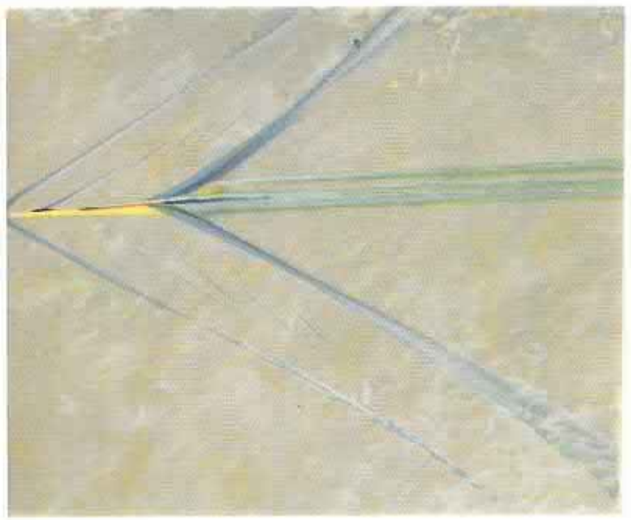
# DE HAVILLAND GAZETTE

No. 102 DECEMBER 1957

*Mach 1·05*

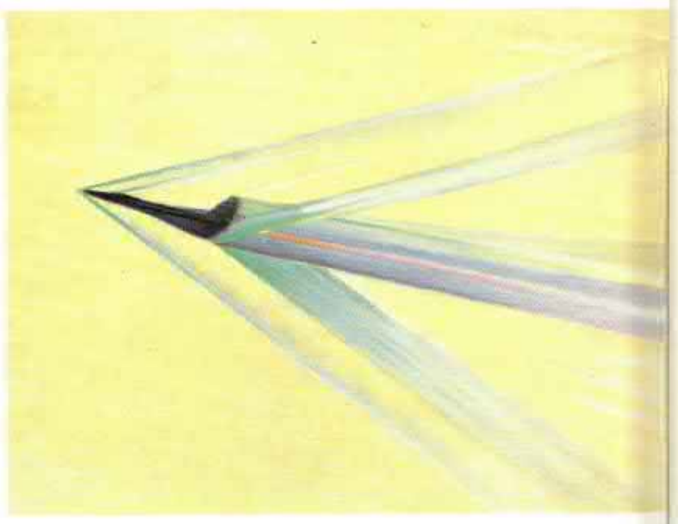
*Mach 1·4*

These studies depicting the phenomena of supersonic flight, commissioned by the de Havilland Engine Company and painted by W. Howard Jarvis S. Av. A. have been published individually throughout the year. They are presented together for the first time on this page.



*Mach 1·8*

*Mach 2·6*



*Mach 2·4*

*Mach 3·2*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*The de Havilland Engine Company is grateful to the Chairman of* Engineering *for his kind permission to reproduce some of the photographs which made possible the article on pages 269, 270 and 271.*

*Acknowledgment is also made to The British Thomson-Houston Company, Ltd., Davy & United Engineering Company, Ltd., Thos. Firth & John Brown Ltd., The Hydro-Electric Power Commission of Ontario, Ashmore, Benson, Pease & Company and The Air Research and Development Command, United States Air Force, whose products are depicted in a setting for which they were never intended.*


# *Christmas Greetings!*

A MERRY CHRISTMAS to our readers. Happy family gatherings, goodwill to all, peace and prosperity in the New Year. The greeting goes out from England, but voices the feelings of de Havilland people throughout the free countries. Engineers and flying men, manufacturers and traders, we are ourselves a world-wide family and the *Gazette* speaks for all of us.

At this season we reflect upon our friendships, and upon the goodwill that we have been lucky enough to enjoy through our innumerable associations. Every journey abroad impresses upon us how much nicer people are than their newspapers or their politicians would have us believe. Freed from the lash of the power-seekers and the ideologists how happy we might be.

The December issue of the *Gazette* tends to be less technical, should we say less formal, than others during the year, but the following pages contain information of importance nevertheless, including revelations in respect of missiles monitored and unmonitored that must remind us of one of the realities with which we are obliged to live.

Christmas is the family festival, as befits its origin, and we shall observe again that the young, at least, remain undaunted by these threats of science.

The grown-ups will ponder on the implications of the first man-made satellites, and it is unthinkable that the *Gazette* should omit to express the profound respect which de Havilland engineers, in line with others everywhere, feel for this technical achievement by the Russian members of their own profession. It is a wonder quite distinct from its political aspect. This great advance in technology cannot fail to have a chastening effect upon the thinking of people in every country, in every walk of life.

How easily—now that man's range of activity is no longer confined to his own globe—how easily this Christmas might it be declared that material science explains everything. The weakness in that is the fact, admitted by sceptics, that mankind has already manifest a quality, a spark of something, which material science has not explained, which indeed runs contrary to science. To give it a name is most difficult, and here the *de Havilland Gazette* immediately gets out of its depth, but if science can explain emotion, art and humour, can it also explain the human element of altruism? Science is without mercy, nature is red in tooth and claw, is it not?

Cynics have explained altruism by arguing that man's intelligence has developed enough to recognise that selflessness pays in this world, and may earn a place in the next. It has a selfish motive. That, however, does not satisfy logic — it does not appeal to the senses. There is a spark which material science has not accounted for. It is this curious spark that will always resist and prevail over the doctrine of subjection of the individual to the system. It is a denial of materialism, it is a certain perverseness, and it shines in the darkest places. Upon that reflection (and apologising if we have trespassed a little) may we wish all our readers good fortune and happiness in the New Year.

# Retirement of Mr. C. C. Walker

MR. CHARLES CLEMENT WALKER, C.B.E., A.M.I.C.E., Hon. F.R.Ae.S., Hon F.I.A.S., Chief Engineer of The de Havilland Aircraft Co. Ltd. and one of its founders in 1920, having resigned from the Board on December 31, 1954, after serving as a Director since 1920, retired on November 30, 1955. His withdrawal from the active life of the de Havilland Enterprise has been a gradual process. He still attends his office some days in the week and all hope that, as with Mr. F. T. Hearle, his abiding interest will bring him frequently to the works so that his old colleagues may continue to enjoy his company and counsel. Nevertheless, the *Gazette* has to record the formality of his retirement, and in doing so takes the opportunity to recall something of his great work and influence.

Mr. Walker has been Sir Geoffrey de Havilland's closest colleague on the technical side since January, 1915, when the project in hand at Hendon was the D.H.2 single-seat pusher fighter (mono-Gnome 105 h.p. engine). "C. C. Walker," Sir Geoffrey once said, "wrote to me at Airco shortly after the start of the war in 1914, asking whether there was a vacancy for an engineer to help in the design office. I saw him for the first time a few days later and it was settled that he should start work at once. He stipulated that he should receive no salary until he proved that he was useful. That is how one of the greatest personalities of this firm came to join us. Ever since those days C. C. Walker has been, in his quiet way, a great power for good in the de Havilland Aircraft Company. His technical qualifications are outstanding, and his influence is to be seen in all the de Havilland designs. It has been my good fortune that he also soon became one of my closest friends."

Mr. Walker was born in Highgate on August 25, 1877, and educated at Highgate School, 1887–92, and University College, 1892–95. He was apprenticed to a heavy-engineering concern on the Tyne, then articled to a a firm of civil engineers in Westminster. He was thus trained as a civil engineer and later, whilst training and working in that capacity he studied the laws of aeronautics through the works of their discoverers, appreciating in particular Dr. Lanchester's early expositions of the theory of flight. Joining the Aircraft Manufacturing Co. at the age of 37, he went straight to work on aerodynamic and stressing problems, bringing basic science to bear in this new field. From then on at Hendon, and from 1920 in the de Havilland Company, he was directly responsible for these two departments which constituted the technical side of design. In recent years, whilst gradually relinquishing the reins, he has maintained a very close advisory contact with the whole technical side of the activity.

Mr. Walker has inevitably been closely concerned in every decision of technical policy, every new aircraft type. He investigated the aerodynamics of multi-engined aircraft as early as the days of the D.H.3 twin-pusher bomber (Beardmore 120 h.p.) in 1916. He shared de Havilland's enthusiasm for the D.H.29 high-wing monoplane in 1921 — an aeroplane that was before its time. From earliest days he argued the need for a controllable-pitch propeller, and a report of his in the early 20's was later published in *Flight* (January, 1927) and reprinted as a technical memorandum of the N.A.C.A. of America; there it found a receptive readership, and practical work on C-P propellers began shortly afterwards.

He played a great part in each of the design exercises for pure performance, especially the D.H.71 monoplane racer, built around the first Gipsy (and Hubert Broad), which did 186 m.p.h. on 130 h.p. in 1927. He contributed much to the D.H.77 interceptor with Halford H-type 337 h.p. engine (1929). He worked outstandingly on the D.H.88 Comet Racer of 1934 and on the D.H.91 Albatross airliner which followed it in 1937. He urged aerodynamic cleanness to achieve air-transport economy through speed at a time when everyone argued that speed had to be paid for. He was a great protagonist for the D.H.98 Mosquito (1939–40) and contributed notably to its aerodynamic efficiency and success. Thereafter he applied himself to the new form of aircraft propelled by the jet turbine, collaborating with Major Frank Halford on the Goblin-engined Vampire that first flew September 20, 1943, at once evoking thoughts of a jet-propelled airliner. The still higher altitudes and speeds made possible by the rocket engine were occupying him before the war ended.

Whilst Mr. Walker appreciated the scope for every form of propulsion nobody had a greater enthusiasm than he for the jet-airliner project, studied at Hatfield from 1943, and through every phase of the Comet development he guided and encouraged the now extensive technical departments at work on it. His contribution to the Company's thinking on technical aspects of the Comet enquiry in 1954 was invaluable; his appreciation of the problems was exceptionally penetrating.

For all his ability in the formulation of technical policy he never minded taking his coat off to an important dull job, and he invariably brought the light of brilliance into its darkest corners. He served for many years between 1929 and 1946 on the Council and committees of the Royal Aeronautical Society, and he could lift the most routine meeting onto an interesting plane. When the Air Registration Board was founded in 1937 to establish civil airworthiness standards he applied himself to the task as a representative of the manufacturer's point of view. As a Council Member of the Society of British Aircraft Constructors for 21 years from 1925 he combined honesty of purpose with an initiative and detachment that helped to keep policy from slipping into ruts. During the second war he was chosen for the Independent Advisory Committee of the R.Ae.S. which the Minister of Aircraft Production (Lord Brabazon, then Colonel Moore-Brabazon) set up in July, 1941. He was beloved for his artless sagacity in the deliberations of such bodies. He has been called upon for advice by authorities on both sides of the Atlantic.

In 1935 he was awarded the R.Ae.S. Silver Medal for his work in civil aircraft design, at the time when Halford was similarly honoured in respect of the Cirrus and Gipsy engines. In 1938, in recognition of his service to aviation, Mr. Walker was made a fellow of University College, where he had studied in the past. In the Birthday Honours of 1947 he was appointed a Commander of the Order of the British Empire. In 1951 he was made an honorary Fellow of the Royal Aeronautical Society. He was elected as the Honorary Foreign Fellow of the Institute of the Aeronautical Sciences for the year 1952.

Recognition, however, has never been sought by Charles Walker. Work and the simple life are for him their own rewards. The *Gazette* once said that his achievements, in the public sense, were far transcended by his personality. Rich human qualities radiate from him and are felt by all who meet him, so that, whether in the design office or in a Hertfordshire garden, to be with him is always a pleasure. To all about him he is approachable and his response is at once kindly, sympathetic, unreserved.

This fraternal outlook, combined with a natural grasp of social and international affairs, produces in him a kind of impartial realism towards world problems and an ability to perceive tendencies and to forecast their outcome. Once the Battle of Britain was over he seemed able to predict the course of the war

(continued on page 273)



# A Quarter Way Round The World in 13 Hours

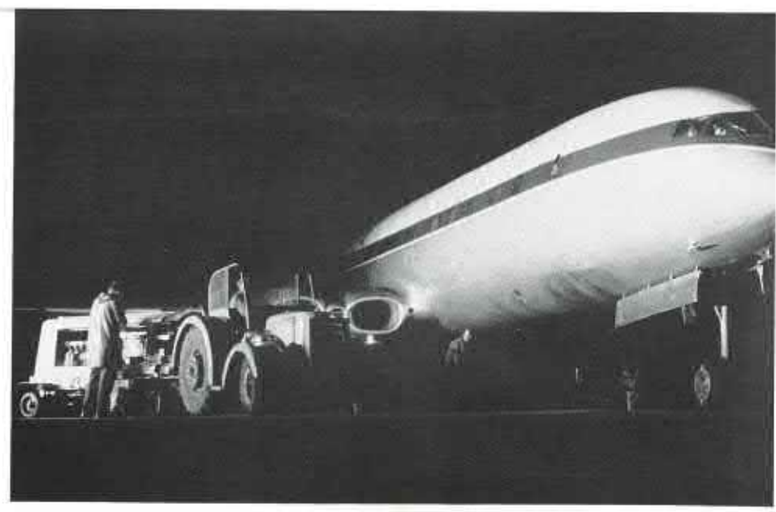
## *Fastest Airline Timetable Cut by More than 7 Hours*

### *Comet's New Speed Records— London–Khartoum London–Johannesburg*

TWICE within eight days the Comet 3, G-ANLO, piloted by John Cunningham, has set up new city-to-city records. On October 16 the Comet 3 flew non-stop from London to Khartoum, 3,064·1 statute miles in 5 hours 51 minutes 14·8 seconds at a speed of 523·4 m.p.h. On the night of October 23–24 it covered the 5,634·6 statute miles to Johannesburg in 12 hours 58 minutes 57 seconds, including 53 minutes on the ground at Khartoum. The flying time of about 12 hours 10 minutes and the actual distance flown, about 6,000 miles (Hatfield–Khartoum–Johannesburg), represents a cruising speed of more than 490 m.p.h. Both records are subject to confirmation by the F.A.I. F.A.I. distance is measured on a Great Circle, omitting Khartoum.

The Comet 3's performance demonstrates in a practical fashion the commercial capabilities of the Comet 4 Intercontinental airliner, 19 of which are now being built for B.O.A.C. A one-stop Comet service from London to Johannesburg could cut existing timetables by more than seven hours, and on this route the Comet 4 could pay its way with only half its seats filled.

Both the flights to Africa were concerned with tropical and high-altitude airfield trials directed towards the certification of the Comet 4.



*The Comet's four Rolls-Royce Avon R.A.29 engines are started up at Hatfield just before 2100 hours G.M.T. on October 23. The flight from Hatfield to Khartoum, some 3,090 statute miles, took about 6 hours and the flight from Khartoum to Johannesburg, 2,913 statute miles, took 6 hours 11 minutes.*


*Mr. Jack Davison, Managing Director of the de Havilland Company in South Africa, greets John Cunningham on his arrival at Johannesburg. Mr. Cunningham was accompanied on the flight by his co-pilots Mr. Peter Bugge and Mr. Peter Wilson, who are actively assisting him in the intensive development flying of the Comet 3. The Comet went to Johannesburg to do measured take-offs and landings on the 5559-foot-high runway at Jan Smuts Airfield.*

*The Comet 3 immediately after its arrival in record time at Jan Smuts Airfield, Johannesburg. The flight from Hatfield was made strictly in accordance with airline operating technique and demonstrates how the Comet 4 could be used on a one-stop service bringing Johannesburg within 13 hours of London.*

# High-Frequency Alternators

*A range of compact power units developed by de Havilland Propellers Limited for guided weapons and aircraft*

IT IS NOW permitted to disclose that several types of small high-frequency alternators designed and manufactured by de Havilland Propellers Limited are used as standard equipment in a number of British guided weapons and military aircraft. These compact power units provide alternating current controlled to the close tolerances demanded by the electronic circuits in modern weapons systems.

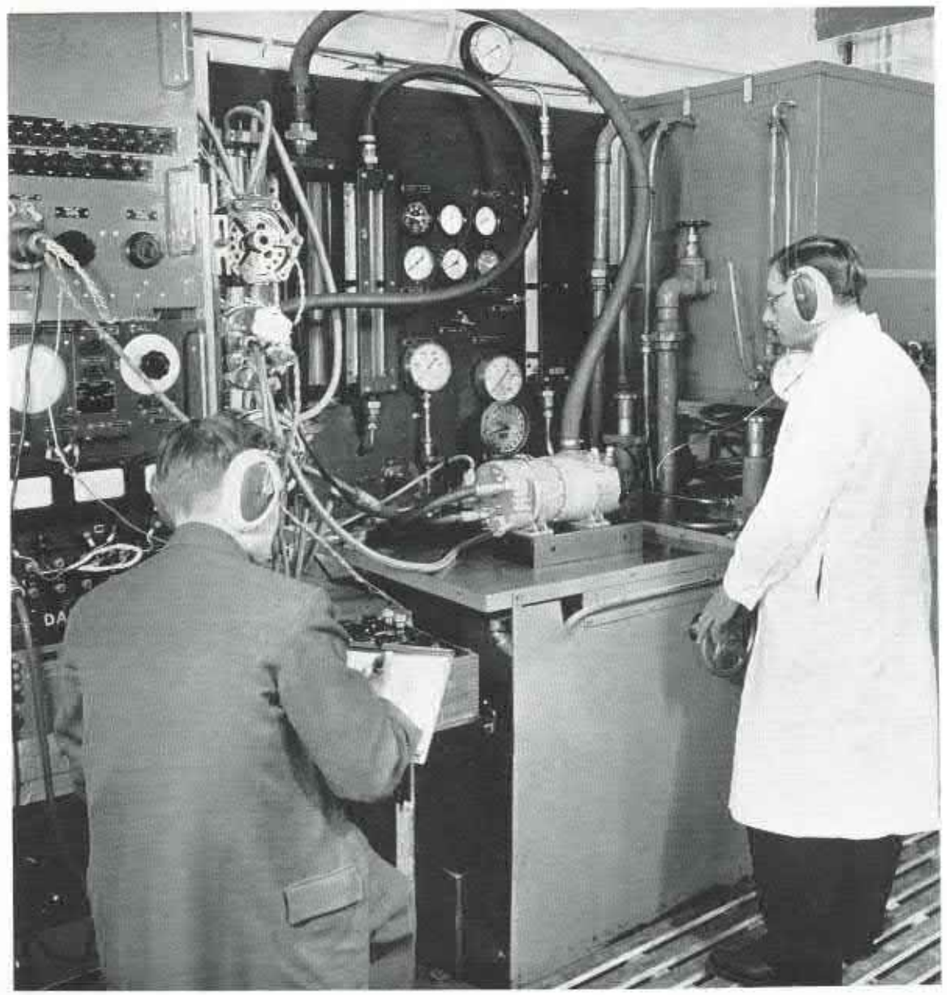
de Havilland entered this specialised field with a firm background of experience of hydraulic, electronic, and precision engineering gained in the manufacture of aircraft propellers. The first project to be undertaken was the design of a cordite-driven turbo alternator on which studies had already been carried out by the Ministry of Supply. This first alternator was developed especially for an early guided weapon, but the subsequent rapid expansion of the missile industry in Great Britain brought the demand for the wide range of power units now in production.

de Havilland power units consist of two main sections. These are the alternator assembly, comprising an alternator, a pack of resonating condensers and a controlled drive, and the controller itself.

### *The Alternator Assembly*

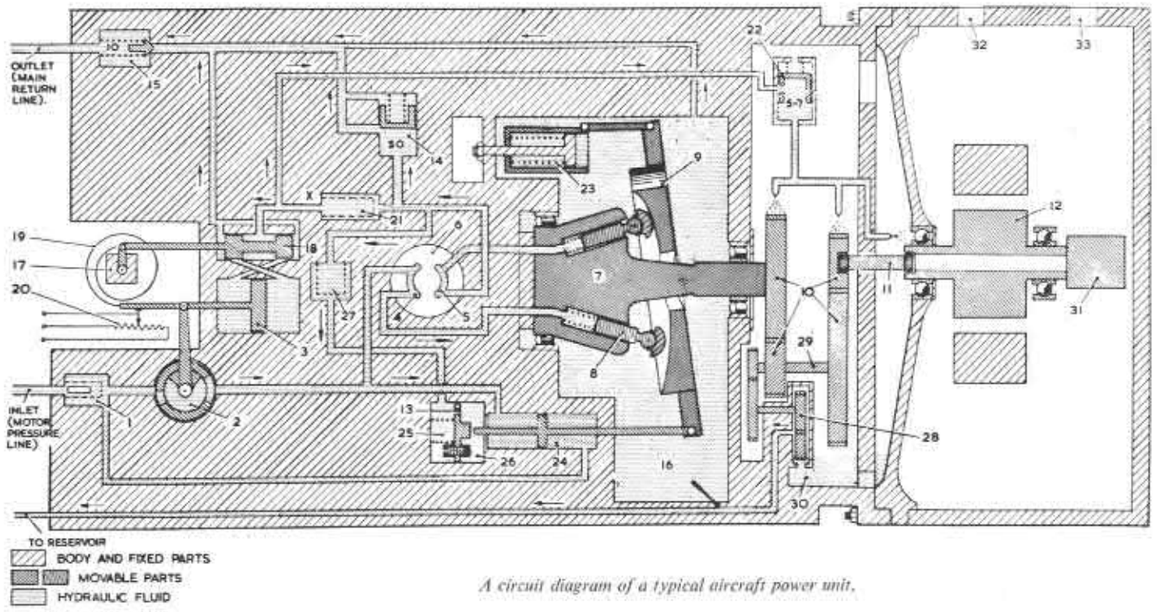
Inductor alternators are used in all de Havilland power units. Several factors influenced the choice of this type of alternator. The requirement for the first power unit to be driven directly by a turbine determined that alternator rotational speeds should be in excess of 20,000 revolutions per minute. An output frequency of more than 2,000 cycles per second was clearly necessary in order to keep the powered components to a minimum size. Use of the simple robust inductor alternator, which contains no slip-rings or rotating windings, provides the obvious solution. At a speed of 24,000 revolutions per minute, an inductor alternator containing a six-pole rotor produces a frequency of 2,400 cycles per second, and a salient two-pole permanent magnet rotor can be mounted in tandem to produce a standard 400 cycles per second frequency if required.

The static part of the alternator consists of two stacks of C-shaped soft iron laminations butting together and shaped to form a circular yoke with four integral poles. Four coils, two field and two output, are wound alternately round the yoke, one coil between each pair of poles. The stacks and rotor bearings are carried in a suitably shaped container with the necessary provision for mounting. Certain later types of alternator have single-piece stator laminations with coils wound round the poles instead of the yoke.



*A hydraulically-driven aircraft power unit on test in one of the Hatfield laboratories of de Havilland Propellers Limited.*






*A circuit diagram of a typical aircraft power unit.*

1. *Inlet Filter*
2. *Throttle Valve*
3. *Servo Piston*
4. *Motor Inlet Port*
5. *Motor Exhaust Port*
6. *Port Insert*
7. *Motor Rotor*
8. *Plunger*
9. *Swash Plate*
10. *Gears*
11. *Quill Shaft*
12. *Alternator Rotor*
13. *Restrictor*
14. *Pressure Maintaining Valve*
15. *Non-Return Valve*
16. *Motor Chamber*
17. *Transducer*
18. *Selector Valve*
19. *Spring*
20. *F/B Potentiometer*
21. *Servo Filter*
22. *Pressure Reducing Valve*
23. *Control Spring Cylinder*
24. *Swash Plate Actuator*
25. *Dashpot*
26. *Non-Return Valve*
27. *Dashpot Filter*
28. *Scavenge Pump*
29. *Gear Lay Shaft*
30. *Oil Sump*
31. *Centrifugal Switch*
32. *Cooling Air Inlet*
33. *Cooling Air Exhaust*

An inductor alternator, although permitting simple mechanical construction, has certain disadvantages. Its high internal impedance, which is particularly emphasised in a small machine, necessitates the use of resonating condensers in series with the load. These condensers are also used to overcome unacceptable variations of waveform which could otherwise result from certain types of load.

The alternator is driven either by a gas turbine or an oil motor. The turbine runs with equal success on high pressure air, cordite gas, high test peroxide, or iso-propyl-nitrate. Oil drive is achieved by a conventional gear motor, linked to the alternator through a drive gearbox.

The sensitive speed control necessary for both gas and oil driven alternators is achieved by the use of a proportional relay, or transducer. This comprises two permanent magnets with their north and south poles coupled by wound cores, which surround a soft iron armature. Each core has two windings, which, when fed with current, can affect the armature position. If the current in the windings is equal the armature remains in a central position, but if the currents vary, the armature turns accordingly. A drive is taken from the armature pivot, sufficient torque being developed either to operate a throttle directly or through a closed loop mechanical servo. This mechanism, a Laws relay, is now used extensively by the weapon industry.

The type of throttle varies according to application. A simple rotary valve operated directly by the relay proves efficient for a clean cool gas supply, whereas with hot gas or extremes of temperature a servo-operated tapered needle is needed. Servo assistance is also necessary for the hydraulic throttles, of which various types have been tried. The most effective has proved to be a "hole and hill" type, which is a rotary valve with two inclined planes cut into its top surface. These planes mate with ports in the sleeve so that rotary motion of the valve varies the area of port uncovered. This system has proved remarkably sensitive in practice.

A mechanical feed back is always provided to close the mechanical servo loop, generally by a spring which couples the transducer armature to the throttle, although later designs accomplish this by a direct linkage mechanism. Mechanical systems such as these have a delay which, when included in the complete frequency control loop, tend to produce instability. To counteract this, the throttle is made to operate an electrical feed-back circuit by moving a wiper arm over a potentiometer.

### *The Controller*

The controller is divided into two sections, the voltage regulator and the frequency governing circuit.

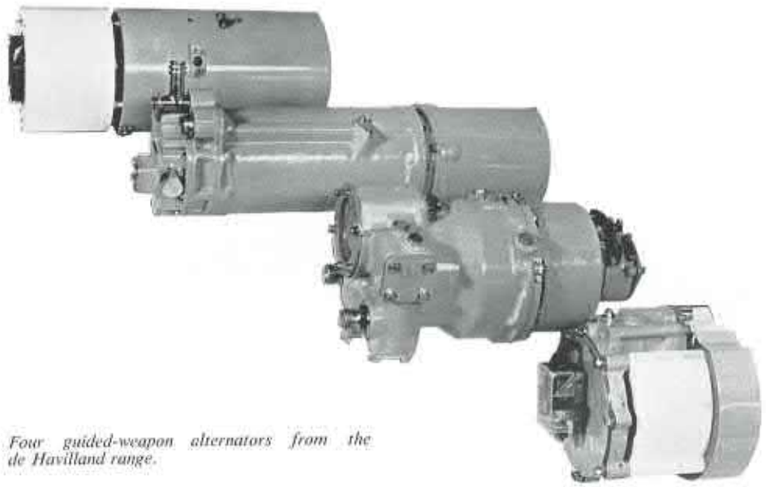
In the voltage regulator, the alternator output is fed into the primary winding of a transformer. The resultant output of the secondary winding is rectified and fed, through a choke, to a neon bridge circuit. This is adjusted so that at a given load (approximately mid-range) the control current is fed either to a single or a multi-stage magnetic amplifier which produces the level of field current required to give the nominal output voltage. Variations in this output voltage due to load changes then cause changes of error current which in turn alter the field current through the magnetic amplifier, so that the initial output voltage variation is reduced.

The frequency governor controls the operation of the transducer. As in the voltage regulator, the alternator output is fed into a transformer and then into two resonant circuits, one tuned above the required datum and one below. These circuits are each connected in series with a bridge rectifier so that at the nominal frequency, the output from both rectifiers is the same. As the tuned circuits are set one above and one below the datum frequency, the output from one increases as the other decreases with an off-speed. The difference in these outputs is then applied through a push-pull magnetic amplifier to the transducer coils. This in turn reacts on the transducer armature, the resulting rotation being in the correct direction to reduce the initial frequency deviation.

### *Aircraft Power Units*

Once the merit of the early work on alternators for guided weapons had been established, it was a logical step for de Havilland Propellers Limited to design a range of associated power units for use in aircraft.

The de Havilland aircraft power unit is of



*Four guided-weapon alternators from the de Havilland range.*

similar basic design to the weapon alternator and is driven by fluid from the aircraft hydraulic system. It is built to a rigid mechanical specification to achieve continuous rating. The high power output demands the use of a swash motor rather than a gear motor and thus two stages of throttling are possible. Fine control is achieved by using a rotary valve, and coarse control for large load changes by altering the angle of the swash plate and thus reducing the motor capacity. In this way, the considerable amount of heat generated in the oil by a single throttle is obviated, with consequent simplification of the aircraft oil-cooling system. The actuator for the swash plate consists of a damped piston which measures the pressure drop across the throttle. If this pressure drop becomes excessive, the piston moves in its housing and, by a simple linkage, alters the angle of the swash plate.

The motor speed is lower than that of the alternator rotor and a gearbox is necessary. For continuous rating, lubrication is essential and an oil tapping is taken off the motor return line. Oil pressure is maintained at a suitable level by a small valve, and is fed through lubricating jets to a two-stage spur gear train. Excess oil is scavenged by a small gear pump and returned to the aircraft hydraulic system. A simple lip seal prevents oil from reaching the alternator. Later developments include a self-contained lubrication system which consists of a small tank with feed and scavenge pumps driven off the gearbox layshaft.

The relatively heavy rotor shaft is carried on angular contact bearings held together by a spring-loaded piston. Attached to the rotor shaft is a small centrifugal actuator which consists of a hollow piston spring-loaded against two small flyweights. At a given shaft speed (below nominal) the piston slides out and operates a micro switch. This switch allows the protective circuits built into the control unit to become operative and to cut off the hydraulic supply via the on-off valve if the unit should subsequently overspeed or underspeed violently. As a protection against run-up to a speed less than the switch setting, a time delay is fitted which causes the switch operation to be overridden in a finite period and the oil supply to be cut off.

It is essential that the alternator coil temperatures do not rise to a value which would impair their operation. The techniques employed in their construction give ample scope for cooling to be effected by ram air, despite the high aircraft speeds, and experience has proved that cooling for the controller and condensers is unnecessary for most applications. Where essential, however, provision may be made for a small flow from a cold-air unit.

The high power developed by the unit demands large condensers. For convenience of installation, these condensers are fitted into a separate case, the bulkhead of which acts as a junction box for the three components which comprise the power unit. A filter is incorporated in this case to improve the output waveform when running into distorted loads.

The controller consists of three circuits within one case. These are the voltage regulator and frequency governor, to which is added a third circuit for protection. As the power unit is used in an aircraft for supplying delicate components, protection is essential against overspeed, underspeed and low voltage. The characteristics of the inductor alternator used are such that protection against high voltage is unnecessary.

### *New Developments*

The range of alternators already produced by de Havilland Propellers Limited is used in a number of current aircraft and guided weapons. Little may be revealed of the latest developments, but it is permitted to disclose that a low speed, high frequency, continuously rated power unit for aircraft use is now on test. This unit is directly driven by a swash oil motor, using return oil as the cooling medium for heat generated by the alternator. Another development is a variable torque device which replaces the moving throttle on turbo-alternators driven by cordite gas or burning iso-propyl-nitrate. This has overcome the problem of throttle jamming caused by dirty fuels. Controller circuits are being re-designed to accommodate the latest advances in electronic techniques, and transistors are being introduced to reduce space and weight.

Comprehensive test facilities have been built up, and there are now several large laboratories engaged on alternator work. Suitably protected rigs have been built for testing units driven by each of the fuels in use.

The experience already gained by de Havilland Propellers Limited in the design, development and manufacture of high frequency alternators ensures that the Company will maintain its lead in this important and steadily growing field.

## THE QUIETNESS OF THE NEW COMET JET AIRLINER

*Anglo-American co-operation in measuring characteristics of Rolls-Royce jet-noise suppressor.*

*Port of New York Authority send acoustical experts to Hatfield.*

THE Comet 3 development aircraft G-ANLO, which returned to Hatfield on November 11 following the successful completion of take-off and landing trials at Jan Smuts Airport, Johannesburg, is undergoing noise-measurement tests at Hatfield. The Port of New York Authority — one of the most noise-conscious airport authorities on the world's trade routes — is co-operating with the Rolls-Royce and de Havilland companies in a programme of measurements of the noise characteristics of this aircraft fitted with Rolls-Royce jet-noise suppressors. The programme should last about two weeks.

The noise measurements on behalf of the P.N.Y.A. are being made by Bolt, Beranek and Newman Inc. of Cambridge, Massachusetts, acoustical consulting engineers.

The Port Authority has had in effect since 1951 a regulation that "no jet or propeller-turbine aircraft may land or take-off at an air terminal without permission." So far the Vickers Viscount, Bristol Britannia and Boeing YC 97J propeller-turbine aircraft and the Caravelle jet aircraft have been granted permission under this regulation.

The Stockholm Airport authority measured the noise of the Comet 3 on its visit to Sweden in June (before the noise suppressors were fitted) and issued a statement that it was not more, even then, than that of piston-engined and propeller-turbine airliners of the latest types in service.

de Havilland have informed the Port of New York Authority that the fitting of the new Rolls-Royce suppressors to the jet pipes of the Comet's Avon RA.29 10,500 lb. thrust engines has reduced the noise to a level below that of many large piston-engined aircraft now in service. This fact was demonstrated at the S.B.A.C. Farnborough Air Display in September.

## MOSQUITO STILL ELUDES RETIREMENT

The October issue of the *Gazette* foretold the likely retirement of the Mosquito after a final tour of duty on "Met Recce," but it is back in business as a target aircraft for anti-aircraft gunners of the N.A.T.O. Forces at Todenhorf Ranges near Kiel.

The Mosquito Squadron does eight hours of target towing daily for both heavy and light anti-aircraft guns. No hits on the aircraft have yet been reported; presumably the Mosquito is as elusive as ever!



# The Gyron Gynorm

*First details of a new jet turbine designed specifically to be the most powerful in the world*

*240,000 lb. (108,860 kg.) static thrust without reheat*

THAT it has always been the policy of the de Havilland Engine Company to strive to foresee the future propulsive requirements of a rapidly progressing aircraft industry has been stated frequently — some might think too frequently — in this *Gazette*.

It is well known that the Gyron and Gyron Junior turbojets and the Spectre series of rocket engines are examples of such far-sighted thinking, but the Gyron Gynorm, of which details are given for the first time on these pages, falls into a different category.

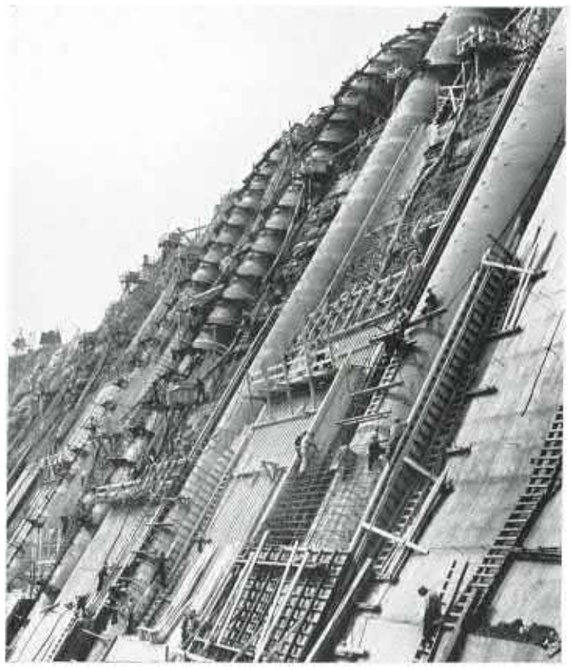
It will be recalled that for some time the de Havilland Engine Company have been at pains to substantiate their claim for the Gyron that it was "the most powerful jet engine in the world." In recent years this has become more difficult for two main reasons. In the first place a security system peculiar to these Isles, whilst allowing a percentage of the total thrust figure to be disclosed, strictly bans mention of the rest. The Gyron, it will be remembered, appeared at the Paris Show with a published output of 25,000 lb. and few knew of the remaining 5,000 lb. closely pegged by Security. In the second place other and less modest manufacturers have at last entered the supersonic field, and unfortunately with even bigger engines.

If this state of affairs was allowed to remain unchallenged, only carefully qualified and, therefore, misleading statements could be made in public. "The most powerful engine in the world," on the successful first run of a competitor's engine, might have to be changed overnight into "the most powerful type-approved jet engine in the world." It only requires the rival company to experience another modicum of unexpected luck and the claim must again be modified to "the most powerful type-approved jet engine in the world now in an advanced stage of development." Further qualification is difficult to achieve without interfering with the geographical impact. It can thus be seen that an engine which started its career quite simply as "the most powerful jet engine in the world" can, within a very short time, end up as "the most powerful type-tested jet engine to have reached an advanced state of development in Southern England" or, at the worst finally "in Hertfordshire."

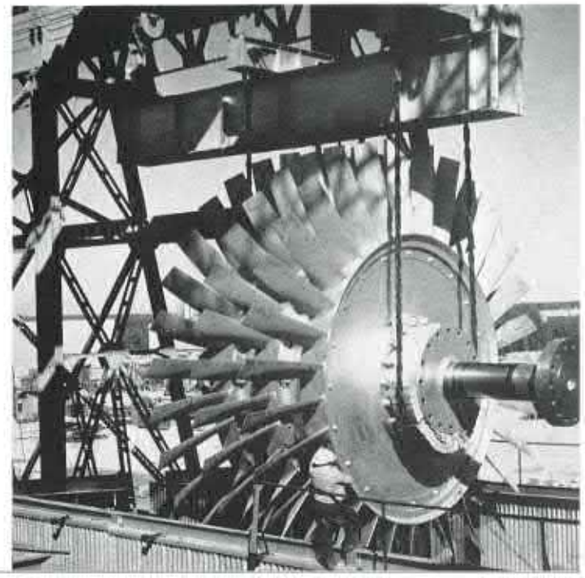
At a time when the implications of a White Paper on Defence have, to say the least of it, put a brake on creative thought, it was natural that a strong and virile design team (striving to foresee . . . etc., etc.) should turn from the operational requirement branches of the various Ministries and Services and for once pay heed to a Publicity Department which, if nothing else, was reputed by several members of the Company to possess a budget capable of handling the financial outlay. It was also felt that if such an advanced engine failed in the long run to be favoured by an actual aircraft application this was not altogether unprecedented in the history of the Company.

The accompanying pictures reveal the Gyron Gynorm to be in all major respects a true member of the Gyron family. Low frontal area is combined with light weight and robust construction — all features indispensable to the special formula for high-supersonic flight. A noticeable difference, however, is in the use of a simple 3-stage axial compressor in place of the more usual 7- or 8-stage layout, and this feature was finally decided upon after a long period of study by performance engineers, and clinched by an objection from the Ministry of Transport and Civil Aviation to the effect that the new test rig scheduled to be constructed in the Company's test colony at Hatfield for larger compressors would seriously interfere with long-term plans for widening the Great North Road.

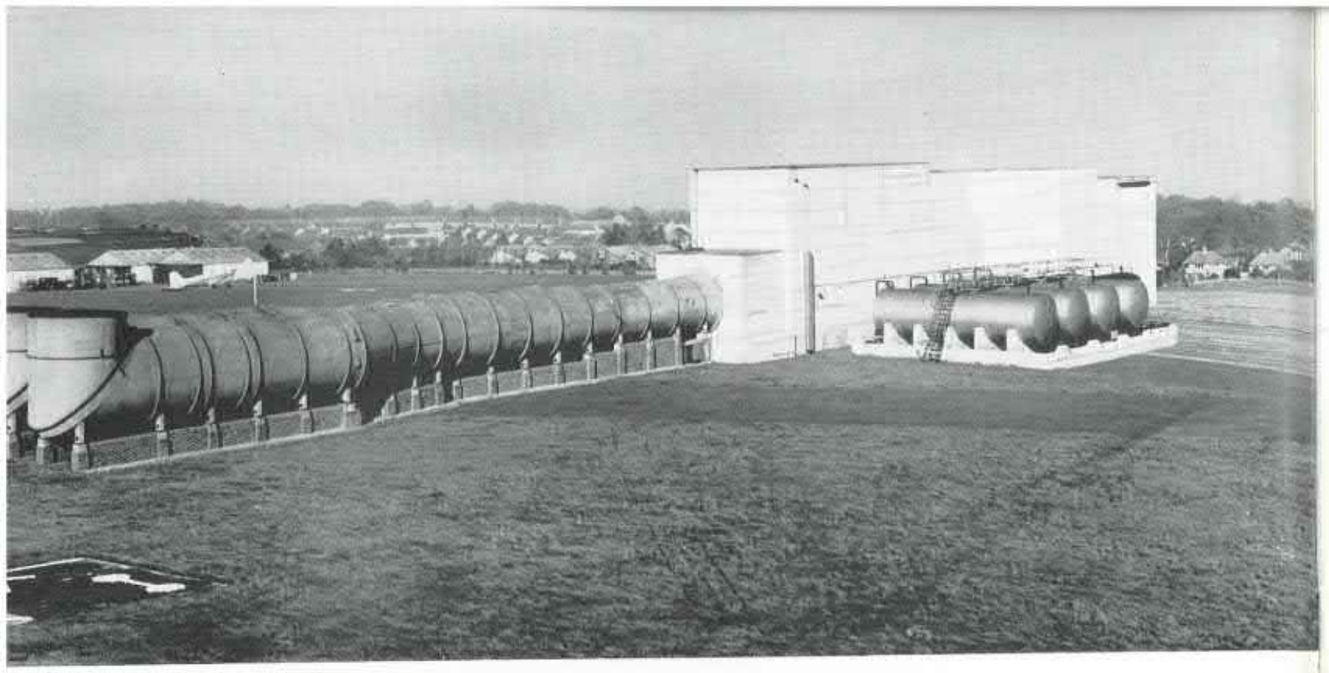
As with other de Havilland engines the Gyron Gynorm was designed and constructed as a private venture and it was only after the prototype had established the validity of the design that the engine was offered to the British Government. At this time future plans for the Gyron Gynorm cannot be discussed but if there is a noticeable restraint in Government circles prior to the issue of instructions to proceed, it is, after all, understandable in an age of military aviation where nobody really knows what they want anyway.



*No small effort was required to cement firm foundations for the new engine's future. This view, taken during the extension of the Halford laboratory at Hatfield, shows something of the unremitting labour necessary today to keep pace with the rising tempo of development.*



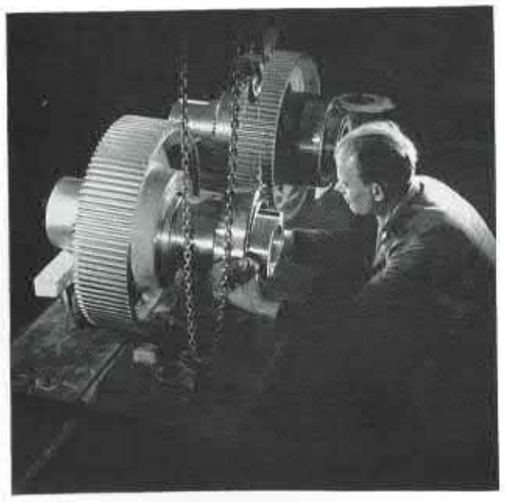
*As an important part of the detailed component matching programme which preceded the first run of the Gyron Gynorm, the three-stage axial compressor underwent an extensive series of calibration and over-speed tests. This photograph, taken as the component is lowered into the compressor test rig, clearly shows its compact form and elegant simplicity.*

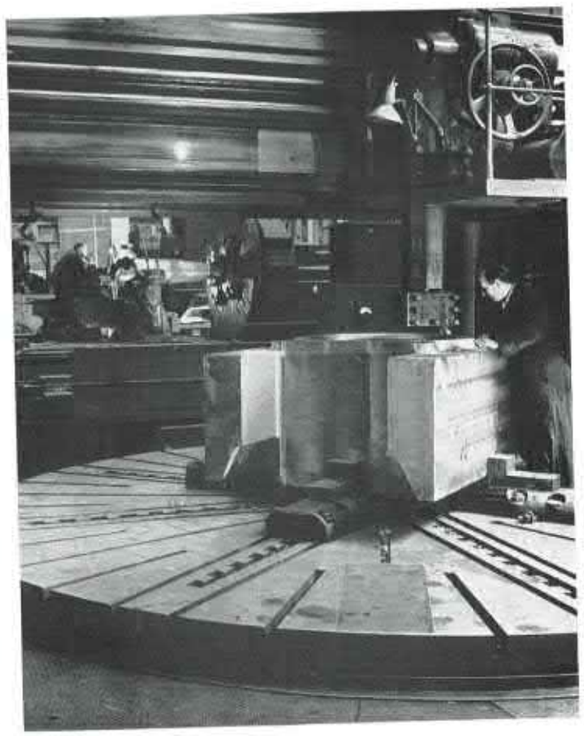


*It was considered that an advantageous situation in regard to both economy and efficiency would result if the test work was carried out under the eye of the Publicity Department from whose budget the entire programme was being financed. For this reason the new test bed shown here was built at the Company's Leavesden works, beneath the windows of the commercial manager's office.*

*Although a slightly scaled-up version of the de Havilland hydrogen peroxide turbo-starter would be fitted to production versions of the Gyron Gynorm, a conventional electric starter motor was used for early running. A craftsman, complete with the intricate tools of his trade, is seen here soldering the armature joints. Mounted in the intake bullet this unit accelerates the engine to its self-sustaining speed within the half-hour.*

(*Below*)
*Detail assembly work on the Gyron Gynorm. The idlers in the fuel and lubrication pump gear-trains are being inspected prior to their installation in the slender intake spoke.*

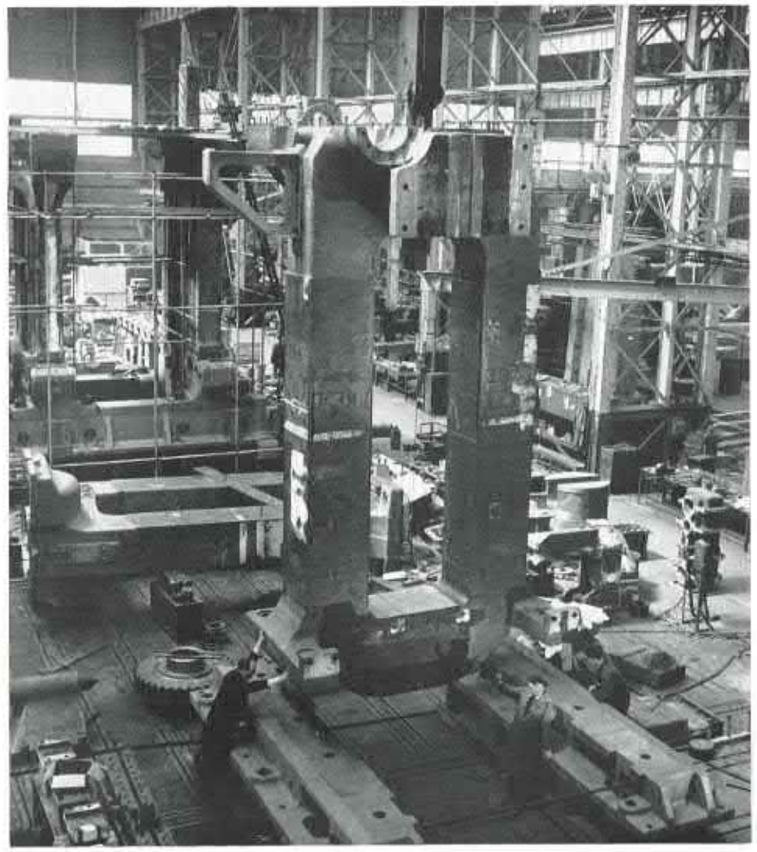




*An intensive programme of work was laid down to accelerate the manufacture of the prototype engine, and in this respect it is interesting to note that it had already completed an unofficial acceptance run before drawings could be issued to the shops. Practical craftsmen with practised eye and a flair for improvisation were responsible for this — often, as is shown here, machining from the solid. In the foreground a rear bearing housing and, at the background, an accessory-drive quill shaft take shape from billets of high-tensile steel.*



*To absorb the massive power output of the Gyron Gynorm equally massive support frames for the thrust-measuring pads had to be constructed. One of the eight required is shown here in the hands of the Plant Department during the fabrication of the Leavesden bed.*



*New and weighty difficulties required solution before a satisfactory two-bearing rotor support could be provided. This problem was overcome in the manner shown below.*

*From the outset the Gyron Gynorm was developed for operation with reheat. An early version of the afterburner assembly is here seen on its journey from the Engineering Division at Stag Lane to the test bed at Leavesden. Subsequent development work enabled some reduction to be made on the weight of this interesting component.*

# "A missile with a human monitor"

## *New British Rocket-Turbine Fighter*

*Saunders-Roe S-R.177 with de Havilland rocket and jet-turbine engines and de Havilland Firestreak air-to-air guided weapons —a step towards the unmanned ground-to-air missile*

The British Government allowed it to be announced on October 11 that Saunders-Roe Limited had for some time been building a number of prototype high-altitude supersonic mixed-power-plant naval all-weather interceptor aircraft under contract from the Ministry of Supply. The development had been undertaken against a British Naval Staff Requirement. Naturally, a decision on the placing of production orders had not yet been taken. These aircraft are to the S-R.177 design, a development of the S-R.53 aircraft which first flew on May 16, 1957, and was demonstrated regularly at the S.B.A.C. Display at Farnborough, England, in September.

This represents a positive step towards the unmanned ground-to-air missile, an important part of the overall missile programme which, as explained in the Government White Paper on April 4, 1957, must engage much of Britain's development resources for defence.

The S-R.53/177 project is the first British aircraft to employ both rocket engine and jet-turbine power units, each having complementary qualities.

The engines are the de Havilland Spectre controllable rocket engine and the de Havilland Gyron Junior supersonic-type jet turbine.

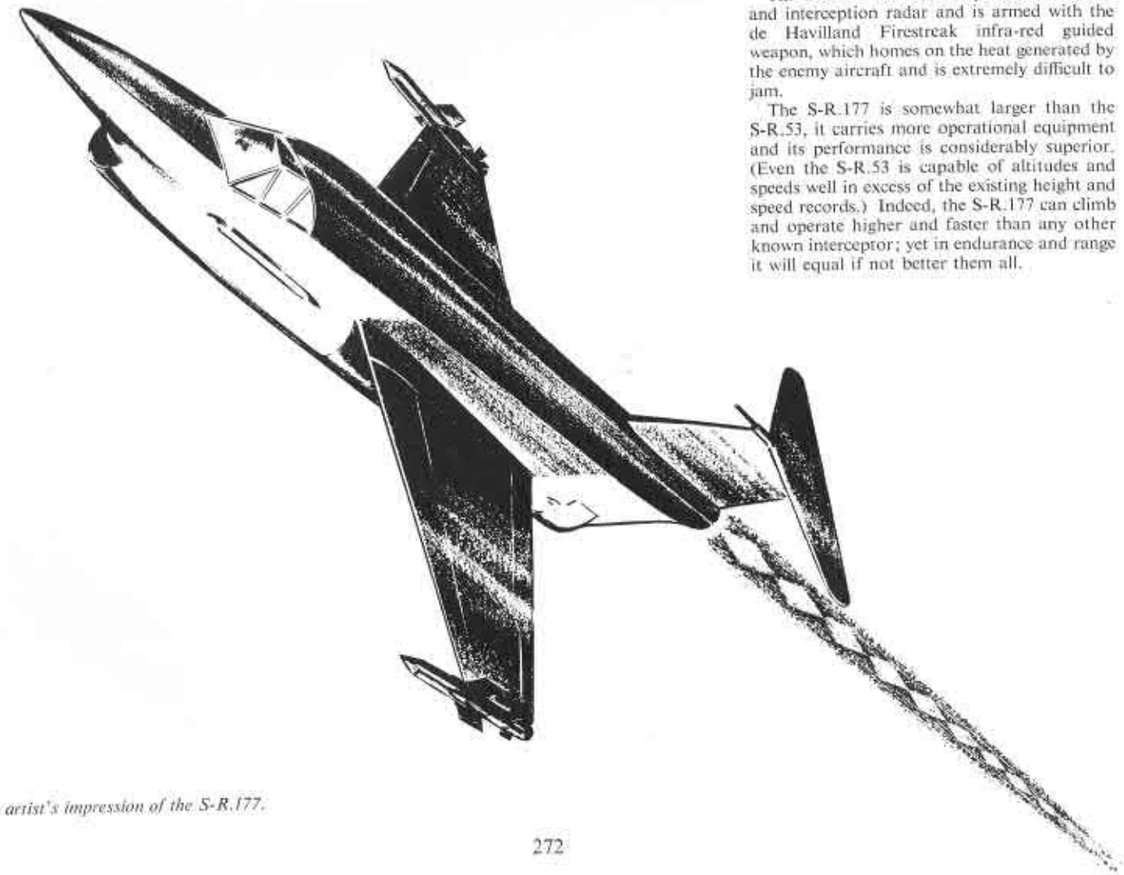
The rocket engine gives a performance that is not merely superior to that of existing jet fighters; an aircraft so powered can do things that a turbine aircraft cannot do. In short it has the performance of a missile—the pilot is there to supervise: he fulfils the functions of electronic apparatus that has not yet been fully developed, To dispense with the pilot is but one more stage, and this it is possible to do. The capability of the S-R.177 equals that of a missile; Mr. Maurice Brennan, B.Sc., M.I.Mech.E., F.R.Ae.S., Chief Designer of Saunders-Roe, has said that it can do everything that a missile can do.

This is because the rocket, not requiring oxygen from the surrounding air, operates with just as much power — even some 10 per cent. more — at very great altitudes where the air is thin as at sea level. Thus the S-R.177, as well as having enormous thrust for a short take-off and rapid climb, can sustain this rate of climb right up to the high stratosphere—away above the jet bomber — and can operate with full power at such heights, where it can rapidly accelerate to fly and manœuvre at much more than twice the speed of sound. No jet-turbine can ever do this. At altitude a turbine gives but a fraction of its power at sea level. With the rocket aircraft the sky is literally the limit.

The jet-turbine engine is still needed in such an aircraft, however, to provide the ability to fly for useful periods and distances and to return to its base after intercepting the bomber. The inclusion of a turbine engine as an equal partner with the rocket engine ensures that in the interceptor role the S-R.177 covers both the medium and high altitude bands.

The S-R.177 carries comprehensive search and interception radar and is armed with the de Havilland Firestreak infra-red guided weapon, which homes on the heat generated by the enemy aircraft and is extremely difficult to jam.

The S-R.177 is somewhat larger than the S-R.53, it carries more operational equipment and its performance is considerably superior. (Even the S-R.53 is capable of altitudes and speeds well in excess of the existing height and speed records.) Indeed, the S-R.177 can climb and operate higher and faster than any other known interceptor; yet in endurance and range it will equal if not better them all.



*An artist's impression of the S-R.177.*



The S-R.177 is seen to be virtually a piloted guided-weapon system, of which the main carrier is recoverable. This system is already within practicable reach — the aircraft, power plants, radar and guided weapon are all sufficiently developed to yield a highly effective element of defence to serve the period while the electronic apparatus of the ground-to-air missile is being developed and brought into operation.

There is another interesting consideration which affects overall defence efficiency. The S-R.177 has a very high thrust-weight ratio for take-off and a low landing weight. These qualities enable it to use relatively small airfields or strips, as well as being ideal for operation from aircraft carriers of present-day size. In war conditions, where there might be insufficient large fields to permit full use of all-weather fighter forces and tactical aircraft, as at present employed, the S-R.177 would be adaptable for highly effective use in these two vital additional roles.

Saunders-Roe and de Havilland have been co-operating for several years on this idea of the combined-power-unit aircraft for very high supersonic performance.

*The Saunders-Roe S-R.53 aircraft fitted with Firestreak guided weapons, climbing rapidly on the power of its Spectre controllable rocket engine. The S-R.53 is actively engaged in a flight development programme directed towards the larger, operational S-R.177.*

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RETIREMENT OF MR. C. C. WALKER

*(continued from page 264)*

stage by stage and, despite a personal sacrifice, he always saw the bright side.

He seldom utters a word that is not interesting; this would be remarkable in a taciturn man, but in one who enjoys discourse at all times it is exceptional. His knowledge, centred in scientific matters but ranging widely, is profound, and one feels that it is lodged in a mind free from prejudice and controlled by a character wholly honourable. He was a keen golfer, swimmer and tennis player in his younger days. Geography always interested him, particularly its geological aspects, river systems and climates. He has captured the best events and funniest experiences throughout the years, and, although the joke often goes against himself, he is ready to recount them, true to the original happening and without a wasted word, in a way that always gives enjoyment. It would be true to say that in conversation with him one not only is entertained but experiences a clarifying of one's own principles, and departs with one's faith in mankind a little stronger.

What would the Company be, we said some years ago, if one could not knock at Mr. Walker's door and seek his guidance about some technical enigma? And how could his advice be given otherwise than after gazing at the carpet and drawing on his pipe for ten or fifteen seconds, and then replying in his deep, slow voice, " Well, take the case of a knitting needle a mile long, with a fly perched in the middle."

From the outset his approach to all engineering and scientific problems has always been essentially objective and from the standpoint of sound physical principles. Whilst putting the humanities first, he has gone so far as to advocate a good working knowledge of physics as part and parcel of the education of people in almost any walk of life. Self-control is very marked in him, and he never allows personal emotion to enter into any discussion; if it shows signs of appearing he will wait for it to pass away, himself remaining a sort of anchor of basic thinking. An example of his ability to bring things back to earth when a technical conversation is becoming confused was the instance when engineers were talking about the Newtonian propulsive efficiency. After pondering awhile he asked " *What* is the maximum when *what* is half of what?"

Once when drifting down the River Waveney in Norfolk he observed that the boat was consistently moving faster than the water, which, he said at the time, was probably due to the friction between the boat and the water being less than that between the water and the banks, since both boat and water were sliding down a slightly inclined plane. He puzzled about this for many years until he heard von Karman confirm his view in a paper on turbulence which he was giving in London.

Himself technical to the very essence, Mr. Walker tends to suspect the word " technician " and will never admit that there is any scientific phenomenon which cannot be expressed in plain language " so that it will appeal to the senses." In a series of simple technical articles published by the Company under the title " Even *I* can understand," he wrote, " Forward thrust in fluid-borne vehicles is obtained by throwing stuff (generally some of the fluid) backwards. To throw back a large mass slowly is more efficient than to throw back a small mass quickly."

He is always on guard against confusing possibility with probability, and he once made young Geoffrey de Havilland laugh immoderately when they were idly discussing the argument that a row of monkeys banging on typewriters must eventually produce a Shakespearian sonnet. They were on the beach at Winchelsea at the time and Mr. Walker said, " Well, the sands of the seashore are rearranged a good deal, but how often do you see them form a portrait of the Kaiser?"

Almost any letter of Mr. Walker's would be worth quoting, but perhaps the following extract from a letter written to the President of the Institute of the Aeronautical Sciences on February 11, 1948, upon the death of Orville Wright, is interesting as the reflection of an English engineer who was contemporary with the Wright brothers:

" It is difficult to recapture the atmosphere of forty-five years ago, but the present writers recall very vividly the intense interest aroused by the rumoured experiments at Kitty Hawk. Little or nothing was known about these events until the brothers came to Europe and demonstrated, and any rumours were received generally with incredulity. Fairly circumstantial accounts however used to appear in *The Scientific American*. These would have been unseen by most people here had it not been for a humble paper called *The English Mechanic* which always reprinted them. It was through this medium that we, knowing flight was soon to arrive and having witnesed Maxim's trials, eagerly sought every paragraph referring to the Wright brothers' experiments.

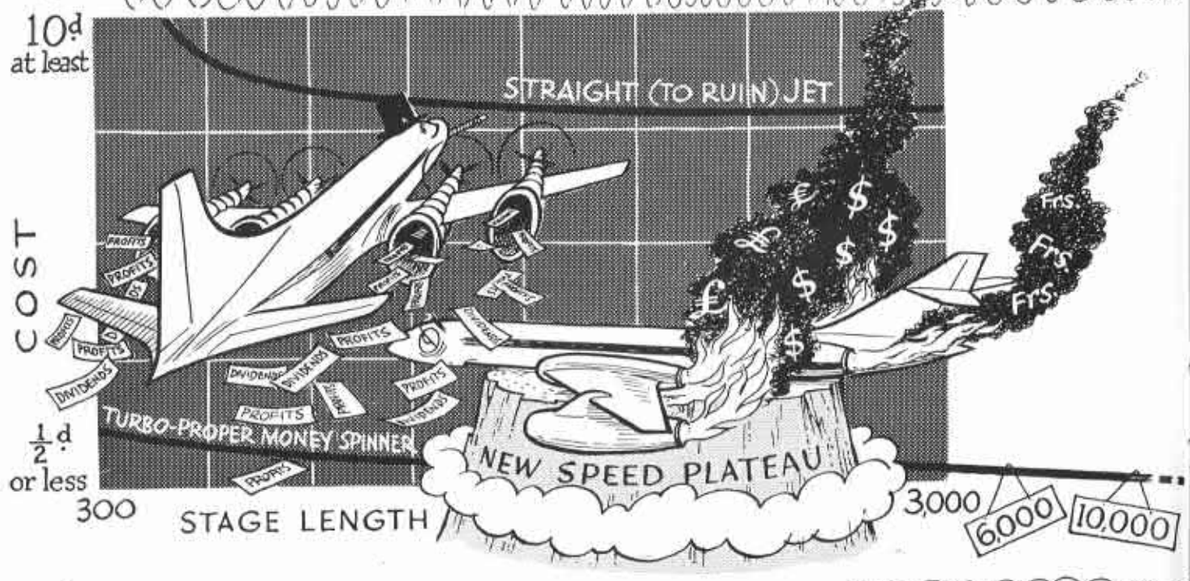
It was no sudden lifting of the veil for us when they came to Europe. We felt we had been in touch for several years with the progress of pioneer work which was about to reach triumphant realisation."

The *Gazette* has stated that the team spirit is strong in Mr. Walker because the common good is his aim. For this reason he has fitted ideally into the team which from 1920 has guided this Enterprise. Forward technical policy has always been the interest of Sir Geoffrey and himself. Up to the middle of the war they implicitly left the production organisation to Mr. Hearle, later to Mr. Nixon, the watchdog on finance, and they looked to Mr. St. Barbe to measure saleability and to direct the sales effort. Nowadays, of course, with the formation of a Holdings Company late in 1955, the hierarchy of administration has become enlarged and decentralised.

Mr. Walker keeps abreast with the latest aeronautical progress, at any rate in the general sense, and maintains contact with many of the leading engineers in Britain, America, and elsewhere. We know that he would always be pleased to hear from old friends. Many de Havilland people and others will have happy memories awakened when they read this inadequate tribute to him; tens of thousands in our own companies on the other hand have not had the opportunity of knowing from personal experience about the part that he has played in the organisation which they serve, and which serves them. For us who know him well and have worked under him for many years the inevitability of his retirement cannot soften our sense of loss.

# "– IT'S IRREFUTABLE!

## THE PROPELLER-TURBINE MUST BE THE MORE ECONOMICAL PROPOSITION..!"



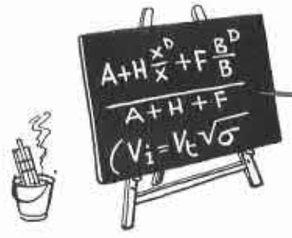

1 "To take hold of a larger column of air must be more efficient. It's a scientific fact!"

3 "Nonsense. There's less fuel to carry, and less airframe structure. And your jet will probably have a lower utilization and that will increase your costs."

5 "Yes, and whatever the loss per mile, the jet makes that on more miles too, and the shorter the stage the sillier the jet costs look."


7 "Freight doesn't care about speed and smoothness – but cheapness always matters..."

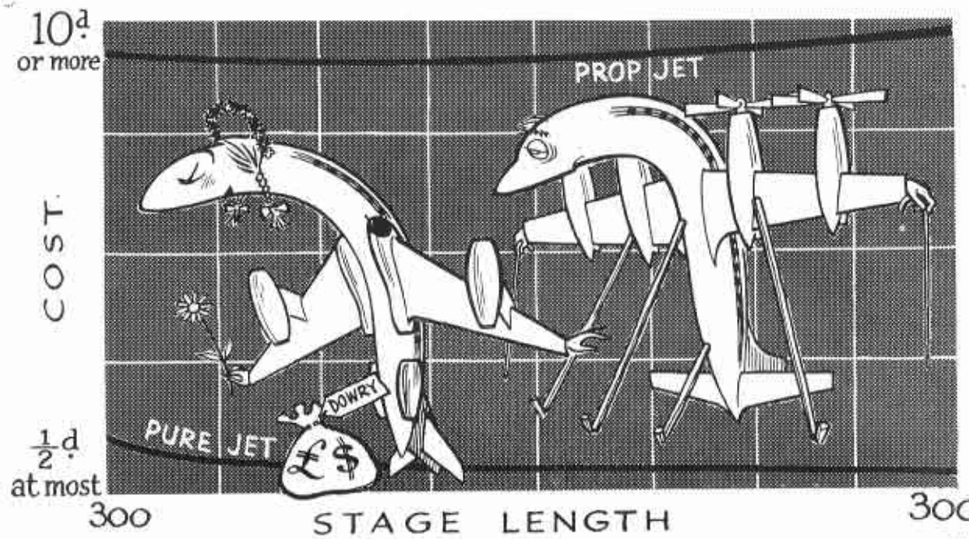
9 "Passengers likewise. Who wants to arrive in New York at 4 a.m.?"




11 "The economics will decide..."

# "– IT'S UNANSWERABLE!"

## THE JET PAYS BEST!"




2 "Agreed! Except that the complexity means more engine cost and more maintenance.."

4 "Rubbish. The jet does use more fuel but all the other 4 costs are lower because it shifts a given volume of traffic in fewer flying hours. And whatever the profit per mile, the jet makes it on more miles."

6 "Even on the shortest stages the difference in cost isn't that big, and the passenger appeal of the jet will give it a higher load factor – so it still makes more money..."

8 "I'll share the freighting with you!"

10 "No need to. Leave 8 p.m., get there in 7½ hours – it's 10.30 p.m. there, early enough for a full night's sleep – if you're that lonely"

12 "The passengers will decide the economics"

13 "AH, WELL, PERHAPS THERE'S ROOM FOR BOTH OF US..."

# Much Travelled Comets

The fourteen Comets now in service are flying about half a million miles a month. Spanning the world from the Pacific Islands across America, Canada, the Atlantic, Europe and Asia to Australia and elsewhere, they are familiar at many military and civil bases. Ten Comet 2s, on intensive transport duties in the Royal Air Force, have flown 7,500 hours (mid-November). Two Comet 2Es are in daily proving operation with B.O.A.C. Two Comet 1As (Ghost engines) are graduating from training to operations in the Royal Canadian Air Force.


*Kenya. The Rt. Hon. Duncan Sandys, M.P., like other members of the British Government, makes good use of Royal Air Force Transport Command's Comets. There to greet the Minister on his arrival at Royal Air Force, Eastleigh, Nairobi, were Sir Evelyn Baring, the Governor, and Group Captain E. G. Palmer, Station Commander.*


*Ottawa. The Chief of Air Staff, Royal Air Force, Air Chief Marshal Sir Dermot Boyle, K.C.V.O., K.B.E., C.B., A.F.C., recently back from a visit to Canada and the United States, is seen here on arrival at R.C.A.F., Uplands, Ottawa, Ontario, where he is being met by Air Marshal Hugh Campbell, C.B.E., C.D. Sir Dermot Boyle had flown over in a Comet 2 of No. 216 Squadron, Royal Air Force. He returned from New York in another Comet.*

*Special Comets for B.O.A.C. Captain Peter Kane is here taking over "the ship's papers" from Mr. John Cunningham, de Havilland Chief Test Pilot. Mr. C. S. Thom, de Havilland Business Director, is present. The Comet 2Es (one is Ministry of Supply property) are making regular flights to and from Beirut in the Lebanon, building up engine hours and experience with two Rolls-Royce Avon RA.29 engines fitted outboard. The larger outboard air intakes are apparent in our picture.*

*Newfoundland. During a recent week five Comet aircraft crossed the Atlantic westbound, three of them non-stop. One is seen refuelling at Gander on its way to Florida. The Comet was carrying ground crew for the Royal Air Force "V" Bomber force competing against the U.S.A.F. in the recent bombing competition.*

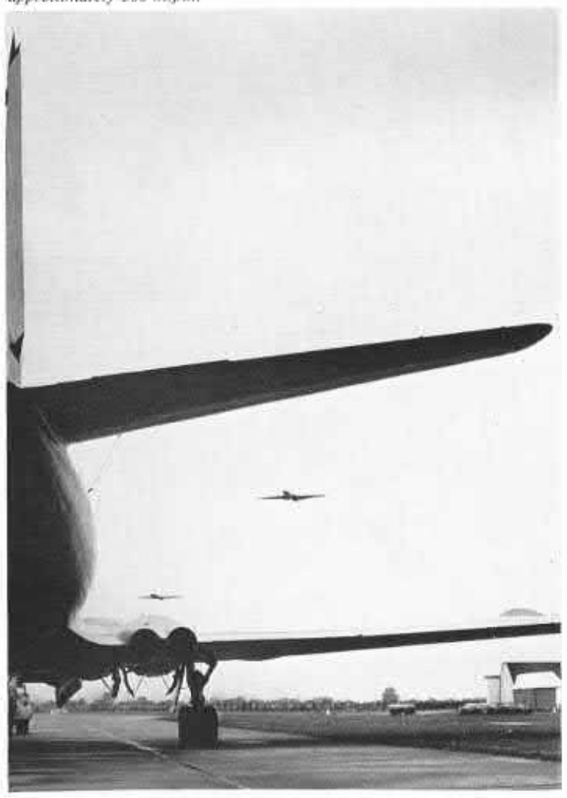
*Arriving without the feeling of having travelled. "V" force Bomber Command ground crews arrived in Florida after lunch on the day of their departure from Royal Air Force, Aldergrove, Northern Ireland. The ground crews went to service the Vulcans and Valiants competing against United States Air Force strategic air command.*


*New York. Air Chief Marshal Sir Dermot Boyle (left) is greeted by Major-General Homer L. Saunders, Vice-Commander CONAC at Floyd Bennett Field. This was the first occasion on which an R.A.F. Comet visited New York.*

*Florida. Royal Air Force Comet 2s and one of the "V" Bombers — a Valiant — "sit it out" on the apron at United States Air Force base Pinecastle, Orlando, Florida, after ferrying ground crews for Bomber Command. Comets have been seen recently in New York, San Francisco, Hawaii, New Zealand and many European and Asian bases.*

# Canada's Much Travelled Comets

*Her Majesty the Queen (third car from the front) inspected crews and aircraft at R.C.A.F., Uplands, Ottawa, during her recent visit to Canada. One of the R.C.A.F.'s two Comet 1As (facing the line of Avro-Canada C.F.100s) left for London Airport shortly afterwards making the Gander to London Airport flight in 4 hours 52 minutes at an average speed of approximately 500 m.p.h.*



*Hatfield. The R.C.A.F.'s two Comet 1As flew past on their return to Hatfield from Johannesburg. Silhouetting them is a Royal Air Force Transport Command Comet 2.*

*Johannesburg. F/Lt. D. Broadfoot, Commanding Officer of the Royal Canadian Air Force Comet detachment at Hatfield is being interviewed by Mr. Patrick O'Malley of the South African Broadcasting Corporation during a flight over the city. The quietness of the Canadian Comets (four de Havilland Ghost engines) facilitates airborne interviewing.*

*Canadian High Commissioner visits de Havilland, Hatfield. The Canadian High Commissioner in London bade farewell to members of the Royal Canadian Air Force Hatfield detachment before they returned to Uplands, Ottawa, Ontario. Left to right are Mr. John Cunningham (de Havilland Chief Test Pilot); Flight Lieutenant D. Broadfoot (Commanding Officer, R.C.A.F. detachment); Mr. P. C. Garratt (Vice-President and Managing Director of de Havilland Canada) and His Excellency the Honourable George A. Drew, Q.C. (Canadian High Commissioner in London).*



# FIRE-FIGHTING OTTERS SKIM LAKES TO REFILL WATER TANK

*At the turn of a switch the tanks are revolved and discharge their load over the fire.*

To increase the efficiency of its aerial fire fighting force the Ontario Department of Land and Forests has developed a new 90-gallon tan and refilling device for its D.H.C.3 Otter air craft. These tanks, one fitted to each float, ca be refilled in 18 seconds while the aircraft skim the surface of a lake. An Otter fitted with thes tanks can deliver 1,800 gallons of water a hour to a fire burning within two miles of a lake

Equipped with 40 Beavers and 5 Otters th Air Service Division of the Ontario Departmen of Lands and Forests is the largest organisatio of its kind in the world. Some 40,000 squar miles are covered by these aircraft, which figh fires with pumps and water-bombs; soon the will be equipped with the new tanks, which ar being adapted also for use by the Beavers The aircraft, which can be fitted with floats o skis, are used also for delivering equipment t fire-fighters and forestry teams on the ground and are available to other Governmen departments.

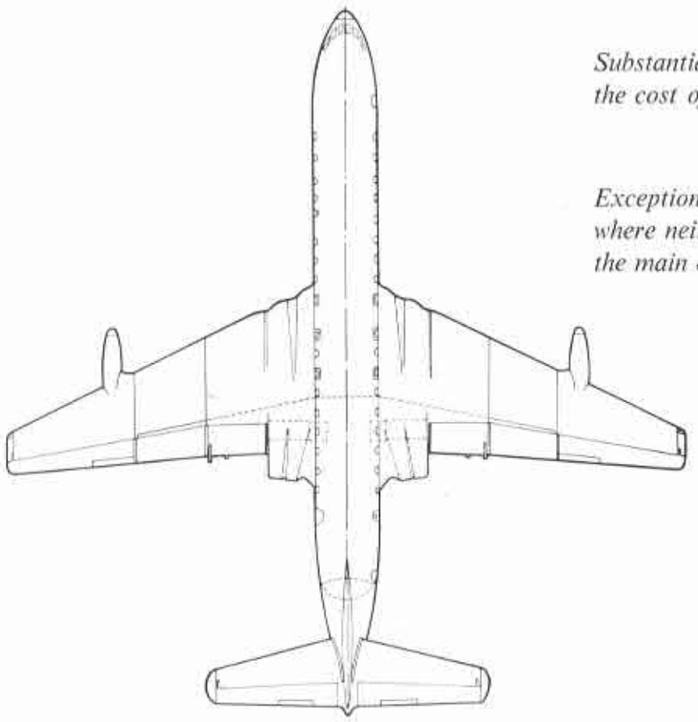
*An Otter fitted with the new tanks and refilling device.*

# JAPANESE BLESS ANTARCTIC BEAVER

*The first Beaver to be taken over by the Japanese Antarctic Expedition was blessed at a Shinto Ceremony at Chofu Airfield, Tokyo. The aircraft was shortly afterwards stowed away on board the Japanese Expedition ship* Soya Maru. *At the ceremony the Beaver was named Shawa.*

# The Intermediate Comet 4C

*Logical combination of the large-capacity fuselage of the Continental Comet 4B with the full-span wing of the Intercontinental Comet 4*



*Substantially more payload than the Comet 4 at the cost of a small reduction in maximum range*

*Exceptional economy and versatility of operation where neither very long nor very short stages are the main consideration*

AN INTERMEDIATE VERSION of the Comet between the Intercontinental Comet 4 and the Continental Comet 4B is announced.

The Comet 4 was developed to serve stages up to 3,000 miles and to pay its way in conditions of moderate traffic density using airfields of moderate size.

The Comet 4A (improved as the 4B) was a logical variant to serve shorter stages (300 to 1,500 miles at low altitude, up to 2,000 miles or more at high altitude) with a larger payload — the main differences being a clipped wing to permit a low-altitude high-speed cruise and a longer fuselage to carry more passengers.

Both are in production, typically suitable to the operations of their respective purchasers, B.O.A.C. and B.E.A.

Operators working stages of intermediate length have shown interest in the possible application of the larger fuselage of the Continental Comet 4B to the full-span wing of the Intercontinental Comet 4, so as to obtain substantially more payload capacity than the Comet 4 at the cost of a small reduction in maximum range.

This formula, combining the superior operating economies of the Continental with a payload-range capability only slightly short of that of the Intercontinental, yields an aircraft of exceptional economy and versatility of operation in conditions where neither very long nor very short stages are the main consideration.

The Intermediate Comet 4C will carry 21,785 lb., say 85 mixed-class passengers on stages up to 2,475 statute miles (2,150 nautical miles). Rolls-Royce R.A.29 engines of 10,500 lb. thrust are fitted as in the 4 and 4B.

It may be useful to summarise the development history of the Comet, which is fulfilling its original promise of yielding several versions, with rising economic efficiency, over the years.

The first Comet with its four de Havilland Ghost engines of 5,000 lb. static thrust was followed by the Comet 1A with a water-injection Ghost engine, more tankage and a longer range. Two Comet 1As are operating with the Royal Canadian Air Force.

The Comet 2, which appeared in 1953, had a lengthened fuselage, a greater payload and all-up weight and was fitted with the more powerful Rolls-Royce Avon R.A.7 engines of 7,300-lb. thrust; this is the version of which ten are now operating regularly — and flying some

**Fig. 1. COMET VARIANTS — LEADING PARTICULARS**

| | *Comet 4* | *Comet 4B* | *Comet 4C* |
|---|---|---|---|
| Overall length (ft.) ... ... ... ... | 111·5 | 118 | 118 |
| Span (ft.) ... ... ... ... ... | 115 | 107·8 | 115 |
| Height to top of fin (ft.) ... ... ... | 28·5 | 28·5 | 28·5 |
| Wing area (sq. ft.) ... ... ... ... | 2,121 | 2,059 | 2,121 |
| Maximum all up weight (lb.) ... ... | 156,000 | 152,500 | 156,000 |
| Maximum landing weight (lb.) ... ... | 113,000 | 118,500 | 118,500 |
| Maximum zero fuel weight (lb.) ... ... | 95,000 | 102,500 | 102,500 |
| Usable fuel capacity (Imp. gal.) ... ... | 8,990 | 7,890 | 8,990 |
| Maximum stage length with capacity payload (statute miles)† ... ... | 3,000 | 2,300* | 2,475* |
| Corresponding capacity payload (lb.) ... | 16,800 | 21,968 | 21,785 |

*Using long-range cruising procedure.

† All stage lengths given in this article are for still air conditions and include fuel allowances set out in Fig. 3.



100,000 miles a week — with Transport Command, R.A.F.

The next step forward, the Comet 4, for which the Comet 3 is the development aircraft, has still more payload capacity and range, achieved by a further lengthening of the fuselage, by an increase in the fuel capacity with pod tanks and by the substitution of the Avon R.A.29 engines of 10,500-lb. thrust. Up to this point the emphasis has been on reducing the cost-per-seat mile, and at the same time increasing the range-payload capacity to meet the requirement for an airliner of moderate capacity capable of serving on the long-stage trunk routes and of operating from airfields of moderate size.

At this stage de Havilland, aware of the demand for a short-haul jet airliner, evolved the Comet 4B designed to provide an express service on the short and medium stages. The carrying capacity has again been increased, to a maximum of 99 tourist-class passengers by a lengthening of the fuselage (the Comet 4B is 25 ft. longer than the Comet 1) and the pod tanks have been eliminated. The stiffer wing, achieved by a small reduction in the wing span, permits the normal operating Mach number to be achieved at a lower altitude. This has the effect of increasing the cruising speed and significantly reducing the block times on short stages. In this form the Comet represents an extremely "flexible" vehicle capable of achieving a low cost per seat-mile on stages varying from 300 to more than 2,000 statute miles.

The two Comet variants now in production represent the two extreme ends of the scale. The Comet 4 with its suitability for stages of 2,000–3,000 statute miles and the Comet 4B with its remarkable ability to pay its way on stages as low as about 300–400 statute miles and up to 2,300 statute miles.

Both types embody features directed specifically towards efficiency in their main roles, and these features are brought together in the Comet 4C, to meet the intermediate class of operation. The production aspect, as would be expected, is not onerous. The Comet 4C fuselage is equal in length to that of the Comet 4B, but the wing has not the structural modifications that were necessary to give that aeroplane a high maximum cruising speed at low altitudes.

Details of the Comet 4C with comparative figures for the Comet 4 and 4B are given in Fig. 1.

### *Operating Speeds*

Although the normal operating Mach number of the Comet 4C remains at M 0·74, the same as for the Comet 4 and 4B, structural considerations resulting from the increased payload and fuselage weight of the Comet 4C make it necessary to reduce slightly the normal operating indicated air speed limit as compared with the other two versions. This small reduction will affect the true airspeed only when the aircraft is operated below its maximum-speed height of 33,000 ft., because at lower altitudes the maximum operating speed is dictated by the indicated airspeed and not by the limiting Mach number. Since, however, the Comet 4C is intended mainly for the longer stages for which a cruising altitude of more than 33,000 ft. is appropriate, the block time which can be achieved in most cases will not be reduced.

The block speed that the Comet 4C can achieve in I.S.A. + 10°C. conditions is shown plotted against stage length in Fig. 2.

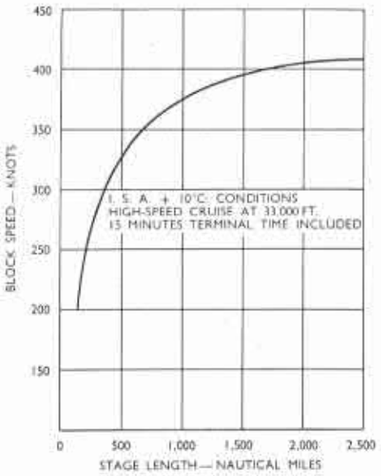



*Fig. 2.*

### *Payload-Range Capabilities*

The payload-range capabilities of the Comet 4C in relation to those of the Comet 4 and 4B are shown in Fig. 3. In this comparative plotting it has been assumed that all three Comets are flown at their respective altitudes for maximum range (i.e. above the maximum-speed heights) and using the same system of fuel reserves, and in addition a line is drawn for the Comet 4C to show the slight reduction in range that occurs when the maximum-cruising-speed procedure is adopted. This latter line is consistent with Fig. 2. The larger payload capacity of the Comet 4B and 4C is shown, while the external tankage of the Comet 4 and 4C gives a useful increase in range at payloads below 13,000 lb. It can be seen that the maximum range with full payload of the Comet 4C is of the order of 2,150 nautical miles, (2,475 statute miles). It will, of course, be understood that this comparison is drawn for a representative passenger-accommodation plan and that different plans can be produced to meet other special requirements of payload or range.

### *Aerodrome Performance*

The take-off and landing performance of the Comet 4C will be negligibly different from that of the Comet 4 operating at the same weight. The following figures refer to an all-up weight of 156,000 lb. and to a maximum landing weight of 118,500 lb. and give a measure of the aerodrome performance which the Comet 4C is able to achieve. As with all the Comet 4 series, compliance with climb requirements will hardly ever limit the allowable take-off and landing weights.

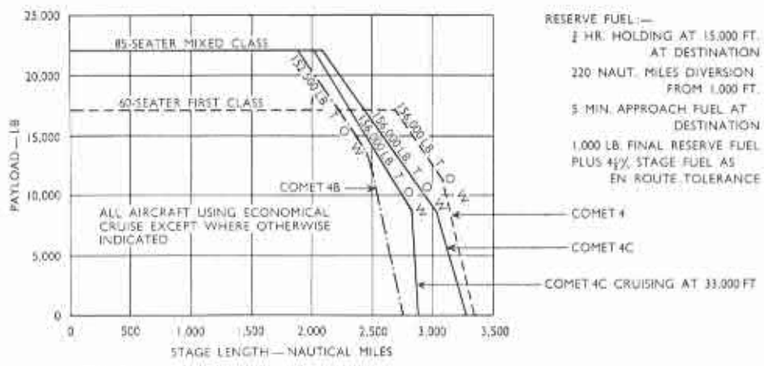



*Fig. 3.*

Take-off aerodrome length to British requirements (Comet 4C):

| *All-up weight* | *Conditions* | *Aerodrome length* |
|---|---|---|
| 156,000 lb. | Sea Level 15°C. | 6,770 ft. |
| 156,000 lb. | Sea Level 37½°C. | 8,080 ft. |
| 156,000 lb. | 4,000 ft. 20°C. | 9,500 ft. |

Landing aerodrome length to proposed new British rational requirement (Comet 4C):

| *Max. landing weight* | *Conditions* | *Aerodrome length* |
|---|---|---|
| 118,500 lb. | Sea level 32½°C. | 6,820 ft. |
| 118,500 lb. | 4,000 ft. 7°C. | 7,240 ft. |

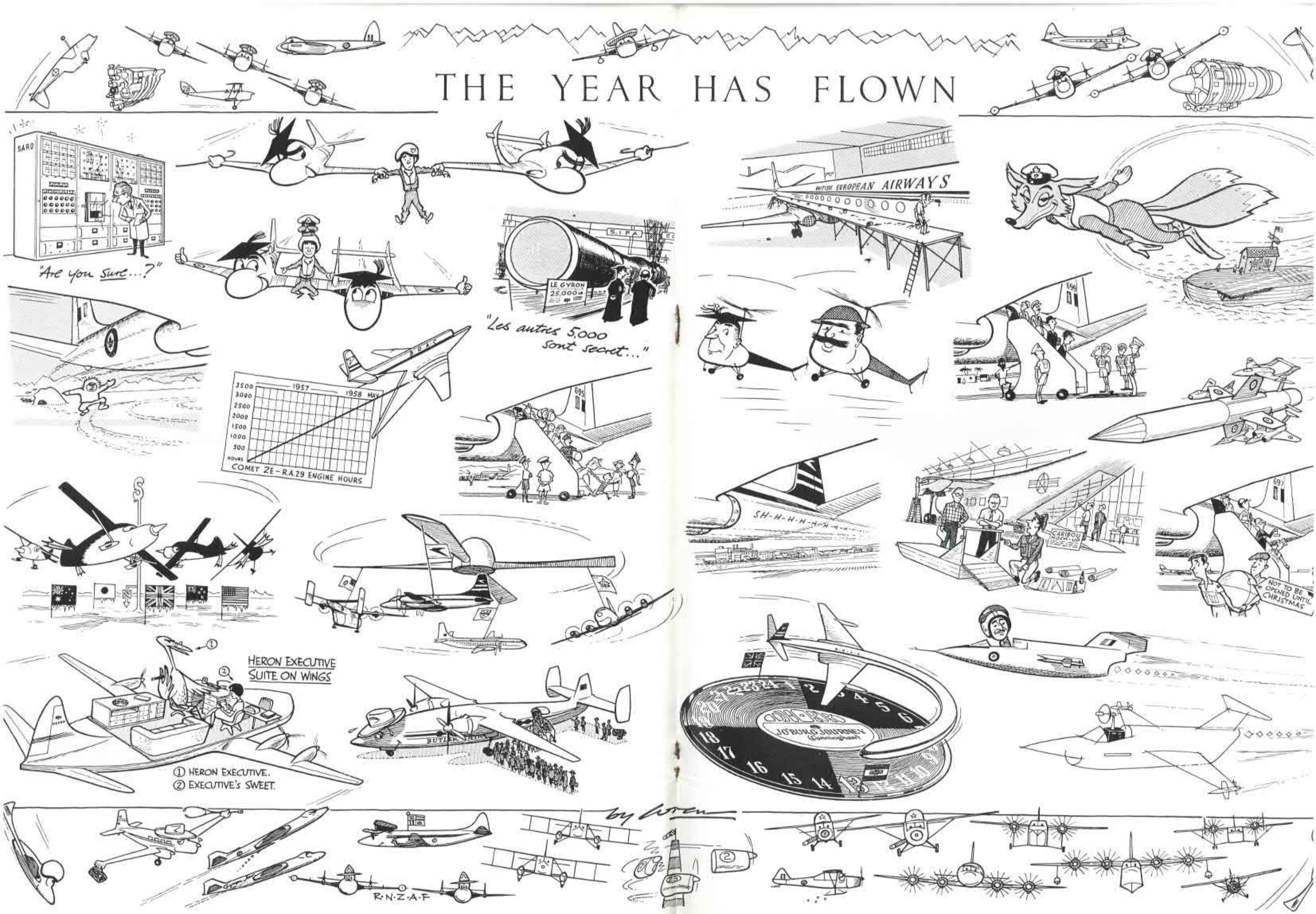
### *Operating Economics*

Using a cruising procedure to give minimum direct operating costs, the cost per mile of the Comet 4B and the Comet 4C are practically identical; it follows that, since both aircraft have the same fuselage capacity, the costs per seat-mile and per ton-mile will be the same.

The Comet 4C is best summarised in the phrase used earlier, by saying that it offers a substantial increase in payload capacity compared with the Comet 4 at the cost of a small reduction in maximum range. This larger payload capacity has a considerable effect in reducing the direct operating costs to a level which indicates that this aircraft in its role will be extremely profitable. In addition its level of aerodrome performance will in general enable it to use existing runways without extension. It is likely to find its principle application therefore among operators having medium-to-long stages in their networks, for example the routes connecting Europe with Australia and the Far East, with South Africa and with South America, all of which routes are characterised by a predominance of sector traffic.

In addition, the Comet 4C can be used over the short stages of the Comet 4B's natural field of operation without any penalty in operating economics. The small increase in block time consequent upon its slightly lower normal operating indicated air speed limit will be no handicap except perhaps in those parts of the world where speed and extreme flexibility, which are the special attributes of the Comet 4B, are of paramount importance. It is therefore likely to find short-range application on the major stages of the European networks, in the Far East, in the Caribbean and in South America.

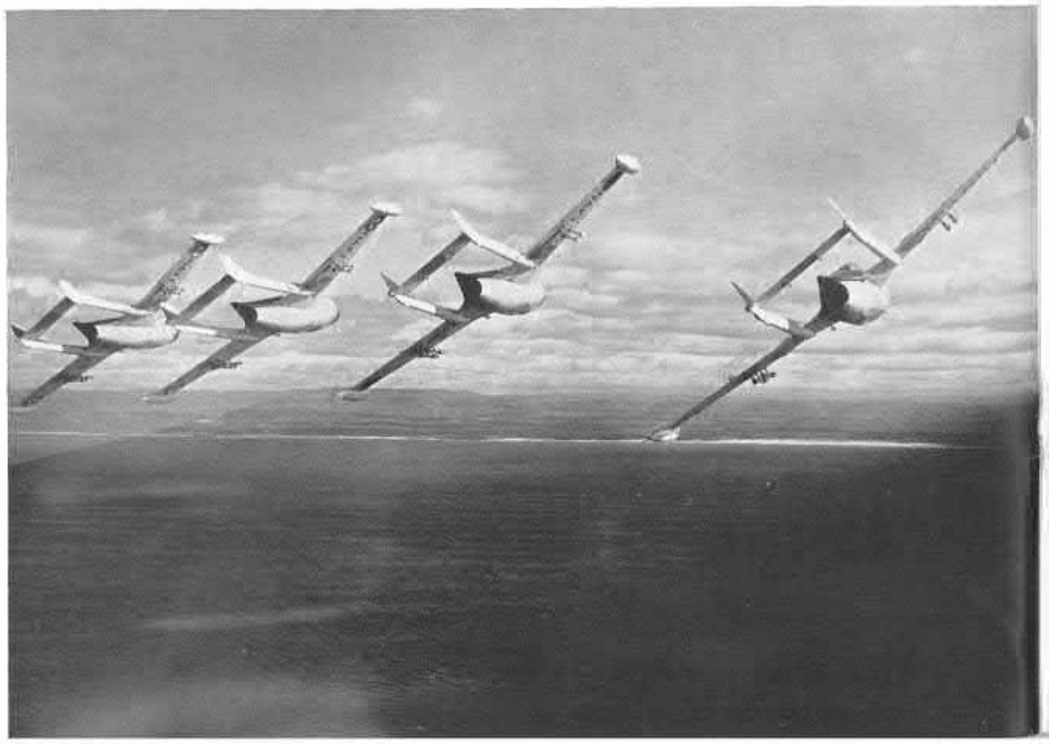
# THE YEAR HAS FLOWN



# Vixens, Venoms and Vampires

## *"Down Under" and "Up Over"*

*Western Germany. These inverted Venom FB 4s, photographed from a Vampire Trainer, belong to No. 94 Squadron, Celle. Leading the formation is S/Ldr. D. G. L. Heywood. The Venom Wing at Celle has until recently complemented the work of No. 123 Venom Wing at Wunstorf.* *(See article on page 288.)*



*Australia. Four Sea Venom F.A.W.53 aircraft of No. 808 Squadron, Royal Australian Navy, turn in for an exercise strike on the air-to-ground range near the Naval Air Station at Nowra, New South Wales.*

*Indonesia. Ten years ago the Indonesian Air Force did not exist. Now, since independence, she has an effective force of Vampire Trainers, as well as other types.*

QU'EST-CE QUE C'EST?

*Headed by Capitaine de Corvette Mauban, a French Naval team has been evaluating the flying characteristics of the Sea Vixen. This photograph, taken at de Havilland, Christchurch, England, shows Lt. Landré (left) and Lt. Gérard (right) investigating the hydraulic system. In its plastic dust cap is the Plessey ram-air turbine which can be lowered into the air stream for the emergency operation of the hydraulic system.*

C'EST UNE VRAIE RENARDE DE LA MER

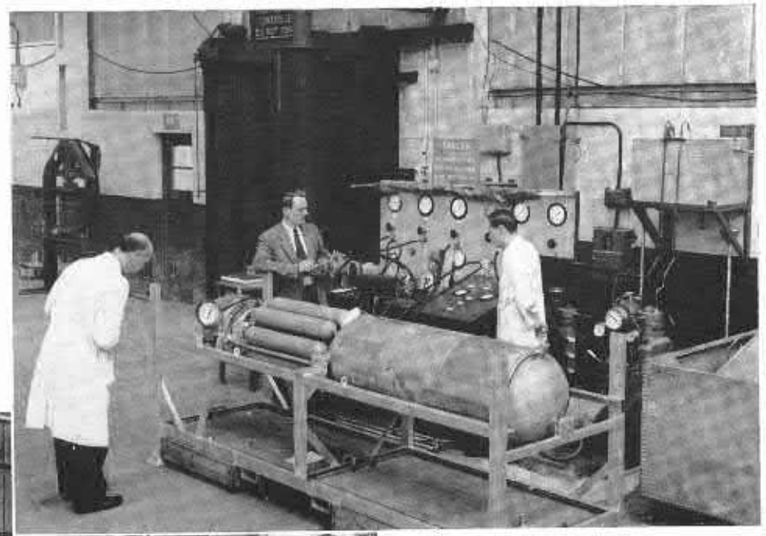
*The French team (two pilots and one engineer) which visited de Havilland, Christchurch, in September, put the Sea Vixen through her paces during their week's stay. This is Lt. Gérard.*

*Australia builds Vampire Trainers. The first Mark 35 Vampire Trainer aircraft to be built at the Australian Company's Bankstown factory was officially handed over to the R.A.A.F. during September. The Rt. Hon. Howard Beale, Q.C., M.P., Minister for Supply and Defence Production, and Air Vice-Marshal C. D. Candy, C.B.E., Deputy-Chief of Staff R.A.A.F., attended. Prior to this government contract many earlier marks of Vampire fighters and trainers had been built at Bankstown. Delivery of the first Mark 35 was on schedule.*

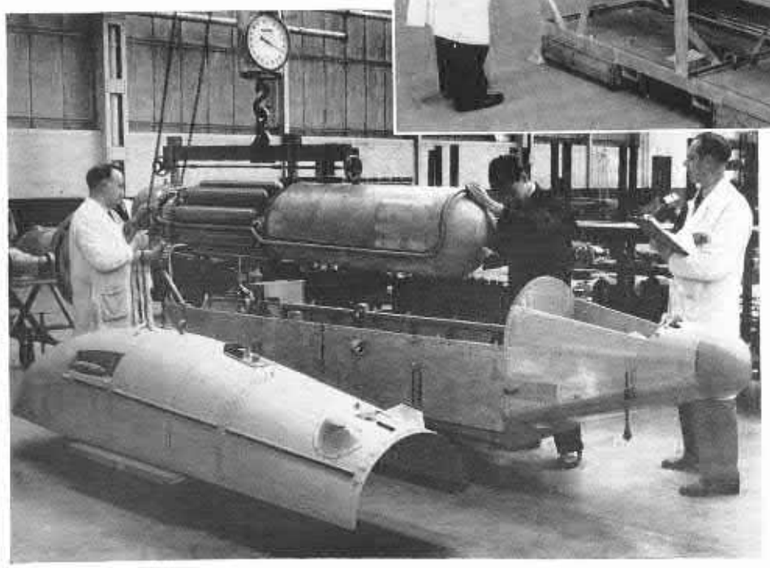
# The Super Sprite in Production

*The de Havilland Super Sprite, the first liquid-propellent rocket engine to have successfully completed a British Government Type-Approval Test, is now in full production for the Royal Air Force. The views on this page show something of the assembly line and the droppable containers, in which the engine is fitted to the Vickers Valiant four-jet bomber.*

*A general view of Super Sprite assembly work at the de Havilland Engine Company's production division where both the rocket and its nacelle are made. Each engine is given an endurance run on the test bed before final assembly.*



*A simulated firing using compressed air to test the propellent feed system is carried out before the engine is installed in its nacelle. This is necessary to ensure perfect operation of the control valve which is stripped for inspection after the final test bed run.*

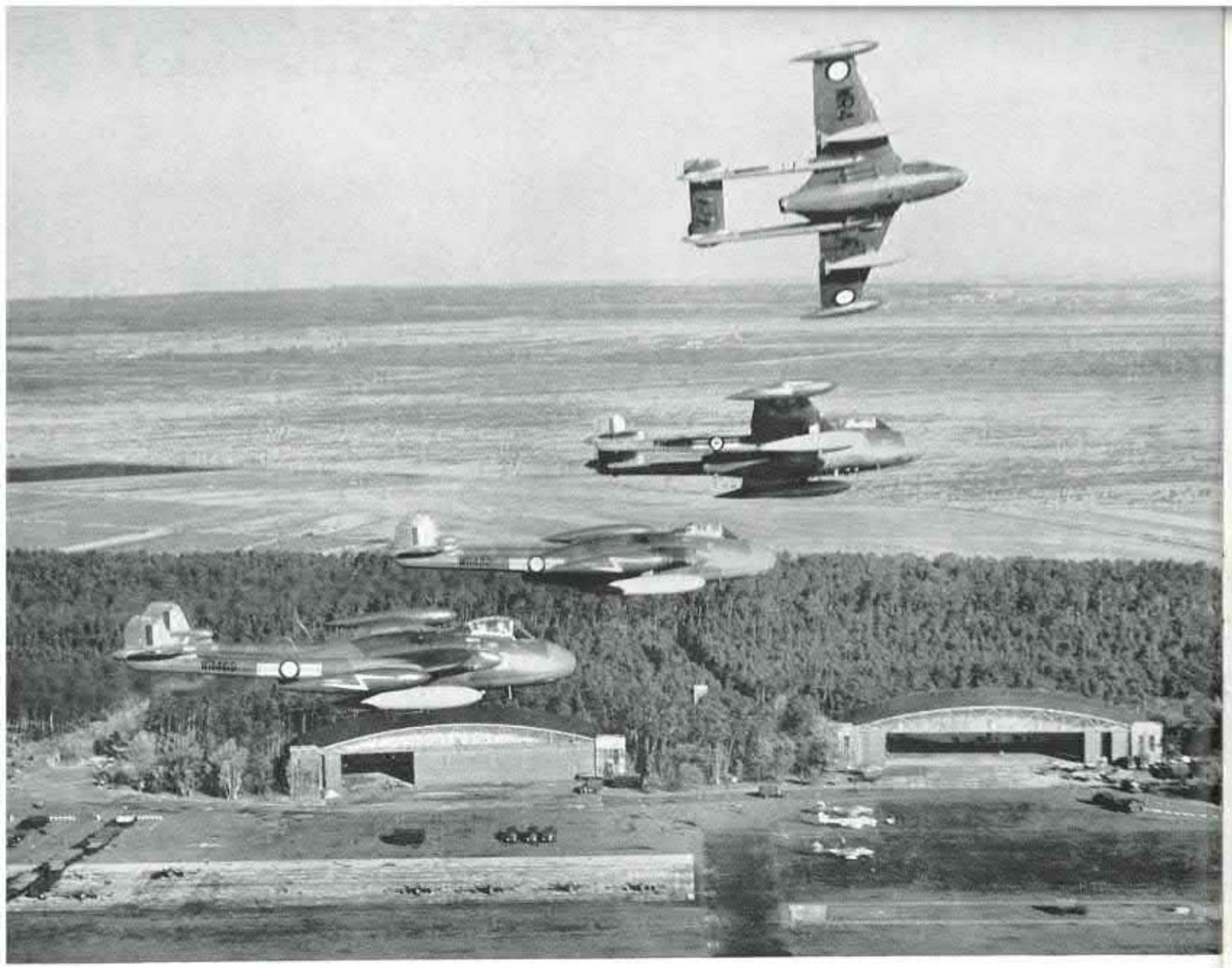


*The rocket, finally weighed and its centre of gravity confirmed, is now ready for installation in its nacelle. This light-alloy container is of monocoque construction and is suspended by means of a 38-foot-diameter parachute when jettisoned after take-off. The landing impact is absorbed by an air bag which is automatically deployed beneath the nacelle during the descent.*



# Ground-testing the Flying-control Circuits of the New Comet

*The complete flying-control system of the new Comet, developed from successful experience with earlier marks, is at present undergoing test on this full-scale ground rig at Hatfield, England. The functioning of elevator, aileron, rudder, air-brake and flap circuits is proved under all normal flight and emergency conditions; important units aft of the pressure dome have been successfully tested at temperatures down to —50° C. Complex circuit geometry is checked and faults are analysed and eliminated. The photograph shows the duplicated control cables, running aft on port and starboard sides from the pilots' controls to the hydraulic-powered servodynes which actuate the control surfaces. Either set of cables provides complete control by means of multiple hydraulic services. Besides functional proving there is a programme of endurance testing to establish long service life. This involves continuous powered actuation of the whole system, with tens of thousands of operating cycles, extending day and night over a period of several months. Such rigs as this speed up the work of certification for the Intercontinental and Continental Comet versions which are in production.*



# NATO Venoms

## *No. 123 Wing's contribution to the defence of the free world*

IT did not take long to reach Royal Air Force Wunstorf, Hanover, Western Germany (Commanding Officer Wg. Cdr. R. L. Smith) where the three squadrons of Venom FB 4s making up No. 123 Wing are based. Air Ministry, London, had kindly made the necessary travel arrangements and they bore the hall-marks of first-class staff work, our arrival coinciding happily with a dress rehearsal for "Operation Christmas," in the Officer's Mess. The aim was simple: the officers were to entertain the N.C.O.s.

The journey from Northolt as far as Wildenrath, Western Germany, was made in the commodious and measured comfort which is such a feature of our competitors' aircraft. The last lap, from Wildenrath to Wunstorf, as if to avoid any suggestion of partisanship, was flown in a Meteor 7. We were ready for the dress rehearsal.

The scene was polyglot and cosmopolitan, and was set in the cellar bar beneath the officers' mess. Both Air Force and Army were there in strength. The latter are responsible for the ground signals organisation without which no tactical air force can function, and they also provide the ground liaison teams responsible for pilot-briefing. The Americans were also in force in one corner; in another, deep in a discussion on skittle tactics, were the Royal Netherlands Air Force — easily recognisable by their "Je Maintiendrai" shoulder flashes; Kilts in one part of the bar, next to them Frenchmen; Gin with Italian; beer with spumanti — it was a gay, nostalgic scene and altogether it formed a not untypical backcloth to a tactical air force whose watchword is inter-allied and inter-service co-operation. Behind the bar, working with fevered efficiency was Paul the barman who, with the remainder of the German staff, helps to make Wunstorf such a very pleasant Mess. However, Wing briefing next morning was at eight o'clock.

The role of No. 123 Wing (Wing Commander A. G. Todd, D.F.C.) is officially described as "Fighter/Ground Attack"; in practice, however, the accent has been on ground attack.

The Venom has many qualities which make it outstandingly suitable for ground-attack duties. Its manœuvrability combined with its steadiness as a gun-platform, its good range, its ease of handling and the ability to carry a wide variety of external stores have enabled it to fit a number of roles. Its one de Havilland Ghost engine fitted with a simple cartridge starter has also played an important part in producing a high standard of serviceability.

Here are some of the typical roles which the Venoms have played :

(1) Fighter-bomber attacks on pinpoint ground targets, e.g. Radar and D/F sites.
(2) Fighter-bomber attacks on enemy aircraft on the ground.
(3) Fighter-bomber attacks on army tactical targets, e.g. bridges, road convoys.
(4) Army close support, e.g. attacks on gun emplacements, tanks, assembly areas, etc.
(5) Airfield defence against air attack.
(6) Army-sponsored visual reconnaissance.

Squadrons train for all these duties and there is seldom any difficulty in meeting the training task. There is no doubt that, in the hands of average marksmen, and led by good pilot-navigators, Venoms can strike hard against pin-point targets which cannot be hit by medium-altitude bombers; their manœuvrability makes them extremely difficult to intercept and, should contact be made with the enemy, the Venoms can "make rings round" many modern fighters.

The recent NATO exercise "Strikeback" provided yet another example of the way in which they have proved their worth. On this occasion, No. 123 Wing was deployed to Schleswigland (close to the Danish border) where their role was to fly four sorties per day representing enemy strikes; for this the Venoms flew with under-wing tanks, which widened their already excellent range considerably and enabled them to approach Denmark from far into the Baltic.

Ground-attack operations follow a well established precedent. No. 2 Group (Air-Vice Marshal S. R. Ubee, C.B., A.F.C.), the formation responsible for the operational control of No. 123 Wing, is situated alongside No. 1 (British) Corps (Lt.-Gen. H. E. Pyman, C.B., C.B.E., D.S.O., M.A.), an arrangement which speeds up planning and decisions on target priorities. At the lower "Wing" level the Army is represented by the Ground Liaison Officer (GLO) who forms a part of the Wing Commander's operational staff. At Wunstorf, Major D. T. MacGregor of the Greys performs this important function and he sees to it that Wunstorf pilots are briefed on the Army's requirements, of the positions of our own troops and the overall tactical situation.

Alternatively, the Wing may be used in its interceptor capacity. Defensive fighter operations are then conducted in the normally accepted manner. At Wunstorf the order to "scramble" comes down from the Sector Operation Centre to Wing Ops by tele-talk; Wing Ops has a direct tele-talk line to squadrons; delays are negligible and the whole Wing can be scrambled in a remarkably short time.

So far the entity of the Wing has been stressed, and the reader might well be excused for thinking that the Squadrons themselves have lost their identity. At Wunstorf this is far from true. Each squadron commander is responsible for the training, discipline and morale of the squadron. Servicing, other than daily servicing, alone is centralised.

No. 5 Squadron (S/Ldr. T. P. Fargher, D.F.C.) whose motto "Frangas non flectas" means — I was assured — "You make 'em, we break 'em," has, for example, a long and distinguished history starting in 1913 with Avro Farmans. Highlights are commemorated on "The Standard". In the first great war, only nine days after their arrival in France, the Squadron forced down the first German aircraft. Encouraged by this early success, they then shot down (as against forced down) the first enemy aircraft of the war. The second great war saw No. 5 operating at home and in India on a wide variety of types but it was not until 1952, when the squadron reformed with Vampire 5s, that de Havilland took a hand in things. In November of the same year the squadron started to re-equip with Venom FB 1s. The Vampires, however, were reluctant to leave and it was the middle of 1954 before the last actually disappeared from the Squadron.

No. 11 Squadron — "keener and swifter than an eagle" — is commanded by a Canadian—S/Ldr. D. G. Evans. Like No. 5, this squadron has also been awarded "The Standard" for its long and distinguished service. No. 11 Squadron's de Havilland history, however, started in 1948 when the squadron was equipped with Mosquitoes. These gave way to Vampire 5s in 1950, and in due course this squadron also re-equipped with Venom FB 1s and later FB 4s.

*No. 5 Squadron received "The Standard" in April, 1954; the Maple Leaf commemorates the Squadron's association with the Canadian Corps during the first great war. "The Standard" is awarded by Her Majesty the Queen for long and distinguished service.*

*F/Lt. the Hon. John Huggins, Flight Commander No. 266 (Rhodesia) Squadron, obviously enjoys his Venom flying. The Squadron's crest, seen here, is an eagle. The Squadron motto "Hlabezulu" (Stabber of the Skies) can just be discerned on the tip tank of the lowest Venom in the picture opposite. R.A.F. Wunstorf, formerly a Luftwaffe airfield and likely to become one again, is in the background.*

Last but not least there is No. 266 (Rhodesia) Squadron whose Venoms bear the squadron crest — an eagle on the port side of the nose. In addition the squadron motto "Hlabezulu" — Stabber of the Skies — appears on each tip tank. As its name suggests No. 266 (Rhodesia) Squadron is manned by Rhodesian volunteers, although the Squadron Commander (S/Ldr. G. R. Baxter) is an Englishman. This squadron takes a special pride in its weapons training, a fact reflected in an unusually satisfactory cannon stoppage rate.

If war were to come to-morrow, many vital targets especially suitable for Venom ground attack suggest themselves; not least I.R.B.M. sites and enemy radar installations. NATO's policy however is clear; infringement of NATO soil means nuclear war and the highest priority has therefore to be accorded to providing the deterrent and the means of attacking the enemy's nuclear bases. The Army's requirements may well come second, unless a land-force emergency were to necessitate a "last-ditch" diversion of effort. In all probability the role of land forces will be very different, the first requirement being the defence and holding of the air bases from which our nuclear power can be exercised. Once this new strategy is accepted there will be little need to retain forces to wage the attritional warfare so necessary in the 1939–45 war.

In these circumstances the decision to disband the NATO Venom wings is understood. Venoms will, however, continue to play an important part combating cold-war threats and carrying out the world-wide police actions which are for ever the burden of the free countries.

*No. 5 Squadron's Venoms line-up for the Air Officer Commanding's annual inspection. No. 11 and 266 (Rhodesia) Squadrons can just be seen in the background. With No. 5 they comprise No. 123 Wing.*

able to declare a dividend this year.

This report would not be complete if I did not give expression to the Directors' warm appreciation of the loyalty and team spirit which have been so evident throughout the many departments of the Company during the period under review. But for these factors the programme of expansion of our technical and productive facilities, to which I have already referred, could not have been accomplished. I am sure that the efforts which our people are making reflect the confidence that we all feel in our Fireguard guided weapon.

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*The following photographs illustrate but a few aspects of the remarkable expansion referred to by the Chairman in his Address*

*A view of the interior of the remarkable new test-rig for static firing trials of Fireguard. The weapon is freely mounted on four suspension rods hanging from the roof. Also on the roof are twin panels from which supply lines run to the battery of instruments in the control room. The platforms which surround the weapon are equipped with guards (not visible in this photograph) which provide maximum protection without hampering the work of the testing crew.*

*The parent fighter carries Fireguards on launching shoes attached to the wings of the aircraft. This photograph shows the installation on one of the latest fighters.*

*A model of the prototype Fireguard. The compact size of the weapon is well illustrated in this view.*

*This fine study shows the Company's head office and engineering base, which may be distinguished from neighbouring factories by their characteristic layout. Security regulations normally prevent the publication of aerial views of establishments engaged on work of national defence; special dispensation to publish this photograph was, however, readily granted in this case.*



*A hole, typical of many, which has been dug in connection with development trials of Fireguard.*

*Just to the right of the building shown in this photograph is the fine new Fireguard production factory, covering fifteen acres, on which construction work was recently completed.*

*The Company's rapid expansion has created a demand for further factory space and office accommodation. Among the buildings to be erected shortly is a new administration block at the main production factory. This will be built on the site shown above, chosen after careful survey.*

*In line with the national policy on technical education, the Company operates a comprehensive apprenticeship training scheme, and there are large numbers of young men under instruction in each of our factories. All aspects of design, development and production are taught by competent instructors, one of whom is shown in this photograph.*

*Mr. G. I. Schayke, B.Sc., Chief Vibration Engineer, whose appointment to the Board is referred to in the Address.*

*The setting for this sunny photograph, taken near the gates of one of the Eastern Group factories, is typical of all Fireguard establishments throughout the country. Pleasant surroundings help to create a happy working team.*

*The infra-red guidance system of Fireguard is extremely sensitive. From a range of more than five miles it can detect the heat of a domestic electric fire.*

*The latest mark of Fireguard, shown here in model form, is a fully-developed weapon which embodies numerous refinements of design made in the light of experience gained during many years of intensive research.*

*New voices in the Wilderness. Fecteau airbase at Cache Lake in the heart of Quebec's newest copper-mining country, Chibougamau. Dock is 1,200 feet long, accommodates 17 seaplanes. New steel and concrete hangar (right foreground) is under construction at cost of $130,000. Start on housing project for company personnel may be seen at upper centre. Site was untrodden virgin forest four years ago.*

# Minefinders' Airline

By SANDY A. F. MACDONALD

*From Quebec's fabulous Chibougamau copper country comes the romantic success story of Arthur Fecteau — pioneer French Canadian bush pilot and Northcountry charter operator. Original assets in 1940 totalled seven dollars in cash. Net worth of A. Fecteau Transport Aérien Ltée. to-day is well in excess of one million dollars.*

270 MILES NORTHWEST of Montreal lies the thriving community of Senneterre — less than 20 years ago a Hudson Bay fur trading post, plus a lumber mill, a saloon or two, and some rough and ready accommodation for the horde of eager prospectors who were then beginning to make it their last contact with civilisation on their trek into the Quebec wilderness in search of gold.

Senneterre lies at the eastern extremity of a belt of greenstone rock formation that extends west a distance of more than 200 miles to South Porcupine, Ontario, and in a north-westerly direction more than 400 miles from Gowgama to Lake Chibougamau. Out of this territory, roughly 55,000 square miles in area, has poured a bountiful harvest of mineral wealth valued in excess of 185 million dollars a year. One giant enterprise alone, the Noranda Mine at Rouyn, accounts for a total production of 33½ million dollars a year from the refining of its gold, copper and silver ore.

Since the first discovery of silver at Cobalt in 1903, which electrified the North American Continent and set a tremendous silver-mining boom in motion, exploration and discovery have kept a great army of adventurous men constantly in the field, pushing the frontiers of this mighty mineral empire northward and eastward. In 1909 the discovery of the Hollinger Mine sparked the beginning of the famous Porcupine mining camp in Ontario. 1912 saw the surge of mining development fan eastward into the Kirkland Lake region. Quebec's 85-mile-long "gold belt" came into existence with the discovery by Ed. Horne of the fabulous Horne property at Rouyn — which now forms part of the multi-million dollar Noranda mining enterprise. Gaining momentum in the early '30's, the tide rolled eastward through Quebec's Bousquet, Cadillac and Malarctic townships, on through Val d'Or and finally into Senneterre, which lies on the eastern fringe of the greenstone mineral shield.

Flying west from Senneterre towards Noranda to-day the gold belt appears to the eye as a continuous 85-mile chain of light coloured patches standing out in startling contrast against the sombre green of the surrounding forest areas. Each light coloured clearing represents a community of mine buildings and their accompanying townsite huddled within the perimeter of a circle whose centre — the dominant landmark of the group — is the mine headframe. Travelling overland through the district, these towering headframes loom up against the horizon in rapid succession, like a long line of giant sentinels standing watch over the treasure hoard that lies buried at their feet.

About the time that the first influx of prospectors began to trickle into Senneterre in 1936, a young French Canadian pilot, Arthur Fecteau, arrived at the settlement, tied his Travelair biplane up alongside the log booms in the Bell River, and announced that air service had now come to Senneterre. Charter flights "anywhere at any time" was the slogan of the single-handed enterprise he established — with its headquarters anywhere the Travelair happened to be moored up at the moment. The ink was dry on the commercial pilot's licence he had received from the Quebec Flying Club prior to his departure for Senneterre, but the pages of his pilot's log were there to record the details of flying hours yet to come.

Young Fecteau, however, was enterprising and resourceful. He managed to promote enough business flying Indians and fur traders into the Abitibi country to keep his tiny one-man business solvent. He was also, by nature, somewhat of a horse trader. About midsummer of his first season at Senneterre he flew the Travelair down to Montreal and traded it on a swap deal for a Cirrus Moth — the first of a long series of de Havilland types that were later destined to be registered in his name.

The business prospered, and in 1937 Fecteau teamed up with a man by the name of Bill Michaud, an amazing individual with the courage — and it took a lot of it at that time — to sink money into flying. With the money Michaud contributed to the partnership, Fecteau purchased a Fairchild 51. Later a Cub J3 was added.

At the outbreak of World War II in 1939 the partnership was dissolved. Fecteau secured a job, and a wealth of experience that year as a commercial pilot flying a D.H. Rapide for an old pioneer Canadian bush operator, Howard Watt, who was operating an air service along the north shore of the St. Lawrence River.

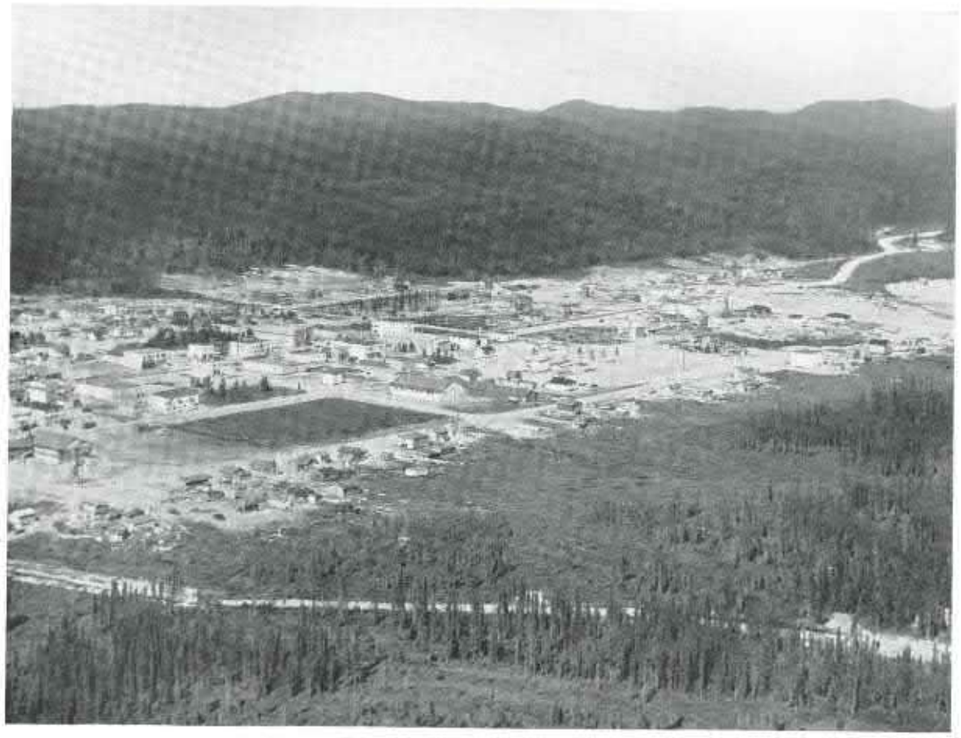
But Arthur Fecteau was from the outset of his career a person possessed of powerful convictions and an irrepressible urge to make and abide by his own decisions. These singular human attributes left only one course open to him — to capitalise on his best efforts. He could only succeed in doing so by conducting a business of his own. That matter settled in his mind, in 1940 he decided to go into business for himself. At the time his total assets consisted of seven dollars in cash! Gay Record, an astute young business man who was serving as a pilot with R.A.F. Transport Command (and who subsequently lost his life on a Transatlantic ferry flight) happened to have a good used Fox Moth at that time for sale. The asking price was $2,500. Fecteau made him a sporting proposition — nothing down and the balance in twelve months' time. Record stroked his chin and turned the matter over in his mind. Then, convinced of Fecteau's sincerity, he promptly accepted his offer. By dint of much hard work, and at the cost of some austerity, Fecteau paid the obligation off in a matter of six months' time.

With the acquisition of the Fox Moth, he returned to Senneterre. There he established a profitable business connection with a Russian Jewish fur trader by the name of Bernard Robonovitch. Robonovitch used Fecteau's Fox Moth regularly to visit Indian trap lines scattered throughout the district to barter for



*1936. The Cirrus Moth in which Arthur Fecteau established his air transport service at Senneterre, Quebec. Principal activity was flying Indian trappers and fur traders in the Abitibi forest areas.*


*de Havilland Canada's first post-war customer was Arthur Fecteau. CF-BFI is seen beached on the shore of the Bell River at Senneterre, at the site where the docks, shipway, and buildings of the busy airbase are now located. CF-BFI was D.H. Canada's Fox Moth Serial No. 1.*



*Chibougamau. Mushroom mining-boom town. In 1950 a tumble-down trading post. Now the "bright lights" for miners and prospectors in the copper camps of the Lake Chibougamau-Opemiska area. Population 2,500. Still in the raw, rude early throes of development, Chibougamau's future as an important copper-mining centre is assured.*

fur and to bring home the loot that remained to poor Robonovitch after, as he dolefully lamented, being regularly "robbed" by these simple Children of Nature.

Events began to move swiftly for Arthur Fecteau. He picked up the bits and pieces that remained of a Junkers Ju 23 following a fuel tank explosion, for a mere song. His objective: to rebuild the Junkers and put it back into service. At that time his facilities consisted of a shack on the bank of the river which he had purchased for $125. Within the walls, which measured 15 feet by 20 feet, he had managed to concentrate a workshop, office, warehouse and living apartment. But the Junkers' overall dimensions were never designed to be crowded into such a Lilliputian scheme of things. Fecteau realised that to get the white elephant he had purchased back into service again, he would have to construct a hangar to undertake the rebuild. Soon the hangar, 65 feet by 65 feet, began to take shape. The financing was a matter of simple elementary economics. At the end of each week Fecteau would take off at the crack of dawn, collect the proceeds of his week's charter flying activities, and return to pay off the workmen who were waiting at the dock for their money as he taxied in. The new hangar completed, the Junkers was completely rebuilt, Fecteau doing the major share of the work himself.

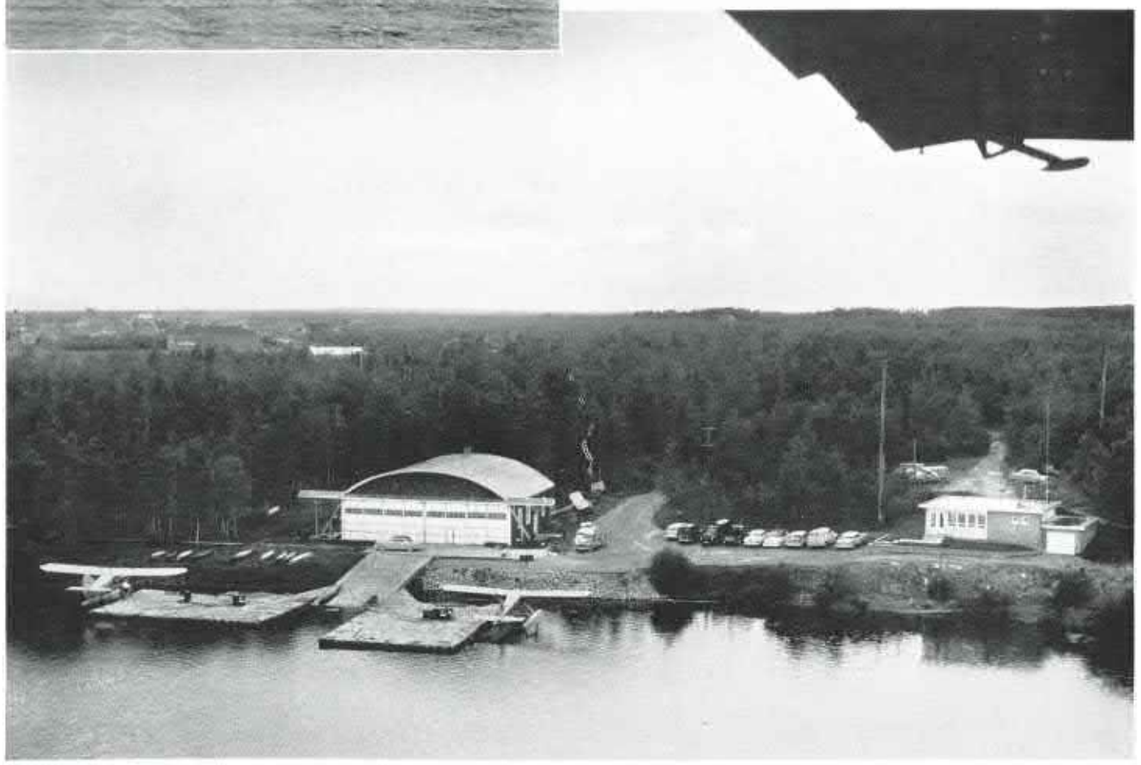
Then disaster struck. The Junkers hit a downdraft on landing, and the Fox Moth collided with a C.P. Airlines seaplane during a take-off from the river. Fecteau gained his business experience the hard way. At the time of the accidents he carried no insurance, which meant that he found himself practically right back where he started. Unallayed by the setback, he set to work to recover his losses. The Fox Moth was sent to the Canadian factory for rebuild. This was the first project to be undertaken by the D.H. Canada post-war organisation when it was reactivated in a small corner of the war-time factory in 1945.

The following year Fecteau bought a new Fox Moth, CF-BFI, the first to roll off the assembly lines of the newly-reorganised Canadian Company.

The years that followed witnessed a remarkable story of growth and expansion. The raw little frontier shack-town of Senneterre that Fecteau first saw in 1936 is now a thriving division point on the C.N. Railway, boasting a lumber mill and two planing mills by way of local industry. The corner drug store, symbolic of the modern way of life in America, is firmly established there. So also are the Household Finance office, rock 'n' roll, and all the dubitable blessings of civilisation. Fifteen years ago, Arthur Fecteau can recall, the milk for the Senneterre Hotel was being delivered by dog team.

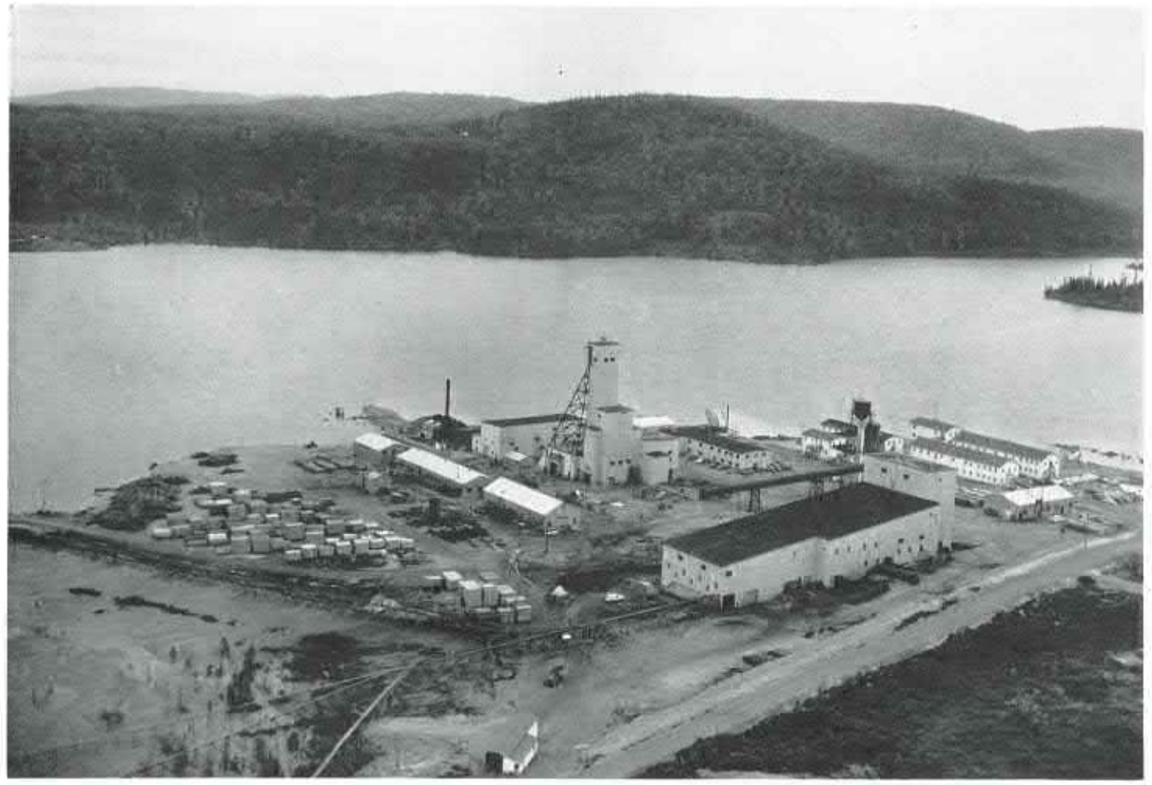
From an original flying service that depended almost entirely on a few Indian trappers and the fur trade for its existence, Fecteau's operations have gradually widened in scope. A substantial amount of flying time is now contracted for annually by the Quebec Provincial Government for forest fire protection and the survey of water power resources. The Department of Indian Affairs calls frequently for the use of planes to transport food and medicine. Many times during the season

*Then. Fecteau's first establishment at Senneterre was the shack on the bank of the river and served as workshop, office, warehouse and living apartment. Aircraft on the left is the Junkers, which he purchased in bits and pieces and right, the Fox Moth which he bought with $7 in his pocket.*



*Now. The hangar, 65 ft. × 65 ft., office and radio station, docks and shipway of Fecteau Transport Aérien at Senneterre, built on the site of the original building in the inset photo above. The town of Senneterre may be seen left in the distance.*





*Bonanza in the bush. Ten new copper mines have sprung up along the shores of Quebec's Doré Lake in the past five years . . . in which a total of 50 million dollars has been invested. This photograph shows the Campbell Chibougamau Mines head frame and mill buildings on Merrill Island as seen from a Fecteau Beaver seaplane carrying prospectors out to search for similar finds.*

urgent requests are received for missions of mercy. But by far the greatest proportion of the increased volume of traffic that has built up over the years has been directly related to intensified activity in exploration and mining development in the district. Prospectors, diamond-drill crews and their supplies constitute the bulk of the payloads hauled by the planes of Fecteau Transport Aérien.

During the early years of struggling expansion at Senneterre, Fecteau increased his fleet by the purchase of war-surplus Norseman aircraft from the War Assets Corporation. His first Beaver was purchased in 1948. It was the seventh to be produced by the Canadian Company. The purchase of the Beaver represented a radical change in thinking on Arthur Fecteau's part. All his equipment prior to this had been acquired second-hand. Now he had become convinced that new modern equipment with increased performance, appearance and efficiency would have a strong appeal to the public. The soundness of this reasoning is perhaps best attested by the fact that since he first established at Senneterre, Fecteau has faced fierce competition from no fewer than six other operators. To-day Fecteau Transport Aérien operates from Senneterre alone. Since 1948 Fecteau has built up his fleet by the purchase of brand new Beavers, Otters and Cessna aircraft. Maintaining the "new look" is the constant responsibility of maintenance crews.

In 1952 Fecteau decided to establish an air base at Chibougamau*. For more than half a century prospectors in the Chibougamau area had been staking its promising copper ore outcroppings, but lack of transportation had discouraged any serious effort to develop its potentialities. In 1950 a road was pushed through from St. Felicien on Lake St. John, 150 miles to the south-east. This, coupled with the highest temporary world price for copper ever recorded, set off one of the most spectacular mining booms in Canadian history. Concentrated in a long narrow finger of Doré Lake, to-day, some ten high-grade copper mines are producing or about to be brought into production. Combined, they represent a total investment of over 50 million dollars. The town of Chibougamau, which six years ago was little more than a backwoods trading post, appears destined now to become Canada's second richest copper-mining centre.

At Chibougamau, Arthur Fecteau selected a site on the west shore of Cache Lake, eight miles from the townsite, cleared an area of roughly eight or nine acres of timber, bulldozed a road into the base, and began to build. A dock over 1,200 feet in length was completed last year, capable of handling 17 seaplanes at one time. A steel-and-concrete hangar 14,000 square feet in area and costing $130,000 was being rushed to completion.

Success comes swiftly in Canada's awakening new frontier outposts to those who are willing to strive and persevere. Four years ago a young couple, Jerry Frigon and his wife,

* Pronounced Chi-boo-gum-oo, from an Indian word meaning "gathering place"

*Are you there? Time-saving devices are utilised by Fecteau Air Transport to speed up the movement of traffic at the Company's fixed air bases. Valere Guay, Base Manager at Cache Lake, carries on two-way conversation over loudspeaker installation at the seaplane dock with the base office. Many such installations help direct the handling, loading and despatch of the Company's aircraft.*

*Destination Lac Bordeleau. One of Fecteau's Otters is loaded with a ton of supplies and equipment destined for a survey party in the country south of James Bay. The Otters have transported entire mining camps, including drilling equipment and building materials. Base crewmen are lashing a canoe on one of the seaplane floats. Ability to carry canoes externally is an essential for such an aircraft.*

*Prospector's Retreat. Typical of thousands of such off-loading scenes in the rivers and lakes of Quebec's Northern mining areas, is the camera record of a Fecteau Transport Beaver unloading supplies at a prospector's camp on the Bell River. An interesting copper outcrop has been staked and the party are preparing to spend the balance of the season in further investigating the possibilities of the find.*

arrived at Fecteau's airbase and announced that they would like to open a restaurant. They had $20 in cash. Arthur Fecteau staked them a site on the top of a hill on which they erected a tent and set to work. To-day, where the tent once served, now stands the Highway Restaurant, a spacious roadside eating establishment whose spotless stainless steel kitchens turn out food that would be a credit to any sophisticated metropolitan hotel!

The Fecteau base at Chibougamau is a scene of constant throbbing activity. Most of the flying, like that originating at Senneterre, is generated by mineral exploration activities in the area. These reach out as far afield as Lake Abanel, 150 miles north-east, where a sensational iron ore discovery has been considered of sufficient importance to warrant the construction of a railway line into that far northerly outpost by the Canadian National Railway.

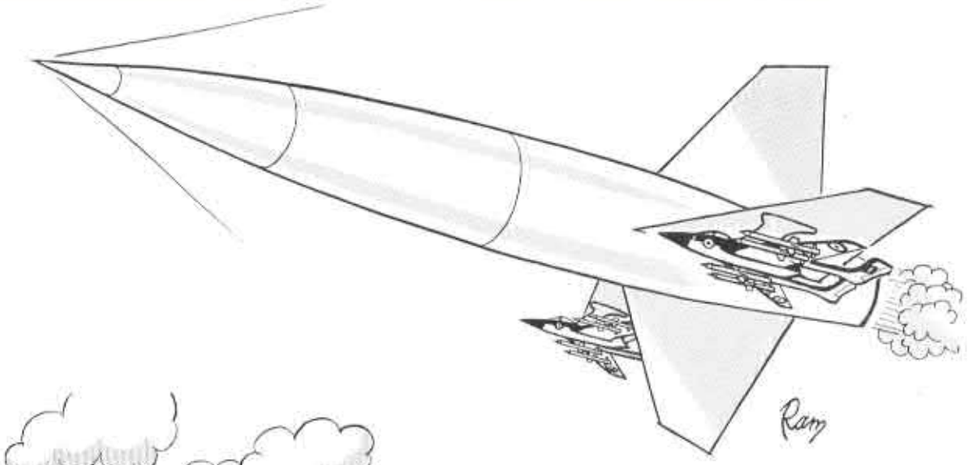
Fecteau Transport planes average 700 hours utilisation a year — a good average for bush operators, whose activities on floats and skis are interrupted by a five weeks' Spring break-up and Fall freeze-up period every year. During 1956 Fecteau Transport Aérien flew more than 760,000 miles, carried nearly 15,000 passengers, and airlifted more than four million pounds of freight. Charter rates average 65 cents per mile for the Beaver and $1.30 for the Otter.

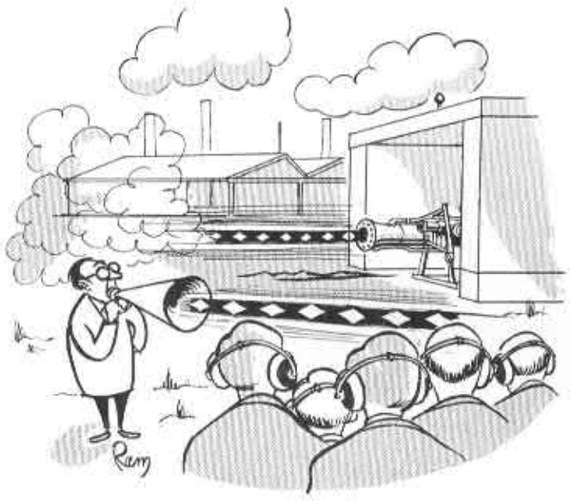
Fecteau places the utmost importance on the selection of his pilots. Three qualifications he considers of prime importance are: "Bush sense", ability to fly safely, and a zealous desire to serve the public well. His senior pilots earn from $7,500 a year up to as high as $10,000 with free housing. His turnover in personnel is negligible. They have to have better than average ability to qualify for the job and once they become established with Fecteau there is little attraction elsewhere to induce them to make a change.

Arthur Fecteau, who flew with us to Chibougamau, stood chatting with us on the dock at Senneterre while our Beaver was being refuelled for the return flight to Toronto. He is a man of medium height, with sharp features, a kindly but preoccupied expression, and bright eyes with a gleam in them that reveal the possession of a tremendous store of human energy. Beside him stood his right-hand man, Sylvio Menard, who started with him as a base helper at the age of 13, studied English out of a book and now speaks it better than the average Torontonian. Mr. Menard is Secretary-Treasurer of the Company which was incorporated in 1955, A. Fecteau Transport Aérien Ltée. That company, whose original capital was the $7 Fecteau had in his pocket the day he bought the Fox Moth in 1940, now boasts assets in excess of a million dollars. As far as Arthur Fecteau is concerned, the making of money, within the meaning of his own homely philosophy, is merely a means towards an end. Most of his earnings have been ploughed back into the business, and to-day he lives almost as simply as he did in the struggling early years of his career. He is in aviation because of his pure love of flying, and in the building of a successful air transportation service he has achieved his life's ambition. That, simply, is the human side of the story of his success.

*"Anywhere at any time." The up-to-date office and waiting-room of Fecteau Transport Aérien at Senneterre, Quebec, is often the last glimpse prospectors will have of civilisation for months to come. In the fabulous Chibougamau copper country, fortune may smile on them. One prospector who came out in 1956 said "I haven't had a bath in four months but now I can afford to buy a swimming-pool."*

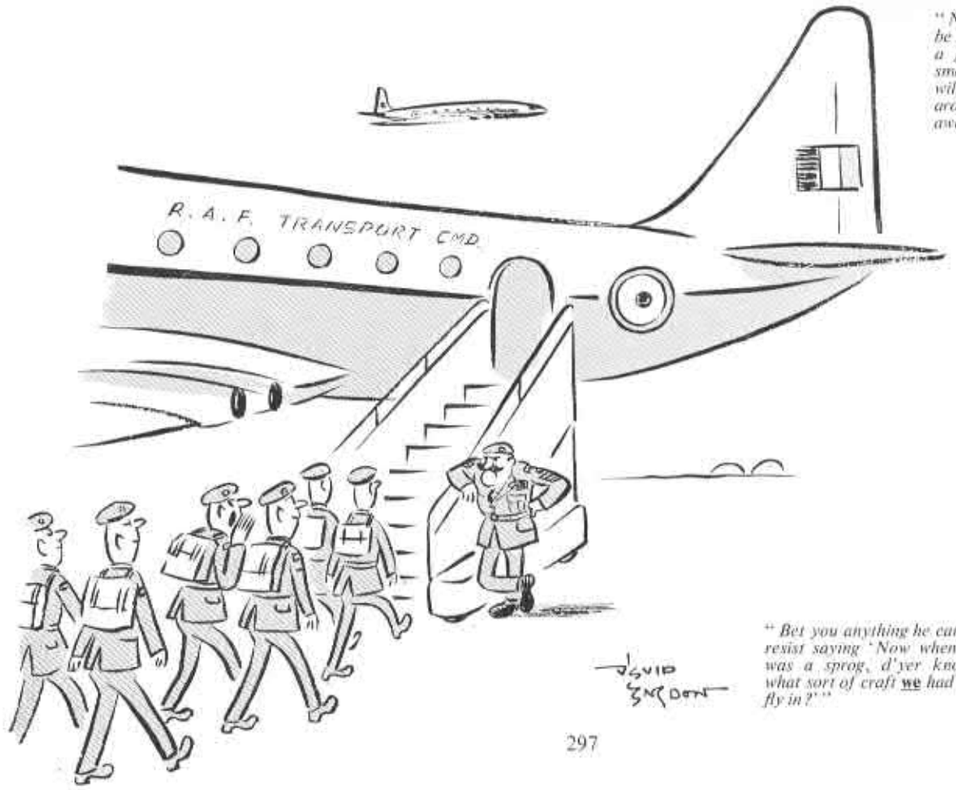






*"Now, what is she going to be like this time? Will it be a gentle approach and a smooth touch-down? Or will she do a quick turn-around and climb steeply away on the wrong course?"*




*"Bet you anything he can't resist saying 'Now when I was a sprog, d'yer know what sort of craft we had to fly in?'"*



## FIRST RUN OF A NEW GYRON JUNIOR ENGINE

ON October 4 the first of a new series of de Havilland Gyron Junior engines ran for the first time and in doing so satisfied the conditions required of it for contract acceptance by the Ministry of Supply. Designated the Gyron Junior DGJ.10 the engine is now under active development.

Security does not permit the publication of details of the DGJ.10 but it can be stated that the new engine is a later development of the 7,000-lb. thrust versions of the Gyron Junior which were exhibited during the year at the Paris Salon and at the S.B.A.C. exhibition at Farnborough.

It is announced elsewhere in this issue of the *Gazette* that one of the important applications for which the Gyron Junior is being prepared is the Saunders-Roe S-R.177 mixed power-plant interceptor where it is employed in conjunction with a de Havilland Spectre rocket engine.

A Gyron Junior is currently being test flown in the port nacelle of an English Electric Canberra and it is planned that later in the year a second Gyron Junior will replace the Rolls-Royce Avon in the starboard nacelle. For reheat purposes, trials will shortly begin on a Gyron Junior-powered Gloster Javelin.

* * *

de Havilland Aircraft Proprietary Limited, Sydney, Australia, has appointed Mr. T. H. Dalton, hitherto Senior Sales Executive under Mr. R. Kingsford-Smith, Sales Manager of the Company, to take charge of the Company's new office in Melbourne. Mr. Laurie Jones has been appointed to the Business Department to take Mr. Dalton's place. Mr. William D. Tulloch has been appointed Public Relations Officer under the Sales Manager.

## THE QUEEN'S HERON FLIGHT IN U.S.A.

*Her Majesty the Queen and H.R.H. Prince Philip on their arrival at Washington Airport on the evening of October 20. They had visited the thoroughbred training farm of Mr. Paul Mellon at Middleburg, Virginia, and travelled in a Heron aircraft of the British Joint Services Mission at Washington.*

## ADMIRAL FLIES OWN BARGE

*Flying himself in a Vampire Trainer, Rear-Admiral C. L. G. Evans, C.B.E., D.S.O., D.S.C., visited R.A.F. Valley before relinquishing his appointment as Flag Officer, Flying Training. There he presented prizes to officers of the Royal Navy on graduating from No. 7 Flying Training School. Valley is on the island of Anglesey.*

## OTTER'S ANTARCTIC RESCUE

The value of Sarah Search Equipment (Search and Rescue and Homing) was well brought out on October 1 when the Otter of the British Transantarctic Expedition at Shackleton Base, Vahsel Bay, Weddell Sea (Pilot Lewis, Navigator Stratton) succeeded in locating and rescuing Pilot Haslop and Medical Officer Rogers and their Auster which had been forced down eleven days previously on the ice shelf near to Halley Base. They had been going to the aid of Lieut.-Col. Smart, leader of the Royal Society's International Geophysical Expedition who had been ill at Halley since the middle of September, after a fall, but the Auster had put down on the shelf in bad weather with an hour's fuel left. On board were twenty-five days' rations for the two men.

Haslop and Rogers reported their situation by radio. Bad weather persisted but on October 1, at the second attempt, the Otter found them, landed alongside, refuelled the Auster and the two aircraft flew back to Halley.

How this was accomplished is interesting.

Having located Halley from Shackleton (200 miles) in 2 hours 20 minutes and then searched the shelf for 40 miles south in vain, the Otter refuelled in Halley, set up a Sarah beacon and took off again to search the shelf northward. Meanwhile, Shackleton had told Haslop to switch on the Auster Sarah equipment and within twenty minutes the Otter picked up its signal. The rest was "easy." Messages report that Col. Smart was making progress.

# Another Dove that works hard for Industry

*Ferranti Limited makes extensive use of its aircraft for executive travel and customer liaison*

THE name Ferranti is world famous. In industrial circles, both at home and overseas, Ferranti Limited have long enjoyed the highest reputation for important electrical equipment such as heavy-distribution transformers, instruments, meters, and, latterly, electronic computers. Less well known to the outside world because of security restrictions is the more recent work undertaken by the Company in the electronic field in connection with airborne radar, radar gun sights and guided weapons.

Founded 75 years ago by the celebrated engineer, the late Dr. Sebastian de Ferranti — best known perhaps for his revolutionary work in the early day of electricity on the generation and transmission of high-power current — the Company under the chairmanship of Sir Vincent de Ferranti, son of the founder, control some eight major production and research establishments in the United Kingdom with subsidiary companies in Canada and the United States.

Quick travel between these bases means much to Ferranti.

The factories and laboratories are located mainly in the Manchester area and in Scotland, with an administrative office and a service department in London. In the Lancashire factories the activities are devoted to the development and production of industrial electrical equipment such as heavy transformers and associated gear, meters, instruments, valves, cathode-ray tubes, computors and electronic systems for guided missiles. In the Scottish establishments the work is mostly concerned with the development and production of radar and navigational equipment and miniaturised electrical components, mainly for aircraft

Ferranti were among the first big industrial groups to realise that the use of a private aircraft would pay dividends in both time saving and cost. Key men could move about the country at will, without reference to timetables and without the other frustrations and delays of surface travel. In recent years the weather demon has been largely thwarted by the very weapons that are Ferranti specialities—radio and radar.

*Captain Allan and Navigator Hayes prior to departure at Turnhouse.*

*Daily routine in the booking office.*

Ferranti have operated a Dove on a steadily increasing scale since April, 1954. At the time the aircraft was purchased it was thought that it could be used, between times, for experimental work in connection with the firm's expanding aviation interests. In fact this particular aircraft never has been so used because from the first it could not be spared from communication duties.

The Dove G-ANMJ is based at Turnhouse Aerodrome, near Edinburgh, conveniently close to the two Scottish factories responsible for the development and production of most of the Company's airborne components. Close liaison between these factories and the many R.A.F. airfields and Ministry of Supply experimental establishments where Ferranti apparatus is in use or under test is of the utmost importance, and a large proportion of the Dove's journeys — about 40 per cent. — are concerned with transporting technicians to and from these establishments, most of which are in Southern England and widely scattered from the Isle of Wight to the west coast of Wales and to East Anglia. The Dove is also occasionally used for travel between Scotland and the London offices. It is the proud boast of the chief pilot, Captain W. Allan, that his passengers can expect to complete this journey more quickly by Dove than by schedule airline, saving up to 45 precious minutes.

Ferranti's operation of the Dove is not primarily directed towards the carriage of directors and high executives; a seat in the aircraft is made available on a priority basis for any member of the staff whose work justifies the speed and convenience which it offers and in order to ensure that the most efficient use is made of the aircraft's seat-mile capacity a central booking organisation has been established in Edinburgh through which all requests for air transport are channelled. By this means an average load factor of 75 per cent. has been realised, resulting in a real measure of economy, and the achieved figure of 200,000 passenger-miles in a year is a striking indication of the volume of work done by the Dove.

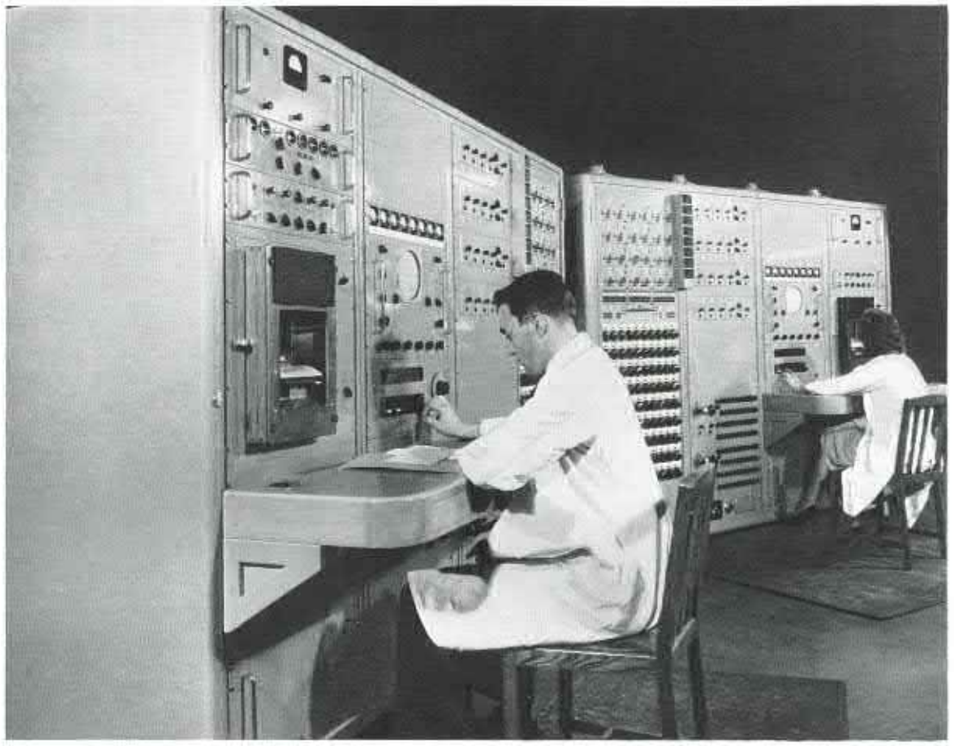
Ferranti's Dove is furnished to accommodate seven passengers without the luxurious interior trimmings usually associated with executive aircraft. It is fully equipped for bad-weather operation and carries comprehensive radio including I.L.S., S.B.A., V.H.F., M.F. and H.F., W/T and a radio compass. A radio operator is always carried.

The Dove and its Gipsy Queen 70 engines are maintained by two Company ground engineers who are able, with the workshop facilities available at Turnhouse, to undertake most of the engineering work including the renewal of the Certificate of Airworthiness. The aircraft is maintained in accordance with Air Registration Board's Approved Schedules in the "hire-and-reward" category and it is flown at all times on the same basis as a "public-use" aircraft. Thus no pains are spared to make the operation safe, regular and reliable.

The Ferranti operation is an excellent and typical example of the value of a private aircraft in serious industry, even in a small country that has not a good weather reputation. The advantages cannot always be displayed in a balance sheet. Ferranti Limited is not alone among British companies in deciding that a company-owned aircraft is indispensable to business efficiency. Many choose the Dove, and five hundred of them have been sold.



# SARO'S NEW ANALOGUE COMPUTER



*This analogue computer, consisting of two four-bay units, has just been built for the Aerodynamics department of the de Havilland Aircraft Company by the Electronics Division of Saunders-Roe Limited. It can operate as two completely separate computers or, coupled together by an interconnecting cable, as one.*

*There is a large programme of work ahead for this machine, which can deal with problems in aircraft stability, ballistics, interception and flutter involving up to six degrees of freedom.*

## J. E. BURTON
## A. F. EBLING
## D. N. S. MOYNIHAN

The *de Havilland Gazette* regrets to record that three members of de Havilland Propellers Limited, John Edward Burton, Albert Edward Ebling, and Dudley Neville Stephen Moynihan, lost their lives on November 6, 1957, in the accident to the Bristol Britannia airliner near Filton. They were flying in the aircraft to carry out observations of the propeller equipment.

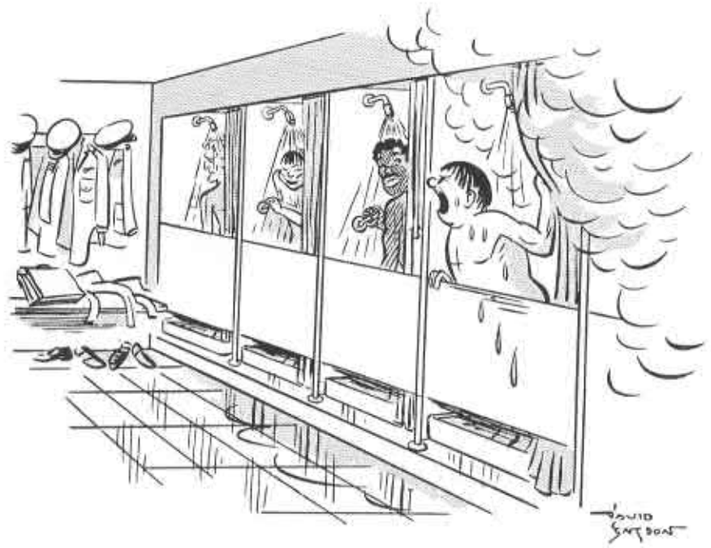
John Burton joined the Company in July, 1946. He held the post of section leader in the strain-gauge department and was thus a leading member of a group of engineers engaged in propeller research. He died at the age of 40 and leaves a widow and one young son.

Albert Ebling was 33 years of age: he joined de Havilland four years ago. He was also employed in the strain-gauge department and was a member of the research team led by John Burton. He was married but had no children.

"Jack" Moynihan joined the Company in 1954. He was a senior development engineer, resident at Bristol, and was responsible for the bench and flight testing of propellers fitted to Bristol aircraft and engines. He died at the age of 37 leaving a widow but no children.

# NEW ROLE FOR THE SAUNDERS-ROE SKEETER

*Carrying a nursing sister in the passenger seat and two patients — one either side of the cockpit — this versatile machine becomes the flying ambulance, and can bring urgent cases to the operating theatre in a minimum of time with reasonable comfort for the patient. Additional lift for the extra load is provided by the rocket booster system installed in this machine.*



*" Don't use the whale 2,000 gallons—unless you want to get me into aqua caliente, I mean gurram pani, I mean . . ."*

*Overheard at lunch:*

Canadian Comet Captain: " We were just overtaking the DC-6 when we heard a funny rumbling noise. Now do you believe in Comet silence? "

*Editor's Note: It is perfectly possible to hear piston-engined aircraft when overtaking them in a Comet. However, the noise is quickly passed.*

* * *

" The automatic telephone isn't working properly."

" No. There's nothing much you can do about it. It puts itself right in the end."

* * *

**MARVELOUS ASHTRAY**

Patent No. 32-1466

*What a phenomenal success its marvelous ashtray.*

*As you will put on somking cigarette's on the tray, its by conduction of cigarette's heat, rotating the sweet meldy from inside of trays automatically, then take off cigarette's the meldy to close.*

*They are give rejoicing for visitor at dewing-room and with your warkable friend in the office-room then to raise the level of efficiency.*

*They will guide to the happily road to dream-land; sleep when a quite sleep the night to free from trouble, at the bed-room.*

*Assotment Color Bule L/-Green Pink L/Bule L/Brown Purple Crimson Lake and Flower Design.*

* * *

The house is named " The Lurch " because she is left in it such a lot.

* * *

He does seem rude. Mark you, his rudeness is more real than apparent.

He whistles — a sure sign that he has not only nothing to worry about but nothing to think about.

* * *

There will always be exploiters. It's just a question whether you want to make all-powerful uncivil servants of them.

* * *

Finishing touches on our exhibition stand:

" Wouldn't our extravagant claims look best just here? "

* * *

" And what was the cabin service like? "

" Oh! Peccable, peccable."

*Made us livid:*

" All the characters speak in the same idiom, which veers between ' Heightened prose ' and ' declasse ' verse; like a Gipsy Moth in a heavy storm, Mr. Hall's style is forever taxi-ing but never able to take off."

*Theatre critic in "The Observer," London.*

* * *

*B.B.C. "Broadcast for Schools":*

" To-morrow's ' Current Affairs ' talk will be on the subject of Stonehenge."

* * *

*From an Engine Company memo:*

Our sub-contracts department have arranged to obtain these switches and supply them to Messrs. Plesseys to make—

" Switch High Pressure to Cable —
Switch — Low Pressure Switch —
High Pressure 56666."

*Switch-back?*

* * *

*From a memo received by the Public Relations Department :*

" We have drastically cut the list of persons to receive Christmas cards and I am, therefore, returning more cards than you sent."

* * *

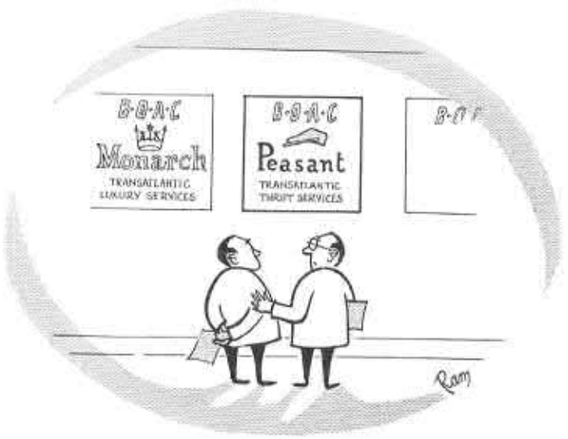
I don't mind the straight path, but I must say I can't bear it to be narrow.

* * *

Yes! You are right! Because, you know, I do agree with you.

* * *

At a luncheon ceremony in Tokyo of the Japanese Antarctic Expedition, Mr. Ineno said he was proud to announce that all but two of the essentials carried by the expedition were Japanese. The exceptions were Scotch Whisky and a de Havilland Beaver.




*" Any good?"*



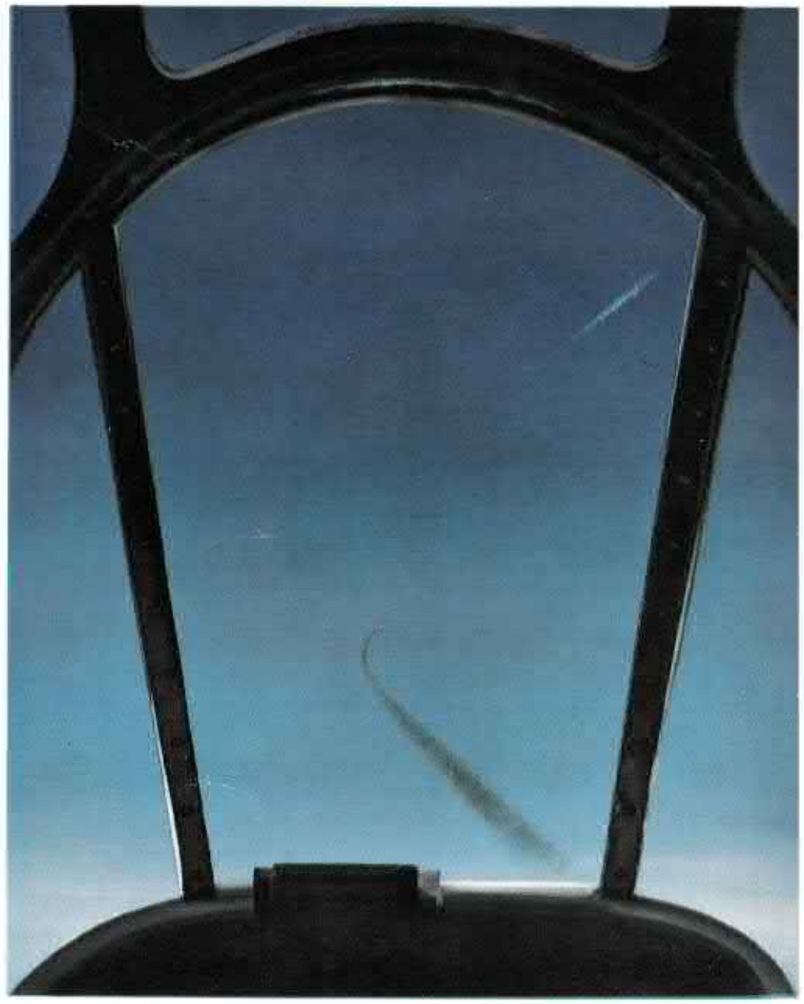
*1914 — one revolver.*

*1917 — two machine guns.*

*1940 — eight machine guns.*

*1954 — four cannons.*

# Fighter Armament 1914-1957



*1957 — Firestreaks.*


*A Beaver moored at the Pacific Western Airlines base at Ganges on Salt Spring Island in the Gulf of Georgia, south-west of Vancouver City. Pacific Western Airlines operate 19 Beavers. The fishing boats and log booms illustrate the island's principal industries.*

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