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Orenda Iroquois

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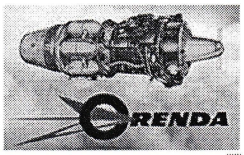
Orenda Iroquois

The **PS.13 Iroquois** was an advanced turbojet engine for military use developed by the Canadian aircraft engine manufacturer Orenda Aerospace, part of the A.V. Roe Canada group. Intended for the Avro CF-105 Arrow interceptor, development was cancelled along with the Arrow in 1959.



Orenda Logo

Design history

In 1953, Avro Canada once again turned to Orenda to produce an engine for the Avro CF-105 Arrow project. Avro had originally intended to use one of three different engines all UK designs: Rolls-Royce RB.106, the Bristol B.0L.4 *Olympus* and a license-built version of the Olympus, the Curtiss-Wright J67. The RB.106 and J67 were selected as the primary and backup engines for the new design, and perhaps ironically it was only the Olympus that managed to enter production. The RB.106 and J67 were cancelled during the Arrow's design phase, too far into the program to select the Olympus. Orenda quickly responded with the PS.13 Iroquois design.

The Iroquois design was based on simplicity and lightness. With this in mind, Orenda pioneered work in the use of titanium, with 20% by weight of the Iroquois (mainly the compressor rotor blades) consisting of this metal. Titanium has light weight, high strength and good temperature and corrosion resistance. It was estimated that the engine would be 850 lb lighter than if steel had been used. During the early 1950s, this material was in short supply, and the lack of knowledge of its physical properties and fabrication techniques created problems which had to be overcome. It was also very expensive relative to the more common materials such as steel and aluminum.

It was recognized that if the engine part could be designed with titanium, then the supporting structure could also be lightened, with an overall saving in weight. Other parts, such as gearbox casings were made with a magnesium alloy. Inconel was another light metal used to make the blades in the low pressure turbine assembly and the metal insulation blanket found at the rear of the engine. This heat resistant nickel-chrome alloy retains its strength at high temperatures and resists oxidation and corrosion. The primary reason for using these light metals was to save weight, and have an engine with a 5:1 thrust to weight ratio that could produce a sea level dry thrust of 19,250 lb (26,000 lb. with afterburner).

The design, development and manufacture of such an advanced jet engine was accomplished in an incredibly short time by the Orenda Iroquois engine team. The detailed design was completed in May 1954, and the first run was achieved in December 1954. The earlier Orenda 9 had more parts but produced less power. For example, the earlier engine weighed 2,560 lb. (1,160 kg) and produced 6,355 lb (2 883 kg) static thrust. The Iroquois weighed 5,900 lb. (2,675 kg) but was reported to have produced 30,000 lb (13 608 kg) static thrust with afterburner for take off. (The earlier engine did not have an afterburner.) The Iroquois was the highest power engine in North America at the time.

Testing

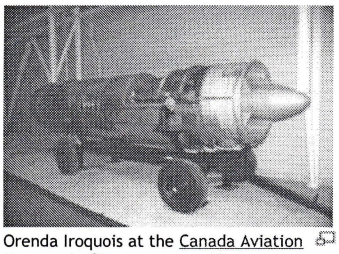
Wind-tunnel tests revealed the engine's successful operation under sustained high inlet temperatures, and the ability to make normal relights up to 60,000 ft (18 290 m), the limit of the wind-tunnel in which the tests were conducted. By 1958, the Iroquois had completed more than 5,000 hours of ground running, and many thousands of hours had been spent testing the engines' principal components at the Orenda test establishment at Nobel, near Parry Sound, Ontario.

A B-47 Stratojet was loaned in 1956 to the Royal Canadian Air Force to test the Orenda Iroquois turbojet for the Avro Canada CF-105 Arrow interceptor. Canadair Aircraft, the sub-contractor, attached the Iroquois engine to the right side of the rear fuselage near the tail, of all places, simply because there was no other place to put it. Flying the CL-52, as it was designated by Canadair, was a nightmare since the thrust was asymmetrical and created great problems for flight control. [1] After the Arrow project was cancelled in early 1959, the B-47B/CL-52, with about 35 hours of engine flight tests to its credit, was returned to the US. Some sources claimed it was bent out of shape by the tests, but in any case, it was subsequently scrapped. The CL-52 was the only B-47 to be used by any foreign service.

The Iroquois was one of the most powerful jet engine in the world, rated at 19,250 lbf (85.6 kN) dry, 25,000 lbf (111 kN) afterburning. It was aerodynamically matched for peak performance at 50,000 feet (15,200 m) altitude and Mach 2 speed. After some 7,000 hours of development testing, up to a simulated altitude of 70,000 feet (21,300 m) and a forward speed of Mach 2.3, the program was cancelled, along with the Arrow on "Black Friday," 20 February 1959.

Surviving examples

The Canada Aviation Museum in Ottawa houses the nose and cockpit section of Avro Arrow RL 206, along with various wing and fuselage components, and a PS-13 Orenda Iroquois engine (see illustration). Another example is found at the Canadian Warplane Heritage Museum in Mount Hope, near Hamilton, Ontario.



Orenda Iroquois at the Canada Aviation Museum in Ottawa

References

1. ^ Rossiter 2002, p. 55-56.

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- *Magellan Aerospace Corporation's Magellan Repair, Overhaul & Industrial - formerly Orenda*. Magellan Aerospace Corporation
- Rossiter, Sean. *The Chosen Ones: Canada's Test Pilots in Action*. Vancouver: Douglas & McIntyre, 2002. ISBN 1-55054-930-8.
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External links

- The Orenda Iroquois (National Aviation Museum)

See also

- de Havilland Gyron - a high power contemporary of the Iroquois

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