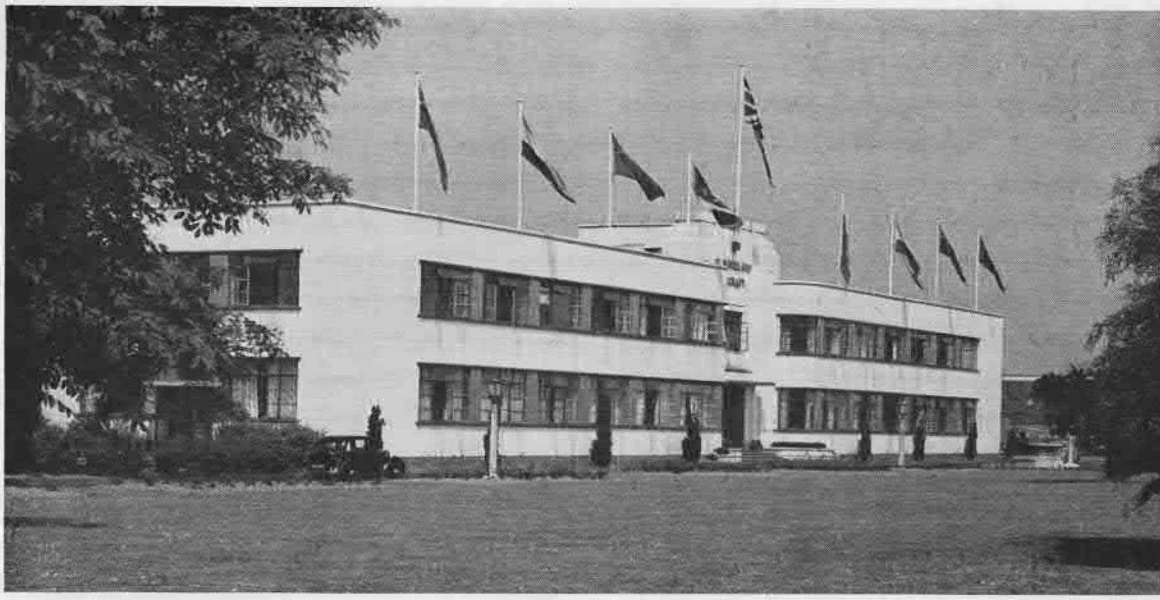
THE DE HAVILLAND AERONAUTICAL TECHNICAL SCHOOL

PROSPECTUS



The headquarters of the de Havilland Enterprise.

THE DE HAVILLAND AERONAUTICAL TECHNICAL SCHOOL

THE purpose of this prospectus is to explain the de Havilland system of technical training for young men entering the aircraft industry. The system was inaugurated within a year or two of the incorporation of The de Havilland Aircraft Company Limited in 1920, and was strengthened in 1928 by the founding of The de Havilland Aeronautical Technical School with the object of affording a comprehensive course of theoretical study in addition to the practical workshop training hitherto provided. The size and responsibility of the School have advanced with the spectacular rise of the aircraft industry, and in 1955 it has nearly 2,500 young people taking courses of apprenticeship, most of them of five years' duration. The policy of the School is laid down by an Education Council which has representation from the de Havilland Aircraft, Engine and Propeller Companies and is under the chairmanship of the Managing Director of the parent company. The Council is assisted by Education Boards comprising senior executives representative of the main departments and factories of all three companies; this governing body was formed in 1943.

In a half-century the aircraft industry has risen to be one of the most important industries in the world, wielding great power in the economic and military spheres. In the 1939–45 war aircraft production became Britain's biggest industry, employing more than two million people. The advent of the gas turbine, in the course of 15 years or so, has made possible flight at supersonic speeds, and with the further development of rocket engines far greater speeds and altitudes are being negotiated and travel beyond the Earth's atmosphere can be foreseen. Parallel with the swift progress in power units an equally remarkable advance in electronics is taking place which is not only revolutionising aerial navigation but making possible the guided missile and, perhaps, the pilotless aircraft.

The de Havilland group of companies, representing a continuous participation since the period of the 1914–18 war, is engaged in all of these newest departments of aeronautical progress. The de Havilland Aircraft Co. Ltd. has a long tradition in civil aviation, with emphasis upon economy of operation, and has been in the forefront of high-performance military developments since 1939. It has produced the first jet-propelled airliner. The de Havilland Engine Co. Ltd., with 30 years of piston-engine experience, and for almost a half of that time progressively occupied with jet propulsion, is to-day building large axial turbines for supersonic flight, also rocket engines for main and auxiliary power; the company's laboratories are of the highest order, by world standards. de Havilland Propellers Ltd., as well as producing the full range of propellers for piston and turbine aircraft, also is engaged upon guided weapons of advanced type, involving the most up-to-date knowledge in electronics, servo mechanisms, etc.

The de Havilland Enterprise embraces establishments in Canada and Australia, both a quarter-century old, each having design and production organisations as well as considerable overhaul and servicing facilities for aircraft, engines and propellers. Both these companies are now entering the field of electronics and guided weapons. There are de Havilland establishments also in New Zealand, South Africa, and the United States of America, and the Enterprise has for many years maintained a world-wide organisation of area representatives, agents, technical and servicing staff.

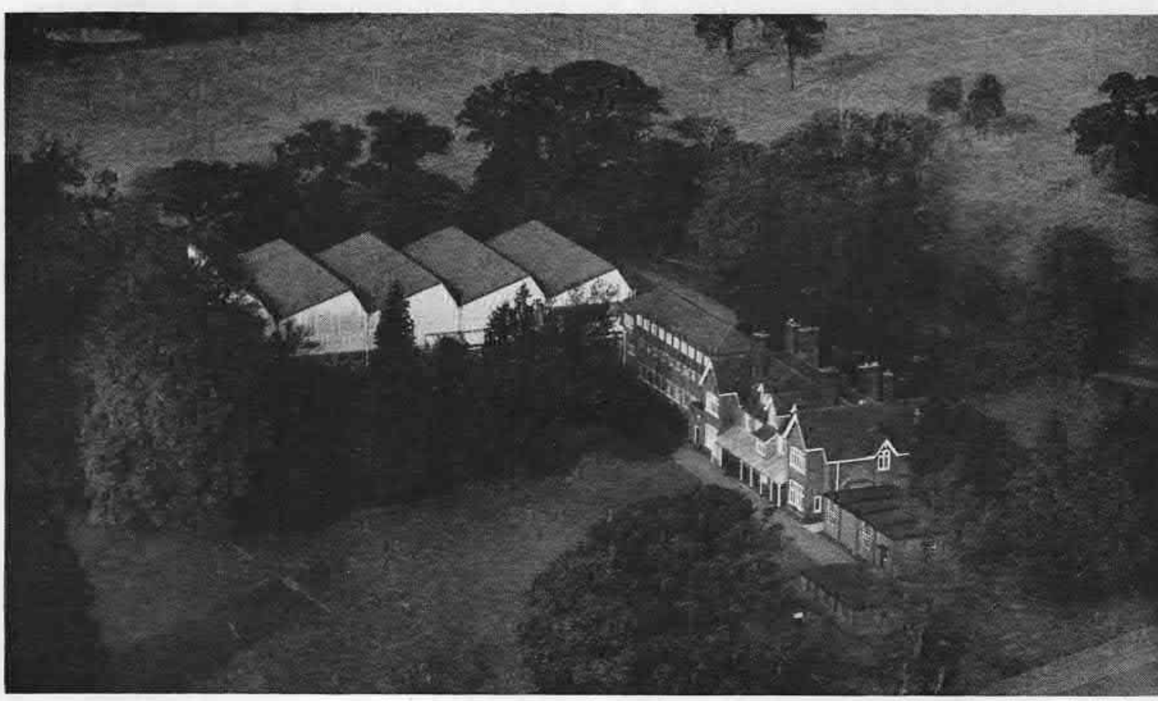
The breadth of de Havilland activities, both technically and geographically, is one of the main elements in the strength of the training system that is centred upon the English companies of the Enterprise.

The aircraft industry to-day employs scientists and engineers of the senior levels and possesses laboratories of a high order in the realms of aerodynamics, thermodynamics, electronics, metallurgy, etc. The industry offers great scope, also, for production engineers interested in the newest materials and methods of fabrication. It is an industry demanding not only accurate and elaborate tooling but also a large element of personal craftsmanship. It is one in which rapid technical progress is being made in many countries.

COMPANY ORGANISATION

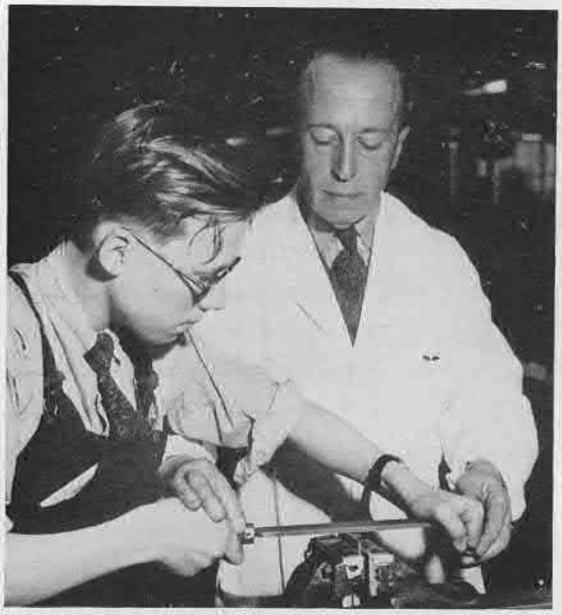
The main channels of opportunity for young men in the de Havilland companies, and other concerns in the industry, may be broadly divided between design, production, servicing, sales and administration. For the three technical channels the de Havilland School affords a comprehensive training over a period of five years, with opportunities for subsequent courses to take specialised diplomas and degrees. The School accepts boys at the age of 16 as craft apprentices and at 17 as engineering apprentices. It also takes university undergraduates during vacation periods and offers short courses for graduates entering industry. In brief, it affords a double system of filtration, accepting young men at various ages, making good their general and technical education to the best of its ability, and fitting them for careers in aviation according to their bent. There is every educational opportunity for an entrant at any age to rise to the highest positions the industry holds, in this or any country.

The apprentice is trained from the outset in either the Aircraft Company or the Engine Company or the Propeller Company. The Aircraft Company has apprenticeship organisations at its factories at Hatfield in Hertfordshire, at Chester, and at Christchurch and Portsmouth, both in Hampshire. The Engine Company has organisations at its factories at Leavesden, near Watford in Hertfordshire, and at Edgware in Middlesex. The Propeller Company has organisations at its factories at Hatfield and at Bolton in Lancashire. The courses of training differ as between the three companies, emphasis in the Engine and Propeller Companies being placed upon mechanical and electrical engineering.



Astwick Manor, Hertfordshire, the headquarters of the School.

EARLY DAYS OF APPRENTICESHIP



The correct handling of basic engineering tools comes first.

Early in their training apprentices learn to operate the simpler machine tools, in this case a grinder.

Instruction in the first principles of machine tools.

CRAFT APPRENTICESHIP

There are no fees for the craft apprenticeship.

The particular opportunity which the aircraft industry offers for the skilled craftsman has already been mentioned. It will continue, and indeed increase. The reputation for craftsmanship which Britain has held over the centuries is one of the strongest elements of the British aircraft industry. For the properly trained craftsman who possesses additional qualities of leadership and a sense of responsibility there is excellent scope for advancement within the de Havilland Enterprise to supervisory and executive positions.

The five-year course of craft apprenticeship starts at the age of 16 years and includes a probationary period of six months before the indentures are signed. In exceptional circumstances a boy may be acceptable up to the age of 18 years. Other brochures are available amplifying the information concerning craft apprenticeship in the separate companies.

A candidate must have had grammar or secondary school education, with manual and practical classwork, and must show mechanical aptitude. Early application, soon after the fifteenth birthday, is advisable. Each candidate is interviewed by a Selection Board, and must pass a medical examination by the de Havilland medical officers.

The entrant is from the outset selected for either the Aircraft Company or the Engine Company or the Propeller Company. He is subject to the discipline of the School and the factory, and from his first day is paid wages at the hourly rates for his trade. The rates vary slightly; in 1955 craft apprentices at Hatfield start at about £2 10s. a week, rising to about £5 11s. in the fifth year, or £7 if over 21 years of age. Provincial rates are slightly lower. The probationary period is six months. During this time, and perhaps for a few months of the apprenticeship proper, the practical instruction takes place in the workshop of the Technical School. Thereafter a decision is reached as to the craft to be followed, and the instruction is continued in the production workshops of the company. Importance is attached to the principle of training the craftsman realistically in the actual factory departments, where his sense of responsibility is developed from an early stage. His progress is carefully watched and recorded. Craft apprentices may gain promotion to engineering apprenticeship.

The theoretical classes, organised in conjunction with the County education authorities, commence from the probationary period, at first in day-time hours; in the later years the apprentice may also attend evening classes in technical subjects. The courses of study lead to the City and Guilds examinations in workshop engineering, aircraft maintenance, telecommunications, aircraft electrical equipment, radio mechanics, sheet-metal working, etc. The young apprentice also attends day-time continuation classes in non-technical subjects to raise the level of his general education.

Tables on the practical training appear on pages 12 and 13.

The craft apprenticeship normally concludes at the age of 21. In most cases military service can be deferred until then, and, of course, offers more interesting opportunities to a man who is a trained craftsman, as well as a better chance to prepare for his return to civil life.

It may be useful to give an idea of the types of work that are done by craftsmen in the various factories of the three de Havilland Companies in Great Britain. No such list can be complete but the following are typical examples of occupations in which craftsmen are employed after completing their apprenticeship:

IN THE AIRCRAFT COMPANY

Craft.	*Occupation.*
FITTER	Construction of parts and assembly of larger components for aircraft. Installing engines, components and equipment in aircraft. Erecting aircraft. Preparing aircraft for flight test. Laboratory work.
MACHINIST	Machining parts for aircraft mainly from forgings, castings, etc. Machining tools and fixtures. Inspecting.
SHEET-METAL WORKER AND COPPERSMITH	Fabricating sheet-metal parts of aircraft components such as wings, fuselages, control surfaces, tanks, etc., employing rubber press, stretcher press and other methods. Pipe-bending.
ELECTRICIAN	Installation and servicing of electrical aircraft equipment including radio. Installation and servicing of factory electrical equipment.

Aircraft and components are manufactured at the factories of the Aircraft Company at Hatfield, Chester, Christchurch and Portsmouth, and a great deal of work in all of the above crafts is undertaken at each of these factories.

IN THE ENGINE COMPANY

Craft.	*Occupation.*
FITTER-TURNER	Machining parts for piston engines, gas turbine and rocket engines. Assembly of components and complete engines.
FITTER-TESTER	Assembly of components and complete engines. Testing of engines. Laboratory work.
TOOL MAKER	Making jigs, fixtures and press tools for use in the manufacture of engines.
SHEET-METAL WORKER	Fabricating specialised sheet-metal components for engines, mainly gas turbines.

The crafts and occupations here listed are all active at the Leavesden and the Edgware establishments of the Engine Company, quantity production being centred at Leavesden. Engine laboratory work, testing, etc., are mainly located at Edgware and Hatfield.

IN THE PROPELLER COMPANY

Craft.	*Occupation.*
FITTER	Making specialised components for propellers. Assembly and testing of propellers. Making parts for guided weapons. Assembly and testing of guided weapons. Laboratory work.
MACHINIST	Machining parts for propellers, guided weapons and other products.
ELECTRICIAN	Making, testing and installing electrical equipment for propellers and guided weapons. Installation and servicing of factory electrical equipment.

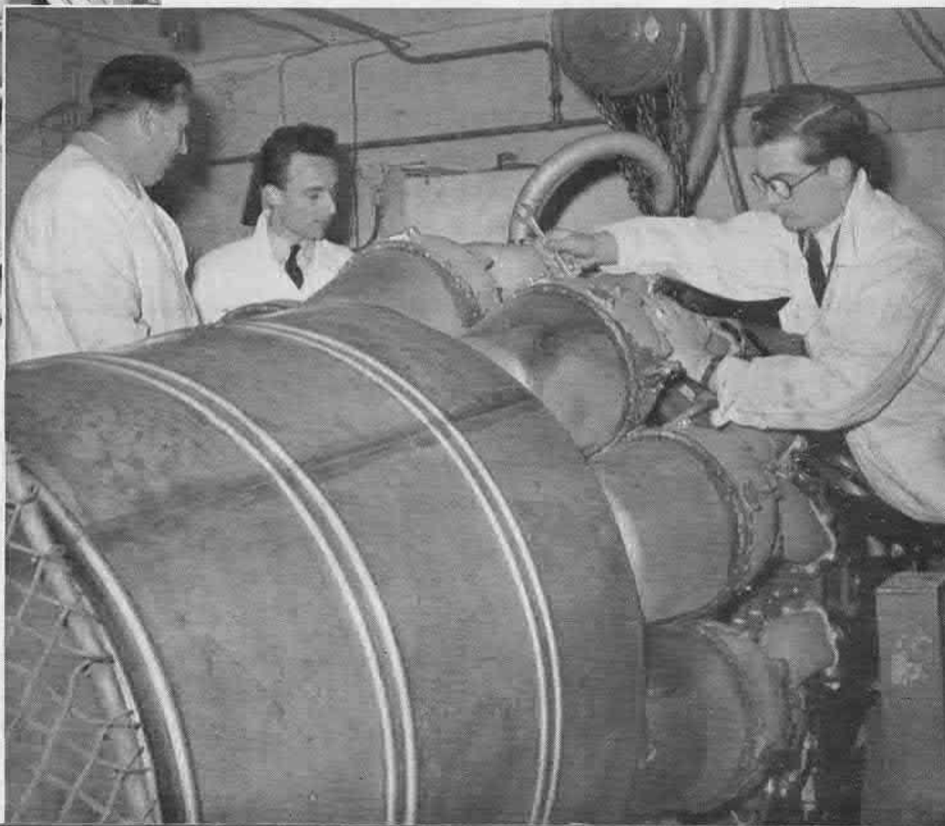
The crafts and occupations here listed are all active at both the Hatfield and the Bolton premises of the Propeller Company, quantity production being centred at Bolton. Most laboratory and test work is undertaken at Hatfield.

It is not necessary to enlarge upon the opportunities which are presented to trained craftsmen who are outstanding in their organising ability and their capacity for leading others and for bearing responsibility.

Simple machine-tool exercises in the school workshops ensure that the apprentice understands the techniques involved before working on components in the factory.

In the factories apprentices work with skilled operators who pass on to them the practical experience gained over many years. Here instructor and pupil are at work on the engine bay of a jet aircraft.

Adjustments being made to a Ghost jet engine on the test bed.



PRACTICAL TRAINING IN SCHOOL WORKSHOP AND FACTORY

ENGINEERING APPRENTICESHIP

Free scholarships are given to candidates for engineering apprenticeships who, in the opinion of the Selection Board will, after their training, qualify as engineers and technicians within the de Havilland Enterprise. There are also limited vacancies under special conditions for fee-paying apprentices, young men who may not have this standard to offer or may not be training with this object in view, including, for instance, people from overseas.

The engineering apprentice has the best opportunity that can be given to rise to the top levels of the industry. The five-year apprenticeship, including a probationary period of six months before indentures are signed, normally starts at the age of 17. It may, however, start at a later age and in some cases men are accepted after the completion of military service. The educational standard must be that of the General Certificate of Education, with the following subjects included: mathematics, physics or other adequate science, English language and at least one other subject. Every candidate is interviewed by a Selection Board, and must pass a medical examination, by the de Havilland medical officer.

The engineering apprentice is subject to the discipline of the School and the factory, and from his first day is paid wages at the hourly rates for his trade. The rates vary slightly: in 1955 engineering apprentices at Hatfield start at about £2 10s. a week, rising to about £7 in the fifth year. Provincial rates are slightly lower. The probationary period is six months. During this time, and probably for the first few months of the apprenticeship proper, the practical instruction, covering the use of hand and machine tools in various types of fabrication, is undertaken in the School workshops. Thereafter it is continued in the workshops and offices of the de Havilland factories, the engineering apprentice spending a period in each of the appropriate departments, beginning with those which afford ground work of the least specialised nature. The importance of training the young man in the actual factory departments, where his sense of responsibility is developed from an early age, applies to the engineering apprentice as it does to the craft apprentice. The progress of each apprentice is carefully watched and recorded.

The theoretical classes, which are organised in conjunction with the county education authorities, commence from the probationary period and are held partly in the day-time and partly in the evenings. Some subjects of general education are included, such as social studies and English.

Tables of the practical training appear on pages 12 and 13.

Under the heading " Company Organisation " reference was made to the three main channels of opportunity for technical men in the aircraft industry — design (including development, research, etc.), production and servicing. A provisional allocation to one channel or the other, according to apparent suitability, is made at the start of the apprenticeship but, as the early training is not specialised, this matter can be kept under review during the first year or two, when particular talents will become evident.

Engineering apprentices in the Aircraft Company who have a leaning towards design, stressing and aerodynamics, then specialise in the subjects required for the Associate Fellowship Examination of the Royal Aeronautical Society. Those more interested in the mechanical aspects of design, however, may study for an Associate Membership of the Institute of Mechanical or Electrical Engineers, which is generally taken by way of the Higher National Certificate. A small number who are interested in laboratory work may study for the examinations of the Institute of Metallurgy. Those with a bent for production engineering prepare for the Associate Membership Examination of the Institute of Production Engineers, again in conjunction with the Higher National Certificate. Apprentices who are considered more suitable for a career on the servicing side prepare for the examinations of the Society of Licensed Aircraft Engineers and the examinations of the Ministry of Transport and Civil Aviation to qualify for Aircraft Engineers' Licences.

A course is arranged for the reading of the London external degree of B.Sc.(Eng.) on the part-day basis, with direct-entry qualifications or with the General Certificate of Education including three passes at Advanced Level in mathematics and science.

Engineering apprentices in the Engine and Propeller Companies who show ability in the more theoretical subjects of design, stress, aerodynamics, thermodynamics, etc., usually prepare for the Higher National Certificate and for the examination for Associate Membership of the Institution of Mechanical Engineers and the Institution of Electrical Engineers and they may also take the examination for Associate Fellowship of the Royal Aeronautical Society. Those more interested in production are prepared for the Higher National Certificate (Production) Examination.

These examinations are taken in the fourth and fifth years of apprenticeship and the young man may then take a position or do his military service. More advanced studies for a specialised diploma or for a degree may be undertaken in the evenings or as a part-time day course, making use of technical colleges or universities. The de Havilland companies endeavour to assist and encourage promising apprentices to obtain these higher qualifications, which are indeed valuable in industry.

The School does not offer a distinct course of apprenticeship for the business and administrational sides of the aircraft industry, such as sales, accountancy and the secretarial departments. The course offered is essentially one of engineering apprenticeship. The engineering training, however, provides an excellent grounding for careers on the business side. Suitability for this side is usually manifest in the later years of apprenticeship, and the training is biased accordingly. One of the more important subjects is works and cost accountancy, and in appropriate cases this subject may be taken from an early year.

The training afforded by this apprenticeship, and the qualifications that can be secured upon completion, are designed to fit a man for a career leading to an executive position in the de Havilland Enterprise.

It will be useful to give an idea of the types of work on which aeronautical engineers and technicians are employed in the various factories of the three de Havilland Companies in Great Britain. No such list can be complete, but the following are typical examples of duties in which engineers may be employed after completing their apprenticeships and securing their academic qualifications:—

IN THE AIRCRAFT COMPANY

Course of Training.	*Occupation.*
DESIGN	Design Drawing Office. Aerodynamics Department (this embraces the Wind Tunnel, Instrument Laboratory, etc.). Stress Office (this embraces Structural Test Laboratory, etc.). Experimental Department. Metallurgy and Metallurgical Chemistry.
PRODUCTION	Methods Engineering. Jig and Tool Design. Planning. Rate Fixing, Estimating and Cost Accountancy. Factory Organisation.
SERVICING	Aircraft servicing. Service Department Technical Representative at home or overseas.

The Hatfield and Christchurch establishments both embrace the three main divisions of design, production and servicing, the laboratory work at Hatfield being more far-reaching. Metallurgy is centred at Edgware. Production and servicing are in operation at Chester, and production alone is undertaken at Portsmouth.

IN THE ENGINE COMPANY

Course of Training.	*Occupation.*
DESIGN	Design Drawing Office. Metallurgical Laboratory. Stress Office. Vibration Department. Experimental and Research Department.
PRODUCTION AND SERVICING	Methods Engineering for the manufacture of piston engines, gas turbine and rocket engines. Jig and Tool Design. Planning. Rate Fixing, Estimating and Cost Accountancy. Factory Organisation. Engine servicing. Service Department Technical Representative at home or overseas. Engine repair and overhaul.

Engine design work, experimental production and assembly, some test work and the metallurgical laboratories are centred at Edgware. Leavesden is the main engine production, servicing and overhaul base. Hatfield is the centre of the engine experimental and test activities.

IN THE PROPELLER COMPANY

Course of Training.	*Occupation.*
DESIGN	Design Drawing Office (propellers, guided weapons or specialised equipment). Dynamics Department. Vibration Department. Stress Office. Experimental Department.
PRODUCTION AND SERVICING	Methods Engineering Department for the manufacture of propellers, guided weapons and specialised equipment. Jig and Tool Design. Planning. Rate Fixing, Estimating and Cost Accountancy. Factory Organisation. Propeller Servicing. Service Department Technical Representative at home or overseas. Repair and overhaul.
SPECIAL ELECTRONICS COURSE	Design, testing, development, production and servicing of electronic components for propellers, guided weapons and specialised equipment. Installation and servicing of factory electronic equipment.

The design, experimental and test activities of the Propeller Company, covering all its products, are centred at Hatfield. Quantity production is undertaken in the Bolton area. Repair and overhaul are located at both Hatfield and Bolton.

EXTERNAL SCHOLARSHIPS

Some outside scholarships are available: the de Havilland Companies participate, for instance, in the John de Havilland Scholarship, an annual award administered by The Society of British Aircraft Constructors which covers fees and living expenses for a five-year course of engineering apprenticeship with one of the recognised aircraft or engine manufacturers. Applicants must not be above 18 years of age. The de Havilland Companies participate also in scholarships which The Society of British Aircraft Constructors itself offers and in the Amy Johnson Scholarship Fund. There are also awards offered by County Councils and other authorities and bodies. Detailed information on these external scholarships is available upon request.

THE ENGINEERING GRADUATE

The de Havilland companies offer opportunities to the university graduate in the various branches of engineering, mathematics, physics, etc. The main entry is to the technical departments on the design and development side, with smaller numbers on production, business and sales, etc.

For the Aircraft Company the entrant is given a post-graduate course which is organised by the Technical School in collaboration with the department in which the man will take a permanent position, the emphasis being on the practical training. For entry to the design side the course is normally 12 months, but it may be less or more, depending on the particular case. For entry to production, more than 12 months may be needed, with time spent in appropriate manufacturing departments. During the course the graduate is given the opportunity to attend lectures at the Hatfield and other technical colleges in necessary subjects which he has not already covered.

For men who have had an aeronautical training at the university and for certain specialised work, direct entry to a permanent position is often possible, particularly in the aerodynamics and structural departments.

For the Engine Company the form of training is broadly the same, the main entry being to the design offices, performance and structural departments, the gas dynamics and metallurgical laboratories, etc. The post-graduate course of one to two years is organised by the de Havilland School and lectures may be attended at the Willesden or Hendon Technical College. To certain departments direct entry is possible in suitable cases.

For the Propeller Company direct entry to a permanent position is more usual as there is wide scope for young graduates having science or physics degrees. With the more specialised aspects of guided-weapon work the graduate is further trained within the particular department. For training for other branches of the company's activities a post-graduate course is usual.

The de Havilland School is pleased to assist and advise students during their time at the university and in each company a small number can be taken for vacation training either in the shops or in the technical offices. This is considered important as it gives the student an introduction to the aircraft industry and it gives the company some knowledge of men who may wish to take a permanent position after graduating.

ADVANCING TECHNICALITIES IN THE TRAINING OF CRAFT AND ENGINEERING APPRENTICES

In the vibration department apprentices carry out a fatigue test.

Metrology. Using a vernier height gauge and dial test indicator in conjunction with a dividing head.

Final assembly of a de Havilland propeller for a Viscount airliner.

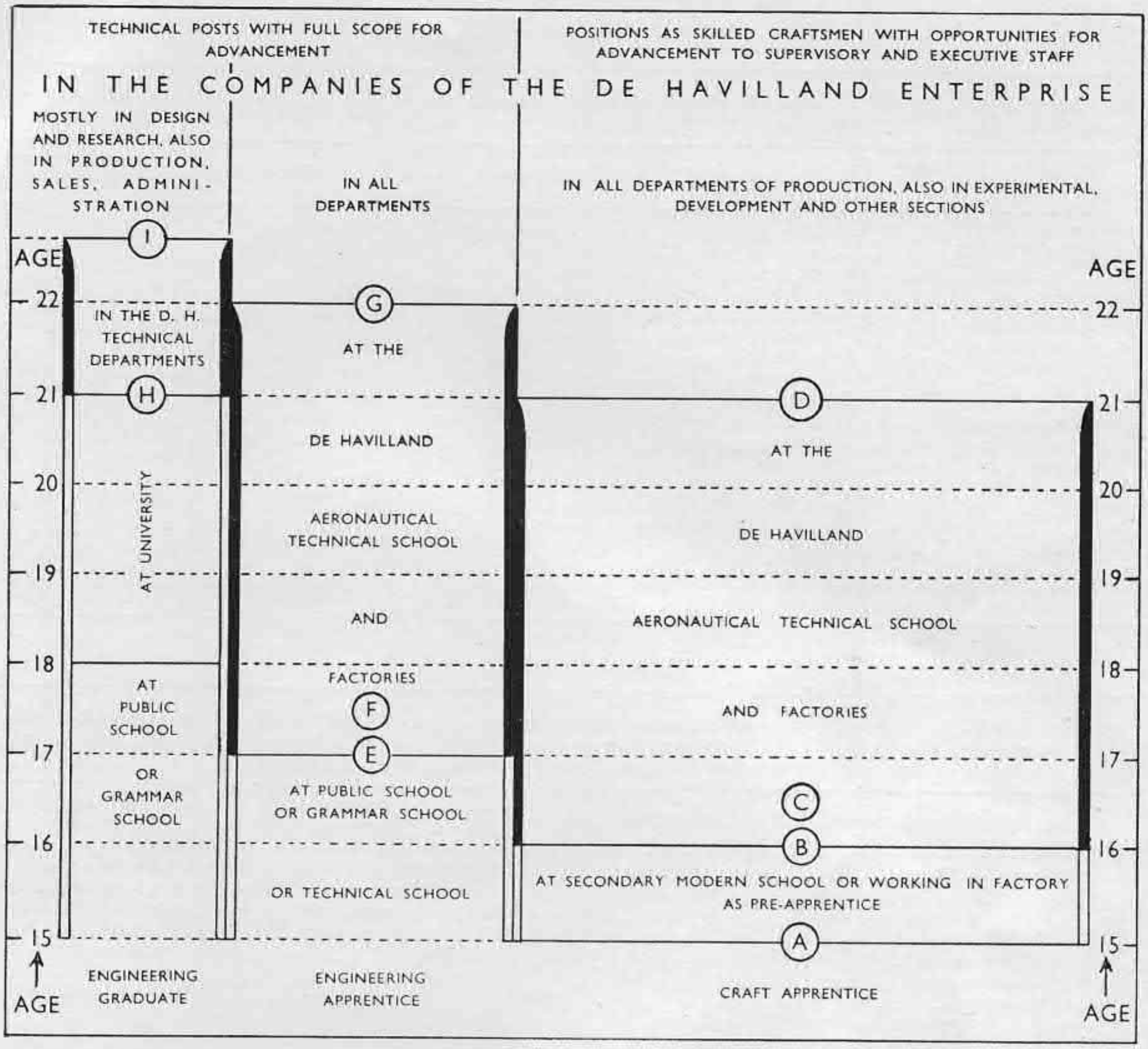
ADVANCING TECHNICALITIES IN THE TRAINING OF CRAFT AND ENGINEERING APPRENTICES

Trimming a Dove canopy in the Perspex department.

Instruction in wood jig making.

A de Havilland geometry class. This subject is important in the training of apprentices.

CHART OF TRAINING AND OPPORTUNITY



This chart is not intended to be precise as to age. Particularly as regards engineering apprentices, it will be clear that boys who remain at school to obtain their General Certificate of Education at the Advanced level or to take the intermediate B.Sc. examination, will enter the de Havilland School at later ages, probably 18 to 19 years.

KEY

A. and B. For those joining as employees at 15 years or entering the School as craft apprentices at 16 years, there is a selection board and test conducted by the de Havilland Technical School, also a medical examination.

C. Assessment at end of six-months probationary period; signing of indentures.

D. Completion of craft apprenticeship.

E. Engineering apprenticeship selection board and medical examination.

F. Assessment at end of six-months probationary period; signing of agreement.

G. Completion of engineering apprenticeship.

H. Engineering graduateship selection board or interview, and medical examination.

I. End of de Havilland post-graduate course. This chart shows it to be of 18 months duration, but the time varies according to circumstances.

PRACTICAL TRAINING

Craft Apprentices

Aircraft Company

1st Year in D.H. School Workshops	Basic use of tools in the following sections:— Woodwork, Fitting, Sheet Metal Work, Machining.				The first half-year is a probationary period.
	Aircraft Joiner and Wood Jig Maker	*Fitter (Aircraft)*	*Toolmaker*	*Machinist*	*Coppersmith and Sheet Metal Worker*
2nd to 5th Years in D.H. Factories	Wood Mill, Wood Detail, Timber Inspection, Aero Jigs.	**Fitting Shop:** General, Bench Fitting, Pipe Bending, Heat Treatment, Processes, Inspection, Aero Tools, Experimental, Press, Foundry, Specialised Aircraft Fitting, Drop Hammer, Rubber and Stretcher Presses.	**Tool Room and Aero Tools:** Shaping, Turning and Milling, Surface and Universal Grinding, Setting-up and Marking-off, Templates, Layout and Development, Bend Blocks, Press Tools, Drilling Fixtures, Precision Tools, Jig Boring, Tool Inspection.	**Machine Shop:** Shaping, Horizontal and Vertical Milling, Boring, Drilling, Grinding, Planing, Slotting. Capstans: Operating and Setting, Turning, including Screw Cutting, Faceplate Setting. Machine Repairs, Inspection. **Experimental Shop:** Machining from solid.	**Sheet Metal Shop:** General Sheet Metal Work, including:— Tank Making, Coppersmithing, Cowl Fixing, Panel Beating, Marking-off and Setting-out, Inspection. **Experimental Shop**

Engine Company

1st Year in D.H. School Workshops	Basic use of tools in the following sections:— Fitting, Machining, Drawing, Internal Combustion Engines, Gas Turbines, Sheet Metal, Toolmaking.			The first half-year is a probationary period.
	Fitter and Turner	*Toolmaker*	*Aero Engine Fitter and Tester*	*Sheet Metal Worker and Coppersmith*
2nd to 5th Years in D.H. Factories.	**Machine Shops:** Grinding, Milling, Drilling, Turning, Gear Cutting, Marking-out. Heat Treatment, Anti-corrosive Treatment and Plant. **Engine:** Assembly and/or **Machine Tools:** Overhaul and Repair. **Experimental Shops:** More advanced machining or more advanced fitting.	**Machine Shops:** including Marking-out, Heat Treatment and Tool Hardening, Cutter Grinding. **Tool Room:** Shaping, Turning, Milling, Surface, Universal and Internal Grinding, Setting-up and Marking-off Templates. Press Tools. Drilling Fixtures. Tool Inspection.	**Fitting Shops:** General Fitting, Heat Treatment, Anti-corrosive Treatment and Plating. General Machining. **Engine:** Assembly, Repair, Testing, Inspection. **Experimental Build Shops.**	**Sheet Metal Shop:** General Sheet Metal Work including Details, Gas Turbine and Rocket Motor Components. Coppersmithing, Marking-off and Setting-out. Inspection, Development work. **Experimental Shop:** More advanced sheet metal work to precision limits. Inspection (Advanced).

Propeller Company

1st Year in D.H. School Workshops.	Basic use of tools in the following sections:— Fitting, Welding, Machining, Drawing.		The first half-year is a probationary period.
	Fitter, Fitter and Turner, Machinist	*Electrician*	
2nd to 5th Years in D.H. Factories.	As applicable:— Bench Fitting, Heat Treatment, Assembly, Repair and Overhaul, Test Beds, Metrology, Inspection, Millwright, Tool Room (including Tool and Cutter Grinding). **Machines** — Shaping, Horizontal and Vertical Milling, Boring, Drilling, Grinding, Capstans, etc. Experimental Machining (Propellers and Guided Weapons).	**Power:** Plant, Installation.	**Light Current:** Electrical Assembly and Wiring, Propeller Electrics, Inspection, Testing.

PRACTICAL TRAINING

Engineering Apprentices

Aircraft Company

<table>
<tr><td colspan="2">1st Year in D.H. School Workshops</td><td colspan="2">Basic use of tools in the following sections:—
Woodwork, Fitting, Sheet Metal Work, Machining, Drawing.</td><td>The first half-year is a probationary period.</td></tr>
<tr><td colspan="2">2nd Year in D.H. Factories</td><td colspan="3">Fitting Shop, Machine Shop, Foundry, Wood Jig Making, Casting, Rubber and Stretcher Press, Drop Hammer, Jigs and Fixtures.</td></tr>
<tr><td rowspan="4">3rd to 5th Years in D.H. Factories</td><td>Design</td><td colspan="2">Production</td><td>Aircraft Servicing</td></tr>
<tr><td>Material Test Laboratory, Heat Treatment, Processes, Fabric and Dope, Hydraulic and Electrical Departments, Instrument Test Laboratory.</td><td colspan="2">Materials Test Laboratory, Heat Treatment, Processes, Fabric and Dope, Hydraulic and Electrical Depts. Tool Room, Works Maintenance Dept.</td><td>Materials Test Laboratory, Heat Treatment, Processes, Fabric and Dope, Hydraulic and Electrical Departments, Engine Cowling, Erecting.</td></tr>
<tr><td>Erecting Shops, Piston and Turbine Engine Installation, Loft, Flight Test, Structural Test Laboratory.</td><td colspan="2">Erecting Shop, Stores Control, Production Machining, Methods, Rate Fixing.</td><td>Erecting Shop, Piston and Turbine Engine Build, Repair and Installation, Magneto and Carburettor Test, Propeller Course.</td></tr>
<tr><td>Drawing Office, Aerodynamics Department, Stress Office.</td><td colspan="2">Cost Estimating and Accounts, Jig and Tool Drawing Office.</td><td>Instrument Test Laboratory, Flight Test, Aircraft Repair and Maintenance.</td></tr>
</table>

Engine Company

<table>
<tr><td>1st Year in D.H. School Workshops</td><td>Basic use of tools in each of the following sections:—
Fitting, Machining, Drawing, Internal Combustion Engines, Gas Turbines.</td><td>The first half-year is a probationary period.</td></tr>
<tr><td>2nd Year in D.H. Factories</td><td colspan="2">Treatments, Machining, Fitting, Tool Room, Sheet Metal.</td></tr>
<tr><td rowspan="2">3rd to 5th Years in D.H. Factories</td><td>Engine Design (Piston Engines, Gas Turbines, Rocket Motors)</td><td>Engine Production and Servicing.</td></tr>
<tr><td>Engine assembly, Test, Repair and Overhaul Departments, Laboratory, Inspection, Engine Development, Stress, Drawing Office, Vibration Test, Performance, Gas Dynamics.</td><td>Production Machining, Engine Assembly, Test, Metrology, Laboratory, Plant and Equipment, Production Control, Rate-fixing and Estimating, Methods, Planning, Jig and Tool Drawing Offices, Production Manager's Departments.</td></tr>
</table>

Propeller Company

<table>
<tr><td colspan="2">1st Year in D.H. School Workshops</td><td colspan="2">Basic use of tools in the following sections:—
Fitting, Machining, Drawing, Welding.</td><td>The first half-year is a probationary period.</td></tr>
<tr><td colspan="2">2nd Year in D.H. Factories</td><td colspan="3">Treatments, Fitting, Machining, Tool Room</td></tr>
<tr><td rowspan="4">3rd to 5th Years in D.H. Factories</td><td colspan="3">Propellers, etc.</td><td>Guided Weapons and Specialised Electronic Equipment.</td></tr>
<tr><td>Design</td><td colspan="2">Production and Servicing</td><td>Design, Production and Servicing</td></tr>
<tr><td>Propeller Course, Test, Repair and Investigation Departments, Laboratory.</td><td colspan="2">Production Machining, Assembly, Test, Inspection, Metrology.</td><td>Experimental Machining and Assembly, Electrical Assembly.</td></tr>
<tr><td>Development, Vibration Departments, Drawing Office, Stress, Dynamics.</td><td colspan="2">Servicing, Planning, Jig and Tool Drawing Office, Estimating.</td><td>Development, including Structures, Hydraulics, Pneumatics, Electronics, Servo Mechanisms, Dynamics and Test, Electrical Standards and Measurement. Drawing Office—Mechanical and Electrical.</td></tr>
</table>

DE HAVILLAND ESTABLISHMENTS

The control tower and flight hangar at the Hatfield aerodrome.

The headquarters establishment of the Propeller Company at Hatfield.

(*Right*) *The de Havilland works at Wellington, New Zealand, established in 1939.*

(*Left*) *The main production factory of the Propeller Company at Lostock, near Bolton, Lancashire.*

(*Right*) *The de Havilland plant at Toronto; the Canadian Company was formed in 1928.*

IN ENGLAND AND OVERSEAS

The administrative headquarters of the Engine Company at Leavesden, near Watford.

One of the main production factories of the Aircraft Company, at Broughton, near Chester.

(*Right*) *The de Havilland factory at Bankstown, near Sydney; the Australian Company, formed in 1927, was the first of the overseas de Havilland establishments.*

(*Left*) *The machine shop at Stevenage in Hertfordshire.*

(*Below*) *The Christchurch works in Hampshire, which shares with Hatfield the responsibilities of aircraft design and development as well as manufacture.*

(*Below*) *The headquarters of the Engineering Division of the Engine Company at Stag Lane, Edgware, where apprenticeship training is centred.*

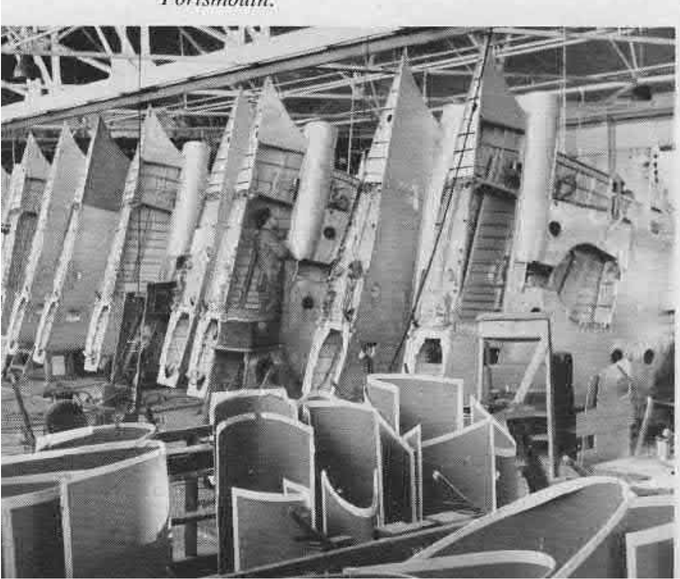
THE PRODUCTION OF DE HAVILLAND AIRCRAFT, ENGINES AND PROPELLERS

Herons for export on the assembly line at Chester.

Civil aircraft, Doves and Herons, in the main erecting shop at Chester.

(Below) Production lines of military aircraft in the Chester factory.

Wings for Venom day fighters, night fighters, and naval fighters are among the aircraft components produced at Portsmouth.



(Above)
Sea Venoms, Venom Night Fighters and Vampire Trainers are produced at Christchurch. Christchurch is engaged also on the development and production of the D.H. 110 naval all-weather fighter.

(Above)
The production of jet engines, rocket engines and piston engines is centred at Leavesden. The department concerned with the machining of Ghost and Goblin compressors is seen here.

(Right)
The main factory of de Havilland Propellers Limited is at Lostock, near Bolton, where a comprehensive range of aircraft propellers is manufactured.

One of the battery of stretcher presses in the metal-forming shop.

The rubber press is used to form many of the smaller sheet-metal components for aircraft.

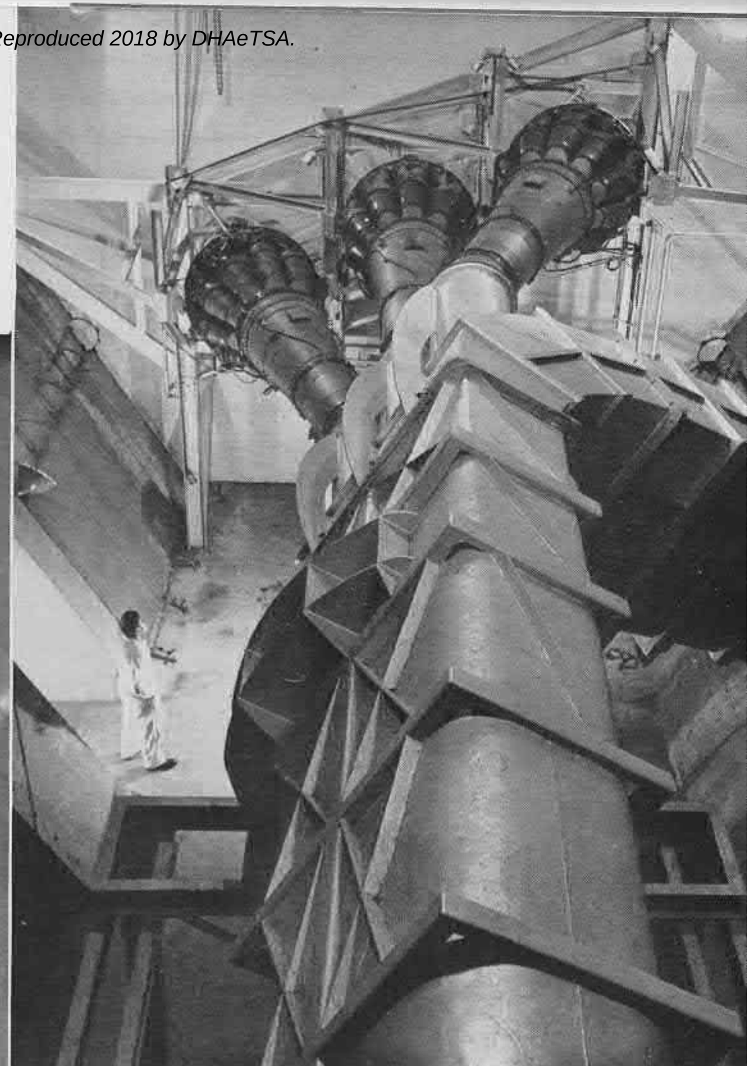
MODERN METHODS OF FABRICATION

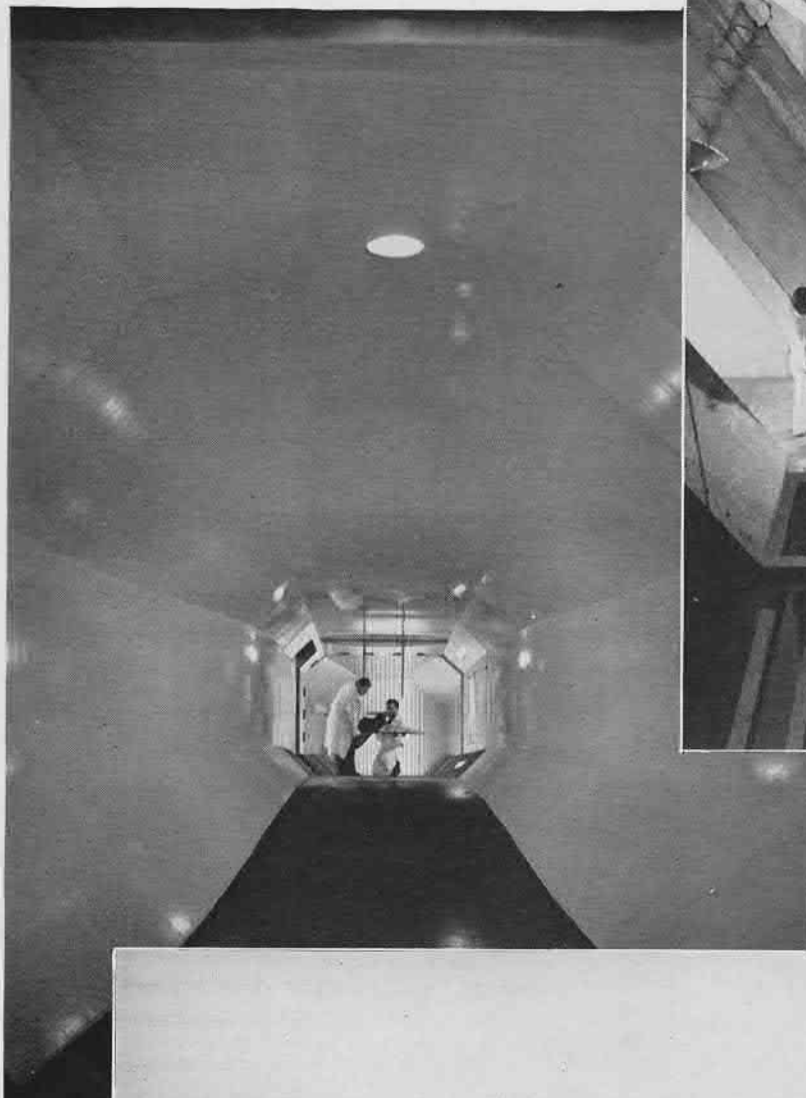
(*Below*)
A 2,000-ton press used in forming hollow-steel propeller blades. The furnace for heating the blades is at the right of the press.

SUPERSONIC WIND TUNNEL

Three Ghost jet engines provide the power for the supersonic wind tunnel at Hatfield.

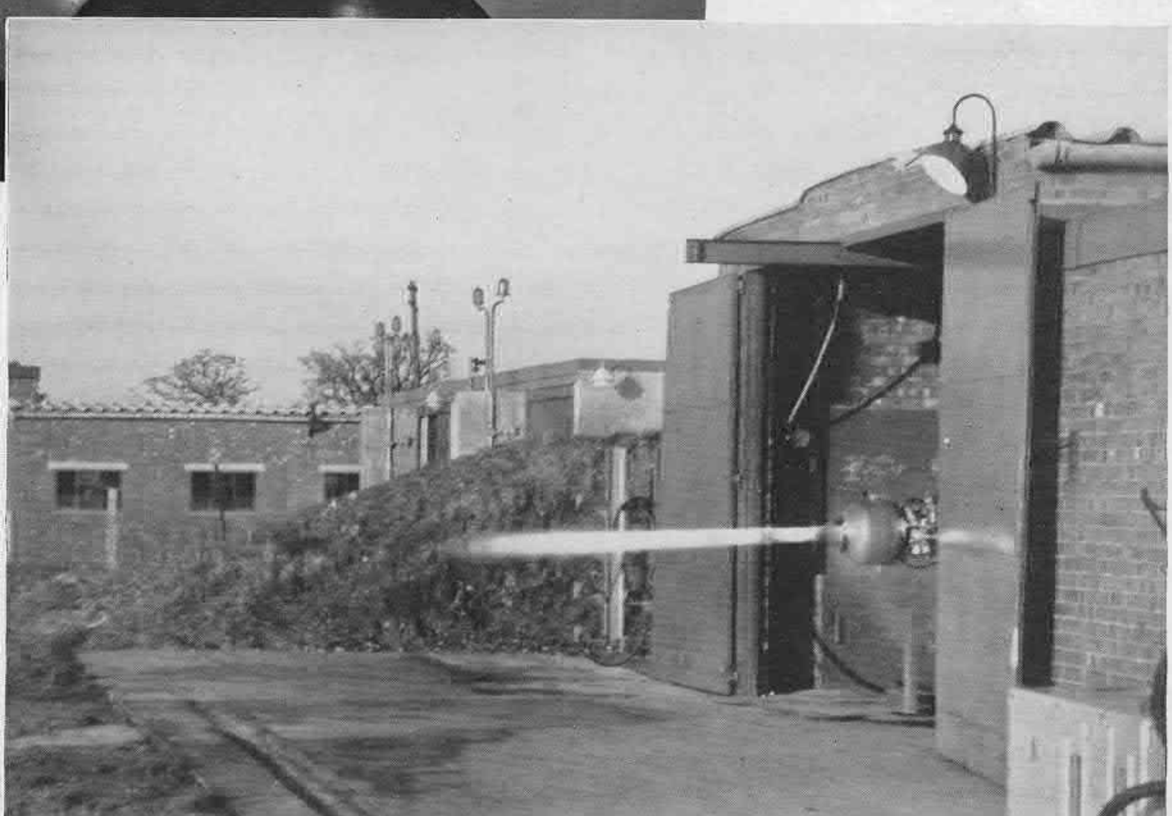
(*Below*) *A scale model of the Comet jet airliner being prepared for testing in the low-speed wind tunnel.*





ROCKET ENGINE ON TEST

(*Below*) *The Super Sprite assisted-take-off rocket engine on test.*



Rugby football on the home ground at Hatfield.

WELFARE

Accommodation

It is necessary for parents to make their own arrangements for the accommodation of apprentices. They will be assisted in this, so far as is practicable, by the welfare sections of the School and of the de Havilland Companies to which they are attached, but unfortunately it is not possible for the School to accept responsibility for the finding of suitable accommodation.

A hostel is maintained at Hatfield to provide a temporary solution to the problem in cases of difficulty and it may be possible to accommodate a new apprentice for a short period while a more permanent living arrangement is being sought.

Messing

Mid-day meals and other refreshments are taken at any of the factory canteens and are available at low prices.

Medical Care

The Medical Officer, with a trained staff, is in touch with the conditions under which all apprentices live and work. In addition the School, as distinct from the works, has a First Aid and Welfare section and the boys are encouraged to seek its advice freely. Those from overseas or otherwise separated from their parents find this section helpful.

A well-equipped factory surgery.

The Enterprise has an excellent library, with branch libraries.

Sports and Recreations

Facilities are available for boys to participate in most outdoor games, and they are encouraged to take part in games which engender the team spirit. Playing fields are provided for rugby and association football, cricket, tennis, etc.

There are many clubs and societies within the organisation covering such subjects as art, photography, music, amateur dramatics. All of these are open to trainees — indeed, apprentices are keenly welcomed into their membership and activities.

Library

An excellent general library, with branches, at which almost any book can be obtained, is available on company premises, with reading rooms open to all who are under training. The engineering section covers all the technical subjects required whilst attending the School. Daily and weekly periodicals and other publications are provided in the reading rooms.

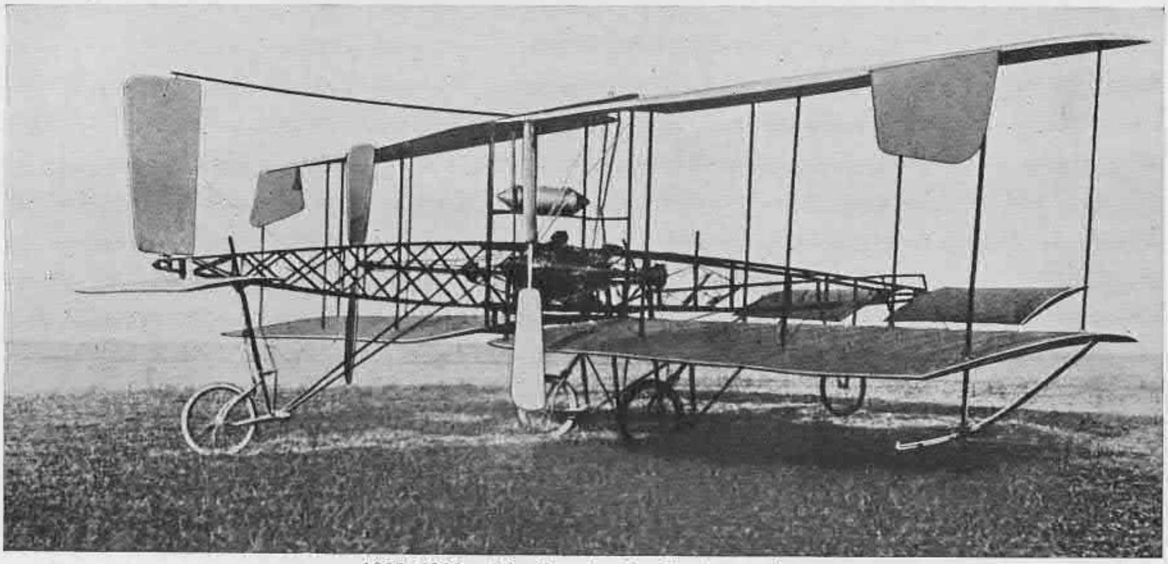
Clothing

The practical work is hard on clothing. It is essential that every boy should possess suitable overalls.

Holidays

During the first year of training boys have a short holiday at Easter and a Summer vacation of two weeks. Afterwards they take the same holidays as the factories in which they are working.

Cricket and other sports in their season are encouraged throughout the de Havilland establishments.



1908–1909. *The first de Havilland aeroplane.*

AN OUTLINE OF DE HAVILLAND HISTORY

THE de Havilland Aircraft Company was formed in 1920 but the real starting-point of the world-wide Enterprise as it exists to-day was in 1908 when Geoffrey de Havilland, a young engineering student, started to build his first aeroplane. Every part of this aeroplane, including the four-cylinder engine and the gear-driven pusher propellers, was designed by de Havilland. It was built piece by piece in a shed off the Fulham Road, London. During the early stages de Havilland enlisted the help of another young engineer, Frank Hearle, an association which was destined to have a profound effect on aviation history.

In December, 1909, de Havilland made his first attempt to fly but the machine came to grief, fortunately without injury to the pilot, or to the engine. The two men at once set about constructing around the engine an improved aeroplane with a single propeller, and on this in 1910 de Havilland taught himself to fly. The Army Balloon Factory at Farnborough purchased the aircraft and gave the two men employment in the factory. At Farnborough de Havilland was responsible for the design of the B.E. series of tractor biplanes. Early in 1914 he left Government employment and was appointed chief designer of Mr. W. Holt Thomas's concern, the Aircraft Manufacturing Company Limited. It was here that the de Havilland team began to take shape. Mr. St. Barbe was one of the earliest, having joined in 1912. Mr. C. C. Walker joined at Hendon in 1915. Mr. Hearle joined in 1917 and Mr. Nixon in 1918.

When war was declared in August, 1914, de Havilland was well on with the design of a two-seat pusher biplane fighter, the Airco D.H.1 which initiated the series of type numbers still in use to-day. It was followed by a single-seat fighter, the D.H.2, which was in action against the Germans in France, and, in 1916, a tractor biplane, the D.H.4, which was destined to make history. First appearing, as did the Mosquito 24 years later, as a bomber with fighter performance, the D.H.4 was developed also for fighting, photographic reconnaissance and other functions. In prototype form this aircraft was fitted with the B.H.P. 230 h.p. engine designed by Major Frank B. Halford who was later to become chairman and technical director of the de Havilland Engine Company.

With the armistice in 1918 hopes for the future of civil aviation ran high and a civil operating company, Aircraft Transport and Travel Limited, was formed by the Aircraft Manufacturing Company. It was not until August 25, 1919, that regular overseas services were permitted and on that day Aircraft Transport and Travel opened a daily service between London and Paris, so inaugurating the world's first international air service. The aeroplanes used at first were the D.H.4A and the D.H.16, both converted bombers. These were followed

1914. *The D.H.1 two-seat fighter designed at Hendon.*

1919. *A D.H.16 London–Paris " airliner."*

by the D.H.18 with accommodation for eight passengers, the first de Havilland aircraft to be designed specifically as an airliner.

In the early days air travel met with little public support. Post-war military orders were practically non-existent and the industry fell upon hard times. Late in 1919 the Aircraft Manufacturing Company closed down but the de Havilland team could not be convinced that there was no future in civil aviation and in September, 1920, The de Havilland Aircraft Company Limited was formed with a humble base at Stag Lane Aerodrome, Edgware.

In the first few years of the Company resources were meagre and profitable business was hard to find. The cross-Channel services competed manfully with the weather and with each other until, in 1924, it became necessary to amalgamate the main British companies to form Imperial Airways.

In these difficult times the de Havilland Company continued to produce biplane transports suited to the current operating conditions. The D.H.18 was followed by the superior eight-passenger D.H.34 and the D.H.50, a four-passenger machine which was widely used, notably in Australia. Alan Cobham made historic flights in this aircraft. In 1926 a successful three-engined transport, the Hercules, D.H.66, was built for the Imperial route to the East.

There had been sustained eagerness to produce a practical light aeroplane, and extremely small engines had been tried in an effort to lower costs, but the experiments were not a success. It was de Havilland's decision to break away from this line of thought, and Halford's engineering of the Cirrus 60 h.p. engine from parts of the old 90 Renault which made possible the Moth two-seat biplane, the aircraft which virtually founded the light-aeroplane movement on a world-wide basis. The Moth first flew on February 22, 1925. It sold readily in all parts of the world, giving the Company its first real success, and it was this development of overseas trade which led to the formation of de Havilland companies in Australia, in 1927, Canada in 1928, India in 1929, and South Africa in 1930.

Logically the Company soon found it desirable to build its own engines and thus the Gipsy range, again designed by Halford, came into being in 1926–27. Club and private flying developed with the Moth and an era of remarkable flying achievements opened in which British skill and daring shone before the world. The solo flight of Amy Johnson in a Moth to Australia in 19½ days in May, 1930, is recognised as one of the finest of all those adventures which did so much to establish Britain as a pioneer of world flying.

The de Havilland Company continued to develop economical light transports. There was highly successful business in these categories typified by the Dragon of 1932 and the D.H.89 Dragon Rapide which, first flying in 1934, is 20 years later, still in service in some parts of the world.

The England–Australia race in 1934 led to the creation of the Comet, D.H.88, a two-seat long-distance racer with two Gipsy six-cylinder engines. The Comet won the race against stiff international competition, by flying from Mildenhall to Melbourne in 70 hours 54 minutes.

The reluctance of the British Government of those days to encourage civil aviation put the British industry at a disadvantage under which it still suffered 20 years later, and it was not until 1936 that the de Havilland Company was able to obtain an order for a transport aircraft which, profiting from the valuable lessons learned from the Comet racer, attained economy by speed resulting from the clean aerodynamic form. This was the Albatross 22-seater. Its development and that of the smaller Flamingo of 1938 was thwarted by the war, but the Company was continually gaining in technical strength

1925. *The first Moth.*

1934. *The Comet at Melbourne—11,000 miles in 71 hours.*

1935. *The D.H.86 early in its long and world-wide career.*

1940. *The versatile Mosquito of the 1939–45 war.*

so that the war, demanding the full exertion of its abilities and resources, afforded it a notable opportunity for expression.

The Mosquito multi-purpose aircraft was the Company's foremost contribution to the war of 1939–45. Almost 6,000 of this type were built during the war by de Havilland in England, Canada and Australia. It was the fastest aircraft on any front from September, 1941, until early in 1944. More than forty variants were produced. In addition to the Mosquito, almost 4,000 Tiger Moth trainers and some 2,000 other aircraft were produced, also 10,000 Gipsy engines and 140,000 propellers.

Mainly as a result of experience with the Comet racer, de Havilland acquired manufacturing rights for the Hamilton variable-pitch propeller and commenced production in 1935. The rearmament programme led to rapid expansion and, at the outbreak of war, the de Havilland plant was the only source of full-scale production in the country. The Propeller Division produced the major share of all the variable-pitch propellers used by the Royal Air Force and the Fleet Air Arm during the war. In April, 1946, the Propeller Division became a separate company, de Havilland Propellers Limited. A notable post-war development has been the production of hollow-steel-blade propellers for turbines such as those in use on the Bristol Britannia airliner.

In 1952 it was announced that de Havilland Propellers were engaged in work on guided weapons. The details of this important work, however, remained secret.

In the winter of 1940–41 Major Halford, although heavily loaded with other responsibilities, was eager to enter the turbine-engine field. The decision to go ahead was made and de Havilland became the first of the established aero-engine builders in Britain to undertake the design of a jet engine specifically for production.

One year later, on April 13, 1942, the prototype engine, the Goblin, ran for the first time. In September a 25-hour flight approval run was completed. Two of the new Goblin engines first became airborne in a Meteor airframe in March, 1943, and in January, 1945, the Goblin became the first jet engine to pass the Air Ministry type-approval tests. Because of the expanding prospects of the Engine Division it was decided to form a separate company and, in February, 1944, the de Havilland Engine Company came into being.

The growing demand for increased power led naturally to the development of the Ghost engine of 5,000 lb. static thrust compared with the 3,000 lb. of the Goblin. It was the Ghost engine which made possible the development of the Comet jet airliner. A further stage in engine development was announced in 1953 when the existence of a new and very powerful axial-flow engine called the Gyron was made known. It was designed for supersonic flight.

Parallel with this turbine development the range of Gipsy engines was continued. The Gipsy Major four-cylinder engine reached a high pitch of efficiency and the six-cylinder Gipsy Queen was produced in two forms, the ungeared and unsupercharged Gipsy Queen 30 of 250 h.p. and the geared and supercharged Gipsy Queen 70 which in the Mark 2 version developed 380 h.p.

Concurrently with the development of the Goblin turbo-jet the design and construction of the Vampire interceptor went ahead. This new jet fighter first flew in September, 1943, 16 months after the go-head decision. It exceeded 500 m.p.h. during its flight tests and was the first aircraft, British or American, to do so by a handsome margin. The Vampire fighter-bomber saw extensive service in the Royal Air Force and was adopted by nearly a score of the world's air forces, while its successor the Vampire Trainer, became the standard advanced trainer for the Royal Navy and the Royal Air Force and many overseas air forces.

As the Goblin gave way to the more powerful Ghost engine, so the Vampire as an operational fighter gave way to the Venom powered with the Ghost engine. The Venom proved to be an important factor in re-equipping the Western air forces because it could be produced during the period of development required for the next generation of swept-wing fighters. The Venom, like its predecessor, was much developed and was produced as a single-seat fighter and fighter-bomber, a two-seat night-fighter and a two-seat all-weather naval fighter. The latest example of the de Havilland participation in the fighter field at this time is the D.H.110, a swept-wing transonic two-seat all-weather naval fighter with two Rolls-Royce Avon engines, which was ordered for the Royal Navy in January of 1955.

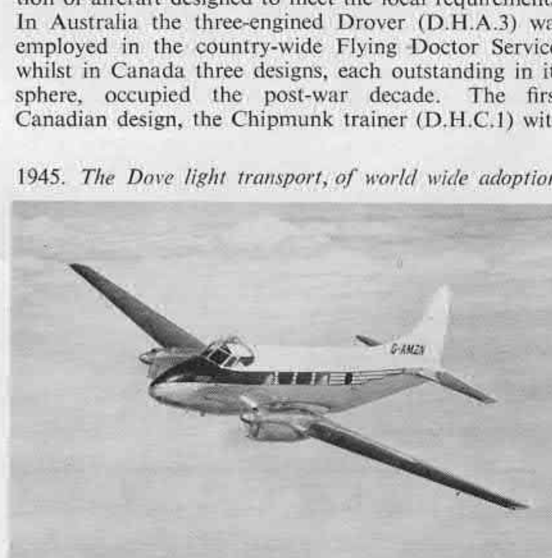
de Havilland re-entered the civil market after the war with the Dove, a light twin-engined transport seating 8 to 11 passengers, powered by two Gipsy Queen 70 engines. The Dove first flew in September, 1945, and thereafter found a ready market throughout the world, not least in the United States where it made history by being imported and considerably employed for charter and executive work.

In 1950 the Heron, a small four-engined transport carrying 14 to 17 passengers, made its first flight, intended primarily for short-haul branch-line service. It was soon widely popular.

While developments in the English plants of the de Havilland Enterprise were making great progress the companies in Canada and Australia set about the production of aircraft designed to meet the local requirements. In Australia the three-engined Drover (D.H.A.3) was employed in the country-wide Flying Doctor Service, whilst in Canada three designs, each outstanding in its sphere, occupied the post-war decade. The first Canadian design, the Chipmunk trainer (D.H.C.1) with

1944. *The Vampire, sold to a score of countries.*

1945. *The Dove light transport, of world wide adoption.*



a Gipsy Major engine, a worthy successor to the Tiger Moth, has been built in large numbers in Canada and England. The Beaver (D.H.C.2) designed as a light transport to carry a pilot and six passengers, was primarily intended for the bush flyer in the northern territories, but its rugged simplicity and excellent performance made it suitable for overseas sale. In 1952 the Beaver was adopted as a liaison aircraft for the United States Army where it is known as the L.20.

The need for a larger transport was met by the Otter (D.H.C.3) first produced in 1951 as a utility transport capable of carrying up to 14 passengers and like the Beaver, adaptable for landing on wheels, floats or skis. It, too, was adopted by the United States Army.

The main civil preoccupation of the Company in the years following the war has been the design and development of the Comet, the world's first jet airliner. Following preliminary studies during the closing years of the war, serious work on the Comet began in 1946 and the aircraft, fitted with four de Havilland Ghost engines, made its first flight on July 27, 1949. Production went hand-in-hand with development and after a period of intensive test flying and route-proving flights, the first jet passenger service in the world was inaugurated by the British Overseas Airways Corporation on May 2, 1952.

1950. *The Heron feederliner with four Gipsy Queen 30 engines and de Havilland propellers.*

On that day a Comet left London Airport for Johannesburg which it reached 23½ hours later. The saving in journey time and the unsurpassed comfort of jet travel appealed to the travelling public and the Comet services operated at exceptionally high passenger-load factors. At the conclusion of the first 12 months of operation, during which the services were extended to Ceylon, Singapore and Tokyo, B.O.A.C. Comets were flying 122,000 miles per week and had earned a profit, no mean feat for any airliner in its first year of operation.

In the early months of 1954, after some 35,000 hours of test and airline flying, two accidents to B.O.A.C. Comet Series 1's resulted in the suspension of services. At the subsequent official inquiry the cause of the accidents was found to be a hitherto unsuspected manifestation of metal fatigue in the skin of the pressure cabin.

An improved version of the Comet, the Series 2 with Rolls-Royce engines was produced in 1953. The de Havilland engine range did not cater for the particular power category of this requirement. The increased power

1949. *The Venom fighter (de Havilland Ghost engine).*

1954. *The Comet 3, a development stage for the Comet 4*

and all-up weight of the Comet 2 gave improved range and payload. In February, 1955, it was announced that an order had been placed for a number of Comet 2's for use by Transport Command, R.A.F.

The next stage in the development was the Comet 3, the prototype of which made its first flight on July 19, 1954. This aircraft, designed for the longer stages of the world's air routes, had an all-up weight of 150,000 lb. and was equipped with four Rolls-Royce Avon engines each of 10,000 lb. static thrust. The test flying of the Comet 3 proceeded apace but production was postponed pending the outcome of the Comet accident inquiry. The intervening time was devoted to the design of an improved version, the Comet 4 which was announced on March 17, 1955. The British Overseas Airways Corporation placed an order for 20 of this new version.

The new Comet 4 equipped with four Rolls-Royce Avon engines of 10,500 lb. thrust is capable of carrying its capacity payload of some 16,400 lb. over stage lengths of more than 2,900 miles at a cruising speed of 500 m.p.h. It will accommodate 58 first-class passengers or 76 tourist-class passengers.

The de Havilland Enterprise to-day embrace activities of the civil and military aircraft, piston engines, turbines and rocket engines, propellers and guided missiles, and there are manufacturing facilities in three continents, also a world-wide servicing organisation.

1951. *The D.H.110 all-weather fighter.*

THE DE HAVILLAND ENTERPRISE IN GREAT BRITAIN

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