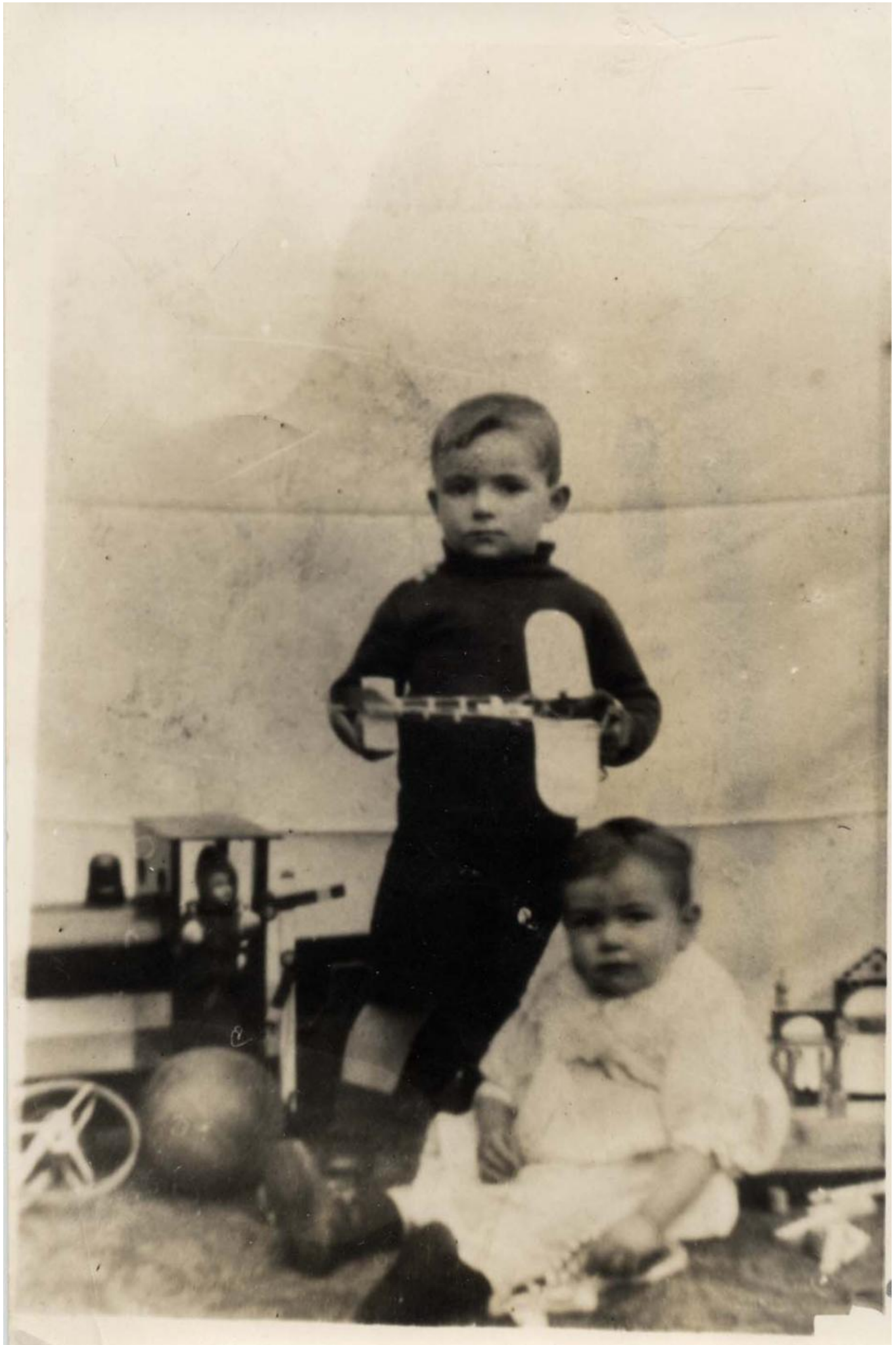
SIR FRANK WHITTLE

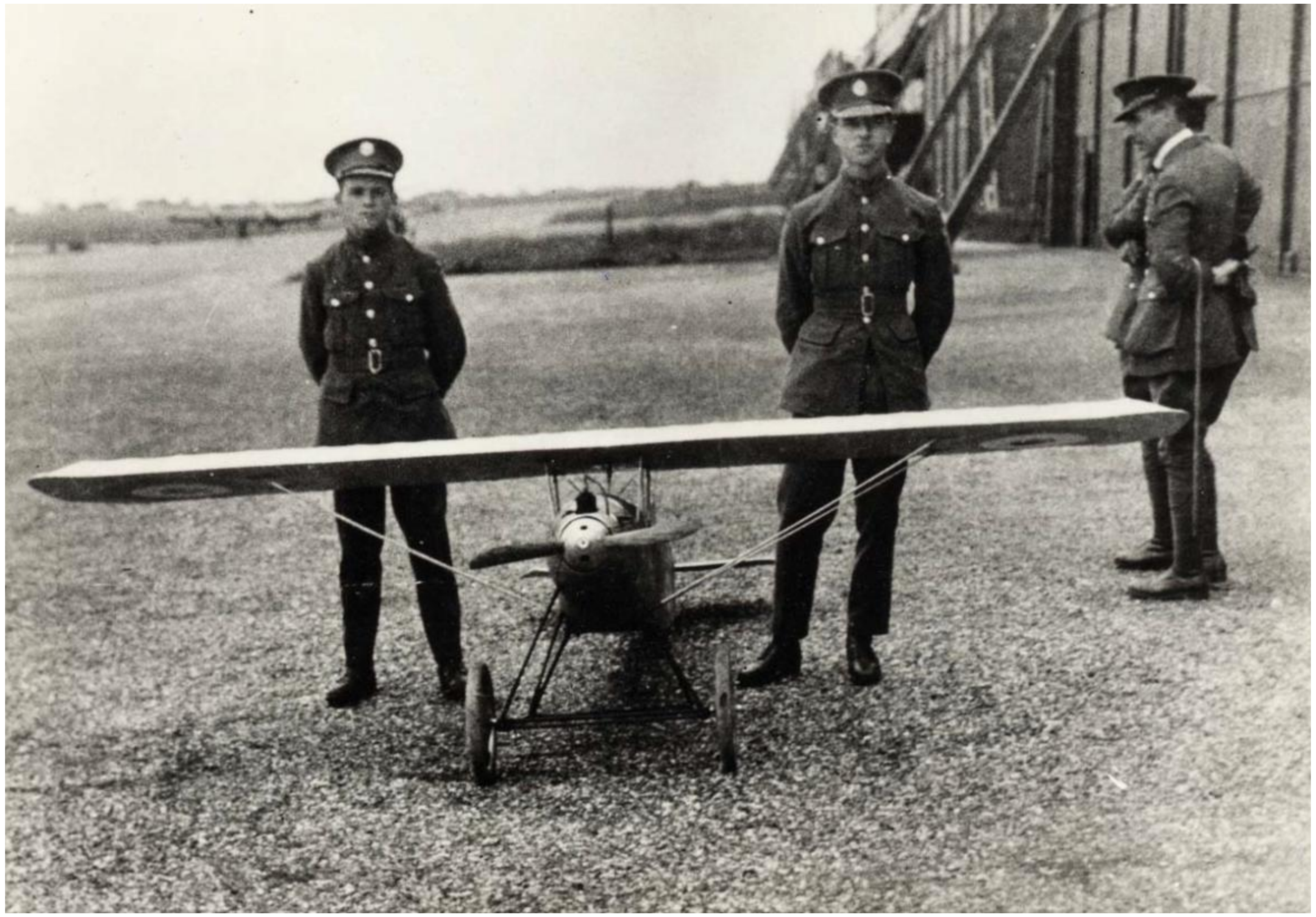
With a Selection of Historic Photographs
Kindly Donated by Ian Whittle

Version 1.0 dated 14 March 2024 IBM Steward CHS

From “Jet Pioneer” to “Genius”



The 'Model' Apprentice



No 4 APPRENTICE WING ROYAL AIR FORCE CRANWELL JULY 1926

The ‘Model’ Cadet - Recruit, Prize Winner & Graduate

Awarded DANIEL GUGGENHEIM MEDAL for achievement for Aeronautics for 1946 "for pioneering the development of turbo-jet propulsion of aircraft - A.R.8.(a) Air Ministry Officers Records dated 29/11/46 (Branch Folder Pr1(a)/836.

Appointed a COMPANION of the ORDER OF THE BATH (C.B.) - London Gazette dated 1/1/47 (4).

Appointed a KNIGHT COMMANDER of the ORDER OF THE BRITISH EMPIRE (K.B.E.) - London Gazette dated 10/6/48. (Birthday Honours).

Received the honarary degree of DOCTOR of LAWS at Edinburgh University July 6th 1951.

Placed on Retired List w.e.f. 26.8.48 (retains rank of Air Commodore)

THE PRIZE WINNERS—JULY, 1928.

Sitting—F./C. Under-Officer N. E. White and F./C. Cpl. G. N. E. Tindal-Carill-Worsley.
Standing—F./C. W. R. Worstall, F./C. F. Whittle, F./C. Sergt. H. J. Pringle.

"Robin" Looseleaf Books 138 Sp. 42074
J. W. Ruddock & Sons, Lincoln and London

COLLEGE SEQUENCE NUMBER	CHRISTIAN NAMES	SURNAME
387.	FRANK.	WHITTLE.

	DATE		DATE		DATE
BORN	1/6/07.	NATIONALITY English.		RELIGION Wesleyan.	
JOINED COLLEGE	2/9/26.	ORDER OF MERIT ON JOINING –		NO. IN CLASS ON JOINING 35.	
LEFT COLLEGE	27/7/28.	ORDER OF MERIT ON LEAVING 2.		NO. IN CLASS ON LEAVING 30.	

PROMOTED		JOINED		DROPPED	
CADET CORPORAL		1ST CLASS	2/9/26.	AFTER TERM	
CADET SERGEANT		2ND CLASS	14/1/27.		
UNDER OFFICER		3RD CLASS	2/9/27.	AFTER TERM	
		4TH CLASS	13/1/28.		

COMMISSIONED IN R.A.F. 28/7/28.

REASON FOR WITHDRAWAL IF COURSE NOT COMPLETED

NAME OF PARENT OR NEXT OF KIN: S.A. Whittle, Esq.

ADDRESS: 18, Vincent Street, Leamington Spa.

PROFESSION OF PARENT OR NEXT OF KIN: Engineer.

CHANGE OF ADDRESS

WHERE EDUCATED: Rugby Road Elementary. Leamington College. S. of T.T., Cranwell. (No4 Apprentice Wing) RAF Cranwell

PRIZES, ETC., ON JOINING

PRIZES, ETC., ON LEAVING: Abdy Gerrard Fellowes Memorial Prize.

REMARKS AND FURTHER HISTORY

Selected Aircraft Apprentice. Posted to No. 111 (F) Squadron w.e.f. 28/7/28, A.M. Posting List No. 148/1928 dated 15/8/28.

Promotions: Flying Officer 28/1/30; Flight Lieutenant 1/2/34. Squadron Leader 1/12/37. T/Wing Commander 1/6/40. T/Group Captain 1/7/43. Wing Commander (WS) 1/1/44. Wing Commander 1/12/43. Group Captain (WS) 1/1/45. Group Captain 1/1/46. T/Air Commodore 1/1/46. Relinquished T/Air Commodore 1/11/47. A/Air Commodore 1/11/47.

Transferred to Technical Branch 24/4/40.

Appointed a COMMANDER of the ORDER OF THE BRITISH EMPIRE - London Gazette No. 36309 dated 1/1/44.

COMMANDER of the LEGION OF MERIT (U.S.A.) 5/11/46.

COLLEGE SEQUENCE NUMBER	CHRISTIAN NAMES	SURNAME
Service No:- 26074 387.	FRANK.	WHITTLE.

P.T.O.

The Prize Winner's Paper - Critiqued by the Genius

Before

SPECULATION *

By Flight Cadet F. Whittle.

I was once asked by an optimistic sub-editor of this magazine for an account of how I intended to reach the moon. I was naturally a little shaken at first, as I have never contemplated leaving this homely planet, but, thinking that I might write a little light fiction, I promised; only to find that I cannot rise to the level of Verne or Wells. It, however, caused my thoughts to soar above the tropopauze (for the benefit of those who have never been initiated to the mysteries of meteorology, the tropopauze is that altitude above which the temperature of the atmosphere remains constant), and the following speculation is the result.

The trans-Pacific flight marks the greatest step in aviation to date, yet it is little more than a score of years since the crossing of the Channel by air was acclaimed as a marvellous feat. There is no reason to suppose that this progress is going to cease, and it is my intention to discuss possible lines of future development. We are not yet satisfied. We want greater range, greater speed, better freight-carrying ability, and more economical air travel.

The formula connecting distance which may be flown with the characteristics of an aeroplane using petrol is

$$R = 2800\ \phi\ \psi\ \eta\ \text{Log.} \left[1 + \frac{\omega}{W}\right]$$

where R is the distance in miles which may be travelled in still air, by an aeroplane of weight W lbs. (without fuel) carrying ω lbs of petrol;
ϕ is the thermal efficiency of the engine;
ψ is the airscrew efficiency;
η is the lift drag ratio of the whole aircraft.

It may be seen that R will be decreased by increasing the speed of a given aeroplane beyond that for its incidence of maximum Lift / Drag ratio, as the rapid increase of passive drag would cause a decrease of η.

It may also be seen that as R is in air miles, the actual range depends upon the winds encountered. Now above the tropopauze (about 35,000 feet) such things as depressions do not exist, because this region is isothermal, consequently there are no convection currents. Therefore winds, if any, will be of constant value.

There is another case for high altitude flight. The density of the atmosphere falls off very rapidly with altitude, and for an aeroplane flying at a given incidence (its best) at any altitude, its speed in level flight must be $\sqrt{\frac{\rho_O}{\rho_H}}\,V_O$, where V_O is its speed at ground level for level flight, ρ_O is the ground level density of air, and ρ_H is the density of air at the altitude of flight. As the lift and incidence are the same as for ground level, so also will be the drag. Therefore $HP_H = \sqrt{\frac{\rho_O}{\rho_H}}\,HP_O$, where HP_O and HP_H are the horse power for level flight at ground level, and the power for level flight at that altitude respectively. Similarly, as the air forces on the airscrew will be the same, $N_H = \sqrt{\frac{\rho_O}{\rho_H}}\,N_O$ where N_O and N_H are the rate of rotation of the airscrew at ground level and at that altitude respectively.

* This article first appeared in the 'RAF Cadet College Magazine,' Autumn 1928.

The value of $\sqrt{\frac{\rho_O}{\rho_H}}$ is given by the curve (Fig. 1).

This curve clearly shows that the most efficient method of obtaining great speeds is to attain great altitudes, as an increase of speed obtained through altitude does not mean an increase of landing speed.

For example, an aeroplane at 80,000 feet must go five times as fast as at ground level. The HP necessary for level flight must also be five times as great, so also must the airscrew revolutions.

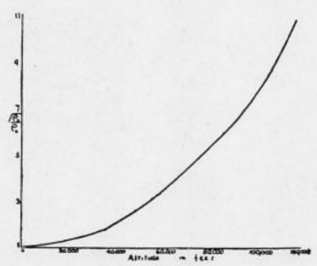


Figure 1

Example :—

Aircraft weight 2,000 lbs fully loaded.
Overall L/D of 10.
Air speed 60 mph at ground level.
Drag will be $\frac{2{,}000}{10} = 200$ lbs.
Speed is 60 mph = 88 fs.
$\therefore$ HP for level flight $= \frac{88 \times 200}{550} = 32$.

At 80,000 feet this machine would fly at 300 mph for the same incidence and would require 160 HP for level flight.

The reasons why we cannot yet reach these altitudes are :—

(1) The engine speed is limited, and thus the only method of obtaining the extra airscrew speed would be by gears.

(2) The tip speed of an airscrew is given by $\frac{V}{P} \times \pi D$, where V = velocity of aeroplane in ft / sec, P is practical pitch of air-screw in feet, D is airscrew diameter in feet. It has been found by wind channel research that the efficiency of an airscrew falls off as the tip speed approaches 1,100 fs, therefore for great speeds $\frac{P}{D}$ must be greater than one, and efficiency falls off for increasing values of $\frac{P}{D}$.

(3) The present type of aero engine depends for its power on the weight of mixture it takes into its cylinders per unit time, and as practical limitations prevent the increasing of revolutions as the density of the atmosphere decreases, a supercharger must be used which will supercharge the air to ground level density to maintain full power. A supercharger which will cope with the rarified atmosphere of great altitudes without absorbing much power has not yet been devised.

Even if winds do exist at these altitudes, their effect on aircraft would be very much less than at ground level. For instance, a 100 mph wind against a machine travelling at 300 mph at 80,000 feet would have the same effect as a 20 mph wind against the same machine doing 60 mph at ground level.

If such advantages are to be attained by high altitude flight, how are we going to overcome the difficulties which prevent it? The solution seems to me to be the development of a more suitable power unit.

We have heard much recently about the rocket-driven car, and of proposals for an aeroplane to be driven on the rocket principle. The principle is this :—If gases be ejected from rest, under pressure in a chamber, through a nozzle, there is a reaction equal and opposite to the force giving the gas its kinetic energy in the nozzle. Now suppose W lbs of gas per second pass through nozzle with a final velocity V fs. Then the force exerted on the gas, and therefore the reaction $= \frac{W}{g}V$ lbs. The kinetic energy per second given to gas by heating agent $= \frac{W}{2g}V^2$ ft lbs — ie, power given to gas $= \frac{W}{2g}V^2$ ft lbs / sec. Now if the vehicle being driven in this manner has a velocity v.f.s. in the direction of the reaction, then the power for driving

$$= \text{Reaction} \times v \text{ ft. lbs / sec} = \frac{W}{g}Vv \text{ ft lbs per sec.}$$

$$\text{Efficiency} = \frac{\text{Output}}{\text{Input}} = \frac{W}{g}Vv \div \frac{W}{2g}V^2 = \frac{2v}{V}$$

Now suppose we want a thrust of 200 lbs and we can at most pass 1 lb of gas per second through the nozzle.

$$\text{Then } 200 = \frac{W}{g}V = \frac{1}{32}V$$

$\therefore$ Velocity of gas = 6,400 fs
and the efficiency of the "engine"

$$= \frac{2v}{6{,}400} = \frac{v}{3{,}200}$$

where vfs is the velocity of the object being propelled. Thus in this particular case, we should require 1 lb of rocket mixture for every second of flight, and even if the velocity were as great as 300 mph — ie, 440 fs — efficiency would only be $\frac{440}{3{,}200} = 13.7\%$.

The rocket principle is obviously impracticable unless one applies it to a rotating nozzle where high linear speeds are possible; then one is, of course, approaching the principle of the turbine, which I now propose to discuss.

The steam turbine is the most efficient prime mover in common use. It has a high thermal efficiency compared with the aero engine and is a smoother running machine. Of course, a steam turbine is out of the question for aircraft owing to the enormous weight, but there seems no reason why an air turbine should not be developed, with petrol or crude oil as the heating agent. In the case of an air turbine the heating agent may mix directly with the working agent and thus exhaust via the nozzles. There being no heat wasted in flue gases, an air turbine should have a greater thermal efficiency than a steam turbine.

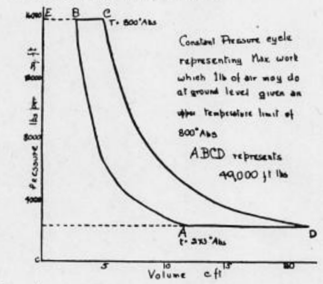


Figure 2

The cycle is shown in the two examples, Figs 2 and 3, which are actual constant pressure cycles for 1 lb of air at ground level (Fig 2) and at 115,000 feet (Fig 3).

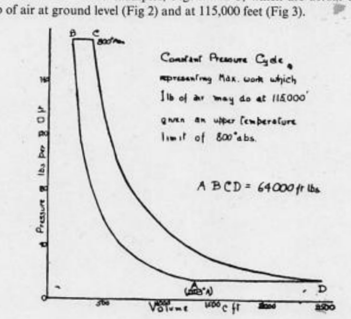


Figure 3

Air is compressed adiabatically AB. It then passes into a heating chamber and is heated at constant pressure BC. It then passes through the nozzles, expanding adiabatically CD, and finally cools at atmospheric pressure outside the engine DA.

The efficiency is given by $\eta = 1 - \frac{1}{R^{Y-1}}$, where R is the compression ratio.

The velocity of the gas at the nozzles, on which depends the most efficient velocity of the turbine rotor [the most efficient velocity of the turbine blades $= \frac{1}{2} V \cos\alpha$, where V is velocity of gas at nozzle, and α is the angle that the axis of the nozzle makes with the rotor] is such that the kinetic energy of the gas equals the area ECDF (Fig. 2); thus the power of the turbine is not dependent on the rpm.

The power is given in the particular cases shown by

$$\text{IHP} = W \times \text{area ABCD} \div 550,$$

where W is the weight of air undergoing the cycle per second.

The maximum work which 1 lb of air may be made to do is only limited by the maximum temperature which the materials of the heating chamber will stand and the temperature of the atmosphere.

Maximum work $= 336\,(\sqrt{T} - \sqrt{t})^2$, where T is the maximum temperature (absolute) and t is the atmospheric temperature (absolute).

The idea as a whole is very similar to the steam turbine, the differences being that air is pumped adiabatically into a heating chamber, where it mingles with a burnt petrol-air mixture instead of water being boiled. As far as the nozzles and rotor are concerned, such an engine would be similar to the steam turbine.

The advantages of such a power unit may be stated as follows :—

(1) The only limit to the compression ratio is the maximum temperature which the heating chamber may stand.

(2) Power is not dependent on r.p.m., as in the case of the petrol engine.

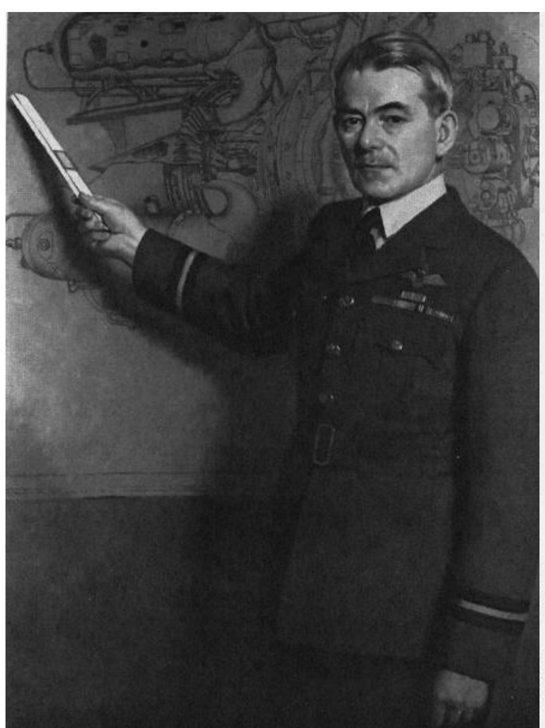
(3) The work which may be done by 1 lb of air increases with altitude, and partly compensates for the smaller quantity of air available.

(4) Supercharging does not appear to be necessary.

(5) Rotors of different diameters may be used to act as gearing.

The main disadvantage as far as air work is concerned is the gyroscopic effect of the rotors, but on reviewing the points for and against it seems as though the air turbine is the aero engine of the future.

After



AIR COMMODORE SIR FRANK WHITTLE

COMMENT ON SPECULATIONS OF 1928

by Air Commodore Sir FRANK WHITTLE, KBE, CB, MA, ScD, FRS, C.Eng, RAF (Ret'd)

The Editor has asked me to agree to the re-publication of 'Speculation' which appeared in the College Magazine for the autumn of 1928 shortly after I had graduated from the College. He also asked me to write a similar article giving my present views about the future. However, I felt obliged to excuse myself from the latter on the ground that, though I have kept in general touch with aeronautical engineering over the past few years, I have been mainly concerned with oil well engineering, and I would need to do a lot of brushing up to attempt such a task. Moreover, the thought was in my mind that one can stick one's neck out a long way as a Flight Cadet aged 21 and get away with it, but I cannot do that today with impunity. Inter alia, there is too big a risk of inadvertently forecasting things which may already be on the drawing board and under security wraps. That could lead to awkward questions as many would assume that I am 'in the know' when, in fact, I am not. I have run into this difficulty in the past. For example, in 1943 I wrote a paper on probable developments in submarine design which was submitted to the Admiralty. A few years later (long after the war) I requested permission to publish. This permission was granted but only subject to important deletions, because I was rather too close to secret work then in progress. However, I agreed to the re-publication of 'Speculation' and to write this commentary on it.

I fear it was a very amateur effort, but I suppose it has some historical value because — so far as I recall — it was the first article on a technical subject by me to be published. It was a condensation of part of my fourth term thesis "Future Developments in Aircraft Design."

Unfortunately, it was marred by printing errors to such a degree that it was probably only comprehensible to anyone so familiar with aerodynamic and thermodynamic theory that the mis-prints would have been obvious. The proofs were never submitted to me for correction, so I cannot wholly be blamed for the apparent errors though, undoubtedly, my handwriting was largely at fault. Generally speaking, the errors took the form of the Greek letter 'rho' appearing as 'P'; the Greek letter 'gamma' appearing as 'Y'; indices appearing as coefficients; + signs instead of the word 'and'; 9 for the symbol 'g' etc. eg

$$\sqrt{\frac{\rho_o}{\rho_H}} \quad \text{appeared as} \quad \frac{\sqrt{P\,o}}{PH}$$

As may be seen, I looked into the possibilities of rocket propulsion and into propellers powered by internal combustion turbines — it had not then occurred to me that the gas turbine was the best way of producing a propelling jet (for aircraft propulsion at least). The penny dropped just over a year later, by which time I had raised my sights to speeds of the order of 500 mph.

Though I did not know it at the time, the first formula in the article (for range) was a form of the Breguet Equation (the figure 2,800 was the calorific value of petrol in foot pounds per pound divided by 5,280 — to convert feet into miles). It can be applied to jet aircraft by the substitution of the appropriate efficiencies.[1] The formula tends to ignore climb and descent — I probably assumed that the extra fuel required for climb was compensated for by fuel saved on descent. It also requires that the flight condition is at constant lift / drag ratio ie, at constant incidence, which implies a gradual climb as the weight is reduced by fuel consumption. I did not then foresee that traffic control requirements would usually prevent adherence to this optimum flight plan. (With jet aircraft one must fly at a speed somewhat higher than that for maximum L / D because as the thrust of a jet engine varies only slightly with speed at cruising speeds any attempt to fly at maximum L / D — ie, minimum drag — would mean that the slightest deceleration would result in the drag becoming greater than thrust, thus causing further deceleration)[2]

My views about conditions in the stratosphere were distinctly optimistic but I could not know this as no-one had ever been there nor, so far as I knew, had anyone devised any means for regular exploration of the stratosphere. Such things as jet streams had yet to be discovered as also the fact that the tropopause is very much higher in the lower latitudes (I have seen cumulonimbus towering many thousands of feet above when flying across the Caribbean at 35,000 feet).

The discussion of propulsion by rocket leaves a great deal to be desired, but I was, of course, thinking only in terms of aircraft propulsion. (I think I would have been as disbelieving as anyone if someone had suggested that man would set foot on the moon within 31 years). I remember being very uneasy at the expression I derived for the efficiency of rocket propulsion because of the implication that if the flight speed became more than half the jet velocity, the efficiency would exceed 100% which is improbable to say the least of it. However, this condition would have meant flight speeds more than seven times greater than the 300 mph I was considering. I must have decided not to worry about such a seemingly remote possibility. One of the things I did not take into account was the work done in imparting kinetic energy to the vehicle in addition to overcoming drag. A satisfactory definition of the efficiency of rocket propulsion still seems to me to be a somewhat elusive thing.

The discussion of the gas turbine in the latter part of the paper is, I fear, very amateurish. It is evident that I was thinking only in terms of what was then known as the simple impulse turbine of the de Laval type and that I was still far from being familiar with turbine theory. The most serious defect of this section, is that I evidently assumed that the losses in the processes of compression and expansion would be negligible whereas, as I came to realise shortly after, compressor and turbine efficiencies were all important. The low values then usual for rotary machinery of this type was, coupled with the lack of materials capable of withstanding high stresses at high temperatures, the main stumbling block in the several unsuccessful attempts to develop the gas turbine in the early years of the century.

On reflecting on this serious defect in my argument, my embarrassment is somewhat mitigated by the knowledge that I wrote a paper entitled "The Case for the Gas Turbine" while I was a floatplane and catapult experimental test pilot at the Marine Aircraft Experimental Establishment, Felixstowe between January 1931 and July 1932. This paper was never published but, though I had still to receive my engineering training at Henlow and Cambridge, it shows that I had greatly advanced in my knowledge of gas turbine theory and had acquired a much more realistic approach and become well aware of the importance of component efficiencies and the need for suitable turbine blade materials. By that time I was, of course, concentrating on the jet engine application of the gas turbine.

The advantages as listed at the end of 'Speculation' also show that my ideas were still somewhat nebulous. The first would have been better stated as "The limiting pressure ratio is governed by the component efficiencies and the maximum cycle temperature which available materials will permit." Item (2) is wrong. I was evidently thinking of steam turbine characteristics. Even so it should have read "Power is not as dependent on rpm .....". However, as everyone now knows, when the compressor is driven by the turbine, power is in fact far more sensitive to rpm than in the case of the piston engine. (The static thrust of our first flight engine — the W1 — was 860 lbs at 16,000 rpm, 1,000 lbs at 17,000 rpm and 1,240 lbs at the full design speed of 17,750 rpm.)

Item (3) was (and is) quite sound and becomes even more true when compressor and turbine losses are taken into account. Item (4) also proved to be sound in the event, but I cannot remember what I had in mind when I included (5). I am also puzzled by the fact that I did not include the advantages of low weight, absence of vibration, insensitivity to fuel type etc. However, a year or so later I was in the habit of including these.

The formula given for the maximum work per lb of air per second for a constant pressure cycle (the last formula in the article) looked very unfamiliar and I thought that there must be quite a serious misprint but on checking I found that, except that the coefficient 336 (the specific heat of air at constant pressure in ft lbs per lb) appeared as 356 it was correct for the ideal cycle. In later years I would have preferred it in the form

$$w_{max} = K_p T_o \left[\sqrt{\frac{T_m}{T_o}} - 1\right]^2$$

where w is the work/lb of air/sec, K_p is the specific heat at constant pressure, T_m is highest cycle temperature and T_o is lowest cycle temperature (ie atmospheric static temperature in an open cycle engine).

A particularly interesting thing about this formula is that it indicated the beginning of a very useful line of reasoning. As time passed I acquired the habit of dealing with thermal cycles almost entirely in terms of absolute temperatures, temperature ratios and pressure ratios. Included in this system was the practice of thinking of velocities in terms of temperature equivalents and vice versa. (The conversion is given by $V^2 = 2\,g\,K_p \triangle T$ where $\triangle T$ is the temperature change corresponding to velocity V. It happens that $\sqrt{2\,g\,K_p}$ has the same digits as the factor for conversion of mph into fps — 1·47 — hence the useful rule that kinetic temperature rise in °C is equivalent to the square of the speed in hundreds of miles per hour, eg, if air travelling at 500 mph is brought to rest the temperature rise is 25°C; for 1,000 mph it is 100°C and so on—hence the problems of kinetic heating which arise at very high Mach numbers).

In detail design one has to allow for a number of minor factors such as increase of specific heat with temperature, the fact that the mass flow in expansion is greater than the mass flow in compression due to the added fuel mass etc., but these secondary 'adjustments' can be ignored for the purpose of preliminary design and especially for comparative purposes when seeking the optimum cycle for any particular application. With this system it is possible to 'work round' a jet engine cycle in a matter of three or four minutes after a little practice.

When compressor and turbine losses are taken into account the above formula for w_{max} becomes modified to

$$w_{max} = K_p T_o \frac{T_o}{\eta_c}\left[\sqrt{\eta_c \eta_t \frac{T_m}{T_o}} - 1\right]^2$$

where η_c is compression efficiency and η_t is expansion efficiency. This condition occurs at a temperature ratio $r = \sqrt{\eta_c \eta_t \frac{T_m}{T_o}}$

eg, for standard sea level conditions ($T_o = 288$°K) with $T_m = 1100$°K, $\eta_c = 0{\cdot}86$, $\eta_t = 0{\cdot}90$ the value of r for w_{max} is 1·72 which gives $w_{max} = 58{,}200$ ft lbs/lb or 106 hp/lb/sec. Thus the mass flow of air for 10,000 hp would have to be 94·3 lbs/sec.

Unfortunately, the temperature ratio for highest overall efficiency is substantially higher (about 2·1) so that peak efficiency can only be obtained at the sacrifice of output per unit flow, and vice versa.

In practice η_c decreases as temperature ratio (and therefore pressure ratio) is increased but η_t increases. Both effects are due to the conversion of losses into heat during the compression and expansion processes.

Well! there is my apologia. If I did drop a few bricks, I can claim that I picked them up again a short time later and learned quite a lot in doing so.

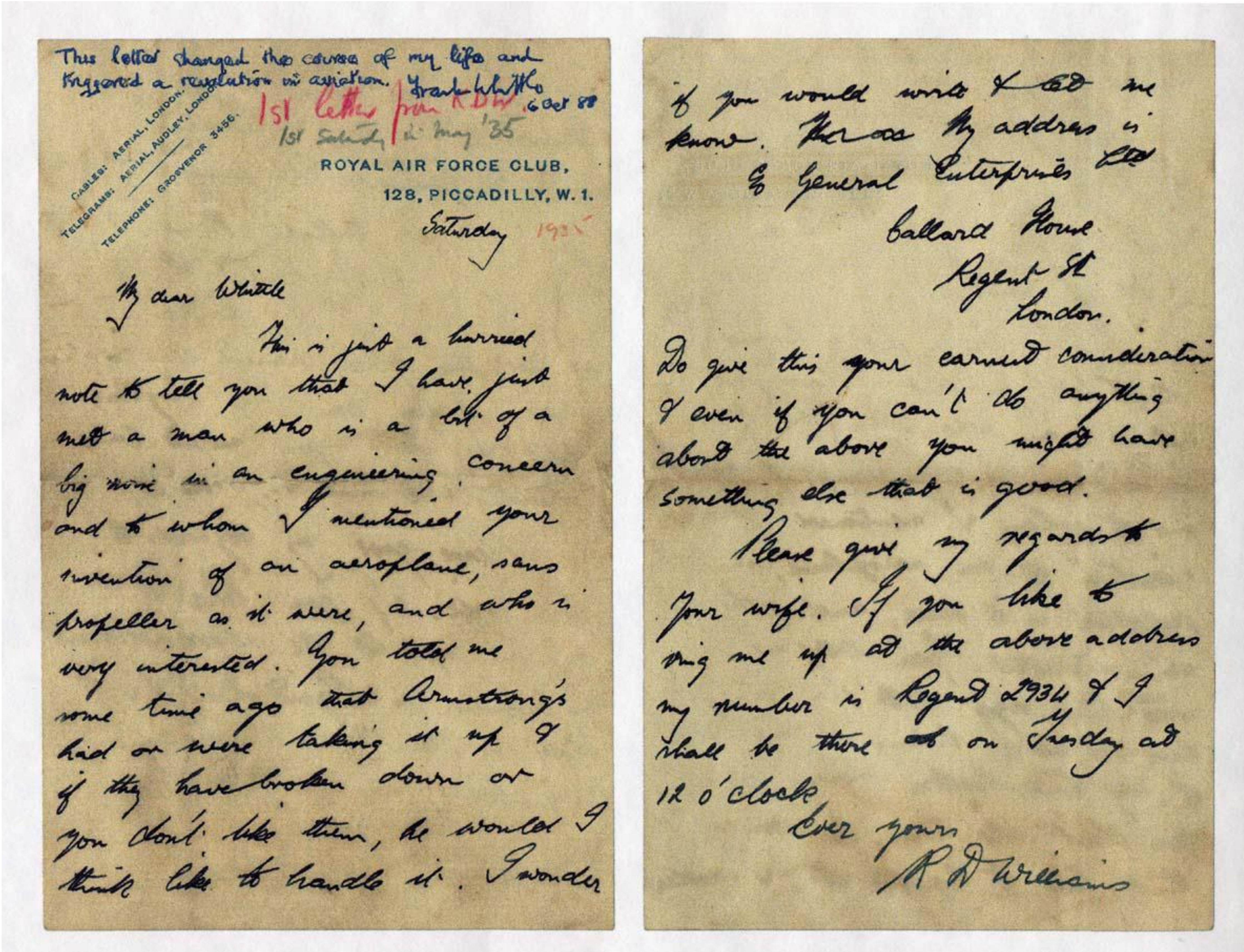
When I look back over the years I am struck by my own relative pessimism at a time when others thought me a wild optimist. The power, size, reliability and performance of jet aircraft have gone far beyond anything I ever predicted. I was, however, usually over optimistic about time and cost, though, in my opinion, my estimates of time **could** have been achieved. For example, there was no serious obstacle to the introduction of the large by-pass ratio turbofan about, say, 1946 or the successful achievement of supersonic flight at about the same time. Unhappily, the contracts for our large by-pass ratio engine (the LR1) and for the Miles M52 experimental supersonic aircraft were cancelled.

[1] It is now often written in the form
$R = \frac{V}{f}\frac{L}{D}\,\text{Log}_e\frac{W_1}{W_2}$ where V is flight speed (mph if R is in miles or knots if R is nautical miles); f is specific fuel consumption in lbs / hr / lb of thrust; W_1 is all up weight at beginning of cruise and W_2 is all up weight at end of cruise.

[2] When I embarked on the task of finding a range formula I fully expected to find that great increases of range could be obtained by flight at great altitudes and my disappointment was great when I was forced to accept that maximum still air range was independent of height.

The Young RAF Officer

'The Turning Point'



This letter changed the course of my life and triggered a revolution in aviation. Frank Whittle 6 Oct 88

1st letter from RDW

1st Saturday in May '35

CABLES: AERIAL, LONDON.
TELEGRAMS: AERIAL, AUDLEY, LONDON.
TELEPHONE: GROSVENOR 3456.

ROYAL AIR FORCE CLUB,
128, PICCADILLY, W. 1.

Saturday 1935

My dear Whittle

This is just a hurried note to tell you that I have just met a man who is a bit of a big noise in an engineering concern and to whom I mentioned your invention of an aeroplane, sans propeller as it were, and who is very interested. You told me some time ago that Armstrong's had or were taking it up & if they have broken down or you don't like them, he would I think like to handle it. I wonder if you would write & let me know. The address My address is
c/o General Enterprises Ltd
Ballard House
Regent St
London.

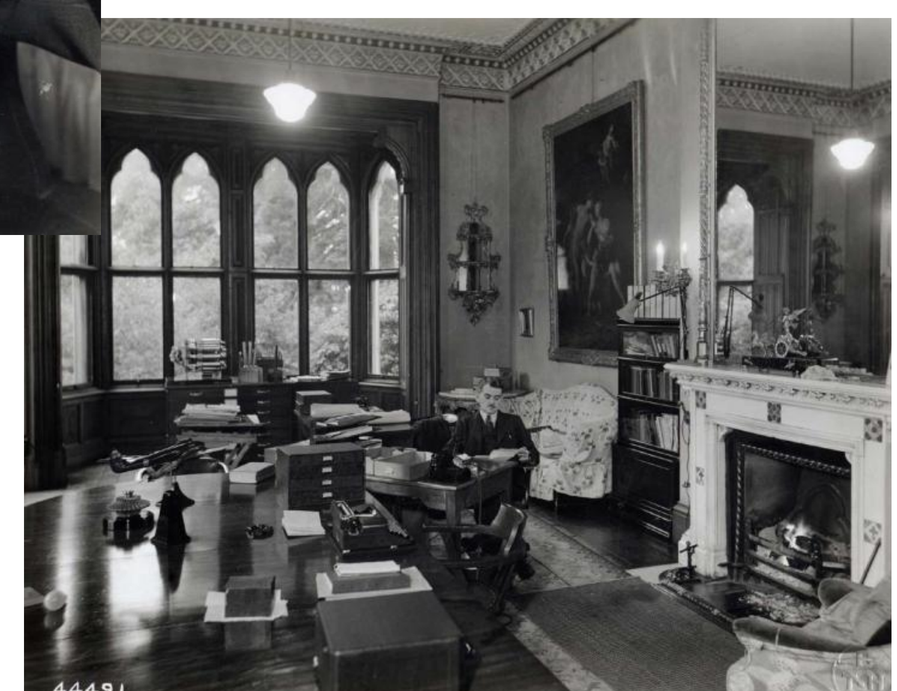
Do give this your earnest consideration & even if you can't do anything about the above you might have something else that is good.

Please give my regards to your wife. If you like to ring me up at the above address my number is Regent 2934 & I shall be there at on Tuesday at 12 o'clock

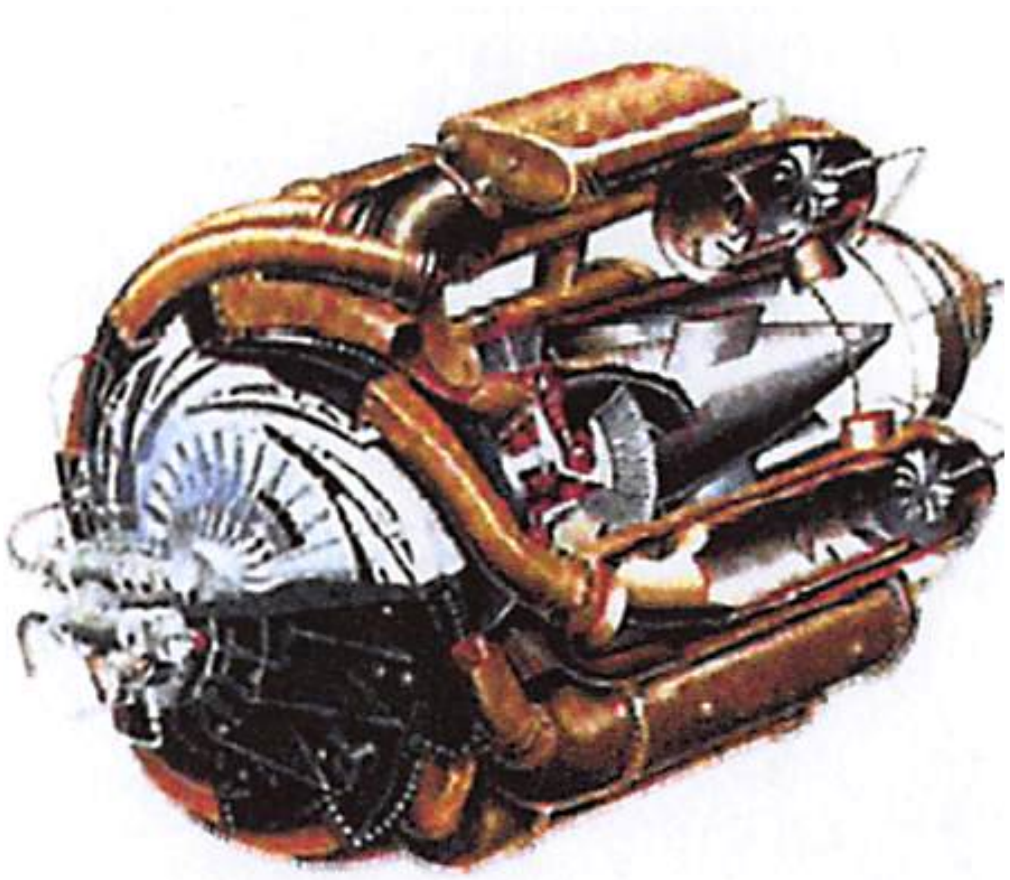
Ever yours

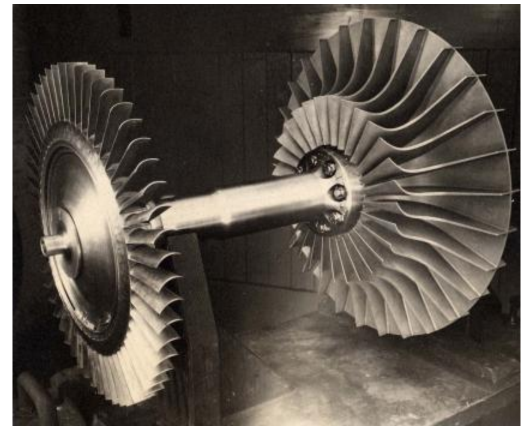
R D Williams

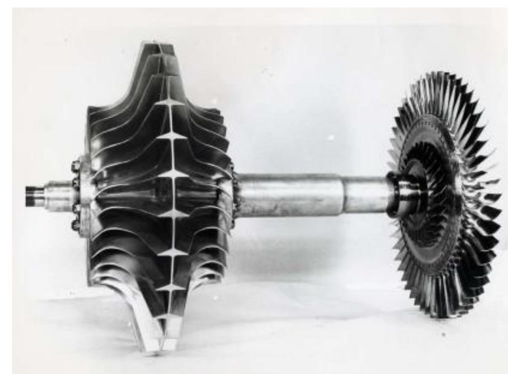
The Development Team

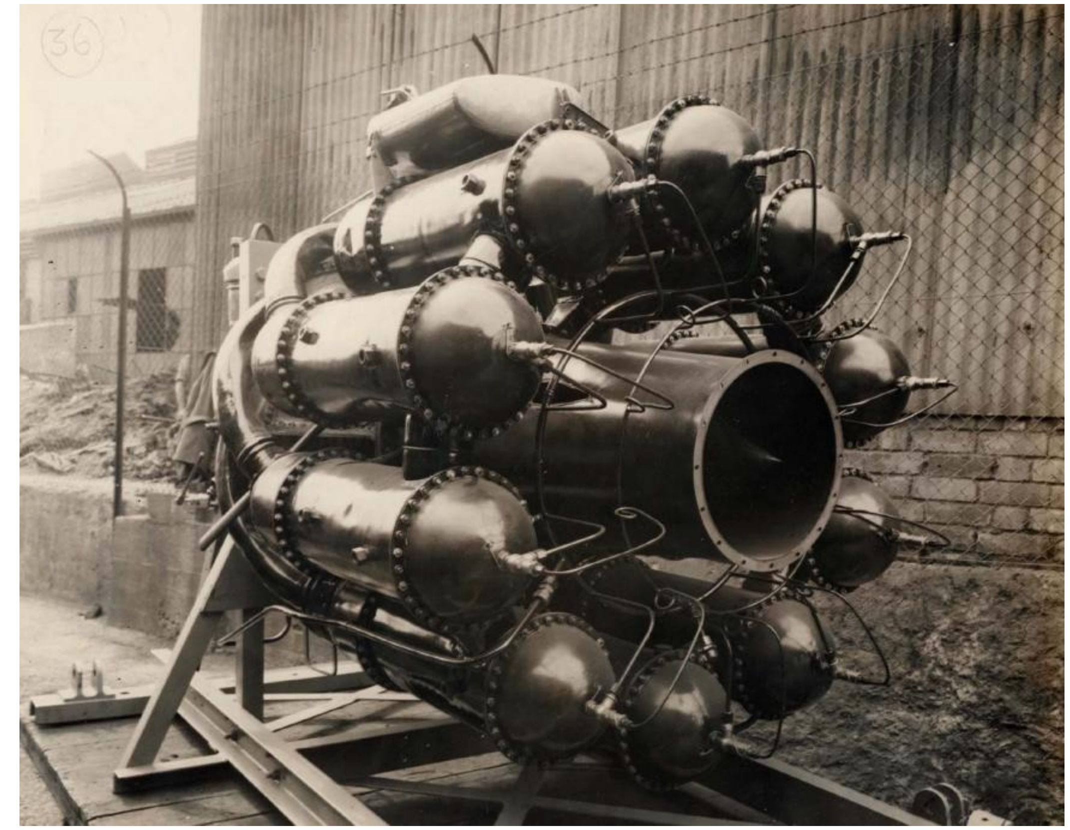


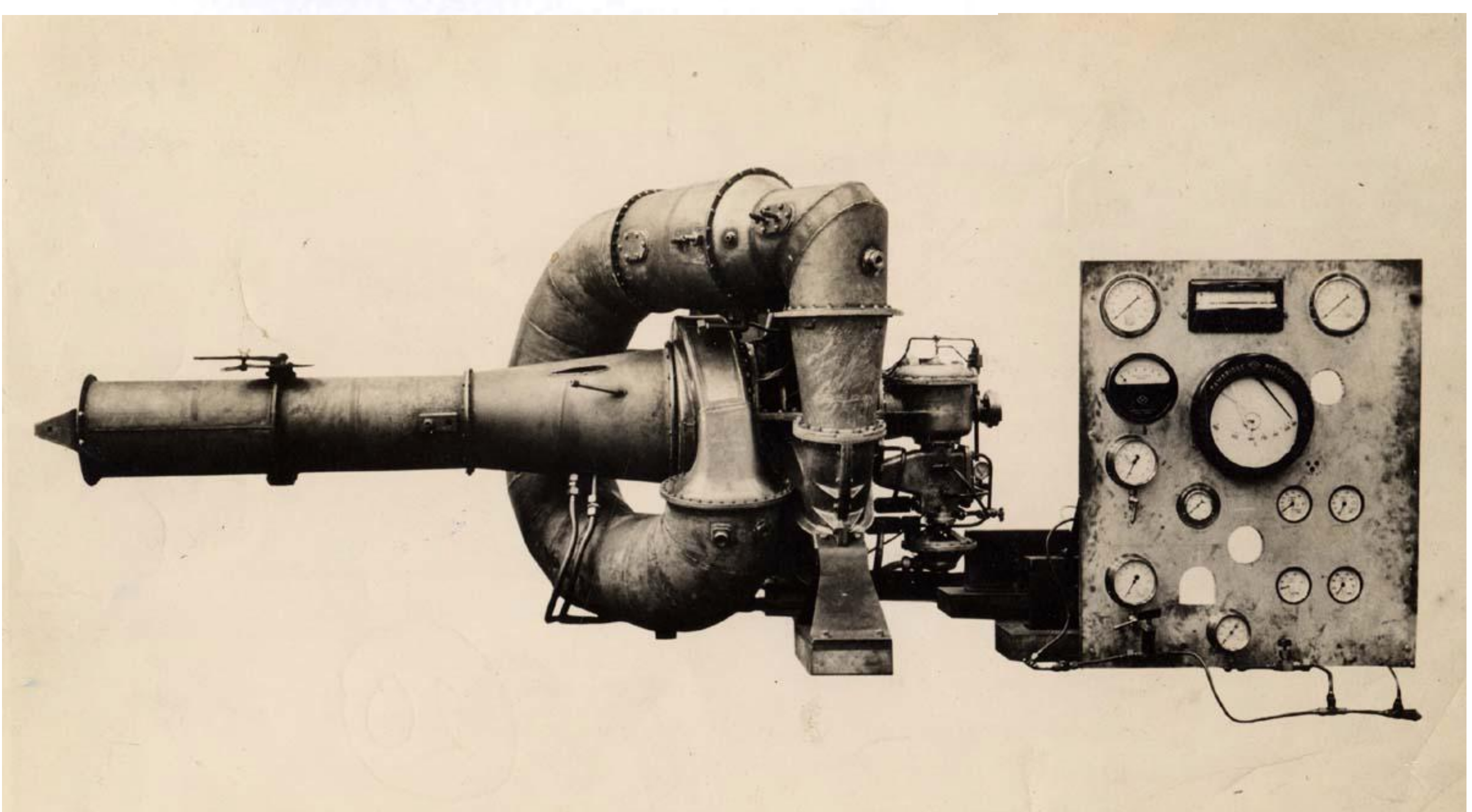
The Gas Turbine Engine - Increasing Compression

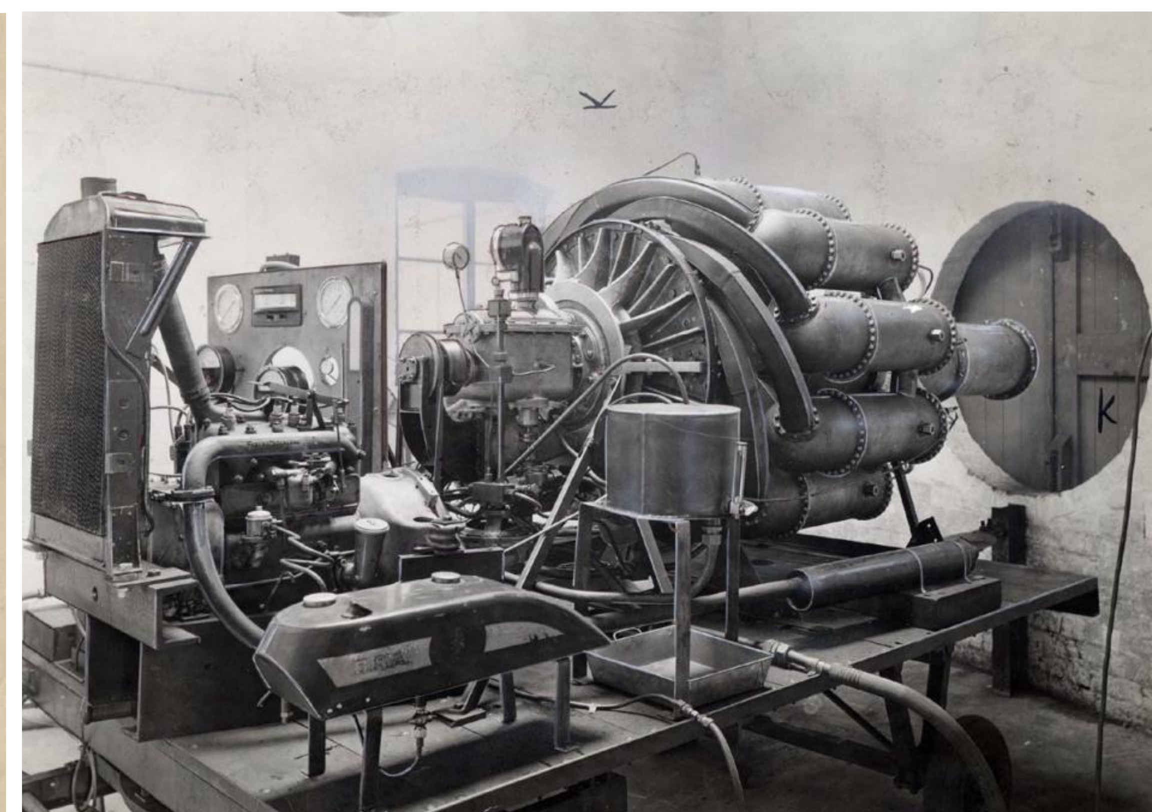










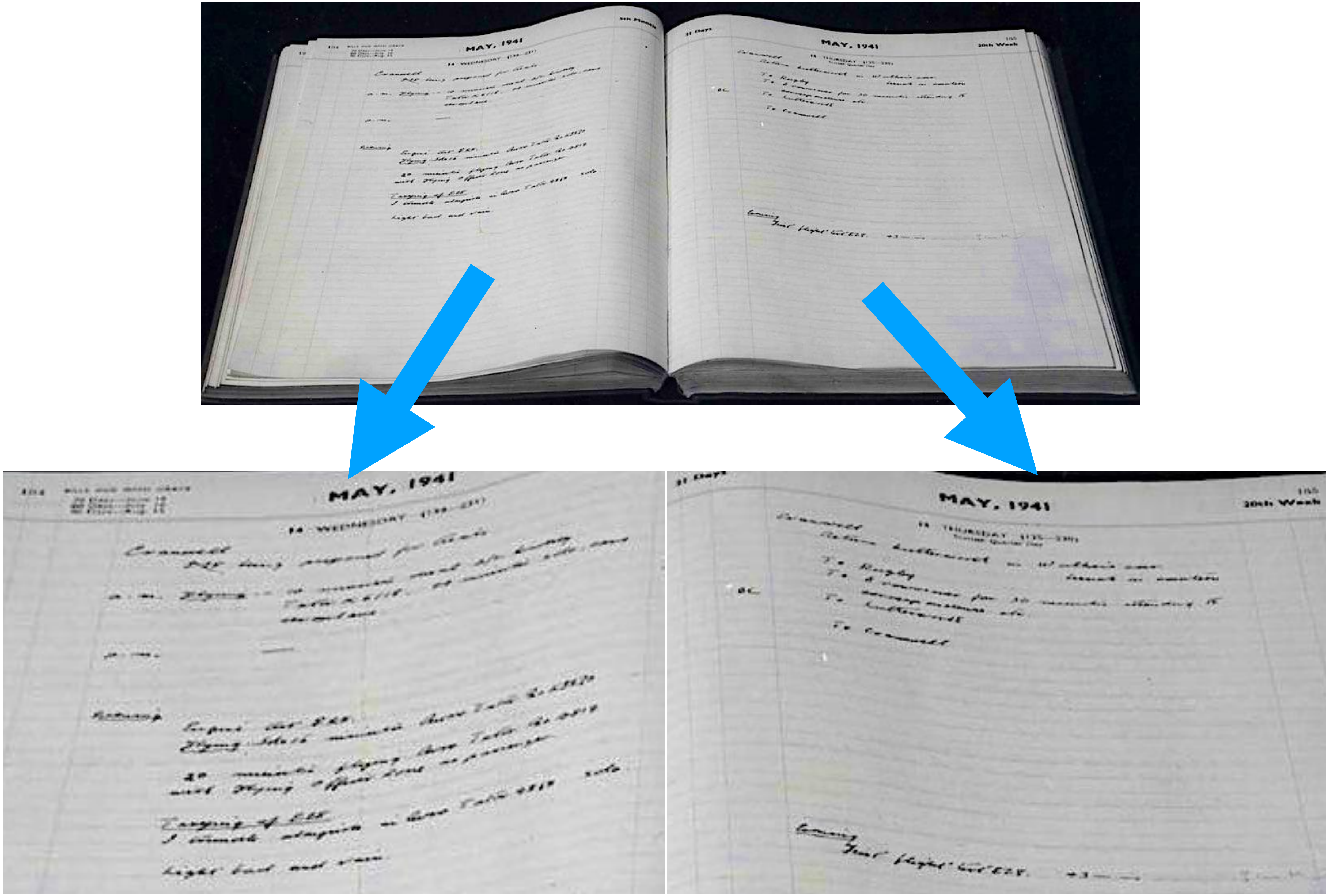


The Test Bed - E28/39

Phillip Edward Gerald Sayer
OBE

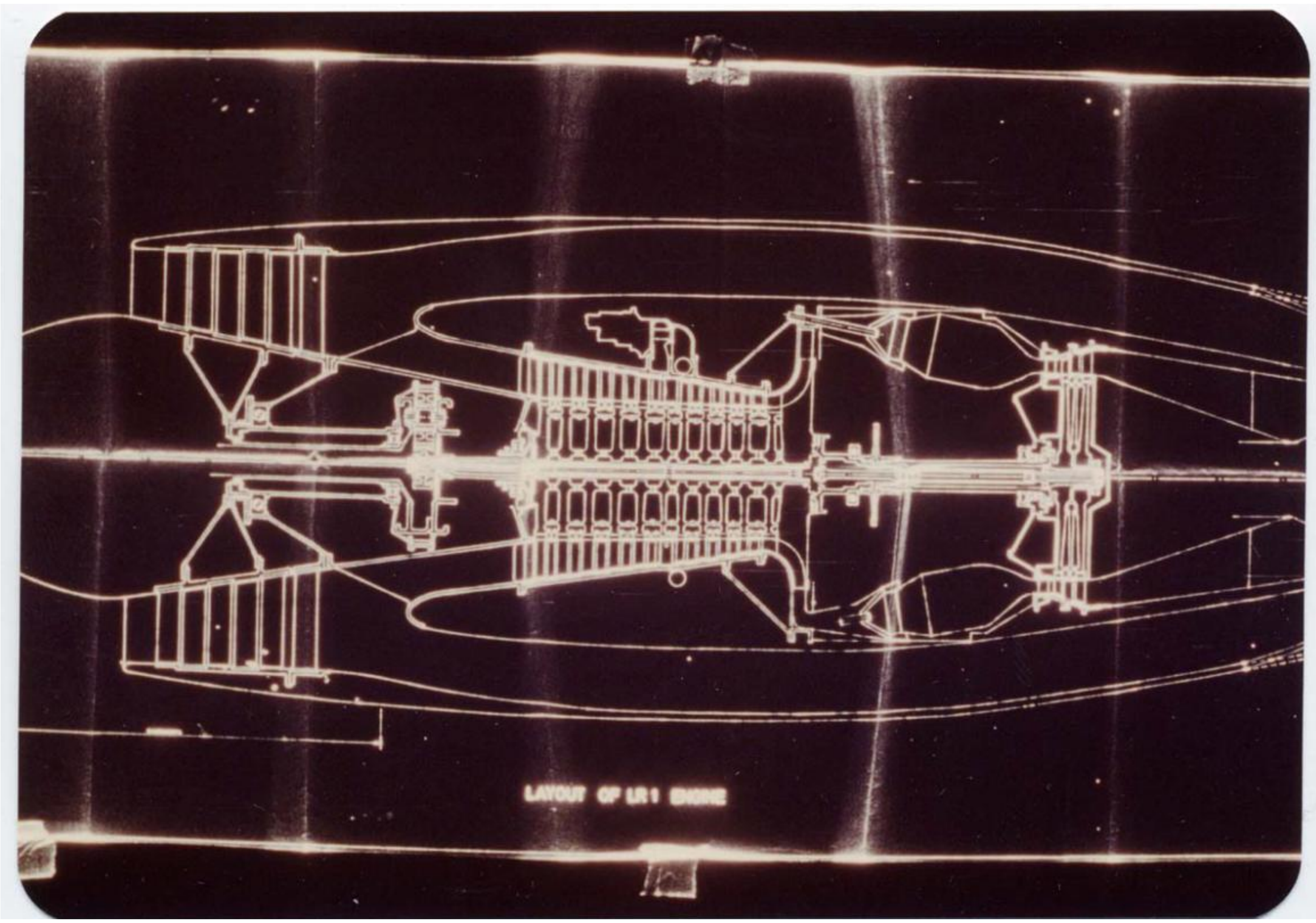
Born	5 February 1905 Colchester, Essex, England
Disappeared	21 October 1942 (aged 37) North Sea
Nationality	British
Occupation	Test pilot
Employer	Gloster Aircraft Company
Known for	Piloting the first flight of the first British jet aircraft
Spouse(s)	May Violet Ellen Wallace-Smyth (m. 1929–1942)
Parent(s)	Wing Commander E. J. Sayer MC (father)
Military career	
Allegiance	United Kingdom
Service/ branch	Royal Air Force
Years of service	1924–1929
Rank	Flying Officer

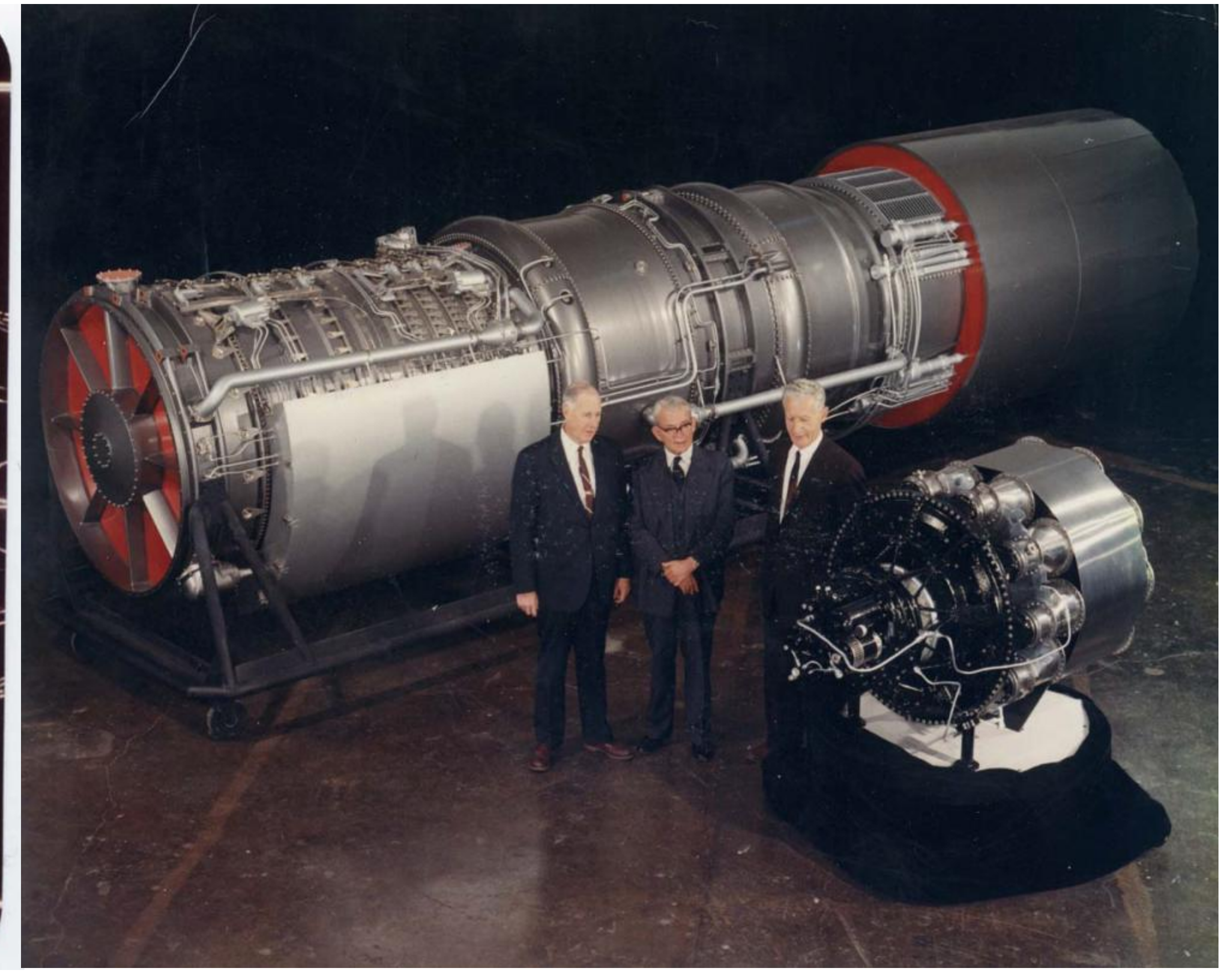
E28/39 Inaugural Flight Logged



Job Well Done - Mess Celebrations

From Gas Turbine to Turbofan





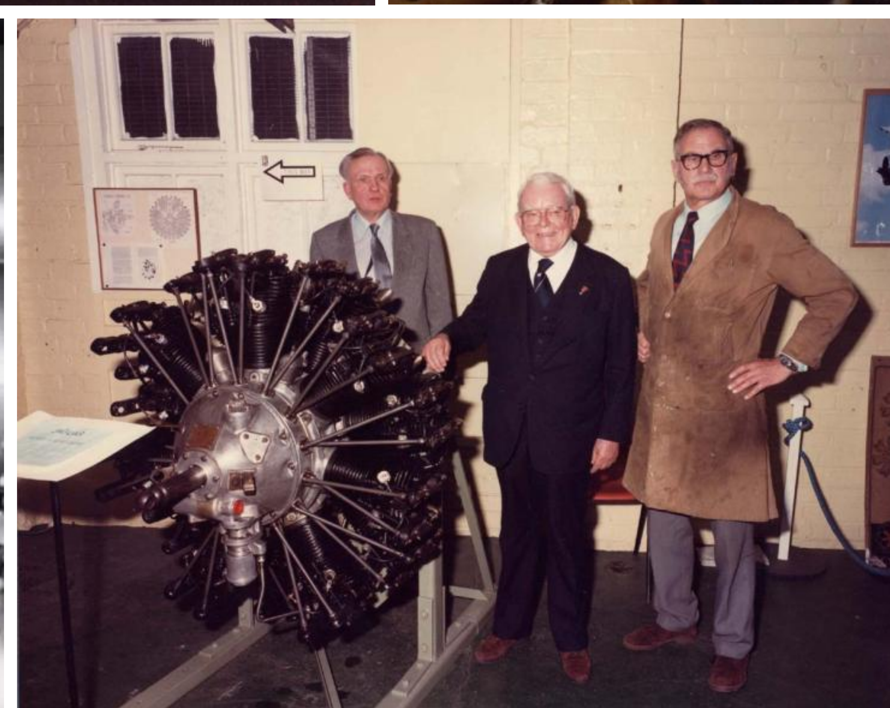
A Little Recognition

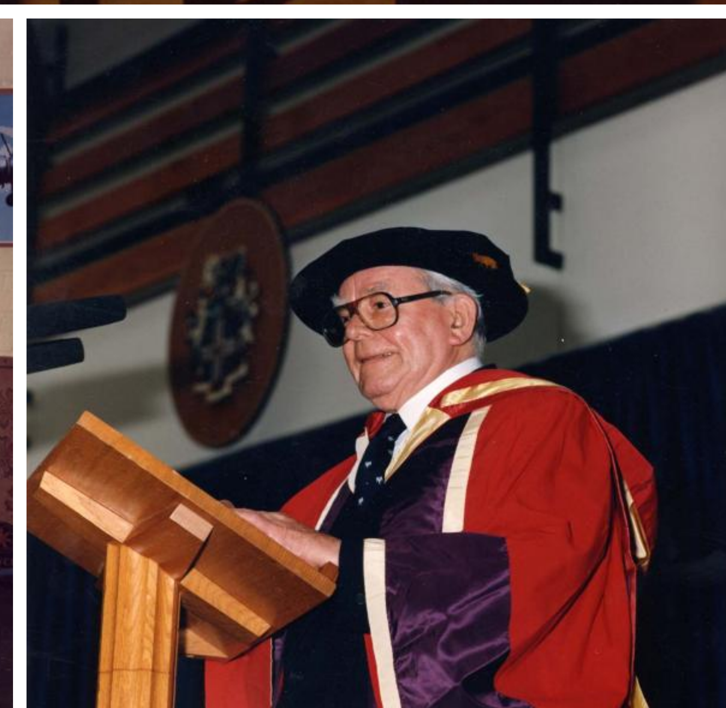
Behind Every Great Man…………..

Carrying on the Flying Tradition

SECOND GENERATION: P/O. I. L. Whittle, son of Sir Frank Whittle, the gas-turbine pioneer, who is now doing his flying training at R.A.F. Station Cluntoe, Co. Tyrone. By a curious coincidence, his course will be the last to qualify for wings on piston-engined aircraft.

Reflections





A ‘Brilliance’ of Engineers

Courtesy of AVM ret’d Bob Hooks

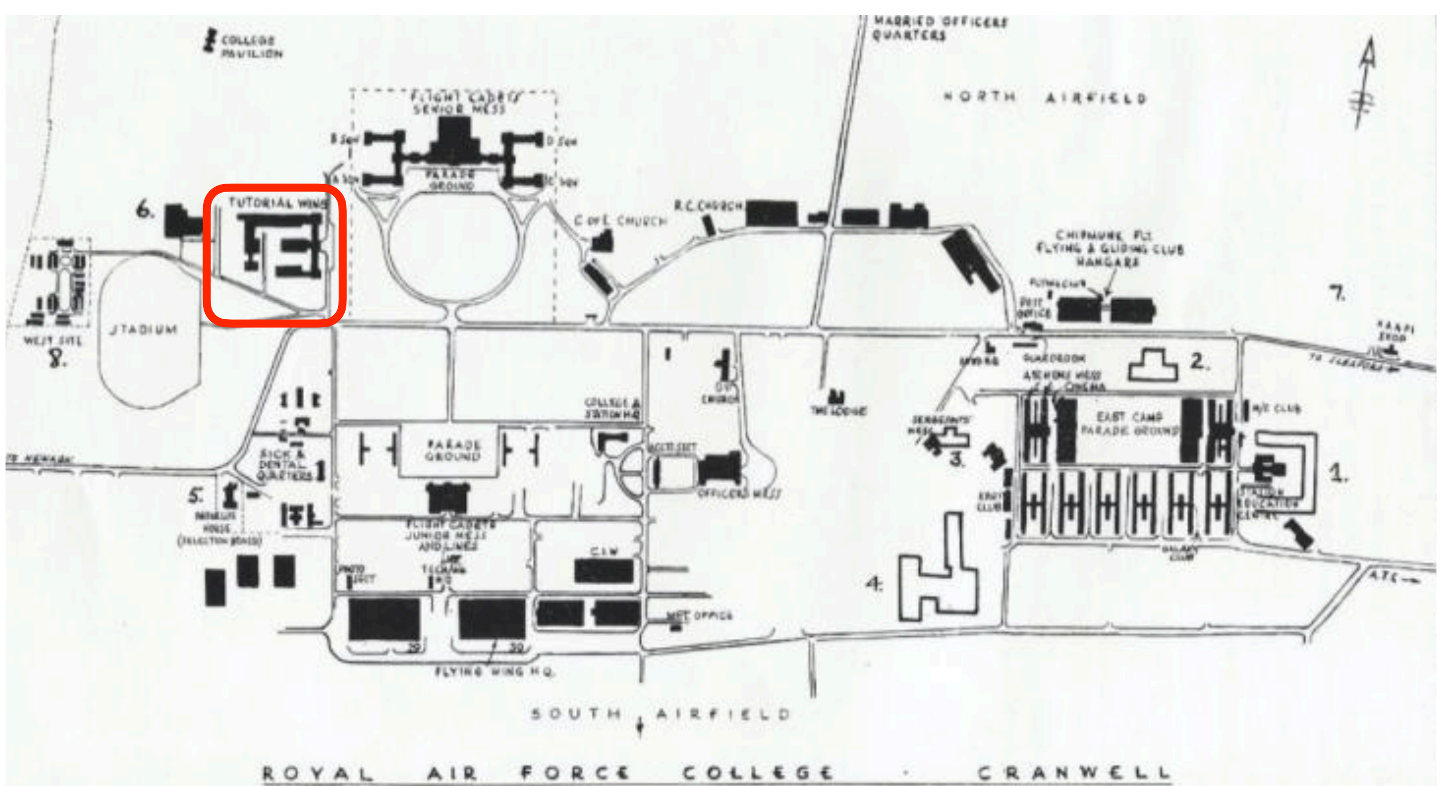
SIR FRANK WHITTLE VIEWS HIS PROTOTYPE JET ENGINE. CRANWELL, NOVEMBER 1967

Whittle Hall - College Journal Autumn 1962 Extracts

New Instructional Building

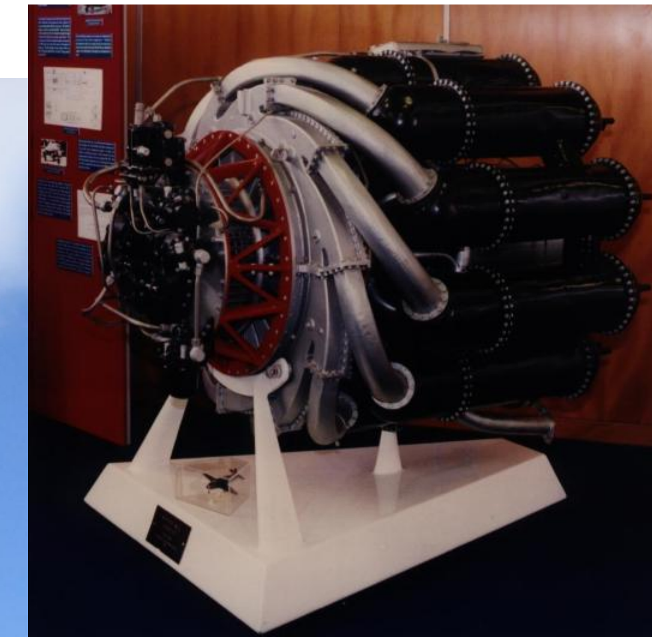
Air Commodore Sir Frank Whittle, K.B.E., C.B., F.R.S., LL.D., officially opened the new Instructional Building on 4th October. Classes in Science and Humanities subjects were held in the new building from the beginning of the Autumn Term before work in the building was complete, but all was ready for the opening ceremony.

Extract from Page 205



Air Commodore Sir Frank Whittle, K.B.E., C.B., F.R.S., Ll.D. in the Entrance Hall to the new Instructional Building *(see p. 205)*

Reunited



Memorial Service - Westminster Abbey

“Imagine. Imagine, if you will, what it is like having those qualities of wisdom, logic, perseverance and determination, coupled with a fine memory and wide interest. These qualities combined are a force. Perhaps, in father’s case, it was a force that benefitted the world at large……….

Ian Whittle, Son.

“Writing in 1984, Sir Stanley Hooker, another great aircraft engineer put it in more measured terms …….he {Whittle} had laid down the performance of jet engines with the precision of Newton, a feat whose magnitude he never appeared to appreciate.

ACM Sir Michael Graydon, CAS

Sir Frank being filmed for *Whittle - The Jet Pioneer*

Courtesy of quantafilms.com