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In this issue

Teams and Ideas

WE have been contemplating the Christmas card sent by Hawker Aircraft, Ltd. It shows, in one of those impeccable paintings by Roy Cross, an echelon of a Hunter, a Tempest, a Hurricane and a Fury; and it has caused us to reflect that if the card had matched in size some others that have come our way, Mr. Cross might have extended the echelon into the middle distance by including the Hornbill and Woodcock and several others. If he had chosen to put in some additional fine perspective work, he could have shown the parent Sopwiths stretching to infinity.

It is a thought for the times that these world-renowned fighters have stemmed largely from the imagination and labours of a team led by Sir Sydney Camm, under whose guidance and tuition some of the most gifted of our technicians have attained seniority and have gone their several ways to form teams of their own—to the greater fame of the British aircraft industry.

In these days, when the concept of a "team" is often debased to include expedient or haphazard collections of individuals pursuing some ephemeral objective, we in the aircraft industry can be thankful that the idea has remained as unalloyed currency among us. The team stands as the symbol of a matchless tradition. It is the chrysalis of ideas; and ideas are the lifeblood of leadership. Thus, whatever may come to pass in the redeployment of industrial capacity and resources, the team must endure.

In this belief we have the support of Admiral Sir Matthew Slattery, chairman of Shorts and of Bristol Aircraft, who declares: "My appointment to the chairmanship of Bristol Aircraft, Ltd., has been taken by some as an indication that the fortunes of this company [Short Bros.] are to be subordinated to those of the Bristol Company. It has been suggested that it is our intention to down-grade our technical team to a subordinate position and that the factory is to become a jobbing shop for other companies' aircraft. This is a complete misunderstanding . . ."

Sir Matthew's declaration is reassuring; for although Short and Bristol are themselves now working as a production team, big teams are not necessarily productive of big ideas.

Global Britannias

SO much has depended, and will depend, upon the Britannia that every long-haul operator has watched it keenly since it first flew in August 1952. The basic economics of the design have never been in doubt. What has prevented the Bristol turboprop from flooding the entire long-range market has been the inclination of operators to buy improved piston-engined types (which were relatively known quantities) and, more recently, to jump on the big-jet bandwaggon for fear of being left behind. The Britannia has thus tended to be squeezed between two different generations of airliner, just as the Navaho missile was sandwiched between two generations of strategic bombardment systems. But whereas Navaho had only one customer (who eventually said "No") the Britannia has already found nine.

B.O.A.C. has had 15 Britannia 102s in service for nearly a year; and in spite of protracted and widely publicized mechanical difficulties they are becoming singularly reliable vehicles. Considering their size and complexity, and the arduous routes which they serve, this is an achievement which emphasizes that the British industry can offer truly competitive aircraft. Today B.O.A.C. and two other operators—all of whom serve New York—are flying the larger and more powerful 300 and 310. The ability of the latter (long-range) series has recently been demonstrated by the longest airline run on record, described on pages 13-18 by a member of *Flight* staff who was on board.

In the past, most airlines have bought new equipment only after other operators have proved that it worked. Though the widespread buying of the big jets runs contrary to this trend, it may well be that the Britannia is one of those aircraft which will achieve its logical measure of success over the years.

FROM ALL QUARTERS

The B.E.A. Jet Deadlock

COMPETITION within the industry to secure the order for the new B.E.A. jet airliner reached a critical point just after Christmas. It was reported on December 27 that Bristol and the Hawker Siddeley group were planning to merge and to form, as a first step, a joint company to finance and develop the project. The report of the planned merger was not denied (it was described as "conjecture") but both companies confirmed that a joint proposal on the B.E.A. jet had been made to the Ministry of Supply.

The extent to which this new move affects an already delicate situation (*Flight*, December 20) is not easy to assess, but it is likely to frustrate yet again B.E.A.'s wish to see work started soon on a 600 m.p.h., 100-passenger jet airliner for delivery in 1963.

The Bristol/Hawker Siddeley proposals appeared as a dramatic move to focus Government attention upon a firm "amalgamation" proposal. The Government have been using the B.E.A. jet order as an instrument in their policy of encouraging industrial re-grouping. The Minister of Supply has, in effect, said: "Amalgamation first, B.E.A. contract second."

The fact remains that B.E.A. have selected the de Havilland project—the D.H.121 (Lord Douglas made this choice last August). And the managing director of the de Havilland Aircraft Co., Ltd., Mr. A. F. Burke, has observed: "When B.O.A.C. wanted to buy American jets the opinion was strongly expressed that they should be permitted to have the aircraft of their choice. Should it not be the same today if B.E.A. wish to have the de Havilland jet airliner?"

It may well be asked whether the Government can now say to B.E.A. that, because the Bristol-Hawker proposals provide for the amalgamation of those two companies, it is therefore in the national interest for the Corporation to change its mind. This might be reasonable if the de Havilland proposals exclude the possibility of industrial amalgamation. So far as can be ascertained, this is not the case. It is understood that the de Havilland scheme—although not involving overnight mergers (which D.H. vehemently feel would cause chaos, friction and the exodus of technicians)—does in fact point the way to re-grouping in the natural course of events. Rolls-Royce (three of whose RB.141s are to power the D.H.121) and Bristol would be the main partners in the D.H. scheme; and believed also to be involved are Handley Page, Fairey, Hunting, Saunders-Roe, and certain component, instrument and equipment firms. All these organizations, with D.H. as design-leaders, and probably under the *aegis* of a joint company, would finance, design, develop and produce the D.H. 121 for B.E.A. and for export.

It now remains to be seen whether the Government will continue to insist on the prerequisite of amalgamations or whether they will accede to the view that technical considerations must come first, with mergers as a natural sequel.

SR.177 Cancellation

FOLLOWING the rejection of the type by Federal Germany, the cancellation of the Saunders-Roe SR.177 project was announced by the company and the Ministry of Supply on December 27. This decision is expected to result in serious unemployment in the Isle of Wight, where between 1,000 and 2,000 workers are likely to be declared redundant. The company statement was as follows:—

"Saunders-Roe have been advised that the Federal German Government do not intend to take any share in the development of the SR.177 mixed-powerplant interceptor.

"It is further understood from the Ministry of Supply that this project is to be cancelled as the SR.177 does not fit in with the terms of the 1957 Defence White Paper and will, therefore, not be required by the Royal Air Force: the Naval requirement does not demand a sufficient quantity to justify the cost of development for this Service alone.

"Very serious redundancy within Saunders-Roe must be expected, which will be confined mainly to the Isle of Wight factories."

The Ministry of Supply, in its announcement, said that the aircraft "commands general recognition as an excellent and unique design in its class," but that it no longer fitted into the broad pattern of the U.K. defence programme. This programme visualized the English Electric P.1 as the last manned fighter for the R.A.F. There had been a Royal Navy requirement for the SR.177, but this involved a relatively small number.

It had been decided, the M.o.S. statement continued, that this Naval requirement "might prove financially feasible" if a German order for the SR.177 were forthcoming. The German Government was informed that Britain was unable to finance this aircraft solely for the U.K. defence programme, and that the project would be ended by December 31, 1957, if the German Defence Ministry had not indicated a firm requirement by that date.

According to a Bonn report, news of the German rejection of the SR.177 was given in a letter to Mr. Aubrey Jones on December 24. The four aircraft reported to be still under consideration by Germany are the English Electric P.1, Lockheed F-104 Starfighter, Grumman Super-Tiger and Northrop N-156.

At the Saunders-Roe factory at East Cowes it was stated that a minimum of 1,000 workers would have to be dismissed because of redundancy. These dismissals were expected to be completed by the end of January.

As described in *Flight* of October 18, 1957, the SR.177 was to have been a development of the SR.53. The second prototype SR.53 was flown for the first time by S/L. J. S. Booth, the company's chief test pilot, at Boscombe Down on December 18. Like the first, it is powered by a D.H. Spectre rocket engine and an Armstrong Siddeley Viper turbojet; but it has "a considerably greater capacity of rocket propellant."

The New Year Honours

A KNIGHTHOOD for Mr. Gerard d'Erlanger, chairman of B.O.A.C., was among those announced in the New Year Honours last Wednesday. Mr. Hayne Constant, Director of the National Gas Turbine Establishment, is appointed C.B., as is Mr. J. E. Serby, Director-General of Guided Weapons. C.B.E.s include Mr. W. A. Summers, managing director of Hunting Aircraft, Ltd., and Mr. Keith Granville, B.O.A.C.'s commercial director. A number of honours in the Military Divisions are given on p. 25, and full lists of both civil and Service awards will appear next week.

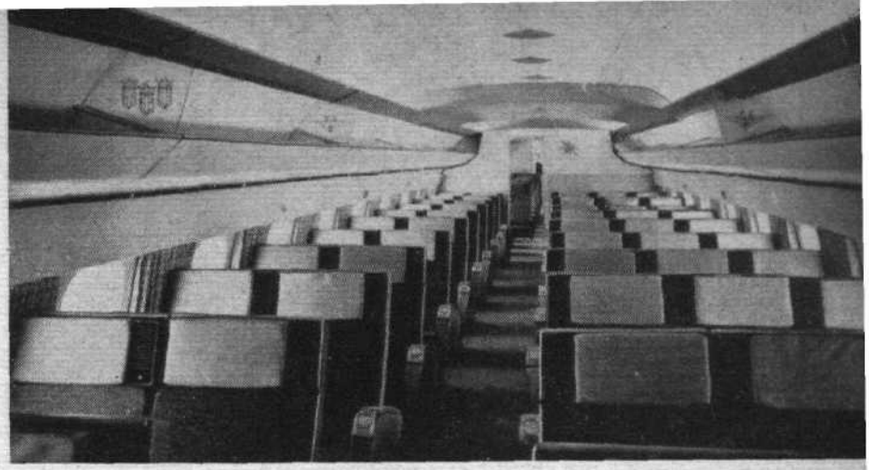
Air Chief Marshal Boothman

AS we go to press we learn with deep regret that Air Chief Marshal Sir John Nelson Boothman, K.C.B., K.B.E., D.F.C., A.F.C., died on December 29 at the age of 56. Among his many achievements was the winning of the Schneider Trophy outright for Britain in 1931 in the Supermarine S.6B at an average speed of 342 m.p.h.; and in 1944, as A.O.C. the photographic reconnaissance group of Coastal Command, he won an immediate D.F.C. for his P.R. flights over the invasion beaches on D-day. From May 1956 he was technical sales director of Kelvin and Hughes, Ltd. A fuller appreciation will be published next week.

U.S. Bombardment Missiles

DURING testimony before the U.S. Senate last month the U.S.A.F. Secretary, Mr. James Douglas, stated that the first squadron of IRBMs was "slated to go into operation in the United Kingdom in December 1958." Since preliminary discussions on

EGYPTIAN JUBILEE: Displayed at Almaza airfield on December 19, in celebration of the silver jubilee of the Egyptian Air Force, are (left) two Mi-1 helicopters; (upper left) a Mig-17 fighter with reheat; then, reading clockwise, a Mig-15bis; an Il-28 light bomber; a Yak-11 advanced trainer; and two Czech Zlin 226s. The tail framing the picture at bottom right is apparently that of an Il-14.



***FIRST PICTURE** of the Douglas DC-8 interior mock-up shows a spacious cabin. Passengers' service facilities have been positioned to give a clean roof line; reading lights are incorporated in the seats.*

the establishment of IRBM bases in the NATO countries have only just been held, it is difficult to see how this schedule can be adhered to. The SM-75 Thor can be fired only from a fixed installation, of considerable size and complexity, which could scarcely be made operational within a year of breaking ground. At the time of going to press no confirmation was forthcoming of the American newspaper story that Britain will meet the cost of establishing the bases (estimated at between $80m and $90m). The same report stated that the provision of the weapons would be the responsibility of the U.S.A.F., the cost of one squadron being reckoned at between $120m and $160m.

At the moment both Thor and the rival Jupiter (product of the U.S. Army's Redstone arsenal) are being continued and are scheduled to be built in quantity. It was stated last month that failure to eliminate one of these weapons may add $200m to the overall programme cost. The ICBM programme likewise comprises two weapons, the SM-65 Atlas and the SM-68 Titan. At its third test-firing last month Atlas achieved a successful programmed flight (as reported in our issue of December 27), and a fourth Atlas is now ready for firing. Convair were last month given verbal instructions to accelerate the whole programme. Gen. Thomas D. White, U.S.A.F. Chief of Staff, told the Senate he wanted the SM-68 programme to be accelerated. In view of the increasing importance of the ballistic weapons, and severe budgetary limitations, it was decided to halve the current year's appropriation for the SM-62 Snark winged bombardment weapon. Gen. White agreed that Snark "could shave manpower losses" and could "be programmed for low-level attack," and Senator Symington was severely critical of the cutback, particularly since Snark is the only near-operational missile with intercontinental range.

Capt. Lewin Joins Blackburn

NOW on the Board of the Blackburn and General Aircraft, Ltd., is Captain E. D. G. Lewin, C.B.E., D.S.O., D.S.C. and Bar, R.N. Capt. Lewin, who leaves his post as Director of Plans at the Admiralty to take up his new position, won the D.S.C. when serving in H.M.S. *Ajax* at the Battle of the River Plate and the D.S.O. when in H.M.S. *Ark Royal* in 1941.

Captain E. D. G. Lewin.

Entering the Royal Naval College in 1926 as a cadet, Capt. Lewin became a Naval pilot in 1935. He did test flying, which included the first successful flight of the Blackburn Roc on floats, and in 1942 became chief instructor at the R.N. Flying School at Yeovilton. After specializing in fighter direction he held the post of staff direction officer to the group of aircraft carriers which supported the Sicily and Salerno landings in 1943, and was later transferred to the staff of Admiral Vian, who commanded the carriers in the British Pacific fleet. For his part in the Pacific operations he gained a Bar to his D.S.C. In 1953 he joined the Admiralty as Director, Air Warfare Division, and was subsequently appointed to the command of H.M.S. *Eagle*. He returned to the Admiralty, as Director of Plans, in 1956.

Russian Aircraft and Engines

LAST week it was reported in Moscow that a Soviet heavy jet bomber had "without landing or refuelling in flight covered a greater distance than any aircraft of this type in the world today." The test pilot Ponomarev said that this was "not an isolated flight"; another heavy bomber had covered a still greater distance. "Even people accustomed to new strides in our aviation," the report continued, "were struck by the perfect shape and giant dimensions of this aircraft." No information was given on the type of aircraft used, although unofficial reports have spoken of a development of the Bison heavy bomber with a pair of engines superimposed at each wing root.

On December 14 an announcement was made of a new type of fighter with a speed reported as 2,000 km/hr (1,242 m.p.h.). The aircraft, which was described as having sharply swept-back wings, was flown by Lt-Col. Nikolai I. Korovushkin; a photograph of this officer shows him wearing what appears to be an American helmet and visor.

On December 27 the newspaper *Red Star* reported that Squadron Leader Mikhailik of the Soviet Air Force had taken off conventionally in a new fighter and had then climbed "almost vertically" to a height of 19,000 metres (62,336ft). The report stated that the aircraft "flew through the sound barrier with great ease and was fully manœuvrable in the rarefied air." Even at 19,000 metres, Mikhailik "found that his aircraft had not reached its limit" and he continued the climb.

The following day a Soviet journal described a fully mobile catapult system capable of launching jet fighters. The device can be operated from all types of terrain and it accelerates the aircraft from a zero-length mounting (apparently with the aid of a solid charge). A test pilot, Col. Vassilli Ivanov, described his sensations during one such take-off, and several other test pilots said that the system was "within the capabilities of any average pilot." (The U.S.A.F. conducted zero-length firings with F-84Gs several years ago.)

On December 26 Moscow Radio stated that a turbojet currently under test was intended for VTO applications. Test pilot Turi Garnayev stated that the unit was a joint design of Rafalyantsev, Kvashnin, Lapshin and Matveyev. He said: "Devices already fitted to bombers and fighters to shorten take-off and landing runs are only an imperfect answer," adding "the turbo aircraft I tested has no wings or tail assembly and in no way resembles the orthodox aircraft." This device is similar in principle to the Rolls-Royce TMR "Bedstead," and is named the Turbolyet.

On the same day the designer, S. Balandin, wrote that high hopes were entertained for a family of high-speed piston engines, with double-ended cylinders and twin pistons, driving through a "linkless" gear (presumably of the swash-plate type). The engines were described as being more efficient and much lighter in weight than conventional piston engines, with "several times more power per litre and a time-lapse of 1½ to 2 sec between half power and full power." The largest in the series was stated to be rated at 10,000 h.p.

WS-110A for N.A.A.

FOR more than a year the keenest prototype-contract competition in America has been that between North American Aviation and the Boeing Airplane Company for the supersonic-cruise CPB (chemically powered bomber) for the U.S. Air Force. On December 23 North American were given the order. The CPB was described in October as "the Air Force's No. 1 priority manned-aircraft weapon system," and it is known as Weapon System 110A.

A. J. Rowledge

IT is our sad duty to record the death of Mr. A. J. Rowledge, M.B.E., F.R.S., M.I.A.E., on December 11. He was aged 81 years of age.

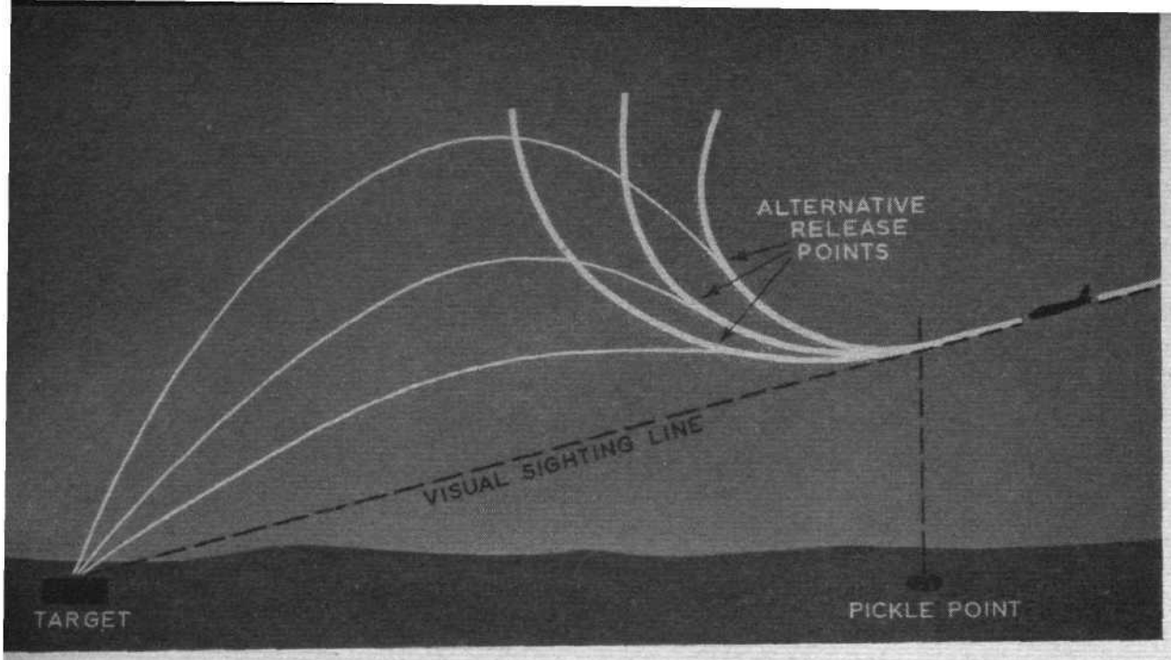
Mr. Rowledge joined Rolls-Royce, Ltd., in 1921 as chief aero engine design engineer and was responsible for the Condor III, the Kestrel, the "R" engines for the Supermarine Schneider Trophy seaplanes, and then the Merlin. He was also responsible for the experimental Exe and Pennine air-cooled engines.

For his work on the Napier Lion during the First World War he was appointed M.B.E.; in 1931 he was awarded the Gold Medal of the Institute of Automobile Engineers for his contribution to the Schneider Trophy aircraft; and he was elected a Fellow of the Royal Society in 1941. In 1945, at the age of 70, he finally retired from Rolls-Royce, Ltd.

THE EDITORSHIP OF "FLIGHT"

H. F. King, M.B.E., has been appointed Editor of *Flight* as from January 1. During the last two years he has carried a large share of the responsibility and undertaken the day-to-day work involved in the editing of the journal. He joined the staff in 1930 and has been Associate Editor since April 1955.

Editor of the journal since 1949, W/C. Maurice A. Smith, D.F.C. and Bar, now becomes Editor-in-Chief, in which position he will retain a close interest in editorial matters, and be responsible for policy under A. B. Bourne, C.I.Mech.E., Editorial Director. Maurice Smith will also continue as Editor of *Flight's* sister journal *The Autocar*, a position which he has held for the past two-and-a-half years.



The M-1 toss-bombing system is flexible. The pilot aligns the target with his visual gunsight and then pulls up as he likes after initiating computation at the "pickle point." The computer will release the bomb when the proper conditions are reached, i.e., at any of the alternative release points shown in the diagram.

AEROBATIC DELIVERY

Two Low-altitude Bombing Systems for U.S.A.F. and U.S.N.

LOFT, toss and over-the-shoulder bombing have now become familiar turns in the fighter/bomber repertoire, and even the bigger "birds," such as the B-47, are getting in on the act. The general principles are well known. An attacking aircraft approaches a target below radar coverage and, by pulling up into a roll-off-the-top and releasing at the critical moment, can lob its bomb on to the target without exposing itself to view or defensive fire. A general description of the process appeared in *Flight* for October 19, 1956. It need hardly be added that the prime purpose of loft bombing is the effective delivery of tactical —and possibly also larger—atomic weapons.

The first U.S.A.F. loft bombing system was developed by Minneapolis Honeywell and given the military designation LABS (Low Altitude Bombing System). The R.A.F. is also to use this and production in England is getting under way. Canberra B(I).8s in Germany are practising the necessary manœuvre, as related in *Flight* for December 27, and the equipment should by now have been fitted.

The U.S. Navy have now also adopted the technique and applied it first to the FJ-4B Fury. Their own system was developed by Lear, Inc., after preliminary tests at the Naval Ordnance Test Station, China Lake, and has been called the AJB-3. It is a relatively inflexible system in that the run-up to the target must be planned in detail, accurately flown and followed by a manœuvre executed precisely up to the point of releasing the bomb. To do this, the pilot follows the indications of a combined attitude and course indicator operated by the Lear remote gyro platform and of a command and indicator g-meter placed alongside it. Though this is not mentioned in descriptions so far published, it is presumed that autopilot coupling could be provided to make the manœuvre at least partly automatic in execution.

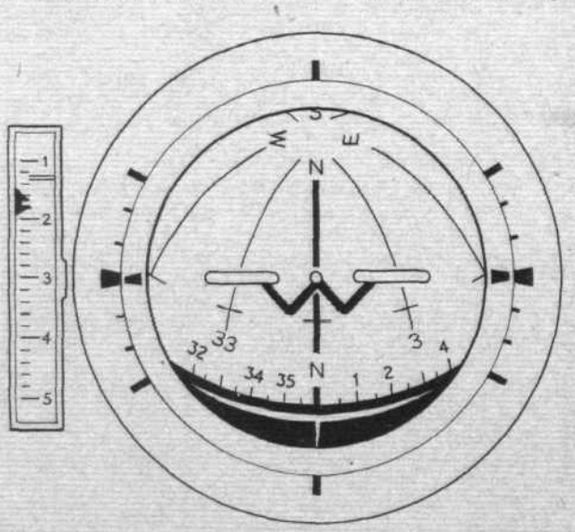
The U.S.A.F. now has a later toss-bombing system under test. It is much more flexible in that it makes the bomb-release calculations semi-automatically during the attack and allows the pilot to approach the target at almost any angle of dive and pull up more or less as he likes. It will compute the relative positions of aircraft and target and release the bomb automatically when the right conditions obtain. Based originally on a bombing computer developed by the Swedish Saab Company, this system is now designated M-1 and is produced in America by the Mergenthaler Linotype Company.

When using the Lear AJB-3 system, the pilot chooses a landmark somewhere short of the target as an initial point. He then determines, according to the characteristics of the bomb and his aircraft loading and speed, the proper climb angle for release and the time it will take him to reach that angle from level flight. He then further calculates the time from passing the initial point to beginning the pull-up and sets this data on the relevant control panels. An intervalometer takes care of the timing and the command g-meter is regulated by his setting of the release angle. On making his run, the pilot presses a button as he passes over the initial point so as to start the whole sequence going. This is colloquially known as "pickling" and the button and the point on the ground are usually referred to, respectively, as the pickle button and the pickle point.

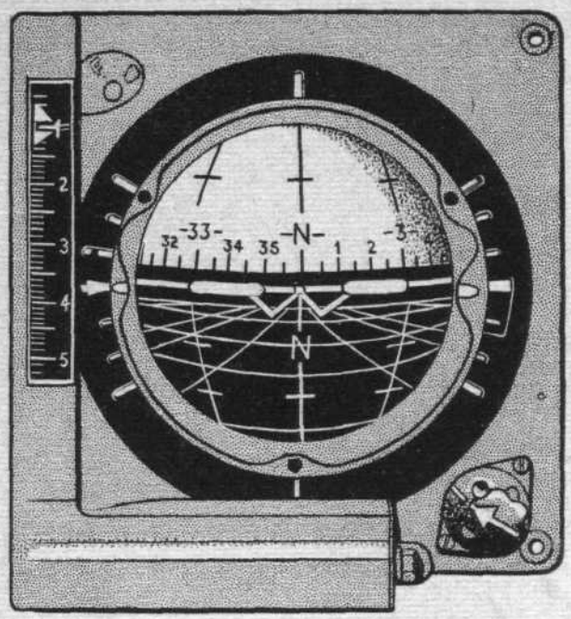
At the right moment during the level run-up, a red light and an aural tone tell the pilot to start pulling up, following the instructions of the programmed g-meter; then at the correct angle the bomb is automatically released and the pilot is free to continue over the top and return to base.

The AJB-3 weighs under 60 lb and consists of the Lear two-gyro stable platform, a related amplifier, compass adapter, rate-gyro erection-cut-off and flight-director instrument with integral g-programmer and g-meter and intervalometer. Data are preset on three control panels. The purpose of the rate-gyro erection cut-off is to stop the electrolytic levelling switches from monitoring the gyro platform to gravity whenever a rate of turn of more than 15 deg/min is reached. All but one of the amplifiers in the platform are transistorized; and several pick-offs are fitted to serve other aircraft systems besides the AJB-3. Compass slaving is also cut off during turns sharper than 15 deg/min and can be eliminated altogether when flying at high latitudes. The drift rate of the heading element of the platform is 2 deg/hr, though this is expected to be improved in future models.

The gyro platform can give accurate attitude and direction indications in all aircraft attitudes; and the director instrument is accordingly designed to indicate accurately under these conditions. It consists of a servo-driven ball, divided at the equator



The combined attitude and heading indicator for the Lear AJB-3 bombing computer shown indicating a straight and nearly vertical climb on a compass heading. Alongside, the two pointers show the actual and required g-loading during the pull-up for bomb-release.



The Lear AJB-3 indicator, with g-indicator alongside. The flat box along the lower edge of the instrument is the g-programmer. A civil instrument would also have I.L.S.-type cross-pointers and a glide-slope needle on the left-hand edge. No g-meter would be required, but a turn-and-slip indicator would be let into the lower edge of the dial.

into pale blue and dark grey halves, representing sky and earth. The latter half is also marked with grid lines disposed to give a perspective effect when viewed by the pilot. A normal compass-heading graticule is engraved round the equator and the 30 deg heading marks are continued as longitude lines over the poles of the sphere. Thus, when going into a vertical climb, the pilot becomes aware of the significance in terms of heading of the aircraft's roll displacement. This is an important feature for loft bombing, because an accurate heading must be maintained during a pull-up to the release angle.

The ball presentation of attitude has been praised by U.S. Navy pilots as being easily read and simple. But such a system is not generally approved in England because, ideally, the pilot should be looking at the inside surface of the ball in order to obtain the most natural impression of manœuvring at very high angles of climb and dive. Seen from the outside of the ball the surface moves downwards as the aircraft nose moves upwards. Similarly, the directional indications move in the unnatural sense, as they do with traditional gyro direction indicators. The British solution is the roller-blind attitude indicator.

Lear are further preparing an extrapolation of the AJB-3 attitude indicator for general civil operations. It will retain the combined attitude- and heading-indicating functions of the bombing instrument, but will also have flight-director cross-pointers together with a small pointer in the left-hand rim giving I.L.S. glide-path indications. A small ball-and-pointer turn-and-slip indicator will be let into the lower rim of the dial. Special internal lighting has been designed with bulbs shining from inside the ball, indications and marks round the dial being illuminated by conventional edge-lighting techniques.

The Lear AJB-3—and probably the Honeywell LABS also—require a planned and timed approach to the target and the execution of a strictly programmed manœuvre leading up to the release point. The whole process is frozen from the moment of pressing the pickle button. The M-1 system, on the other hand, is a great deal more flexible. The barometric pressure height of the target and the characteristics of the aircraft and bomb are pre-set on the control panels. Automatic and continuous sensing devices then assess the barometric height of the aircraft and its angle of dive at the pickle point, at which time the pilot centres the target visually in his gunsight. The computer then solves the equations necessary to establish the distance and relative height between aircraft and target; and the pilot is free to pull up as he likes. The computer will order the release of the weapon at the right moment. The dive towards the target can be made at anything between seven and 75 deg from the horizontal and the pilot's only precision task is to maintain accurate heading. The M-1 weighs about 30 lb and is fitted in the F-84F, F-86, B-57, F-100 and F-101.

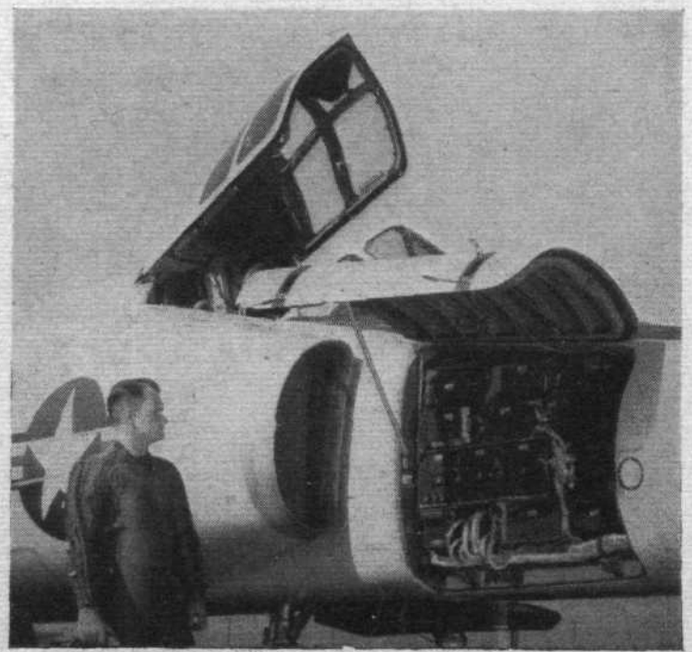
Advantages of the M-1, in addition to its not requiring an initial point and precise pull-up, are that it allows the pilot to attack targets not previously surveyed and to throw the weapon a good deal farther than is the case with LABS. It can also be used at heights as great as 20,000ft. But the minimum height is 2,000ft and this carries penalties in safety and unexpectedness of approach. So that the computation should be correct it is also desirable that the barometric pressure altitude of the target be reasonably accurately known, or that it should be estimated fairly accurately by the pilot if he is making an attack on the spur of the moment.

The central component in making computations for the bomb release is a three-dimensional parabolic cam, operated according to signals from a pitch gyro and pressure-sensing devices. The cam-follower is correctly positioned by a servo which measures the ratio of aircraft and target pressure altitudes, the first of which is obtained from a pressure transducer in the aircraft. The equation is actually solved according to the characteristics of a bomb in a vacuum, the appropriate corrections being derived from wind, bomb shape and aircraft weight values set by the pilot and by accelerometer reading used automatically to allow for the aircraft's angle of attack. The computer then continuously compares the ideal bomb-release angle with the aircraft's actual angle of climb and signals the release when the two coincide. Voltage ratio signals rather than pure voltage values are used in order to avoid the effects of fluctuating current supplies. A secondary cam is followed to actuate a warning light system which tells the pilot when his manœuvre is going to be adequate for effective release of the weapon.

The Mergenthaler Corporation has also published details of a comprehensive test cabinet which allows complete inspection and checking of the M-1 system prior to its installation in the aircraft.

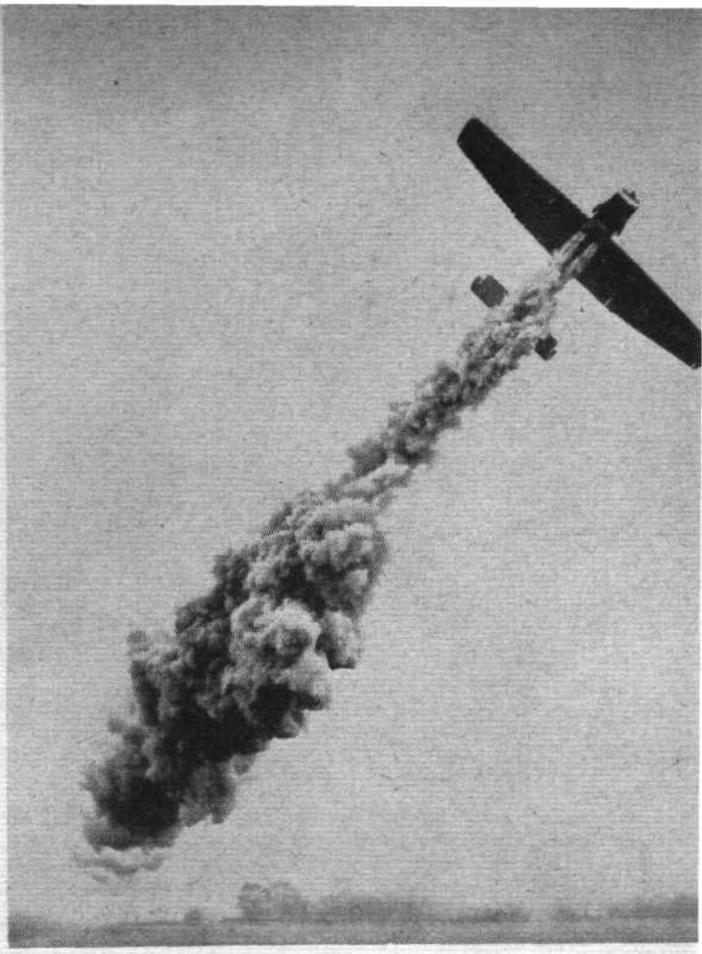
FIGHTER COMPUTER

DURING the past dozen years tremendous efforts have been made in the progressive improvement of fire-control systems of intercepter aircraft. From the simple addition of a search radar, to enable the pilot to find his quarry, systems have become progressively more automatic in function. A major technological advance was represented by the "collision-course" automatic interception evolved for the U.S.A.F. single-seat F-86D. The prime contractor for this system, Hughes Aircraft, of Culver City, Cal, later developed the even more advanced MG-10 fire control for the Convair F-102. This fire-control, in its ultimate form, can take over the complete task of steering the aircraft, effecting an interception, launching the GAR-1 Missiles (or spin-stabilized FFARs) at the optimum point and then bringing the machine back to base. The general principles were outlined in our description of the F-102 in our issue of April 19 last. This photograph (right) is the first to show a newer element in the system, the "Digitair" digital computer, which serves as a central calculating device capable of making 9,600 arithmetical movements per second, or of taking 6,250 basic "decisions" per minute. It leaves the pilot free to monitor the entire mission. "Black box" weight is 120 lb.



The Digitair computer is installed on the port side of the long nose of the Convair F-102A all-weather intercepter. Developed by Hughes Aircraft, and manufactured by them during the past six months, the Digitair is here being inspected by Hughes pilot Robert R. Carson.

HERE AND THERE



JETTISONING the remains of its fertilizer load after a recent topdressing demonstration at Rearsby, an Auster Agricola gives an unintentional but spectacular imitation of a rocket-assisted take - off. The Agricola can carry three-quarters of a ton of dry agricultural chemicals or 144 gallons of crop-spray fluid.

Tu-104s for Brazil?

IT is reported that the Brazilian airline Panair do Brasil are considering the purchase of Tu-104s. No further details are available as *Flight* goes to press.

France's New Carrier

THE first aircraft carrier to be built in France since the war was launched at Brest on December 21. Named *Clémenceau*, the 27,000-ton vessel will have the British angled deck, steam catapult, and mirror landing aid. She will carry 60 aircraft.

Bréguet-Dornier Agreement

CO-OPERATION in the production of civil and military aircraft is the purpose of an agreement to be drawn up between the West German Dornier works and the French Bréguet company. The plan was announced by the German Association of Aircraft Industries.

Griffon Excelsior

DURING recent test flights from Istres a Nord 1500 Griffon, powered by an Atar E3 and a ramjet, achieved Mach 1.85 in a climb; its best performance to date has been a vertical speed of 1,250 m.p.h. when flown by Armand Jacquet. This the manufacturers believe to be the highest speed ever achieved by an aircraft in vertical flight after taking off under its own power.

Aluminium Enterprise

FIRST metal was poured at the new aluminium smelter of the Canadian British Aluminium Co., Ltd., at Baie Comeau, Quebec, on December 23—less than 20 months after work on the site began. This marked the completion of the first of the four production stages of the £50m plant, which will eventually have an annual output of 160,000 long tons of virgin aluminium ingot.

Mark of Esteem

TO mark his 40 years' association with Boulton Paul Aircraft, Mr. J. D. North (chairman and managing director) has been presented with a piece of antique silver. Works personnel from cleaners to directors subscribed to the presentation, which was made at the annual Christmas luncheon by Mr. Geoffrey Haynes (director and secretary). At the same function, the Rex Farran Memorial Trophy was presented to D. E. Johnston, best all-round senior apprentice for 1957.

Scrapped Meteors

SIXTEEN Gloster Meteors of the Royal Dutch Air Force have been sold for scrap at 1,600 guilders (about £150) each. They had no instruments, armament, radio, or cameras.

C.P.A.'s Britannias

BRISTOL AIRCRAFT have undertaken to deliver the first of Canadian Pacific Air Lines' six Britannia 314s on February 15. They will be used on the airline's polar services between Canada and Europe.

T.W.A.'s President Resigns

THE president of T.W.A., Mr. Carter L. Burgess, has resigned as a result of a "disagreement" with Mr. Howard Hughes, T.W.A.'s largest shareholder. Until recently, notwithstanding Mr. Hughes' influence on T.W.A.'s re-equipment policies, the two men had never met.

The Big Recognition Contest

ON Saturday, January 18, the eleventh annual All-England Aircraft Recognition Contest takes place at the Royal Institution, London. Some details of entries received were given in *Flight* last week, but applications may still be made to the hon. secretary of the Aircraft Recognition Society at 15 Tavistock Street, London, W.C.2 (Temple Bar 7238).

Hercules for Germany

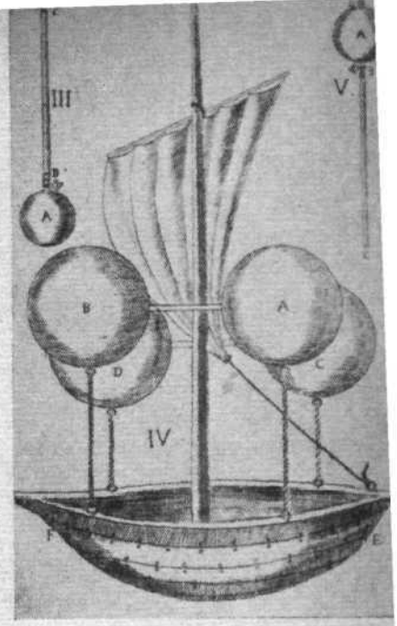
SOME thousand Hercules piston engines are being built by the French S.N.E.C.M.A. company, under Bristol licence, and it was announced last week that deliveries to Germany had begun, to meet the needs of German-built Noratlas airframes. Over 600 engines have already been delivered for the French Noratlas programme. Overhaul period is 1,000 hr in military service, but the Armée de l'Air are proving ten engines for 1,200 hr.

UNVEILED in the officers' mess at the R.A.F. Technical College, Henlow, last month was this portrait of Lord Trenchard. Air Marshal Sir George R. Beamish, A.O.C-in-C. Technical Training Command, performed the ceremony. Looking on are Sir Frederick Handley Page (right) who presented the portrait to the College, and G/C. D. Smythe, station commander at Henlow. Sir George Beamish, a former pupil of the College, is shortly retiring from the Service.

DREAM OR NIGHTMARE?

Aviation and Mankind: Some New Angles on a Perennial Argument

By MAURICE ALLWARD



De Lana's boat of 1670 was the world's first serious scientific suggestion for a practical flying machine. With the proposal the inventor made a remarkable prophecy that the "dream" might ultimately become a "nightmare."

IN 1670 the Jesuit priest Francesco de Lana-Terzi put forward the world's first scientific suggestion for a practical flying machine. De Lana, as he is more simply known, was one of the most distinguished men of science of his day, and his "aerial-ship," as he called it, was designed to be raised by four large spheres, each twenty feet in diameter and made of wafer-thin copper. Twenty years previously Otton von Guericke had invented the air pump, with which some knowledge had been gained regarding atmospheric pressure and the vacuum. On de Lana's boat the spheres were to be evacuated of all air on the supposition that, being thus made lighter than the surrounding air, they would rise in it.

In practice the spheres would, of course, have collapsed under the pressure of the surrounding atmosphere, even though de Lana suggested they should be round to avoid this possibility. In theory, however, the idea was sound and is, indeed, remarkable as the first logical approach to the balloon problem.

Almost as remarkable as de Lana's design was his prophecy of the use to which, if made, his boat would probably be put:—

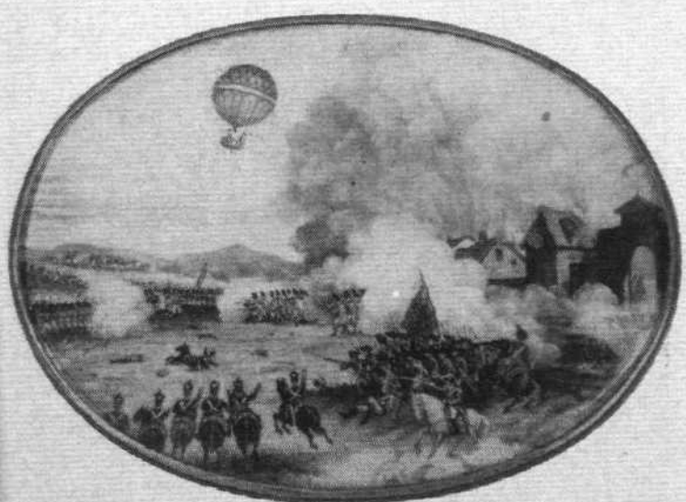
> "I do not foresee any other difficulties that could prevail against this invention, except one; but this seems the greatest of all. For God would surely never allow such a machine to be successful, since it would cause much disturbance among the civil and political governments of mankind. Who can fail to see that no city would be proof against surprise, as the ship could at any time be brought above its squares, or even the courtyards of its dwellings, and come to earth so that its crew could land. In the case of ships that sail the sea, the aerial ship could be made to descend from the upper air to the level of their sails so that the rigging could be cut. Or even without descending so low, iron weights could be hurled down to wreck the ships and kill their crews; or the ships could be set on fire by fireballs and bombs. Not only ships, but houses, fortresses and cities could thus be destroyed, with the certainty that the airship would come to no harm, as the missiles could be thrown from a great height."

De Lana's suggestion became fact in 1783 in the form of a Montgolfier hot-air balloon, and mankind made the first aerial voyage in the history of the world. The effect of this major event on the people of the day can well be imagined. It was, naturally, acclaimed as a feat of supreme courage, as indeed it was.

It was also hailed as an event which heralded "a new epoch of life on earth." Tiberius Cavallo commented: ". . . a man elevated to such a height, into an immense space, by means altogether new, viewing under his feet, like a map, a vast tract of country with one of the greatest towns existing, the streets and environs of which were crowded with spectators, attentive to him alone, and all expressing in every possible manner their amusement, and their anxiety. Reflect on the prospect . . . and the consequences; and then see if your mind remains in a state of quiet indifference." But the new epoch did not materialize.

It is significant that during the preliminary "tethered" trials before the flight, armchair strategists of the time had already begun to suggest uses to which balloons could be put: observation, mapping, transport (including the carriage of materials to besieged cities)—and bombing! That such suggestions should be voiced so early during the development of a great invention led Horace Walpole to record: "I hope these new mechanic meteors will prove only playthings for the learned and the idle, and not be converted into new engines of destruction to the human race, as is so often the case of refinements or discoveries in science."

FOR the last 287 years aviation has been playing a steadily increasing part in our lives. Has this impact been beneficial or harmful? Here Maurice Allward reviews in a controversial manner some of the effects of the twin prongs afforded by aviation—speed and range.



Nightmare: De Lana's dream became fact on November 21, 1783, when a Montgolfier hot-air balloon made the first aerial voyage in history. Within ten years balloons were being used for war. This old print shows the Battle of Fleurus, 1794.

It was a vain hope. Within the short space of ten years the French Convention instituted the world's first air arm. One year afterwards aviation was at war, the first use of the balloon for military purposes being recorded on June 2, 1794, at Maubeuge. Many valuable observation ascents were made, particularly during the Battle of Fleurus on June 26, 1794. The military observer used a telescope and signalled to his ground forces with flags. From then onwards the balloon has been used in virtually every war, right up to the present time.

Having seen some of their predictions materialize, dreamers then put forward some very ambitious suggestions. For military attack, giant Montgolfiers, each carrying 3,000 soldiers, were proposed to enable Napoleon to over-pass the Royal Navy when he invaded England. A contemporary print on the same theme shows a Channel tunnel for underground attack, together with a great fleet of French troop-carrying balloons. From the shores of England rise a number of man-carrying kites, each supporting a defender firing blunderbusses at the invaders. Both these proposals, it seems, alarmed few people other than their own authors; so far as general society was concerned the impact of balloons was slight. In particular, their military usage did little to change the localized character of war.

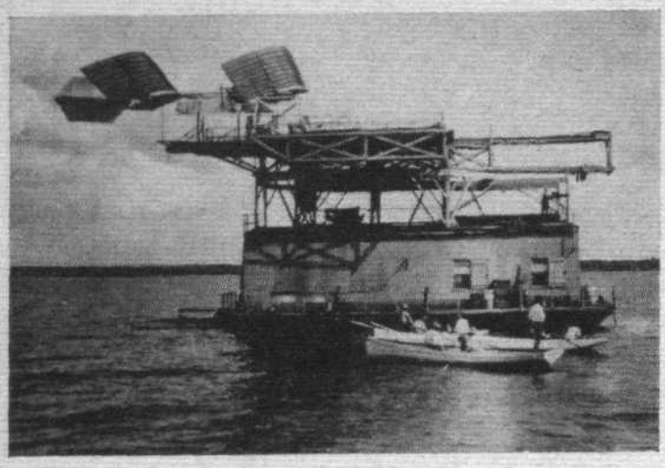
* * *

Heavier-than-air developments may be considered as beginning in 1804. In that year Sir George Caley produced a clean, modern-looking model glider, with an adjustable tail unit—the world's first proper aeroplane. Nearly 100 years later Professor Samuel Pierpont Langley, head of the famous Smithsonian Institution in Washington, flew a powered model three-quarters of a mile—the first successful powered aeroplane in history.

In 1898 the United States went to war with Cuba and, although it was to be five years before man conquered the air in a heavier-than-air machine, an indication of what the world would do with this priceless conquest was given by the invitation of President McKinley to Langley to: "construct a flying machine with possibilites as a weapon of war." Langley accepted, but—through damage caused by the launching catapult—just failed to produce the world's first real aeroplane.

In the following year the Hague Peace Conference went on record to the effect that aircraft "present or projected, would not by international law be permitted to take a combatant part in war." The discharge of projectiles or explosives from the air was solemnly prohibited; air vehicles were to be limited in use to "reconnaissance or equally passive rôles."

On December 17, 1903, the ingenuity, tenacity and skill of the Wright brothers gave the world the first practicable aeroplane, sometimes claimed as the greatest scientific achievement of all



Langley's "Aerodrome" of 1903—produced at President McKinley's request "to construct a flying machine with possibilities of war"—before the secret of heavier-than-air flight had been solved.

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time—certainly second only to the current harnessing of the power of the atom.

What was the impact of the conquest of the air? For the first decade or so the effect was negligible. During this period it proved difficult enough to produce a frail contraption of sticks, string and canvas that would *fly*, let alone making it do some work.

July 25, 1909, witnessed the event of greatest significance during this period. On the morning of that day Louis Blériot took off from Barraques, on the French coast, and, just over half an hour later, landed on English soil near Dover Castle. This first crossing of the Channel—England's traditional moat—filled the headlines of the world's newspapers. To some who appreciated what it meant, the flight struck an ominous note. In later years the famous air pioneer Sir Alan Cobham commented: "The day that Blériot flew the Channel marked the end of our insular safety and the beginning of the time when Britain must seek another form of defence besides its ships." The remark applied, of course, equally well to the historic insular immunity of many other nations. This was, perhaps, the greatest impact that flight was to make.

In 1914, before aviation's wings were fully feathered, the most terrible war in history flared up. At the beginning, the aircraft available were suitable for little else but the "reconnaissance or equally passive rôles" envisaged at the Hague Peace Conference. When, four years later, it ended, fast, heavily armed fighter machines had shot one another out of the sky, reconnaissance aircraft had reported on and photographed the movement of armies on the ground. Torpedo-carrying aeroplanes had sunk ships at sea, low-flying aircraft had straffed infantrymen in muddy trenches and, of most significance in this analysis, bombers had showered high explosive and incendiary bombs on cities.

Aviation, still in its early teens, had already become an *enfant terrible*. The 250-year-old prophecy of de Lana had materialized with frightening accuracy.

Since then aviation has, of course, continued to expand rapidly. What has been its effect on society? Without doubt, the impact has been very great and considered broadly it can be seen to have taken effect along two major and quite separate ways, one civil and the other military.

Aviation offers two fundamentals: speed and range. The characteristic of speed seems to have been used most in peace; that of range more fully occupied in war.

Taking the civil aspect first, let us survey the impact of the speed made possible by aviation. At the turn of the century vast areas of the great outback of the Australian continent were being settled. The farms were the biggest in the world, rarely close enough even for telephone connections. The problem of providing an adequate medical service is obvious. With individual doctors trying to serve practices extending over areas of up to 280,000 square miles, people lived under the shadow of disaster, because, in the case of a broken leg, appendicitis or pneumonia, death often arrived much sooner than the doctor.

Then, in 1927, an aircraft was hired from a local airline and a doctor appointed to attend urgent medical and accident cases. It was an event of some significance in that great continent because, from that small beginning the now famous Flying Doctor Service has evolved. Today the service operates from 16 bases. More than 1,000 farms, many of them 400 miles from the nearest doctor, can call for help and receive aid in a matter of hours. The effect of this on the peace of mind of the society comprising the scattered homesteads can well be imagined. The service had not only banished fear, but also largely mitigated the loneliness of the communiy. The radios, an integral part of the service, are used in "off-duty" hours for sending business telegrams and even private messages, an invaluable comfort to the womenfolk, many of whom see no neighbours for weeks or months. Little wonder that, in 1954, the humane work of the service was recognized by the grant of the coveted prefix "Royal."

More recently, large areas of North Canada have not only been serviced from the air, but have even been initially populated through the agency of aviation. In order to exploit the natural resources of the inhospitable sub-polar regions, after the original surveys have been made, whole communities are set up with the aid of aircraft.

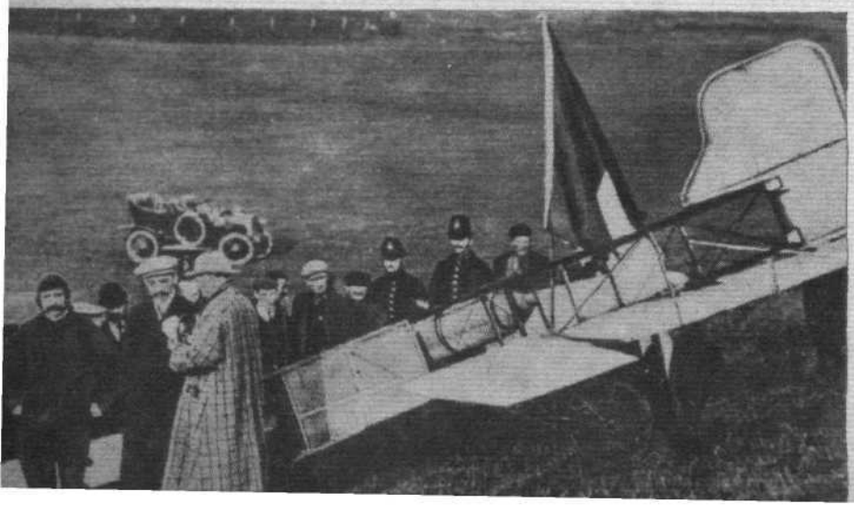
A unique task befell aviation as a result of the granting of independence to the sub-continent of India and its resultant partition into two States. Pakistan is formed of two large land areas—separated by over 1,500 miles of inherently hostile Indian territory. An air service between the two States permits the normal everyday exchange of government and goods taken for granted in normal countries, with obviously beneficial impact on the separated societies of this newly born country. Without aviation this trade would be impossible, and there would be a consequent strain on Pakistan's already none-too-secure economy. Of greater significance is the fact that, lacking the swift and regular air service between the two portions of the country, a central government would not be able to function either efficiently or effectively. Without aviation, Pakistan would, by now, probably be two separate and independent States.

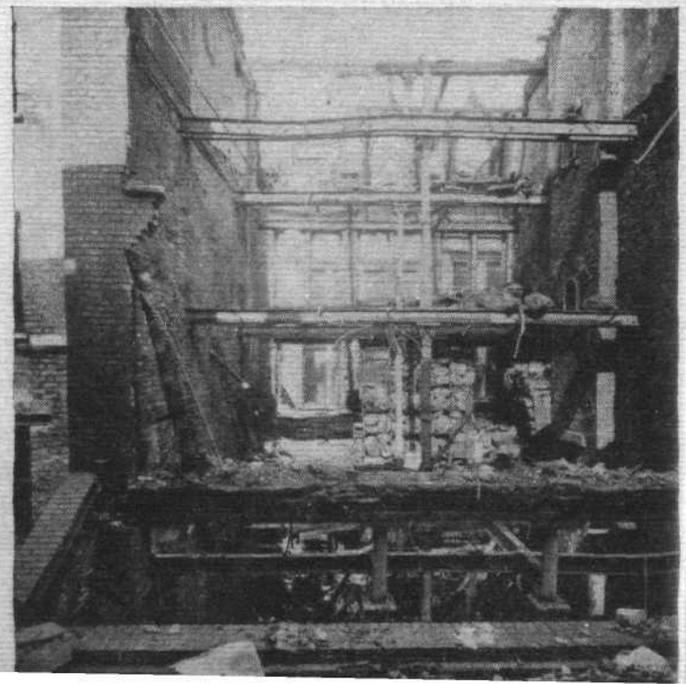
Throughout the world more than 80,000,000 people a year now use the speed offered by aviation, for business or pleasure. Although only a small percentage of the total world population, this is many more than can be accounted for by the passage of government officials and heads of business concerns; millions of ordinary people —members of ordinary society—are, therefore, making use of aviation.

By far the greater portion of these are people going on, or returning from, vacations. The shorter travelling time by air enables them to stay longer at their destinations. The impact here, although affecting large numbers of people, is slight on society. Most of the holiday-makers would have an equally benefi-

(Below) July 25, 1909: Blériot lands at Dover after crossing the Channel and Britain loses her historic insular immunity.

(Right) Nightmare: Six years after Blériot's flight, bombs from Zeppelins brought war to Britain for the first time in nearly 1,000 years.





Crop spraying: In the calculable future the continued existence of the world's society might well depend upon aviation.

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cial vacation if they had travelled by alternative means of transport.

The speed-up of business transactions resulting from the use of aircraft, often quoted as a supreme advantage of aviation, may well be a mixed blessing; certainly thousands of ulcer-pained American executives must have their doubts. A slowing down of industrial development would cause no lasting harm and might, indeed, could prove beneficial. Certainly, the use of air transport by politicians and heads of State to speed across the world to make hasty decisions affecting the future of millions can be viewed with suspicion. Sounder decisions could hardly have failed to have been made if, since the war, all journeys to top conferences had been made by boat and train. The consequential time afforded for sober reflection and prolonged consideration of the affairs at issue might, by now, have given us a more stable world.

Another world-wide use of aviation is the aerial spraying of anti-pest insecticides and soil fertilizers, the value of which is now well proved. It is not only quicker than doing the same job by ground equipment, but often cheaper, because it does not damage any of the crop as often happens when wheeled equipment is used. In 1954 in the United States three million acres of rangeland were sprayed to kill grasshoppers at a cost of 4s 6d an acre; in the past the insects had often cost farmers 28s an acre in terms of lost food for cattle.

Similarly, beneficial results have been obtained all over the world; Colorado beetles have been attacked in French potato fields; 36 million locusts in Kenya have been destroyed at a cost of less than £200; an outbreak of the dreaded cotton-jassid insects in the Sudan has been averted by spray from helicopters.

Soil fertilization, or top dressing, is now conducted on a scale which would not be possible by means other than aviation. For example, in 1950, 5,000 tons of phosphates were spread over 48,721 acres in New Zealand. In 1954, 200,000 tons were dropped over 5,000,000 acres. It is estimated that in the U.S. alone the use of aircraft adds about £1,300,000,000 to the income of farmers, with an obvious beneficial impact on the local society.

With the population of the world growing by 68,000 mouths every day of each year, the increased productivity of the soil made possible by the use of aircraft for top dressing may in time prove to be aviation's biggest impact. In the calculable future the continued existence of the world's society may well depend on—aviation.

That, briefly, sums up the impact of the civil prong of aviation. What has been the impact of military flying during the same period? Here range seems to have had a bigger effect than speed.

* * *

During the Great War of 1914-18, the ability of aircraft to cover great distances meant that, for the first time in history, war reached out far behind the traditional "front line" and affected the ordinary people who, previously, had been largely isolated from its day-to-day terror.

In this fundamental impact some detected an inherent benefit. The argument was put forward that, as this hitherto immune society, and particularly its politicians, now stood to suffer directly from war, there was less likelihood of nations engaging in war. Unfortunately, the contrary has proved to be true; since 1918, aviation has greatly intensified the menace to the whole world of any struggle between civilized states. In Europe in particular the range of aircraft revolutionized the character of warfare without diminishing in any way its likelihood.

One who realized that the peace theory was but a pious if worthy hope was the British statesman, Sir Leo Morey, who, in a speech to the League of Nations in 1919, argued: ". . . if the nations armed themselves with aeroplanes enough, the outbreak of war in twenty or even in ten years' time would mean such widespread terrorism throughout the world as had never before been known and all the parties to the contest would be inexorably driven by the foulest of all forms of competition to the murder of non-combatants on a gigantic scale."

Sir Leo was right on both time-scales, the Spanish Civil War of the early thirties seeing the destruction by bombing of the village of Guernica. This tragedy filled the headlines of the world and caused many to recall Orville Wright's classic comment: "What a dream it was, what a nightmare it has become," brought about by earlier misuses of his great invention. The world war of 1939-45 saw much more than the destruction of one village; towns and cities were devastated by the score.

When, in 1945, the twin mushrooms of atomic bombs spread above the Japanese cities of Hiroshima and Nagasaki, aviation had, in fifty years, grown into a potential destroyer of the civilized world.

The ability of the aeroplane to overcome distance, a foretaste of which had been given during the 1914-18 war, had been demonstrated with terrifying effectiveness to the societies of half the world between 1939-45.

* * *

What has been the impact of aviation since the end of hostilities? It is popularly argued that fear of the consequences of a new global war, waged with atomic and thermo-nuclear bombs, has maintained an uneasy peace.

It is, perhaps, opportune to consider the successful harnessing of atomic energy, because this is now inseparable from any thorough survey of aviation. Most of the senior statesmen of the world appreciate that in the hydrogen bomb Mankind has a weapon capable of destroying the world. Now, this is, of course, a common claim made for all new weapons, from the introduction of the longbow, gunpowder, the machine-gun and poison gas. History has proved these earlier prophecies of doom to have been wrong; but, viewed in the perspective of the years, they have become less so.

Up to the end of the eighteenth century, the overall effect of war, viewed impartially, can be shown to have been beneficial; it was, without doubt, largely instrumental in developing and spreading civilization. Ruskin went so far as to say that war was a "vitalizing and purifying influence essential to the progress of humanity." In his book *The Crown of Wild Olive*, he wrote: "I found, in brief, that all great nations learned their truth of word and strength of thought, in war; that they were nourished in war and wasted by peace; taught by war and deceived by peace; trained by war and betrayed by peace; in a word, they were born in war and expired in peace."

Since then, owing to the increasing destructiveness of weapons devised by science, war has begun to inflict more and more harm than benefit on the common fabric of civilization. As far as the first world war is concerned the nations engaged, particularly Britain, even today feel the effects of the loss of the flower of their respective manhood experienced during the conflict.

The war of 1939-45 caused an upset that has not yet subsided today—nearly fifteen years later. With the thermo-nuclear bomb man has not only fashioned a weapon representing a gain in destructive power many, many times that of any previous weapon;

Nightmare: The atomic mushrooms over Hiroshima and Nagasaki meant that modern aviation had, in fifty years, grown into a potential destroyer of the civilized world.

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it is also a weapon of quite a new kind. In sheer destructive power alone it is sufficiently great to obliterate the capitals of the world and to reduce to a shambles the organized civilization we now enjoy; but its greatest terror is its inherent radioactivity. In this there lies a force capable of destroying all animal life as we know it today.

The uneasy global peace since the end of the war, referred to earlier, has been punctuated by periods of bitter local conflict, "hot" or "cold," in which aviation has played an important part. In the summer of 1948 Russia closed all the surface routes into West Berlin. Without aviation, Britain and America would have been faced with the alternatives of either giving up the city or attempting to force a land route, with consequent risk of starting a world war. Aviation offered a third course of action and the now-famous Berlin Airlift was inaugurated. Day and night a vast armada of transport aircraft flew into the airports of Templehof and Gatow at intervals of from two to five minutes. For nearly a year to the city of 2¼ million people were airlifted the goods required not only to keep it alive, but at work. In all, over 2,000,000 tons of supplies were carried in 277,728 sorties, showing that aviation could avert as well as win wars.

Two years later South Korea was invaded and aviation was, first, the medium by which United Nations forces were able to reach the peninsula before it was over-run; secondly, the medium by which it was held; and, lastly, the medium which ultimately caused the aggressors to call off the fighting. During this period air attacks on North Korea were so effective that towards the end they all but ceased, as all targets had been destroyed.

To return to the argument that fear has, by and large, maintained an uneasy peace since 1945, the possession of enormous bomber fleets by both America and Russia may have at the same time increased international tension. The phenomenal advances in aeronautics have greatly increased the possibility of surprise attack, because, together with nuclear weapons, they hold out to the State possessing great air strength the prospect of achieving a quick and decisive victory.

From the foregoing it can be seen how great and widespread has been the impact of the twin prongs of aviation on society. Whether the total balance is for the good or evil is not easy to say. So far, the overall impact has probably been for the better, because it may well be that although flying has increased the tempo of war, and spread its terror over much greater areas, as far as actual loss of life is concerned it is predominantly a humane weapon. Certainly, the deaths in action during the 1939-45 war, in many respects predominantly an air war, were nothing like so severe as those experienced during the land-locked 1914-18 holocaust.

If, however, there should be another global war, the sum will very definitely be in the negative. There is little doubt that any lingering traces of the concept of the military target, destroyed with the minimum damage to its surroundings, will vanish. With the H-bomb, complete industrial areas, such as the Ruhr in Germany, the Midlands in Britain, the Great Lakes in the United States and the basin behind the Ural mountains in the U.S.S.R., will be the targets. Destruction will be unimaginably great and (as Air Marshal Sir Robert Saundby said recently) will produce "catastrophe on such a scale that a new word will have to be invented to do justice to it." For aviation to continue to serve mankind for the better there must be no more war.

"No more war." The eternal hope of mankind but one not yet fulfilled. What are the chances of the present generation succeeding? Today a person of the not very great age of 60 will have witnessed no fewer than fifteen major wars, varying in duration from a few months to over six years. In fact, no single generation within living memory has known unbroken peace. An analysis of history from the fifteenth century B.C. to the middle of the present one shows that during this great span of nearly 3,500 years there have been fewer than three hundred years of peace—an appalling average of about twelve years of war to one of peace.

On the basis of this past experience the outlook for the future, bearing in mind the availability of the atom bomb, is not particularly hopeful. It is no use suggesting the ban on the use of the hydrogen bomb by international agreement. Experience has shown that such agreements are possible to only a limited extent; certainly during both world wars practically all such agreements were repudiated. Each belligerent violated or evaded every treaty or convention that tended to hamper the full exploitation of all available means to victory.

The destruction of all stockpiles of atomic bombs might mitigate the terrors of war in its opening stages but, once engaged, all the resources of science would be ruthlessly exploited as soon as the warring nations could mobilize them. In any future global war, the hydrogen bomb will be used—by whichever side thinks it is losing. As Sir Arthur Harris, war-time commander of Britain's Bomber Command, has explained: "When a man is being strangled to death he reaches for any weapon. . . ."

The only solution is the abolition of war. This will entail the complete reversal not only of the general method of human life hitherto, but also of the general method of nature, that is, of conflict and survival. Yet, this is the aim Mankind must set itself if it is to survive. If it fails, then the "range" prong of aviation, coupled with the twin Frankenstein of the atomic bomb, will bring life as we know it to an abrupt end.

OIL, WATER AND AIR

DAS ISLAND, a speck of desert projecting above the surface of the Persian Gulf midway between Bahrain and Sharjah, possesses a 1,500-yard rolled sand runway, a small hangar, a radio beacon and H.F. and V.H.F. R/T.

The presence of these facilities in so unlikely a spot will make possible the aerial support of an ambitious B.P. and C.F.P. enterprise known as Abu Dhabi Marine Areas, Ltd. This company has for some years been exploring a large offshore area, centred on the coastal town of Abu Dhabi, to locate the presence of oil; and some two years ago it was decided to acquire a marine drilling rig of American design. This formidable piece of equipment, weighing altogether 5,250 tons, was built in Germany under the supervision of American and British engineers and towed to Das Island *via* the Suez Canal. The journey took 92 days, and the rig was finally moored in the specially constructed harbour on November 23.

The rig consists of a huge floating platform which carries the derrick and is equipped with power houses, air-conditioned living quarters and a helicopter deck. It is supported by four caisson legs which are thrust down to the bed of the sea by means of DeLong hydraulic jacks. When firm contact is established, further jacking raises the platform up the legs clear of the water.

When in the selected position the rig will be some 20 miles W.N.W. of Das Island, and communication with it will be maintained by boat and helicopter. The helicopters, Westland Widgeons, operated by Bristow Helicopters, Ltd., are based on Das Island. Air services between Das Island, Bahrain and Abu Dhabi are provided by Gulf Aviation, Ltd., using Herons and Doves.

Aerial view of Das Island showing the runway and hangar in the background, and in the foreground the harbour containing the rig a few days after its long journey from Europe. Beyond the harbour is the technical site comprising offices and workshops. The photograph was taken from the clear-vision window of a Gulf Aviation Dove cockpit.

"Flight" photograph

The English Electric P.1B prototype has two Kelvin Hughes high-speed pitots. The lower is standard and serves the pilot's instruments; the installation projecting from the intake centre-body serves test instrumentation.

Supersonic Pitots

Measuring Static Pressure with Accuracy

ONE of the prime instrumentation difficulties at very high speed is the accurate measurement of static pressure. The pitot/static head, which is used for "probing" the airflow and as a convenient point for measuring static pressure, has to project into the undisturbed "free-stream" air around the aircraft.

The distance to which the region of disturbed air extends from the parent body depends on the speed at which it is moving and its shape. This means that a particular pitot/static location on one 300 m.p.h. aeroplane may be far from the optimum on a different aircraft with the same performance, and quite useless on a high-speed aircraft. An example is the Mosquito, which had its pitot head mounted high up on the fin. On fast jet aeroplanes this position would normally be subject to very large errors.

Accurate measurement of static pressure is very much more difficult than the measurement of dynamic pressure. For example, during the computation of position-error on an airspeed indicator, by far the greater proportion of the final inaccuracy can be ascribed to the static-pressure circuit. As the region of disturbed air gradually extends farther out from the aircraft so must the pitot/static head be lengthened to reach the undisturbed air beyond it. This explains the very long pressure tubes—frequently as much as 10ft—carried by modern high-speed aircraft.

Airflow around an aircraft has more influence on the choice of location for the pitot/static head than any other one factor. On most aircraft of conventional plan-form the most suitable position for the pitot head is usually to be found either near the wing tips or on the nose of the fuselage. As a basic rule, the tip of the pressure head on high-speed aircraft should be about 25 per cent of the local chord ahead of the leading edge, to ensure that the static slots are in an area of undisturbed air. This is at best only a very general figure, and one which has to be modified for individual types of aircraft. More accurately, the distance of the pitot-head tip from the part of the aircraft to which it is attached is governed by the aircraft's limiting Mach number, the shape of the local surfaces, and the angle of sweep of the wing.

Numerous instruments rely on an accurate knowledge of static pressure for their functioning. As all pilots know, the static pressure is usually obtained by cutting narrow slots all around the side of the casing of the dynamic tube, so that the pressure in the casing equals the undisturbed outside air pressure. A false static pressure could be obtained if some or all of these slots were in disturbed air, for the recorded pressure would then be higher or lower than the true value.

In designing a pitot/static head some of the adverse effects experienced at high Mach numbers by the airframe are encountered with equal or greater severity by the pressure head. For example, although the tube may be well out in the undisturbed air ahead of the main structure, as the aircraft approaches Mach 1 the pitot/static head will build up its own private shock wave. This shock and its associated discontinuity can have an appreciable effect on the static pressure, but one way of overcoming its influence is to decrease the outside diameter of the casing and increase the distance of the static slots from the nose of the pitot head. On a pressure head the effect of a shock wave extends for a distance equal to a given number of casing-diameters from the nose; the actual figure is related to the Mach number. If the diameter is reduced, it follows that the length of tube affected by the shock wave decreases.

As some part of the tube will be affected by turbulence, a number of slots leading to the static air chamber are cut along the length of the casing. This means that, whatever the speed, some static slots will always be in a region of smooth airflow and the pressure head will never give a completely false static reading over the critical speed range (which, in any case, is normally very limited).

A compromise must always be accepted in the choice of the diameter and length of the pitot/static head, for these two dimensions are directly related. As the length increases, so must the diameter also increase to maintain stiffness in the tube. A thin tube may be the aerodynamic ideal, but at high speed it might begin to flutter—probably more severely than the part of the airframe carrying it—and could well suffer major damage as a result.

Another reason why pitot heads have to be larger in diameter than the ideal is that the higher an aircraft goes the greater is the heat required to warm the pressure head. This naturally calls for the use of bigger heaters. Until a few years ago it was thought that icing of the pitot head was unlikely to occur above 35,000ft but recent experience has shown that fine ice crystals present in the air up to at least 45,000ft are liable to affect its functioning.

Very high speeds would seem to call for a modification to the shape of the entry end of the pitot head. Tests so far show that very little is gained, and some useful attributes lost, by changing the familiar spherical end of the tube for a more pointed one. One of the more obvious problems associated with a really sharp-lipped, pointed head is that it is very difficult to de-ice.

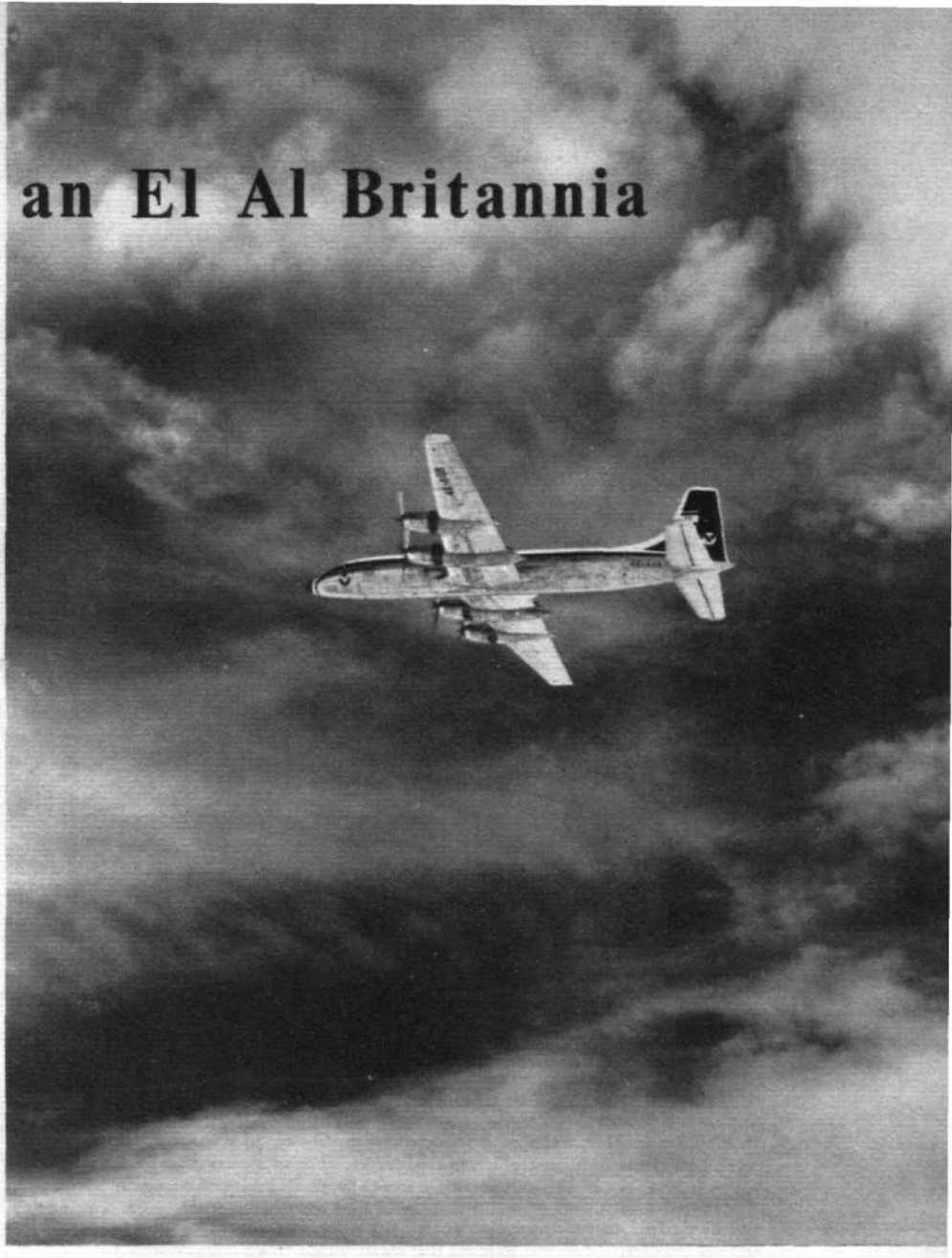
S.A.C.

The play of light and reflection endows the photograph above with an almost mystical quality. It is, in fact, the camera's view of a KC-97/B-47 refuelling operation, with the pilot of the B-47 seen actually closing in on the boom. The picture is wonderfully symbolic of the global operations of the U.S.A.F.'s Strategic Air Command (S.A.C.); and the smaller views—showing navigation satchels being picked up and a crew running to their aircraft—are evocative of the security measures and alertness which are so characteristic of the mighty Command which of late has been so often in the world's headlines.

6,000 Miles in an El Al Britannia

Impressions of a Fifteen-hour 400 m.p.h. Record Flight from New York to Tel-Aviv

By J. M. RAMSDEN



JUST before Christmas the Israeli airline El Al played an overture to the inauguration of their transatlantic Britannia services by flying non-stop from the U.S.A. to Israel. The author of this article, a member of the staff of "Flight," was on board. He describes the journey, and gives his impressions of how the first foreign operator of Britannias is settling down with its new aircraft.

THE headlines in the *Jerusalem Post* of December 20 said that our Britannia had smashed 16 world records. I am not quite sure what they all were, but of two things I am certain. First, that by flying the 6,100 miles from New York to Tel-Aviv non-stop in a time of 14 hr 57 min, we had flown farther, and faster, than any other commercial airliner. Second, we had convincingly demonstrated that the Britannia is not just a long-range turboprop according to the brochure. I might add that our flight was more than an "anyone-could-do-it" operation with full tanks and a tailwind: as I hope to show, El Al know how to get the best out of the Britannia.

We had some difficulty at New York with the refuelling. No matter how hard the El Al engineers tried, they couldn't get full tanks. New York's Avtur had an unusually high specific gravity; had the bowser been capable of delivering at a high enough pressure we might have achieved full tankage. (Compared with London's 50 lb/sq in pressure, at New York we got only about 35.) As it was, having first drained the tanks and then made careful estimates of fuel mass by measuring its s.g. and temperature, we took off 275 Imp gal short of the Britannia's 8,547 Imp gal maximum usable. For this reason it was decided to remove all but one row of the six-abreast tourist seats, saving about 2,000 lb (and converting the aeroplane—as someone remarked during the trip—into a long-range ballroom).

We passengers sat in the 18 first-class seats at the back end. I asked whether we made any difference to the trim, remembering how on a B.O.A.C. Britannia 102 trip last year our hefty captain's retirement aft for dinner had cost us 4 kt. But it was reckoned to make no difference on this aeroplane, notwithstanding the critical nature of our flight, and we were certainly very comfortable in our berths and slumberette seats. There were 25 people on board, made up of two flight crews (totalling ten); three technicians from Bristol and D.H. Propellers; three journalists besides myself (representing the *Manchester Guardian*, *Time* and the Israeli Press); Mr. J. E. D. Williams, an Englishman who is in charge of El Al's planning and development; Mr. Yoel Palgi, El Al's deputy managing director; and seven others. Our commander was El Al's chief pilot, Capt. Zwi Tohar, a wartime R.A.F. Bomber Command pilot (Wellingtons) who has been flying the Atlantic for El Al since the airline was formed in 1948.

The idea was to get up high quickly and to cruise as high as possible without running into the Britannia's V_{no} of 250 kt. Ideally, for maximum range, we should have cruised at the speed for minimum drag, i.e. at maximum L/D, drifting up in a cruise-climb as we burnt off fuel weight. But this idealized method of getting the most out of a turbine aeroplane is no longer permitted for traffic control reasons, so we made the most of the stepped-climb procedure. We took off at 0630 G.M.T. (Zee, as the Americans call it), and climbed fast, levelling out at our first selected cruising level of 25,000ft, an odd-number quadrantal height since we were flying eastwards. Our take-off weight was 161,000 lb, considerably less than the new approved gross of 180,000 lb for the Britannia 310-series.

Soon after take-off the stewardess switched off the cabin lights, since it was long past our American sleeping time. I arranged to talk to "Jed" Williams and to Mr. Palgi in the morning. It was the phrase "in the morning" which more than anything measured the length of the journey ahead. In the next 15 hours we were to have a night's sleep, breakfast, lunch, and dinner—and we would still have three hours to go before arriving overhead at Lod Airport, Tel-Aviv. People had been in commercial airliners for 15 hr and more, of course, but they had not covered the distance—6,100 st. miles—we intended to travel in that time.

The Bristol representative winced slightly at the way the *Manchester Guardian* heaved himself into his berth, explaining with mocking reproof on behalf of his stress office that steps were provided for this operation. Those of us in sleeperettes were probably just as comfortable as the lucky four in berths, with our 53in of fully-reclined pitch and our woollen El Al rugs. Those in the normal 42in pitch first-class seats slept soundly, though I think the I.A.T.A. surcharge for a sleeperette will be found to be worth $50. Cost of a berth is $75, and providing one has the privacy of curtains I think this is worth the money too. The soporific hum of the Proteus and the confining effect of the lowered berths made our cabin very cosy.

Before finally settling off I strolled up front. The duty crew, in their grey gold-braided uniforms, were intent and pre-occupied. The jetstream forecast by New York met. could not be found, though we had changed course twice. "Jed" Williams, who had had a hard day at the airport, was comparing his radio- and pressure-altimeters and keeping watch on the outside temperature gauge, trying to get wind of the elusive jetstream by the rapid tell-tale changes in pressure and temperature. He reckoned that the forecast stream we were seeking had changed direction from northwesterly to north, and a cross-check with a weather-ship tended to confirm this. Unless we found a tailwind soon, it was touch and go whether we would make Tel-Aviv non-stop.

When we were awakened for breakfast at 11.30 G.M.T. by the stewardess (looking remarkably neat and uncreased after her night in a tourist chair) it was daylight, the sun having risen fast to meet our flight into the dawn. We were now on the third step of our cruise, at 29,000ft. Up front, the crew were more optimistic

Typical of a proving flight is the scene (left) in the 72-seat tourist cabin during the flight to New York. (Right) the 18-seat first class cabin; four berths fold into the roof.

6,000 MILES IN AN EL AL BRITANNIA . . .

of our chances. We had found a 90 kt tailwind component for about two hours during the night, and were now being steadily puffed along by a wind component of 30 to 40 kt. In an hour or two we should receive London's six-hourly European met. forecast, and the moment of decision—to press on to Tel-Aviv, or to refuel at Rome—would come somewhere over France. For the time being, gallons-gone *versus* distance-to-go looked promising, and at 13.10 we began to ascend our next 2,000ft step to 31,000ft. The captain flicked us up on his S.E.P.2 autopilot, maintaining the A.S.I. to within 5 kt of the new (lower) target speed which, according to El Al's cruising charts, apparently worked out at 205 kt for the particular weight, height and outside temperature conditions prevailing.

The point at which one starts the next step is, I was told, very critical: a couple of knots too soon or too late, as the A.S.I. creeps up with decreasing weight at constant height, and quite a serious effect on economy results. The actual technique of the climb is also very critical: El Al have tried many methods, including just simply allowing the aircraft's momentum to carry it up. But as the nose went up the speed dropped and drag increased, and this was tried only twice in proving flights. Techniques are, of course, still being refined and streamlined, and a large document known as the Green Book, which contains cruising tables, charts and recommended practices for all routes and conditions, constitutes El Al's operational bible. El Al have worked all this out for themselves in the course of paper operations going back to September 1955, and in proving flights since last September when their first aircraft was delivered. I was allowed to look at the Green Book, but not to make notes from it. My impression of this document was that it appeared to be an exceedingly workmanlike effort to get the most out of the Britannia, its two fundamental precepts being to extract the most value from every pound of fuel, and to make things as simple as possible for the crew. "Seventeen years as a practising navigator," remarked Jed Williams, "have tended to make me avoid fancy techniques, however good they may be in theory." They had no "prima donnas or special wizards" in El Al.

Full realization of the detail of El Al's performance work dawned on me when I noticed in the Green Book detailed Britannia charts for the 200-mile London-Paris sector. At least three different operational techniques were considered, the conclusion being that block time and fuel consumed were much of a muchness, the approach techniques being likely to waste more money than this or that kind of cruise.

For the record flight to Tel-Aviv 11 rows of tourist seats were removed, as shown here, because full pressure-refuelled tankage could not be obtained at New York.

I asked about the extent of Bristol's support, and whether it was not unusual for an airline—particularly one as small as El Al—to be expected to do so much basic performance work. It *was* unusual, I gathered, but Bristol had provided them with a Tel-Aviv-based performance engineer, and had very quickly learnt that a theoretical cruising grid, say, was not always sufficient in airline practice. Of the rest of Bristol's technical support, I was later told by Mr. Palgi that it has been "of the highest possible order."

I asked why El Al's scheduled London-New York times were faster than B.O.A.C.'s (10 hr 50 min westbound, compared with 12 hr, and 8 hr 30 min eastbound, compared with 9 hr 50 min). I never really got a conclusive answer to "that loaded question," as a Bristol representative described it, so I expect that the truth lies somewhere between a little optimism on one side and a little cautiousness on the other. I know that both airlines have been out to break the Atlantic "four-minute-mile"—New York-London in eight hours—and El Al actually got within three minutes of it on a proving flight on December 7. But a good deal of nonsense has been spoken and written about the transatlantic Britannia rivalry between El Al and B.O.A.C. It has been said that the Israeli airline was all-out to beat the British Corporation in the introduction of transatlantic Britannia services. This is not so, though it may have appeared to be so. A storm in a teacup was caused by a $3,400 full-page El Al advertisement in the *Herald Tribune* of December 6. (The president of Aeronaves de Mexico, whose Britannia 302s were at that time due into New York on December 16, was so impressed that he asked to reproduce it at Aeronaves' expense in Mexico City newspapers.) The advertisement showed a photograph of the sea, with the heading: "Starting December 23 the Atlantic Will Be 20 Per Cent Smaller," and the caption: "Watch for the inauguration of the first jet-prop service across the Atlantic, introducing the Bristol Britannia."

At this time B.O.A.C. had stated that their Britannia services

El Al carry one stewardess and three stewards on Britannia services. Until now El Al have not offered first-class service, but they are learning very quickly about the scale of the competition in this kind of business, and are offering a high standard of service.

would start "within the first three months of 1958," though the Corporation were unofficially aiming for December 19. (*Flight*, November 29.) B.O.A.C. then *officially* announced that their inaugural service would be on December 19. Brig-Gen. E. Ben-Arzi, managing director of El Al, is reported to have said when asked that no one in Israel felt anything but pleasure that B.O.A.C. should be first on to the Atlantic with Britannias.

The vigour and drive of El Al's advertising and public relations in New York is impressive. No opportunity is lost to get the Britannia "jet-prop" (never once did I hear mention of the word turboprop) into the newspapers. I even heard America's "Mr. Television," Milton Berle, getting "the folks to give it a big hand." El Al's view is that Americans don't buy things, they're sold them—and 60 per cent of El Al's traffic originates in the U.S.A. I incidentally learnt quite a lot about American-style public relations during a morning in El Al's New York office. The airline's reaction to a scurrilously inaccurate Britannia story in an influential popular magazine was not protest and a demand for correction: instead they took the view that the fault was partly their own, and they set about getting a new and different story into the magazine. When the U.S. press rang El Al they always seemed to be given full information, which isn't easy when head office is 6,000 miles away.

By 1600 hr the sun was fast receding behind us, and we were flying into the dusk. We were over Marseilles, and crossed-fingers were the reply received by someone who asked whether we were going to make it. One moment I looked down at Marseilles in daylight; when I looked out a moment later it was dark. The Proteus engines, humming imperturbably after ten hours, had merged into the blackness, their bulk intermittently illumined by our flashing roof-top beacon. The altimeter showed 33,500ft, the odd 500ft indicating that we were now flying European airways. We started our climb to 35,500ft—a comparatively slow ascent to our final cruising level. This was jet height, unlikely to be reached by payload-laden Britannias in service. But temperature, as much as weight, determines cruising level: it was −65 deg C outside, and we stayed at 35,500ft for the next four hours until it was time to descend. It might conceivably have been worth climbing to 37,500ft, but by 20.15 G.M.T., when our speed and weight were ready for the next 2,000ft step, it was time to chop the throttles for the descent to Tel-Aviv.

"FLIGHT" PHOTOGRAPHS BY THE AUTHOR

Just before darkness I talked with Mr. Yoel Palgi, El Al's deputy managing director. Like his managing director, Brig-Gen. Ben-Arzi, Mr. Palgi wears a permanent, genial smile. He became a legendary figure during the war as a Resistance leader in the Balkans; his understanding of the air transport business is apparently also something of a legend.

I began by asking him why, with El Al's Lockheed affiliations, and his country's associations with wealthy Jewish interests in America, they had chosen the Britannia. Because it was, in their opinion, the best technical product available, he replied. Did he think the Britannia would hold its own against the big jets?

Ten hours out from New York, with another five to go before reaching Tel-Aviv. El Al's Britannias have a flight crew of five, and the airline has "definitely decided" on the need for a full-time flight engineer.

"For a while," he said, "perhaps until 1963." Opinions differed within El Al, but his view was that in order to maintain the market-penetration which he hoped would be achieved by the Britannia, they might have to think about jets in about 1963. El Al, he explained, had no ambitions to be anything more than a minor Atlantic carrier, but they hoped to double their share of the traffic—from its present 1.3 per cent (7,900 passengers in 1956) to 2.7 per cent—with their Britannias.

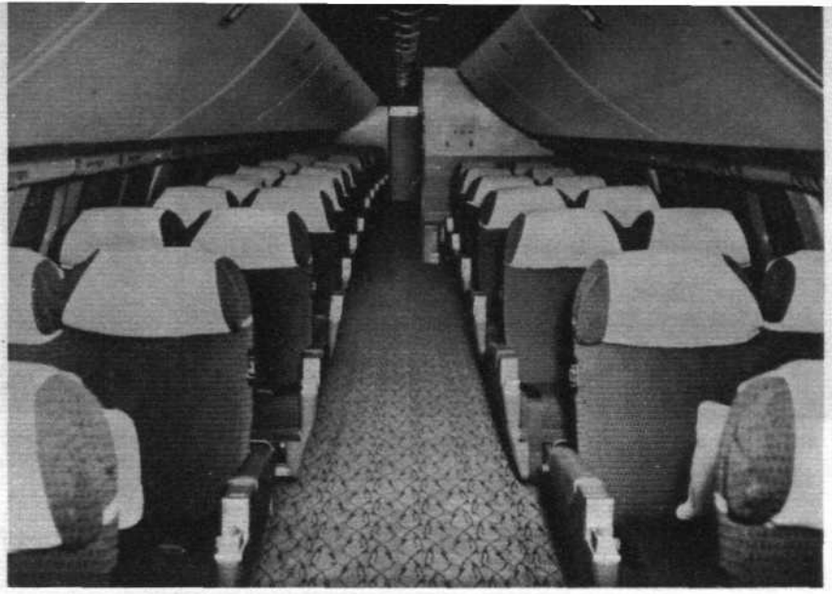
I knew that, alone among Atlantic competitors, El Al have always concentrated on tourists, at least since 1952, ignoring altogether the first-class business. I asked Mr. Palgi why this was so, hoping he would go on to comment on El Al's future policy as to I.A.T.A.'s thrift-class fares, due to come into force on April 1. The U.S.-Israel traffic potential, he explained, has not been great enough to justify different classes of service, nor had El Al the right aircraft (four early-model Constellation 049s), the frequencies or the advertising budgets to offer different classes of service. Though El Al had fifth-freedom rights at London, Paris, Rome and Athens, about 80 per cent of their traffic was carried between New York and Tel-Aviv. "People tend to think of us as a way of getting to and from Israel and America: they don't normally think of us as a transatlantic carrier with European terminals." Hence the neglect hitherto of first-class business, though with Britannias they now had an opportunity to promote it. He pointed out that transatlantic traffic between Europe and America had doubled in five years: traffic between Israel and America had increased by only a half in the same time. El Al now had a chance to carry the public they had been losing, though the first-class passenger was "the most unfaithful kind of public imaginable." You had to catch him, "and you can't catch him without competitive service, and the right frequencies. Now we have a chance." The Britannia would concentrate on the Atlantic route, and the 049s would do the European sectors for a while. Their resale value would probably be small, he admitted.

What had El Al's policy been within I.A.T.A. towards thrift-class fares? He smiled broadly at this question, and I imagined that El Al had made a determined stand on their policy. "In principle, we are flat out for thrift-class fares," he said, but El Al had to consider them in their own specific interests. Thrift fares as proposed in I.A.T.A. were between the European gateways and America; and El Al did not have the capacity to offer tourist-class

(*Concluded on page 18, after double page of Britannia pictures*)

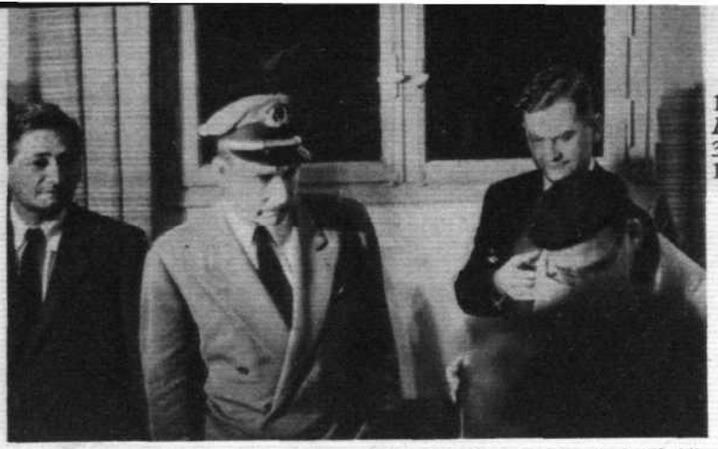
Early-morning scene at the arrivals area of New York's new international terminal at Idlewild. We hope to describe this remarkable new terminal in an early issue. El Al's Britannias will be in and out of New York at a once-weekly frequency for the time being.

GLOBAL BRITANNIAS



LAST month Britannia 312s and 313s were introduced on to the North Atlantic, Britannia 302s on to the New York - Mexico service, and an epoch-making non-stop flight was made by El Al from New York to Tel-Aviv.

These photographs record Britannia activities in the closing days of December 1957: B.O.A.C.'s Britannia G-AOVC, about to start the first transatlantic service by a British aircraft, is seen standing alongside the statue of Alcock and Brown —first to fly the Atlantic direct; above is the same aircraft taxying out to take-off and the seats and bunks of B.O.A.C.'s 52-seat de-luxe and first class interior. Below is El Al's 313 shortly before the Israeli airline's inaugural transatlantic flight on December 22-23 and on the left is Aeronaves de Mexico's second 302, which entered service on December 18. The following day a Britannia flew between Mexico City and New York in 5hr 20min—an hour and 20 minutes faster than the current scheduled time for other aircraft. Canadian Pacific will be the next airline to take delivery of Britannias.



Arrival scene at Lod Airport, Tel-Aviv, on December 20. Being interviewed on the right are, from left to right, Brig.-Gen. E. Ben-Arzi, El Al's managing director; Capt. Z. Tohar, chief pilot and captain for the record flight; and Mr. Yoel Palgi, deputy managing director.

6,000 MILES IN AN EL AL BRITANNIA (continued from page 15)

fares between Tel-Aviv and Europe, nor were they prepared to meet the time-consuming expense of a change to thrift seating and amenities at their European terminals. In other words, El Al wanted to offer thrift fares right through to Tel-Aviv. But I.A.T.A. resisted this as discriminating against the other Middle East carriers. El Al sought to offer tourist accommodation at thrift fares, their justification for this argument being that, alone among Atlantic operators, their tourist layout had six-abreast seats. They argued in terms of passenger volume, rather than T.34 passenger pitch, which they maintained does not fully define passenger comfort, since this depends on the design of the seat. In the end El Al won their point. They would offer tourist accommodation for thrift fares—and Britannia travel for good measure. My guess is that they will have a decisive competitive advantage. As generally agreed, free sandwiches and non-alcoholic drinks will be served to thrift-class travellers.

Mr. Palgi explained El Al's choice of American Hardman six-abreast tourist seats rather than British types. It was their conclusion that Hardman offered the most comfortable triple tourist chair. It cost "quite a lot of dollars," and it was heavier. He reckoned that the total weight penalty of installing American chairs in the Britannias amounted to 600 lb, but that this was worth it "for the remarkable difference in tourist-class comfort." I must say I had flown tourist by El Al Britannia to New York without complaint—an 11½ hr trip of which seven were spent sleeping without a stir. There are 12 tourist rows in all, set at 36in pitch on standard-track rails. Some chairs are upholstered in turquoise, others in grey with turquoise arms. The deep-pile aisle carpet is mushroom, the cabin walls are grey, and the linen window-curtains are patterned in greens and yellows.

The general effect is most pleasant, though, with great respect for El Al's taste, it was my personal opinion that the brown "wood-veneer" bulkheads didn't quite strike the right note. They present a real opportunity for what the Americans are calling jet-age décor, and providing an effect can be achieved which does not make the cabin too "busy," and which is serviceable, contemporary styling of the bulkheads would probably make all the difference to El Al's Britannias.

El Al have not yet finalized their first-class configuration, pending discussions with the A.R.B. about the quick-release mechanism of the two emergency exit doors at the extreme aft end. This is one of those matters which can, if the authorities insist that chairs must not be in front of exit doors (as they are in front of window exits), mean loss of revenue—and four first-class passengers without sleeping berths or sleeperette-type chairs.

I was particularly interested to learn how El Al had organized themselves for the introduction of their new aeroplane. This is a problem which many airlines are now having to tackle. El Al had to decide whether to create a new Britannia group, or to adapt their existing departments to handle Britannia development. They finally compromised, forming in September 1956 a "planning and development group" (under J. E. D. Williams) to handle operations and performance, adapting existing departments to handle comparatively straightforward matters such as training and spares. Though shortage of manpower is El Al's big problem (payroll is 1,300) this has its own advantages—the most important being "speed of communication." Major problems can be settled quickly without resort to ponderous administrative machinery: in the event, El Al's compromise has worked. Gradually, the planning and development group will be allowed to drift back into the existing administrative system.

I asked Capt. Tohar about training. I gathered that every pilot has about 160 Britannia hours before he carries passengers—15 hr conversion-flying and 30 hr flight familiarization at Tel-Aviv, followed by 75 hr of route-proving and a final 30 hr of check-flying. Expense of the first two items would have been cut had El Al had the Redifon Britannia simulator, but this is not due for delivery until June. Three captains were trained at Bristol, including Capt. Tom Jones, the British flight superintendent. Of El Al's 16 captains, all are Israeli except for three Americans and Capt. Tom Jones. (The airline has no particular policy about the nationality of its staff.) About 120 Israeli engineers have taken aircraft or engine courses (or both) at the Bristol school, or at the new El Al school—"of which we are very proud"—at Tel-Aviv. The number of Bristol-trained instructors at the airline's school has varied between five and ten.

I paid a last visit to the flight deck just before the descent. Some of the crew had, I believe, been on continuous duty for 36 hours, but their jubilation was unconcealed. In progress, in fact, was a light-hearted dispute in Hebrew about the ownership of a banana. Incidentally, there had been no snags.

We had made it, with 4,500 lb fuel reserves intact—sufficient for another hour and ten minutes cruising. We had flown a distance of 6,100 miles in 14 hr 57 min, at an average speed of 408 m.p.h. (of which about 50 m.p.h. was tailwind). At Lod Airport, as we taxied up to the waiting crowds, the floodlights and the cameras, I heard someone remark that El Al had done well for the Britannia.

RETURN OF B.M.W.

THE Bayerische Motorenwerke in München-Allach, whose B.M.W. engines powered many German aircraft in the Second World War, announced on December 18 that it had Government permission to build all types of aircraft engines again. At present the company's engine division has Defence Ministry contracts for maintaining foreign engines and constructing them under licence.

M. ROBERT ESNAULT-PELTERIE

IT is with regret we record that M. Robert Esnault-Pelterie, whose pioneer work and inventiveness had made him one of the outstanding figures in French aviation, died at Nice on December 6 at the age of 78.

He learned to fly in 1906, having two years earlier built a glider; and in 1907 he won the Grand Prix de la Société des Ingénieurs Civils for constructing an aircraft which was revolutionary in three aspects—a monoplane, with a radial engine mounted in the front.

Among other pioneer achievements by M. Esnault-Pelterie were his design of the first oleo-type undercarriage and the "stick" type of control column; setting-up in 1908 of the first aircraft factory and his interest in astronautics from as early as 1913.

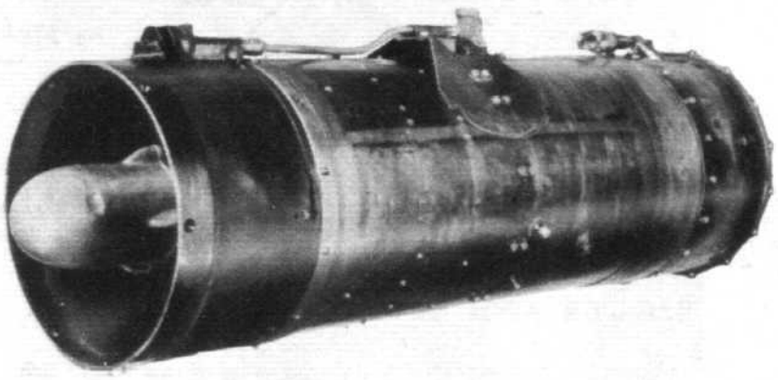
He was elected a member of the Academy of Sciences in 1936 and in recent years had lived in Switzerland. By sad chance, his death occurred before an exhibition at Le Bourget commemorating the fiftieth anniversary of the achievements of 1907.

E.P.9 FOR AFRICA

DELIVERY flight of the first Edgar Percival EP.9 to be supplied to Africa is being made by Beverley Snook. The aircraft, registered ZS-CHZ, was leaving Stapleford just after Christmas, and is being flown to Durban by way of Lyons, Marseilles, Cagliari, Tripoli, Marble Arch, Benghazi, Tobruk, Mersa Matruh, Cairo, Luxor, Wadi Halfar, Atbara, Khartoum, Malakal, Juba, Kisumu, Nairobi, Tabora, Mbeya, Kasana, Ndola, Salisbury, Bulawayo, Pietersburg and Johannesburg. Purchasers of the machine are Lush Products (Pty.), Ltd., a crop-spraying and top-dressing company based at Durban.

Demonstration flights are being made at various aerodromes *en route*. The aircraft is fitted with combined spraying and top-dressing equipment, and also with passenger seats.

The Rolls-Royce Soar, of rather more than 1,800 lb thrust, set entirely new standards of thrust/weight ratio when it appeared in 1953.



Dangers of Applying the "Square-Cube Law" in Forward Planning

By J. M. STEPHENSON

BIGGER AND BETTER TURBOJETS

IN the year 1873 the famous physicist, Hermann von Helmholtz, published an article on aerodynamics, entitled *A Theorem of Geometrically Similar Movements of Fluid Bodies, and its Application to the Problem of Steering Balloons.* In it he pointed out that aerodynamic forces vary with surface area, and weight (or buoyancy) with volume. The control problem of geometrically similar balloons thus becomes steadily more difficult with size, since forces increase more slowly than weight, according to the "square-cube" relation:

$$(\text{Force})^3 \propto (\text{Weight})^2$$

Helmholtz used similar reasoning to prove to his students that men would never be able to fly merely by flapping canvas wings with their arms; and he thus exploded an ambition older than mythology.

This point relating the size and flying ability of birds (along with many other applications of engineering to biology), was amplified by Professor W. D'A. Thompson of Cambridge in a classic treatise *On Growth and Form* (1917). The discussion therein of dynamic similarity is of remarkable interest to present-day engineers, whose only serious difficulty may be that many of the humorous asides are intended for gentlemen, i.e., are quoted in Latin or Greek.

The Ultra-light Gas Turbine. In the past few years the so-called square-cube law of the aforementioned scholars has been seized upon by many aeronautical engineers, and distorted to guarantee the pedigree of all manner of hobby-horses. It has been used to show that the Brabazon was too big, the Gnat too small and the Gyron too powerful. Perhaps the most novel deduction has been that future aircraft will use dozens and dozens of tiny jet engines, some pointing down for lift, some backwards for thrust—and presumably some sideways for control, and inwards for pressurizing. The latest entry in this class is from the Air League of the British Empire, whose proposed 1,500-knot Transatlantic Express has 70 engines and 44 passengers.

At about the same time, a large aero-engine manufacturer on the other side of the Atlantic displayed a wonderful confusion between dry engine weight (to which alone the square-cube rule can be claimed to apply) and fuel consumption, in an advertisement for small turboprops: "The 3/2 power principle . . . results in the well-known fact [*sic*] that propulsive efficiency increases with decreasing power-plant size, whether one studies insects, birds, or aircraft gas turbines."*

The vogue for the very small aircraft gas turbine was started about ten years ago, when Dr. Griffith of Rolls-Royce correctly pointed out that, so long as most parts of a turbojet engine could be exactly scaled down in dimensions, the ratio of thrust to weight would automatically improve. A cluster of small engines would thus be lighter than an original single engine.

For example, if a 10,000lb-thrust turbojet weighs 3,000 lb, exact scaling to 5,000 lb thrust by halving all the cross-sectional areas would yield an engine weighing only 1,060 lb. Two such engines would be nearly 900 lb lighter than the original, for the same thrust. The argument can be continued indefinitely: an even more shrunken engine yielding only 1,000 lb thrust would in theory weigh only 95 lb, so that ten little engines arranged in the wings of an aircraft like the Pipes of Pan (or clustered around the tail) would give the required 10,000 lb thrust with a weight saving of more than 2,000 lb (or ten passengers). The general effect is shown graphically in Fig. 1.

The apparent attraction of such arrangements has led some people to elevate the cluster principle almost to the status of that more famous square-cube law which is so much in the news now—Kepler's Third Law of Satellites, published in 1619:

$$(\text{Period})^2 \propto (\text{Distance})^3$$

(Or, for engineers, Period $= 84\ (1+h/4{,}000)^{3/2}$ minutes, where h is the average altitude in miles.)

The Limits. There are two physical reasons why the "square-cube law" of jet engines does not apply as simply as this. First, no complex piece of machinery can be scaled down indefinitely and still work. There is always an absolute minimum to the practicable thickness of sheet and strip, to the clearances that can be maintained between moving parts and to the accuracy of machining. As the dimensions of more and more parts fall to these limit values, an engine departs further and further from similarity as its size is reduced. The second limit of the "law" is that it does not apply directly to propeller gears, or to accessories. Many of the latter (for example, governors, igniters, thermocouples) are functional in nature, and already as small as they can be made.

For both these reasons, the similarity law departs from the square-cube line at the small sizes. The first attempt to breach these limits was made by Rolls-Royce with the series of engines which led up to the 1,860lb-thrust R.B. 82 Soar of 1953 (photo). In these engines, much use was made of welded sheet, and the bare minimum of accessories was fitted.

The Best Size. As a simplification it may be assumed that there is a minimum absolute weight (say, 200 lb) below which a reasonably efficient and controlled turbojet cannot be made, however small the thrust required. The data of Fig. 1 is replotted in Fig. 2 to show the *ratio* of weight to thrust; and when the lower weight limit is added, it appears that there is a best size for a light jet engine. In this example the minimum occurs at 2,000 lb thrust.

While Rolls-Royce were developing the Soar, many anxious calculations were made by the other manufacturers, and at Farn-

*"Aviation Week," September 9, 1957, p.161.

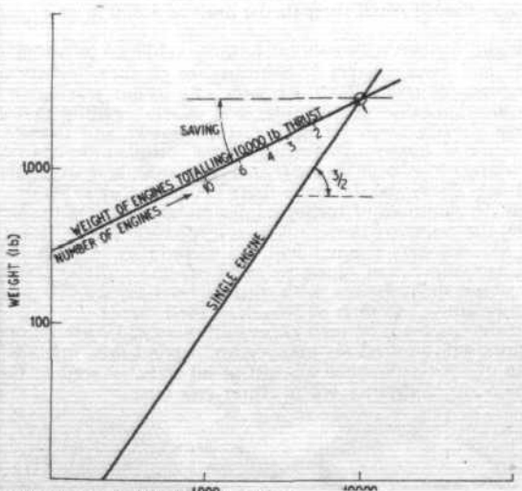


Fig. 1 (left). Theoretical weight-saving by using clusters.

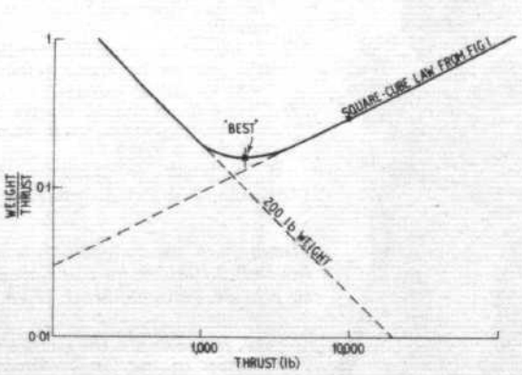


Fig. 2 (right). "Best" size by arbitrary weight limitation.

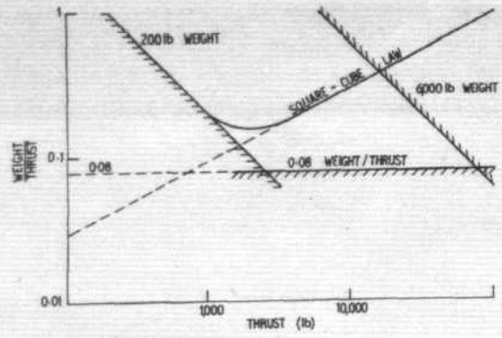


Fig. 3 (left). More limits.

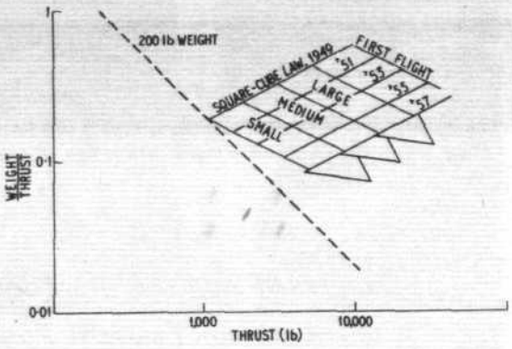


Fig. 4 (right). Direction of development.

BIGGER AND BETTER TURBOJETS . . .

borough,† to find out what is the true value of this "best" size. As one might perhaps expect, it always turned out to be the size the calculator had already decided to build, thus merely confirming that he was doing the best he knew how. Finally, when the Soar was made available for sale in the States, it became clear to everyone there that 2,000 lb thrust was just right, and no less than a dozen U.S. engine builders offered to develop such engines for the Air Force. So far, neither of the two engines which won this competition—Fairchild's J83 and General Electric's J85—has flown, and the market even for these is looking a lot thinner than it did four years ago.

Two other limit lines can be applied to the field of the "square-cube law." First, an upper limit can be set to the weight of a single turbojet that any aircraft builder may be willing to use. This line is drawn in Fig. 3 as 6,000 lb, though the exact value is not important. Next: whatever the optimists may believe, there must be an absolute limit somewhere to the improvement that can be squeezed from the turbojet formula. In Fig. 3 an again arbitrary value of 0.08 is shown as the lowest weight/thrust ratio that will ever be attained. The square-cube line has now been considerably hedged in, and we pass to the most important factor of all: time.

The Time Factor. The usual development of a successful series of engines follows a ten-year course, with the first flight made after 3 years, acceptance for production aircraft after 5 years, and the first flight of a growth version (with up to 50 per cent more power) after 6 years. Major technical development of a given series normally ends after ten years, and most attempts to prolong development life beyond this have not succeeded. Of course, production may continue for very much longer.

The important point to note here is that development of an engine normally involves increases in both power and weight, but with the power increasing twice as rapidly as the weight. (The physical reason for this is that it is much easier to "beef up" parts that fail, than to pare down all those that don't.) Thus, a broad front of development can be drawn, as in Fig. 4, to cover the fields generally thought of as Large, Medium, and Small turbojets.

Across this front, "square-cube law" lines can be drawn, representing the state of the art at any given time, and showing, incidentally, the improvements in weight/thrust ratio that can be achieved by down-scaling an engine. On Fig. 4, such lines are drawn for the years 1949, 1951, 1953, 1955, 1957—on which engines made their first flights. All British turbojets built during the past ten years fit these lines quite closely; others are mostly about two years behind.

Turbojets of the Future. A discussion of the kind presented here is not of much interest unless it yields some positive predictions. In a very interesting article on the difficulties surrounding technical prediction (*Flight*, March 15 and 29, 1957), Mr. A. V. Cleaver gave would-be prophets a three-part warning:—

(1) "It is highly dangerous to make negative predictions," especially in describing ideas as "wholly visionary," or "of no commercial value."
(2) "Long-term journalistic predictions" frequently turn out to be more reliable than those of "soberly skilled experts."
(3) "Allowances should always be made for . . . new developments, even when these cannot be foreseen in detail."

It is hard to disagree with these propositions in general, but they do not provide much help. The fallacy in the second is that for every "journalistic" prediction which turns out to be nearly correct hundreds of quite different results have been foretold by forgotten scribblers. Mr. Cleaver quoted with glee the undue caution of Nevil Shute and others: he might have included a paragraph written by a man who is frequently hailed today as the father of science-journalism and future-writing. Listen to H. G. Wells in 1902 on the "coming invention of flying":—

> "I do not think it at all probable that aeronautics will ever come into play as a serious modification of transport and communication. . . . Man is not, for example, an albatross, but a land biped, with a considerable disposition to being made sick and giddy by unusual motions."

It appears to the present writer, however, that any dangers facing prophets today are more likely to be those of over-optimism and complacency. Every schoolchild knows for sure that in a few years' time he will travel to work by flying armchair, there to converse in binary notation. Spare weekends will be spent on gay round-trip cruises to Proxima Centauri. Few people are anxious now to point out the limitations to our capabilities, for, as Mr. Cleaver emphasized, this is the least rewarding task.

Like Man himself, all of our creations have their phases of early growth, maturity and saturation—when they are replaced by the next most promising device. A plot of the classic growth curve to a logarithmic scale (Fig. 5) shows the period of exponential growth very strongly, and it is this line which is generally extrapolated to indicate the direction of progress. But attempts to predict the saturation limits for any one type of device are always desirable, if only to show what kind of new developments will be of most value.

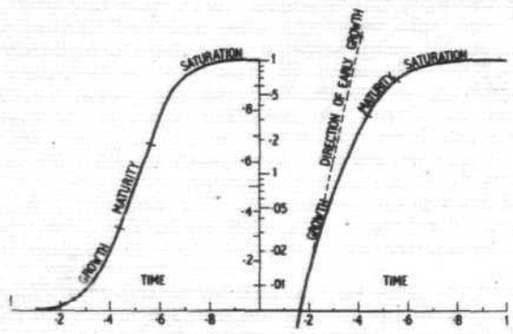


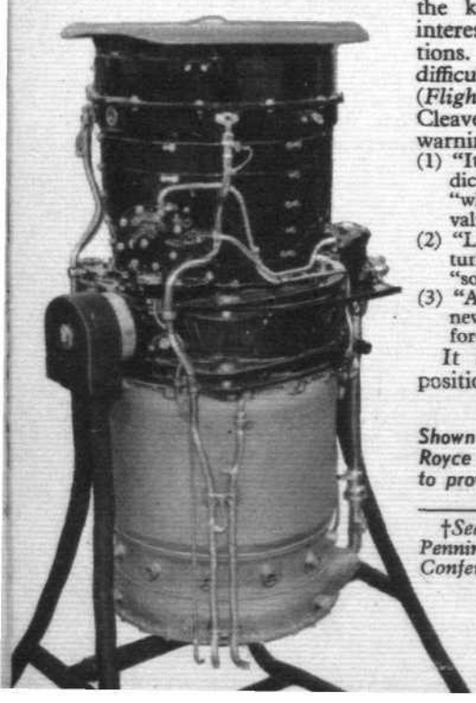
Fig. 5a. Linear scale of progress. Fig. 5b. Logarithmic scale.

With this justification, some forecasts are set down about the development of turbojet engines. Future State of the Art lines can be drawn on Fig. 4, and subjected to limits such as those shown in Fig. 3. The following conclusions appear:—

(1) The "square-cube law" relating engine thrust and weight applies only to a given State of the Art, and takes no account of progress in design techniques. It always over-estimates the saving in weight obtained by clustering engines.
(2) Present-day *small* turbojet engines are certainly very light, but neither their development potential nor long-term market are substantial. They should reach their thrust limit of 4,000 lb in a year or two.

The best weight/thrust ratios ever likely to be achieved in turbojet engines will be not from clusters of beercan-size engines, but from large single engines of 50,000 lb thrust, which fly in ten years' time. If this proposition appears unacceptable, it is worth recalling that a similar situation already holds for both piston engines and ramjets.

(3) The present series of *Large* turbojets will soon complete its course, with engines around 35,000 lb thrust (sea-level static), and weighing close to 6,000 lb. These should make their first flight in 1959.
(4) The long-term development of turbopets lies chiefly in the direction now pointed by the unrelated series: Viper, Orpheus, Gyron Junior. These future *Medium*-size engines will use techniques of both the present-day *Large* and *Small* types, to yield, by the middle 1960s, the ultimate series of turbojets with thrust between 20,000 and 50,000 lb, and weighing less than one-tenth of their thrust.
(5) Though active development of such super-turbojets will cease before 1970, the engines will be used for many years beyond this, for take-off and landing of rocket-powered aircraft of all sizes, as well as for the more prosaic job of driving VTOL inter-city buses.



Shown here as an exhibition model, the Rolls-Royce R.B.108 can be trunnion-mounted and used to provide vertical thrust. Five are in the S.C.1.

†*See, for example, the lecture presented by Alan Pennington to the Anglo-American Aeronautical Conference in 1951.*

SYDNEY'S RADAR DEFENCE SYSTEM

A Potent Combination of Australian Personnel and American Equipment

(Above) The plotters marking information received on the screen. They work on the reverse side, writing backwards with great rapidity. (Below) The reporting room. Information is fed in via cathode-ray tubes and relayed to the plotters working on the transparent screen. The plotters' results are also displayed in the control room (below, right), where fighter controllers are seen carrying out an interception on a P.P.I. tube.

DOMINATING the heights above the Sydney suburb of Manley are two massive 30ft structures supporting the search aerials of the R.A.A.F. No. 1 Control and Reporting Unit. Costing £A1m, this new station is entrusted with the protection of the Sydney Harbour district, and the combination of American radar equipment and Australian personnel appears to be more than equal to the task.

Illustrated at the top of the page is the AN/FPS-6 30ft-diameter height finder, which is brought to bear when an aircraft has been picked up by the other aerial, a 40ft AN/FPS-3A search unit, which rotates through 360 deg. The system can pinpoint aircraft flying supersonically at over 50,000ft.

Information collected by the aerials is displayed on P.P.I. tubes in the reporting room and interpreted by recorders who radio-phone all the information they gather to plotters at the other end of the room. The plotters collate this information and write the results on a large Plexiglas screen representing the defended area.

Their work is duplicated by radio-phone on a similar screen in the control room next door where the fighter control staff, with the complete tactical picture in front of them, direct operations accordingly.

To test the system, a force of Canberras from Queensland recently tried for one day to attack Sydney. Not one of them, it is reported, succeeded in penetrating the screen. Every bomber was identified, tracked and successfully intercepted by fighter squadrons operating from instructions received from the station, though the attack was directed and executed by R.A.A.F. officers with considerable experience of wartime flying operations.

The Brookvale radar station is commanded by S/L. F. J. Boorman, who received special training in the use of the new equipment in the U.S.A. Many of his staff also received training in America or Great Britain; but the station is now completely self-sufficient, and conducts its own training courses in the practical and theoretical sides of radar defence. This system is complemented by the extensive airfield development programme referred to in *Flight* of December 20.

CAYLEY CENTENARY

Tribute to a Pioneer: Capt. Laurence Pritchard's Lecture to the Royal Society of Arts

TO mark the centenary of the death of the great aeronautical pioneer Sir George Cayley—on December 18, 1857—an address was given to the Royal Society of Arts on the corresponding date last month by Capt. J. Laurence Pritchard, C.B.E., F.R.Ae.S., secretary of the R.Ae.S. from 1925 to 1951.

The lecturer began by describing Sir George Cayley's background and early career. The Cayley family were of Norman stock and after the Conquest received large grants of land in Norfolk: they settled in Yorkshire some 500 years later. Sir George was born in Scarborough. His educational tutors were George Walker and George C. Morgan, the former a leading mathematician and the latter a lecturer on science and mechanics. From these men he received not only a sound grounding in their own subjects, but also a knowledge of politics and other subjects which were to stand him in very good stead.

In the latter part of the 18th and the first half of the 19th centuries a number of local philosophical societies were formed for the exchange of ideas and information on scientific subjects. Cayley grew up in that atmosphere and made many famous friends in the scientific and engineering world. He himself founded two scientific societies, and of one—the Yorkshire Philosophical Society—he became vice-president. This was the mother society of the British Association, of which Cayley also became vice-president.

Before he was 25 Cayley had begun to take a lively interest in the problems of flight, but he had already learnt the lesson that one of the best ways of encouraging interest in any branch of science was to form a society where men could talk and publish papers. He made three unsuccessful attempts to form one. But he was not deterred, and when in 1832 he was elected M.P. for Scarborough, he had the idea, during one of his many visits to London, of forming the Polytechnic Institution in Regent Street. Its objects were to provide facilities for research in, and teaching of, engineering and science, and to draw the attention of the public to discoveries in both fields.

Mechanical Ingenuity

When he was only 19 Cayley inherited his father's estates, which he found to be in poor shape. Much of the land was flooded, but he began a drainage system which was so successful that he was 25 years ahead of his neighbours in the growing of crops on land which was once covered with coarse grass and rushes. Work on these flooded lands brought him to design and patent the forerunner of the caterpillar tractor. He also patented another invention of a different character. In his notebook he wrote:—

> In thinking how to construct the lightest possible wheel for aerial navigation cars, an entirely new mode of manufacturing . . . occurred to me, *vide* to do away with wooden spokes altogether and refer the whole firmness of the wheel to the strength of the rim only, by the intervention of tight strong cording.

Cayley always recognized the importance of power, and the hot air engine was a hobby of his for over 40 years. He became an associate of the Institution of Civil Engineers, where the subject was often discussed. James Stirling, in a lecture at the Institute, reported the use in the Dundee Foundry Works of an engine invented by Cayley which had been "raising 700,000ft-lb/min."

In the same year as that in which Cayley first showed his interest in the hot air engine he gave a description in his notebook, under the date November 22, 1807, of a gunpowder explosion engine. It was designed to fulfil the need for a "simple and light first mover on a small scale for the purposes of some preparatory experiments in aerial navigation." This model was very ingenious. It was in effect an internal combustion engine, a measured amount of gunpowder providing the pressure to move the piston and a powerful bow spring returning it ready for the next explosion. Two connected stopcocks corresponded to the modern inlet and outlet valve. The outlet cock, to release the compressed air, closed automatically as the inlet cock opened to deliver the gunpowder.

Later Cayley suggested the use of hydrogen or carburetted hydrogen gas as a fuel, "for," he said, "a much cheaper engine of this sort might be produced by a gas light apparatus and by firing the inflammable air generated with a due proportion of common air." He also suggested the use of oil of tar as fuel. He was the first, in fact, to consider an internal combustion engine for aerial purposes and might have gone some way in developing it if he had not, like so many others, concentrated on the expansive power of hot air.

It was not until about 30 years ago, when J. E. Hodgson discovered Cayley's "aeronautical and miscellaneous notebook," that his work was fully appreciated. On the inner cover of the notebook appeared the words, "You, to whom it may concern when I have gone, may find the seeds of thought in these screwls, G.C." The notes covered a wide range of subjects including agriculture, mechanics, astronomy, bird and mechanical flight, aerodynamic research, ballistics, electricity and magnetism, strength of materials and so on.

In his famous paper on aerial navigation Cayley laid down for the first time the basis of heavier-than-air flight. In it he discussed the fixed-wing machine. He drew attention to the importance of lightness, particularly with regard to the engine; he also discussed the problems of longitudinal and lateral stability, and ways of ensuring both. He was well aware of centre-of-pressure movement, and its effects at different angles of the wing to the airstream. His notebook revealed the care he took to obtain the data quoted in his paper. In it he noted, among other things, the weights of various birds, the areas of their wings, the weight of their pectoral muscles, and their speeds, as a guide to the conclusions he was drawing. "I am apt to think," he wrote, "that the more concave the wing, to a certain extent, the more it gives support, and that for slow flights a long thin wing is necessary, whereas for short quick flights a short broad wing is better adapted."

Early Gliding Experiments

Under the date December 1, 1804, he described the experiments he made with a whirling arm apparatus of his own construction to gauge the pressure on a surface moving at an angle through the air at a known speed. He was well aware of the mistakes he might make and tried to allow for them. He made a model and a full-size glider to test his results. The model, which he tested down a steep hill, had an adjustable tailplane and a movable centre of gravity.

The large glider was tested years later. "The coachman went in the machine," related Mrs. Thompson, Cayley's granddaughter, "and landed on the West side (across the slope at Brompton Hall) at about the same level. The coachman got himself clear and when the watchers had got across he shouted, 'Please, Sir George, I wish to give notice. I was hired to drive, not to fly.' "

While his paper was being prepared, Capt. Pritchard commented, "the first convertiplane" was announced. In an article published in the *Mechanics Magazine* for April 8, 1843, Cayley described and illustrated the construction of a machine which was, in fact, the first convertiplane. He observed:—

> Aerial navigation by mechanical means alone must depend upon surfaces moving with considerable velocity through the air. . . . To be of ordinary use, they must be capable of landing at any place where there is space to receive them and of ascending from that point. They should also be capable of remaining stationary, or nearly so, in the air, when required. Very great power, in proportion, to the weight of the engine, is necessary to answer these, or indeed, any of the purposes of aerial navigation by mechanical means alone.

Studies for Airships

Cayley wrote a number of papers on dirigible airships. He believed that the bigger they were the more efficient they would be, and that they should be streamlined to lessen their resistance. He also stated the importance of guarding against the external pressure on the surface when the airship was flying.

In one of his papers, written in 1816, he proposed an airship with a lift of 163,000 lb, driven by steam. It was to have a length of 432ft, and he suggested a double skin for the recovery by condensation of water converted into steam. He estimated structural weight at 41,000 lb, and allowed 60 tons for engine, fuel, cargo, crew and passengers. Speed was to be 20 m.p.h. with fuel and water for 48 hours. Still-air range was estimated at 960 miles, carrying 50 persons.

Capt. Pritchard concluded his lecture with an extract from a letter Cayley wrote in December 1817, to Lord Stanhope, who had been expressing the view, shared by many people, that when the aeroplane came it might bring more evil than good. One hundred and forty years ago last month Cayley wrote:—

> I should agree with you, my Lord, in thinking that aerial navigation should be well considered in its results to human society before it be introduced. . . . Navigation had its attendant evils which were balanced by a greater good. . . . Navigation certainly produced the invasion of the country by Cæsar, by the Saxons, and by the Normans; these events were evils to those who bore them. But to these very things we owe our civilization, our love of liberty, and our urbanity of manners. But for navigation we might have this day been naked savages with painted limbs and dwelling in huts. . . . A new and more extended power commensurate with the still further state of civilization, in my view of the case, presents itself. . . . Our business seems to me to be to put the practicability to the test, and never to hesitate as to the result.

CORRESPONDENCE

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

The Airliner Pilot's Outlook

IN reply to Mr. O. W. Neumark's letter in *Flight* for December 13, in which he asks why I did not comment [article, "The View Ahead," *Flight*, November 8] on bubble canopies for civil transports, may I give some of the objections to their use?

Although a bubble canopy provides nearly the optimum visibility it is not really compatible with good flight-deck design. Even with Mr. Neumark's interesting proposals for reflecting instrument readings from the window and a contiguous panel below it, each pilot would find difficulty in monitoring the other's instruments and actions, and also in communicating unless wearing a headset. However, the eventual introduction of simplified controls and a reduction in the number of instruments might make the bubble canopy acceptable for civil aviation.

Of course, one is tempted to be very pessimistic and suggest that with cruising speeds of 500 kt and a "VFR" forward visibility of 5 n.m. even an "open" cockpit would be of little use from the anti-collision point of view.

The civil pilot has enough to do when looking after his own aircraft, and therefore I cannot entirely agree with the implication of Mr. Neumark's first paragraph that the responsibility for anti-collision watch rests with the pilot. If it is given the right equipment A.T.C. must be made primarily responsible for separation, which would leave the pilot only with the responsibility for keeping watch for those aircraft which are "unknown" and represent an agreed and, therefore, an acceptable level of A.T.C. error.

I must agree with Mr. Neumark that it is difficult to see how an aircraft's instantaneous accelerations relative to a ground aiming point can be converted into a dot on the window which will show the projection of the aircraft's trajectory relative to the horizon. All one can suggest is that if there is a need for such a device, if there is room for it and if its cost is not unrealistic, then someone will soon find a way to provide it.

London, N.W.2. L. F. E. COOMBS.

Flying on One Eye

I SHOULD like to comment on the remarks of your correspondent Mr. K. Tudor (*Flight*, December 6) regarding the number of eyes needed for safe driving and flying. I have been deprived of binocular vision for 37 of my 43 years but have found no difficulty in landing either powered or motorless aircraft; most of my cars have been fast, and I have had a no-claim bonus for 22 years, together with one or two modest successes in motoring competition.

Mr. Tudor is evidently a victim of the widely held fallacy that stereoscopic vision plays an important part in flying an aeroplane. Obviously it would be needed for the interpretation of a 3-D instrument presentation system, and conceivably for close-formation aerobatics; but in the normal flying of a light aircraft, two eyes are no better than one—at least so far as judgment is concerned. If the bad eye is totally u/s, the field of vision will be restricted laterally, but a person thus afflicted tends to develop head movements which largely compensate. He may also be temporarily blinded by an irritant affecting the serviceable eye, but binocular people will agree that the vision of both eyes is usually impaired, often totally, when this occurs.

Returning to the question of stereo vision, we need consider only the act of landing, since nothing else in ordinary flying can be held to call for depth perception. The eyes are a rangefinder with a base of about three inches; when landing a light aircraft, the gaze is (or should be) concentrated about 100 yards ahead, which is over 1,000 base-lengths away from one's personal distance-measuring system and hence far outside its accurate coverage. In any case, it is not the accurate judgment of *distance* that is important in touching down, so much as the appreciation of the *aspect* of the ground with respect to the aircraft.

People with normal vision are apt to assess the monocular person's handicap simply by blocking one eye and observing how flat everything looks. In doing so they forget the part played by "translation parallax," or the judgment of the relative positions of objects by their apparent relative motion when one's head moves. We all use this subconsciously, and a person losing an eye soon develops the faculty to a high degree. During the war I knew a pilot having only one operative eye, from whose duties it was clear that many shared my admiration of his outstanding skill and judgment. While sharing, in turn, Mr. Tudor's instincts for self-preservation, I was happier being flown by this man than by most pilots regardless of how many eyes they used. There must have been many like him since flying began, including, I believe, a certain Mr. Wiley Post.

In motoring, the importance of stereo vision is inversely proportional to the speed of the vehicle. It is essential to the rallyist when creeping between a pair of posts in a width-judging contest, but the racing driver has little opportunity to use it. Putting it another way, while I may well be able to take a corner or land an aircraft as competently as Mr. Tudor, he would undoubtedly be better than me at judging the contents of a glass viewed from above, and might register greater emotion at an anaglyphic view of Miss M. Monroe; stereo-pairs of photographs, which exaggerate depth, would be a joy to him while falling flat for me. These exercises involve short-range depth-perception, and the only aerial manœuvre one can think of which might really need that faculty is a literal belly-landing.

All power, then, to one-eyed persons who aspire to fly light aeroplanes, and to their sponsors like Mr. Conry. In case I succumb to the urge again myself, and am faced with the persistent ignorance and prejudice of officialdom in the matter, and even with the fatuities of Mr. Tudor, I sign myself

Great Bookham, Surrey. CYCLOPS 2.

Old Bore's Almanack for 1958

JANUARY: New American ground-to-sea ballistic missile announced by sober-faced U.S. Navy commander who tells world that recent alleged failures of ballistic missiles were really successful firings of new weapon. Reported that completion of first stage of new Gatwick Airport will be on time, and will help to relieve summertime traffic congestion at London airport. B.E.A. keep suspicious silence.

FEBRUARY: British jet engine maker claims his new silencer is so successful that it is impossible to tell by simply listening whether jets are running. C.A.A. says this is dangerous and refuses to certificate new long-range American airliners fitted with the device. British firm institutes crash programme to make its engines noisy. Daily newspaper says that abolition of Fighter Command is overdue.

MARCH: Sonic bangs on South Coast spark off flood of rumours about Fairey Delta making another attempt on the world air speed record. First flight for Fleet Street journalists in the Fairey Rotodyne, but only stories about Peter Twiss's absence from that aircraft appear. Russians announce VTO version of the Rossiya. Newspaper says end of Fighter Command is imminent.

APRIL: B.E.A.'s summertime schedules do not mention Gatwick. Rumours of Fairey Delta's record attempt persist. Details of new version of British ICBM given—it will have a pilot, be carried by V-bombers and called a stand-off bomb. Newspaper forecasts end of Fighter Command, but does not say when.

MAY: First Boeing 707 for B.O.A.C. flies many months ahead of schedule and arrives over London airport (helped by a tailwind) with too much fuel aboard to land. Pilot asked to stack awhile. Grey-haired Fairey P.R.O. admitted to nursing home. New orders for French Caravelle announced and French industry demands that the Paris Air Show should be held annually. Newspaper forecasts end of Fighter Command "shortly."

JUNE: Captain of B.O.A.C.'s first 707 reminds London Control, tersely, that he has stacked over Epsom for three weeks. Control surprised, and contracts let for extending London airport runways. Fairey's present two F.D.2s to Science Museum. Fairey P.R.O. discharged from nursing home. Newspaper says Fighter Command will soon have no fighters, only missiles.

JULY: Extension to one runway at London airport completed and B.O.A.C.'s first 707 lands. It uses only 1,000-yard extension. British jet-engine manufacturer jubilant, because nobody heard the engines and its thrust-reversal gear contributed to the short landing run. Newspaper says world speed record by P.1 will be Fighter Command's last fling before it is issued with missiles.

AUGUST: Russian trade delegation flown from London to Prestwick in DC-7C and S.B.A.C. condemns this "almost certifiable bungling." First details of next month's Farnborough Show reveals that sonic bangs will be allowed only on private days and that guided-missile manufacturer has offered to fly a missile at the show. Newspaper reports final decision about future of Fighter Command will be made soon.

SEPTEMBER: New ejector seat for Fleet Air Arm announced. It can be used in the air, on the water, under the water and when the aircraft is entangled in a crash-barrier. Farnborough Show opens and S.B.A.C. has to refuse "with regret" the offer to fly a missile in public. Newspaper publishes supplement about Fighter Command, but makes no mention of its impending doom.

OCTOBER: English Electric P.R.O. joins lesser-known Fleet Street journal and writes a feature on why the P.1 cannot attempt speed record. Is fired by editor for inaccuracy. First B.E.A. aircraft lands at Gatwick. Newspaper says that missile development

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is lagging and the Government is considering reviving Fighter Command.

NOVEMBER: Fog closes London and Gatwick airports simultaneously for five days. Russians launch horse-carrying Sputnik. United States offers to deliver ICBMs to NATO in "about a year." New overseas orders for Hunters makes total of these aircraft exported exceed total number delivered to R.A.F. Newspaper reports that 20 aerodromes are to be refurbished to accommodate Fighter Command for a couple of years while missiles are developed.

DECEMBER: Four British aircraft companies merge and make a massive take-over bid for the rest of the industry. Monopolies Commission holds special meeting. Newspaper says that British missiles now ring Fighter Command aerodromes and that a new drive for fighter pilots is to be started because recruiting fell seriously during the year, owing to reports that Fighter Command was to be abolished. Christmas Day falls on Thursday.

London, W.C.2. CRYSTAL BALL.

Seeker After Truth

UNTIL now, I have always been successful in concealing my age from your December 20 correspondent Father Clinton (my Bristol spies tell me he is 61), but here I have to confess that I am 48¾: if that is "comparatively young" to him, he should try explaining it sympathetically to my girl friends. But seriously, if "Pop" Clinton had any idea how the present-day historian is bombarded by an ever-increasing farrago of bogus claims ("my grandfather flew long before the Wrights"—he probably rode a broomstick with grandma), hair-splitting nonsense ("he may not have flown properly, but he *did* leave the ground"—yes, when careering downhill on a linen-covered bedstead and was airborne when he hit a boulder), and erring memories (an acquaintance of Blériot's once challenged my statement that the type XI had wing-warping), etc., he would, I am sure, have some sympathy with my light-hearted use of the word "spoof" when yet another crimson herring is towed across the sky. And as for the Russians, who now claim they invented *everything*, well——. Believe me, most of us know well enough when we are treading dangerous ground, and then we are cautious and even humble in our search for facts.

It was easy enough for Henry Ford to say at that 1919 trial that "history is bunk" (not, by the way, "*all* history"), but he never tried writing it, and was never involved in threading his way through claims, half-truths, and such things as family pride, as we constantly are. I was recently dealing with one dear old gentleman of 61 or more years, who asserted that his brother flew before the Wrights, until I produced an article by his brother saying the opposite. And what about those wicked characters at Bristol who used to call a certain aircraft the "Bristol Box-kite," when it conspicuously lacked the one and only feature of a box-kite that makes a kite into a box-kite? That's the sort of trouble we have all the time.

London, W.1. CHARLES H. GIBBS-SMITH.

History in Catalogues

THE letter from "Historian" (November 8) regarding the Humber aeroplane catalogue is extremely interesting and makes one wonder how many similar links with the pioneering days of British flying are still in existence.

The Humber catalogue from which your correspondent quotes must have been published in 1910, for it describes the aeroplanes this company presented at the 1910 Aero Show at Olympia. Of the three monoplanes exhibited, one was designed by M. Le Blon and another by Capt. Lovelace.

Although I have no earlier example, I have a catalogue issued at about the same time by A. V. Roe and Co. of Brownsfield Mills, Manchester. It is entitled *The Aviator's Storehouse* and includes a reproduction of a page from the January 29, 1910, issue of *Flight* portraying Mr. (now Sir) A. V. Roe as one of the pioneers of flight.

The catalogue gives the flying ground as Brooklands and, although the company's telegraphic address is the same as it is today, the telephone number, in those days, was Manchester Central 698. The latest machine described is the triplane with triplane tail, the machine which did quite well at Wembley Park in 1909. The "write-up" maintains that "The control is very novel and simple; all the planes can be tilted, and the mainplanes warped in addition—the importance of this cannot be over-estimated." The price for this aeroplane was £400 when fitted with a 20 h.p. Avro motor to £600 with a 35 h.p. Green engine. Terms: Half the price with order, one-quarter on delivery, the remaining quarter to be paid "when we show a five-mile flight, and have given instructions in flying. Carriage and packing extra."

Also offered for sale is the adjustable-pitch Avro propeller—from 6ft diameter, two blades, for 11 gns to 10ft diameter, four blades, for 30 gns. And one could have purchased a 20 h.p. Avro motor for £100, or a 40 h.p. model for £200.

There is, however, a mystery concerning one of the aircraft described in this catalogue. There is a two-view drawing of an Avro monoplane which is very similar to the early Antoinette, but I have never discovered any photograph or other evidence of this machine. Can any of your readers interested in the history of aviation (and there must be many hundreds) confirm, or otherwise, that this monoplane was, in fact, constructed?

Another catalogue in my collection was issued by L. Blériot, of Paris and London, the "latest aeroplane offered being the No. XI.2bis—the 'Big Bat'."

Your correspondent would spend a very interesting afternoon if he called on the librarian of the Royal Aeronautical Society, the custodians of most of the historical literature on aviation in this country.

Hounslow, Middx. H. COWLEY.

The Sopwith Schneider

I HAVE been much interested in reading J. M. Bruce's four-part article on "The Sopwith Tabloid, Schneider and Baby" in your issues of November 8-29.

There was one particular operation which the small Schneider seaplane carried out in the 1916-17 era and which I am sure could not have been done by any other type at that time. As this has not been mentioned, I feel you may be interested to hear of it.

During the "Zeppelin" seasons at Great Yarmouth one Schneider seaplane was hoisted on to the well-deck of the trawler *Kingfisher*. We then steamed out to Smith's Knoll and cruised around for three or four days in the hope of sighting Zeppelins approaching the coast. For some time the late Vincent Nichol and I shared this duty, and as neither of us were particularly good "trawler sailors," we did not look forward to it a bit.

Nichol was fortunate (?) in that he *did* sight a Zeppelin late one evening. He was hoisted overboard and wound his Monosoupape engine until he practically fainted—but without avail. I never sighted an airship at all, but I did manage eventually to hoist out and get off a lumpy sea one morning to fly back to Great Yarmouth.

The machines we had at that time must have been among the very first Schneiders. They had warping wings and were generally pleasant to fly but were distinctly tricky to take off or put down on anything but a completely flat sea.

Harry Hawker came down to Yarmouth to test-fly the first one or two, and I remember the remark of my then C.O. (Commander de Courcey Ireland) as a new Schneider arrived at the station on a lorry: He said: "Here comes my ***** coffin." He was a great man and always insisted on flying everything new. He was killed shortly afterwards at Kingsnorth in the B.E.2C-*cum*-Blimp experiment.

Hayes, Middx. C. H. CHICHESTER SMITH.

FORTHCOMING EVENTS

Jan. 4. British Interplanetary Society: "High Altitude Research During the International Geophysical Year," by Dr. R. F. L. Boyd.
Jan. 8. Kronfeld Club: "On the Yorkshire Gliding Club," with films by J. C. Riddell.
Jan. 8. British Institution of Radio Engineers: West Midlands Section: "Instrumentation of Space Vehicles," by N. R. Nicoll.
Jan. 8. British Institution of Radio Engineers: North Eastern Section: "The Earth Satellite Project," by P. H. Tanner, B.Sc.
Jan. 10. Helicopter Association: "Boost Systems for Helicopter Gas Turbines," by A. W. Morley, Ph.D., A.F.R.Ae.S.
Jan. 15. R.Ae.S.: Main Lecture at Leicester: "Rolls-Royce Engines," by A. A. Lombard, F.R.Ae.S.
Jan. 15. Kronfeld Club: Debate.
Jan. 17. Institute of Navigation: "Influence of Atmospheric Conditions on Radar Performance," by Dr. J. R. Saxton.
Jan. 21. R.Ae.S.: Section Lecture: "Environments and Environmental Testing," by P. J. Duncton, A.F.R.Ae.S., and T. F. R. George, A.F.R.Ae.S.
Jan. 22. Kronfeld Club: Film Show.
Jan. 23. R.Ae.S.: Guided Flight Section: "Guidance and Control," by L. H. Bedford.
Feb. 1. British Interplanetary Society: "Meteoric Hazards to Space Flight," by Dr. N. H. Langton, M.Sc., A.Inst.P.
Feb. 4. R.Ae.S.: Section Lecture: "Power Controls for Supersonic Aircraft," by G. Selwood, A.F.R.Ae.S.
Feb. 5. Kronfeld Club: "The Oxygen Story," by G. Melvill-Jones.

R.Ae.S. Lectures (to Jan. 10):—

Jan. 6, *Derby*, "Missile Guidance," by E. V. Truefitt; *Halton*, Film Show. Jan. 7, *London Airport*, "Airline Operational Flying," by Capt. W. Baillie; *Luton*, Junior Paper Evening. Jan. 8, *Bristol*, "Fail Safe Structures," by N. F. Harpur; *Brough*, "The Speed Record," by P. Twiss; *Gloucester*, "Design and Development of the Aeronautical Gas Turbine with Special Reference to the Rolls-Royce Dart," by L. Howarth; *Hatfield*, Social Evening; *Reading*, "Automatic Pilots," by N. Sullivan and F. A. Summerlin; *Southampton*, Annual General Meeting and Film Show; *Weybridge*, Brains Trust. Jan. 9, *Isle of Wight*, "Modern Tank Testing," by W. A. Crago. Jan. 10, *Preston*, Annual Dance.

Four of the senior R.A.F. officers who have received awards in the New Year Honours. From left to right, Acting Air Marshal E. C. Hudleston, Vice-Chief of the Air Staff (K.C.B.); A.V-M. A. W. B. McDonald, A.O.C-in-C. Technical Training Command (K.C.B.); Acting A.V-M. W. E. Oulton, S.A.S.O.-designate, Coastal Command (C.B.); and Air Chief Marshal Sir Donald Hardman, formerly Air Member for Supply and Organization (C.B.E.).

SERVICE AVIATION

Royal Air Forces and Naval Flying News

Honours and Promotions

WITH effect from January 1, Air Chief Marshal Sir Dermot Boyle, the C.A.S., has been promoted Marshal of the Royal Air Force; and in the New Year Honours over 200 officers and N.C.O.s of the R.A.F., R.A.F.O., R.A.F.V.R., R.A.A.F., W.R.A.F. and the R.A.F. Nursing Service have received honours and awards. A list of honours is published below; lists of awards, and of R.A.F. promotions (several of which affect those named in the Honours List), will be published later.

ORDER OF THE BATH

Knights Commanders: Acting Air Marshal E. C. Hudleston, C.B., C.B.E.; A.V-M. A. W. B. McDonald, C.B., A.F.C.

Companions: A.V-M. V. S. Bowling, C.B.E.; A.V-M. F. W. Felgate, C.B.E.; Rev. Canon A. S. Giles, C.B.E., M.A., Q.H.C.; A.V-M. J. F. Hobler, C.B.E.; A.V-M. F. E. Lipscomb, C.B.E., M.R.C.S., L.R.C.P., D.P.H., D.T.M. and H., Q.H.P.(Ret.); Acting A.V-M. E. C. Bates, C.B.E., A.F.C.; Acting A.V-M. W. E. Oulton, C.B.E., D.S.O., D.F.C.; Acting A. Cdre. H. J. Maguire, D.S.O., O.B.E.

ORDER OF THE BRITISH EMPIRE

Knight Grand Cross: Air Chief Marshal Sir Donald Hardman, K.C.B., O.B.E., D.F.C.

Knight Commanders: Air Marshal P. B. L. Potter, C.B.E., M.D., Ch.B., D.P.H., D.T.M. and H., Q.H.S.; Acting Air Marshal H. A. Constantine, C.B., C.B.E., D.S.O.

Commanders: A. Cdre. H. G. Blair; A. Cdre. C. T. Weir, D.F.C.; Acting A. Cdre. G. H. White, O.B.E., A.C.A.; G/C. R. H. C. Burwell, O.B.E., D.F.C., G/C. H. J. Hobbs; G/C. H. E. Hopkins, D.F.C., A.F.C.; G/C. D. H. Lee, D.F.C.; G/C. D. C. McKinley, D.F.C., A.F.C.; G/C. H. C. S. Pimblett, M.D., B.S., D.Obst.R.C.O.G.; G/C. P. R. Walker, D.S.O., D.F.C.; G/C. F. W. Wiseman-Clarke, M.B.E.

Officers: W/C. E. Baldwin, D.S.O., D.F.C., D.F.M.; W/C. A. D. Balmain, A.F.R.Ae.S.; W/C. D. Bower, M.B.E., A.F.C.; W/C. B. G. Dickinson; W/C. E. Donovan, D.F.C.; W/C. D. W. Edmonds, D.F.C., A.F.C.; W/C. F. J. French, D.F.C., A.F.C.; W/C. D. A. Green, D.S.O., D.F.C.; W/C. H. G. Hastings, A.F.C., A.F.M.; W/C. A. Hindley, A.F.C.; W/C. E. J. Penton-Voak, B.Sc.(Eng.), A.F.R.Ae.S.; W/C. N. A. Smith, M.B.E.(Ret.); Acting W/C. W. M. Cookson, M.B.E., M.I.Mun. and Cy.E.; Acting W/C. E. I. Elliott, R.A.F. Regt.; Acting W/C. A. G. Mason, R.A.F.V.R.; S/L. P. E. Lindsey-Halls; S/L. C. T. Lynas; S/L. W. L. Price, M.Sc., Dip.El., A.M.I.E.E.; S/L. W. Smith; S/L. S. Wandzilak, D.F.C., A.F.C.; Acting S/L. J. Ernsting, M.B., B.S., M.R.C.S., L.R.C.P.

Members: S/L. H. B. Alty; S/L. H. Ashman, B.Sc.; S/L. A. Barrell; S/L. F. G. Harley; S/L. R. S. Harries; S/L. V. T. Land; S/L. A. J. A. Wood; Acting S/L. L. S. W. Durston; Acting S/L. G. Gleave, R.A.F.V.R.; F/L. J. A. Cant; F/L. K. G. Flintoft; F/L. C. C. Harvey; F/L. P. R. Hetherington; F/L. H. T. W. Houghton; F/L. A. S. Jarvis, R.A.F. Regt.; F/L. S. H. Jenkins; F/L. A. B. McGuire, R.A.F. Regt.; F/L. G. M. McNeil, B.Sc.; F/L. D. H. J. Martin-Jones, M.A.; F/L. G. A. Morgan-Smith; F/L. R. F. Redding; F/L. L. A. Robertson (Ret.); F/L. W. M. Shevlin, R.A.F. Regt.; F/L. W. M. C. Skinner, R.A.F. Regt.; F/L. R. Smyth; F/L. G. Stringer; F/L. L. G. Tweddle; Acting F/L. G. Robertson, R.A.F.V.R.; W/O. A. S. Beebe; W/O. R. R. Bird; W/O. W. T. Bond; W/O. J. Brophy; W/O. A. J. Garnett; W/O. R. Hedley; W/O. G. E. Ingram; W/O. G. S. Jalland; W/O. N. C. Lee; W/O. G. J. Lord; W/O. L. Nicholson; W/O. W. H. Roberts; W/O. E. Smith; W/O. J. J. Tooley; M/Tech. G. L. Squire; Acting W/O. V. Pattison.

"Victorious" Commissioning

HAVING been rebuilt over the past seven years, and described by the Admiralty as "the world's most modern aircraft carrier," H.M.S. *Victorious* is to be recommissioned at Portsmouth on January 14 and will begin her sea trials in February.

Victorious, which will be the sixth modern aircraft carrier to join the Fleet since the war, is the first to be equipped with a fully angled flight deck and also has the latest type of mirror landing aids, steam catapults, high-speed aircraft lifts and radar. Her modernization—which has involved increasing her overall length by 35ft 6in—has been the largest job of its kind ever undertaken in a Royal or a commercial dockyard.

"Grapple" Command Change

FROM next April A.V-M. W. E. Oulton, who has been Commander of task force "Grapple" (the series of nuclear tests conducted from Christmas Island in the Pacific) is to be S.A.S.O. at H.Q., Coastal Command; his place as task force commander has been taken by A. Cdre. J. Grandy, with the acting rank of air vice-marshal.

A.V-M. Oulton was Director of Maritime Operations and Navigation at Air Ministry before going to Christmas Island. During the war, while commanding No. 58 Sqn.—with Halifaxes—in Coastal Command, he sank three U-boats in the Bay of Biscay in one day and for this was awarded the D.F.C. Later that year (1943) he set up and commanded the first Allied air base in the Azores, being subsequently awarded the D.S.O. As recorded above, he has been appointed C.B. in the New Year Honours.

A.V-M. Grandy recently completed the 1957 course at the Imperial Defence College and before that was Commandant of the C.F.E. He commanded No. 249 (Hurricane) Sqn. at North Weald early in the war and on a sortie during the Battle of Britain his aircraft was shot down. Later in the war, as a wing commander, he flew on several hazardous operations in Burma and was awarded the D.S.O.

Senior Postings

APPOINTED Director of Flight Safety at Air Ministry with the acting rank of air commodore, G/C. J. C. Millar succeeds A. Cdre. D. M. Somerville on the latter's retirement. Also announced is the appointment of G/C. H. W. Penney (as acting air commodore) to the post of S.A.S.O. at No. 41 Group, Maintenance Command, from February.

A. Cdre. Millar won the D.S.O. in March 1945 for two operations he carried out while commanding No. 178 (Liberator) Sqn. with the Mediterranean Allied Air Force; the first being a low-level mine-laying in Venice harbour and the second an attack on railway sidings at Graz, both pressed home despite heavy opposition. He was also thrice mentioned in despatches during the war, and his appointments since have included that of Chief Signals Officer at Bomber Command. Recently he completed the 1957 Imperial Defence College course.

G/C. Penney has been a Deputy Director of Equipment since January 1956 and prior to that he was on the staff of No. 40 Group. His other post-war appointments have included that of a Deputy Director of Organization at Air Ministry, Senior Equipment Staff Officer at F.E.A.F. headquarters and command of No. 25 M.U. in the U.K. He was made C.B.E. in 1951 and last year, in the Birthday Honours, a C.B.

High-level Supply-drop

IN what is believed to have been the highest air-supply operation ever carried out a Pembroke of the R.A.F.'s East African Communications Flight, based at Eastleigh, made two free drops from 16,000ft on December 18 and on Christmas Eve in support of the Nairobi Royal Technical College expedition which is on Mount Kenya studying its glaciers for I.G.Y. research. The Pembroke had previously been

In ten days' time—on January 14—No. 1 Squadron, Royal Rhodesian Air Force, is due to arrive at R.A.F. Khormaksar for a six weeks' attachment during which it will come under the operational command of the C-in-C. British Forces Arabian Peninsular, A.V-M. M. L. Heath. These photographs were taken during a recent visit to the squadron by the Governor-General of the Federation, the Earl of Dalhousie (third from the left in the group above). With him are G/C. A. M. Bentley, Acting A.O.C., R.R.A.F.; Mr. R. Malcomson, member of the N. Rhodesia Legislative Council; and Sir Roy Welensky, Prime Minister of the Federation. Above left, S/L. C. Paxton, C.O. of No. 1 Sqn., is strapped into his Vampire by S/Tech. R. Campion before taking off on a bombing exercise; and at the top, another of the squadron's Vampires starts up, during recent training.

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supplying the 14-man party near its base camp at 12,700ft with items such as solid and liquid rations, medical requisites, fuel, clothing, tents and mountaineering equipment; its December 24 drop consisted of a Christmas dinner for the expedition.

The technique has been to thrust the supplies out of the aircraft during low-speed runs at about 100ft above a marked dropping-zone. One special difficulty which the pilot, F/L. E. Meddings, has had to face is that strong northerly winds and the aftermath of the "short rains" usually create considerable turbulence, even in the lee of the mountain; and in addition the Pembroke is operating very near its ceiling.

Antarctic Maintenance

A REPORT from S/L. J. Lewis, C.O. of the R.A.F. detachment with the Trans-Antarctic Expedition, says that maintenance of the unit's Otter and Auster has been going "smoothly and normally" despite snow and wind and −70 deg temperatures. The two aircraft had already done 360 hr flying up to the time last month when the detachment began its main task of providing air support for the expedition's ground party during its four months' push across the South Pole and ice cap.

There has been no engine-starting trouble so far, thanks to the efficiency of the standard R.A.F. pre-heaters used; but the hazards of shifting winds which drive snow into every nook and cranny have had to be countered by packing placed in every aircraft aperture and only removed when flying is about to start. In the winter (at the time of our northern summer), when air and surface movement were alike impossible, an 8ft pit was dug into which the Otter was man-handled down a ramp until its wings were only 4ft above the surface. The Auster was simply picketed nose to wind and when the drifts around it rose to above 3ft it was moved by hand to a new site. The Otter's pit was dug out after every gale and the snow scattered to prevent new drifts.

Airframe and engine maintenance has been carried out by F/S. P. B. Weston and radio work by Sgt. E. Williams. A "snocat" vehicle's transit case has been adapted for use as a workshop, with a tent and other large cases; and a mobile refuelling rig evolved consisting of a pump mounted on a large wooden box on a sledge. From experience gained in Antarctic conditions, the pre-heater is used not only to warm up engines but also tools—to avoid cold burns—and hydraulic jacks, to prevent them freezing.

Recent Appointments

AMONG R.A.F. appointments recently announced by Air Ministry are the following:—

G/C.s H. H. S. Brown for duties as medical adviser to the Director of Aircraft Mechanical Engineering Equipment Research and Development; D. Lumgair to H.Q., 90 Group, for administrative staff duties; A. Muir to Air Ministry, for medical duties.

W/C.s J. Hamilton to Air Ministry, for duty in the Department of the Air Member for Supply and Organization; R. L. Scott to be Officer Commanding, R.A.F. Hospital, St. Athan.

S/L.s N. Storer to No. 7 School of Recruit Training, for administrative duties (with the acting rank of wing commander); D. R. Levinson to the Ministry of Supply (with the acting rank of wing commander).

Outstanding Sports Year

FOR R.A.F. and W.R.A.F. athletes 1957 proved an outstandingly successful year. At the R.A.F. athletics championships in July (during the heatwave) five new R.A.F. records and one new W.R.A.F. record were set up and an existing R.A.F. record equalled. When the R.A.F. won the Sefton Brancker Athletics Competition (*v.* Middlesex and the Civil Service) at Uxbridge later the same month it was their fourth success in five years and third consecutive victory. R.A.F. athletes also came first in the A.A.A. decathlon championship and in the 220 yd at the A.A.A. championships. Six R.A.F. and three W.R.A.F. records were set up during the year as a whole—by the R.A.F. in the 220 yd (21.7 sec), 440 yd (48.9 sec), 880 yd (1 min 53 sec), 440 yd hurdles (55 sec), long jump (23ft 2in) and javelin (207ft 2in); and by the W.R.A.F. in the discus (100ft 11in), 80 m hurdles (12.6 sec) and 440 yd (65 sec).

IN BRIEF

F/L. R. P. J. King, who is on U.S.A.F. exchange posting at Shaw A.F.B. in South Carolina after flying Swifts in 2nd T.A.F., recently became the first non-American pilot to fly the McDonnell Voodoo. He was formerly with No. 2 Squadron.

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Six Australian-built Canberras from No. 82 (Bomber) Wing of the R.A.A.F. took part in Air Week celebrations at Manila International Airport last month.

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Sir George Erskine has been appointed a member of the finance and general purposes committee of the R.A.F. Benevolent Fund and also elected to its council.

* * * * *

No. 72 (Basutoland) Squadron, based at R.A.F. Church Fenton and equipped with A. W. Meteor 12s and 14s, has been offered an alligator as a mascot by the Southport Zoological Society.

* * * * *

For the second year in succession R.C.A.F. drivers won the armed forces division of the Canadian national truck roadeo championships, held recently in Toronto. Cpl. H. Norden gained first place, L.A/C. T. Day was third and L.A/C. R. C. Shackleton runner-up, in competition with 50 other drivers.

Photographs of the first production Boeing 707 published on these pages last year recorded progress from the sub-assembly jigs to the flight line. Our first 707 picture of the New Year shows the machine airborne, taking off from Renton in a downpour. It was flown by "Tex" Johnston.

CIVIL AVIATION

VISCOUNT 810 AIRBORNE

ON Monday, December 23, the first Viscount 810/840 (Dart 525s) made its initial flight, from Brooklands airfield at Weybridge. The pilot was Capt. R. Rymer, and the aircraft was flown to the nearby airfield at Wisley for flight testing. It will be recalled that the airframe is similar to that of the Viscount 800, but has been strengthened in order to be adequate for the "400 m.p.h. Viscount" of 1960—the V.840 with Dart 541 powerplants.

The four Dart 525s installed in the V.810 are de-rated to 1,990 e.h.p. for take-off at sea level. The aircraft will have a cruising speed of 365 m.p.h. and an initial gross weight of 67,500 lb. The same airframe with Dart 541s (limited to 2,350 e.h.p. for s.l. take-off), the 840, will have an initial certification gross weight of 69,000 lb.

The first batch of the Viscount 810 series is destined for Continental Airlines, who will start V.812 services next spring. A four-seat lounge compartment aft of the main passenger cabin, in place of the normal freight compartment, is a feature of this version. The 812 also carries nose radar (provisioned as standard on 810s) and airsteps at the forward passenger door. Over forty-five 810s are on order; those for Lufthansa (9), South African Airways (7), P.I.A. (3), Cubana (4) and V.A.S.P. (5) will be delivered this year.

BOEING 707: FIRST FLIGHT . . .

COMFORTABLY within the target date of December 31, the first production Boeing 707 flew for the first time on December 20. The flight—five miles from the Boeing Transport Division factory at Renton Municipal Airport to Boeing field at Seattle—was a short one, made in pouring rain; the aircraft was airborne for seven minutes. It was flown by "Tex" Johnston, Boeing's chief of flight test (he flew the prototype 707 over three years ago in July 1954) with J. R. Gannett, senior Boeing 707 project test pilot as co-pilot and T. J. Layne as flight engineer. Tex Johnston said after landing that the first production 707 "comes up to all our expectations."

The aircraft will now be used for company flight tests and C.A.A. certification flying (see *Flight*, December 13). The second production 707 is nearing completion and will be rolled out early in the New Year. This aircraft will be finished in PanAm colours.

. . . AND MORE 720 SALES

WHEN, on November 22, United announced that they had placed an order for 11 Boeing 707-720s they ended many months of speculation about their medium-jet plans. Yet 11 aircraft did not represent the 40 per cent of the total United fleet that Mr. W. A. Patterson, the president of the airline, had been quoted as saying that he would purchase, particularly as at the time the -720 order was placed the airline also decided to increase their DC-8 order to 40.

On December 17, after signing the £14m contract for the first 11 aircraft, Mr. Patterson announced that United had plans to buy another 40 -720s, at a price of more than £1,280,000 each, to bring their medium-jet fleet to 51. They will be introduced on United's routes from 1960 "to meet a greatly increased market in 1965." Previously reticent about plans for short-range jets, United's president said that the airline was in the market for 40 additional aircraft, for ranges under 500 miles. They were not yet available, but might be turboprops. Questioned about this later, Mr. W. Allen, president of Boeing, said (referring presumably to the Boeing 727) that the company "has had under consideration for some time the announcement of a smaller jet, but it is only in the planning stage and depends upon the availability of a suitable powerplant."

The first flight of the Viscount 810/840 from Brooklands was another that was made in poor weather: notice the helices traced by the propeller tips. The only external difference between the 800 and 810/840 series is the horn-balanced rudder of the latter.

A VETERAN RETIRES

WHEN, on December 31, Mr. A. C. Campbell Orde relinquished his appointment as B.O.A.C.'s development director the Corporation lost an old friend, for he has been closely connected with it from its inception. During the war years he held a succession of responsible posts, and since 1946 he has been in charge of technical development—during a period which has covered the development of the Comet, the Britannia and the VC-10.

Mr. Campbell Orde has been actively engaged in British civil aviation since the earliest days of the London - Paris service in 1919 when he was a pilot with Air Transport and Travel; and he expects to continue his connection with the business in which he has spent almost 40 years.

NORTH ATLANTIC INAUGURALS

AT 10.30 a.m. on December 19, B.O.A.C.'s Britannia 312 G-AOVC left London Airport to inaugurate the first regular transatlantic service by a British aircraft, and the first turboprop service on the North Atlantic.

An incidental but no less important first was that, by a short head, the first transatlantic Britannia service was flown by a British airline. It would have been fitting indeed if (as had been hoped) a record could have been established on this crowning day of Britannia achievement; but strong headwinds were forecast and a circular northern route *via* Southern Greenland had to be flown. The flight was made at heights of up to 31,000ft at an I.A.S. of about 350 m.p.h., and the aircraft arrived at Idlewild international airport, New York, after an elapsed time for the crossing of 12 hr 44 min. The 3,750 st m were flown against an average headwind of 45 m.p.h.

Among the 40 passengers on board were Mr. Basil Smallpeice, managing director of B.O.A.C., and Mr. Gilbert Lee, general manager of B.O.A.C.'s western route. Mr. Smallpeice is quoted as saying that the Corporation's Britannia timetable was fixed as the result of a year's test and long experience with headwinds on the route, and that the aim was to guarantee the schedule at least four times out of five—a surprising remark in view of El Al's similar predictions for a tighter timetable.

On the same day that B.O.A.C. inaugurated their turboprop transatlantic service, an El Al Britannia was flown non-stop from New York to Tel-Aviv. It arrived at Lydda airport after flying 6,100 miles in 14 hr 57 min, at an average speed of about 408 m.p.h.—a flight for which the Israeli airline claimed 16 world records. Some impressions of this flight are given in an article "6,000 Miles in an El Al Britannia" on pages 13-18.

B.O.A.C. completed the inaugural round trip on December 21, with a return flight from New York to London in 8 hr 48 min. The

CIVIL AVIATION . . .

strong winds of two days before had slackened and although an average speed of 405 m.p.h. was achieved, and the flight arrived an hour earlier than scheduled, a record again eluded the Corporation.

To complete a rousing Britannia week, El Al's inaugural trans-atlantic service was flown on December 23. The Britannia left L.A.P. with 69 passengers on board at 11.53 p.m. on December 22 and arrived in New York eleven hours later at 10.55 a.m. G.M.T.

MEXICO'S SECOND BRITANNIA

THE second Britannia 302 for Aeronaves de Mexico S.A. was delivered to the airline on December 17, the day prior to the start of Britannia services between Mexico and New York. It was flown out by Mr. Godfrey Auty, deputy chief test pilot of Bristol Aircraft, with Capt. F. Lopez of Aeronaves as first officer; stops on the 5,600 st m route were made at Prestwick, Gander and Miami. This brings deliveries of Britannias up to 23 out of the 77 on order. Fifteen 100 series and three 312s have gone to B.O.A.C., all three 313s for El Al have been delivered and so now have the two 302s for Aeronaves. Two Britannia 305s of the five ordered by Northeast are almost complete, and the 114-odd modifications requested by C.A.B., including the strengthened undercarriage, have been incorporated. Bristol anticipate little trouble in obtaining the certification by April that Northeast have imposed as a condition of their postponed acceptance. The rôle of these aircraft during next summer is still not clear: it now seems unlikely that they will be used by B.O.A.C., but it seems reasonable to surmise that a Corporation subsidiary—who would not be faced with two "odd men out" in a Britannia fleet—might be glad of such additional capacity during the peak travel months.

POLAR IMPASSE

DEADLOCK and postponement of discussions were the only results from talks last month between the U.S. and French Governments on a polar route to the U.S. west coast for Air France. France has been trying to amend the 1946 air transport agreement between the two countries—which entitled the French flag carrier to serve only New York, Chicago, Boston, Washington and Houston—since PanAm and T.W.A. started "over the top" services to Paris. Talks were held in Paris in October, and in Washington in December, but no agreement could be reached. The French negotiators are to consult with their government and will try again to reconsider the viewpoints of the two nations during further discussions in January.

THE VANGUARD'S PROFIT POTENTIAL

IN facing sales competition from medium-range turbojet aircraft the manufacturers of turboprop airliners emphasize the importance of economic performance.

This is implicit in a financial evaluation of the Vanguard recently issued by Vickers, in which it is estimated that this aircraft's "profit potential . . . is as much as 35 per cent higher than that of any other comparable aircraft on offer today."

After converting the cost and revenue figures used in this study from American to British units, the following picture emerges: Total load is first established at 93 passengers and baggage, 400 lb of mail and 7,000 lb of freight, making a load equivalent to the maximum design payload of 27,000 lb. Average revenue rates for each class of traffic are then taken—5.1 pence per passenger mile, 51 pence per mail-ton-mile, and 26 pence per freight-ton-mile. Maximum possible revenue at 100 per cent load-factor is then established to be 48s per aircraft-mile. Direct costs are then calculated on the basis of the A.T.A. formula. The figure for total costs is found by adding on 100 per cent to cover overheads. The resulting total operating cost curve drops from 25s per aircraft-mile at 200 miles down to just below 21s at 2,000 miles.

Numerous variations can be played on this cost/revenue theme. It is possible to show profits of over 100 per cent on cost if a load-factor of 100 per cent is taken. When a passenger load-factor of 60 per cent is combined with a 100 per cent load-factor for freight (all freight capacity being utilized by loading about 11,000 lb of freight at an average density of 10 lb per cubic foot), profit margins are shown to vary between 50 per cent and 75 per cent of cost. From these figures it is concluded that the Vanguard is "mathematically the most economical and profitable aircraft in its class ever designed."

The crew of Britannia G-AOVC on the inaugural transatlantic turboprop service were Capt. John Meagher (right), Capt. Peter Sleight and Stewardess Phyllis Lamming. Other photographs of this occasion appear on p. 16 and 17.

Whether or not this is the case—and there is no reason to believe that this claim is not substantially true—it would be helpful to see profit evaluations based on more realistic assumptions. Cost rates and payloads cannot validly be questioned in the case of an aircraft not yet built. Revenue figures quoted are conservative in the light of existing rates, but seem a realistic assessment of rates prevailing in 1960. It is not on these figures but on choice of load-factor that the Vickers' estimates appear to err on the side of optimism. A load-factor of 100 per cent is ambitious. A freight load-factor of 100 per cent combined with a passenger load-factor of 60 per cent is only slightly less so, for there are few medium-haul routes on which regular loads of 56 passengers and 5½ tons of freight are simultaneously available. There is little resemblance between the flow of passenger traffic and freight traffic on the world's medium-haul routes. Not only does freight tend to move between different centres but freight also shows patterns of daily, weekly and seasonal variation quite unlike those for passenger traffic.

The major economic attraction of the Vanguard is surely not ability to carry heavy simultaneous loads of passengers and of freight, but operational flexibility in being immediately able to cater for whatever traffic is available, be it day or night, summer or winter.

LONDON—MOSCOW AGREEMENT

ON December 19, after a week of discussion, an agreement was signed in London by the United Kingdom and Russia for reciprocal services by Aeroflot and B.E.A. between London and Moscow, with a stop at Copenhagen. Signatories to the agreement were the Rt. Hon. David Ormsby-Gore, Minister of State for Foreign Affairs and Chief Marshal of Aviation P. F. Zhigarev. Marshal Zhigarev was assisted by Mr. Danilychev and Mr. Vereshchagin, and the M.T.C.A. received assistance both from the Foreign Office and B.E.A. advisers. A clause provides for termination of the agreement at six months' notice.

No date has been fixed for the opening of services; as we commented in a leading article last week many technical and commercial matters have to be settled and much must be done to explain and bring into line the operating procedures of the two airlines. But the agreement will come into effect when both countries "are satisfied that the conditions they consider necessary for safe, economic and acceptable operations exist. The matters requiring further study on both sides include aircraft performance and characteristics, navigational and airport facilities, details of routing required by either country, communications for exchange of meteorological and other necessary information, air traffic control systems and procedures and commercial arrangements between B.E.A. and Aeroflot."

While the Britannia was making turboprop headlines last week the first American turboprop airliner, the Electra, was embarking on flight tests. First delivery date remains at September 30 this year.

Becoming increasingly familiar on European routes is the Tu-104. Here is one, in the colours of Ceskoslovenské Aerolinie C.S.A., seen during a recent visit to Athens. It is being photographed by two U.S. Air Force officers.

The air services agreement is thus an agreement in principle, and first steps will be for both parties to investigate and satisfy themselves on a comprehensive range of technical matters; neither B.E.A. nor anyone else has really precise knowledge of Russia's civil aircraft or civil aviation facilities, and one immediate result of this agreement is that much interesting information should become generally available. An exchange of information will begin at once and a British technical mission will visit Moscow early in the New Year for an on-the-spot study. A similar Soviet mission will also visit the U.K.

One of the problems which was discussed during the talks was that of aircraft noise, and the agreement provides that if, as a result of tests, either country finds the noise level of the aircraft concerned to be excessive, suitable modification shall be made before it is introduced on to London - Moscow services. The M.T.C.A. intend to "set a firm lead for international practice" on acceptable standards of noise level at London Airport, and the Tu-104, as the first foreign jet likely to use London on regular services may have to be the noise-level guinea-pig. No noise-suppression devices have yet been seen on the Tu-104.

NORTHERN LIFELINE

THE 1957 report of MacRobertson-Miller Airlines, Ltd., is refreshingly different. No glossy pages will be found. Except on the outside cover, only two colours have been used throughout. This report is not trying to *impress* anybody. It is an appropriately straightforward explanation of the affairs of a small privately owned Australian airline, and of the world within which that airline functions.

For shareholders it has been a satisfactory year. Net profit was £A62,357, equivalent to a profit of 4.7 per cent on a gross revenue of £A1.3m. There must be few airlines showing such a comforting gap between revenue and expenditure. That this carrier's shares are an attractive proposition to investors is shown by an increase in the number of shareholders from 854 to 904.

The MacRobertson-Miller network stretches across Western Australia from Darwin in the north to Perth and Albany in the south. Realizing that the prospects of a local airline are basically dependent on the prosperity of its home territory, the management of M.M.A. employ their annual report to give readers a useful idea of the industrial and agricultural future of the area over which they operate.

CONTROL OF THE UPPER AIR

ON the first day of last month, the C.A.A. put into operation its air traffic system for the "Continental Control Area" of the U.S.A. above 24,000ft. Use will be compulsory only in restricted visibility conditions. Until now control above this height has been available only along the Federal airways and the new system represents a threefold increase in area coverage at high altitudes. Mr. James T. Pyle, Administrator of the C.A.A., said that this was an initial stage which would "serve to get one foot wet in the vast new ocean of the air . . . while we continue to train for a more comprehensive programme."

The next step is to lower the floor of the Continental Control Area to 15,000ft by next spring. By 1962 C.A.A. hope to be able to control all aircraft over the 3,000,000 square miles of the land mass of the U.S.A. The Administration's plans for coast-to-coast radar cover above 15,000ft should be complete later next year.

BREVITIES

QUEBECAIR has been admitted an associate member of I.A.T.A. The third Canadian member, the company brings the number of associate members to nine. There are now 61 airlines in the association.

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Eagle Airways opened a new office and terminal at 75 Deansgate, Manchester, on December 20.

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British Aviation Services have appointed Mr. W. E. Hogsflesh as general manager of the Hermes and Aquila Airways divisions of Britavia.

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The M.T.C.A., in Civil Aviation Information Circular 107/1957 *Instrument Rating Flight Tests*, announce that radio range fringe-flying is withdrawn from the requirements of the instrument-rating renewal tests. It remains, until further notice, a requirement of the initial test. In future, all tests on I.L.S. will be continued to a height of 250ft above aerodrome level.

The Canadian Department of Transport is installing new surveillance radar at Montreal, Toronto, Winnipeg and Vancouver.

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A Scottish Airlines' York crashed at Stansted, Essex, on December 23. The crew of four lost their lives.

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An application by B.E.A. for an inclusive-tour service between L.A.P. and Zurich between December 28, 1957, and March 2, 1958, has been approved by the A.T.A.C.

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Grumman are offering the Gulfstream for $700,000 (£250,000), exclusive of interior and equipment, with delivery in 1959. The first customer is said to be the Sinclair Refinery Co., and Grumman are reported to have 19 firm orders.

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The Bristol Aeroplane Company has concluded an agreement with Air Carrier Engine Service, Inc., to provide an engine overhaul and repair base at Miami. It will be open in 12 months' time and will cater for Proteus and other turbine engine overhauls in the U.S. and Caribbean areas.

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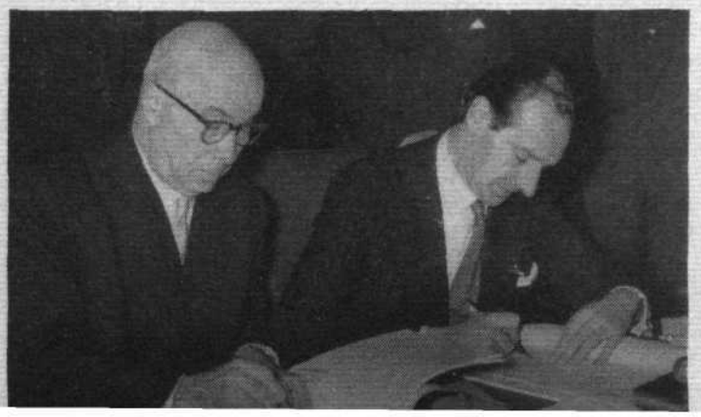
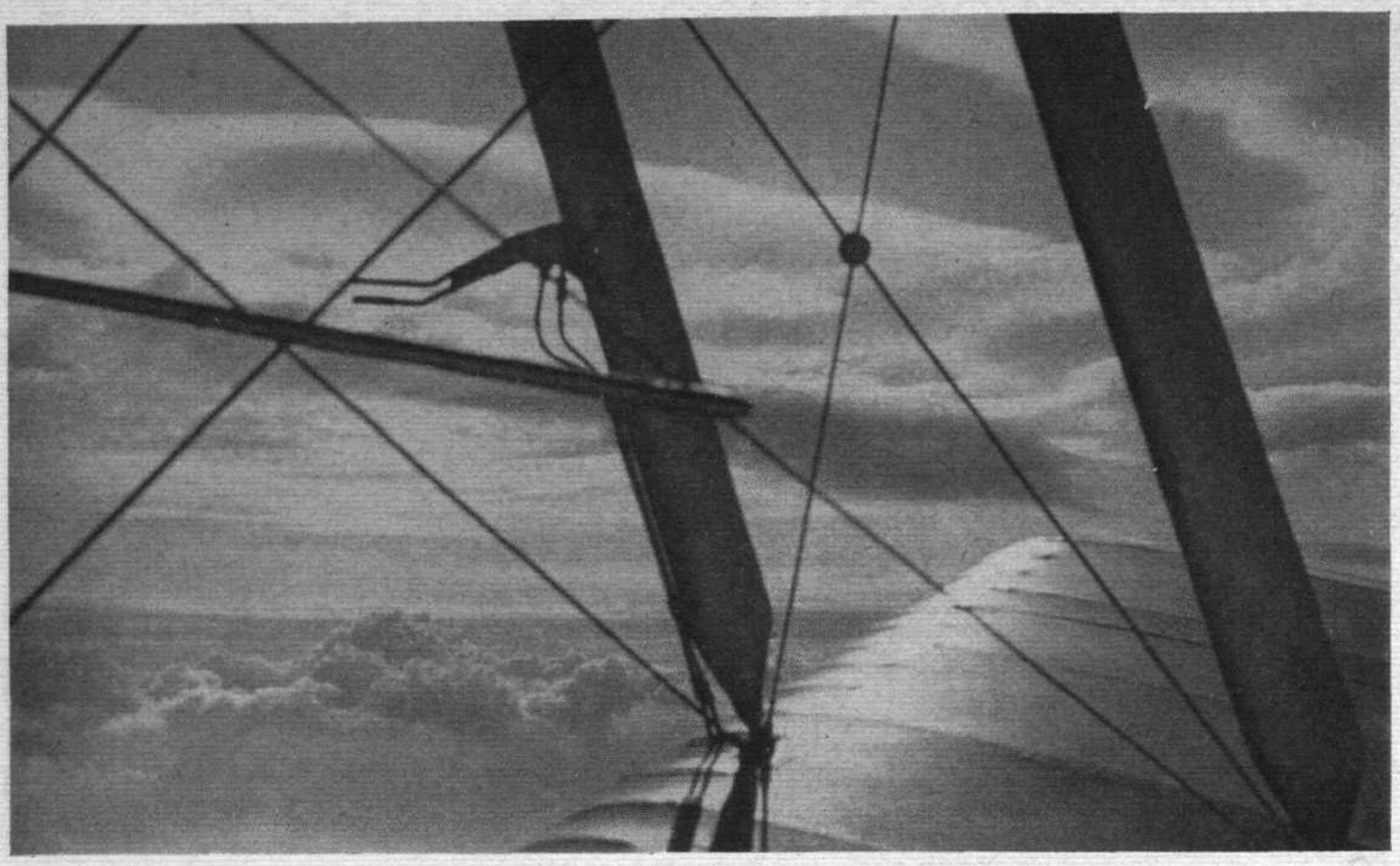
The flight engineer's position in the jet airliner of the future is far from clear. Following the case made by the American Flight Engineers' International Association in *Flight*'s columns of July 5, it is reported that the U.S. Airline Pilots' Association is now arguing that the third crew member should be a pilot (presumably qualified as an engineer) rather than a full-time flight engineer. The management of Pan American, who will be the first to introduce big jets, are pressing for a flight engineer.



Chief Marshal Pavel Zhigarev, head of Aeroflot, and the Rt. Hon. W. D. Ormsby-Gore, M.P., Minister of State for Foreign Affairs, sign the first air transport agreement between the U.K. and the U.S.S.R. (News-item on opposite page.)



Club pilots' toast for the New Year: wide skies, the Tiger's purr, the airman's world. The real airman's world, lying above the noisesome ground yet below the ice-clear space of the jets, where the air is live and the view lies open-wide.

CLUB AND GLIDING NEWS

NEXT week's Royal Aero Club film show at Londonderry House will consist of films taken by William Courtney during a visit to the Middle East, showing various R.A.F. and civil-aviation activities. Members and associate members of the club, and their guests, are invited to the performance, which is at 6.15 p.m. on Thursday, January 9. Among the films is one showing progress with the new Hong Kong airport, and others illustrating visits to Aden and the Maldive Islands.

ANNUAL meeting of flying members of Exeter Aero Club was held on December 7, when Denis King was re-elected chairman of the committee. In his survey of the past year, the chairman said that well over 1,500 hours had been flown on the club's four types of aircraft—Auster, Tiger Moth, Messenger and Gemini. Four pilots' suppers, a cocktail party, three patrols to Roborough and a dance had taken place during the year. A new briefing room with aviation library had been opened, a solo names board erected, and a trophy cabinet placed in the lounge. Active flying membership had increased by 26 to a total of 102.

Always particularly active in social activities, members of the Exeter club have staged no fewer than three amateur dramatic productions during the last year. These comprised *Ladies in Retirement*, *The Paragon*, and a Christmas pantomime, *Beauty and the Beast*.

CHRISTMAS edition of the Surrey Flying Club newsletter was an ambitiously produced "special" printed and illustrated on art paper. Bernard Pratt and David Whitlock were mainly responsible for the production of the magazine, which included a number of photographs which first appeared in *Flight*. The frontispiece is a *Flight* photograph of the Keith Shackleton oil painting of Dr. A. P. Thurston, president of the club.

Recently on display at the clubhouse at Croydon were plans for a "club aerodrome" which had been prepared by an architect in connection with his thesis. The scheme was based on a hypothetical order from Surrey Flying Club for the re-design of Redhill, the club's former base.

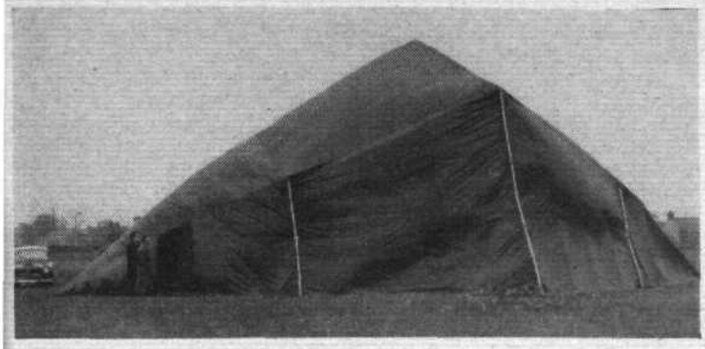
MID-JANUARY is the starting date for a full-time course at Elstree Flying Club for the Commercial Pilot's Licence. The number of students on this course has been restricted to six, and it is hoped to repeat the course at intervals of approximately four months. Initial flying is to be carried out on Chipmunks and will include the required instrument and night training, cross-country flying and all preparations for the licence. The course is intended for *ab initio* pupils, but P.P.L. holders may also be eligible. Each student has a full programme for six days per week; full catering facilities (and accommodation as required) are available.

Modestly omitted from C.F.I. David Ogilvy's latest letter, but indicated in a Christmas-card signature, is news that will interest many club pilots—that of his recent marriage to Audrey Windle, an assistant instructor at Elstree and editor of the newsletter of the British Women Pilots' Association.

WITH the expected addition of a further two Jackaroos during this month, the aircraft fleet of the Wiltshire School of Flying, Thruxton, will comprise four Jackaroos, four standard Tiger Moths, four Proctors and two Taylorcraft Austers. It is hoped to standardize on the Jackaroo by summer 1958.

PLYMOUTH AERO CLUB is now offering a special C.P.L. course for holders of Private Pilots' Licences. The cost is £625 and it includes 20 hours advanced dual, ten hours instrument instruction, a ten-hour twin conversion course, ten hours night-flying (including cross-country), and 120 hours solo (mainly cross-country). The club believes this to be the least expensive course for the commercial licence that is available, and perhaps the only one to include twin conversion in the basic cost. Recent parachuting activities at Roborough have included a night drop by Peter Lang and the first drop by a woman club-member, Miss Mina Rhind. The Plymouth club's 1958 air display is planned for June 14.

GLIDING in France during 1957 showed an overall increase in activity compared with the previous year, in spite of a marked decrease in operations by clubs in the Paris region. The increased activity at the provincial centres which counterbalanced the Parisian reduction amounted to 24 per cent. Recently promulgated by the Service de la Formation Aéronautique et des Sports Aériens of the French Government is a list of 15 "top category" pilots for 1958. The fortunate fifteen—comprising Mademoiselles Abadie and Dupuy de Mery and Monsieurs Barbera, Combettes, Fonteilles, Labar, Lacheny, Landi, Lartigue, Lepanse, Mandard, Marchand, Rouvière, Trubert and Weiss—will receive priority and special facilities (including 100 litres each of free car petrol and aviation fuel) at national gliding centres, and in turn will provide a detailed monthly account of their soaring. S.F.A.S.A. will keep a dossier for each individual, which will be used in the selection of pilots for foreign competitions—a logical, efficient and essentially Gallic procedure.



"Closed" and "open" views of the Airborne Service Equipment shelter described in the first news-item below.

THE INDUSTRY

Portable Shelter

SHOWN in the heading illustration is a new portable fabric shelter which, state its makers, has a useful storage capacity of about 40,000 cu ft, and could accommodate an aeroplane with a wing span of 40ft, or three 3-ton lorries.

The tubular light-alloy framework (which is covered with polyurethane-proofed nylon) is fitted with baseplates and so designed that the shelter can be erected on rough or soft ground, P.S.P., or a hard surface. The structure is pivoted on two central axes at ground level. Six support-struts (three on each side) are attached to points on the outer framework and meet and pivot at the axes. Hinged struts enable the entire front section, or rear section if required, to be raised. This can be done by one man.

Approximately 500 sq yd of fabric are used, and the total weight of the shelter is about 10 cwt. It can be packed into two wooden cases (one measuring 5ft × 3ft × 3ft, the other 3ft × 2ft × 1ft) and two canvas valises, each 11ft × 1ft × 1ft.

Advantages claimed for polyurethane-proofed nylon are its combination of lightness and strength, immunity from rotting and attack by insects, and the ability to withstand repeated flexing as the shelter is opened and closed. It is also stated that the material is completely waterproof and is unaffected by extreme cold.

The makers are Airborne Service Equipment, Ltd., of Priory Works, Arterial Road, Southend-on-Sea, Essex.

Handley Page Prize-giving

"IDEALLY, technical-college staffs should return to industry with their students during a course." This opinion was expressed by Sir Frederick Handley Page at the Handley Page apprentices' annual prizegiving, held at Willesden on December 13. He was referring to so-called "sandwich" courses, during which students spend long periods alternately in industry and at college and also rejoin their respective companies during vacations.

Sir Edward Boyle, Parliamentary Secretary to the Ministry of Education (who distributed prizes to 15 undergraduate, engineering and trade apprentices), agreed with Sir Frederick and also felt that industry should reciprocate by allowing senior technical staff to augment the teaching capacity of colleges.

Handley Page prizegiving: Sir Edward Boyle presents an award to J. Raine. In the background is Sir Frederick Handley Page.

Figures quoted by Sir Frederick showed that there were 360 apprentices in the company, compared with 60 in 1945. At that date there were two grades of apprenticeship; today there were seven. At the end of the war only a third of those entering an apprenticeship at Handley Page had any educational certificate. Now most entrants had some certified standard of attainment, in many cases an advanced one.

A new undergraduate scholarship, reserved for apprentices who qualify in their first year for entrance to London University, was mentioned by Sir Frederick. It covers university fees, text books and wages.

Dr. J. S. Tait, the new principal of the Northampton College of Advanced Technology, said that two of the three winners of the Stafford prize were Handley Page apprentices. This prize is awarded by the company and honours the director of its technical department, Mr. R. S. Stafford. He is a governor and former student of the College.

During the last financial year about £35,000 was spent by Handley Page, Ltd., on its apprentice training. Apprentices' wages accounted for a further £51,000. The total is about a third of the company's net profit for the year.

Famous Founder

FIFTY years ago—on December 17, 1907—William Thompson, Lord Kelvin, died. Although best known for his inventions, particularly in the electrical and navigation-instrument fields, Lord Kelvin also made valuable contributions to other sciences, notably that of thermodynamics. Among his inventions are the mechanical depth-sounder, the galvanometer and the first portable electrometer.

He commercialized many of his seventy patents and in 1890 founded the firm of Thomson and James White. On his death he was succeeded as chairman by his nephew, Dr. Bottomley, and in 1913 the name of the company was changed to Kelvin, Bottomley and Baird, Ltd. During the Second World War the firm became associated with Henry Hughes and Son, Ltd., and the two companies later amalgamated under the name of Kelvin and Hughes, Ltd., the instrument designers and manufacturers so well known in the aircraft industry today.

A.V-M. Spencer Joins Jessops

APPOINTED to the technical liaison staff of William Jessop and Sons, Ltd. (Brightside Works, Sheffield), is A.V-M. G. M. C. Spencer, C.B., C.B.E. He will be concerned particularly with titanium and vacuum-melted steel.

A.V-M. Spencer retired from the R.A.F. in 1956 after holding the post of A.O.A., H.Q. Technical Training Command, for two years. Beginning his career as a midshipman in the Royal Navy during World War 1 he transferred to the R.A.F. as Cranwell cadet in 1920, served in India until 1929, and returned to Cranwell the following year as an instructor.

After the outbreak of war he served as a station commander and staff officer in Bomber Command in North Africa and during the re-occupation of Europe. In the year 1946 he formed and commanded the Central Bomber Establishment, and in 1949 was appointed A.O.C. R.A.F. Gibraltar. His penultimate appointment was that of A.O.C. No. 19 Group, Coastal Command, a post he held until 1952.

Napier Apprentices' Distinctions

NEARLY 80 per cent of Napier apprentices who sat for examinations during 1957 secured passes. This was remarked on by Mr. J. F. A. Radford, chief of personnel and training, in his report at the company's 13th annual apprentice presentation at Acton Town Hall on December 11.

Mr. Radford said that the total number of apprentices under

Napier prize-giving: Trade apprentice Peter Barnes receives his indentures from Mr. W. E. Lewis, works manager.

THE INDUSTRY . . .

(continued)

training was 391. The number was smaller than last year but this was part of a deliberate policy to obtain the optimum number of 378, which would fulfil all the company's needs in the future.

The guest speaker, Mr. H. M. Mathews, Director of Engineering for the English Electric Co., Ltd., said in his speech that if he had one word of advice it was that much benefit could often be derived from a brief deviation from a man's chosen career.

The principal awards of the evening were the company's trophy and prizes, which were presented by Napier's managing director, Mr. H. Sammons.

A Film About Hydulignum

A DOCUMENTARY film entitled *The Hydulignum Story* was attended by more than 80 guests during its première at the British Council Film Theatre in London on December 3.

As is well known in the aircraft industry, Hydulignum, which is made by Horden-Richmond, Ltd., is a laminated and densified wood manufactured by interleaving synthetic resin glue film between veneers of beech or birch, and then compressing these under great heat and pressure. The result is an extremely strong material, one-sixth the weight of steel and half the weight of aluminium, and capable of being machined with ordinary woodworking tools. *The Hydulignum Story* describes the manufacturing processes and illustrates some of the principal applications, among which are press tools and jigs, spinning chucks, propeller blades, and helicopter rotor blades.

The film opens with shots of Spitfires in flight—their airscrew blades and those of many other World War 2 aeroplanes were the origin of Hydulignum.

Manufacturing processes are then described, beginning with the selection of veneers. These are passed through kilns to obtain uniform and correct moisture content, trimmed to size, and assembled into packs. Sheets of resin glue are then interleaved and the combined pack mechanically loaded into multi-daylight hydraulic presses and subjected to pressures of over 1 ton/sq in and temperatures up to 145 deg C. After cooling, samples from each batch are tested, trimmed, and either stored or passed to the machine shop for manufacture into components.

Some applications of Hydulignum are then illustrated, beginning with press tools. A deep draw tool is shown being profiled, followed by the pressings made from it.

Examples shown of Hydulignum tools used in the aircraft industry include rubber press tools, drill and router templates, stretch-press tools and assembly jigs, as used in the manufacture of the Britannia, Viscount, Comet 4, and Sea Vixen aircraft.

The first application of the material to blades to be shown is the 40 fan blades for the new transonic wind tunnel of the Aircraft Research Association. Each blade, with its steel retention plates, weighs over 200 lb.

The remainder of the film covers the production of helicopter rotor blades and the manufacturing techniques and tests required to meet A.R.B. requirements, and a summary of the servicing facilities offered by the manufacturers to helicopter operators.

Thrust Cradle Test

SOME figures have been given by Heenan and Froude, Ltd., of Worcester, for the test performance of a large turbojet engine thrust cradle they have designed and manufactured for a Government department.

The requirement was for measurement of very large thrusts with the highest possible degree of accuracy, and the method adopted was to mount the movable portion of the cradle on three self-aligning oil-floated bearings.

After the underlying bedplate had been set down it was found that this had a slope of 1:24,000—which, though fractional, proved sufficient to cause the moving part of the thrust cradle (weighing seven tons) to move from top to bottom of the slope in a few seconds. And as further evidence of the freedom of this method of suspension, it was discovered that a weight of 8 oz suspended from a piece of thin string over a pulley proved ample to move the cradle from one end of its travel to the other.

IN BRIEF

Wayne Tank and Pump Co., Ltd., are now installed in their new premises at Western Road, Bracknell, Berks, to which address all communications should be sent.

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Mr. Charles Bayley, A.M.I.S.E., has joined the technical sales staff of the Solderless Connectors Division of Hellermann, Ltd., Crawley, Sussex.

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A booklet illustrating current products is being distributed by the R.F.D. Co., Ltd., Godalming, makers of inflatable rafts and other life-saving equipment. The company also makes target gliders and other training equipment.

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Among products covered by pamphlets issued by Armstrong Patents Co., Ltd., Beverley, Yorks, are the "Heli-Coil" insert-thread repairing kit, the Universal Stillage, and a simple hydraulic remote-control system for a wide variety of industrial applications.

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Well known as specialists in the overhaul of aircraft engines of up to 450 h.p., Hants and Sussex Aviation, Ltd., of Portsmouth Airport, have been granted United Kingdom distribution rights of the series of engines manufactured by the Continental Motors Corporation. This, they state, should enable them to provide for users of these well known American units a service comparable with that which they have offered operators of British engines for many years past. The service includes an exchange scheme.

Manager of the Aerad division of International Aeradio, Ltd., since its formation in 1948, Capt. E. Brook Williams has retired on reaching the age of 60. He remains available to I.A.L. as a consultant. His association with aviation began in 1937, when he joined British Airways as navigation instructor. On the formation of B.O.A.C. in 1940 he was appointed superintendent of navigation. He transferred from B.O.A.C. to International Aeradio in 1948 and was largely responsible for the success of the "Aerad Flight Guide."

A new aircraft tap by Baynes Aircraft Interiors, Ltd., of Langley Aerodrome, Slough, Bucks. The handle is spring-loaded to close automatically, and is operated by a quarter-turn in an anti-clockwise direction. Flow is 9 pints at 4ft head, 11 pints at 6ft head, or 13½ pints at 8ft head. The tap is made from brass alloy, chromium-plated, and weighs 15¾ oz. Height less the threaded portion is 2.6in, and maximum width just over 4in.

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A new catalogue giving details of their entire range of aircraft pneumatic components has been introduced by the Hymatic Engineering Co., Ltd. Information comprises an outline drawing of each item, details of its use and performance, an explanation of its functioning, and a brief specification.

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The Hylite range of titanium alloys manufactured by William Jessop and Sons, Ltd., has now been extended to include Hylite 15, a commercially pure titanium supplied to D.T.D. Specifications 5003 and 5023; and Hylite 45, containing 6 per cent aluminium and 4 per cent vanadium. This latter is a high-strength alloy which responds to heat treatment.

* * *

Principal guest at the third annual dinner dance of Folland Aircraft, Ltd., supplies department, held recently at Southampton, was Mr. Godfrey Evans, Kent and England wicket-keeper. Also present were the company's three test pilots and Mr. W. E. W. Petter, C.B.E., F.R.Ae.S., managing director and chief engineer, who thanked the suppliers, many of whom were present, for the help they had given in the production of the Gnat.