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NEWS RELEASE

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TYPE 188's FIRST FLIGHT

The Bristol Type 188, the world's first stainless steel supersonic aircraft, made its first flight today when it took off from British Aircraft Corporation's airfield at Filton with Mr. Godfrey Auty, Bristol's chief test pilot, at the controls.

The 188 is designed for research into problems at speeds of supersonic flight.

It was accompanied on its first flight by a Hunter chase aircraft, piloted by Mr. K. M. Ashley, a Bristol Aircraft test pilot. Mr. Ashley and Mr. J. I. Williamson, another of the company's test pilots, will share with Mr. Auty the work of flying the 188.

After landing Mr. Auty said:
"The 188's first flight was satisfactory and according to plan. I am looking forward to the job of developing the aeroplane to its design limits with the utmost confidence."

Dr. A. E. Russell, Technical Director of Bristol Aircraft, said:
"In the Type 188, Britain now has available a unique aviation research instrument. It will play an important part in solving many of the problems connected with high-supersonic flight, particularly those relating to kinetic heating and propulsion."

The Bristol Type 188 Supersonic Research Aircraft.

GENERAL

The Type 188 supersonic research aircraft was designed and built under Ministry of Aviation contract by Bristol Aircraft Limited, a company of British Aircraft Corporation. It is a single-seat monoplane of welded stainless steel construction, and is powered by two de Havilland Gyron Junior DGJ.10 reheated turbojet engines.

A second aircraft is in an advanced stage of construction at Bristol Aircraft's Filton works, and a complete airframe has been undergoing structural tests at the Royal Aircraft Establishment, Farnborough, since May 1960.

MAIN POINTS OF INTEREST

The following is a summary of the main points of interest about the aircraft; these points are dealt with more fully in the separate release "Background Information About the Type 188."

1. The Type 188 is the world's first supersonic stainless steel aircraft and is potentially the world's fastest conventional aeroplane. It is built of stainless steel because aluminium alloy deteriorates at the extreme surface temperatures which the airframe was designed to withstand.

2. The aircraft is designed for investigating flight problems, particularly kinetic heating problems, at supersonic speeds. It is designed to cruise for long enough to establish steady research conditions, so that the structural heating and cooling effects associated with high-supersonic flight can be realistically studied.

3. The aircraft is one of the world's most advanced and versatile aviation research instruments, and much of the high-supersonic flight data it will gather cannot be obtained with any other existing aeroplane. A great deal of this data will be invaluable in the development of a future supersonic aircraft.

4. It is a pure research aircraft and its shape was determined solely by the research functions it had to fulfil. It is not, and was never intended to be, a model of a supersonic transport.

5. It is more fully instrumented than any previous British research aircraft, and associated with it is one of the world's most advanced installations for recording, processing and analysing flight data.

6. No other means exists in Britain for flight testing Mach 2 installations beyond their normal operational limits. The 188 will therefore be an invaluable research instrument in the civil as well as the military field.

7. The installation of the Type 188's engines in separate wing-mounted nacelles will facilitate supersonic propulsion research because changes can be made in air intakes, engines or exhaust nozzles without a major rebuild of the aircraft structure.

8. Many unprecedented problems have had to be solved in the design, development and manufacture of the Type 188. Bringing this new and most complex aeroplane to the flight stage has forced advances in the "state of the art" in many different aviation fields. These advances include:

(a) Materials - new types of materials and new fabrication methods have had to be evolved to meet the high-temperature conditions in which the aircraft will operate.

(b) Components - virtually every item in the aircraft, down to the smallest rivet, has had to be specially developed for the new high-temperature conditions.

(c) Testing - new wind tunnel and test techniques have been established and new test equipment designed and proved.

(d) Flight development - the airborne electronic instrumentation in the 188 and the ground data processing installation is a prototype of the future flight research facilities which will be necessary to enable flight development programmes for high-supersonic aircraft to be completed in a reasonable timescale.

BACKGROUND INFORMATION ABOUT THE TYPE 188

THE AIRCRAFT'S RESEARCH TASK

Versatility in the research role was regarded as the overriding need when the research requirements to be met by the Type 188 were being formulated. These research requirements were exacting and varied.

The aircraft was required to be suitable for operation in the difficult conditions of flight experienced at high supersonic speeds where, even in the deep cold of the upper atmosphere, the outside of the aircraft is subjected to very high temperatures.

The aircraft was required to be capable of flying at supersonic speeds for long enough periods for steady conditions to be established, so that detailed study could be made of aerodynamic phenomena and structural heating and cooling effects in these extreme conditions.

The aircraft was required to be able to take-off under its own power, climb to operating height, fly its research flight pattern descend and return to base.

Special provision had to be made for use of the aircraft in progressive research into propulsion development.

Means had to be provided for collection of flight data in far greater volume and far greater detail than ever before.

MEETING THE RESEARCH REQUIREMENTS

(a) Configuration

The general aircraft configuration resulting from these requirements looks clean and simple but is in fact a subtle arrangement of carefully-shaped wings, body and nacelles. The wing, which has a span of 35 ft. 1 in. and an area of 396 sq. ft. is of constant chord between the body and the nacelles, but outboard of the nacelles the leading edge is swept back at an angle of 38 degrees and the tip of the wing, formed by the balance area of the aileron forward of its hinge, has a leading edge sweep-back angle of 64 degrees.

The fuselage, oval in cross section, is 71 ft. long overall, and has a maximum width of 3 ft. 9 in. and a maximum depth of 4 ft. 11½ in. It contains the pilot, in a small pressure cabin, the instrumentation recorders, fuel and most of the services. The fuselage has been tailored to the minimum section that will accommodate the pilot at the forward end and the main undercarriage wheels in the central area.

There is a small amount of waisting which, with the location of the separate engine nacelles, gives a favourable distribution of areas for supersonic flight. The tailplane is mounted on top of the swept-back fin, clear of the jet efflux from the engines.

(b) Choice of Stainless Steel

To meet high-temperature conditions, the decision was taken to build the Type 188 in stainless steel. At speeds beyond about Mach 2.2, aluminium alloys begin to suffer unacceptable deterioration in strength and stiffness, and when design investigations began the high-strength titanium alloys - which now show capabilities roughly midway between those of aluminium and steel - were not so well advanced as they are today.

(c) Engine Installation

Installation of the engines in nacelles mounted in the wings was decided on to facilitate changes in air intakes, engines or exhaust nozzles. Had the engines been buried in the fuselage engine and intake installation would have been unnecessarily complicated and time-consuming.

The use of separate nacelles also makes possible, by suitable disposition, a substantial reduction of drag at supersonic speeds by inducing favourable shock wave interaction between fuselage and nacelles.

(d) Instrumentation

To enable it to collect flight data in the required volume and detail, a considerable load of airborne electronic recording and measuring equipment is installed in the aircraft. Much of this miniaturised equipment has been specially developed for the Type 188, and all of it has had to be carefully protected against the effects of kinetic heating at high speed.

Hundreds of transducers and other devices installed in various parts of the aircraft will continuously measure and transmit records of changes in temperatures, pressures, vibration, acceleration and many other factors. This data will be recorded in the aircraft, either on tape or as trace recordings, on film for subsequent analysis. Much of the data will also be telemetered to ground during flight for recording and monitoring.

(e) Operations Room

After initial flight testing at Boscombe Down the Type 188 will return to Filton, which will be its main base for the development programme.

In preparation for this programme Bristol Aircraft has set up a new Operations Room, with specially-designed facilities for recording, processing and analysing flight data.

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Throughout its flight development programme the aircraft will be under close and continuous control from the ground, thus ensuring that maximum research value is extracted from Type 188 flying time. It will be tracked and positioned by radar, and constant V.H.F. radio contact will be maintained between the pilot and the operations room.

During flight, data on systems functioning and other engineering quantities will be telemetered to the operations room. and processed. Some "pilot information" quantities, including air speed, Mach number, altitude, engine rpm, fuel consumption and jet pipe temperature, will be displayed on a duplicate set of aircraft instrument dials at the control console.

A ground pilot will monitor the displays and will be able, over the V.H.F. radio link, to give an advisory service to his colleague in the air. The ground pilot will in fact assume the responsibilities normally allocated to a second pilot or observer.

Other telemetered data will be simultaneously presented as trace recordings, and these will be monitored by trained observers.

Flight data will also be recorded on tape and film in the aircraft, and these airborne records will be subsequently processed and analysed in the operations room.

TYPE 188, THE X.15, AND THE SUPERSONIC AIRLINER

As comparisons between the Type 188 and the American X15 are inevitable, it should be emphasized that the research functions of the two aircraft are widely different.

The X.15, a magnificent technical achievement, is a rocket-propelled, air-launched aircraft designed for the exploration of the extremely high altitudes and temperatures and the re-entry problems associated with space vehicles. Only a comparatively small part of its flight data is relevant to future "conventional" high-supersonic aircraft.

The Type 188 will operate in a different flight environment and much of the flight data it is designed to collect will be invaluable in the development of supersonic aircraft. A great deal of this data cannot be gathered by any other current research aircraft.

Before a first-generation supersonic airliner is certified for passenger operation, an essential requirement will be the test-flying of techniques and installations. The Type 188 is the only aircraft available in Britain for this purpose.

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ADVANCING THE "STATE OF THE ART"

The design, development and manufacture of the 188 have posed many unprecedented problems. These problems arise mainly from the extremely wide range of working temperatures over which the aircraft and its installations must function.

Some equipment cannot be protected against these conditions and must be built to withstand them. Other items have to be cooled, and because the external air is hot, it is necessary to adopt special measures such as boiling off stored water and using the aircraft's own fuel for cooling. A high capacity refrigeration system has been installed to protect the pilot and the extensive instrumentation. Special transparent materials have been developed for the windows of the small pressuried cockpit, capable of withstanding the extremely severe conditions of heating, cooling and pressure.

This new and complex aircraft has been the means of bringing about advances in the "state of the art" in various fields of aviation. The main headings under which these advances fall are:

(i) materials
(ii) components
(iii) test procedures
(iv) flight research development

(i) Materials

The decision to build the Type 188 in stainless steel necessitated a considerable development programme, in co-operation with the steel manufacturers, Firth-Vickers Stainless Steels Limited of Sheffield.

Suitable materials were evolved and methods of fabrication, welding, jointing and fastening were established. A method of welding stainless steel, known as puddle welding or argon-arc fusion spot welding, has been perfected by Bristol Aircraft and has been used as the main jointing means throughout the Type 188 structure. This technique is extremely flexible in application and allows welds to be made in locations inaccessible by other welding methods.

(ii) Components

To meet the high-temperature conditions in which this aircraft will be operating, almost every component, down to such items as bolts, rivets and other fasteners, has had to be specially developed. In the electrical system, for example, components such as cables, connectors, fuses, relays, solenoids, microswitches, plugs and sockets, are all exposed to temperatures beyond the development potential of current items, and new components have been produced.

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As a result of the intensive effort put into the Type 188 development programme, a very wide range of high-temperature components has been developed and will be available for future high-supersonic aircraft.

(iii) Test Procedures

During Type 188 development, new laboratory procedures have been developed for thermal stressing, high-temperature structures and system testing and for flutter testing on rocket models and in wind tunnels.

The main aircraft systems - fuel, hydraulics and electrics - have been exhaustively tested in special laboratory rigs. Hydraulics and electrics systems testing is done in a single rig, the units being functioned from pilot's controls in a dummy cockpit. This cockpit also forms part of a flight simulator in which an English Electric LACE computer simulates aerodynamic forces and the aircraft responses to control movements, the results being presented to the pilot as a visual display. Mr. G.L. Auty, Bristol Aircraft's chief test pilot, has spent many hours "flying" the Type 188 in this simulator.

(iv) Flight Research Development

The airborne flight recording equipment in the Type 188 and the associated ground installation for recording, processing and analysing flight data are as advanced as anything of their kind in the world. Bristol Aircraft's instrumentation laboratories and the Royal Aircraft Establishment, Farnborough, have both contributed to the design and development of this instrumentation.

For future high-supersonic civil transports, certification authorities are bound to require flight data in greater volume and greater detail than ever before. The Type 188 instrumentation and data processing facilities, and the techniques being developed for the flight development programme, provide the means whereby such future certification requirements can be met in a reasonable timescale.

ENGINES

The Bristol T.188 is powered by two de Havilland Gyron Junior reheated turbojet engines, each designed to develop 14,000 lbs. static thrust. At high altitude and supersonic speed this is equivalent to a combined output of approximately 180,000 h.p. The Gyron Junior DGJ 10 is based on the original Gyron design conceived in 1951 and built as a private venture by the de Havilland Engine Company. The Gyron Junior is the only British turbojet to have been specifically developed for propulsion at flight speeds in excess of 2½ times the speed of sound.

Many problems are imposed by the high stresses and temperatures characteristic of flight at such supersonic speeds, and among special features in the design of the engines to meet these conditions is the wide use of stainless steel and titanium construction.

Its reheat system, operating at the exceptionally high combustion temperature of 2,000°K, is far in advance of those currently in service.

The Gyron Junior has undergone an extensive development programme on behalf of the Ministry of Aviation. Flight testing of engine and afterburner unit in the subsonic regime has been undertaken in a modified Gloster Javelin. The engine capabilities at much higher speeds have been investigated in the high altitude supersonic test facility at the Natioanl Gas Turbine Establishment. The data acquired during this research programme will provde much invaluable experience which can later be applied in the design of other high-supersonic projects.

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F I R S T   F L I G H T   O F   T 188

1. Test pilot: GODFREY AUTEY, Chief Test Pilot of Bristol Aircraft Company Limited.

2. It is a supersonic research aircraft designed and built by Bristol Aircraft Limited, powered by two de Haviland GYRON JUNIOR TURBO JETS each designed for 14,000 pounds static thrust at high altitude and a supersonic speed that equals 180,000 h.p.

3. It is world's first supersonic stainless steel aircraft, potentially world's fastest conventional plane. Built of stainless steel to withstand heat barrier.

4. Shape is determined solely by research functions. It is not a model of supersonic transport.

5. All components down to rivets developed to withstand heat barrier temperatures.

6. Aircraft must be able to take off under own power, fly at operational heights and return.

7.

WING SPAN:	35 ft. 1 in.
AREA:	396 sq. ft.
FUSELAGE:	71 ft. OVERALL
MAX. WIDTH:	3 ft. 9 ins.

8. Contains pilot in small pressure refrigerated cabin.

9. Tail plane mounted on top of swept back fin clear of exhaust.

10. Plane has considerable load of airborne electrical recording and measuring equipment.

11. The American X 15 is rocket propelled, air launched as distinct from T 188 which takes off unassisted.