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FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

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IN THIS ISSUE

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The Broad Front

MONDAY, May 15, was the 20th anniversary of jet flight in Britain. On that date in 1941 the Gloster/Whittle E.28/39 was first taken into the air—for seven minutes—by the late Jerry Sayer. This historic flight had, in fact, been antedated by that of the Heinkel He178 on August 27 of the previous year; but it was none-the-less a lustrous achievement and the begetter of massive export orders in the post-war years—orders for which the Whittle patents were directly responsible. Britain gained her reward and was able to enjoy it in comparatively leisurely days.

We find the word leisurely applied in a more disturbing context in a leading article in the *Daily Mail*, to which one of Britain's greatest aircraft designers has drawn our attention. The leader reads: "World competition in air and space is ferocious. But one has the feeling that Britain's attitude towards it is much too leisurely." This opinion will be shared by many; yet Britain's bid for leadership in air transport equipment has never been so strong. We now have the prospect that no other nation will be able to offer a range of transport aircraft so cohesive and complete as that comprising the Short Skyvan, de Havilland Jet Dragon, Handley Page Herald, Avro 748, BAC-107, de Havilland Comet, BAC-111, Vickers Viscount, Armstrong Whitworth Argosy, de Havilland Trident Mks 1 and 2, Vickers Vanguard, Short Belfast, and Vickers VC10 and Super VC10.

Restraint and Advance

Yet the gnawing feeling that "Britain's attitude is much too leisurely" persists; and even as we have been writing, affirmation has come from Sir Reginald Verdon Smith, chairman of the Bristol Aeroplane Company. In the company's 51st annual report to shareholders he said, "If one asks almost anyone in the industry who is familiar with the administrative process whether he is satisfied with its operation at present he will very likely reply that today more than ever before we depend too much on waiting to see what others in other countries will do, and that thereafter the machinery moves too slowly and by unnecessarily small stages. No one will dispute the need to exercise strict economy in the spending of public funds but there is reason to feel that the restraints and scrutinies being applied at the present time are making it harder to keep abreast of competition from elsewhere and unnecessarily difficult to keep the advantage where we happen to have gained a technical lead."

And just where, it may be asked, has Britain gained her technical lead? She has gained it in each and every one of the transport aircraft we have listed (and we do not forget *ils ont copié Caravelle!*). She has gained it, too, in the field of VTOL with the Westland Rotodyne, Hawker P.1127 and Short SC.1, and in the same fields with the lift and lift-thrust engines of Rolls-Royce and Bristol Siddeley. These are achievements that do not shame the name of Whittle. Mistakes, indecision, indifference, paltriness there have been; yet in spite of them Britain not only remains in the Big League but is fielding a team to challenge the New York Yankees, the Dynamos and all the rest on their own grounds. We find ourselves heartily in agreement with Sir Reginald Verdon Smith who, subject to reservations which we have already quoted, considers that the prospects of the aircraft industry can be viewed with much greater confidence today than was the case two or three years ago. We have built—and shall build. We must—and shall—sell.

FROM ALL QUARTERS

OFF GROUND AGAIN after twenty years: the historic E.28/39 is lifted to its new "hangar" in London (see "Gloster-Whittle Anniversary")

BAC-111 and Spey

AS intimated last week, British Aircraft Corporation have now released preliminary details of the BAC-111 short-haul jetliner, and announce an order for ten (plus five on option) from British United, and a letter of intent for five from Ozark. Details are given on pages 673-674 of this issue.

Powerplant of the BAC-111 is the Rolls-Royce Spey, and many new details of this important engine will be found in a review of Rolls-Royce aircraft gas turbines which begins on page 667.

Roy Ewans Resigns

CHIEF designer and an executive director of A. V. Roe & Co Ltd, Mr J. R. Ewans is to resign at the end of this month. No reason has yet been given, but Mr Ewans is reported as saying that he has made his decision "for purely personal reasons," and that there had been no disagreement between himself and the company. Avro said last weekend that they would be unable to comment until the end of this week.

Mr Ewans, who joined the company as chief aerodynamicist in 1949, was responsible for development of the Mk 2 Vulcan and the Avro 748. Latterly he has been working on the 761 project, a twin-Spey medium-range airliner developed from the 771 and comparable with the BAC-111.

HSG Link with Germany

IT was announced on May 15 that the Hawker Siddeley Group's representation in Common Market countries is to be greatly strengthened by an extension of a previous agreement between Hawker Siddeley Aviation and the Otto Wolf steel and engineering group of Cologne. Not only is this aviation link to be expanded, but Otto Wolf will now work with Hawker Siddeley Industries in a trading association covering "a wide range of products."

It is relevant to note HSG's existing agreements with SEREB (Paris) for space research, Focke-Wulf (Bremen), an indirect link through Bristol Siddeley with Klockner-Humboldt-Deutz on aero engines and a government-to-government agreement to evolve a V/STOL tactical aeroplane based on the Hawker P.1127.

World's Busiest Air Route

TODAY, May 18, was due to be the last day of the Air Transport Licensing Board's hearings into Cunard Eagle's application for a North Atlantic service. Just published by the International Civil Aviation Organization are some remarkable facts about traffic on this route during 1960. The North Atlantic experienced the largest regional increase in passenger traffic in the world, carrying 395,000 more passengers on scheduled flights than in 1959, for a total of 1,761,000. With charter and special flights, the total becomes 1,920,000—an increase of 25 per cent over the previous year's 1,540,000. This increase accounts for about 30 per cent of the year's overall increase in international passenger traffic.

Within the last three years North Atlantic passenger traffic has nearly doubled, from 1,020,000 in 1957 to 1,920,000 in 1960. Sea travellers now constitute less than one-third of the whole North Atlantic passenger traffic.

Maytime Toreadors

FOR five days and nights last week Britain was under air attack. "Enemy" forces were aircraft of Bomber Command, USAF, RCAF, French Air Force and RAF Germany; defenders were Fighter Command and the Fleet Air Arm. This was Exercise Matador, an annual test of the country's defences and early-warning radar. Nuclear fall-out was simulated, and 15,000 members of the Royal Observer Corps gave up their weekend to practise reporting procedures.

For the professionals, especially the fighter pilots, such exercises may entail periods of inactivity. No attacks came in the first 90 hours of the alert and at Leconfield, where a *Flight* staff member had the privilege of visiting 19 Sqn, most of Friday was spent at a 2hr state of readiness which went down to half an hour when a big enemy force was reported off Norway. For 50min pilots sweltered in their cockpits awaiting telebrief instructions; then the emergency died away, and as the squadron's blue-and-white checkerboard flag fluttered intermittently in a soft evening breeze, immersion-suited crews sat around on the grass listening to tape-recorded jazz. But in the early hours of Saturday morning the squadron's Hunter F.6s and the Javelin FAW.4s of 72 Sqn were scrambled. Interceptions were claimed and during that day some of the aircraft operated from three different airfields: with Leconfield subjected to nuclear fall-out they landed at Middleton St George and later went into Leuchars.

The C-in-C Fighter Command, Air Marshal Sir Hector McGregor, stood down his command at 0925 last Monday after the last of six raids had occurred and a maximum scramble been mounted. Most interceptions in Matador were made well out to sea; the Continental warning system had worked well and serviceability was good on both sides.

Rotodyne Order Report Denied

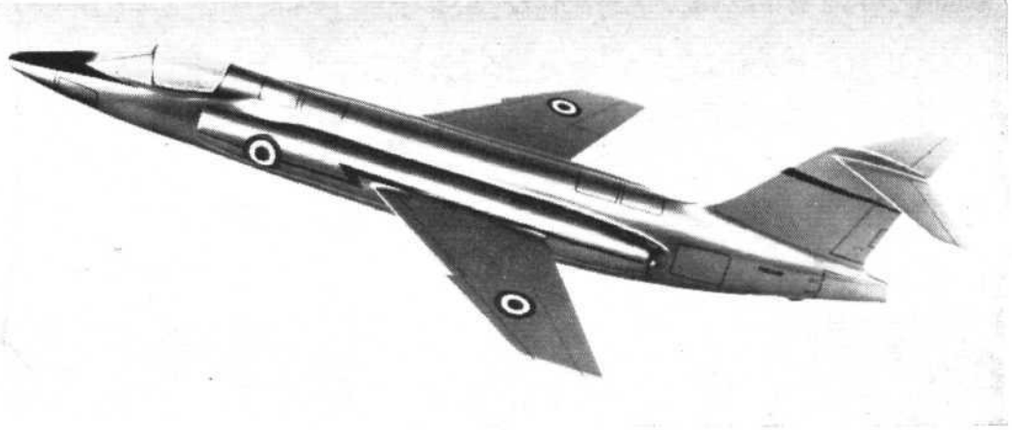
INVITED by *Flight* to comment on a London newspaper story last week that "the RAF is to buy 12 Rotodynes at a cost of up to £1m each to airlift the Army" and that "British European Airways is to take a further six Rotodynes," a Westland spokesman said that the assertion was a speculative one. No Ministry orders had been received, but the company was about to tender for the supply of an initial 12 Rotodynes which would be operated by RAF Transport Command for the Army in troop-carrying, freighting and casualty-evacuation roles. Though technical talks had been held with BEA from time to time, there had been no contractual discussion.

Gloster-Whittle Anniversary

LAST Monday, May 15, was the 20th anniversary of the first flight of the Gloster-Whittle E.28/39—Britain's, and almost the world's, first jet aircraft (a Heinkel He178, turbojet-powered, had flown on August 27, 1939). During 1939 Mr W. G. Carter, Gloster's chief designer from 1936 to 1948, was invited by the Air Ministry to design a jet-propelled aircraft, to be powered by the Whittle W.1 engine. By April 1941 the first of two prototypes, number W4041, was ready for taxying trials; and at Cranwell on May 15 it was flown, for 7min, by the late Jerry Sayer. The story of these events has often been told, but one point in particular which can be repeated here concerns Sayer's flight-test report. Stamped SECRET in inch-high letters, the form is divided into the usual component sections, and against "Airscrew Type and No" is entered "No airscrew fitted with this method of propulsion." The engine, incidentally, is entered as "Whittle Supercharger Type W.1."

Now the famous prototype is a prized exhibit in the National Aeronautical Collection at the Science Museum in South Kensington. The collection is at present being re-housed in the hangar-like top floor of a new block (*Flight* last week, page 612) and the E.28/39, as the picture above shows, was among the bulkier exhibits that had to be hoisted up outside the building.

SWIVELLING NOZZLES of the Bristol Siddeley BS53 Pegasus are explained by Dr S. G. Hooker, technical director (aero), to a visiting group from the Royal Swedish Air Force Board headed by their chief, Gen L. G. H. Thunberg. Also in the picture are Sir Arnold Hall, managing director of Bristol Siddeley (right), Dr R. C. Plumb, an assistant chief engineer (fourth from the left) and Col S. L. Flodin (third from left), one of the Swedish visitors to Patchway



FLAT-RISING FIAT: This model of the G.95 shows one of several Fiat proposals for STOL and VTOL tactical aircraft. It appears to have two propulsion turbojets and four groups of lift engines

RAeS Honours

AMONG awards announced by the Royal Aeronautical Society are honorary fellowships to Sir Sydney Camm, CBE, FRAeS, director and chief engineer of Hawker Aircraft, and to Mr J. D. North, chairman and managing director of Bolton Paul Aircraft. These awards are being presented at the Wilbur Wright Memorial Lecture, normally given in May but this year to be delivered on September 12 during the eighth Anglo-American Aeronautical Conference. Details of other awards will be given in *Flight* next week.

The Boeing Company

FOR many years the largest single airframe manufacturer in the world, Boeing Airplane Co will henceforth be known by the title above. This change is intended to reflect the firm's wide range of interests, which now embrace ICBMs, pilotless intercepters, large helicopters, nuclear power and manned spacecraft, as well as a limited range of non-aeronautical activities. Boeing have thus followed the lead of Chance Vought, and are likely in the course of time to be followed by several other eminent US "frame makers."

It is Rumoured That . . .

AMONG an exceptional spate of unconfirmed reports circulating within the British industry are the following:—

British Aircraft Corporation have made a new bid to secure acceptance of the "Lockheed 222" as heavy STOL freighter for RAF Transport Command. The US Government is said to be offering to finance development of this C-130 development (*Flight*, February 17, page 198) under MWDP.

According to the *Daily Express*, "A modified form of a French two-engined Breguet anti-submarine plane [obviously the Br.1150 Atlantic] is being considered as a possible replacement for the Coastal Command Shackleton. Fitted with a third engine to increase range, this plane would also be made in Britain under licence."

Dr Barnes Wallis, of Vickers, and Dr R. R. Jamison, of Bristol Siddeley, are named by the *Daily Telegraph* in an exposition of "a plane that can penetrate any known or contemplated defence system." Although it would have a high wing loading, it would be capable of continuous manœuvre at altitudes greater than 100,000ft.

A New Rotary Engine

ON May 9 a Hampshire firm of engineers and machinery merchants opened their doors to those interested in a new rotary-piston engine. Broadly, the unit is a kinematic inversion of gas-turbine fuel pumps, in which an inclined ball-bearing imparts a swash-plate drive to axial pistons. The example demonstrated has a diameter of some 10in, and a swept volume of 700cm³. It has six double-ended cylinders, which are curved to maintain a constant radius from the centre of a spider (carried on the inclined ball-bearing) on which the pistons are mounted. The engine operates on a two-stroke cycle, with scavenging by a Roots-type blower.

Among the advantages claimed are simplicity, compactness, excellent dynamic and pneumatic balance, and the elimination of both oil lubrication and liquid cooling. The engine shown unfailingly started at the first pull of the rope, and behaved in a most encouraging manner. Development still has a long way to go; but many eminent engineers were keenly discussing the unit five hours after their arrival at the demonstration. The company concerned is William R. Selwood Ltd, of Chandler's Ford, Hants.

Waveney Group Rally

THE Waveney Flying Group's air rally at Seething airfield, near Bungay, on May 7 went well despite a very strong and gusty wind. Visiting aircraft landed on 2,700ft of the 250° runway and parked on 1,500ft of the 12/30 runway of the wartime airfield which the group has leased for 15 years from local farmers. More than 30 aircraft arrived. There were sales demonstration aircraft, including three Cessnas, a Comanche, Aircoupe, Champion, Bölkow KL 107, Mousquetaire, Super Aero and Meta-Sokol: and visitors included JAP-engined and Volkswagen-engined Turbulents, Archbishop Tiger Moth, the Chilton all the way from Valley, a British-registered Jodel D.112, the Globe Swift and a selection of age-before-beauty types which included *Flight's* Gemini. Farm Aerial Services Ltd laid on a canteen and the local Civil Defence unit provided control and ground-to-ground radio service.

Unfortunately, the wind proved too strong for crop-spraying, glider and parachuting demonstrations and for a projected air race to Bungay and back, but C. A. Nepean Bishop gave two very graceful aerobatic displays in the Archbishop and the commercial team kept busy with demonstrations. The group's own Messenger spent the afternoon giving introductory flights to some of the large number of visitors who arrived by road.

IN BRIEF

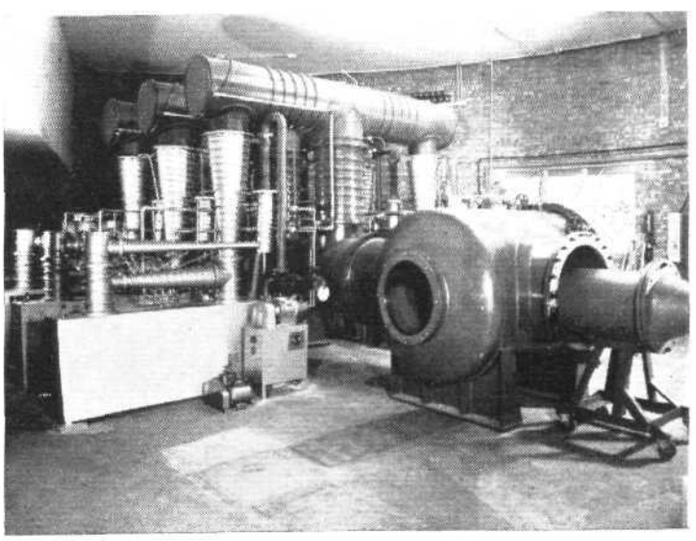
The Louis Blériot Trophy, to be awarded to the pilot of the first aircraft to average 2,000km/hr (1,242 m.p.h.) for 30 min, is likely to go to Maj Elmer Murphy, USAF. On May 11 he averaged 1,302 m.p.h. for 30min 45sec over California in a Convair B-58.

The Guild of Air Pilots and Air Navigators' Award of Merit has been awarded to Mr Cecil L. Pashley, manager and chief instructor of Southern Aero Club. The award was announced by Capt O. P. Jones, representing the Master of the Guild, at the party held by the club to honour him last Saturday, May 13. Mr Pashley, who is 70, has been flying for over 50 years.

At Dumbarton last Saturday Wm Denny & Bros launched their experimental sidewall Hovercraft, which weighs 4 tons, is 60ft by 10ft and has two Mercury 300 outboard motors driving v.p. propellers. An air cushion is provided by two 3-cylinder two-stroke Excelsior engines of 25 h.p. each. Of mixed plywood and metal construction, the Hovercraft is capable of 15kt. It is designed to clear the water by about 6in, but the sidewalls remain immersed to give directional stability.

Prof George Temple, CBE, MA, DSC, FRS, FRAeS, Professor of Natural Philosophy at Oxford University, has been appointed chairman of the Aeronautical Research Council in succession to the late Prof W. J. Duncan. Prof Temple, who is 60, has had a distinguished academic career and in 1947-49 was Chief Scientific Adviser to the Ministry of Civil Aviation.

The index to Vol 78 (July-December1960) of *Flight* is now available, price 1s (by post 1s 3d), from Associated Iliffe Press Ltd, Dorset House, Stamford Street, London SE1. Copies of this volume can be bound (with index) at a cost of 25s, return postage included; or binding case and index are available separately, price 7s 6d (by post 9s). Copies for binding (with sender's name and address enclosed) should be forwared to Associated Iliffe Press Ltd, Binding Dept, 4/4a Iliffe Yard, London SE17, and advice and remittance sent separately to the publishing department at Dorset House.



LOW-DENSITY TUNNEL: This new low-density wind tunnel was on show for the first time at the Open Days of the National Physical Laboratory, Teddington, last week. Pressure can be varied between 10 and 100 microns of mercury; the booster diffusion pumps, backed by mechanical pumps, have a speed of some 20,000 litres/sec; and the test stream diameter in the working section varies from 3in at M2 to one inch at M10

The Distinguished Service Medal of the National Aeronautics and Space Administration is presented to Cdr Alan Shepard by President Kennedy in Washington on May 8 (see "The View from Space"). The astronaut's wife Louise is on the left of the picture

Missiles and Spaceflight

THE VIEW FROM SPACE

by William Hines, "Washington Star"

ASTRONAUT Alan B. Shepard told a news conference in Washington on May 8 that he had experienced "no bad moments" in his 15-minute sub-orbital flight in a Redstone-boosted Mercury space capsule the previous Friday. The 55-minute conference was Cdr Shepard's first ordeal-by-press since his brief ride into space. He handled himself (and the newspaper men) coolly and calmly, and answered apparently as frankly as he could all questions relating to his assigned mission. To questions of a personal nature, or requiring expression of an opinion on public topics, the astronaut was courteously but firmly uncommunicative.

Little that was new in the scientific or technological vein came out of the meeting. But the conference was significant because it brought a clear picture of what it is like to ride a rocket to altitude, experience weightlessness for an appreciable period, and return to Earth after being in space.

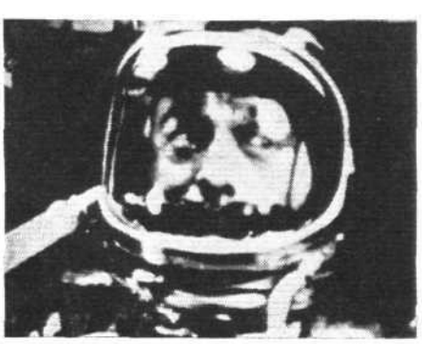
Cdr Shepard said he was "surprised at the lift-off, that the ignition of the Redstone and the lift-off were as smooth as they were." Noise and vibration were not as much of a problem as he had expected, the astronaut added.

From altitude, his first look at the Earth "sort of took my breath away." He continued; "I had been pretty well briefed on the land masses as they should appear, and the cloud cover as it should have appeared." His view of the earth stretched as far north as Cape Hatteras, North Carolina, nearly 600 miles from the point directly beneath him. Hatteras was obscured by clouds, as were the Bahamas. He could clearly make out the Florida peninsula, however, and its large central water feature, Lake Okeechobee, as well as Andros Island and Bimini on the fringe of the Bahamas.

Astronaut Shepard said that he found the transitions from high g-loading to zero-g on the ascent, and from zero-g to high-g on descent, gradual and not unpleasant. Weightlessness, he commented, "is quite a pleasant sensation, particularly so after the accelerations of the booster ride." Zero-g was no impediment to the manipulations required of him by the tasks prescribed.

The astronaut undertook to correct an erroneous impression in some news stories that he had experienced trouble at two points in the lift-off. He explained that while "there were two specific points in the flight plan which we had judged ahead of time to be rather difficult from the standpoint of stress on the bird," these were found to be no problem. These two crucial points in the profile were in the transonic region and in the region of maximum dynamic pressure ("max Q").

There was no heating in the cabin on re-entry, Cdr Shepard said—pointing out, however, that the Q on a Redstone profile re-entry was nowhere near as high as that on an Atlas orbital flight.



Photograph of the astronaut in the Mercury spacecraft during the May 5 ballistic flight, taken by the automatic pilot - observer camera mounted in the main instrument panel of the capsule. The astronaut's couch was constructed of crushable honeycomb material bonded to a glass-fibre shell and lined with rubber padding

The astronaut reported that he could not see stars in the sky through his periscope. He turned to his associate, Lt-Col John H. Glenn, for elaboration, and Glenn told of a discussion among the Mercury astronauts on this point. Some believed stars would be visible and some believed not, and a bet of a steak dinner was down on the proposition.

"I felt that we probably would [see stars], even on a short flight like this," Col Glenn said. "Al did try and see the stars out through the window, and I am still claiming foul because I claim there was not enough time left for his eyes to adapt at that time, and Gus [Air Force Capt Virgil I. Grissom] claims this is final proof at the moment." Cdr Shepard said the Moon and planets were not visible, either, but added that this may have been only because they had set by the time the capsule reached apogee at about 9.39 a.m.

The astronaut confessed to a feeling of apprehension before the flight but, in answer to the conference's final question, said he never had had any misgivings about being in on Project Mercury. He refused to say more about the Russians' managing an orbital flight before the American sub-orbital mission than that "We were very much disappointed." He said, however, that the Mercury flight could have been undertaken "a lot earlier" than Gagarin's mission had the project's managers chosen to rush the attempt.

Newsmen were struck by Cdr Shepard's continual use of the first-person plural in describing what was essentially a one-man mission. "We" had been his word since he reached Washington from Grand Bahama Island in mid-morning of May 8. At the news conference, this exchange occurred:

Reporter: Commander, to whom are you referring when you say "we"?—"We" went so far, and "we" went so high?

Cdr Shepard: I think maybe it is appropriate at this time, as I have said before, earlier today, that I am acutely aware of the hundreds of individuals who made this flight possible.

The astronaut said the space capsule performed so well throughout the flight that revisions suggested by him afterward were minor in nature and few in number.

In a brief opening statement, Cdr Shepard made the point that "this particular flight was one which was certainly accomplished in the open." He added: "We had very few secrets about our plans; mostly launch dates were classified, but very little else was. This has been a little annoying to us at times, but I think we all rationalized with the thought that the free democratic society which produced us, and which produced Project Mercury, certainly had a right to be represented in such a fashion."

Cdr Shepard was accompanied throughout the day by his wife, his parents and hers, and a sister of Mrs Shepard. They had first been received at the White House by President Kennedy, who conferred on the astronaut the Distinguished Service Medal of the National Aeronautics and Space Administration.

Later, Cdr and Mrs Shepard, together with other members of the Mercury group, were driven up Pennsylvania Avenue to the Capitol, while about 250,000 persons lining the street cheered. The astronaut was greeted by members of Congress, went downtown again for the news conference, and attended a luncheon given by Space Administration officials.

COMMUNICATION SATELLITE COMPANY FORMED

International participation in a government-regulated satellite communications system is the aim of Communication Satellites Inc, a co-operative company whose recently announced formation was initiated by US General Electric. It plans to provide its members with a commercial microwave relay service by satellite for worldwide transmission of communications traffic, including telephone and telegraph. General Electric state that by the co-ordination of scientific efforts the new company could minimize the delay in commercial satellite communication development.

If these plans are approved by the US Government, American aerospace and communications firms will be invited to participate, and it is envisaged that governments as well as private firms may wish to join.

To avoid excessive influence by one member, GE have suggested that the maximum interest in Communication Satellites Inc be restricted to about 10 per cent per company. Other provisions would be designed to ensure a "fair" basis for the availability of services and facilities both to countries and to companies.

The temporary headquarters of the new enterprise is at General Electric's Philadelphia offices. Its temporary officers are H. W. Paige, president; D. T. Atkinson, executive vice-president, and H. T. Hokanson, vice-president for space operations, all from GE's Military Space Vehicle Department.

"As soon as the missile has changed from external to internal power the launcher boom is automatically elevated . . ."

BLUE WATER

ONE of the most common missions for a guided weapon is to deliver a warhead from one point on the Earth's surface to another. The giants in this field are the ICBMs, costing hundreds of millions to develop and deploy, and unlikely to be used by any nations other than the USA and USSR. In contrast, smaller tactical missiles are very much cheaper, and there is scarcely an army in the world which is not studying the available hardware. In many cases the national budget makes such study a trifle wistful; but at least a dozen countries have announced requirements for a tactical guided weapon, and the field is one of particular interest to the member-nations of NATO.

First missile to be developed for tactical precision bombardment —as distinct from the anti-city function of the German A.4 ("V-2") —was the Corporal, which achieved initial operational capability with the US Army in 1953. Although for eight years it has been a bird in the hand, it is by modern standards unacceptable on the grounds of weapon-system bulk, weight, complexity, cost, manpower and reaction time.

In 1956 Corporal was adopted by the British Army, and English Electric Aviation's guided-weapons division at Stevenage and Luton were appointed foster-parent to look after it. By 1958 the War Office had formulated requirements for a British "corps-support" missile to replace Corporal in the Royal Artillery. By this time both the user and the foster-parent knew enough about the employment of tactical missiles for the basic deficiencies of the earlier weapon to be corrected.

The War Office specification stipulated that the new missile should be capable of operation within stated minimum and maximum ranges, and laid down the types of warhead and fuzing systems. It required that the new missile should be readily air-transportable (the Argosy C.1 is an obvious carrier), and should have maximum flexibility in the field. It was stipulated that the guidance system should be immune to countermeasures, and special emphasis was placed on the need to achieve a weapon system of minimum cost and complexity, demanding little specialized troop training.

At Stevenage, Herts, design and systems evolution progressed steadily through 1959, and the opportunity was taken to effect one drastic revision of the basic system. Instead of developing a special transport vehicle, it was decided to use as a basis a standard 3-ton truck (Bedford). Eventually, the entire weapon system was fitted on this vehicle and in a single Land Rover. Similar evidence of rationalization and simplification is apparent throughout the design of the missile.

Only two basic facts concerning the Blue Water missile may be divulged at this time: it has a solid-propellant motor and inertial guidance. More may be deduced. It is clear that the missile is not truly ballistic in flight, nor is it wing-supported, but it follows a curvilinear trajectory controlled by the cruciform of moving surfaces arranged around the central part of the body. Several new details can be seen in the accompanying illustrations; previously, the only clear indication of appearance was provided by a drawing exclusively published by this journal last September 16.

Although details are withheld, the missile can be broken down into sections, which may be functionally tested while still in their containers. Alternatively, the complete missile may be assembled in a rear area and delivered either by helicopter or mounted on its launcher (in which case the upper wings and fins are removed to lessen the likelihood of their being damaged).

The launcher consists of a simple beam, hinged to the rear of the truck and hydraulically elevated to an angle just over the vertical. A movable jib and winch is built into the launch vehicle to pull missiles directly on to the launcher while the truck is backed up to a missile supply vehicle. Fire-control equipment, and missile servicing systems, are packaged in a saddle which fits directly over the truck chassis. Umbilical connections lead from it to the missile.

In action, the launcher/transporter loads itself while under the cover of a wood or other shelter, and then travels to a preliminary firing position where it lies concealed at immediate readiness. In the Royal Artillery survey regiments are provided to map battle areas and determine precise target co-ordinates. One of their newest items of equipment is the PIM (precision indication of the meridian), also by English Electric Aviation, which employs a rate-integrating gyro for the rapid determination of true north under all conditions.

All that is needed to operate Blue Water is the launcher/transporter and a long-wheelbase Land Rover carrying an electronic computer. A Blue Water troop also has two additional Land-Rovers, one of which is the detachment vehicle (carrying kit and stores) and the other a radio vehicle for communication with brigade or divisional HQ, possibly 200 miles away.

An intended firing point is accurately surveyed, and a standard Hilger & Watts theodolite set up at the point indicated and the co-ordinates fed into the computer. As soon as a suitable target is located, the fire-unit commander issues the order "Take Post," whereupon the launcher starts to move out of cover. Before it reaches the firing point, a rough bearing to the target has been obtained, and the reciprocal is passed to the theodolite operator. Under his direction two marker posts are driven into the ground, and the launcher drives up to these posts so that the target lies exactly to the rear of the vehicle. In practice, no Royal Artillery driver has failed to park the launcher within 2° of the target heading.

The theodolite is placed at 90° to one side, while the computer is driven up on the other and connected by a multi-core cable. During the ensuing few minutes the computer produces precise trajectory information, together with instructions to detonate the warhead at the desired burst height. At the same time, the launcher is jacked-up and levelled transversely by the rear retractable feet, and the missile igniter leads are connected and the inertial-guidance travelling clamps released.

Final accurate platform alignment is accomplished by the theodolite, the operator looking through a small window in the missile to null the drift rate of the gyros. Eight minutes after leaving cover the computer has imparted full mission information, and it drives off to serve another launcher. At about the same time the theodolite operator completes his alignment of the stable platform, and his remote-control switches and theodolite are stowed away, together with the marker posts and other equipment. The firing area is cleared, except for the launcher and the troop commander and his sergeant.

The former operates the warhead safety switch, while the sergeant arms the firing circuits. Both then double away with the firing box, and the officer operates the switch which energizes the missile's own power supplies. As soon as the missile has changed from external to internal power the launcher boom is automatically elevated; the firing switch is then operated a second time to launch the missile.

Blast damage to the launcher is negligible (it is the latter factor which dictates that the launcher should point *away* from the target). Most comparable weapons employ an initial high-thrust booster charge and a long-duration motor to provide cruise thrust. Flight speed is highly supersonic and the trajectory is controlled by the fixed fins and cruciform of wings actuated hydraulically according to signals generated by the inertial guidance system. The latter automatically takes care of any disturbance which may arise during the departure from the launcher or due to variation in wind velocity at different altitudes. The actual flight speed is unlikely to be of consequence, so long as it is always high enough for full control to be maintained. When firing at short ranges the missile may impact under power.

Compared with its competitor, the Sergeant, developed by Sperry Utah and JPL for the US Army, the Blue Water weapon system is significantly lighter, cheaper, more flexible and less vulnerable. The American weapon system consists of a larger and heavier

"The theodolite is placed at 90° to one side, while the computer is driven up on the other and connected by a multi-core cable . . ."

Missiles and Spaceflight . . .

missile, launching station, gas-turbine generator set, firing set, organizational maintenance test station, field maintenance test station, four transport semi-trailers and eight rigid boxes in which the portions of the missile travel. Assembly of the missile takes place on the launcher, when concealment is impossible; and the countdown takes approximately 30min, compared with 10min for Blue Water.

On the other hand, Sergeant ought to be available roughly one year earlier than the British missile, and political pressure from the US industry is such that it is bound to be adopted by the US Army. Moreover, the same pressure has for many months been relentlessly applied to force NATO adoption of the American weapon. Last November Lord Caldecote, executive director (guided weapons) of British Aircraft Corporation, announced that Blue Water would shortly be tested over its full range at Woomera, earlier testing at Aberporth having been restricted by the size of Cardigan Bay. The following month the defence ministers of Britain and West Germany discussed the joint development of Blue Water by the two nations, but in February Germany completed plans to buy an evaluation quantity of Sergeants.

It would be a severe blow if Britain were to be the only country to adopt Blue Water, for unit cost would then become excessive. The best hope for the future lies in the fact that the missile has already been evaluated by the US Army in America, and that all who have examined it have been very favourably impressed. British Army trials are to be conducted by the 29th Field Regiment, RA, and as we go to press a demonstration by the GW Wing School of Artillery, is scheduled at Larkhill, Wilts, for May 16.

BLUE STREAK PROGRESS

Answering a Commons question on May 8, the Minister of Aviation said "The cost of keeping the launcher in being is about £3.25m to the end of April [from the cancellation as a weapon in April 1960—Ed.]. We have progressed to the stage that last week two static firings of the complete rocket were successfully carried out. I hope that answers from the countries concerned to the Anglo-French proposals will be received soon." Further pressed, Mr Thorneycroft explained that current expenditure was being devoted to "bringing the launcher up to the point at which the whole integrated system . . . can be fired statically. This has been done twice successfully at Spadeadam and, therefore, that money has been extremely usefully spent."

On the same day Mr Dean Rusk, US Secretary of State, told the NATO council in Oslo that, if requested, the United States would be willing to furnish "Scout, Thor and Atlas rockets" for scientific purposes to NATO and other European organizations. Three days later, in response to a series of questions in the Commons, the Prime Minister assured the House that America did not intend to keep the field of space research for themselves. He went on: "I am informed that any question of American launchers being used would have to be from American bases, which could not possibly take the place of a European or British launching system, but would be additional to, and not in place of, a European or a British system."

MORE DYNA-SOAR DETAILS

Much new information on the US Air Force Dyna-Soar space glider became available during a meeting on April 27 of the Dayton-Cincinnati section of the Institute of the Aerospace Sciences. A broad review of the programme was given by Mr Jack T. Keating, of the Dyna-Soar Engineering Office, USAF Systems Command, at Wright Air Development Center. As illustrated in an artist's sketch in *Flight* for March 16, Dyna-Soar will be boosted from Cape Canaveral into sub-orbital flight by a modified Titan 2. Four large, fixed fins at the base of the booster will compensate for the aerodynamic surfaces of the glider at the other end of the assembly.

"A solid-propellant rocket in Dyna-Soar will effect separation from the booster," Mr Keating said, "both in space and in the event the launching goes awry near the ground." In case of failure during launch, the total impulse of the solid rocket will be sufficient to give Dyna-Soar enough velocity for the pilot to circle and land safely. Titan 2 will permit testing of the critical areas of hypersonic research, piloting and landing characteristics. A larger, subsequent booster—only Saturn is in prospect—will make it possible to gather engineering data all along the re-entry corridor, and learn more about manœuvrability at hypersonic velocities at high altitudes.

At first Dyna-Soar will go through a series of air drops from a B-52, much as the X-15, to check the vehicle's gliding ability. Later, the probes in which Titan 2 is employed as a booster will begin to check performance along portions of the re-entry corridor. These will be ballistic-trajectory shots, reaching moderate altitudes and supersonic speeds. The first of these will result in landings at Mayaguana, down-range from Cape Canaveral, then at St Lucia, and finally in South America—presumably in Brazil, though Keating would not confirm this "at the insistence of the US State Department."

He said that Dyna-Soar will be 92ft long, have a 49ft wingspread, and will weigh 22,000lb empty (values much larger than previous estimates). "Its landing characteristics are not as 'hot' as some pilot-controlled vehicles flying today," he added. It will land on skids, and during the landing approach it will be at a high (though unspecified) angle of attack. The lower surface, which will absorb much heat of friction during re-entry, is flat "because it is easier to be sure of the temperature of a flat surface."

The vehicle will have windows, though these will be covered during re-entry, covers later being jettisoned, so the pilot can see to make his landing. The guidance system will include a display showing the pilot the distance he can achieve versus the distance to where he wants to land. The guidance system is being developed by Minneapolis-Honeywell, and the communications system by RCA.

In the later stages of the programme, the entire Dyna-Soar re-entry corridor will be explored. Several points picked off the chart indicated that Dyna-Soar will travel at approximately 25,000ft/sec at 59 to 62 miles altitude, at 10,000 to 15,000 ft/sec between 36 to 41 miles, 5,000ft/sec between 25 and 36 miles, and as slow as 1,000ft/sec between 16 and 20 miles. These speeds and altitudes roughly define the re-entry corridor, the lower end of which is currently being investigated by the X-15.

An indication of the timing sequence for Dyna-Soar flights was given in somewhat greater detail on May 1 by Maj-Gen John W. Carpenter III, who commands the Air Force Flight Test Center at Edwards. He told the Aviation/Space Writers' Association meeting in New York that, "subject to appropriate funding, the Dyna-Soar test programmes will begin in approximately three years."

He announced that Edwards has already assigned pilot-engineers to work with the Dyna-Soar system contractor, Boeing Airplane Co. However, no individual pilots have been selected for the Dyna-Soar glider as yet, "but we have identified and assigned a group of personnel for the test force and we will begin a 'pilot' course on June 5, 1961, for six students drawn from within the Air Force Systems Command. Four are presently instructors at the test pilots' school at Edwards, and in practice will be teaching themselves the elements of the proposed curriculum. The training will be aimed at producing pilots in the dual role of aircraft testing and manned space-vehicle testing, such as will be required for Dyna-Soar."

ENTAC WINS

By far the largest market of its kind in the world, the US Army announced on May 8 that it had adopted the French Entac as a standard infantry anti-tank missile. As described in our special "Missiles" issue of November 4 last, this wire-guided weapon was developed by the DEFA in competition with the Nord SS.10, which it surpasses in flight performance and general efficiency. In particular, Entac's guidance system is not purely of the acceleration type, such as is employed in most weapons in this class, and operator proficiency is accordingly obtained rather more readily.

Britain's V.897 Vigilant is undoubtedly technically superior to all other weapons in this category. Moreover, its high unit price is more than counteracted by the small number of firings needed to acquire and maintain skill in its employment. Several months ago the US Army decided to buy an evaluation quantity of Entacs, at which time there was still a chance that the weapon chosen for inventory service might be the SS.10 or SS.11 (both widely used by the US 7th Army in Germany), or the German Cobra, which a year ago was chosen for evaluation by the US Marine Corps. Vickers doubtless hoped that the Entac purchase could be held to an evaluation quantity, but the temperature of such trouble-spots as Laos and Cuba seems to have spurred the Kennedy administration into what looks like a final choice. The first missiles will undoubtedly be French-made, and the initial contract is likely to be for about 18,000 rounds, costing some $20m (£7.1m).

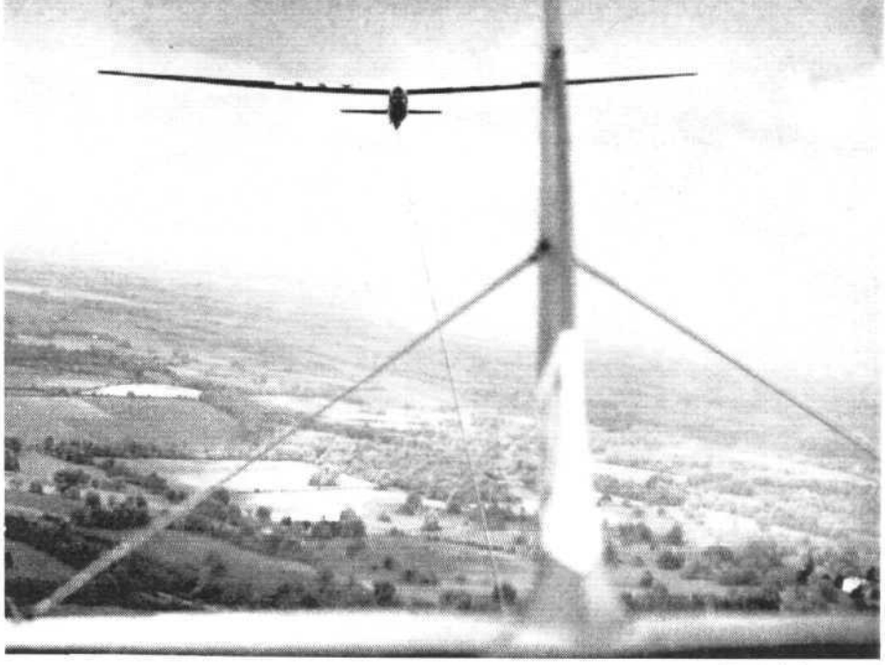
On May 10 the US Secretary of Labor announced that President Kennedy had directed him to do everything he could to reduce delays to experimental firings at Cape Canaveral and to hasten the deployment of operational ICBMs. Labour difficulties in the latter sphere have led to "phenomenal" costs and widespread delays.

"The public is being misled in the furore over liquid versus solid fuels," claims Dr Albert C. Hall, v-p engineering, The Martin Company. He suggests that the "real issue" is whether or not a propellant combination is storable. Martin's Titan 2 will not only employ storable propellants, but as a result of their hypergolic nature, they will need no mechanical ignition system. Dr Hall claims that the payload/range capacity of this ICBM is "at least twice as great as any other in the Free World."

During the NATO foreign ministers' conference in Oslo on May 9 the US Secretary of State, Mr Dean Rusk, gave an assurance that five Polaris submarines, apparently to be administered by the US 6th Fleet, will be placed under NATO command (additional to the ships under purely US jurisdiction which operate from Holy Loch). The similar Eisenhower offer last December is reported to have been contingent upon purchase by the NATO nations of a further 100 Polaris missiles, presumably for land deployment.

The National Gliding Championships

Opening Days at Lasham



Tug's-eye view of a sailplane on tow: the Slingsby Skylark 3F entered and flown by Don Snodgrass in League 1, on aerotow behind an Auster Tugmaster

"Flight" photograph

SECURITY of tenure for Lasham Gliding Centre was the plum pulled out by the Minister of Aviation, Mr Peter Thorneycroft, at the official opening of the National Gliding Championships at Lasham at noon on Saturday last, May 13. The marriage between the RAE satellite-tracking station on the airfield and the gliding faction was "now all right," the Minister reported, and Lasham could remain a gliding centre both for this island and, he hoped, for the Commonwealth as well.

This news—not unrelated, perhaps, to some overtime put in at Lasham only the previous night by Mr Thorneycroft's Parliamentary Secretary—was good to hear, particularly at the start of Britain's largest-ever gliding contest. As for the lines along which Lasham is now likely to develop, these are described exclusively for *Flight* in the article "Lasham's Great Expectations," by the Chairman of Lasham Gliding Society, which begins on the next page.

Clerk of the Course Ann Welch took over from the Minister to declare the task for the day. This was to be a race around one of Lasham's "milk-run" 100km triangles, with turning points at Thruxton and Welford, and was to be flown by League 1 pilots only. For League 2 it was a free day. The weather situation, outlined by Jock Findlater of the Met Office, was generally anticyclonic, and "By and large, all the thermals will be dry"—i.e., invisible in the hot blue sky and not marked by cumulus.

Time of first take-off had been given as 1.30 p.m. at the briefing, and it was 1.30 on the dot when the Slingsby-entered Skylark 3F (No 189) flown by A. J. "Rocky" Stone began to roll. Whatever panics there may have been behind the scenes, the championships' aerotow system gave every appearance of functioning well at the first push on the button, using Chipmunks for the RAF entries and Tigers and Austers for the civilian sailplanes.

Soon it became clear that pilots would be unlikely to set up record times around the triangle. Soon after that, it became clear that pilots would indeed be lucky to get around the triangle at all. Meanwhile, back at Lasham, the second International Glider Trade Fair was in business, with Beagle-Auster and Vigors Aviation doing their best to prove that aircraft with engines could be nice, too. Slingsby Sailplanes Ltd displayed a cutaway drawing and model of the company's forthcoming T.49 two-seater, and "Glider Doctor" Don Campbell showed a Bensen Gyro-Glider.

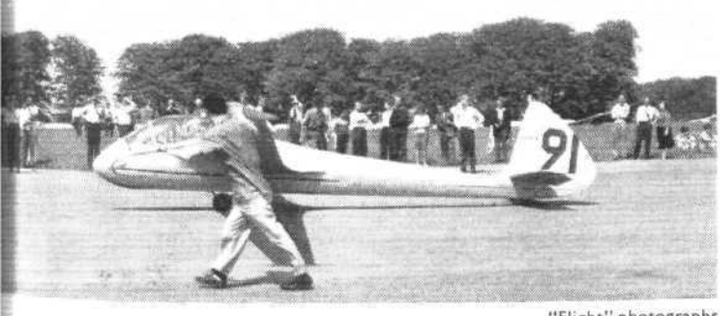
Only one pilot—Sgt John Williamson of the RAF, flying an Elliotts Olympia 419X—completed the Lasham-Thruxton-Welford triangle, the length of which was in fact 112.5km or 70 miles. His time was 3hr 53min, corresponding to an average speed of 18 m.p.h. The remainder were marked on distance alone, but only 12 had exceeded the minimum scoring distance of 20 miles. The top five were: 1, Williamson (Olympia 419X), 320 pts; 2, W. A. H. Kahn (Skylark 3B), 218; 3, P. A. Wills (Skylark 3F), 213; 4, J. D. Jones (Skylark 3F), 187; and 5, Mrs Anne Burns (Skylark 3B), 156. The only League 1 pilot flying a 15-metre glider to score was Flt Lt G. A. Coatesworth (Olympia 401X), who thus took the standard-class lead.

An ingenious task was set for both leagues on the second day of the contest, Sunday, May 14. With forecast winds that were westerly and quite strong, the presence of the London Control Zone to the east was clearly an embarrassment. The answer was to specify a turning point at Benson, 30 miles to the north, after which pilots could fly in any direction in the quest for maximum distance. In the event the Lasham-Benson leg turned out to be more upwind than crosswind, and the majority of pilots failed to reach Benson. Of those who did, many turned round and headed south again rather than try and skirt the zone to the north-east.

Early that afternoon, the control-room map showed a heavy cluster of landings packed in between Lasham and Benson. Later, six numbered pins along the south coast were seen to belong to Brennig James (Shoreham), George Burton (Brighton), P. G. Burgess (Beachy Head), Ted Stark and John Williamson (both near Rye) and Anthony Deane-Drummond (Hythe). These were joined by J. D. Jones and David Ince, but it was Roger Mann in a Skylark 3F who made the day's best distance—160 miles to Torquay. Deane-Drummond was second with 130 miles, and the best League 2 flight was one of 75 miles to West Deane, near Salisbury, by David Kerridge in a Skylark 3F of Surrey Gliding Club. On overall points, the League 1 lead after two days' flying was retained by John Williamson.

KENNETH OWEN

(To be continued)



"Flight" photographs

Above, the Polish Jaskolka piloted by Arthur Doughty of London Gliding Club begins to roll on take-off. Other Polish sailplanes at Lasham comprised two Bocian two-seaters

Right, Sgt John Williamson of the RAF takes off in his Olympia 419X for the flight which gave him the League 1 lead on the first day of the championships. He was the only pilot to complete the Lasham-Thruxton-Welford triangle

National Gliding Championships...

Lasham's Great Expectations

BY DAVID CARROW, DFC, Chairman, Lasham Gliding Society

The author (right) talks at the airfield with John Cochrane, general manager of Lasham Gliding Centre

"Flight" photograph

LASHAM, site of the 1961 British National Gliding Championships, is a disused wartime airfield lying on a 600ft high plateau in the open countryside between Alton and Basingstoke. It is a most attractive setting, but largely ruined at the present time by the squalor and dilapidation of the buildings and hangars on which, without security of tenure, it has been pointless for the gliding community to spend more than the absolute minimum. Nor, apart from one small hangar where the situation became so desperate that we had to take a chance, have we erected any worthwhile buildings. One welcomes this opportunity to apologize publicly to our visitors for this side of the picture.

The airfield is ideally situated for gliding, being clear of existing or proposed airways. It is within reach of London and of many of the large centres of population in Southern England. We have members from Brighton, Bournemouth, Winchester, Salisbury, Oxford, Reading and a great number from London. The local terrain is excellent for soaring, being open, with numerous sources of convection for our thermals. We are just far enough from the south coast not to be worried by sea-breeze effects. Being located on rather high ground we are sometimes affected by low stratus but, against this, the winter rains drain off well and we very seldom get bogged down.

Gliding started at Lasham in 1950 when the Army Gliding Club obtained permission from the Air Ministry to commence operations. Shortly after this the Surrey and Imperial College Clubs, moving of necessity from Redhill, settled in too. Since that time several other clubs have joined us so that Lasham may now be thought of, not as one unit, but as a "Federation" of seven independent clubs, comprising, in addition to those already mentioned, those of the Boy Scouts Association, the Crown Agents, Leighton Park School and the Polish Air Force Association.

There is at present a great shortage of sites for gliding and a number of other organizations are discussing with us the possibility of joining our "Federation." We shall welcome these, subject to the obvious need to control our size, and more particularly our training facilities, to avoid too much frustration! But as regards size we are already by far the largest gliding centre in this country and, we believe, probably the largest in the world.

Rapid Growth of Activity

Back in the early days of 1951, the Army and Surrey Clubs operated happily and independently on opposite sides of the airfield, but it soon became apparent that there was much to be gained by a closer co-operation. A rather informal measure of integration, under the nominal control of the Surrey Club, was agreed in 1953 and this worked excellently for several years. By 1958, however, with the rapid growth in membership and in gliding activity in general, it became clear that Lasham must be placed on a more formal basis, under the day-to-day control of a full-time general manager (the voluntary committee members were by then showing distinct signs of wear after many years of quite heroic work).

Thus was formed, in December 1958, the Lasham Gliding Society Ltd, constituted as a friendly society (like many good trade unions), with everyone flying at Lasham an equal member and with any profits shared back amongst the members or ploughed in for further development of the facilities. The Society became responsible for the running of Lasham in July 1959 and operates under a committee of management which is elected by the members and is representative of all the major groups. Our job is to run Lasham for the greatest good of the greatest number of Lashamites.

A word here about the clubs: these are all financially independent organizations responsible to their own groups of members. The Surrey Club accepts members from the general public without special restrictions, while all the other clubs are operated by and for the benefit of particular groups of people. Some of these, such as the Army Club, receive—naturally enough—sports fund grants of one sort or another. Others, for example the Polish group, have fully to pay their own way. Fundamentally, it is because of these differing financial structures of the various units that the Society becomes necessary. If all the clubs were on the same financial basis there would be no need for a rather complex structure of independent units—although an amorphous mass of 800 club members with 20 club aircraft is a horrifying thought, and some artificial divisions would certainly be needed. I mention all this in some detail because it may be of interest to the gliding and light aircraft movement generally to see how the problem has arisen and how we are solving it.

The Lasham Gliding Society's prime object in life is to provide those facilities at Lasham which are best administered by a central organization. These include launching, instructional, hangarage, accommodation, catering and other airfield facilities. The LGS is entirely unsubsidized and has to make its own way in this hard competitive world. It bears all the running charges at Lasham (apart from the fleets of club and syndicate-owned aircraft) and pays all the staff. It receives grants from the clubs to enable it to do this, the intention being that all should share equitably in the cost of running the Centre and providing our communal facilities.

The Society runs a communal training school for teaching *ab initio* pilots up to the point where they can be accepted for soaring and more advanced instruction within their clubs. This instruction is, at every stage, under the supervision of our three professional instructors, Derek Piggott (CFI), Derek Goddard (Deputy CFI) and John Everitt, supported by a large and enthusiastic body of voluntary instructors from the various clubs, with a voluntary "Master Instructor" controlling the instruction within each club.

A complete outsider coming to Lasham therefore joins the Surrey Club, and that club, like all the others, then sends him along to the communal "school" for his training. At a certain post-solo stage in this training, he is accepted back by his club and thereafter progresses up his own club's fleet of aircraft.

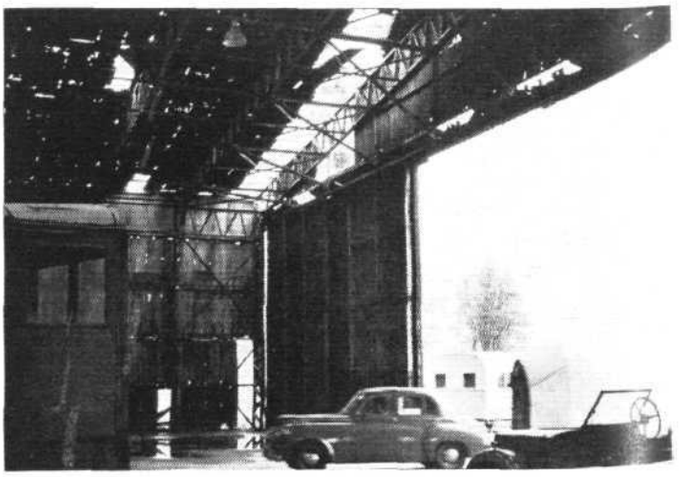
The Society itself only runs the training school, and does not offer soaring facilities in high-performance aircraft. Soaring is, in my view, best arranged on a decentralized basis within the individual clubs or syndicate groups, many of whom spend unconscionable periods of time on fettling their aircraft, trailers and equipment so as to ensure that extra margin of performance which can mean so much in competitive gliding.

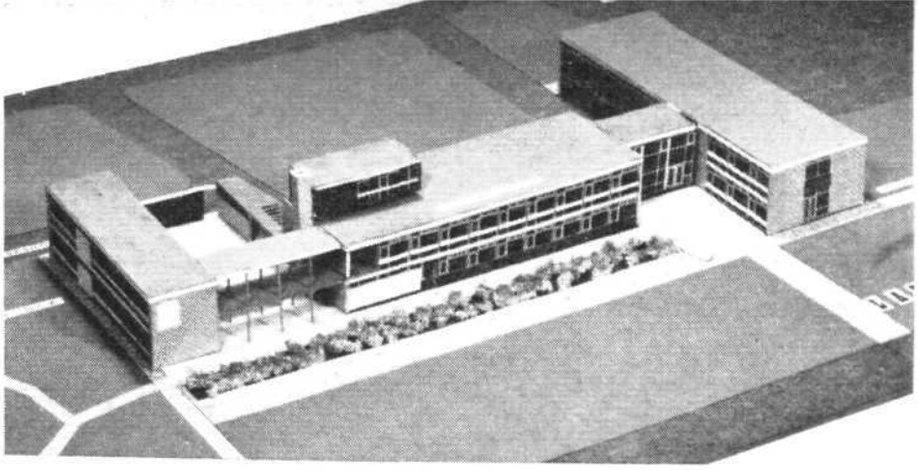
One of the LGS top-priority purposes in life is the provision of all the launching facilities at Lasham. To this end it has available as a theoretical maximum (alas, seldom attained in practice) two tow-cars, three winches and two Auster Tugmasters. Launching is a yardstick of our success and the best year to date was 1959 when over 24,000 launches were made. This year our target is 25 per cent up on that figure, i.e., 30,000 launches which, on our present thinking, represents about the maximum that can be safely and efficiently achieved on the airfield.

But launches are not everything—the end product of gliding is the ability to stay up, to soar and, best of all, to go places. We have three main cross-country routes from Lasham in the sector from north anti-clockwise round to west-southwest (to the east we have the London Control Zone complex). Perhaps our most popular "milk run" is the trip westwards to Somerset, Devon and Cornwall —to Dunkeswell, Perranporth and even Land's End. Next we have a north-west route to Nympsfield and, beyond, to the Mynd, and finally the fabulous northern route, up past Oxford to Yorkshire, Newcastle, even to Portmoak, or turning off at Edgehill or at Kettering, across into East Anglia to the coast at Yarmouth.

Present problem: "Dilapidation of the buildings and hangars . . ."

"Flight" photograph





Future hope: "We are steadily building-up Lasham towards our aim of a National and Commonwealth Gliding Centre . . ." (Model of a possible design for Lasham Gliding Centre clubhouse, with administration and accommodation wings)

Really long (by our puny British standards) cross-countries are possible on most soaring days in one or other of these directions. The incitement, the gamesmanship amongst the keenest of our soaring pilots means that people do *not* laugh when a member declares a British out-and-return record to the Mynd, and are not particularly surprised when he achieves it! Declarations of goal flights to Perth and beyond are not unheard of, and the atmosphere is such that even lesser mortals are tempted to try tasks well beyond their capacity—and occasionally to achieve them.

It is no coincidence that all the members of the 1960 British team for the World Championships flew regularly at Lasham, that Denis and Anne Burns who brought back five world records from South Africa recently are amongst our keenest private owners. This may all sound boastful, but, nevertheless, the enthusiasm at 8 a.m. on a Sunday morning, with eight to ten Skylark 3s being rigged before breakfast, is something that has to be experienced to be believed.

Let it not be thought, however, that we only train people on the one hand and break records on the other. True, our name as a gliding centre rests on these twin pillars, but we also have a strong backbone of straightforward "middle-class" soaring ability. Cross-fertilization of ideas, particularly between pundit and pupil, is one of the main attractions of Lasham, and a newcomer to the place can immediately visualize the whole range of the sport. Further, we have access to a wide range of scientific talent and many of the bright ideas on instrumentation in British gliding stem from our members.

We first offered to run the British National Championships at Lasham in 1955 and they have been held there biennially ever since. The figures of competing aircraft are instructive: 39 in 1955, 70 in 1957, 77 in 1959 and this year we have accepted 90 entrants with well over 20 disappointed competitors having to be turned away. These figures emphasize more than most statistics the fantastic advances in British competitive gliding which have been made in recent years.

Voluntary Efforts

In all our activities we are, like every other gliding club, entirely dependent on most of the work being done by unpaid, voluntary members. It is true that, as well as three instructors, we have John Cochrane as general manager, Bob Lintern on the engineering side and several other permanent staff. But nevertheless the great burden does and must continue to fall on the members themselves. This is an inescapable feature of gliding as a sport.

The biggest strain on the members comes, of course, with the National Championships, when a large number of voluntary jobs have to be filled, from tug marshals to programme sellers and from turning-point observers to control-room telephonists—not to mention crew-members (skilled and experienced trailer-drivers are at a premium) to assist the competing pilots themselves. It is true to say that a top-class competitive pilot is, nowadays, the spearhead of a real team effort, and that the capability, enthusiasm, cheerfulness and plain tact of his crew are very important factors indeed. Nothing steadies a pilot's temperament so much as a really reliable crew behind him: nothing unnerves the crew more than the feeling that their pilot does not really trust them and is double-checking every single detail himself!

This, then, is our existing set-up. What of our plans and "Great Expectations" for the future?

First of all, we are steadily building-up Lasham towards our aim of a National and Commonwealth Gliding Centre able, by virtue of its size and its organization, to provide outstanding first-class facilities in all aspects of our sport. In order to achieve this we have first of all to secure our base at Lasham, to develop the airfield as a centre of which we and the nation can be proud. In this object we are receiving warm-hearted assistance from the Ministry of Aviation, where we have received repeated affirmation of the Minister's interest in the vital sector of British civil and sporting flying which we represent. We are at present, therefore, negotiating for a lease of the major portion of the airfield necessary for our operations, whilst the Royal Aircraft Establishment, with whom we have in the past had most amicable relations, wish to continue to occupy a small sector on the south-east side for their radio experiments. Our very good friends Dan-Air Engineering will also continue at their maintenance base.

As soon as the lease is signed we have quite a substantial capital fund subscribed by our members immediately available and waiting for the erection of buildings. The first requirement is a really large and worthwhile clubhouse with ample catering and other club facilities, where members will be able to bring their friends, relatives, wives, children and girl friends. The absence of this is one of our greatest present frustrations.

Hangarage is the next problem and here we plan sufficient space to accommodate the school training gliders and probably the majority of club-operated aircraft, whilst a covered weatherproof trailer park will be erected for the most exotic birds and for the syndicate-owned gliders. Hangar space for these latter will almost certainly be uneconomic though we are encouraging the idea of a do-it-yourself series of interlocking hangars, on strictly controlled and planned lines, for the private owners. I feel that quite a lot of semi-professional bricklaying will be undertaken over the next decade. Workshops for maintenance and repair will also be needed and a properly arranged caravan park with full facilities is also being planned.

Particularly we wish to encourage members to bring along their wives and families for weekends and for holidays; one even dreams eventually of facilities on the country-club scale. Such dreams are, I am sure, not unworthy, provided always that one remembers that the prime object of the whole exercise is still to glide, and that everything else is simply a means to that end and must never be allowed to become an end in itself, otherwise decadence sets in—but I digress.

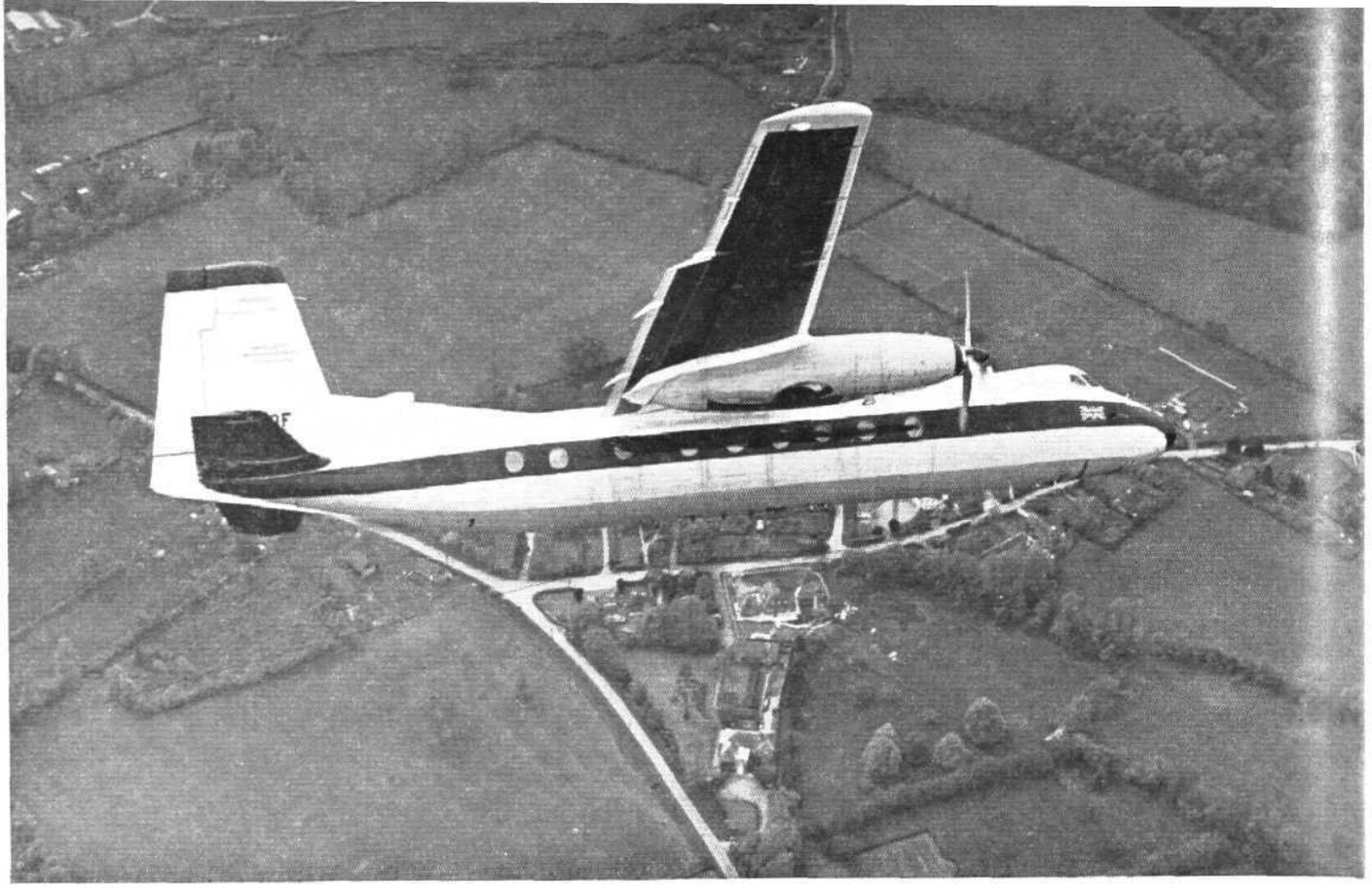
We have at the moment a concentration of instructional talent without equal in the country and this needs harnessing in the best possible way. We now run five-day (weekday) holiday courses for members, courses for the public who wish to join and learn to glide, and courses for instructors. The members come first, since they "own the joint" and must in general have priority over outsiders. Courses for the public, some of whom continue afterwards on a permanent basis, are an excellent way of attracting new blood (although at present we have an almost excessive blood pressure without tapping this source).

My own view is that the best service we can do ourselves, our staff, and the gliding movement in general is to offer (from 1962 onwards) an extended series of instructors' courses, both for our own members and for those from other clubs, building-up in time to a more-or-less permanent Instructors' School both for British glider pilots and also for visitors from the Commonwealth and overseas.

One sure side-result of this would be a significant increase in the exports of British gliders. These already go abroad in substantial quantities, but if we at Lasham can attract students in the same way as the State-subsidized centres in Eastern Europe, then it is certain that these students, returning to their home countries as instructors, will be the more attracted towards known and tested British products for their local gliding movements.

On the high-performance side our future visitors will find, on almost every soarable summer's day, local competitive flying—out and returns, triangles, goal races—and by this means we hope to stimulate and encourage higher competitive standards in the UK and elsewhere, right up to world-beating class.

We are very keen to attract young people to Lasham; much of the future of this country depends on air-mindedness and there is no better way of achieving this than by gliding. We already have the Air Scouts, who plan a substantial expansion of their activities at Lasham just as soon as security of tenure is achieved. We also have Imperial College, and we are having talks with another club which is being formed within London University. We work closely with bodies such as the Central Council for Physical Recreation. But we do not offer gliding "on a plate," without frustration, without really hard work. Only by the life being of necessity just that little bit difficult are the right people attracted, the worthwhile people retained. Long may it remain so.



Controllability in handling—demonstrating compliance with British Civil Airworthiness Requirements Section D2.8, paragraph 2.1

PROVING TH

Test-flying Techniques on the Aircraft th

THIS is a story of flight-test routine—a story of the flying that precedes delivery to an airline of a new aircraft variant, in this case the Herald Series 200. It was September last year when Handley Page announced that six Heralds had been ordered by Jersey Airlines, and that they would be 200-series aircraft. These are extended by 42in in front of the wing and have a gross weight increased to 40,000lb. As related on page 665, the first is to be delivered in the late summer, dressed in the airline's new Charles Butler-designed livery with a sun-yellow flash and fin.

No great changes in handling characteristics were expected as a result of the fuselage stretch, but an extensive flight-test programme was necessary to convince the ARB that the Herald's stability and control were not impaired by the associated forward movement of the c.g. A lot of development flying, leading to tail-surface modifications, was devoted to ensuring that passengers could be seated at random in Series 100 aircraft. A similar aim is being followed in developing the 200. Moving passengers up and down the fuselage at intermediate stops to adjust the loading is popular neither with airlines nor with travellers.

In aerodynamicist's terms the extended fuselage has brought the c.g. forward by 1 per cent of the standard mean chord. Some wind-tunnel tests were carried out on a model of the new fuselage, but the effects were shown to be negligible. Any adverse changes could, it was anticipated, be ameliorated by the forward shift of c.g. A test schedule was agreed with the ARB on the basis of that used for the Series 100 aircraft, and when the aircraft first flew on April 4 the Handley Page test team were ready to go ahead with a programme which, it was expected, would last about two months. At the end of this time the first 200 should be awarded a special-category Certificate of Airworthiness, leaving only about a week's production test flying to obtain a normal C of A for the first production aircraft.

In this account the part of the programme concerned with performance testing is necessarily glossed over; the small differences that occur between 100- and 200-series aircraft are the result of the 1,000lb increase in maximum weight and not of the extended fuselage. These differences will largely disappear when the Series 100 is cleared, as intended, at the same maximum weight of 40,000lb.

From a handling point of view the aspects that are now being examined in test flights from Woodley concern the stall, flying at minimum control speeds, stability and sideslips. Conducted over a whole series of configurations, tests under these four broad headings establish the handling behaviour of the aircraft.

In the stall, for example, there are two aspects to be examined: the manner in which the aircraft handles and the speed at which stall occurs. On the Series 100, the stall is innocuous and there is no wing drop. British Civil Airworthiness Requirements, the bible for all flight test and experimental work, demand that if wing-drop does occur it must follow the pitching-forward of the nose, and must not exceed a bank angle of 20°. As the Herald's wing was originally designed to give good stalling characteristics it was difficult to visualize any deterioration in performance with the extended fuselage, and the 200 behaves, if anything, slightly better. What was not expected was that stalling speed with flaps down would be a few knots lower than previously; at a typical weight of 33,500lb Vso is 63kt.

The stalling programme is formidable, each stall being carried out at four c.g. positions, four configurations (clean, flaps deflected 5° and undercarriage up, flaps at take-off position and undercarriage down, and flaps and undercarriage down), and at three different aircraft weights. To determine the speed at which stall occurs, each is performed five times in each configuration. Then there are stalls in turning flight to be investigated, power-on stalls, dynamic stalls and stalls with one engine inoperative—a total of 600 altogether.

With the aircraft ballasted at the right c.g. position and at the right weight the technique is to trim-out at a speed 40 per cent above the expected stalling speed, and then to reduce speed at about 1kt/sec until the aircraft stalls. During this period out-of-trim forces, control angles and aircraft attitude are measured on a trace recorder. Stalls in turning flight are carried right through until full breakaway occurs; it has been demonstrated that the Herald rolls out of the turn on all occasions. Quite extreme attitudes are sometimes developed during investigation of the stall with power on. This may also be the case in dynamic stalls, in which the airflow separation point is approached appreciably faster than at 1kt/sec, and with some g loading on the aircraft. Less stringent conditions are attached to the behaviour in the latter case, but there must still be no violent wing-drop.

The Herald stall programme has been carried out at convenient heights between 6,000 and 12,000ft, height lost in recovery being measured and recorded. One aspect of stall performance is that the configuration does not lend itself to providing natural, aerodynamic stall-warning, and a stick shaker is fitted to provide this information artificially. As experience is gained in the flight-test programme this device is set to operate between 5 and 10 per cent above the stalling speed in each configuration.

What happens if there is sudden and complete failure of one powerplant, particularly when the aircraft is taking off? This is the

Pictured at Woodley before departure for the Channel Islands is one of the two Herald Series 100s which Jersey will operate until the 200s are delivered in the "late summer" this year. Flags on the nose indicate the aircraft's go-anywhere capability

HERALD 200

to be the Mainstay of Jersey Airlines' Fleet

BY ALASTAIR PUGH

ILLUSTRATED MAINLY WITH "FLIGHT" PHOTOGRAPHS

question to which minimum control speed tests provide an answer. There are two parts to this series of tests, the determination of V_{MCA}—minimum control speed when the aircraft is airborne—and V_{MCG}—the minimum control speed of the aircraft on or near the ground.

A definition of V_{MC} is the minimum speed at which the aeroplane can be controlled after sudden and complete failure of one power unit. The aircraft is said not to be under control if it is no longer possible to keep it flying straight, so that V_{MC} is the threshold control speed when full rudder is applied. Because it is during take-off that engine failure is most critical, tests are conducted in this configuration—flaps in the take-off position, undercarriage up and the live engine at take-off power. Angle of bank must not exceed 5 and the pedal load must not be greater than 180lb. Handling is watched carefully during simulated engine failure and feathering, because BCARs require that the aircraft must not get into a dangerous attitude and the heading change following transition to asymmetric power must not exceed 20°.

V_{MCA} tests give a measure of fin, rudder and aileron power. Among all the tests carried out on the 200-series Herald, this is where any changes might have been expected to have shown up. In the normal way it is not possible to fully similate a failure of the Rolls-Royce Dart engine and Rotol propeller combination, so an autofeather over-ride switch is fitted in the cockpit for test purposes. When auto-feathering occurs, out-of-balance forces are reduced, so that the test case simulates a true condition.

Few variations were found between the Series 100 and Series 200 aircraft during V_{MCA} tests: maximum pedal load reaches 140-150lb before re-trimming, full aileron movement is not required and minimum single-engine control speed is 80-87kt, depending upon altitude. This speed, together with the stalling speed, decides the take-off safety speed, V_2 (1.1 V_{MCA} and 1.2 × stalling speed), which can then be written into the manual.

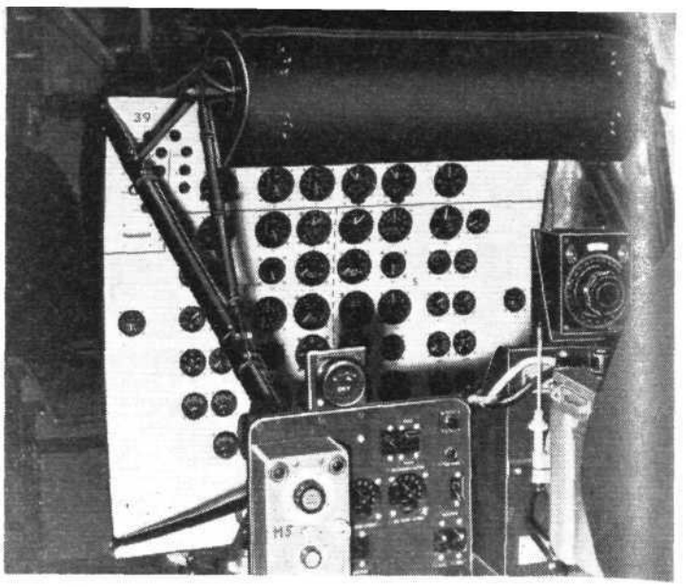
The next stage of tests, determination of V_{MCG}, presents the test pilot and his observers with some of their most difficult problems. There is also an element of risk, because what is being measured is the minimum speed at which the aircraft can be held on the runway should an engine fail on take-off. As in all test flying it is normal to start at a fairly high speed and to repeat the test at progressively lower speeds until critical conditions are reached. At first the aircraft is flown off the runway, the lateral deviation from the centre line due to out-of-balance yaw being measured. Next a series of tests is performed in which the live engine is throttled back and the aircraft braked to a stop. The limit is reached, and V_{MCG} is deter-

For obtaining position-error measurements, the Herald trails a static line and (just out of the picture) dart

Stalls power-on in turning flight—BCAR Section D2.11, paragraph 1.2.3

Determination of V_{MCA}—minimum control speed in the air—BCAR Section D2.8, paragraph 4.1

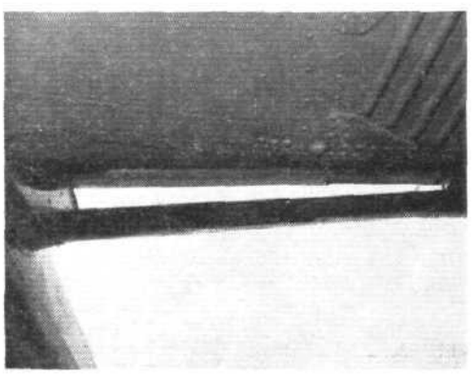
Time required to feather—BCAR Section D2-8, appendix paragraph 3



Particularly in the stick-fixed stability case, and in sideslips, a great number of variables must be measured. This is the data recording panel

Baulked landing—BCAR Section D2-4, paragraph 4.3

Approach technique—BCAR D2-8, paragraph 3.3



Developed by flight test was this inverted tailplane slat, which appears on all Heralds. It alleviated a tailplane-root flow-breakaway at extreme angles of sideslip

PROVING THE HERALD 200 . . .

mined, when the point is approached at which the swing becomes so great that the aircraft could not be held on the runway. These tests on the Herald were done at Radlett, at Bedford and at Nairobi in Kenya, the last-named airfield being chosen because it is at an altitude of 5,400ft.

Some years ago, during early flight tests of the first prototype Herald, it was found that there was lack of elevator power at forward c.g. Initially, tailplane incidence was altered from 0 to −2°, but some difficulty was then experienced with lack of downward elevator movement in other flight conditions. Also, when the aircraft was sideslipped, a further down-load was introduced on the tailplane root advancing into the sideslip, causing the airflow to break away from the elevator lower surface. This sudden change of airflow resulted in the elevator "snatching" downwards. This characteristic has been found on various other aircraft. Two steps were taken to effect a cure: the tailplane was returned to its original setting and the size of the tailplane and elevator were increased. The effect of this change upon elevator snatch was to delay its onset until a larger angle of sideslip had been reached, and this—combined with the fitting of an inverted slat at the tailplane root—produced an effective cure. Introducing the larger tailplane, however, meant that it was necessary to modify the elevator balance system; hinges were inset, the shielded horn balance dispensed with and a new tab system introduced. This comprises an inboard spring tab, a central trim tab and an outboard non-linear geared tab.

With all this development work behind them, Handley Page do not anticipate major changes on Series 200s. It is possible that the Herald's very positive longitudinal stability, as measured in extreme conditions, may be slightly reduced, but any adjustments that may be needed it should be possible to achieve simply by altering tab angles.

The type of stability which is under discussion here is stick-free static stability. To meet the requirements of BCARs, control forces must not exceed 50lb and must be in the sense that a push force increases speed and a pull reduces it. Following a disturbance in climb, cruise, slow cruise, approach and landing, the aircraft should return to its trimmed position. Both power-on and power-off cases have to be examined.

Since the Herald's high wing lends itself to meeting stability requirements in the low-speed configuration, it is the case with wheels and flaps down at high power around which testing is concentrated. Stick-free static stability characteristics are examined by trimming the aircraft hands off at the required speed and then increasing speed by 15 per cent, measuring the stick force required to do so, and letting go. Speed is then reduced to 11 per cent above the trimmed speed and the stick again released, following which the aircraft must return to within 10 per cent of the original trimmed speed. This 10 per cent is an allowance that is made for friction within the control circuit.

Next on the list is determination of stick-fixed static stability. This is a measurement of the elevator and tab angles required to trim the aircraft in certain conditions, and an aerodynamicist's rather than, perhaps, a pilot's appreciation of the stability of a particular aeroplane. The procedure, once again, is to set up the right configuration with the right amount of power at the right speed and to trim the aircraft carefully until everything is stabilized. The position of the elevator and its tabs is then measured by instrumentation and a graph completed of tab positions against coefficient of lift. The slopes of these curves indicate the stability of the aircraft.

Assessing dynamic stabilities provides, stick-free, a check on

Stick-fixed static longitudinal stability—BCAR Section D2-10, para 2

PROVING THE HERALD 200 . . .

control surface hinge moments and, stick-fixed, a check on tail size. If, in the former case, a control surface is overbalanced, the oscillating behaviour of the aircraft following a 10-15 per cent alteration in speed will be divergent, instead of being dead-beat or convergent after two or three oscillations. To check stick-fixed dynamic stability in pitch, the stick is held forward until speed builds up, and is then centred and held steady. If there follows an oscillation of appreciable amplitude, the tail area is probably insufficient. To some extent these two phases of dynamic stability are interdependent; good stick-fixed stability, for example, may overcome a slight deficiency in stick-free performance provided the margin is fairly small.

In pitching manœuvres, a bobweight and bungee spring contribute to the Herald's docile handling. Weight and spring are balanced at 1g loading, the system being designed in such a way that the elevator is deflected downwards under g loading, assisting the aircraft to recover. The bobweight also improves elevator stick forces per g, which at 25-30lb are fairly typical of civil airliner practice. These forces are sufficiently high to prevent the aircraft being overstressed by inadvertent application of excessive elevator angle.

Stability tests on the Series 200 are currently in progress and c.g. limits are being determined; as this was written the programme was about half complete, with another four weeks to go.

Sideslipping is the technique used to check control surface power, lateral stability and aileron and rudder control balance. A sideslip is entered in the normal way by crossing the aileron and rudder controls, the relative angle of yaw of the fuselage then being measured by a yaw vane under the wing. The associated control forces are also measured and the maximum angle of sideslip must be reached with a positive force gradient. That is to say, control force rate can reduce as sideslip angle increases but forces must not at any stage decrease. These tests are particularly stringent in the case of the Herald, and in showing compliance with BCARs, sideslip angles of 24° have been reached.

Another aspect of sideslip behaviour is that of finding out what happens when, while still in the sideslip, the pilots' aileron or rudder control is released. Depending upon which case is being examined, the aircraft should return to level flight or the yaw should cease and the control should return—within the frictional band—to its trimmed position. All these points are checked at various weights, various speeds and at various c.g. positions, so that the total number of sideslips that have to be flown exceeds the stalling requirement, although the time taken to perform each is rather less.

Finally, and before delivery to the airline, a very simplified version of all the foregoing tests is applied to production aircraft. Handling is briefly reassessed, and the functioning of all the systems is checked in great detail, right down to the lights in the cabin, heaters in the galley, and the recline on the seats.

Another test sortie complete, and back to base at Woodley

Contributors to the Herald

The following list of suppliers of components used in the Herald has been provided by the manufacturers of the aircraft:

Bloctube Controls Ltd (control pedestals), Delaney Gallay Ltd (heat exchangers), Dowty Rotol Ltd (propellers), Electro-Hydraulics Ltd (undercarriage and hydraulics), Elliott Brothers (London) Ltd (radio and flowmeters), Field Aircraft Services Ltd (aircraft radio), Fireproof Tanks Ltd (fuel tanks), Firth Cleveland Instruments Ltd (fuel gauging equipment), Sir George Godfrey & Partners Ltd (cabin superchargers), Goodyear Tyre & Rubber Co (Great Britain) Ltd (wheels, tyres and brakes), Graviner Manufacturing Co Ltd (fire extinguishing equipment), Integral Ltd (hydraulic power packs), King Aircraft Corp (connectors), Lockheed Precision Products (hydraulics), Marconi Wireless Telegraph Co Ltd (radio), Normalair Ltd (pressurization and air conditioning), The Plessey Co Ltd (actuators and accessories), Rolls-Royce Ltd (Dart RDa.7 engines), Rotax Ltd (electrical equipment), L. A. Rumbold & Co Ltd (passenger and pilots' seats and furnishing), The SPE Co Ltd (fuel float valves and pumps), Sangamo-Weston Ltd (electrical instruments), Smiths Aviation Division (aircraft instruments), Sperry Gyroscope Ltd (automatic pilot), C. F. Taylor Ltd (glass-fibre components), Teddington Aircraft Controls Ltd (valves), Teleflex Products Ltd (controls), Thermoplastics Ltd (transparencies), Thorn Electrical Industries Ltd (electrical accessories), Triplex Ltd (windscreens).

It is understood that the following companies are also concerned: Esso Petroleum Co Ltd (fuel and lubricants), Sciaky Electric Welding Machines Ltd (spot welding), Shell-Mex and BP Ltd (fuel and lubricants).

HERALDIC ERA

Jersey Airlines' New Equipment : ATC Problems

FROM tomorrow onwards a new aircraft shape, that of the Handley Page Herald, will be seen regularly in the skies above the Channel Islands: Jersey Airlines are introducing them from May 19 on their Bournemouth - Jersey schedules. They are having six Series 200 Heralds, in 48/50-seater configuration, but their first two machines will be Series 100s, on lease from Handley Page Ltd. The first two Series 200s are being delivered later this year, the second pair in 1962 and the remaining two in 1963.

Choice of the Herald for Jersey Airlines was dictated partly by patriotic considerations, partly by the preference of the company's traffic staff for a high-wing configuration. The type should fit well into its new environment, operating over stage-lengths averaging only 100 n.m. in what Jersey Airlines' energetic chairman and managing director Mr M. L. Thomas describes as an "ultra short-haul market."

This season, the airline is not scheduling its Heralds to the same extent as it will be able to do in 1962 and subsequent years: the first two aircraft (the Series 100s) are 44-seaters; later machines are being built to the company's specification with a 42*in* extension to the fuselage, and will be capable of operating at a 40,000lb take-off weight.

Acquisition of turboprop aircraft by Jersey Airlines underlines the striking progress the company has made since its institution in 1948. It has behind it the inspiring tradition of the pioneer pre-war company, Jersey Airways, whose DH Dragons used to land on the beach in St Aubin's Bay in the mid-1930s. This concern later became Channel Islands Airways, in which the Great Western and Southern railway companies took a financial interest; and after Jersey Airport was opened in 1937 the number of passengers carried in a year went up to 35,000 and the amount of freight to 1,200,000lb. Just before the war, CI Airways became the first company to operate the DH Flamingo; immediately after, a reorganization was started, and by the end of 1946 (the year in which Bristol Wayfarers were introduced) 74,646 passengers had been carried, over double the total for the best pre-war year.

Normally, relations between the Channel Islands and the UK Government are quite sunny (Channel Islanders habitually refer to Britain as "the mainland," though Victor Hugo described their islands as "bits of France thrown into the sea"), but a cloud passed over these relations in April 1947 when Channel Islands Airways were brought under control of the then newly formed British European Airways. Although the islanders are extremely patriotic, they have an intense local pride in their airfaring tradition: they had kept services going across the Channel until mid-1940; their pilots had operated during the war in support of the RAF; and immediately after it the company got under weigh again, starting its first regular post-war services in June 1945.

But with the British genius for compromise another independent Channel Islands airline company, Jersey Airlines, came into being in 1948. In the early years of its existence this operated only over

HERALDIC ERA . . .

routes not served by BEA; but by the energy and efficiency of its operations, and as a result of ever-expanding traffic, the company earned the right to share in BEA routes to the Channel Islands. Thus towards the end of 1955 there was an agreement between Jersey Airlines and the Corporation for Jersey to take over (from April 1956) some of the schedules and services being operated by BEA with de Havilland Rapides. At that date (November 1955) *Flight* commented that Jersey Airlines "have expanded at an impressive rate," adding that "the success of the company is closely linked with that of the DH Heron feederliner. . . ." In March 1956 the MTCA sanctioned the proposal for Jersey to take over from BEA (from April 22) certain Channel Island routes, including those between Guernsey and Southampton, Alderney and Dinard.

Thus, from being allowed certain crumbs from the rich man's table, Jersey Airlines have asserted their right to an equal share with BEA in main routes from the UK to the Channel Islands; and now, with tomorrow's introduction of the Heralds, they will be able to offer their passengers travel at turboprop speeds and standards of comfort.

With the growth of Jersey Airlines, and increasing services to the Channel Islands by BEA and the independents, there has been a comparable growth in airport services and control facilities. Both Jersey and Guernsey have runways long enough for Viscount operations (5,100ft and 4,800ft respectively); Jersey Airport with its Marconi S.264 equipment has radar surveillance extending as far as the London FIR; and the Channel Islands Control Zone, though almost entirely within the Paris FIR, has authority for all traffic through its area up to and including Flight Level 190. These developments reflect the general growth in air transport since the war, but are particularly epitomised in the Channel Islands, whose only alternative means of communication is by ship.

Busy Jersey

Last year, there were 62,158 movements in the CI Control Zone and Jersey Airport handled 39,170 of them—more than half. These figures include all types of aircraft, and it should be noted that Jersey is one of the few major airports in the UK that allows club flying (by the Channel Islands Aero Club) on its premises, a condition being that all flights are made under radio control.

At the height of the season, when Jersey Airport handles well over 300 aircraft a day (on July 25, 1959, there were 366; on August 6 last year, 337), a three-minute landing rate is achieved; and last year—the first full year of Marconi S.264 operation—holding was avoided because aircraft were "seen in" by this long-range radar installation.

Mr J. R. Curry, the Jersey Senior Air Traffic Control Officer, refers to the CI Zone facilities as "an area control service."

Key year for the zone was 1959, for it was in that year—when, on June 26, Princess Margaret inaugurated the S.264—that the zone's upper limit was extended to 20,000ft to provide for Viscount traffic, and Blue 32 (the Paris - Shannon airway) was introduced, passing directly over Jersey—though under exceptional traffic conditions there may be temporary re-alignment over Dinard. Blue 32 continues as an advisory route, ADR 592 (to the Scillies, then north-westwards). Then last year a seasonal airway, Blue 26, was established for operations between Gatwick and Jersey from March to October and it has been re-introduced for the same period this year. For ATC reasons this airway is restricted to Decca-equipped aircraft, the only aid permitting accurate reporting to ATC. With Red One (Southampton - Jersey), Blue 26 provides a two-way traffic system into Jersey Airport, variable according to the landing direction.

Another route entering the CI Zone is ADR (advisory route) 160, serving the West Country and the Midlands via Weym[outh] and Chepstow. There is a proposal to replace it by a new air[way], Amber 25 (Manchester - Jersey), realigned farther westward[s via] Ebbw Vale and Start Point. This is still in the project stage, [but] could be put into operation this summer using existing D[ecca] Navigator coverage as the basic navigational aid, supporte[d by] other facilities in a "crash programme" effort. All negotia[tions] affecting the CI Control Zone are triangular, between Jersey, the MoA and the French, because of the zone's situation in the Paris FIR. The Commandant of Jersey Airport, Mr G. Griffiths, in the absence of an Aviation Ministry acts in the capacity of Director-General of Aviation for the States of Jersey.

When Mr Curry recently described the control zone in a paper he wrote on it he made special reference to certain aspects: the density of traffic, so that at weekends in peak months there may be up to 550 movements in one day: the fact that, since almost the whole of the zone is over the sea, the siting of beacons is restricted (there are three NDBs, on Jersey, Guernsey and Alderney); and the basing of routeing procedures, of necessity, on these beacons. In this context, the SATCO commented, international acceptance of an area fixing-aid such as Decca "would open up a wide field of application" in the CI Zone. Mr Curry added that a limited number of Decca routes were being introduced in the Zone on an operational trials basis. Monitored by radar, these Decca routes would give an added flexibility in Control Zone routeings, so urgently required.

The Marconi S.264, said Mr Curry, fulfils the dual function of an area radar and approach control radar, coverage extending over the whole of the zone area and beyond, from 5,000 to 20,000ft. Referring again to the problem caused by sea surroundings, he said that because of this environment it was impossible to mark the zone boundaries; thus controllers had to rely on estimates received from aircraft to provide standard separation. When MoA completed their radar installation programme for the south of England, full coverage would be provided for aircraft flying between the London area and the Channel Islands; and it should be possible "to reduce the existing standard procedural separation of aircraft flying at the same speed and altitude from ten minutes to five minutes or less, and at the same time to add to the safety factor."

The Heralds which are coming into service with Jersey Airlines from May 19 are Decca-fitted, so will be equipped for precise navigation from the start, able to determine their position exactly in relation to the zone boundaries. The Heralds' advent will not add appreciably to the Channel Islands' air traffic problems, since only two aircraft are involved initially and they will be using approximately the same slabs of sky as the Viscounts; but the symbolic significance of the Heralds for Jersey Airlines is quite strong, for it puts the company—however modestly—in the turboprop market. (When *Flight* visited Jersey recently Mr Thomas commented bluntly: "If we don't get a modern aircraft we might as well wrap up.")

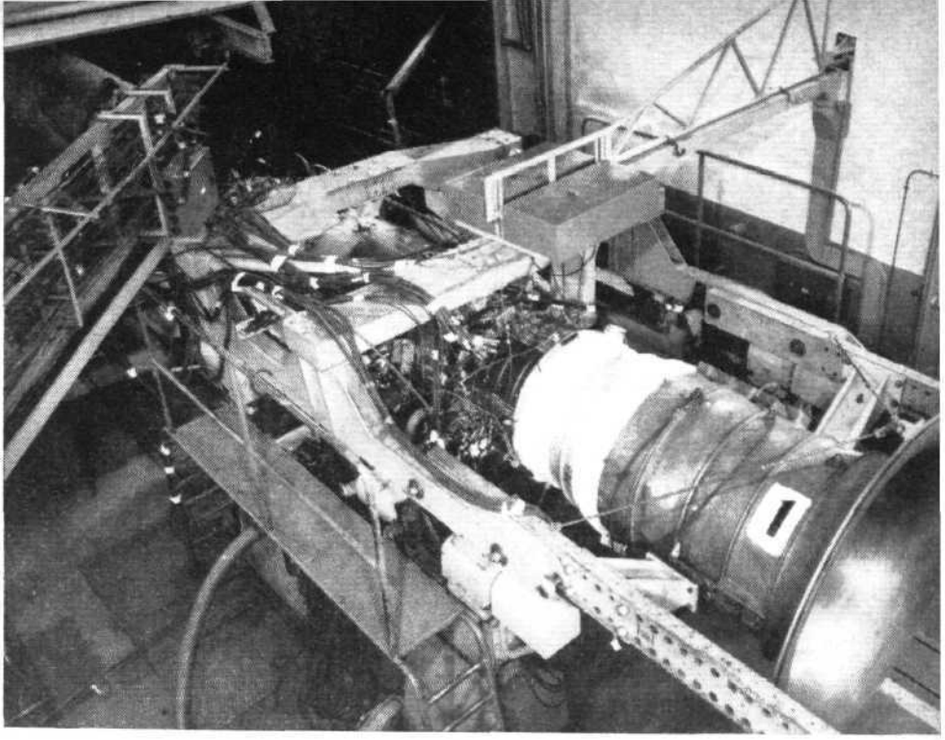
There is another significance, too, for Jersey and the Channel Islands as a whole—which are as intensely air-minded as they were in the 30s when the DH Dragons and Expresses used the sands—in the coming of the Heralds. They will provide faster, more capacious services than the Dakmasters and Herons; and this means a lot to an island community which looks on itself as part of Britain but has to cross a hundred miles of water to get there. The islanders are socially and economically accustomed to air transport. As Senator W. H. Krichefski, president of the Jersey harbour and airport committee and chairman of the CI Air Advisory Council for Civil Aviation, graphically puts it: "When I was a boy, we used to get our daily papers by the evening boat; now, if we don't get them first thing in the morning, we wonder what's wrong." Holidaymakers, too, are accustomed to "flying there": out of 442,276 who travelled to Jersey last year, 389,357 went by air. The Heralds, in making their Jersey Airlines' début, will take their place in an air-minded community for the service of air-minded commuters. H. W.

The Herald's entry into service has been preceded by a comprehensive programme of overseas flying to prove the aircraft in extreme conditions and to conduct sales demonstrations. This is the Series 100 aircraft that took part on the first South American tour; it is seen at Rio

SIX DERBY WINNERS

Rolls-Royce Aero Gas Turbines

BY THE TECHNICAL EDITOR



Spey I running in test cell

ON August 17, 1956, this journal published a review of Rolls-Royce commercial gas turbines, under the title "Four Derby Winners." These four engines were the Avon, Conway, Dart and Tyne, and a lot of water has flowed under the bridges across these rivers since that account was written. Of the 48,000 Rolls-Royce employees, 38,000 work on aero engines, and 8,500 of these are design and development engineers whose output is not inconsiderable. The author feels, therefore, that if the Rolls-Royce engine picture is ever again to be examined as a single canvas, the time is now; for every week brings new problems, new experience and new accomplishments.

AVON No aircraft engine has a more extensive background of operating experience than the Rolls-Royce Avon turbojet. Development of the original AJ.65 started in 1947, leading to the Avon 100 described in *Flight* on December 16, 1955. In 1951 the much more advanced Avon 200 series was produced, described in *Flight* for October 11, 1957. Today, well over 3,000,000hr has been flown by military engines, and flight-time on the commercial Avons is approximately 1,000,000hr. It is appropriate to discuss the two families separately.

Commercial The original airline Avon was the RA.29, which differed from earlier versions principally in having a zero compressor stage (making 16 stages in all) and a third turbine stage. The first engines built to the Stage I (RA.29/1) standard were the Mk 522 (take-off thrust, 10,500lb)* for the Caravelle 1, and the 524, 525 and 525B (10,250lb) for the Comet 4, 4B and 4C. The Comet engines, many of which incorporate reversers, have now flown 700,000hr in scheduled operation. The Mk 524 engines in BOAC Comet 4s are at present cleared for 2,600hr between overhauls, and 2,900hr will be approved when a sufficient number of engines have been inspected at that figure. No other turbojet has yet exceeded 1,600hr.

Further development of the commercial Avon has been directed towards the achievement of increased power for the Caravelle. The Stage III rating (Mk 527, 11,400lb) was established merely by improving the turbine-blade material and fitting a two-position nozzle. The nozzle area is varied by a flap hinged between two of the silencing lobes, and the nozzle is usually fully open except at take-off. The Mk 527 went into production for the Caravelle 3 in January 1960, and earlier Caravelle engines have been brought up to this standard at overhaul.

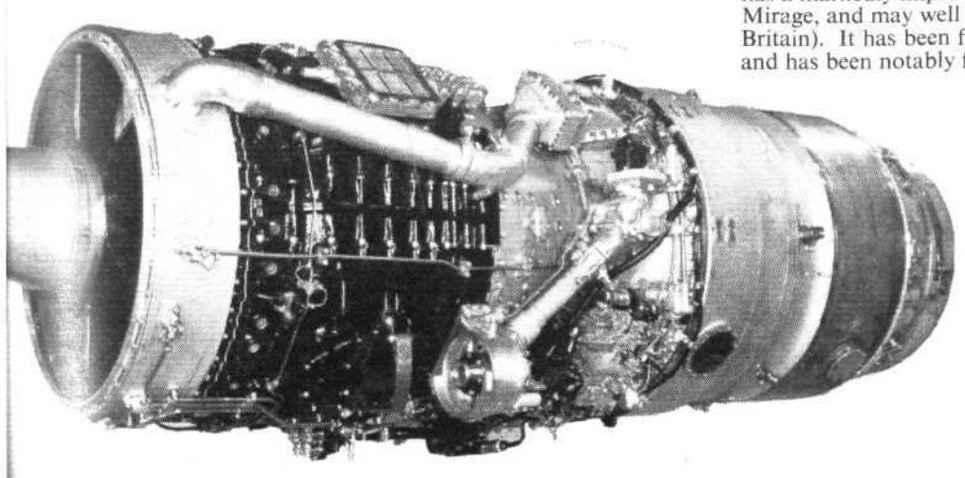
Much the largest advance in the development of the commercial Avon occurred when a "zero-zero" stage was added at the front of the compressor, to produce the Stage VI engine for the Caravelle 6. The basic Stage VI is the Avon 531 (12,200lb), in which flame temperatures remain approximately at the level of the Mk 527, and a number of refinements combine with the increased pressure ratio to reduce the specific consumption. This engine entered scheduled service on February 18, 1961, with Sabena. The Avon 532R (R for "reverser") incorporates improved material and cooling arrangements in the first turbine stage in order to operate at higher temperature (12,600lb). Fitted with a modified fuel system, incorporating a separate shut-off cock, the engine is fitted to the 20 Caravelle 6Rs bought by United. The FAA will start these engines off at an overhaul life of 1,200hr.

Military Supplementing the many thousands of military Avon 100 and 200s is a new family with mark numbers starting at 300. These engines are at present more widely known by their experimental nomenclature of RB.146, and are essentially a cross between the RA.24 and the commercial RA.29. The RA.24 is in large-scale use with the RAF and Royal Navy, both with and without reheat, and has a higher flame temperature and air-cooled turbine blading. To produce the RB.146 Rolls-Royce added the civil engine's zero-stage, but retained the original two-stage turbine (although with a low-pressure wheel of increased diameter). Aluminium alloy is used for the first five compressor stages, the remainder being steel or titanium.

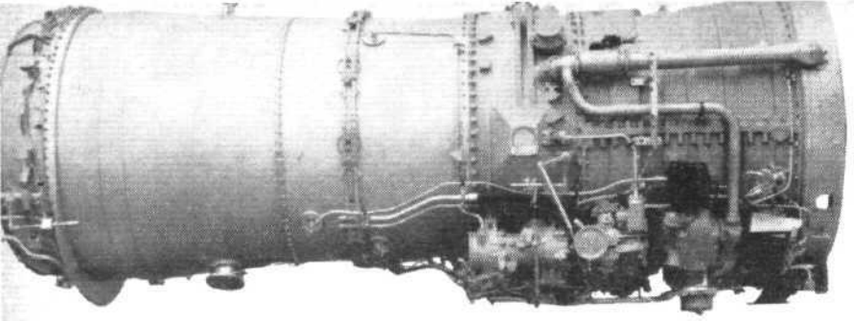
During the past ten years Rolls-Royce have developed a series of reheat jetpipes (afterburners) of steadily increasing capability. As flight Mach number increases, the optimum propelling-nozzle diameter does likewise. Most of the early reheat nozzles had a diameter of 2ft, and even in the Swift and Lightning installational limitations hold it to some 28in. On the other hand, the Mirage and Draken impose no restriction in this regard, and first-class installations are flying in both.

For the former aircraft, Dassault and Rolls-Royce reached a joint agreement last year to offer an RB.146-powered version for export and to effect a one-off trial installation. Designated Mirage IIIO, this aircraft has an airframe made available by the French Air Ministry and an engine belonging to the British Ministry of Aviation and designated Avon Mk 67. The Rolls-Royce reheat system is served by an air-turbine fuel pump and has a fully variable nozzle with roughly twice the area of previous patterns. The nozzle has 16 hinged fingers, alternate fingers being driven on rollers along curved tracks under the thrust of eight ball-screwjacks engaging in an annular gear-ring coupled to a Plessey air motor. The aircraft first flew on February 13. It has already conducted extensive trials with operational loads (picture, April 20, page 525), has a markedly improved performance compared with the standard Mirage, and may well be the fastest aeroplane in Europe (including Britain). It has been flown by French, Australian and other pilots, and has been notably free from any major powerplant trouble.

* *All ratings are minimum guaranteed.*



Avon RA.29/1



Conway RCo.42/1 mock-up

SIX DERBY WINNERS...

Engines for the Saab-35B Draken are made under licence by SFA (Svenska Flygmotor), whose RM-6C is the Avon Mk 60 with an SFA afterburner. The RM-6C is in production at Trollhätten, and compares closely for performance with the British Avon 301. Some of these advanced Avons, including that flying in the Mirage, have a convergent/divergent nozzle, which confers a significant improvement in performance at high altitudes and Mach numbers.

CONWAY A full description of this pioneer powerplant was published in *Flight* for January 15, 1960, when its evolution from the early concepts of Sir Frank Whittle was noted. The present Conway stems from as recently as 1956, when Trans-Canada Air Lines asked for a by-pass turbojet (turbofan) of some 15,000lb thrust for their DC-8 aircraft, while the Ministry of Supply contracted for a 17,250lb engine for the Victor B.2. It is now common knowledge that the need to fit the engine into the wing of the Victor resulted in the by-pass ratio being fixed at the low value of 0.3; yet the present engines are superior to their American rivals in thrust, installed weight and specific fuel consumption.

Bench running of the first engines of this type started in November 1957. Production deliveries for the Victor B.2, Boeing 707-420 and Douglas DC-8-40 started in 1959, and commercial service with both the latter aircraft began on April 1, 1960. It is worth noting that the 707-420 has an all-British installation, incorporating a Rolls-Royce reverser and silencer, whereas the DC-8-40 retains the Douglas-designed nacelle, partly built by Ryan, using the characteristic ejector nozzle and target-type reverser.

All the 300-odd engines so far despatched to Boeing and Douglas are of the RCo.12 standard of build, the 707 engine being the Mk 508 and the DC-8 engine the Mk 509. Even today these are very advanced engines, having a high pressure ratio, two major rotating assemblies, a relatively high flame temperature and two propulsive flows. Ideally, Rolls-Royce would have preferred to start the engine off in military use, and then enter airline service with one major operator. Instead, the Conway has been plunged into intensive commercial service in two types of aircraft built 6,000 miles away, and with a whole range of operators simultaneously. All things considered, teething troubles have been surprisingly few, and the engineers at Derby now express themselves well pleased.

Service Experience

In general terms, trouble with the Boeing installation has been less than with DC-8 engines, and the incidence of snags of all kinds has fallen encouragingly from the high levels suffered during the first months of service. For example, BOAC, who have the largest fleet of Conway-engined aircraft (707-436), experienced 0.67 unscheduled engine removals per 1,000hr flying in June 1960. The corresponding figures for the subsequent months are: 0.6, 0.61, 0.67, 0.35, 0.3, 0.34, 0.29, 0.21, 0.12 and (for the 14,000hr last month) 0.00. On April 30, total hours in scheduled service were 286,400, of which 188,360 were flown by Boeings and the remainder by DC-8-40s. Initial approved life was 1,000hr; the figure has now climbed to 1,600hr in the case of Lufthansa (Boeing), and 2,000hr should be reached by most operators in the first quarter of 1962. Between overhauls, nothing need be done to the engine, or to the Rolls-Royce reverser on the 707, apart from routine external servicing.

Apart from isolated problems peculiar to the Douglas installation, more than two-thirds of all unscheduled removals have resulted from four clearly defined causes. In addition, some h-p compressor-blade trouble was experienced during early operations with the DC-8-40, until a thrust-reverser drill to eliminate gas re-ingestion was evolved and adopted. This is now satisfactory and the reverser trouble has ceased. Development has also produced solutions for the four causes of most of the trouble in 1960, which were:—

L-p compressor front bearing Originally, clearances in this bearing were exceedingly fine, and at high altitude the cold casing contracted enough to pinch the rollers and either break up the track or promote creep of the inner race. Practically all this trouble was confined to the first 50,000hr, and it has been almost unknown since the summer of last year. The immediate palliative was to raise the clearance between the housing and the race by 0.003in, and to make the inner race more of an interference fit on the shaft to remove the possibility of its rotating. These measures, carried out in the field, have been most satisfactory, and at the first overhaul the bearing housing is machined out to restore the original bore dimensions. New production housings are stabilized by being carefully heat-treated.

Centre bearing Plucking of centre-bearing cages was found to be restricted to components from one particular manufacturer, and a satisfactory alternative was quickly introduced.

H-p compressor blading Failures of h-p compressor rotor blading were at one time a major source of trouble, and its solution demanded protracted investigation. It was found that at rotational speeds well below the maximum a slight stall developed around the outer radius of the h-p compressor, leading to vibration in a form of flapping mode which, if continued for a sufficient time, led to fatigue failures originating at points of local debris damage. It was an infrequently encountered condition, and one which proved elusive when attempts were made to simulate it on the ground, but by the late autumn it was decided to minimize running between 57 and 70 per cent r.p.m., and the trouble virtually ceased overnight. Later action to eliminate the rotating-stall problem entirely will probably involve decreasing the blade twist at the front of the rotor and then slightly increasing the twist on later stages. This should result in a compressor with improved idling characteristics, without penalty. At the same time, the opportunity will be taken to increase the axial clearance between the inlet guide vanes and first h-p rotor stage, to prevent contact between the two sets of blades in the event of bird ingestion.

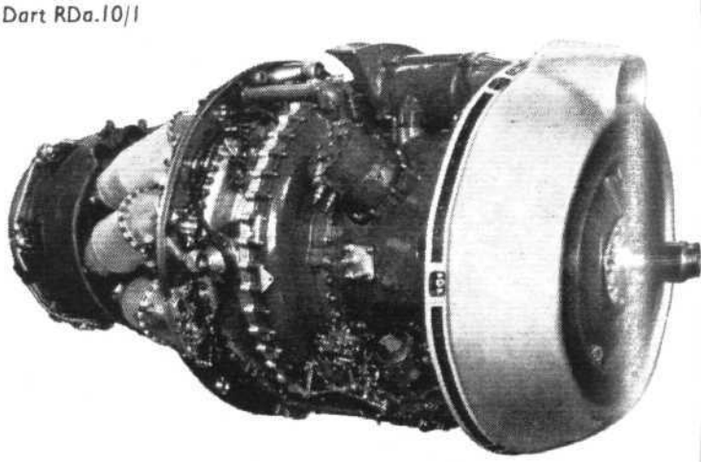
H-p turbine blading Although Conway flame temperatures are some 200°C higher than those of the Dart, the use of air-cooled blades restricts metal temperatures in the h-p stage to within very few degrees of those in the earlier engine. Nevertheless, for obvious reasons, the introduction of new materials in cooled blades has always lagged behind that in solid blades. Thus, the Conway started off with h-p blading in the older Nimonic 95A, and, notwithstanding Rolls-Royce's painstaking research over many years into all aspects of cooling blades from the inside, a few of these blades suffered failure resulting from thermal cracking. The introduction of cooled blades in Nimonic 105 has provided the answer; but, at the same time, it is worth noting that the life of the entire hot end of the engine is closely related to both the total time spent at peak temperature and the number of occasions at which this temperature is reached. Thus, long-haul operations facilitate the achievement of higher component lives, and much also depends on an operator's take-off technique. Inevitably, the hottest parts of all gas turbines suffer when take-off power is held for protracted periods, and modern anti-noise techniques are having a very beneficial effect. At some airfields, for example, an initial steep climb is made at full power to gain as much height as possible before reaching a populated area; power is then reduced and the aircraft held level for a time which may be as great as 15min, before opening up to climbing r.p.m.

Sufficient experience has been gained for Rolls-Royce to know that in the matter of overhaul life and component life the Conway will match the world-beating standards set by the Avon and Dart. This is the more remarkable when it is remembered that Avons are already running to a 2,900hr trial overhaul cycle, and have many components which have reached lives of over 5,500hr.

This being the case, Rolls-Royce have with confidence embarked upon a programme of Conway development. The obvious steps to take in such development are: increased flame temperature (to give more power); add a zero-stage (to give much greater power, and improve specific consumption); and reduce clearances, and effect detail refinements throughout the engine (to minimize leakage and further improve specific consumption).

During the early design of the Conway, a zero-stage was added to the l-p compressor, so that in all production engines the first compressor stage is overhung ahead of the front bearing. Advantage has been taken of this fact in the design of a new front end to the engine, fabricated in steel sheet, in which increased taper on the first rotor stage allows the diameter of the intake to be opened out

Dart RDa.10/1



by .25in. The increased mass flow gives 1,000lb more thrust, and the incorporation of detail refinements confers an improvement in cruising consumption. The resulting engine is designated Conway RCo.15B. Delivery of these engines is now in progress for the "Super DC-8s" of Canadian Pacific, for scheduled service at the end of the year. CPAL are to convert their RCo.12-powered aircraft (the first three of their fleet) to RCo.15B power at a later date.

First run of an RCo.15B took place early in 1960, and manufacture of engines to the production standard began more than a year ago. Rolls-Royce also offer an engine designated RCo.15, incorporating only the revised zero-stage and thus giving the 18,000lb guaranteed minimum rating, but not enjoying the improved consumption resulting from the detail modifications to the gas path. Although both the RCo.15 and RCo.15B require a new nose cowl, their installation is in other respects identical to that of the RCo.12, and initial overhaul life is not expected to be substantially less than the corresponding figure for the RCo.12.

Next step in the development of the Conway is a larger one. By 1959 it was clear to Rolls-Royce that the by-pass ratio of the Conway was lower than the optimum, and it also seemed likely that a 20,000lb-thrust engine would before long be asked for by transport manufacturers. Two courses appeared to be open to the Derby designers: either a new 20,000lb engine could be drawn on a clean sheet of paper, or a new l-p line could be designed to fit around the existing h-p assembly. In the event, the latter course was adopted. The h-p system is notoriously the difficult and expensive part of an engine, and its retention in the new Conway was considered a very great advantage in reducing development difficulties and in ensuring a rapid build-up to a satisfactory overhaul life.

The VC10 Engine

Designation of the new engine is Conway RCo.42. Its h-p compressor, combustion system and h-p turbine are basically identical with those of the RCo.15B, so that by the time the engine enters service these critical parts will have exceeded 2,000,000hr in airline service, and maximum lives of individual hot parts should be of the order of 6,000hr. Around this nucleus Rolls-Royce have matched a new l-p system consisting of a compressor of increased capacity and a rebladed turbine, giving a by-pass ratio of 0.6. Rig-testing of the new l-p assembly started early in 1960, and the first RCo.42/1 engine ran for the first time in March 1961. This "1½-generation" powerplant is now entering production for the Vickers-Armstrongs VC10, 18 of which have so far been ordered. Deliveries to Weybridge will begin for certification testing in September, and quantity deliveries will be made throughout next year.

In the RCo.42/2, detail refinements could effect an improvement in specific consumption, but it is unlikely that this unit will be built. The same improvements are incorporated in the RCo.42/3, in which a substantial increase in thrust is gained by clearing the engine to operate at increased r.p.m. This method raises both the mass flow and pressure ratio, but it demands engineering changes in the casings, discs and blades. Accordingly, the RCo.42/3 is being developed to a schedule about a year later than that for the RCo.42/1. The RCo.42/3 is the engine chosen for the first 30 Super VC10 aircraft for BOAC, and the first powerplants for these aircraft will be delivered towards the end of 1963.

Reference to this journal's report of the 1960 SBAC Show indicates that at that time Vickers were thinking about stretching the VC10 still further, to an overall length of 196ft 6in and a gross weight (as a freighter) of 373,000lb. The powerplant specified was the "Conway 7," which we described at the time as an RB.163 Spey scaled up to give a thrust of about 24,000lb. In the event, it is now considered unlikely that this "Super-Super VC10" will be built, but basic calculations on the Conway 7 have been completed and such an engine could be produced within three years if a firm requirement were to materialize.

DART It is now 15 years since the development of this turboprop began, and it was affectionately described as "agricultural machinery" by one of its largest users five years ago. Nevertheless, it is impossible to open a discussion of the Dart with any feelings other than profound respect, for it has proved—and we are speaking strictly metaphorically—a blazing torch, which has illuminated the way along which all other modern airline engines have followed.

Scheduled service began with the Dart 505 (later 506) in the BEA Viscount 701 in April 1953, at an overhaul life of 400hr. Total time in airline service today exceeds 15,000,000hr, and the scheduled overhaul life with most operators is substantially greater than that of any other powerplant in the world. First operator to exceed 3,000hr was Capital Airlines (now part of United), who run their Dart 510s to 3,100hr. A time of 3,200hr was reached by TCA's Dart 506s last March, and in January BEA achieved 2,750hr on their powerful Dart RDa.7 Mk 520s (their 510s are on 3,000hr).

Overhaul life depends greatly upon the operator. For it to be high, stage-lengths must be long (because this gives the engine an easier life), and utilization must be intensive, so that time-expired engines can be "pulled" quickly and in sufficient numbers to prove each new extension of life. The attitude of the airworthiness authority in the country concerned also has a bearing on the permitted figure, but in the case of the Dart no authority regards it with suspicion. It is worth noting that over 800 aircraft have been ordered with Dart power, including airliners for 128 civil operators in 37 countries. In 16 of these countries there are located 23 bases at which Darts are regularly overhauled.

It is not possible to forecast the ultimate time between overhauls which the Dart will reach. Already, most operators need pull their engines only once a year, and the matching of very long engine life with the routine maintenance demanded by the airframe in which it is fitted is a problem involving many difficult variables. Nevertheless, operators in general are keen to extend engine overhaul life, and 4,000hr can be predicted with confidence. The complete powerplant goes through the same scheduled life, with no more than routine inspection between times. The overall life of the major individual parts is in no case less than two engine overhaul periods, and typical figures for the major hot parts for a Dart 510 are: flame-tubes and h-p turbine blades, 6,000hr; h-p disc, 9,800hr; nozzle-box, 12,000hr. Basic carcase life has not yet been determined, and the life of the more critical components is being progressively extended by the introduction of improved materials, cooling arrangements and detail design.

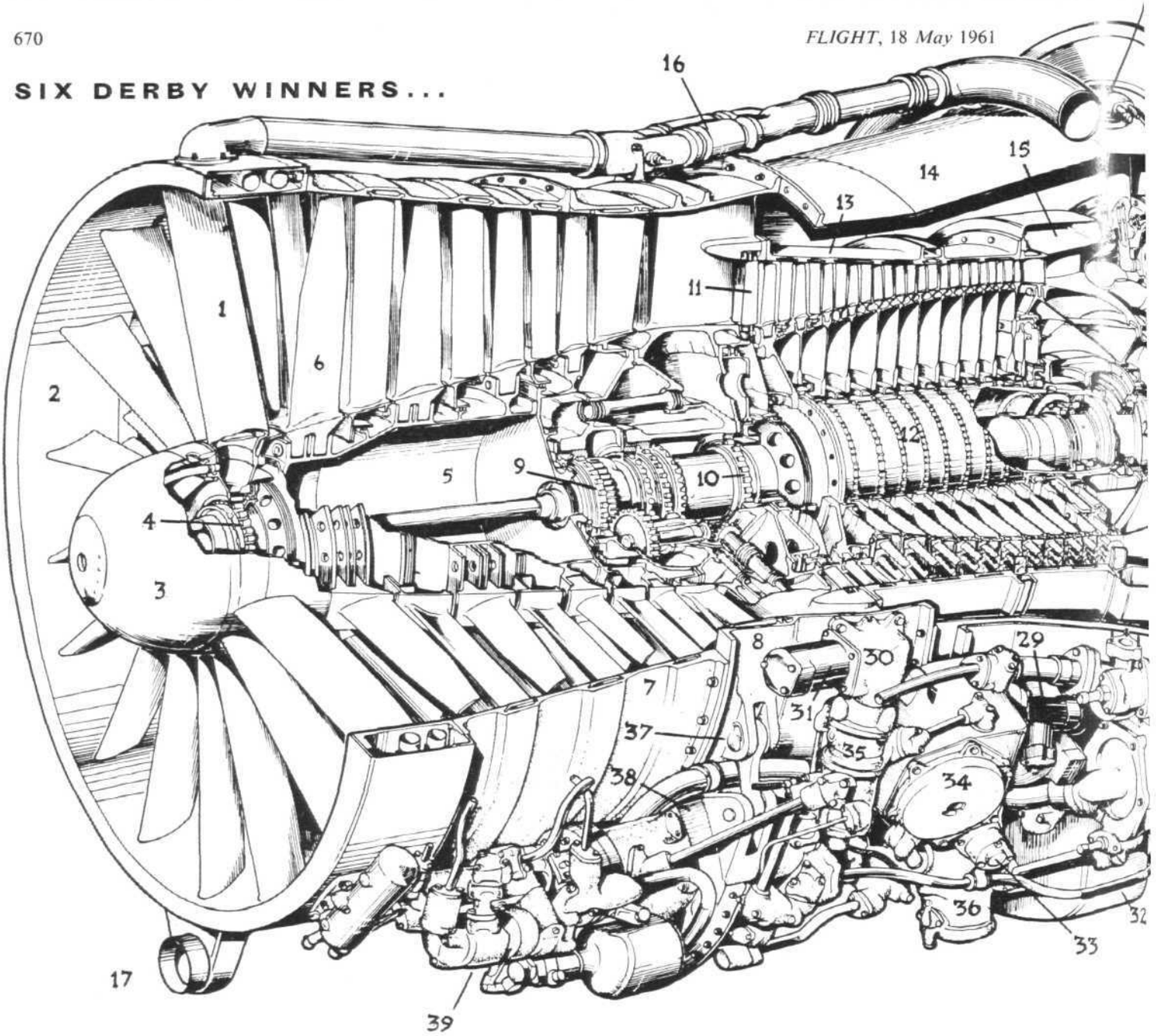
Practically all the 3,250 Darts so far manufactured have been to the RDa.3, RDa.6 and RDa.7 ratings, described in our issues of March 20, 1953 and February 28, 1958. Many marks of RDa.6 and RDa.7 remain in full production. All are civil engines, apart from the Mk 21 which powers the Breguet Alizé ASW aircraft; rated at 2,020 e.h.p., the Mk 21 matches an RDa.6 compressor with an RDa.7 turbine. From these families has now been evolved another military engine, currently in volume production for the Argosy C.1s of RAF Transport Command. Designated RDa.8 Mk 101, this engine is essentially an RDa.7 with 65°C increase in flame temperature, and a water/methanol system which boosts,

ROLLS-ROYCE AERO ENGINES

First run (month and year)	Engine designation		Type	Compressor and turbine stages	Max basic dry weight (lb)	Mass flow (lb/sec)	Pressure ratio	By-pass ratio	Guaranteed min rating lb-thrust] [e.h.p.	Typical cruise rating; altitude(ft), speed(kt), output (lb or e.h.p.) and s.f.c. (e.h.p.)	Max app. overhaul life (hr)
—	Avon	RA.24R	TJ*	NA	NA	NA	NA	—	11,250 (14,430*)	NA	NA
Nov 51		RA.28	TJ	15, 2	2,869	NA	NA	—	10,150	NA	NA
March 56		RA.29/1	TJ	16, 3	3,308	173	9.1	—	10,500	25,000; 425; 3,400; 0.936	2,600
June 58		RA.29/6	TJ	17, 3	3,471	185	10.3	—	12,725	25,000; 425; 4,680; 0.898	1,400
59		RB.146	TJ*	NA	NA	NA	NA	—	13,230 (16,600*)	NA	NA
Nov 57	Conway	RCo.12	TF	7 + 9, 1 + 2	4,544	281	14.1	0.3	17,500	35,000; 475; 4,800; 0.900	1,600
June 60		RCo.15B	TF	7 + 9, 1 + 2	4,584	295	14.3	0.3	18,500	35,000; 475; 5,200; 0.862	—
March 61		RCo42/1	TF	4 + 3 + 9, 1 + 2	5,001	363	14.6	0.6	20,250	35,000; 475; 5,430; 0.840	—
Not yet run		RCo.42/3	TF	4 + 3 + 9, 1 + 2	5,100	363	14.6	0.6	21,800	35,000; 475; 5,570; 0.820	—
July 46	Dart	RDa.3	TP	2, 2	1,026	20.5	5.4	—	1,480	20,000; 300; 955; 0.655	3,200
Nov 50		RDa.6	TP	2, 2	1,106	20.5	5.4	—	1,660	20,000; 300; 985; 0.634	3,100
July 56		RDa.7	TP	2, 3	1,207	23.5	5.6	—	1,815	20,000; 300; 1,315; 0.573	2,750
March 58		RDa.10/1	TP	2, 3	1,377	27	6.35	—	3,030†	20,000; 300; 1,612; 0.556	—
July 55	RB.108		TJ	8, 2	262	NA	NA	—	2,010	NA	—
Nov 59	RB.141/11		TF	5 + 11, 2+2	3,613	273	16.75	0.7	15,000	NA	—
—	RB.145		TJ	NA	NA	NA	NA	—	2,750	NA	—
Dec 60	Spey 1		TF	4 + 12, 2 + 2	2,200	202	16.75	1.02	9,850	36,090; 560; 2,750; 0.777	—
April 55	Tyne	RTy.1	TP	6 + 9, 1 + 3	2,275	46.5	13.5	—	4,785	25,000; 370; 2,685; 0.405	—
—		RTy.11	TP	6 + 9, 1 + 3	2,275	46.5	13.5	—	5,325	25,000; 370; 3,180; 0.389	—
—		RTy.12	TP	6 + 9, 1 + 3	2,177	46.5	13.5	—	5,500	30,000; 320; 2,695; 0.391	—
—		RTy.20	TP	6 + 9, 1 + 3	2,205	46.5	13.5	—	5,855	30,000; 320; 2,786; 0.388	—
—		RTy.21	TP	6 + 9, 1 + 3	2,279	46.5	13.5	—	6,180	30,000; 320; 2,803; 0.389	—
Not yet run		RTy.22	TP	6 + 9, 1 + 3	2,279	46.5	13.5	—	7,075†	30,000; 320; 3,005; 0.383	—

Notes: * With reheat (afterburning); † With water/methanol boost; NA, not available.

SIX DERBY WINNERS...



1, Wrapped-sheet intake guide vanes; **2,** fabricated steel intake; **3,** nose fairing housing hot-air circulation tubes; **4,** l-p compressor front roller bearing, with self-contained metering and scavenge pumps; **5,** one-piece l-p rotor drum; **6,** pin-attached, aluminium rotor blading; **7,** one-piece l-p casing; **8,** diffuser casing; **9,** l-p compressor rear bearing and accessory drive; **10,** h-p compressor front bearing; **11,** h-p compressor variable intake guide vanes; **12,** h-p rotor drum; **13,** h-p compressor casing; **14,** by-pass duct; **15,** bleed-air manifold; **16,** engine anti-icing hot-air valves; **17,** anti-icing outlet to nose cowl; **18,** fireproof bulkhead; **19,** fuel manifold; 20, ten flame tubes with integral discharge nozzles; **21,** main thrust bearing on h-p shaft; **22,** air-cooled rotor blading of first h-p turbine stage; **23,** rear disc of l-p turbine; **24,** rear engine mounting; **25,** hot/cold flow mixer; **26,** bleed-air fuel heater; **27,** bleed-air to constant-speed drive and alternator cooling ejector; **28,** fuel/oil heat exchanger; **29,** fuel-pressure transmitter; **30,** l-p wheelcase; **31,** oil filter; **32,** oil tank; **33,** l-p fuel warning switch; **34,** l-p fuel filter; **35,** l-p governor; **36,** oil filter; **37,** control-unit suspension link; **38,** h-p wheelcase; **39,** combined fuel control unit.

In the RB.163 Spey, Rolls-Royce have brought together all their unparalleled experience in the design of high-pressure, high-temperature by-pass engines for the provision of the most efficient possible propulsion at speeds in the neighbourhood of Mach 1. Many significant design details visible in this cutaway drawing, prepared by the manufacturer, are commented upon in the text on the opposite page

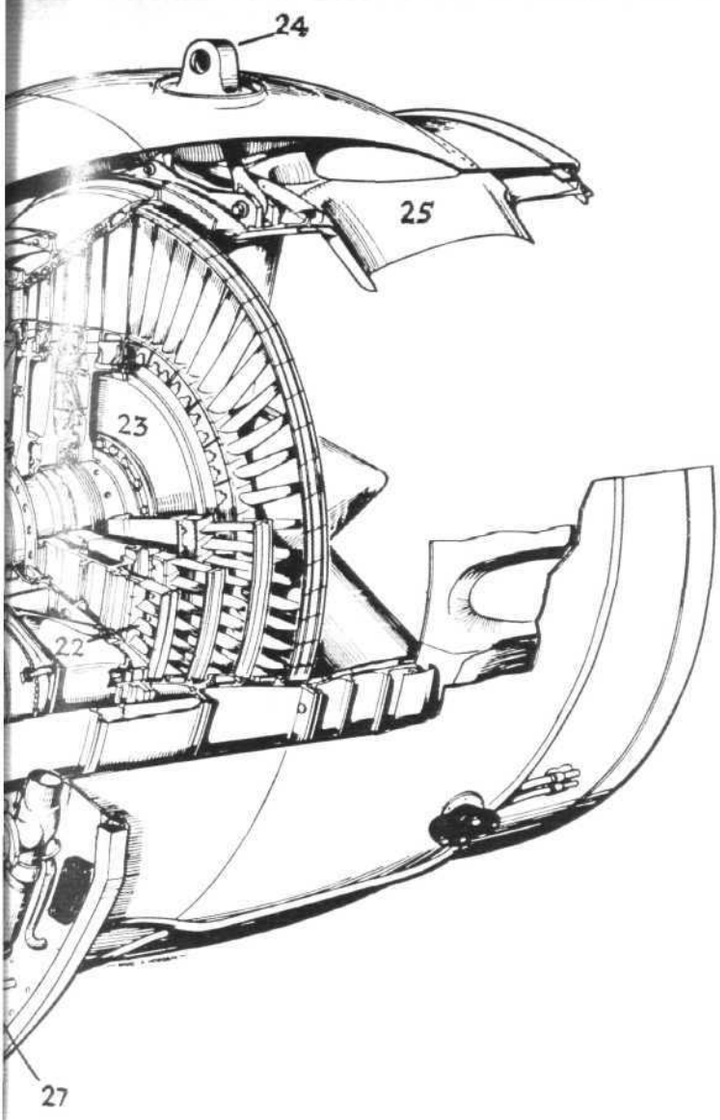
rather than merely restores, take-off power. The w/m system is torque sensitive; at sea level, for example, 2,680min e.h.p. can be achieved at up to ISA + 30°C, while at 5,000ft the corresponding power is 2,400 e.h.p. The guaranteed minimum rating of the RDa.8 without wet boosting is 2,310 e.h.p., the increased temperature raising the output by 290 h.p. in comparison with the otherwise identical RDa.7.

At the Rolls-Royce flight-test establishment at Hucknall, Notts, there may be seen an Elizabethan with an RDa.8 mounted in the starboard position. On the port wing of the same aircraft is mounted an RDa.10, and with this engine the way is open to further development within the bracket 2,500-4,000 h.p. In fact, the RDa.10 and its paper successors effectively bridge the gap to the Tyne, and Rolls-Royce have no plans for a new turboprop in the Dart power-class.

Differences between the RDa.7/8 family and the RDa.10 start right at the intake, which is opened out to accept a 15 per cent greater mass-flow. The throat area of the compressor rotating guide vanes has been increased, the l-p impeller has a greater diameter (to give a higher pressure ratio), flame temperature is increased some 65°C, the turbine nozzle guide vanes are of improved material, the first turbine rotor stage has air-cooled Nimonic 105 blading, the reduction gear has spread centres to increase its capacity, a water/methanol power-boost system can be fitted and provision is made for a reversing propeller, with a conical spinner reminiscent of that used on the Tyne.

Interest in these more powerful Darts is hardening for a number of applications. The only one so far announced is the Namco YS-11, a large local-service airliner which is now a firm project for Japan and the Far East. For this aircraft the RDa.10/1 was officially type-tested in February 1961 at a wet rating of 3,030 e.h.p. An initial shipment of five prototype engines is being made, and the first YS-11 should fly early in 1962. For military applications the RDa.12 bears the same relationship to the 10 as does the 8 to the 7, an increase in flame temperature raising the dry and wet ratings to 2,795 and 3,255 e.h.p. respectively.

SPEY This is a particularly opportune time at which to discuss the RB.163 Spey, for this week Rolls-Royce have released for publication design details previously restricted on commercial grounds. Moreover, a little more can be revealed of the engine's manifold applications, together with notes on future development



ROLLS-ROYCE SPEY Mk 1

The story of the Spey began in 1958, when Rolls-Royce decided to embark upon the design of an entirely new transport powerplant, smaller than the Conway and having a higher by-pass ratio. Under the project number of RB.141 a design was sketched aimed at a thrust of some 12,000lb, and the engine was chosen for the Airco D.H.121 jetliner. This machine won the competition for a new BEA short/medium-range transport, and a provisional order was placed in February 1958. However, the RB.141 steadily grew in thrust to 14,000lb, and the D.H.121 was soon pronounced by Lord Douglas as too large for his airline's requirements. The BEA chairman demanded a return to the original specification, and the result was the D.H.121 Trident, of reduced span and length, matched to the entirely new RB.163 Spey with a minimum rating of 9,850lb.

Although this made the RB.141 an orphan, its design had reached an advanced stage, and Rolls-Royce elected to continue a full RB.141 programme to fill a possible hole for an engine of this size. The first RB.141 ran in November 1959, and nine engines were running at the end of 1960. A great deal of the data obtained have been carried directly across to the Spey and other powerplants, and the RB.141 itself could be made available rapidly should the occasion so demand.

But it could not be derated to match the optimum BEA requirement, and accordingly the RB.163 Spey programme was initiated with some urgency. The basic design was completed in September 1959, three weeks after BEA signed a firm order for 24 of the revised aircraft. It is widely believed that the Spey is a direct scale of the RB.141, but in fact it differs in some respects, partly owing to the increasing importance of reducing jet noise and partly a natural corollary to the fact that its design started 18 months later.

It appears to have been largely the need to meet any future requirement for take-off or fly-over noise, rather than considerations of propulsive efficiency, which dictated a substantial increase in by-pass ratio over the RB.141. Raising this fundamental parameter to the Spey's level of unity results in minimum jet noise when silenced to the severe standard laid down by BEA. In fact, the RB.163/1, for the Trident 1, meets all known noise requirements with no silencing whatever. Almost exactly similar engines are specified for the BAC-111 (pp. 673-4) and Sud Caravelle Junior, and are likely to find other applications.

The table two pages earlier shows the different work distribution between the two compressor spools of the Spey, in comparison with that for the RB.141. Eighteen months of additional knowledge is manifest in the radically different construction of the l-p compressor, which has resulted in a saving in weight. As the cutaway shows, the four stages of aluminium blading are pinned to flanges machined around a single drum, the front roller bearing for which is supported by a ring of wrapped-steel intake guide vanes heated by bleed air.

In contrast, the h-p spool adheres to more conventional construction, the 12 rows of aluminium, titanium and steel blades being mounted on discs bolted or dogged to the hollow h-p shaft. The high-pressure 12-stage compressor has variable inlet guide vanes, and an intermediate bleed (which in the Spey discharges into the by-pass duct). Overall pressure ratio is higher than in any previous production engine in the world. There are ten flame tubes, and the h-p and l-p turbines both have two stages of blading, the first h-p stage being air-cooled. Mixing of the hot and cold flows takes place just downstream of the turbine.

A Rationalized Fuel System

It is worth paying particular attention to the Spey fuel system, which—like that of the RB.141—represents a radical advance on all that has gone before. Particularly during the past ten years, the control systems for aircraft gas turbines have disturbingly increased in complexity, and today typically consist of a mass of rubber rings, half-ball valves and microscopic orifices, any one of which can either leak or become blocked. Rolls-Royce felt the time had come to start again, and on the Spey the control system handles the entire engine fuel-flow. In many respects similar to propeller control systems, the new arrangement meters the fuel through large orifices in rotating sleeves, and incorporates kinetic (Woodward) governors. The resulting unit is very robust, is insensitive to dirty fuel, eliminates 80 per cent of the fuel-pressurized joints in former systems and gives precise control of r.p.m. under all conditions. It has been designed by Rolls-Royce and is manufactured by Lucas Gas Turbine Equipment Ltd.

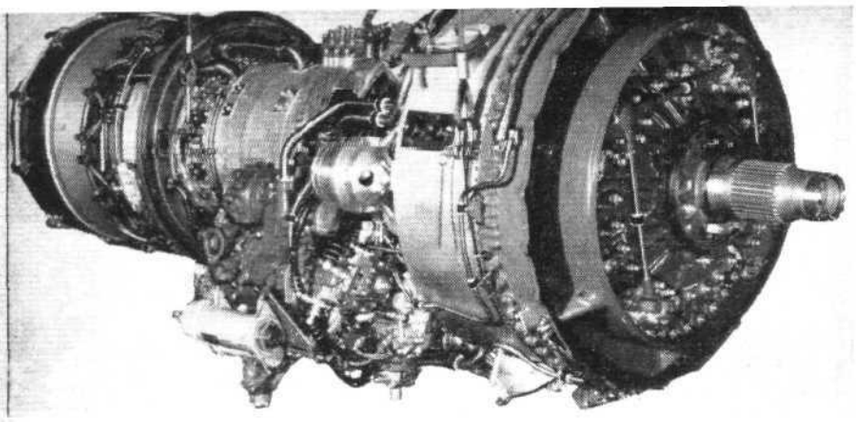
All engine-mounted aircraft accessories are grouped on a single external wheelcase. A closed-circuit lubrication system is used, each group of bearings being scavenged by a separate pump. Electric or pneumatic starting may be provided (the latter is specified for the Trident), driving the h-p assembly. Direct bleed of air from the h-p compressor serves engine—and, if necessary, aircraft—anti-icing, as well as cabin pressurization—a choice amply justified by the absence of a single case of oil contamination of cabin air during over 4,000,000hr commercial and military operation of R-R direct bleed systems.

It is clearly undesirable to start off with an engine which is already "stretched," and the Spey 1 is conservatively rated, and has been developed as an integrated package for the Trident 1 incorporating a reverser and simple six-lobe noise-suppressor. The first of these engines ran in December last. Four are now running, flight-testing in a Vulcan should begin in September, the Trident is due to fly before the end of this year, and production deliveries are due to start at the end of 1962. The Spey 1 has no water system, and by such simple means as the addition of demineralized-water injection, refinement to the gas path and the use of later blade materials, ratings can easily be raised to more than 11,000lb.

Nothing can at this stage be divulged concerning military applications of the Spey, apart from the facts that the engine has an MoA development contract as the RSp.1, that a production contract is being negotiated and that a number of military versions, both with and without reheat, are under development. As we reported on November 18 last, the London *Daily Express* has announced that a military Spey has been chosen for an advanced version of the Blackburn Buccaneer naval strike aircraft. In such an application, substantially increased ram pressures and temperatures would demand corresponding strengthening to the engine carcase, and the shorter flight-time might permit higher flame temperatures and increased thrust. Certainly, the Spey has a specific consumption appreciably better than any comparable engine currently available.

TYNE In our last assessment of Rolls-Royce engines we outlined the background history to the original RB.109 project, and the Tyne itself was described in our issue of April 22, 1960. The engine is by a wide margin the most advanced propeller turbine known to exist anywhere; and it is recognized that turboprops involve all the development difficulties of the turbojet, with many new ones of their own. All things considered, the story of the Tyne is immensely encouraging; but it has had its fair share of problems, and one wholly unpredictable fault, of which more anon.

In the Tyne Rolls-Royce have combined high pressure-ratio and



SIX DERBY WINNERS...

high flame temperature, to obtain the best possible specific weight and specific consumption. The engine is a two-shaft unit, the propeller being driven by the l-p system. All Tynes have air-cooled nozzle guide vanes and h-p turbine rotor blading. The engine is at present in the early stages of commercial and military service, and its development stretches ahead to powers far exceeding anything previously obtainable from any long-life prime mover of comparable size and weight.

Before discussing this programme of development, it is convenient to explain the metallurgical problem which smote the engine last year. Last May, when hours on complete engines exceeded 20,000, a Tyne running on the bench at Derby suffered catastrophic failure of an h-p compressor disc. Although this appeared to be an isolated occurrence, every engine which had flown was examined, and in one of these powerplants another h-p disc was found to have a radial crack with an origin near that of the disc which broke up. Rolls-Royce requested Tyne users—Vickers-Armstrongs and Canadair—to suspend flying while a widespread investigation sought the cause of the trouble.

It was soon determined that the failure stemmed from an obscure metallurgical condition affecting less than 0.5 per cent of all the wheels concerned, and restricted flying with cleared discs was resumed in July. Extreme difficulty was experienced in reproducing the failure on the bench, but eventually it was concluded that, although Rex 535—high-tensile, creep-resistant steel—was giving perfect service in the Conway and the latest Avons, trivial differences in the manufacture of the Tyne wheels could lead to an undetectable loss of properties. Accordingly, Rolls-Royce scrapped the 3,500 discs previously made, and started a crash programme to produce discs in vacuum-melted material, using modified forging dies to increase the working of the material and heat-treating according to a revised schedule.

This cure is complete and permanent, and the Vickers Vanguard ultimately received its C of A on December 2. The Vanguard 952 for BEA has the RTy.1 Mk 506, with a minimum rating of 4,785 e.h.p. The Vanguard 953 aircraft for TCA have the RTy.11 Mk 512, incorporating improved material in the h-p turbine rotor blades to permit an increase in flame temperature. Cruise power is even further advanced, by raising the recommended r.p.m. from 12,500 to 13,500. Both engines are now in intensive airline service, and an approved overhaul life is at present being negotiated. The only major trouble experienced affects the turbine bearings and the h-p compressor shaft oil seal, which was found to wear and lead to excessive oil consumption. This problem was cured by the introduction of gramophone (spiral) seals. The problem at the rear end has been more serious. Some vibration had been noted during bench running, but more severe vibration, some clearly propeller-induced, has been suffered during Vanguard services. TCA have been particularly prone to the trouble, and voluntarily reduced their cruise r.p.m. to 13,000. The vibration has affected both the h-p and l-p turbine bearings, and a complete cure is expected by redesigned housings. Generally, however, the performance of this complex and powerful unit has been most encouraging.

To match the engine to aircraft demanding increased take-off thrust at the expense of reduced jet thrust, Rolls-Royce have evolved the RTy.12 Mk 515, in which an increase in jetpipe nozzle area raises the power fed into the propeller. Engines of this type are soon to enter service in the Canadair CC-109 and CL-44D-4, and are specified for the Short Belfast. Both the Canadair and Short aircraft have a 16ft de Havilland propeller, the Vanguard propeller being a 14ft 6in unit.

Stage 3 in the Tyne's development is a military rating, and this is a direct stretch of the RTy.12, with practically no mechanical changes. Designated RTy.20, it has a still higher flame temperature, obtained at the expense of falling below airline-type overhaul periods. A water/methanol system is also available for the RTy.20, to restore power up to ISA + 17°C. The Tyne Mk 21 of this family powers the Breguet 1150 Atlantic, with a 16ft propeller, and the

Tyne Mk 22, driving an 18ft propeller, has been chosen for the Transall C-160.

Having requirements unlike those of any other aircraft, the Westland Rotodyne is scheduled to be powered by a Tyne derived from the RTy.12, and employing w/m boost to give a 2-min contingency rating of more than 7,000 s.h.p. Investigations have shown that further development of the Tyne is feasible up to 10,000 h.p. within the existing frame-size of the engine.

VTOL Rolls-Royce have for many years pioneered the technique of jet-lift VTOL (vertical take-off and landing) by the employment of separate lift and propulsion engines. The subject is a vast one, and many manufacturers have tended to prove that their own particular solution is the optimum. Rolls-Royce thinking is based on considerable flight and laboratory experience, and both separate lift and propulsion engines—the so-called composite powerplant—and swivelling-nozzle or tilting engines are active projects.

The first Rolls-Royce lift engine was the Nene, which powered the "bedstead" which flew in 1953. Thrust/weight ratio of the Nene was 3.2. The axial Soar of the same era had a t/w ratio of 6.6, and the RB.108, powerplant of the Short SC.1, improves this ratio to 8.1. The RB.108 first ran in 1955. Since that time development of specialized lift engines has been intensive, and a unit entering the development phase achieves the outstanding t/w ratio of 16.

Although there is always one size of engine at which t/w ratio is a maximum, this is not a critical factor, and thrust can be placed anywhere within the bracket 2,000-8,000lb without more than 10 per cent penalty. Specific consumption is not important in pure lift engines, for they are rarely called upon to run for more than a minute at a time; their control system can be simplified, for they need run only at less than 5,000ft and 250kt; and the low forward speed and ram pressure allows a substantial reduction in carcase weight. Moreover, the combustion system has to operate only over a restricted range of conditions, and can be designed for enormous heat-release per unit volume. Drastic simplification can be effected throughout the fuel and accessory systems, and the main rotating assembly can be hung between only two bearings and incorporate new materials for minimum weight.

VTOL Techniques

Most missions—by any type of flying machine—can be divided into a cruise regime and an entirely different phase of getting off the ground and back again. The latter demands a total lift greater than the weight while the cruise regime demands propulsion by the smallest possible engine(s), operating at a substantial throttle opening, if acceptable range is to be achieved. Although the use of a single engine with swivelling nozzles is ideally simple, and minimizes the propulsion dead-weight that has to be carried around in cruising flight, the thrust available for cruising is greatly in excess of that required, and the resultant throttling raises specific consumption and curtails available range. On the score of weight there is little to chose between the two sytems; much depends on the skill of the designer.

One of the most direct and instructive methods of comparing the several competing systems is to examine all the possible methods of making a supersonic type of aircraft clear a 50ft obstacle 500 ft away, and of being fully wing-supported at a given distance and height. Rolls-Royce have carried out many detailed studies into optimum powerplant arrangements and take-off techniques, using this type of comparative basis.

Failure of a lift engine at any given point can be shown to be not catastrophic, if the autostabilization and lift-engine system is designed to hold any lift asymmetry. The question of how the autostabilization should work is fundamental, and the SC.1 has undoubtedly provided most of the answers. It is worth noting that such a system is also demanded by an STOL combat machine, and the latter's overall t/w ratio must in any case exceed unity. Moreover, the VTOL machine can be overloaded just as can the STOL, and the most important factor is to decide whether the overall t/w shall be 1.2, 1.4 or some other value.

Failure of the propulsion engine is actually the most critical case in a composite-powerplant type of machine. Other problems concern the ingestion of debris and hot gas at take-off, which could not only shorten engine life but could critically reduce thrust at an embarrassing moment. The hot-gas problem is not severe, and Rolls-Royce have found that it is possible to fly upwards out of the centre of a doughnut-like vortex ring of hot gas without ingesting lift air more than 2° or 3° above ambient. The debris problem is more serious, and can play havoc with the ground, and anything standing on it, and well as with the aircraft. Again, the "rolling" technique takes the aircraft clear before the point of unstick is reached; and, it will be remembered, the SC.1 has taken off vertically and operated from plain grass.

BAC ONE-ELEVEN

Jet Viscount-replacement

DETAILS may now be divulged of the British Aircraft Corporation's new short-hauler, the twin-jet BAC-111, or "One-Eleven." As previously reported, the aircraft is a development of the BAC-107 (previously the Hunting H-107), and is sized to meet the Viscount-replacement market. There will, in fact, be two BAC short-range jet transports, since the smaller and lighter BAC-107 is to be continued, but to a time scale about one year later. (As previously reported, the VC11 has been discontinued.)

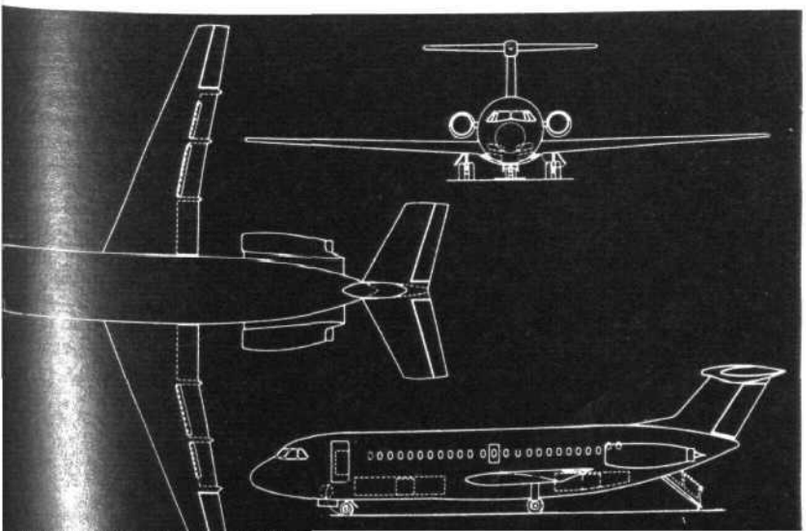
The One-Eleven is powered by two Rolls-Royce RB.163 Spey turbofans with a guaranteed minimum static thrust of 9,850lb at sea level; the BAC-107 has two Bristol Siddeley BS.75s of 7,350lb. It is natural to compare these aircraft with, respectively, the Viscount 810 and Viscount 700, which stand in a similar complementary relationship. The One-Eleven is the first aircraft to be designed and planned wholly by BAC. Under Vickers leadership, construction is already under way; the first flight is scheduled for the "spring of 1963," with deliveries to airlines from the "autumn of 1964." Final assembly is to be undertaken at Hurn, but Luton, Weybridge and Filton are all sharing in design and manufacture.

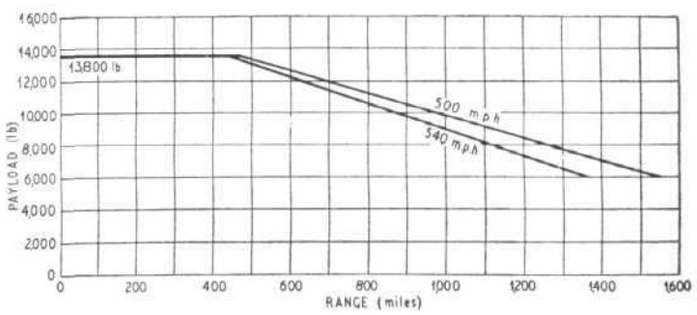
Simply stated, the BAC-111 is a short-haul jet, of 66,000lb maximum weight, with only 20° wing sweep and a stubby fuselage which tapers off rather abruptly behind the engine intakes. Accommodation is provided for up to 59 passengers seated five-abreast. Standard equipment will be more comprehensive than that of the simpler BAC-107, and special provision will be made for quick turnround. For example, an a.p.u. will be standard, to provide ground air-conditioning and starting. There are two passenger-loading doors, one forward to serve the first-class cabin in a mixed-class configuration, and a ventral door aft, *à la* Boeing 727 or Caravelle. Both are equipped with airsteps, and the rear entrance can be used while one engine is running.

Structural and systems design leans on Vanguard and VC10 practice, machined wing panels being employed as part of a similar philosophy of low stress-levels and multiple load-paths. Systems and systems components with which airline experience has already been accrued are also to be used, though no detailed information has yet been released.

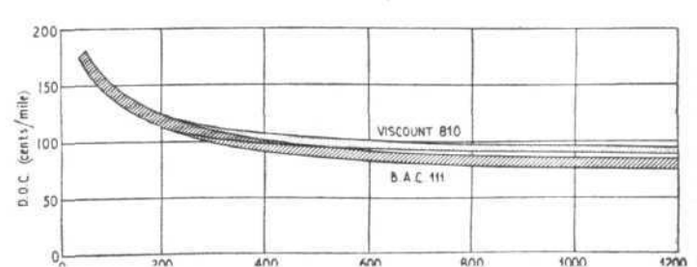
The control-surface layout is broadly similar to that employed on the VC10, with a high-set tailplane, extensive flap area, spoilers in the upper surface of the wing, but no leading-edge slats. Provision is to be made for autoflare, although, because control is manual, surfaces are not sub-divided into individually actuated sections as are those of the VC10. Air-conditioning intakes are located in the fuselage under the wing leading edge, directed to what is clearly an equipment bay between the front and rear freight holds.

Although performance is considerably greater than that of the Viscount, it is not obtained at the expense of field performance. Maximum cruising speed is 540 m.p.h. at altitudes between 20,000 and 30,000ft, but BAC say that departures from both upper and lower limits are not heavily penalized, the increase in direct costs when cruising at 10,000ft below the optimum height being only about 5 per cent. At the economy-cruise speed of 500 m.p.h. the maximum range with reserves is extended by about 200 miles. Tyre pressure at maximum weight is 120lb/sq in and the LCN is 32. Full payload may be carried over about 450 miles, the payload range curve from that point being fairly flat—so that, for instance, 57 mixed-class pas-





Payload/range curve (above) is drawn for maximum and economical cruising speeds, at 25,000-30,000ft, ISA, still air and with 2hr holding. (Below) Seven separate costing methods were used to plot these cost bands



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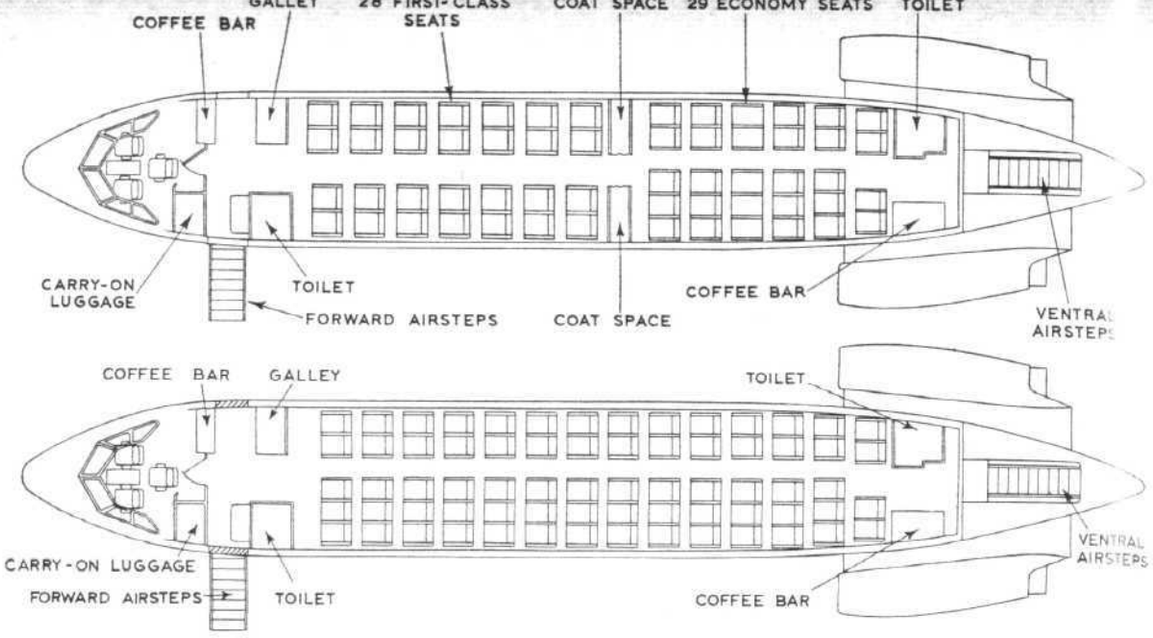


First British jet transport with ventral loading, the One-Eleven can seat 57 mixed-class passengers or 69 tourist five-abreast

sengers can be carried over a stage length of 800 miles with reserves or 43 passengers 1,200 miles—a combination of range and load almost identical with that of the Viscount 800. The jet should, however, be cheaper to operate by an average of about 3.5d per aircraft-mile over stages longer than 300 miles. On US costs, and on ATA assumptions, direct operating costs per seat-mile are 2.6 cents (2.2d) at 100 miles and 1.4 cents (1.2d) at 750 miles. At a typical US revenue-rate of 7 cents per passenger mile, the aircraft should break-even on a 50 per cent load factor on stages above 200 miles.

What is described as an "intensive world-wide market survey" has been conducted, from which BAC conclude that there is a large potential demand for both the BAC-111 and BAC-107—in particular as small partners to a big-jet fleet. It is claimed that no comparable aircraft is currently being built, although it is known that Sud Aviation are very busy with Caravelle Junior, which is very similar and has the same engines. But then it would be strange indeed if Vickers and their partners were allowed a second time to sell an aircraft in this class almost completely unopposed.

BAC-111

Two Rolls-Royce Spey turbofans of 9,850lb guaranteed thrust

Dimensions: Span, 88ft 6in; length, 93ft 8in; wing area, 980 sq ft; aspect ratio, 8; track, 14ft 3in.
Weights: Max ramp, 66,300lb; max take-off, 66,000lb; landing, 62,500lb; zero-fuel, 56,000lb; design payload, 14,000lb.
Payload accommodation: Total accommodation length, including toilets and galleys, 53ft 9in; between toilets, 44ft 6in; interior height, 6ft 6in; interior width at arm-rest height, 10ft 4.3in; dimensions of largest door, 5ft 6in × 20ft 9in; max passengers, 59; freight volume, 500 cu ft; dP, 7lb/sq in.
Fuel capacity: 2,250 Imp gal (2,702 US gal, 18,000lb.).
Performance: Max cruising speed, 540 m.p.h.; economy cruise, 500 m.p.h.; typical fuel consumption, 0.776lb/hr/lb at 25,000ft, ISA, and M0.78; take-off field length, ISA, sea level, 4,600ft; max range with 2hr holding at 20,000ft, 1,550 st m.

TEN ONE-ELEVENS FOR BUA

ANY aircraft company can announce a new aircraft for the cost of a press conference and a scale model; it is not so easy to announce a new project with the backing of a firm order. This is what the British Aircraft Corporation did last week when, on May 9, they released first details of the BAC-111 and announced (as briefly reported in *Flight* last week) an initial order for ten from British United Airways, Britain's biggest independent.

Sir George Edwards, BAC's executive director (aircraft) and Mr F. A. Laker, executive director of British United Airways, were the spokesmen for the two companies at a news conference in London. Sir George said that an initial batch of 20 aircraft was being built, and that the first would fly in the spring of 1963. Production would be sufficient to satisy the requirements of four or five customers by the summer of 1965 (British United will receive the first of their ten in 1964). BAC had been authorized by the president of Continental Airlines of Denver, USA, to say that Continental had evaluated the 111 and have expressed themselves interested enough to send a team to England to study the aircraft and with a possibility of an order within 90 days. Sir George said he had "seen less likely orders come to fruition." In addition, he said, a letter of intent for five aircraft had been received from the US local service airline Ozark. [Since then, on May 10, Ozark announced a firm order—see page 679.]

The BAC-111 in British United Airways livery

"We are now quite satisfied," Sir George said, "that the 111 is the formula that a lot of airlines are going to want." He was "especially happy" that the initial order was being placed by British United; BAC could now say "there you are, it is on the go. It is not just one of those things that we'll build if you'll buy it." There was undoubtedly a US domestic market for this type, amounting perhaps to a hundred aircraft. In a number of places the 111 would, he said, operate as a Viscount replacement, and in a number of other places it was a "natural growth" aeroplane.

It was BAC's intention, said Sir George, to proceed also with the smaller 107 project, powered by Bristol Siddeley 75s, "because our first indications show a market for a lighter, more austere aircraft than the 111." Final assembly of the 111 would be at Hurn, the wings would be built by Hunting and the tail and rear fuselage by Bristol.

Mr Laker, for British United, said that his airline took pride in the fact that it carried all its fare-paying passengers in turboprops—the Britannia and the Viscount, both of which were BAC aircraft. It had given him great satisfaction to be able to place this order with BAC, and he hoped to order more.

He wanted, he said, to anticipate the question "Why have we gone off the Trident?" [Last January British United had announced their readiness to buy five DH Tridents.] There were a number of reasons: (1) He believed that ten 111s would "give us more flexibility than five Tridents." British United's route-pattern was such that "if a Trident goes unserviceable on a Saturday morning that means 20 per cent of our capacity lost . . . with the BAC 111 it would be only 10 per cent, less if we take up our option on five more"; (2) though the BAC-111 had less speed than the "souped-up" Trident this would, he hoped, be regained on BUA's routes by the faster turn-round of the smaller aircraft; (3) noise-level would be lower than that of other types; (4) field performance was "very much superior" to that of other types such as the Caravelle and the Trident—an important consideration in view of the types of airfield BUA used; (5) "We are convinced that we can operate the 111 at a lower seat-mile cost than the other types I have mentioned"; (6) because the 111 was smaller "we will be able to offer the same personal cabin service. We believe that passengers are getting fed-up with being herded into big aircraft."

(Concluded on page 681)

1936-1961 25

SHAMROCK SILVER JUBILEE

The Growth of Ireland's National Airline

BY LANGDALE SUNDERLAND

Mr J. F. Dempsey joined Aer Lingus as secretary/accountant in 1936, and has been general manager since 1946 and a director since 1957. He is also general manager of Aerlinte Eireann

ECONOMIC circumstances, and the disturbed political situation which ushered in the new Irish Free State in 1921, delayed the growth of commercial aviation in Ireland until the mid-1930s. In fact, the first civil aeroplane on the Irish Register did not appear until the autumn of 1928; and it was not until two years later that the first air-taxi service was started, by Iona National Air Taxis of Dublin.

Ireland did not enter commercial aviation until 1936, by which time the world airline industry was just beginning to break-even without the necessity for costly annual government subsidies. But this late start was in no way detrimental to Ireland's national airline, which was thus able to avoid the organizational metamorphoses that had created almost insoluble problems for some of the older national airlines.

In the spring of 1936 it was decided to form Aer Lingus, and on May 27 of that year a daily return service was inaugurated between Dublin (Baldonnel) and Bristol, using a twin-engined D.H.84 Dragon seating five passengers. The legislation authorizing the formation of Aer Lingus as a State-sponsored company was yet to be passed when the first services began, but the company was formed and a staff of twelve recruited. The services were operated under the title of Irish Sea Airways in conjunction with Blackpool and West Coast Air Services, a company founded by the late Capt G. P. Olley, and this company assisted Aer Lingus to purchase its first aircraft and spares (most of which were kept in a large biscuit-tin!) until the airline was officially in existence as a publicly owned organization with funds at its disposal. These early flights operated with 100 per cent regularity until one morning a puncture delayed the Dragon's departure for half-an-hour—after which the stock of spares was increased by a spare wheel and tyre.

Aer Lingus Teoranta (Air Fleet Ltd) is a subsidiary of Aer Rianta Teoranta (Air Routes Ltd), which was established to maintain external and internal air services, to develop air navigation and to foster aeronautics in Ireland. Aer Rianta is not itself an aircraft-operating organization, though it has managed Dublin Airport since 1940 on behalf of what is now the Department of Transport and Power.

Today Aer Rianta is the majority shareholder in Aer Lingus (apart from a 4½ per cent share held by British European Airways Corporation), and owns the entire share capital of Aerlinte Éireann Teoranta (Airlines of Ireland Ltd).

By the end of its first year of operations Aer Lingus had opened seasonal routes to the Isle of Man and Liverpool and extended the Bristol route to London (Croydon). In the autumn of 1936 a 14-seater D.H.86A Express was acquired to supplement the Dragon, and by the spring of 1937 these two machines had carried 892 passengers and almost four tons of cargo and mail.

Slowly the traffic rose during the years preceding the Second World War and the original Dragon was replaced in 1938 by the improved D.H.89 Dragon Rapide, seating eight passengers. A D.H.86B joined the 86A in the same year, and in the summer of 1939 two Lockheed 14s were added to the fleet of three de Havilland aircraft.

The outbreak of war temporarily caused a complete suspension of Aer Lingus services, but by October the Liverpool route was re-opened and a daily Dublin - Liverpool service operated right through the war years. Manchester was used as the terminus of this route between August 1940 and November 1942. In spite of wartime difficulties, the fleet—which now consisted of two D.H.86s and a Douglas DC-3 (assembled in Holland and delivered in April 1940, only days before the Low Countries were invaded)—carried a total of 41,000 passengers. From January 1940 they operated from the new Dublin Airport, five-and-a-half miles north of the city centre.

Like most airline operators all over the world, Aer Lingus expanded rapidly after the end of the war, but it was some time before the basic route-pattern was finalized and suitable equipment chosen. In the financial year 1945–46 over 21,000 passengers travelled on the services to Liverpool, London, Paris and Shannon. During the next twelve months the company concentrated on these four routes, replacing the de Havilland biplanes by nine DC-3s. Eight new routes were opened in 1947: from Dublin to Amsterdam, Belfast, Brussels, Glasgow and Manchester; from Shannon to London and Paris; and from Belfast to Liverpool, using Vikings and Dakotas. Pressurized Constellations (hired from Aerlinte, operator of the projected North Atlantic route) were introduced on the Dublin - London service and on a new Dublin - Rome service.

But Aer Lingus was learning the economics of air transport the hard way: this too-ambitious expansion was rapidly and effectively checked. By June 1948 the Constellations and Vikings were withdrawn and the Dublin - Belfast, Dublin - Rome, Dublin - Brussels and Belfast - Liverpool services were suspended. In the ensuing twelve months the airline concentrated on its established routes and a further increase in traffic justified the reopening of the seasonal Isle of Man service and another summer route to Jersey. The Shannon - London service was routed via Dublin and an all-the-year-round service between Dublin and Birmingham was introduced. The first "Starflights," night-tourist flights at reduced fares, were operated on the Dublin - London route in 1950 to encourage passengers to travel at the least busy part of the day.

The year 1950 marked a turning-point in the history of Aer Lingus, for henceforth the company was to operate without subsidy. From the lessons learned in the years of experiment, the network has developed in accordance with a policy of planned expansion and equipment has been carefully chosen to fit the route-pattern. By 1951 Aer Lingus had carried its millionth passenger and re-opened its pioneer route to Bristol; and in 1952 the services were augmented by routes to Cardiff and to Edinburgh.

Delivery of four Vickers Viscount V.707s in the spring of 1954

"Iolar" (Eagle), the first Aer Lingus aircraft, a D.H.84 Dragon 2, at Baldonnel in May 1936

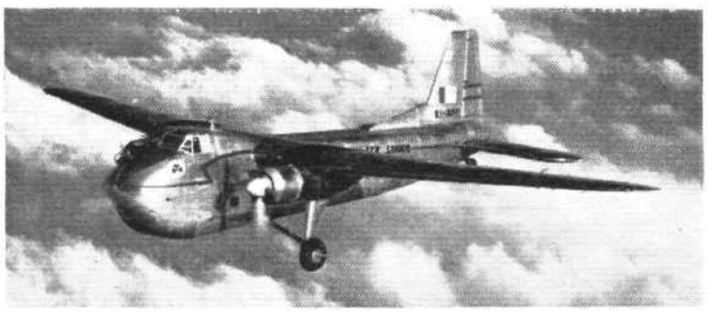

Aerlingus, Teóranta. 59
Aerport Áta Cliat. Baile Domnaill.
DUBLIN AIRPORT, BALDONNEL.
Ainm (Name) MORGAN
ó (From) DUBLIN 09.00 6 7 36
Go (To) BRISTOL
Aer (Fare) £ FREE
(Agreed stopping place)
(Valid until)
(Issued by)
(At) Dublin 6 7 36
(Baggage Ticket No.)

An early Aer Lingus ticket, issued July 6, 1936

Bought in the autumn of 1936, D.H.86B "Sasana" (England), with D.H.86A "Eire" (Ireland), served with Aer Lingus for ten years

Just over 21 years ago—in April 1940—EI-ACA, the first Douglas DC-3 for Aer Lingus—was delivered by Fokker. Since then the airline has operated 19 of these aircraft; five of them remain in service today

EI-ADF "St. Ronan" was one of seven Vickers Vikings used on United Kingdom and Ireland routes in 1947-48



Four Bristol Wayfarers Mk31E were purchased by Aer Lingus in 1952 pending delivery of their first Viscounts

When first delivered in April 1954, Viscount V.707 EI-AFV "St. Patrick" was in natural metal finish with green-and-white flash

Aer Lingus put their first Viscount V.808 into service on the main routes to the UK and Western Europe in May 1957. Since then EI-AJI "St. Gall" has been joined by another six

In April 1958, after ten years, the Aerlinte North Atlantic service was revived, using three Lockheed L.1049 Super Constellations leased from Seaboard & Western. "St. Patrick" operated from Dublin to Boston and New York, via Shannon, until December 1960, when the company's first Boeing 720 entered service

Aer Lingus was the first European airline to place the Fokker F.27 Friendship in service (in November 1958), mainly on United Kingdom routes. EI-AKF "St. Finian" is one of seven Friendships named after Irish saints whose names begin with "F"

A trio of Lockheed L.749 Constellations of Aerlinte Eireann, EI-ACS "St. Patrick," EI-ACR "St. Enda" and EI-ADA "St. Brigid," on the apron at Shannon in September 1947

SHAMROCK SILVER JUBILEE . . .

considerably modified the pattern of the company's operations and enabled new routes to be opened during 1954-55 to Lourdes, Biarritz and Barcelona. Further new equipment was ordered in 1956 in the form of three 60-seater Viscount V.808s and seven 40-seater Fokker F.27 Friendships, to be delivered in 1957 and 1958, a logical partnership of turboprop aircraft for short and medium-length routes.

The company celebrated its twenty-first anniversary in 1957 by opening routes from Dublin (via Manchester) to Brussels, Düsseldorf, Frankfurt, Rome and Zürich. In 1959 three more Viscount V.808s were delivered and the route-system spread northward to Copenhagen and southward to Lisbon. In the same year a seasonal route to Blackpool, in conjunction with Silver City Airways, was opened; and during 1960, in addition to re-opening the direct Shannon - London route, Aer Lingus inaugurated an all-the-year-round route to Leeds and Bradford, in pool with BKS Air Transport; they also started a special low-fare seasonal service to Cherbourg. By this time the fleet had grown to seven V.808 Viscounts, seven Friendships and five Douglas DC-3s, the last-named being used mainly for charter and cargo work.

A new strength and balance were given to the Irish airline system when routes across the North Atlantic from Dublin and Shannon to New York and Boston were opened in 1958, using leased Super Constellations. This service is operated by Aerlinte Éireann (Airlines of Ireland), a sister company of Aer Lingus, originally founded to serve the North Atlantic route which it was hoped would start in 1948. The two companies operate together as a single airline, Aer Lingus - Irish International Airlines, having a unified management and staff. By the end of 1960 the first of three Boeing 720-048 turbojets was superseding the piston-engined Super Constellations on the company's North Atlantic routes. All three new aircraft were in service by Easter this year. Carrying 117 first-class and economy-class passengers, each takes approximately six hours for the flight from Dublin to New York.

During 1960 almost three-quarters of a million passengers travelled by Aer Lingus - Irish International Airlines and nearly 13,000 tons of freight were carried over the North Atlantic, European and United Kingdom sectors of the system.

The silver jubilee of Aer Lingus falls next week—on May 27—and brings with it new prospects (and all the new problems) associated with a virile, expanding, yet still—by international airline standards—compact organization. Nevertheless, in the commercial field, the Irish airlines, by reason of their low overheads and of the complementary nature of their networks, possess unique advantages over their North American competitors, who are denied access to certain important Western European countries to which Aer Lingus already operate.

Looking into the future, with the Irish airline now serving almost all the densely populated regions of the United Kingdom, the frequency of these services will undoubtedly be increased—in fact, there are plans to operate the Boeing 720s on the busy Dublin - London route this summer and, possibly, to other destinations on the Continent. The medium and short-range sections of the system will this year include an extension of the Jersey route to Rennes, a Dublin - Belfast and a Dublin - Cork service, as well as services from Cork to Bristol, Cardiff, London and Paris. Frequency on the North Atlantic will reach a peak of two return flights daily during the tourist season, and this should ensure for the national airline an even larger share of the traffic terminating and originating in Ireland. Further plans include a cheap-fare, high-density service on United Kingdom routes and to selected Continental destinations, using 100-seater turboprop aircraft; and, by next spring, the reduction of reservation costs by drastic simplification of the complex airline reservations system.

Fifth aircraft to bear the name of Ireland's patron saint is EI-ALA "St. Patrick"—a Boeing 720-048, flagship of the Aer Lingus - Irish International Airlines fleet

Straight and Level

FOR more than a year now prototype Blue Streaks have stood forlornly in their test towers near Astwick Manor at Hatfield. Work goes on, in bottom gear, at a cost of £3¼m since April 13 last year (when the project was cancelled as a weapon) up to April 30 this year.

This is exactly the amount of money, £3¼m, that the Government proposes to give Cunard for the construction of a new *Queen*. The Government is also prepared to lend a further £15m. The opposition to this project, which the Government is pushing through with tremendous vigour, is considerable: the Press and everyone you talk to are hostile, and there are many rebels on the Government benches. Meanwhile Cunard is putting its own money into air transport and into a fleet of American jet airliners. The taxpayer could be forgiven for calling that a bit much.

The cost of the new *Queen* cannot, of course, be compared with the cost of Blue Streak, which is so expensive that the Government is trying to bring other European countries into a commercial-satellite launching partnership. But, oh, the thought of all the energy and money that the nation is expending on a vanished status symbol of the 'thirties, while space, where Britain should be, beckons the neglected Blue Streak.

● A great number of tests carried out at a Ministry of Planes experimental establishment have confirmed beyond all doubt that frogs possess a much higher capacity for resistance to high g than do human beings.

The experiments were carried out on a large wheel in East London and have shown that these amphibia suffered no ill effects from loadings as high as 25g for periods up to five hours.

These encouraging results [writes Straight and Level's technical expert Dr J. Nit] have caused the authorities to give serious thought to a British-flag space programme using frogs as subjects. Special training and conditioning would have to be given, but so far experiments in this direction have lacked success—due, it is thought, to a lack of interest and co-operation from the subjects.

These creatures are particularly suitable also because of their low metabolism; this, combined with a capacity to endure low temperatures, will simplify environmental engineering problems connected with outer space.

Contracts will soon be awarded for genetical research aimed at breeding frogs capable of sticking the British flag in any kind of planetary surface.

As this reproduction of a poster shows, when the station is about to close you can get away with anything, metaphorically speaking

● I don't know how people really feel about taking business aircraft into London Heathrow. I imagine there are very few people who would really gain anything by it. But permission for limited use of the London Heathrow has now been given and the heat is off.

London Gatwick is different. So long as you have the appropriate radio frequency, 119.6Mc/s, the people there are delighted to let you in and they bend over backwards to make you welcome.

Full marks to Gatwick. An amusing arrival must have been that of the radio - equipped Rollason Turbulent which can have required little more than two per cent of the runway length available. I can imagine the approach controller saying: "You are clear to land, number one . . . correction, number two behind the Viscount . . . correction, number three behind the Viscount and the Ambassador . . . correction, number four behind Viscount, Ambassador and Dakota . . . you are clear to take off and fly on 270 for three-quarters of a mile to the first intersection, report short final for the first high-speed turn-off . . . park next to the lamp-standard beside stand fourteen . . ."

It takes much more than this to ruffle an MoA traffic controller.

● "Some cylinder heads may be salvaged but still the cost runs about $12,000 for parts, plus a premature overhaul which more than doubles that figure. How many seats do we have to fill to pay for this?

"At average per-passenger profit—about as many customers as we can cram into our entire fleet for two average trips apiece. This approximates to one whole day's work for the entire airline.

"One lousy little piston pin in backwards and over twenty-three thousand company people spin their wheels just to stay in the position where we left off yesterday. Some days it doesn't even pay for an airline to get out of bed."—Flight Safety Foundation.

● BOAC and BEA will need plenty of good arguments if they are to convince the new Air Transport Licensing Board that their business must not be pinched by the independents. How about not saying to the chairman: "We're all right, Professor Jack"?

ROGER BACON

It rains in New Zealand too, especially—as in the Old Country—when there's an air show on. Hats off as well as umbrellas up to Ft Lt B. D. Gordon, RNZAF, for this display in a Canberra B.12, the only one of four to get airborne. Hats off, too, to the photographic artist who prepared this (I hope) fake picture

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

North Atlantic Sea v Air

IT is nice to be put in the hero class by Roger Bacon (page 597, May 4). He knows how to brag and clearly can write with a very perky pen. I wish I *could* play the ukulele, because if I could I would strum infinitely more soothing melodies than the shrill, shrieking, screaming noises he makes with his jets. I never go out of my way to deflate anybody unless they have definitely asked for it. Mr Bacon has. Let him read an article in the Liverpool *Journal of Commerce* (May 5) written by their very experienced air correspondent and entitled "Passenger Traffic Problems—Low Profits and Vast Aircraft Procurement—Need to Improve Service and Safety." It should take the smile off his face. It is revealing and, above all, it is realistic—a quality still lacking (though understandably lacking by the very nature of their upbringing) among air operators.

If and when the waves wash over me as I go down in my sinking ship, I hope Mr Bacon will hover overhead so I can shout up to him, "Yes, you have won." But let me positively assure him that there will never arise provocation for him to risk his life doing that.

London W1 C. M. SQUAREY
General Manager, Ocean Travel Development

[Roger Bacon writes: "I have read the article in the *Journal of Commerce*. It didn't wipe the smile off my face, because there wasn't one on it. I am concerned, not crowing, about the beating that British sea transport is taking from air transport, and I can find nothing in the recommended article (by Mr John Stroud) which 'deflates' the points I made. Air transport has its difficulties, but at least it faces up to them." —Ed.]

Desert Hazards

YOUR article about the merger that eventually resulted in the formation of BOAC ("Speedbird Anniversary," page 406) made interesting reading. I was in Iraq from early 1928 to late 1931, and it was through the efforts of Imperial Airways that we were able to receive letters from England in seven days, an amazing achievement in those far-off days.

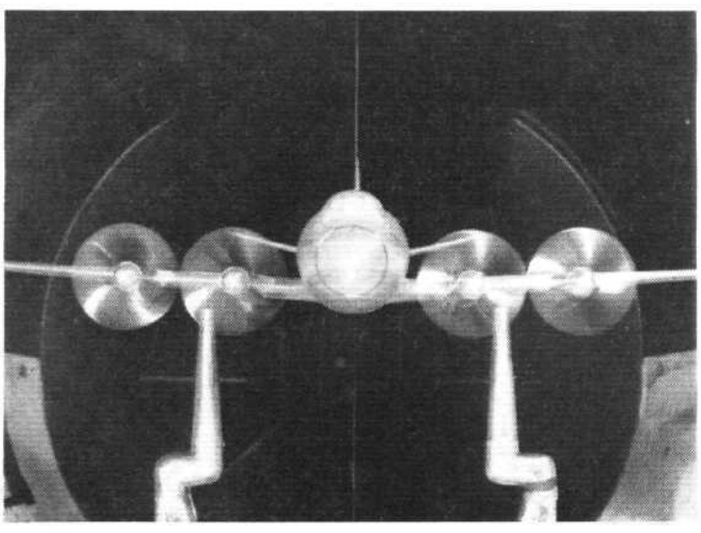
Flying over the desert had its hazards, as the enclosed photograph [reproduced above—Ed] shows. These Hercules of Imperial Airways had forced-landed in the Syrian Desert and had been located by Victorias of 70 (B) Squadron.

Darlington, Co Durham J. T. BENNETT

Powered Wind-tunnel Models

IN keeping with the historical note that is generally prevalent in the Correspondence column, I feel obliged to comment on the AWA section of your modelmaking article in the April 27 issue. It seems to have taken AWA almost as long to catch up with powered testing techniques as it did for "one of the first company-owned wind tunnels" to follow the first company-owned wind tunnel, which was in operation at Weybridge before 1920 and was testing aircraft such as the Vixen, Virginia, Vanguard, Vespa, Venture, Vendace, Wibault,

Viscount wind-tunnel model, with propellers powered individually by electric motors (see letter from Mr G. St Q. Crockett)



Desert forced-landing (see letter from Mr J. T. Bennett)

Scout, Vireo, Valiant, Vellore, Vildebeest, Jockey, Southampton, etc, during the twenties.

Internal motors to drive propellers were in use at the RAE before 1946, and at Weybridge externally driven propellers went out with the Windsor. A rig similar to that used on the Argosy was employed on a $\frac{1}{10}$th-scale Viscount (36in span) in 1948, with a 5 h.p. motor in the fuselage driving four propellers through shaft-drives and bevel gears. Later models had locally built 1 h.p. motors in each nacelle, and the art is still progressing (12 h.p. and more).

Weybridge, Surrey G. ST Q. CROCKETT

Australia's First Airliner

HAVING read both your article on the de Havilland Australia DHA-3 Drover in "Sport and Business" (November 25) and the letter from Mr Ward (March 16), I wonder about the bright echo which is always to be received from your readers when an airliner has been represented as "the first" or "the only" one.

Mr Ward is quite correct when stating that W. S. Shackleton's Lascoter of 1928 actually was Australia's first airliner. The sole prototype of that type, VH-UKT, covered 100,000 miles during scheduled and charter flights.

But it is not true that the Drover was Australia's "only" multi-engined airliner, nor that it was the second one. W. S. Shackleton designed a three-engined airliner also, built by Larkin as the Lascondor in 1930. The prototype, VH-UMY, was a seven-seater powered by three 150 h.p. Mongoose engines.

A twin-engined airliner (VH-URP) designed by Wg Cdr L. J. Wackett and named the Codock was tested in 1934. It was a five-seat high-wing light transport powered by two 150 h.p. Napier E.97 Javelins. Similar in layout was the Tugan Gannet (VH-UUZ), which was used in scheduled airline service by Motor Development Ltd, of Sydney, and Ansett Airways in 1943. This aircraft was powered by 200 h.p. DH Gipsy Six engines.

Frankfurt-am-Main P. GERHARDT
(German Register Specialist, Air-Britain)

FORTHCOMING EVENTS

May	20-22	Fréjus-St Raphaël Aero Club: Rally, Fréjus.
May	22	RAFA Air Displays, Hucknall, Notts, and North Weald, Essex.
May	22	SSAFA Air Display, Yeadon, Yorks.
May	22-24	IAS: National Telemetering Conference, Chicago.
May–June	26-4	Paris Show
May	27-28	Royal Belgian Aero Club/ANCUPA: Touring Aircraft Rally, Liège/Bierset.
May	27-28	Como Aero Club: European Air Touring Congress, Como.
May	28	East Anglian Flying Club: At Home, Ipswich Airport.
June	1	French Aero Club: Helicopter International Grand Prix, Le Bourget.
June	1-2	Verona Aero Club: Rally.
June	2	RAeS Rotorcraft Section: "Development of Stabilizing Equipment for Helicopters," by P. D. MacMahon.
June	2-3	RAeC: London - Cardiff Air Races, Panshanger - Rhoose.
June	3-4	Coulommiers Aviation Circle: 1st Brie Rally.
June	3-4	Daphiné Aero Club: Rally, Grenoble.
June	3-5	Luxembourg Aero Club: 2nd Moselle Wine Rally.
June	4	Milan and Varece Aero Clubs: 20th International Tour of Lombardy, Venegono.
June	6-15	Aviation Union of the Escaut: Aerial Tour of France.
June	9-11	"Pilgrimage of Wings" to Lourdes, Tarbes.
June	10-11	Dieppe Aero Club: International Rally.
June	10-12	Quiberon Aero Club: 7th Rally.
June	15	RN Air Station Lee-on-Solent At Home.
June	17	RN Air Station Yeovilton At Home.
June	17	Tenth Tactical Reconnaissance Wing, USAF, Open Day, RAF Alconbury.
June	17	RAeS Rotorcraft Section: Helicopter Rally and Garden Party, Dunsborough Park, Ripley, Surrey.
June	17	Opening of Bedfordshire Air Centre, Cranfield.
June	17-18	West Aero Club of France: Wines, Flowers and Chateaux of Anjou Rally, Angers.
June	18	Aosta Rally.
June	24	RN Air Station Arbroath at Home.
June	24	Bristol Air Day.
June	24-25	RAeC: Invitation Rally for Members and Associate Members, La Baule.
June	24-25	Vichy Aero Club Rally.
June	24-25	"Wings of Joigny" Rally.
June	24-25	Coutances and Channel Central Aero Club: International Rally, Lessay.
June	25	Leicestershire Aero Club: At Home, Leicester/East Oadby
June	25	Wolverhampton Aero Club: Competitions Day.
June–July	30-3	Palermo Aero Club: 13th Aerial Tour of Sicily.

AIR COMMERCE

BEA's SEVENTH CONSECUTIVE PROFIT

A NET profit of "at least £1¼m" was achieved by BEA in the financial year ending March 31, 1961. Final figures will not be available for some time, but the £1¼m profit is the figure after payment of interest on all capital. It is BEA's seventh consecutive annual profit. Though it is less than the 1959-60 record profit of £2m it is, to quote Lord Douglas, "a creditable result for a year when profits throughout the airline industry have declined sharply and great airlines well known for efficiency and profitable operation have themselves sunk into the red for the first time in many years."

The reduction in profit was largely the result of a fall in overall load factor by 2.5 percentage points to 65.2 per cent. BEA's load ton-miles increased by 19 per cent to 155m, and capacity increased by 24 per cent.

With the forthcoming Licensing Board hearings evidently in mind Lord Douglas comments that the disappointing results of the American domestic carriers seemed to be due primarily to wasteful competition—and hence low load factors—on many routes. He draws attention also to "another threat to our future profitability," estimating that the Ministry's new landing fees will increase BEA's expenditure by about £440,000 during the current year; the new tax on kerosine should add another £150,000, and the proposed employment tax a further £140,000.

The 1960-61 year was the first in which BEA carried more than 4m passengers. Thus BEA is now the fifth largest passenger-carrier in the world, after Eastern (8.9m), American (8.5m), United (8.0m), and TWA (5.2m). In other words, BEA is the world's biggest passenger carrier outside the USA.

OZARK AND THE BAC-111

DURING the news conference last week at which Sir George Edwards of the British Aircraft Corporation announced British United's order for ten BAC-111s, he mentioned also that Ozark Air Lines of St. Louis had given BAC a letter of intent for five aircraft. Two days later, on May 11, the airline's president, Mr Joseph H. Fitzgerald, spoke of an "order," adding that the British Aircraft Corporation had an advantage in manufacturing this type of aircraft as US manufacturers were not making aircraft in the same class. (Sir George Edwards, at the BUA news conference, had said that there was at present no competition, nor any in view, for the BAC-111.)

Ozark is one of 13 US local service airlines, being fifth in terms of revenue passenger miles (nearly 100m in 1960), and fourth in terms of passengers carried (more than 560,000 in 1960). It operates a fleet of three F-27s and 24 DC-3s on more than 5,000 miles of routes serving 45 towns and cities in ten mid-western states from Minneapolis-St Paul in the north to Nashville in the south and from Sioux City in the west to Louisville in the east. Among the other cities it serves are—in addition to St Louis—Chicago, Indianapolis and Kansas City. Ozark employs about 1,100 people, and in the second half of 1960 earned total revenues of $6.3m. Its total operating expenses were $6.08m. Net profit was about $393,000, compared with about $40,000 in the second half of 1959.

The Potez 840 feederliner made its first flight in public at Toulouse-Blagnac on May 9. Powerplant is four Turboméca Astazou of 442 s.h.p., and seating capacity is 16-24

NOW RADAR SPEED TRAPS?

GREATER ability to see and be seen in VMC, to change course with minimum prior notice and to manœuvre as required by ATC, are the reasons which have prompted the FAA to propose a speed limit on aircraft within 50 miles of their destination airports.

Aircraft operating in both instrument and visual conditions, in controlled and in uncontrolled airspace, would be included in the proposals, but there would be no restriction on aircraft operating at heights greater than 14,500ft. The speed limit is 250kt (288 m.p.h.), but it is recognized that some US military jets may be unable to operate safely at these speeds, in which case they would be required to fly as slowly as possible within their safe operating limitations. Radar controllers would presumably have to keep a check on potential air-hogs.

One of the advantages of such a limit would be that speed differentials are reduced, simplifying separation in terminal areas. According to the new FAA administrator, Mr "Jeeb" Halaby, the Agency is trying to regulate traffic with the minimum restriction on free movement, but as speed differentials increase, he says, more regulation is inevitable. Only when automatic systems are in operation may high speed operation be possible in terminal areas.

The regulation which the FAA is proposing is not entirely new, since in conditions of reduced visibility within control zones US helicopters are presently restricted to about 180 m.p.h. A similar limit has been proposed for aircraft operating in the airport traffic area which it is proposed to set up around all airports equipped with control towers. This area, five miles radius from the centre of the airport and effective up to a height of 2,000ft, is part of the FAA's plan (see "Partnership of the Skies," *Flight*, February 24, 1961) to introduce a system of graduated airspace around airports. Under this scheme a traffic area of strictly limited size would extend upwards from ground level around US airports and would be surrounded by "proximity" or "transition" areas beneath which is uncontrolled airspace for use by light aircraft.

PRIVATE AND PUBLIC IMAGES

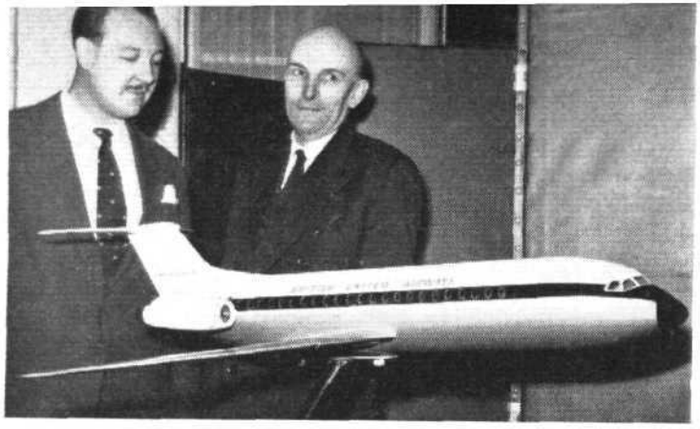
WHAT of the "public image" that British United Airways are at present so vigorously projecting of themselves? There was the series of articles in the Brighton *Evening Argus*, reviewed in *Flight* for May 4. These may have given the southern English public the impression that BUA is young, vigorous, dynamic, energetic, progressive and enterprising, while the corporations are fat old fools—though we wonder whether the articles impressed the informed public, the Licensing Board and the grey eminences around the Ministry who will decide BUA's bid for a share of the corporations' business.

Then there was British United's order for ten BAC-111s, which got a tremendously good Press and which needed no public-relations gloss. And there was the controversial British United political pamphlet of last January, *Independent Airlines—The Future*, which broke the long hush that had fallen on British air transport during the formation of the new Board. In February there was a television interview with Mr F. A. Laker, BUA's executive director, in which he said that the corporations "could do better with a bit of stimulus." Certainly BUA's cuttings albums must by now be fairly full.

Meanwhile Cunard Eagle (the extent of whose European applications involves 50 per cent more capacity than those of BUA) are maintaining an almost complete silence—except for the chairman's recent lecture to the SLAE (*Flight*, April 6), and his interview with Frank Beswick in last week's issue. The announcement of the Boeing 707 order—which was actually placed a couple of months ago—was brief and belated, perhaps understandably. Cunard are not oblivious to the feelings of the hapless taxpayer, who is being asked to contribute half as much to a new *Queen* liner as Cunard is prepared to pay, out of its own pocket, for two new jet airliners (American ones at that) for the same route.

British United's public imagery has perhaps been too negative and too defensive—anti-corporation rather than a positive promotion of British United. It cannot be that BUA hope to make the corporations look like "fat old fools"; if they do, they would be underestimating the respect that exists for the corporations. In particular, they would be misjudging the respect of the man-in-the-street for BEA, which is now the fifth biggest passenger-carrier in the world, and the biggest outside the USA—and which has just made a profit for the seventh consecutive year. (BUA do not discuss their own finances.) Instead of attempting to tarnish corporation public images, BUA might profitably direct their efforts to explaining—in a way that has not yet fully been done—the advantages to British air transport of independent and corporation airlines operating routes in parallel.

(*Concluded on page 683*)



Two British independents have been doing some serious shopping in the last two weeks: left, Mr F. A. Laker, executive director of British United Airways, is seen with Sir George Edwards, executive director of the British Aircraft Corporation, in London on May 9, when they jointly announced an initial order for ten BAC-111s by Britain's biggest independent. The BAC-111, and last week's news conference, are the subject of reports on pages 673 and 674 of this issue. Right, Mr Eric Rylands (centre), managing director of Skyways, is seen with Sir Colin Weedon of Rolls-Royce (left) and Sir Wavell Wakefield, chairman of Skyways, after signing the final contract for the airline's three Avro 748s. The occasion was recorded in last week's issue, page 647

AIR COMMERCE . . .

SKYVAN'S FRENCH COUSIN

WHEN the baby-freighter formula was being explored by Miles at Shoreham a few years ago, it was to Hurel-Dubois that they turned for a high-efficiency wing. The aeroplane that resulted, it now transpires, has had offshoots not only in the Short SC.7 Skyvan that is being constructed at Belfast, but in a new French project, the Hurel-Dubois HD-130.

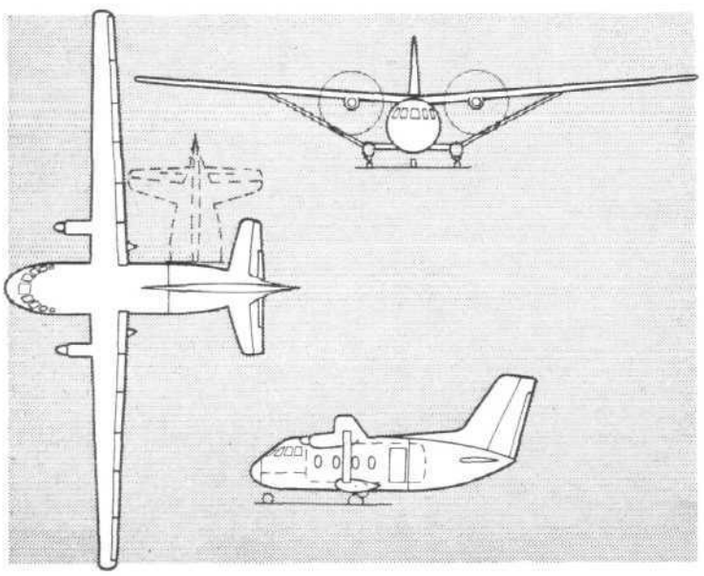
Designed around two Turboméca Astazou 2 turboprops, and retaining the Hurel-Dubois high-aspect ratio wing that was such a distinctive feature of the HDM 105, the HD-130 is a light transport competitive with the Skyvan. The wing promises exceptional short-field capabilities under adverse temperature/altitude conditions, a good view for the passengers, and greater airscrew ground clearance—an advantage when operating from stony, unprepared strips. The HD-130 conforms to US CAR 3 and 4b and SR 422b standards, and is designed to operate from airfields as high as 15,400ft. Hurel-Dubois considers that the HD-130 will fill a gap which, as time goes on, will be felt by users of transport aircraft in overseas and often underdeveloped countries—whether airlines, aerial-work operators or public or private organizations. This gap is between the smaller types such as DH Rapides and 3/4-seater light aircraft on the one hand, and aircraft like the DC-3 on the other. These aircraft are often near the end of their useful lives and not well adapted to prevailing traffic conditions. The HD-130 can carry 12-15 passengers over distances of up to 620 miles. Unlike the Skyvan, the fuselage of the HD-130 is of circular cross-section and pressurized, although the aircraft can be offered without pressurization to customers who do not need this feature. Swing-tail loading is used, the tail being opened and closed electrically. Floor sill height is 3ft 3in, and a truck or medium-sized car can be driven up a ramp into the hold. The fuselage has an external diameter of 7ft 10in, and there is a door in the port side 2ft 3½in wide, just ahead of where the tail swings open to starboard. Passengers are carried in four rows of single seats to port and double seat units to starboard; seat pitch is 37in and the central gangway is 15¾in wide. A toilet and coat space could be provided.

The wing is a light alloy box-spar structure with a root chord of 5ft 11in and a tip chord of 2ft 11½in. Dihedral is 5° and angle of incidence 2°. Double-slotted flaps are each divided into four parts and occupy 60 per cent of the span, while the slotted ailerons are supplemented by spoilers. Air brakes on the wing struts are intended to steepen the approach, the struts being attached to the stub-wing fairings into which the main wheels are partially retracted. Low-pressure tyres are fitted, and the nosewheel also retracts. Fuel is carried in flexible wing tanks, and the HD-130's performance would be improved by the installation of future developments of the Astazou rated at 610 e.h.p.

Powerplants: Two 554 e.h.p. Turboméca Astazou 2s driving 8ft 10in diameter airscrews.

Dimensions: Span 85ft 3in; length 43ft 11in; height, 19ft 8in; wing area, 376 sq ft; aspect ratio, 19.2. *Weights:* max take-off, 11,440lb; payload plus fuel, 3,920lb; max payload, 2,815lb; empty, 6,945lb. *Payload accommodation:* Cabin volume, 578 cu ft; cabin length, 15ft 7in; max width, 7ft 4½in; max height, 5ft 11in; usable floor area, 85.5 sq ft. *Fuel capacity:* 264 Imp gal. *Performance:* Cruising speed, 215-221 m.p.h.; range with max payload, no reserves, 310 miles at 215 m.p.h. and 9,840ft; range with max fuel, no reserves, 1,242 miles; take-off run to clear 50ft, 1,560ft; landing run from 50ft, 1,961ft; single-engined ceiling, 16,250ft; rate of climb on one engine, 390 ft/min.

This is a general arrangement of the new Hurel-Dubois HD-130 light transport which falls roughly in the same class as the Short SC-7 Skyvan, though it is rather larger. It is the subject of the note above



KLM AT STANSTED

OPERATIONAL restrictions on the use of jets at London Heathrow have caused KLM to transfer all their DC-8 charter flights to Stansted, Essex. The company says that the reason for this is noise restrictions over built-up areas in the vicinity of London (which limit payloads) and other operational limitations which prevent charter or unscheduled flights landing at London at peak times of the day.

About 25 charter flights will be operated from Stansted in the next four months, increasing passenger throughput by at least 2,500.

KENNARD FAMILY AIRWAYS

OVER the period of the past few weeks new airlines have been formed in England, Scotland and Ireland. Skycraft International, an Irish independent associated with Air Safaris, started operations on April 16 from Belfast and Dublin; two weeks ago came news of a new charter company for Scotland, Caledonian Airways (Prestwick) Ltd, and on May 5 was announced the formation of a new independent which is to have headquarters at Rochester. No name has yet been found for this new British operator, the directors of which will be Wg Cdr Hugh Kennard and his wife Audrey. Until last November, both were with Silver City, Wg Cdr Kennard as joint managing director and Mrs Kennard as manager of the passenger division.

Rochester airport, where the company's "twin-engined turboprop aircraft" will be based, is at present a quiet grass airfield operated by Short Bros and Harland, and not used commercially except by Channel Airways on seasonal services from Southend. Yet it is a "natural" for development by an independent airline: only 29 miles from London, it is reasonably accessible from the South London industrial areas, and communications to the north will be improved when the new M.2 motorway, by-passing the Medway towns, is linked to the Dartford - Purfleet road tunnel.

Although negotiations for use of the airport had not been concluded at the time of going to press, the intention is to use Rochester as the main operating and maintenance base and to expand to other bases later. Passenger, inclusive-tour and scheduled service licences for both internal and Continental routes are to be applied for, and it is hoped to start operating early next year. Later, Wg Cdr

AIR COMMERCE . . .

Kennard hopes to attract sufficient trade from exporters and importers in London and the south-east to operate freight services.

It may be recalled that it was Hugh and Audrey Kennard who, in 1946, formed Air Kruise at Lympne, and they may be regarded as the pioneers in this country of inclusive-tour travel. Nothing has been said about the source from which the new company will receive financial backing, but the amount is said to be substantial.

1961 SAFETY RECORD SO FAR

ALL 78 occupants of Air France Super Constellation F-BHBM lost their lives when the aircraft crashed 20 miles south of Edjele, in the Sahara Desert, on May 10. There were 69 passengers and a crew of nine on board.

The flight, Air France 406, left Brazzaville late on May 9 bound for Paris, and had called at Bangui and Fort Lamy. When it crashed it was *en route* for Marseilles, where it was reported overdue at 0500hr GMT. Search aircraft found the wreckage some hours after.

In reviewing the 1960 safety record we said: "It is a sobering thought that if traffic increases in 1961 at the same rate as in 1960 and the fatality rate remains at an optimistic 1.2 per 100m passenger-miles, then nearly 1,000 passengers are going to be killed in 1961 on scheduled services." Nearly five months into 1961, only (relatively speaking) 272 passengers have been killed.

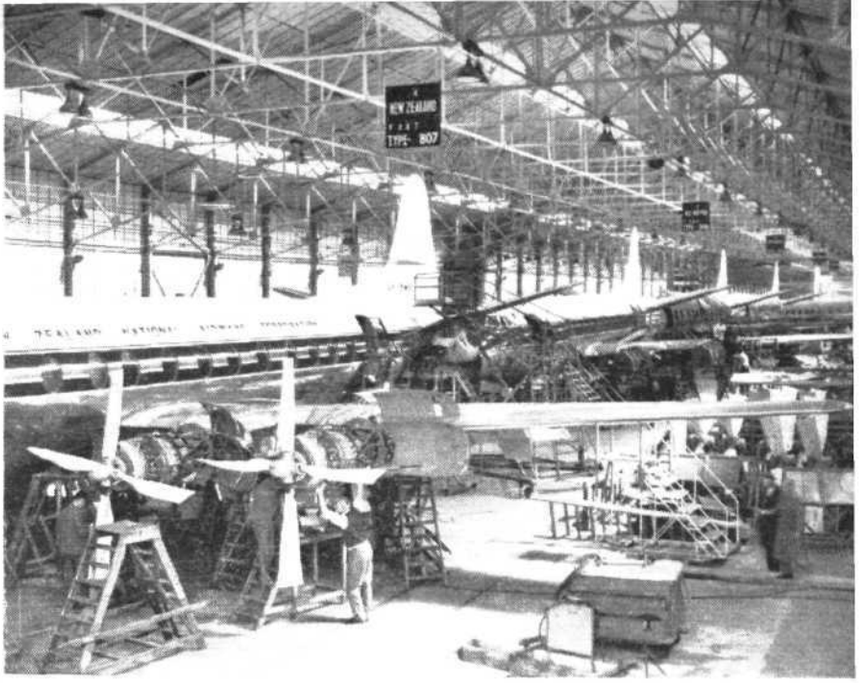
TROUBLE IN THE PHILIPPINES

FEW airlines have had to undergo such a searching cross-examination as that to which Philippine Air Lines has of late been subjected. The tragic loss of two DC-3s last winter led to a short-lived amount of adverse customer-reaction, a longer-lived attack in the Press, and a Senate inquiry that is still scrutinizing the company's affairs. PAL has until now been administered by a firm of managing agents, A. Soriano y Cia, with Mr Soriano (who is part of the Filipino establishment) as president. The present fracas has resulted in a substantial re-organization of the airline's management, including the resignation of Mr Soriano.

In these harassed circumstances it is hardly surprising that the annual report for 1960 is a sketchy affair. PAL's traffic trend in 1960 was a microcosm of world developments in general, with traffic increasing quickly (in this case by 24 per cent) under the stimulus of high-density, low-fare services, but with load factors dropping because capacity increased even more rapidly. Another typically adverse influence was a rise in unit costs, largely the result of higher depreciation charges. The net effect of these adversities was a reduction in profit from Pesos 2.5m to 1.6m.

Early next year PAL will be taking delivery of two DC-8s—bought at a cost of $5.3m each—which will allow resumption of the trans-Pacific services to the USA that were abandoned in 1954. Meanwhile, their only international operation continues to be the daily Viscount service linking Manila and Hong Kong. The company's four Viscounts (one was only recently added to the fleet) also fly over a number of the more important inter-island services within the Philippines. The bulk of these domestic services are, however, operated by a fleet of almost 30 DC-3s, supplemented by a pair of F-27s. The economy of these domestic services is now squeezed by weight restrictions imposed on the DC-3s following the two accidents. The final group of PAL services consists of the highly uneconomical rural network, which is operated by a fleet of four Twin Pioneers (a fifth is on order) and four Otters. Last year these rural services lost almost Pesos ½m.

The expenses—and losses—likely to arise in the early stages of DC-8 operation, coupled with the threat of increasing jet competition on regional routes and diminishing returns from the domestic services, do not add up to a picture which can be too pleasing to PAL's shareholders.



Vickers can still make up an impressive assembly line out of Viscount orders, as this picture testifies. It shows Viscounts in production at Vickers' Hurn factory, with an 807 for New Zealand National Airways in the foreground and 810s for Japan, Germany and Ghana behind

TEN 111s FOR BUA (from page 674)

But the main reason, he said, was that the BAC-111 is "a straight, one hundred per cent replacement for the Viscount." His airline had had "a few things to say" in their specification for their new jet; for example, it had to be the same size as the Viscount, operate to the same WAT curve, and operate non-stop between London and Malta against a 40kt wind with reserves, the design case.

At question time a number of important remarks were forthcoming from both Sir George and Mr Laker. Asked about the flying control system, Sir George said that it would be manual, but the aircraft would be capable of development from autoflare to autolanding. Had the type of autopilot been specified? "Let's say no to make it easy" was the good humoured reply. Was the order conditional on the success of British United's licence application? "I was rather afraid of this one coming up," said Mr Laker, who remarked that it would be a pity to turn a BAC press conference into an attack on the corporations. "Let me say that we want ten BAC-111s to do our existing business. The ten will be supplemented by a further five in the event of our licences being granted."

Had the remaining ten of the 20 aircraft being built yet been earmarked? The indications were, said Sir George amid laughter, that "thirty of the remaining ten would be earmarked fairly soon."

What was the price? Sir George said he expected that the fixed price would not be lower than £775,000, rising to more than £800,000, depending on special equipment and developments. He remarked that BAC were already developing the 111, "to take the corner of the payload-range curve from about 500 miles to, say, double—to over 1,000 miles." Design weight was the zero fuel weight and the wing had been designed for the gust case and not for the take-off case.

How about British United's order for four VC10s? No decision has yet been made, replied Mr Laker. Would there be Government participation in the 111? The short answer to that, replied Sir George, was yes; the Government was prepared in principle to contribute to the cost of launching the project. He did not know in what proportion, and even if he did he would not be allowed to say. Would Government support be forthcoming for the 107 also? For the moment, replied Sir George, support would just be for the BAC-111. He thought that the development costs of the Viscount ("in simple arithmetic that a plumber can understand") were about half the sum paid to the Government in royalties. It had been "not too unsuccessful a venture for the Government."

Other points that came out during question time were that the VC11 has been shelved, it having been decided that the BAC-111 is "a better bet." Collaboration with an American company on the 111 had "not been seriously discussed. . . . This is an area," said Sir George, "in which we are pretty good on our own."

One type of airline pooling for which there is universal approval is that of common spares-holdings, a device with which TWA, and 32 other operators participating in a conference at Kansas City recently, will this year save £12m. The meeting had the resounding title "World Wide Consolidated Meeting for Pooling and Technical Facilities and Services at Line Stations." Among those taking part were (l to r) D. M. Munro, BOAC; E. Komayayasi, JAL; A. E. Jordan, TWA; R. Lozet, Air France; and K. L. Kantham, Air-India

Flying by Silver City to demonstrate a Silver Cloud of luxury motoring in Rome and Milan recently were a Rolls-Royce sales team, two Rolls-Royce cars and two Bentleys. Total value of the cars with British purchase tax is nearly £35,000

AIR COMMERCE . . .

TWA AND JP.4

A STATEMENT recently issued by TWA reads as follows:—"It is possible that, due to certain inaccurate statements, the impression may have been gained that TWA is a large user of the jet fuel referred to as JP.4.

"In view of the official enquiry now taking place in Britain into the relative merits of jet fuels, it is not our intention at this time to enter into the pros and cons of JP.1 (kerosine) versus JP.4. However, we do think it timely to correct the record regarding TWA's use of specific jet fuels.

"During 1960 TWA's total system-wide use of JP.4 amounted to *two per cent* of the airline's world-wide jet fuelling. The use of JP.4 is related to availability of jet fuels at certain points which affects all airlines. The percentage remains unchanged during the current year.

"At no time has any TWA jet flight operating to or from London used JP.4. The fuelling of TWA's transatlantic jet flights through London has been and remains exclusively carried out with JP.1, i.e., the jet fuel used by the British national carriers.

"We trust this information will serve to correct any misconceptions which may have arisen due to TWA's name being aligned incorrectly with companies whose use of other fuels may be extensive."

ECCO LA PISTA DI FIUMICINO

THE main runway at Fiumicino, the new airport for Rome, is still in trouble. For ten days from April 11 it was closed from 0745hr to 1015hr each morning. This was later extended to April 26 and then again until May 6. Now it is understood that, as from May 7, it will be completely closed for at least 15 days so that the middle and northern portions may be repaired. Even when reopened a small part of the southern end will remain unserviceable.

Fiumicino has got away to a sorry start. Abnormal weather conditions have already caused nearly 70 diversions to Ciampino since January 16. Airline buses have been held up by traffic and rambling side streets so much that flights have been delayed. Promised extra trains have not materialized and the extra cost to airport workers has already caused one strike.

Jet efflux, it was found, blew straight into the terminal building; so, whilst the provision of blast fences is awaited, jets are parked 2,000ft away and passengers have to walk. There are fewer Customs officials than at Ciampino, so crews go through with passengers. There are also fewer aircraft parking positions. The terminal building was not designed for air conditioning and the need for it has already become apparent.

However, the picture is not altogether black. The buildings are more spacious than are those at Ciampino, passengers are not so crowded and meals cost less. It is easier to reach aircraft, thanks to better exit numbering and an improved public address system. Interline changing is also simpler and much quicker.

CHECK PILOT CHECK

ESTABLISHED in the Civil Aviation Licensing Act, 1960, is a requirement that, with certain exceptions, no civil aircraft may be used for trade or business unless an Air Operator's Certificate has first been obtained. Before the Director of Aviation Safety can grant this certificate, the applicant must submit to inspection and supervision by Ministry of Aviation inspectors to ensure that his aircraft can be operated safely. Operations must also be subjected to the scrutiny of Ministry flight inspectors.

The latter are permitted to board and fly an aircraft and to enter and remain on the flight deck; but because it conflicts with the traditional freedom of the commander of an aircraft to carry out his duties without interference, this provision of the Act is regarded by pilots as being highly contentious.

The Act does not specify the duties and powers of inspectors; these are set out in the Ministry document *Notes for the Guidance and Information of Applicants for an Air Operator's Certificate* (see *Flight*, January 20). The Director of Aviation Safety is required only to satisfy himself that the applicant's organization, facilities and operating standards are satisfactory. While the Ministry appears to be genuinely concerned only with matters of safety, and the adequacy of the facilities provided to enable the crew to comply with regulations and procedures, airline pilots fear that they may be liable to criticism arising out of ill-judged observations and misunderstandings of their actions. Although the regulations state quite clearly that it is not the manner in which the aircraft is handled or the professional skill of individual members of the operating crew which are under inspection, there is a real reluctance on the part of qualified and experienced pilots to have their operating practices examined by flight inspectors.

It will be recalled that when the FAA adopted flight inspectors in the United States there was considerable opposition from the Air Line Pilots' Association, and it is understood that BALPA are now also objecting strongly to the same principle. The subject is a comparatively new one, the nearest approach to it so far being the inspectors carried on trooping flights—although they do not concern themselves with the manner in which an aircraft is manœuvred.

Pilots argue that in no other form of transport is a commander so liable to criticism arising out of ill-informed observation. It is difficult enough for a co-pilot in the right-hand seat to determine the reason for every decision made by his superior. No one has yet been able to pontificate on the exact manner in which an aircraft must be manœuvred in order to comply with the many regulations and mandatory procedures which govern the movement of aircraft in the air. There are so many factors to be considered during every minute of flight that only the man actually responsible is fully able to understand what is going on. Some captains believe that even the most experienced inspectors would not be in a position properly to judge the action of the commander of an aircraft, even with the same qualifications and experience.

The other type of examiner to which the Air Operator's Certificate refers is the training inspector responsible for training and the periodical checking of aircrew. This inspector must be allowed to witness tests, and for this purpose may enter and remain on the flight deck provided the commander is satisfied that the safety of his aircraft is not being jeopardized by the presence of the training inspector.

As this system is only an extension of the checking which has been operated for many years there are unlikely to be strong objections from the pilots, but there could be a conflict between the opinions of the training inspectors and the delegated examiner on the manner in which a flight check was carried out. Unless training inspectors have qualifications and experience at least equal to those of examiners the latter would be reluctant to accept their decisions in the event of a question arising as to whether an examinee had completed a check satisfactorily.

Exporter extraordinary is Dr E. S. Calvert, senior principal scientific officer at RAE Farnborough, whose ideas on approach lighting and visual glide-path indicators have recently brought him from America the 1961 Laura Tabor Barbour Air Safety Award and the Monsanto Aviation Safety Award (see page 610, last week). He is pictured here on his return from New York

Early 1962 is the schedule for delivery to Cunard Eagle of two Boeing 707-420s, the £6m order for which was confirmed on May 10. An option on a third aircraft has been placed. Cunard Eagle say that the Boeing was chosen "in view of its route availability and its excellent operational characteristics," and that they are also "considering the purchase of Vickers VC10 aircraft for delivery late in 1964." (It is believed that an announcement of British United's proposed order for four VC10s will be made in the very near future)

Private and Public Images

(Continued from page 679)

Last week Lord Douglas of BEA did some image-projecting in the following terms:—

"I mentioned two months ago that we would oppose the applications made by British United Airways and Cunard Eagle Airways for networks of services in parallel with BEA out of Gatwick and Heathrow respectively. Since then other applications for routes in parallel with BEA have been made to the Licensing Board by two more airlines, Tradair and Overseas Aviation. We have now heard that the Licensing Board will hear the applications from all four companies together starting on June 20.

"BEA certainly does not propose to make its case in public in advance of the hearing before the Licensing Board, and the Board must make its decision in the light of the evidence produced at the hearing. Misleading comments have, however, recently been made against BEA by certain newspapers and I feel that these inaccuracies should be corrected and answered now.

"A recent newspaper headline announced that BEA had 'declared war' on private airline companies; it was even said we were 'attacking' the private airlines. This certainly is a topsy turvy way of looking at the position. The question is who is attacking whom? Far from BEA making war, the companies who want some of BEA's traffic are making what is in effect a kind of take-over bid; but this is a take-over bid with a difference, because in this case those who are making the offer would not have to pay anything if they succeeded in the transaction!

"What the applicants to the Licensing Board in effect want is to achieve a take-over of part of a nationally-owned undertaking by private interests without payment of compensation. In such circumstances it is only natural and right that BEA should uphold its position, and that is what we are doing. We are not making war on anyone.

"We are only seeking to safeguard a most successful and profitable national undertaking which has been built up through the efforts of its staff over the last 15 years, and to ensure the development which is essential to our continued success. We are in fact reacting in the way that any commercial enterprise (as BEA is) would react to an attempt by a competitor to filch its business.

"That is why I recently told the Chairman of British United Airways that I thought no useful purpose would be served by a further meeting between us which he had suggested, because the only object of such a meeting could have been to reach some arrangement in advance of the Licensing Board's hearings. In my opinion the future of British air transport is meant to be decided by the Licensing Board set up by Parliament, after full hearing of the issues involved. That is why I think it only proper that the Licensing Board should exercise the functions which have been prescribed for it.

"BEA thrives on competition and has faced it successfully against foreign airlines and surface transport for 15 years. Now we are going to ask the Licensing Board to confirm BEA in the proud position it holds as Britain's national flag carrier in Europe. To imply that BEA is in some way acting improperly in doing this—as has been implied—reminds me of the proverbial notice in a French zoo '*Cet animal est très méchant. Quand on l'attaque, il se défend.*'"

In reply to Lord Douglas, Mr F. A. Laker of BUA said:—

"Lord Douglas's outburst is not strictly accurate. Firstly our shareholders are largely shipowners from whom the airlines, including his, have been taking traffic for years. Secondly, our investment in aviation is already substantial and was increased only yesterday to the tune of £8 million which we are spending on British jets, so we cannot be said to be paying nothing for our stake in the business. Thirdly, BEA's war on the independents in fact started some years ago—behind the scenes—when they successfully persuaded the IATA airlines to offer cheap fares to package-tour operators on their scheduled services. BEA were seeking the all-in-holiday traffic that the independent airlines had pioneered and built up, and it is because we feel we have the right to protect this traffic that 13 of the routes British United have applied for are seasonal holiday services.

"I cannot understand the significance of Lord Douglas's remarks about take-over bids. We are not making a take-over bid. We are merely staking a claim to an interest in a growing industry which can only benefit the passenger at a time when air traffic is rapidly expanding."

BRITISH UNITED v. CUNARD EAGLE

EVER since the beginning of the year, when British United Airways and Cunard Eagle Airways applied for overlapping networks of European and UK-domestic services, it has seemed that the two independents have been wastefully duplicating their aspirations. Their adversaries—after foreign airlines—are the corporations, not each other.

On January 20 last we noted (page 99), that there had been "no behind-the-scenes gentlemen's agreement [between the two independents] as to which places will be applied for"; and in reviewing this internecine independent conflict in our issue of March 16 ("British United *v.* Cunard Eagle," page 354) we wrote that both independents obviously appreciate that the issue is not British United *v.* Cunard Eagle, but British United *or* Cunard Eagle *v.* the corporations. We predicted "endless and possibly fruitless argument" between the two independents before the Licensing Board.

It is not yet too late for a "behind-the-scenes gentlemen's agreement"—the gentlemen concerned being Mr Miles Wyatt of British United and Mr Harold Bamberg of Cunard Eagle. Whereas a deal between the corporations and the independents would be defeating the purpose of the Board, a deal between the two leading independents would not. How about Cunard Eagle swapping its European applications for British United's UK domestic applications? The future pattern of independent influence would then be as follows:—Cunard Eagle: western routes and UK domestic; British United: Europe, southern and eastern routes.

BREVITIES

Mr J. B. Bentley, a former Fleet Air Arm pilot, has been appointed editor of the BALPA journal *The Log*. He was previously with Iliffe Transport Publications Ltd.

The shareholders of Riddle Airlines have approved the merger of Riddle with Aerovias Sud Americana. The CAB were to give a decision on the proposal on May 15.

An airport for Madeira is to be constructed by a Portuguese firm and should open in about two years' time. Services to Madeira at present use the Island of Porto Santo, the 40-mile connection being completed by ship.

Mr Harold L. Graham, Jr, president and director of Cunard Eagle Airways (Bermuda) Ltd and vice-president and director of Cunard Eagle Airways (Bahamas) Ltd, has resigned "for personal reasons." The resignation became effective on May 15.

More details are now available about the Scandinavian Governments' plan for refinancing SAS. The transport Ministers of Sweden, Norway and Denmark have agreed to raise the capital by Kr210m, each country contributing in the traditional 3:2:2 ratio. Contributions will be shared between Governments and private sources. For example, the Swedish Government will contribute Kr33.75m, and private sources an equal amount. Similar arrangements will be made by the Danes and the Norwegians. The Swedish Government is also providing an interest-free loan of Kr22.5m.

Within a few years the Oceanic Air Traffic Control Centre at Prestwick may be transferred to Preston, Lancashire. The Scottish Air Traffic Control Centre, both civil and RAF, will remain in Ayrshire.

PIA is the sixteenth foreign airline to be granted an Air Registration Board Certificate for the repair and overhaul of airframes, components, radio and radar and engine overhaul. A similar recognition by the FAA was granted in September 1960.

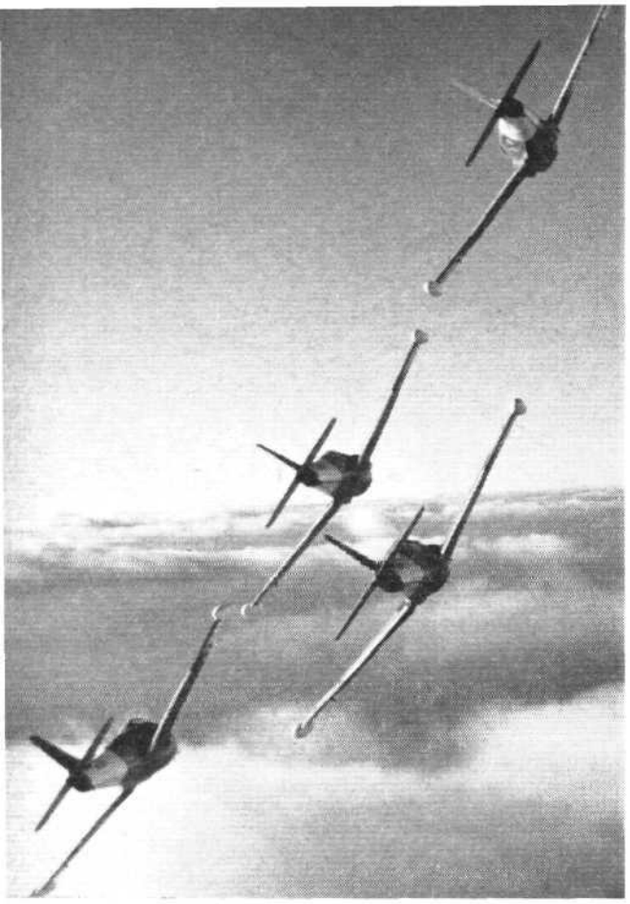
NAMCO, the Nihon Manufacturing Co of Japan, hopes to have the first prototype YS-11 turboprop flying by the end of this year. First production deliveries, however, are not expected until 1964. All-Nippon Airways are considering the purchase of 25, five for delivery in 1964, nine in 1965 and 11 in 1966.

El Al took delivery of its first Boeing 707-420 in a formal ceremony at Boeing Field, Seattle, on May 7. Attending for the airline were Brig Gen Ephraim Ben Arzi, El Al president; Dror Galezer, deputy managing director; and Chaim Pearlman, El Al resident representative at Boeing. El Al has ordered two 707-420s and two Boeing 720Bs.

As expected, BOAC have briefed counsel for the forthcoming important Licensing Board hearings. The corporation's advocate will be Mr Henry Fisher, QC, barrister son of the Archbishop of Canterbury. As recorded in our issue for April 27, page 580, British United Airways have retained Mr Gerald Gardiner, QC. BEA have retained Mr Neville Faulks, QC.

SERVICE AVIATION

Air Force, Naval and Army Flying News



This year's CFS Jet Provost aerobatic team in action: they make their first public appearance in Britain at next Monday's RAFA display at North Weald. Members are Flt Lts Frank Brambley (ldr) and David McCann, Plt Off Bruce McDonald and Flt Lt Tom Whittingham. Reserves are Flt Lts Ian McKee and Walter Elsegood

V-force Dispersal

AS *Flight's* Gemini arrived over Scampton on Wednesday of last week, for its pilot to see something of the Bomber Command dispersal exercise called Mayflight, four Vulcans took off in rapid succession and headed northward for a Scottish airfield. This pattern was being followed at V-force stations all over the country, so that by 1700hr that day none of them—except for Scampton, the object of a Press visit—had more than four aircraft left.

Bomber Command's plan, stemming from the 1958 Defence White Paper requirement that the retaliatory force should be capable of defending itself, is for the V-bombers to be so dispersed that with the Thor bases—four complexes of five sites—an enemy would have to destroy about 50 targets to prevent retaliation.

In this plan each V-force base (assuming three squadrons) has five dispersal sites, four aircraft being positioned on each of the six airfields. Readiness time has been gradually reduced to three minutes—by linking the crews in their cockpits directly with Bomber Command HQ, by simultaneous engine starting, and by "operational readiness platforms" at which the aircraft are in close proximity to the runway. At these dispersal airfields, facilities for crews and maintenance personnel are completely self-contained and do not impinge on other activities; they are Bomber Command territory on what may be Royal Navy or MoA stations.

Exercise Mayflight, testing the dispersal of the V-force, preceded Exercise Matador (see page 654) in which the Vulcans and Victors flew to exercise the UK defences and early-warning radars. At a presentation at Scampton of Bomber Command's retaliatory role, all potential targets were shown as being within 1,500 n.m. of the UK; the V-force range was given as 2,500 n.m. and that of the Thors as "up to 1,500 n.m." The warning, coming to Bomber Command from Whitehall, might be strategic or tactical. Even when scrambled, the bombers "come back automatically unless given a positive warning to go on."

Whitehall and IDC

TAKING over as Director-General of Manning from July 18, AVM J. G. W. Weston, CB, OBE, succeeds AVM D. M. T. Macdonald, CB, who is retiring from the RAF. The new director-general has been a member of the Imperial Defence College directing staff since March 1959 and is succeeded there by Air Cdre P. T. Philpott, Director of Joint Plans at Air Ministry since September 1959.

Under the Umbrella

MEMBERS of the Pathfinder Association at their annual dinner in London on May 8 took a typically searching and not wholly reverential look at the Royal Air Force. They heard from the Deputy Chief of the Air Staff, Air Marshal R. B. Lees, that nowadays "it's under the umbrella of Bomber Command that the rest of the Air Force goes to work"; and from the command's C-in-C, Air Marshal Sir Kenneth Cross, that his force possessed more aeroplanes than the two national air corporations put together and had a hitting power equivalent to that of 29 million Lancasters.

Whether they were properly impressed by these facts—or by Air Marshal Lees' apostrophe of the anti-submarine accuracy of Coastal Command and the mobility of Fighter and Bomber Commands, and by Sir Kenneth's praise for the 96 per cent accuracy of crews in the recent bombing competition—they relished the barbed aphorisms of TV sports commentator Kenneth Wolstenholme in his unerring vivisection of the guests. But it was perhaps Peter Swan who touched the pulse of peace and war most significantly, in his mention of "people like myself, to whom the danger of life lies in cutting the lawn on a Sunday morning," and his remark that though the PFF had finished at the end of the war its spirit had continued.

New Heart in the Squadrons

HARDLY a dismal word about the possibility of disbandment of university air squadrons was spoken at the recent annual dinner of Oxford UAS. The problem is that while the University still values the UAS as a club and for the ties with the RAF which it represents, and while the RAF still values the air-mindedness in prospective top people, the Treasury looks askance at the £1¼m it costs to run all the squadrons each year, even though this sum represents only 1/500th of the RAF budget. Financial planners are less and less impressed by the intangible benefits of instilling air-mindedness into a generation which, they feel, is almost automatically air-minded.

The conflicting opinions seem to be approaching reconciliation, for two critical reasons. The RAF is desperately short of pilots of high calibre and can see a requirement for manned aircraft and the men to man them for at least ten years ahead; and the tangible returns in the form of aircrew recruits from the squadrons are reaching significant proportions. The forthcoming UAS review, set for June, is therefore not causing serious disquiet.

The new CO of Oxford UAS, Wg Cdr R. P. Harding, noted the allocation of new quarters at the flying base at Bicester, the affiliation of OUAS to RAF Abingdon during the past year and the inclusion of the squadron in the visit to Oxford by the Queen last summer. Miss Round, secretary of the squadron since 1938, was made an MBE—richly deserved—in the New Year honours list. In lighter vein, the CO observed that Maj Gagarin had set a new fashion in circuits and bumps.

Air Chief Marshal Sir Edmund Hudleston, VCAS, stressed the need for new aircrew in the RAF and noted the improved UAS recruiting record. There was room, he observed, for intellectuals in the RAF and it was they who would face a challenge greater than that of the early pioneers and who would be responsible for space achievements in the future.

Mr A. L. P. Norrington, the Vice-Chancellor, suggested that the link between the RAF and the universities was not only important, but should be strengthened and extended to any new universities which might be formed. He also suggested that the squadron should broaden its experience by operating a helicopter which could then be used to speed the Vice-Chancellor on his many time-consuming visits to various parts of the country

The Hack Trophy for the best all-round member of the squadron was presented to Flg Off A. C. Collins and the Siddeley Trophy, for the best pilot, to Plt Off J. M. Macnair.

Wg Cdr R. P. O'Donnell

WE record with regret the death—on May 10—of Wg Cdr Rudolph Peter O'Donnell, MVO, OBE, formerly Organizing Director of Music, RAF. Concerned throughout his career with military music, first in the Army and then in the Royal Marines, he transferred to the RAF in 1931 and in 1939 was appointed Organizing Director of Music. Subsequently he was responsible for forming three notable groups, the RAF symphony, string and dance orchestras. Wg Cdr O'Donnell retired from the Service in 1949.

IN BRIEF

Flt Lt D. A. Proctor, No 7 FTS, Valley, won the Wright Jubilee Trophy in the annual aerobatic competition for RAF instructors. Flt Lt P. A. Clee, No 1 FTS, Linton-on-Ouse, came second and Sqn Ldr P. D. G. Terry, RAF College, Cranwell, was third.

No 92 Sqn are making their first public appearance in the UK as the RAF Fighter Command aerobatic team when they perform at the RAFA Eastern Area Whit Monday air display at Hucknall (see below).

The RAFA are running two air displays next Monday, May 22, and a third is being organized by SSAFA. As in previous years, the RAFA displays are at Hucknall, Notts, and North Weald, Essex; the SSAFA display is at Yeadon, the Leeds/Bradford airport.