

Bristol Siddeley Orpheus

Orpheus



Sectioned Orpheus at the Midland Air Museum

Type	Turbojet
Manufacturer	Bristol Siddeley
First run	1957
Major applications	Fiat G.91 Folland Gnat Fuji T-1
Developed into	Rolls-Royce Pegasus

The **Bristol Siddeley Orpheus** was a single-spool turbojet developed by Bristol Siddeley for various light fighter/trainer applications such as the Folland Gnat and the Fiat G91. Later, the Orpheus formed the core of the first Bristol Pegasus vectored thrust turbofan as used for the Hawker Siddeley Harrier "jump jet".

Design and development

The engine had its genesis in a 1952 request by Folland for an engine in the 5,000 pounds (22 kN) class to power a new trainer and lightweight fighter-bomber they were developing. Stanley Hooker, relatively new

to the company after an earlier career at Rolls-Royce, took the project under his wing. He delivered a relatively simple and easy to maintain engine, which was put into use in the Folland Gnat, flying in 1955. Developing a Sea Level Static thrust of 4,520 lbf (20.1 kN), the Orpheus 701 had a 7 stage axial compressor driven by a single stage turbine.

Other users, mostly trainers, soon followed, including the Fuji T-1, Hindustan Marut, HA-300, and the experimental Hunting H.126 and Short SB5. In 1957 NATO ran a competition for a light fighter design, asking for entries in both engine and airframe categories. The Orpheus was the unanimous winner of the engine contest, and was thus selected to power the Fiat G.91R and G.91T using Fiat-built versions of the engine.

Many companies in the 1950s were looking at ways of producing a vertical takeoff and landing aircraft. Michel Wibault had the idea of using a turbo shaft engine to drive four large centrifugal blowers which could be swiveled to vector the thrust. Hooker's engineers decided on using the Orpheus to drive a single large fan that would supply air to a pair of rotating nozzles, while the exhaust flow from the Orpheus was split into two and would supply another pair of nozzles at the rear of the engine. This experimental system developed into the Pegasus.

Variants

BOr.1

First run on 17 December 1954, rated at 3,285 lbf (14.61 kN) by Spring 1955, powered the prototype Folland Gnat.

BOr.2

(Mk.701 / Mk.703)

BOr.3

(Mk.801 / 803 / 805)

BOr.4

(Mk.100)

BOr.12

With a simplified reheat system the BOr.12 was rated at 68,100 lbf (302.92 kN) dry and 8,170 lbf (36.34 kN) with afterburning.

Mk.100

De-rated to improve reliability and fuel consumption and increased engine life, rated at 4,230 lbf (18.82 kN) for the Fiat G.91T and Hawker Siddeley Gnat T Mk.1.

Mk.701

Rated at 4,520 lbf (20.11 kN), the Mk.701 was used in the production Folland Gnat F Mk.1 for Finland and India.

Mk.703

The Mk.703 rated at 4,850 lbf (21.57 kN) powered the Hindustan HF-24 Marut Mk.1.

Mk.801

The Mk.801, rated at 4,520 lbf (20.11 kN), powering G.91s. The Mk.801 was identical to the BOr.2 engine except for accessories.

Mk.803

The Mk.803, with improvements to the compressor, rated at 5,000 lbf (22.24 kN), replaced earlier marks used in G.91s.

Mk.805

The Mk.805, de-rated to 4,000 lbf (17.79 kN), powered the Fuji T-1 trainers of the JASDF and the Hunting H.126 jet-flap research aircraft.

FIAT 4023

Mk.803 engines License built by FIAT.

FIAT 4023

Mk.803 engines License built by FIAT with added fire detection system.

Applications

Aircraft

- Breguet Taon
- Fiat G.91
- Folland Gnat
- Fuji T-1
- HA-300
- Hindustan Marut
- Hunting H.126
- Short SB5

Other applications

An Orpheus, number 711 powered the Bluebird K7 hydroplane in which Donald Campbell was killed whilst attempting the water speed record on Lake Coniston in 1967.

A dragster powered by an Orpheus, the "Vampire", is the current holder of the British land speed record.

Specifications (Orpheus BOr.3 / Mk.803)



Bristol Orpheus as fitted to the Fiat G91

General characteristics

- **Type:** Turbojet
- **Length:** 75.45 in (1,916 mm)
- **Diameter:** 32.4 in (823 mm)
- **Dry weight:** 835 lb. (379 kg)

Components

- **Compressor:** 7 stage axial compressor
- **Combustors:** Can-annular with 7 flame tubes
- **Turbine:** Single stage turbine
- **Fuel type:** Aviation kerosene
- **Oil system:** Pressure spray and metered feed to gearbox and rear bearing. Oil from the rear bearing is lost overboard to the jet efflux.

Performance

- **Maximum thrust:** 5,000 lb. (2 kN)

- **Turbine inlet temperature:** 1,184 °F (640 °C) maximum continuous
- **Specific fuel consumption:** 1.08 lb./lb./hr.(110.1 kg/kN/hr.)
- **Thrust-to-weight ratio:** 5.988 lbf/lb. (0.0587 kN/kg)