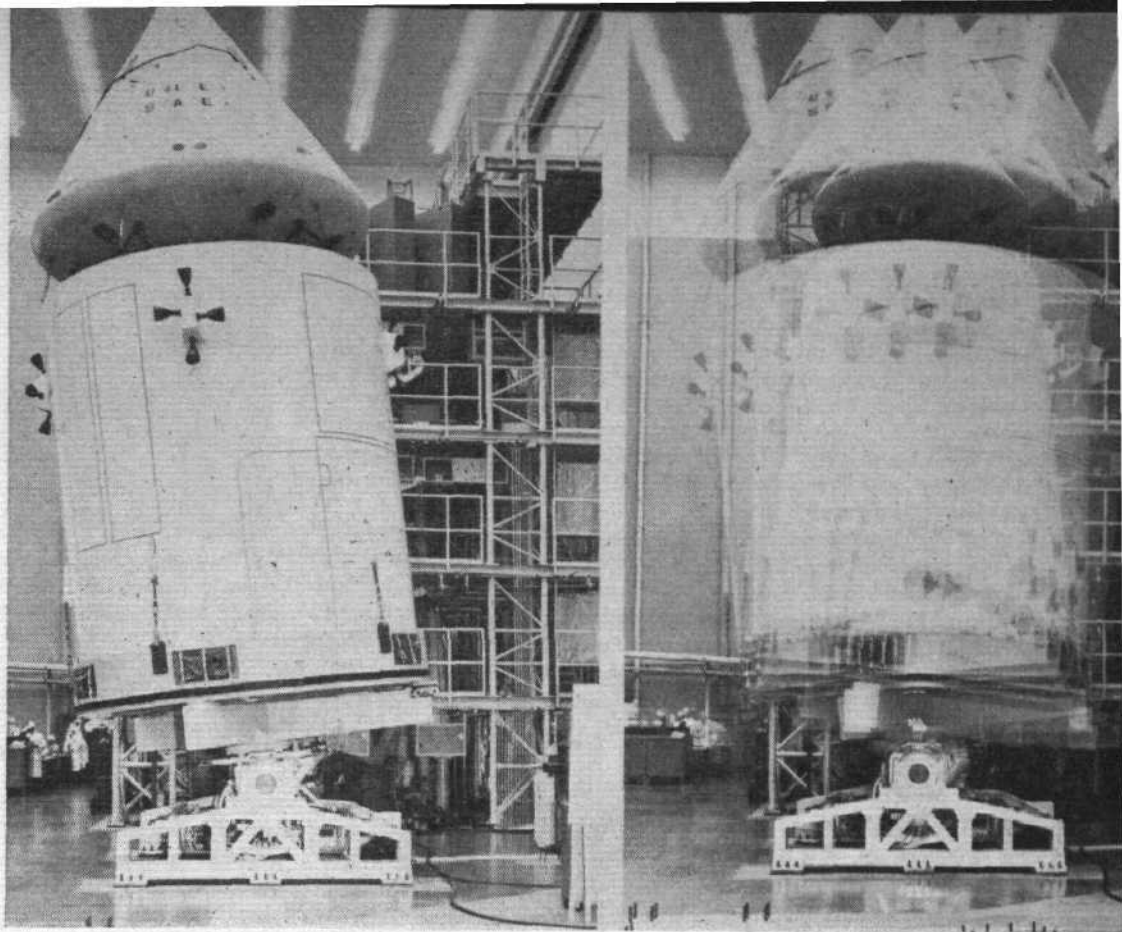


Poised above the Lockheed JetStar production line at Marietta, Ga, this 22ft-dia, 4,000lb, aluminium "lampshade" is actually a structural test specimen of the adapter ring which mates the Apollo three-man Moon-exploration spacecraft with its Saturn launch vehicle

Germany

HFB Capital Increased At a recent extraordinary general meeting of the stockholders of Hamburger Flugzeugbau GmbH it was decided to increase the capital of the company by DM3m—to DM10m—by means of a cash subscription. The new holdings were taken over by the previous owners, members of the Blohm family. Hamburger's capital expansion is, no doubt, connected with the decision to increase the size of the first production batch of HFB 320 Hansa jet business transports from ten to 20 aircraft.

The guidance and navigation unit aboard NASA's Apollo spacecraft is tested on this "polarity checker" at the space and information systems division of North American Aviation, Downey, California. The checker includes the rocking unit on which the spacecraft is mounted, and associated electronic checkout equipment to measure the response of gyroscopes



Spaceflight

MARINER SWITCHES AERIALS

Last Friday, March 5, the radio transmitter aboard the US Mariner 4 spacecraft was scheduled to be switched automatically from its low-gain aerial, which had been in use since the launch of the spacecraft on November 28, to the high-gain aerial which will be used for the remainder of its flight to Mars. At that time the craft had travelled some 160,000,000 miles towards the planet, and was some 27,000,000 miles from Earth. On February 19 project officials at the Jet Propulsion Laboratory, Pasadena, reported that the spacecraft was continuing to function normally and was transmitting data on scientific measurements taken in interplanetary space.

HOW HARD THE MOON?

NASA is negotiating with Philco Corp, Aeronutronic Division, on a contract for research, development and preliminary design of a lunar penetrometer system applicable to the Apollo programme. A penetrometer is an instrumented package capable of assessing the hardness, penetrability and bearing strength of a surface upon which it falls. Penetrometers ejected from an Apollo spacecraft orbiting the Moon could provide surface information for scientific assessment of remote sites which might be inaccessible to manned spacecraft or unmanned Earth-launched probes.

The nine-month study is estimated to cost approximately one million dollars. A contract will be negotiated and managed by NASA's Langley Research Center, under the direction of the Office of Manned Space Flight at NASA Headquarters.

The study will require Aeronutronic to develop and test penetrometers and data-transmission equipment needed to relay lunar-surface information to an orbiting Apollo spacecraft. It does not call for the production of flight hardware, but is to establish definitive data on which to decide whether an engineering prototype or flight hardware should be built.

This type of lunar surface probe is one of several systems now under study by the Office of Manned Space Flight in support of NASA's overall Moon exploration programme. Philco was one of seven firms which responded to a request for proposals.

WEST-COAST DELTAS

The US National Aeronautics and Space Administration and the Department of Defense have agreed to establish Delta launch-vehicle facilities at the Western Test Range near Lompoc, California. NASA and DoD will share the costs of establishing the facilities in proportion to their respective estimated use of the vehicle. Existing USAF Thor-Ablestar installations will be adapted for Delta use wherever practicable.

Launch pads and blockhouses will be shared, with each agency responsible for its own missions. NASA will exercise launch-vehicle control over all WTR Delta launches. This will include supervision of the contractor in the assembly, check-out and launch of the vehicle.

NASA is responsible for developing an improved Delta to meet both agencies' requirements for use at both the Eastern and Western Test Ranges. After the improved vehicle is judged reliable, the Department of Defense will phase-out the Thor-Ablestar and will use Delta instead.

The USAF will procure the Thor first-stage and will contract for all booster services. NASA will procure the Delta upper-stages and contract for Delta-stage services. Each will reimburse the other for contractor-supplied services it uses.

OAO EXPERIMENT WITHDRAWN

Instrumentation for NASA's first Orbiting Astronomical Observatory has been revised to keep the launch on schedule for late this year and to allow more time for developing a Smithsonian Astrophysical Observatory experiment that has encountered delays. Inclusion of three X-ray and gamma-ray telescopes on the first OAO has been approved, while the Smithsonian's Telescope experiment has been deleted from the first OAO and rescheduled for the third in the series. Unaffected by the change, and proceeding on schedule for a 1965 launch aboard OAO 1, is the University of Wisconsin's photometer-telescope system to measure the energy distribution and emission intensities of stars.

The Telescope experiment is designed to map the stars and nebulae through observations in the ultra-violet region of the

Spaceflight

spectrum. Development problems have centred on the image tube used to detect specific bandwidths in the ultra-violet.

The three X-ray and gamma-ray telescopes, already fabricated, contain experiments proposed by Massachusetts Institute of Technology, Lockheed Missiles and Space Division, and NASA's Goddard Space Flight Center. The MIT experiment is designed to survey the sky to detect high-energy gamma rays that do not originate from Earth. The 37lb instrument uses two detectors, a crystal scintillator and Cerenkov counter to determine the direction of incident gamma rays.

The Lockheed experiment is designed to survey the night sky to seek new sources of low-energy (soft) X-rays and to study those recently discovered. Primary detection elements are two 75lb arrays of high-gain gas proportional counters—gas-filled chambers which count penetrating X-rays and measure their energy. The 60lb Goddard experiment will detect low-energy gamma rays using a thallium-activated sodium-iodide crystal and three photomultiplier tubes.

PEGASUS PROGRESS

NASA reported on February 26 that the Pegasus I satellite, launched on February 16, was functioning normally, and that preliminary evaluation of data received had indicated a number of meteoroid impacts on all three panel groups. Pegasus has sensor panels of three different thicknesses to permit an analysis of the various sizes of meteoroids encountered.

Scientists at NASA's Marshall Space Flight Center reported that the number of penetrations of the panels was not greatly different from the expected level, although it would be several months before the data were thoroughly evaluated. The spacecraft's wing-like structure, 96ft long and 14ft wide, offers more than 2,300 sq ft of area instrumented to detect collisions with meteoritic particles.

Pegasus is in orbit at an altitude varying from 309 to 493 miles. Periodically the satellite's magnetic core memory is commanded from ground stations to report the record of impacts. That information is recorded at one of seven STADAN (space tracking and data acquisition network) stations of the Goddard Space Flight Center. In addition, impacts are reported to Marshall by four stations as they occur. Stored data and real-time data have been in agreement, indicating that the memory system is functioning as desired.



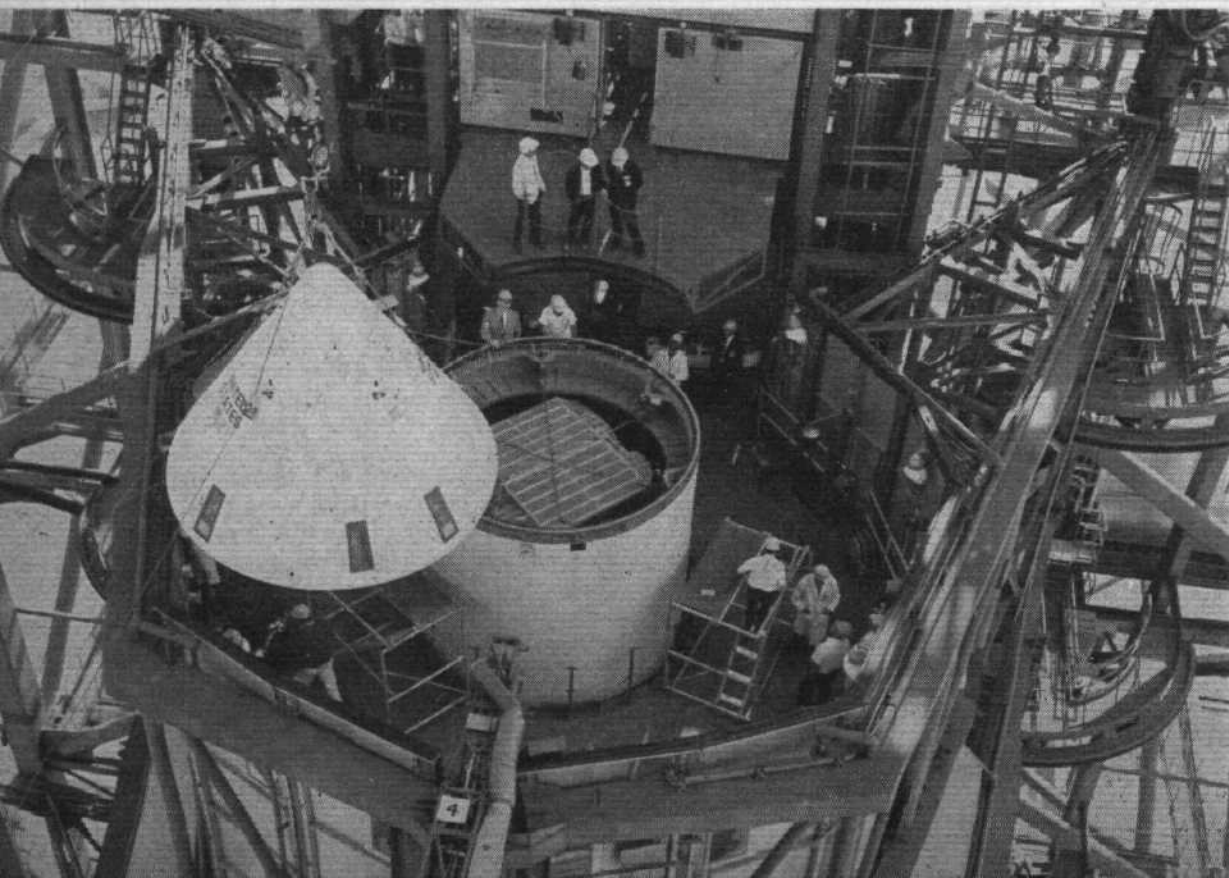
An integrated manned space systems simulator is being installed at the Convair division of General Dynamics, San Diego. When the unit is operational, a test conductor will be able to monitor from this control console a simulated mission being flown in a spacecraft in an adjoining room. Models in the closed-circuit television system are computer-driven to display the astronauts' view: engineers will use the simulator to study design requirements for a manned orbital laboratory and other spacecraft

Of the satellite's 416 detector panels, 16 (having an area of 80 sq ft) are covered with material 1-1/2 mils thick; 32 (160 sq ft) have an 8-mil cover; and 368 (more than 2,000 sq ft) have a thickness of 16 mils. Scientists expect to encounter about 1,000 impacts in the thinnest section, and 70-150 in each of the other areas in the one year that the satellite is expected to be active.

Good, readable data are being received from the satellite at present. In addition to impact information, data on temperature, power levels, and intensity of radiation are being received (the intensity of radiation encountered is as predicted).

During the first several orbits, the roll rate of the Pegasus gradually increased to a level somewhat higher than expected because of the venting of residual propellants in orbit. The exact action which produced this roll rate has not yet been completely defined. The roll rate has now decreased from about 10° to 2.5-3° per sec. No further roll increase is expected.

The Pegasus orbit extends to about 31° north and south of the



NASA's Pegasus satellite, as reported on this page, is working well in orbit. Folded for launch within the Saturn SA-9 vehicle (left), the spacecraft extended in orbit to a span of 96ft

equator. Up to 2hr before sunrise and after sunset the satellite is visible, under favourable atmospheric conditions, as far north and south as 43° latitude. If sighted from a point 43° from the equator, the satellite would be near the horizon and in sight for only a few minutes. It would be dim or almost invisible unless atmospheric conditions were extremely clear (haze or smoke near the horizon would probably hide it from view). The satellite has a brilliance almost equal to that of Venus. Between 31° N and 31° S it is visible

for up to 10min on each pass, depending on its angle of elevation.

Pegasus 1 is one of three such satellites planned. The other two will be launched aboard Saturn 1 vehicles in the second and third quarters of this year. Pegasus 1 was launched by the Saturn 1 vehicle SA-9 in a flight in which all performance test objectives were met. The guidance system, being flown for the third time in its completed form, performed satisfactorily, placing the satellite in an orbit close to that predicted (310-465 miles).

NEW LIGHT ON ELECTRON SATELLITES

A NUMBER of details of the instrumentation and experiments carried by the two pairs of the Soviet Union's Electron satellites have been released in various official journals. The type of launching, separation and injection procedures used are known, and the sketches of the first two spacecraft published in *Pravda* have been widely reproduced. But the dimensions and weights of the Electrons have never been disclosed.

From additional data appearing in the Soviet journal *Tekhnika Molodezhi*, however, it is now possible to attempt to calculate the size of these spacecraft. The journal quotes A. Kichatov of Moscow University as stating that solar panels aboard Soviet spacecraft, including Electrons 1 and 2, cover a total area of 215.2 sq ft and employ a two-layer cell configuration. From the distribution of cells shown in the original pictures we can work out the size of the spacecraft.

"Angled" views such as those in the original sketches give the best overall impression of the craft, but dimensions are better measured from a side or end-on view. Measuring the ratio of the minimum to the maximum apparent diameter gives the sine of the angle ϕ through which the craft must be turned to give a side view. The ratios were found to be 0.588 and 0.581, giving angles of 36.06° and 35.58° for Electrons 1 and 2 respectively. The sketches were then redrawn using the maximum apparent diameters as before, but dividing all the measurements along the satellites' longitudinal axis by cosine ϕ . The scales of the two drawings are almost identical.

Electron 1 carries six solar paddles, each consisting of four 18-cell panels. Measurements (see table) were taken from the three paddles which most nearly faced the observer. Electron 2 carries solar cells on its cylindrical section, an upper skirt and a lower skirt.^a The cylindrical section is surrounded by 12 panels each

having space for 32 cells, but only 75 per cent of each panel collects sunlight since eight solar cells are replaced by shutters for the temperature-control system. Both the upper and lower skirts carry 12 trapezoidal panels, each with 16 cells. The table gives the area of these panels, deduces a true scale for the drawings, and lists the probable dimensions.

If the quoted solar-cell area is correct and applicable to the total area covered by the cells, it appears that the domed cylinders around which both craft are built measure about 11ft long and 6ft 6in across. They are similar in appearance to published pictures of certain 49° Cosmos satellites—which from optical observations appear to be about 7ft long and 4ft across—and are a little larger than Sputnik 3 and the US Nimbus weather satellite.

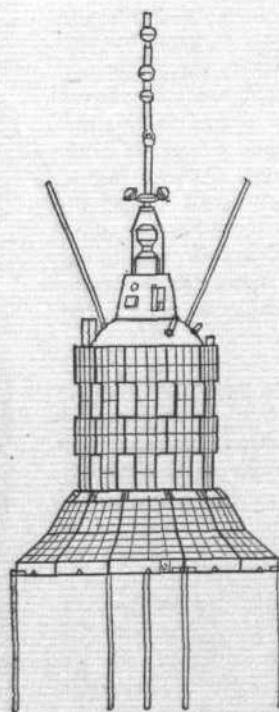
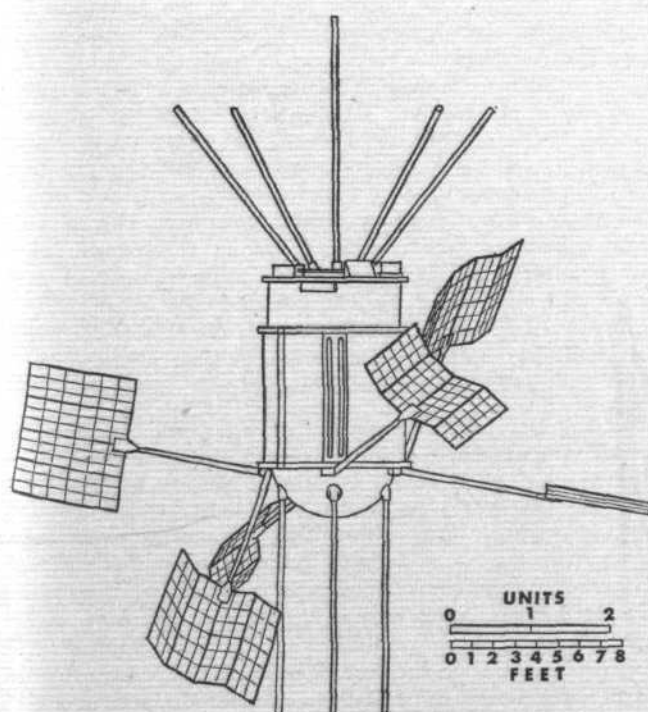
If, on the other hand, the phrase "two-layer cell configuration" means that 215.2 sq ft is the effective area, i.e., the actual area covered is 107.6 sq ft, then the first results obtained should be multiplied by $\sqrt{0.5}$, or 0.707, which gives the second values shown in parentheses.

J. A. PILKINGTON

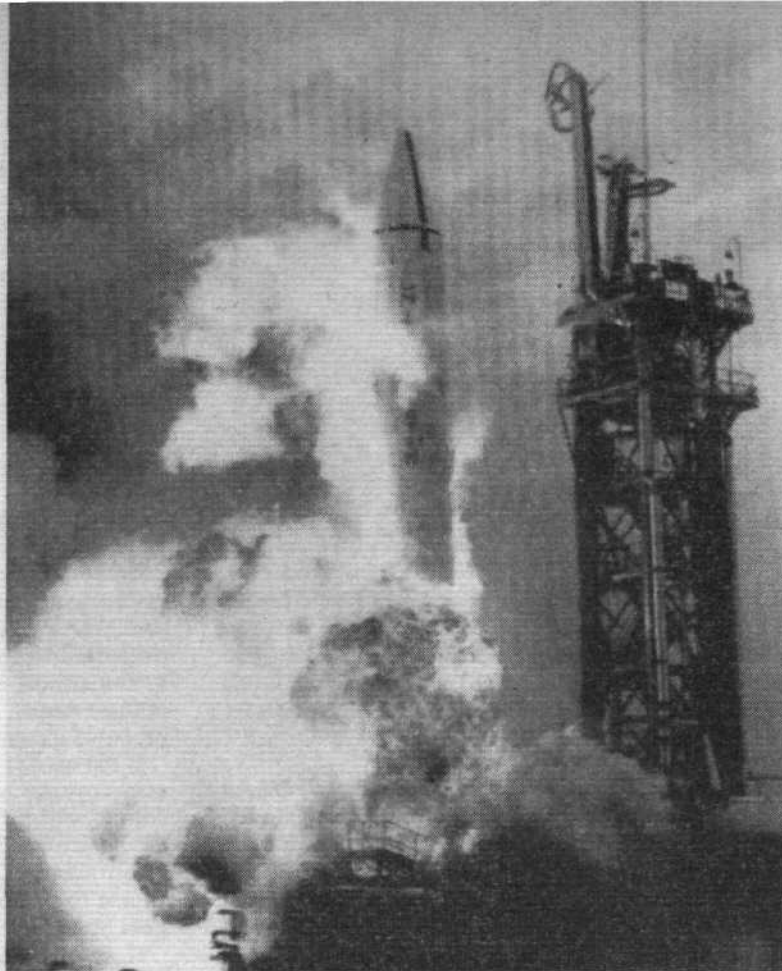
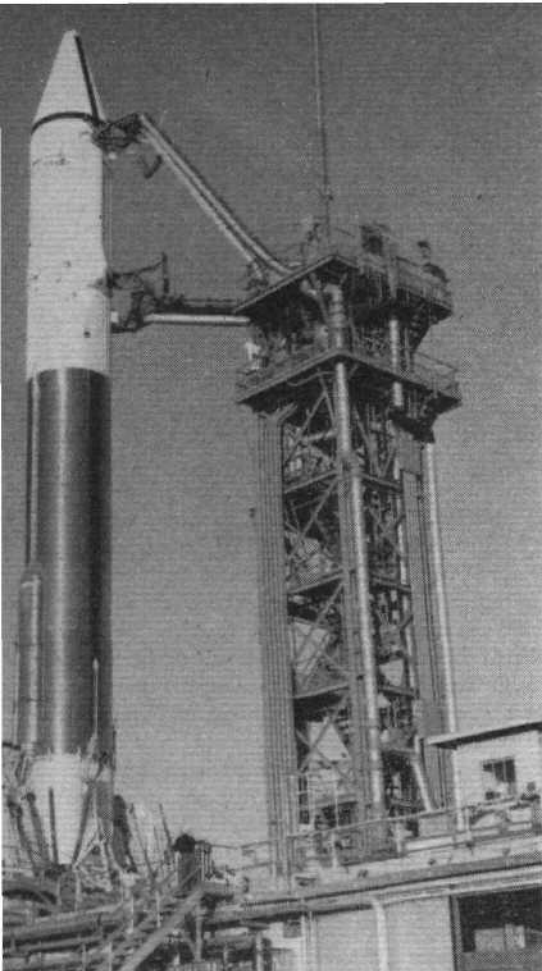
Electron 1 Size of panel, 1.35 × 0.48 units; area of panel, 0.64 sq units; area of paddle, 2.58 sq units; total area, 15.47 sq units.
Electron 2 Cylindrical section panels: size, 1.74 × 0.46 units; area, 0.80 sq units; effective section area, 0.75 (12 × 0.80) = 7.2 sq units. Upper skirt panels: size, 0.58 × 0.43 units; area, 0.25 sq units; section area, 3.01 sq units. Lower skirt panels: size, 0.75 × 0.58 units; area, 0.44 sq units; section area, 5.26 sq units; total area, 15.47 sq units.
Conversion 15.47 sq units = 215.2 sq ft; 1 unit = 3.73ft.

| | Overall length (ft) | Overall width (ft) | Diam of cyl section (ft) | Length, excluding arials (ft) |
|------------|---------------------|--------------------|--------------------------|-------------------------------|
| Electron 1 | 34.2 (24.2)* | 26.3 (18.6) | 6.4 (4.6) | 10.8 (7.7) |
| Electron 2 | 31.4 (22.2) | 12.0 (8.5) | 6.5 (4.6) | 16.5 (11.7) |

Electron 1's paddles when flat measure 7.1ft × 5.0ft (5.0ft × 3.6ft). * Alternative dimensions in parentheses, depending on cell-area assumption (see text).



Side elevations of Soviet spacecraft Electron 1 (far left) and Electron 2, derived (see above article) from official perspective sketches



Before and after lift-off: the fifth Atlas Centaur vehicle on, and just off, the pad at Complex 36, Cape Kennedy, on March 2. The vehicle was to have placed a Surveyor dynamic model into a lunar transfer trajectory (see "Atlas Centaur 5")

Spaceflight

ATLAS-CENTAUR 5 FAILS

The unfortunate Atlas Centaur programme hit trouble again on March 2 when the fifth vehicle in the series, AC-5, exploded on lift-off from Pad 36 at Cape Kennedy. A NASA spokesman said that one of the two main engines of the Atlas booster apparently shut down immediately after lift-off. The vehicle fell back on to the pad and was destroyed by fire, which also caused severe damage to the ground facilities. None of the blockhouse personnel was hurt.

For the AC-5 launch the Atlas stage was equipped with uprated booster engines, each capable of developing about 165,000lb thrust. The vehicle's MA-5 propulsion system was completed by the 57,000lb thrust sustainer engine and two 1,000lb thrust vernier engines. One of the objectives of the flight was to obtain data on the uprated propulsion system. Other objectives were to study the operation of the guidance system and to obtain further data on components and systems already tested on earlier Centaur flights.

The payload aboard the vehicle was a dynamic model of NASA's Surveyor spacecraft—a dummy spaceframe ballasted to simulate the dynamic-response characteristics of the actual spacecraft. Using this model it had been hoped to evaluate the dynamic interaction between the Centaur and its payload during the powered phase of flight prior to injection into orbit.

The AC-5 vehicle was scheduled to be flown along a simulated lunar transfer trajectory until its propellants were depleted or until full lunar transfer energy was achieved and guidance cut-off accomplished. The dynamic model of Surveyor was to be separated from the Centaur vehicle, but neither vehicle nor payload would have hit the Moon. Following separation from the second stage, the dynamic model would have continued on a highly elliptical Earth orbit with an apogee of about 500,000 miles, a perigee of about 100 miles and an orbital period of about 35½ hr.

The AC-5 flight was the fifth of eight scheduled engineering development flights intended to qualify the Centaur vehicle for operational space missions. When operational, the vehicle's primary job will be to soft-land instrumented Surveyor spacecraft on the Moon to conduct surface studies. The first attempted launch, on May 9, 1962, ended in an explosion 55sec after lift-off. At the

second attempt, on November 27, 1963, the Centaur stage was successfully placed in Earth orbit.

Since this initial flight success, the vehicle has been flown twice, on June 30 and December 11, 1964. In the first of these flights five of six primary objectives were accomplished but the second-stage engines shut down prematurely and the stage did not attain orbit. The December 11 flight successfully accomplished all primary objectives (but not the intended re-start of the Centaur engines in orbit), including the first use of the vehicle's inertial-guidance system not only to steer the Atlas-Centaur following booster shut-down but also to perform other in-flight manoeuvres.

As on the December 11 flight, the guidance loop was to have been "closed" on the AC-5 flight, i.e., guidance steering signals were to be utilized for vehicle steering. The guidance system was to generate pitch and yaw steering signals to the autopilots for flight control from 8sec after booster engine cut-off to the end of the Centaur retro-maneuvre.

The Atlas-Centaur vehicle is being developed for NASA's Office of Space Science and Applications under the technical direction of the Lewis Research Center, Cleveland, Ohio. Prime contractor is General Dynamics (Convair), with the second-stage RL-10 hydrogen engines being built under the direction of the Marshall Space Flight Center by Pratt & Whitney. The vehicle's all-inertial guidance system is provided by Honeywell. The Surveyor dynamic model for the AC-5 flight comprised a spaceframe supplied by Hughes Aircraft Co, contractor to the Jet Propulsion Laboratory for the Surveyor project; and a retromotor simulator assembly built by Convair. The model weighed about 1,400lb, compared with approximately 2,250lb for the actual Surveyor spacecraft.

John Glenn, Consultant Col John H. Glenn, Jr, the first American to orbit the Earth, was sworn in as a consultant to NASA on February 26. The ex-astronaut retired from the Marine Corps in January and will now work with NASA Administrator James E. Webb "in various aspects of NASA programmes as his time and interest allow, including participation in conferences, appearances both in the United States and overseas, and following up on developments underway." Col Glenn made his three-orbit flight on February 20, 1962. In January 1964 he left the NASA manned spaceflight programme to seek the Democratic nomination for senator from Ohio. Injuries received in a fall caused him to withdraw from the campaign in the spring of 1964.



DEFENCE

British Phantom Takes Shape

THE ONLY FIRM DECISION yet taken on the exact form and equipment of the Phantoms for the RAF and Royal Navy is that they are to have Rolls-Royce Spey engines. These will incidentally have both seventh and 12th stage bleed for blowing flaps and leading-edges, the seventh stage for take-off and the 12th for landing. The 12th stage bleed will be sufficient for an approach or a "bolter" overshoot, but not for take-off, because of j.p.t. limitations and consequent loss of thrust.

A major, though not the biggest, problem is whether the British Phantoms can be fitted with British missiles and fire-control radar or whether it will prove too costly to displace the existing and probably inseparable combination of Westinghouse APQ-72 radar and Sparrow 3 missiles. A change of missile/nav/attack system would increase the cost of the aircraft 15 per cent beyond present estimated levels, but no change would cause serious loss of business to the British electronics industry deprived of P.1154 work.

A major investigation is in hand to see how much British equipment of all kinds

can be incorporated and whether any production can be carried out in Britain. Such work would be incorporated in the existing network of McDonnell sub-contracts, which already cover a large proportion of the Phantom airframe.

The RAF has studied all desirable changes within the framework of target cost figures and MoA is negotiating with McDonnell through the US Navy Bureau of Weapons, which it trusts as an effective intermediary in the purchasing process. The possibility of additional McDonnell sales of the eventual Spey-engined Phantom have not been ignored as a bargaining point and as an additional incentive to McDonnell. The final decisions are to be reached in a few months.

The only sure British contribution in addition to the Spey seems at the moment to be a reconnaissance pod. Martin-Baker-manufactured ejection seats are, of course, already fitted in US Phantoms.

Buccaneer S.2s Delivered

THE HAWKER BLACKBURN DIVISION of Hawker Siddeley has delivered the first Buccaneer S.2s, powered by Rolls-Royce Speys, to the Fleet Air Arm aircraft holding unit at Lossiemouth. They will be assigned to the IFTU to be formed in April.

Walleye Glide Bomb

HUGHES AND TWO OTHER COMPANIES have been awarded US Navy contracts for production proposals for the Walleye television-guided glide bomb and an improved version of it.

Sioux for Marine Commando

THE COMMANDO SHIP *Albion*, due to sail for Singapore tomorrow, is carrying the new

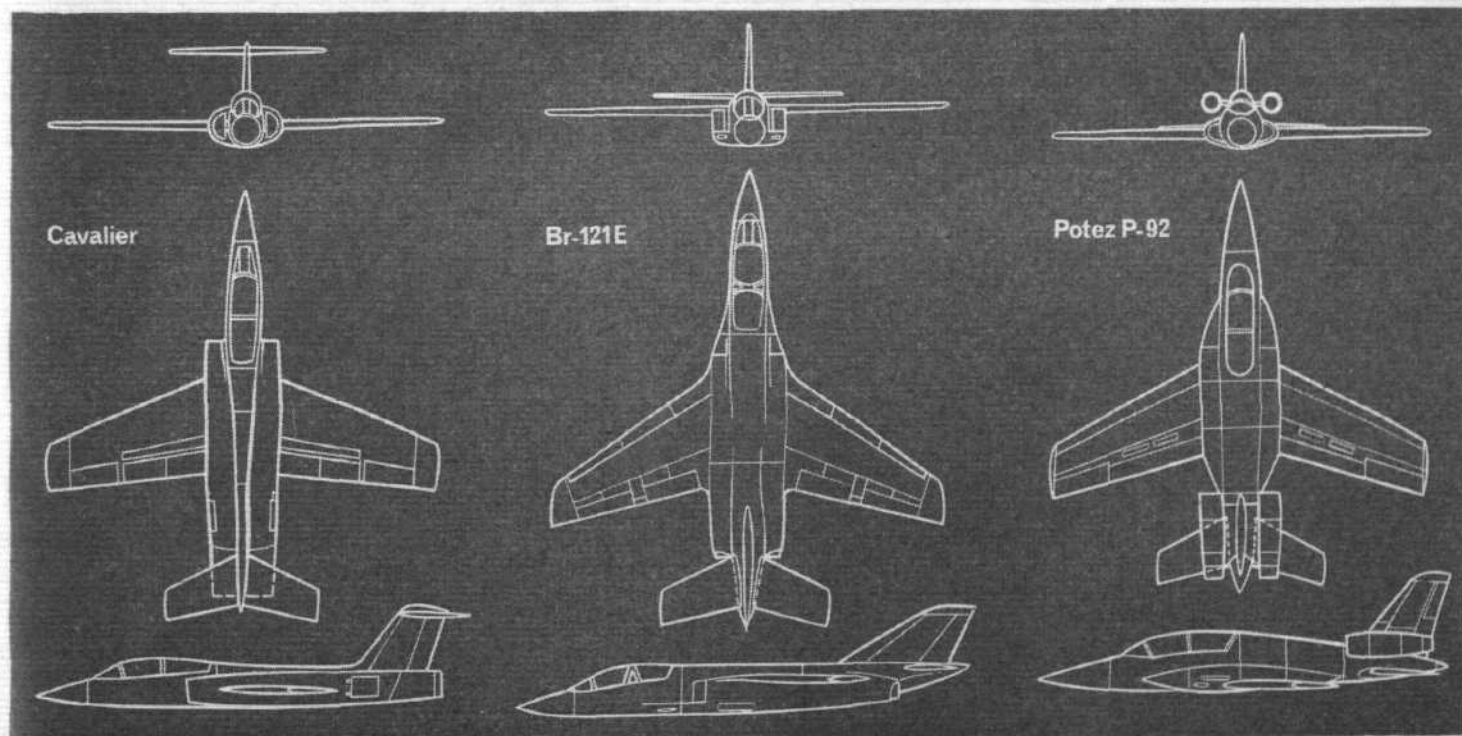
air troop to be attached to 40 Commando in Singapore and subsequently to every Commando. Each troop consists of two Agusta Bell 47G Sioux helicopters, two Royal Marine pilots and seven Fleet Air Arm ratings. Some 30 RM short-service officers are to be trained as helicopter pilots. All 50 Agusta-built Bell 47s have now been delivered and the first of 100 Westland-produced machines should fly any day now. A transmission problem has been cured.

C-5A HLS Performance

SOME QUANTITATIVE PERFORMANCE TARGETS for the C-5A Heavy Logistics System aircraft now under competitive study by Lockheed, Douglas, Boeing, General Electric and Pratt & Whitney, have been reported in *Aviation Daily*. The C-5A is to have four engines, a cruising speed of 550 m.p.h. and be able to drop 600 paratroopers. Take-off distance to 50ft on a hot day at a maximum gross weight of 725,000lb is 8,000ft. With a manoeuvring load factor of 2.5g, payload-range would be 100,000lb for 5,500 n.m. or more than 200,000lb for 2,700 n.m. At reduced load factor, maximum payload could be 250,000lb. With 16 or more tyres on its high-flotation undercarriage, the C-5A should be able to land on the same rough fields as a C-130 and use "600 per cent more airfields" than the C-135. Soft-field landing distance could be as little as 4,000ft, with take-off in the same distance after unloading. The C-5A is designed to carry 99 per cent of all US Army equipment—and springs indeed from the fact that the C-130 and C-141, with their 9ft x 10ft cabin cross-sections, will carry quantitatively most US Army equipment, but not the important outsize items.

Continued overleaf

Three proposals for the initial French Ecat trainer/strike aircraft have been illustrated by our French contemporary "Aviation Magazine" and are presented here as "Flight" three-view drawings. On the left is the Dassault Cavalier, now superseded. Next is the reconnaissance version of the Breguet Br-121, which has tactical single-seat (Br-121A), tactical two-seat (Br-121B), interceptor (Br-121C) and trainer (Br-121E) variants. Similarity to the Br-1001 Taan is evident. At right is the Potez P-92 with rear-mounted engines. The main fuselage forms a 660 imp gal fuel tank, all controls and cables being run in the lateral bulges. Latest reports indicate that there is still time for British companies to take part in the design stage of the initial Ecat programme. All these three projects are twin-engined. Variable sweep is planned for the second-stage Ecat





Two USAF F-100Ds take-off from Da Nang airfield, in South Vietnam, while a trio of Hawk surface-to-air missiles stands guard in the foreground. On the left is a Hawk tracked loader vehicle

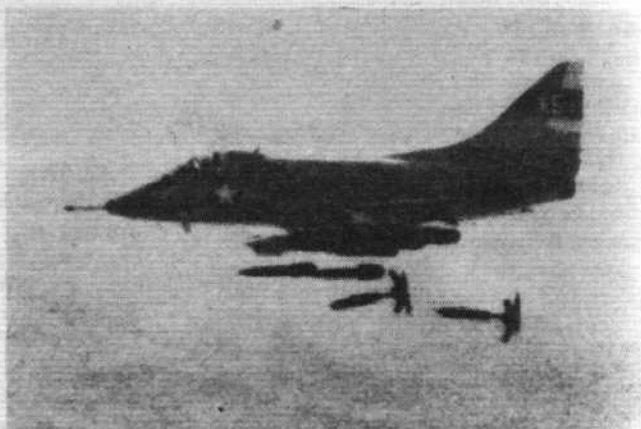
Propulsion for the C-5A is a major field, with General Electric reported to be planning a system of optimum gas-generator units mounted externally on a tip-driven, large-diameter fan unit. This offers flexibility in the number of fan stages and an option on the number of gas generators providing the basic power. Pratt & Whitney are reported to be already running their STF-219 (*Flight*, last week) with a thrust of nearly 40,000lb, 4:1 by-pass ratio, gas-generator pressure ratio of 24:1 and an extremely low s.f.c.

The British Air Staff Target 364 for a heavy transport aircraft, reported in *Flight* last week, calls for a 120,000lb payload to be carried over 5,200 n.m., though the maximum payload capacity is not stated.

Second F-111 Flies

THE SECOND PROTOTYPE CONVAIR F-111A variable-sweep strike fighter made its first flight from Fort Worth, Texas, on March 1. The aircraft was airborne for 1hr 5min at subsonic speeds and heights up to 15,000ft. The take-off was made with the wing fully forward at 16° sweep. It was swept to 26° during the climb, handling was checked at 70° and the landing was made at 26° sweep—the same angle as used for the whole of the first flight by the first prototype. Maximum sweep angle is 72.5°.

Snakeye is the designation of these new retarded bombs, seen being dropped from a Douglas A-4 Skyhawk. The cruciform airbrakes deploy immediately after release to slow the bomb, make it fall more steeply and allow the aircraft time to clear the area before the explosion. This "lay-down" technique is also used for low-level nuclear delivery



Westland Helicopter Projects

THREE MAIN CLASSES of helicopter project are being considered by Westland, all with civil potential, but with the realization that development must initially be supported by military orders. First is a light helicopter, broadly in the category of the US Army LOH. It is to be a turbine-powered four-seater with a gross weight of about 2,500lb to be available in about 1970. The desirability of twin engines has been recognized. Westland have for some time been discussing such a machine with Sud-Aviation. As a military machine it would be a successor to the Bell 47G Sioux. [Top of col 3]

Gnomes guaranteeing mission completion even following an engine failure, would have a gross weight from 30,000lb to 35,000lb including 6,000lb ASW gear. Civil capacity is 55 to 60 passengers. This project lies in the area of OR.358.

Skyhawk Trainer Ordered

THE US NAVY HAS PLACED a \$27,400,000 order with Douglas Aircraft for 35 TA-4E Skyhawk two-seaters to replace existing operational trainers. There is an option for further purchases in future. The two-seater is formed by inserting an additional 28in fuselage bay behind the existing cockpit, all other dimensions and weapon capabilities being retained. Performance is restored by fitting the P & W J52P-8A engine, which has 10 per cent more thrust than the standard J52 of the A-4E. More than 1,500 A-4s of all types have now been delivered.

Italian F-104Gs to Holland

THE FIRST of 25 F-104G Super Starfighters which are being assembled on Fiat's Turin production line for the Royal Netherlands Air Force was delivered on March 2. The 25 aircraft being built by the Belgo-Italian consortium for the RAAF are additional to the 95 destined for the same force of the 350 which the Fokker-led Dutch-German consortium is building.

One of the 20 Jet Provost T.52s for the Iraqi Air Force at BAC's Luton airfield before delivery. The 12th, 13th and 14th were delivered early last month





These four pictures were recently issued from Russia. Though showing the customary retouching and fogging, they offer a rare glimpse of Russian missiles in operation. Above are two pairs of the ramjet propelled surface-to-air missiles first seen last May

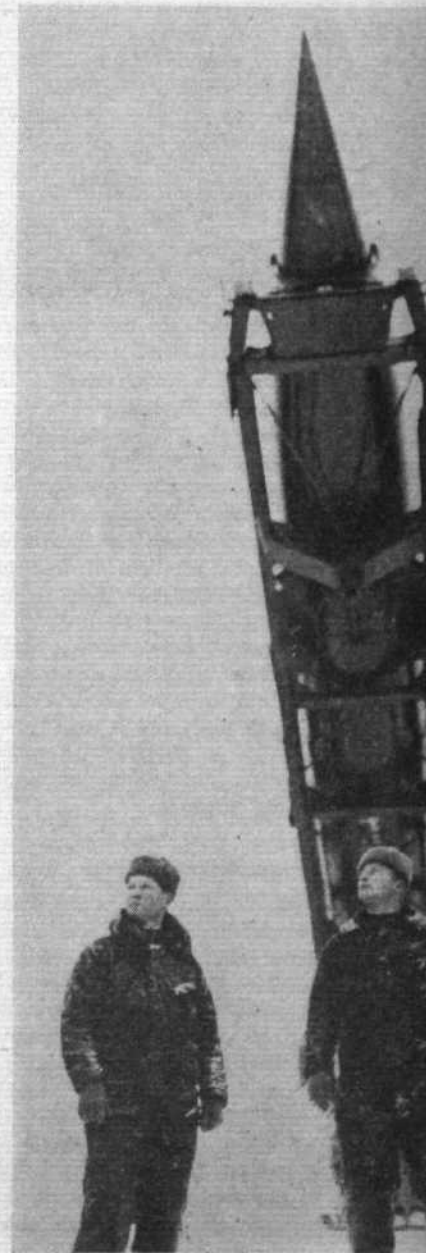


A rare action view of an unguided tactical Frog-type missile departing from a tracked launcher, apparently with six spin motors in action

Russian troops prepare to launch a Frog tactical missile. One man is folding down the ramp support stay while another walks away unreeling the firing cable. Altogether six men are visible



Two Russian soldiers effectively mask the launch platform of what appears to be a Shyster strategic missile during its erection by its transporter frame



DEFENCE IN PARLIAMENT

Dissention Over a Foregone Conclusion

THE two-day debate last week in the House of Commons on the Defence White Paper (summarized in *Flight* last week) was distinguished mainly by a lack of any real controversy on the basic defence issues, except in so far as a section of the Labour Party is opposed to any nuclear arms at all, while the leadership accepts the limited nuclear capability existing in the V-bombers and planned in Polaris submarines. The Liberal Party, which largely voted alongside the Conservative Opposition on this occasion, introduced its own amendment. The Government motion was duly carried and the amendment defeated.

The initial foray opened with an amplified summary of the White Paper by MR DENIS HEALEY, Minister of Defence, and with a riposte from Mr Thorneycroft, which was partly an attack for attack's sake and partly an attempt to widen the conscience split within the Labour Party.

It was inevitable, in view of the recent change in Government and the well known economic stringency, that much of the debate should have involved recriminations and fruitless discussion of slightly distorted versions of points of detail. The conscientious moral element injected its own specialized flavour, to be exploited in its turn.

Little truly constructive could emerge from the present fluid defence situation. Nevertheless, several overall conclusions were evident. First, it seems to be finally universally agreed, for a number of reasons, that Britain's existing and planned nuclear force is not—and cannot sensibly be, or be termed—independent. Second, our troops in Germany are not effectively placed for conventional defence, hardly have any function in a nuclear conflict and, though extremely expensive to maintain in their present location, would hardly prove cheaper if moved to Britain or elsewhere. Third, the problem of defence costs is to a large extent related to manpower, which accounts for at least half of the total bill. Shortage of helicopters, a well known fact, made an admirable opening for detailed recriminations by Mr Thorneycroft, whose Government, and whose personal periods in office as Minister of Aviation and of Defence, had nevertheless been responsible for the shortage.

Co-operation

No full conclusions can be expected until the defence review is complete, but the economical solution, inevitably, is the sharing of commitments, both in manpower or military presence and in R & D. Perhaps most significant is Mr Healey's statement that, while we can look after our requirements for the next ten years, subsequent provisions must be made in terms of co-operation with our political opponents on some form of arms control and disarmament. In the meantime, the United Nations are

for international peace-keeping purposes.

Mr Healey also put defence expenditure into focus when he remarked that Britain was now spending on defence per head of the population twice what it spends on drink and tobacco. Both Russia and the USA had reduced their defence expenditure last year, but the USA still spent 9 per cent of her national wealth on defence, compared with Britain's 6.8 per cent. US reductions had brought the per-head amount down from £98 to £96. The British figure was £39. Russia's defence budget had been reduced, but was still £11,000m, or 12 per cent of her national wealth and £50 per head. Poland had increased her defence budget by 5 per cent, Rumania by 10 per cent and Yugoslavia by 20 per cent.

Projects

Concerning Anglo-French co-operation, which had been discussed with the French Minister of Defence a few days before, Mr Healey said that he hoped to be able to announce during the next few weeks a firm agreement on the initial strike/trainer project and a longer-term project for a variable-sweep development of it. Further discussions would follow later this year on a joint helicopter and an early-warning aircraft. Similar objectives would be pursued with our other allies in the next months.

An incidental aeronautical fact to emerge during the debate was that the C-130E's take-off distance varied, according to required range, between 3,400ft and 3,000ft while the HS.681 was to have had a take-off run of 1,700ft. This difference, said Mr Healey, was not important in view of the airfields actually available in significant geographical areas.

Opening for the Opposition on the second day, SIR ALEC DOUGLAS-HOME, Leader of the Opposition, claimed that despite the criticisms of his Government's policy implicit in the opening paragraphs of the Defence White Paper, "the Government had adopted the Conservative defence policy almost in its entirety." He said that while arguing that the Services were seriously overstretched in manpower and money, the Defence Minister had gone on to announce that logistic support units would be offered for a six-battalion UN force, soon to be followed by the battalions themselves. (Mr Healey had previously made it clear that infantry would not be included, but Mr Thorneycroft had already questioned the possibility of even "earmarking" the logistics units.)

The most striking feature of the White Paper, said Sir Alec, was the Government's change in emphasis on the nuclear element of defence. "They are now convinced of the value of a nuclear deterrent and a nuclear arm." Similarly, the Prime Minister's earlier insinuations concerning certain defects which would reduce the value of Polaris in war had gone by the board;

Polaris submarines were now described as "a massive contribution" to an Atlantic force.

MR HAROLD WILSON, the Prime Minister, thought it was significant that the Opposition leader had not mentioned the words "independent deterrent" until the last few words of his speech. Sir Alec knew very well that the Government had not adopted the policy of an independent deterrent, which had been proved conclusively not to have existed while Sir Alec was in office.

The previous Government had cancelled the Avro supersonic bomber in 1957, when it was intending to rely on Blue Streak as a deterrent, "on the perfectly fair grounds that this would not be in service before 1967." But the present Government had inherited a situation last October in which the supersonic bomber eventually put into the programme, TSR.2, could, at the earliest, not be in service before 1968. Having cancelled a bomber on the grounds that it would not be ready until 1967, the previous Government had then spent hundreds of millions of pounds on one that would not be ready until 1968.

Mr Wilson was scathing about Mr Thorneycroft's "irresponsibility," the previous day, in speaking about helicopters. One reason for the Government's inability to cut this year's estimates by as much as they would have liked was the need for a crash programme to buy helicopters, "to make up for the deficiency for which Mr Thorneycroft and his predecessors were responsible."

Increased Cost

MR DENIS HEALEY, Secretary of State for Defence, winding up for the Government, said that although the estimates were up this year they were up not by the "much more than 3½ per cent" which a member of the last Government had forecast, but by only 2.8 per cent. "I hope the House is duly grateful for that." He contrasted Sir Alec Douglas-Home's assertion that he supported saving on equipment provided it did not harm the fighting men, with the Opposition's motion of censure and three-line whip two weeks before against the Government's aircraft programme, which would save £300m and give the forces the aircraft when they needed them.

He thought the reasons why the Opposition had stopped boasting of an independent deterrent—the existence of which had been denied by the Chief of the Defence Staff, who had served the last Government ably for many years—was that they had lately learned that the use of nuclear weapons independently by Britain would bring total destruction to the whole population of our island. The Opposition had at last learned sense.

The White Paper was accepted by 298 votes to 287, a majority of 11, and the Opposition amendment defeated by 298 votes to 293.



Straight and Level



HELLO, is that the Ministry of Planes? Can I speak to the information department please? Thank you. Oh good morning. We have a report that the Minister has been down at Gatwick all morning sawing eight feet off the wings of every independent airliner on the tarmac, stuffing potatoes up the exhaust pipes, and puncturing the tyres. What goes on, old man?

—Sounds like a load of absolute tripe, dear boy, but I'll check for you. Only too glad to help, you know. Hold on a minute while I take a reading on it. Would you like a quote from the Minister? Don't mention it—that what we're here for, dear boy. Hold on... Well, it's just as I thought. Absolute balderdash. He sawed only six feet off each wing, stuffed potatoes in the oil coolers, and far from puncturing the tyres he merely strewed the tarmac with rolls of barbed wire. OK? Oh yes, you wanted a quote. How about: "There is no new restrictionism. In my belief both corporations and independents have a part to play"—no, let's say "a vital role to play in British civil aviation." All right? Not at all, dear boy—any time.

● I have heard of naval aircraft flying with wings folded, but never (until the F-111) of wings being spread in flight. Here is a case recorded by the immortal Grampaw Pettibone, aged US Navy aviator and spreader of flight safety in the US Navy's publication *NA News*. "Lowering the wing" here refers to wing-incidence change in the F-8E Crusader, which took off at night from a land base in the United States.

The pilot described his afterburner take-off as "normal." Grampaw continues "After becoming airborne, the pilot suddenly became rudely aware that the aircraft was configured in an abnormal manner when he was unable to lower the wing. While attempting to determine his difficulty, he suddenly discovered that the wings were still folded.

"As he wasn't having any trouble controlling the aircraft, he climbed to 10,000ft and attempted to spread the wings but found that the wing spread handle would only go to one inch from the normal

—from "The Daily Telegraph"

I am sure Sir Giles will rule out the Dutch Fokkers as I have tested all three of these turbo-prop. aircraft and would prefer the two British planes for the job he has in mind.

The NOISE it must have made



The pilot of this Auckland Gliding Club Tiger Moth, Mr George Hill, escaped with only scratches when he crashed into the roof of Ardmore Teachers' College, Auckland, New Zealand, on January 27. The Tiger had been towing a glider

spread position. He then applied approximately one-half negative g and the port wing spread. After repeating the procedure the starboard wing spread. During this manoeuvring speeds in excess of 300kt were attained. With both wings spread the pilot lowered the wing normally and locked it. Everything now appeared normal, so he proceeded to his destination and made an uneventful landing. Luckily, the aircraft sustained only limited damage in the wingfold area."

● From an advertisement in *Power Laundry and Cleaning News*:—

"Even at speeds of up to 600 m.p.h. stewards and hostesses of BOAC remain cool, calm and super-efficient. Maybe it's the fact that their jackets and blouses have just the right touch of Powles Hunt Starch to see them crisply through the journey!"

● Mr John Stonehouse, Parliamentary Secretary, Ministry of Aviation, in the Commons on March 1:—

"I was getting to the discussion of domestic trunk services, and I am making the point that if we allow competition on these domestic trunk services we lead to waste and

inefficiency. [Hon members, Oh!] Oh yes, because extra terminal facilities need to be provided."

Mr Stonehouse went on to say that even on the densest routes two operators increase costs.

I have never seen any evidence to support this, and I doubt whether Mr Stonehouse has. But facts can be jolly awkward when political minds are made up.

● Cancellation of the 1154 must be a great personal blow to Sir Sydney Camm, whose fighter designs have been in RAF service for 30 continuous years. If the nation had gone ahead with his P.1121 in 1957 the RAF would have had a Mach 2.1 aircraft in service today which would have almost been a TSR.2 as well as an interceptor. No doubt, too, it would have been painted with the insignia of many air forces. But the P.1127 Kestrel—thanks primarily to American support for the Bristol Siddeley Pegasus under the Mutual Overseas Weapons Development programme—will perpetuate the Camm stable.

● "Do things ever get back to normal in this industry?"

ROGER BACON

DEBATING AIRLINE POLICY (continued from page 365)

explanation of the arrangements being made for writing off the corporation's deficit and for the contingency allowance. To some people, he said, the proposal would look like paying off a deficit in advance of events. He asked under what powers the Minister had made his air transport policy statement. This policy meant that, if the independents went to the ATLB and obtained approval, the Minister was inciting BEA to appeal against the decision and he was saying in advance that he would grant that appeal. He was,



Mr John Stonehouse: "For the last five years corporations and independents have operated under a miasma of doubt and uncertainty"

in effect, abandoning his own quasi-judicial status as Minister and removing the independent status of the Board. The Minister had given in to the pressure of his own back-benchers to do away with the competitive element and to return to monopoly.

MR JOHN STONEHOUSE, Parliamentary Secretary to the Ministry of Aviation (Lab, Wednesbury), said that for the past five years

both corporations and independents had operated under a "miasma of doubt and uncertainty." This had inhibited the successful development of British air transport, had resulted in inefficiency and had wasted the time of executives and others in meaningless appeals and litigation. Since the passing of the Licensing Act the air transport industry had staggered from one *ad hoc* decision to another, never quite knowing what to do for the best. Airline executives had been spending more time preparing for quasi-judicial proceedings than actually running their businesses and the appeals and counter-appeals had embittered relations in the industry.

An attempt had been made in the five years since the Act to build up a case law, but this had not worked because the ATLB had been given only a vague policy directive which could be interpreted in almost any way. After all the granting of licences and hearings of appeals the Government had often failed to get the traffic rights from foreign administrations. There were two interpretations of this situation. One that the concessions demanded were too great and the other was that the previous Government had failed to press the negotiations with enough vigour. In the first case the situations could have been anticipated and whatever conclusion was drawn the previous Government acted as Tantalus for the independents.

The Government recognized the importance of the independents, but they regarded their role as being complementary to, rather than competitive with, the corporations. The independents must be prepared to pioneer and the Government would then back them to the hilt.

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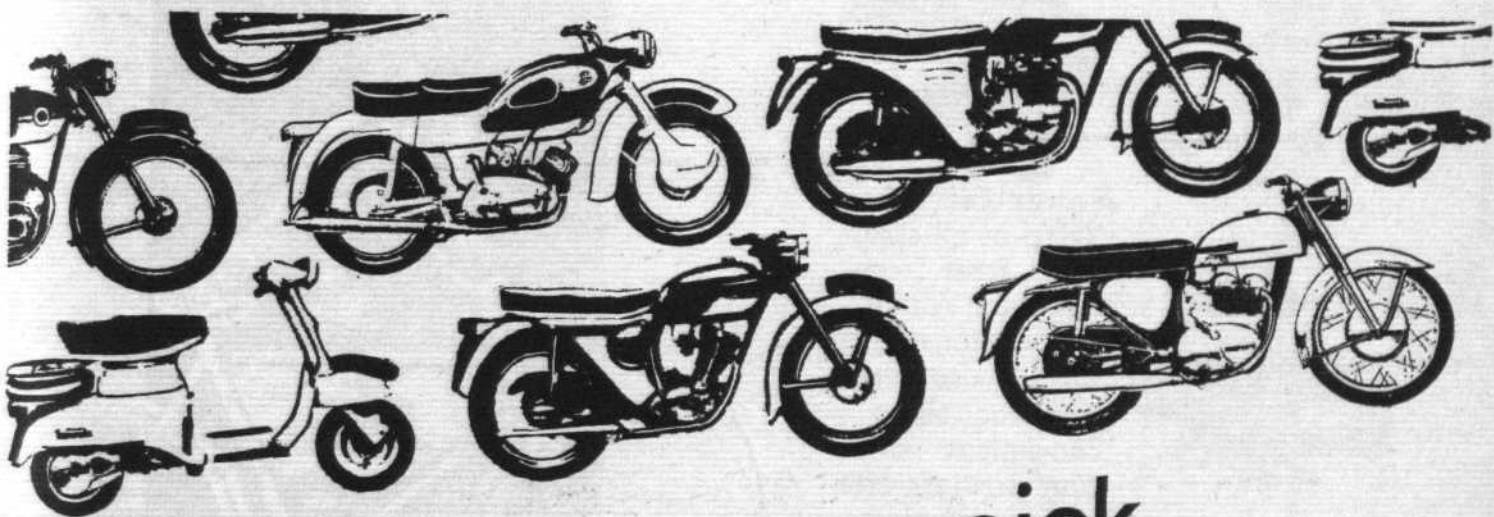
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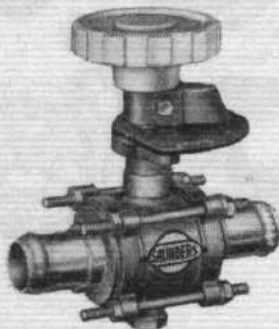
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also with self-closing action is the Diaphragm Tap below, as supplied for aircraft domestic water systems.



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- ★ Civilian or military Air Traffic Controller
- ★ Pilot, Navigator or Flight Radio Operation in civil or military aviation

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- ★ Free passages to New Zealand
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Watchkeeping ATCO's earnings are up to approx. £2,000 a year excluding overtime. Generous annual and paid sick leave and superannuation.

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Applications close on May 2, 1965.

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- Soil Mechanics;
- Highway and/or Traffic Engineering.

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Lecturer: £1,460 × £85 to £2,225 (bar) × £85 to £2,565.

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The salary on appointment may be above the minimum of the scale.

Application forms and further details are obtainable from the Academic Registrar to whom completed applications should be returned within three weeks of the date of this advertisement. Please quote ref. CM/F. [6216]

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Required by the GOVERNMENT OF ZAMBIA to take charge of aviation forecast office, carry out routine outstation inspections and to initiate and encourage research.

Appointment on contract for one tour of 36 months in the first instance. Salary scale (including Overseas Addition) £1,930 rising to £2,135 a year. Gratuity 25 per cent of total salary drawn. Free passages. Liberal leave on full salary. Generous education allowances.

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Apply to CROWN AGENTS, M. Dept, 4 Millbank, London SW1, for application form and further particulars, stating age, name, brief details of qualifications and experience, and quoting reference M3M/59732/FE. [6237]

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Age limit: 40

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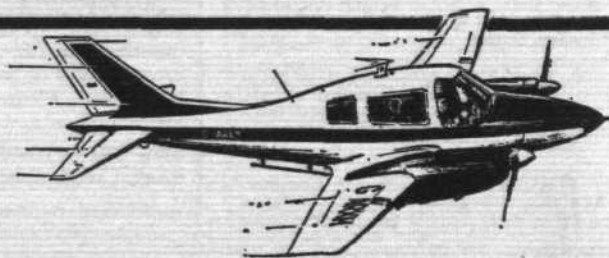
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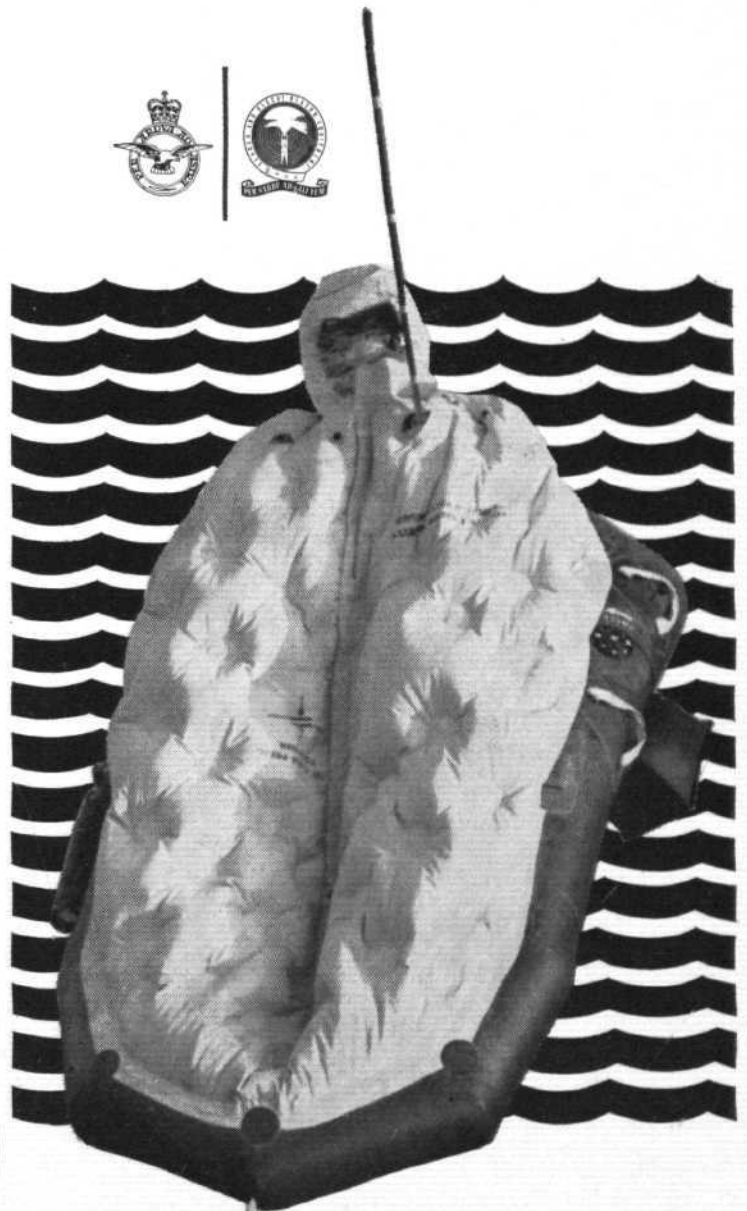
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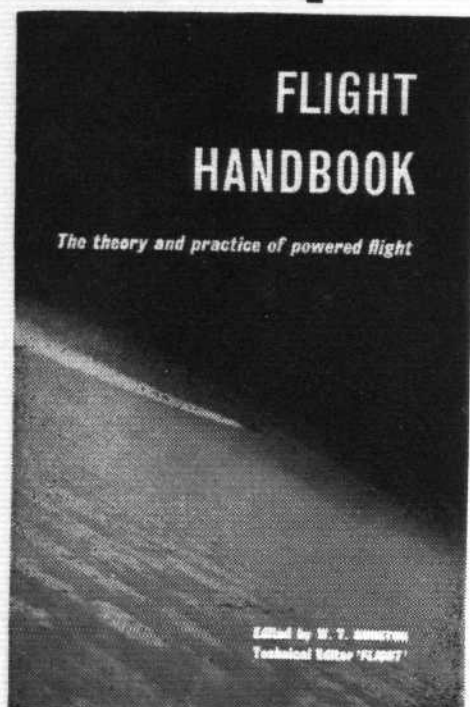
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