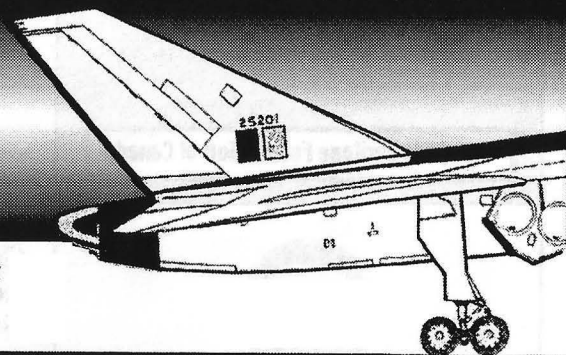


Pre-Flight

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Changes to the Corporate Identity through 50 years



Introduction and Acknowledgement

The next few issues of Pre-Flight will carry a comprehensive story of Orenda's first 50 years. What you will read in Pre-Flight are some of the highlights from Orenda's past: the engines, the new plant, the advances in technology; and a few glimpses of Orenda today (up to the year 1996). Many memories are associated with each of these areas. We trust you are able to bring any of your own memories into focus as you go through Orenda's.

Special thanks are extended to the countless thousands of Orenda employees through the years who are Orenda's history. Without all of you, there would be no yesterday, no today and no tomorrow.

We at the Aerospace Heritage Foundation of Canada would like to extend a very special thank you to Mr. Brad Martin, Commercial Manager, Industrial Gas Turbines, Orenda Aerospace Corporation, Magellan Aerospace Ltd., 3160 Derry Road East, Mississauga, Ontario, Canada for permission to re-produce in Pre-Flight the interesting history of Orenda, who in 1996 celebrated 50 years of service to the world's aerospace industry.

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Aerospace Heritage Foundation of Canada



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The Aerospace Foundation of Canada (AHFC) is a federally chartered non-for-profit organization. The current emphasis of AHFC is on Avro and Orenda. The Foundation is actively trying to locate former employees of these companies. No part of this newsletter may be reproduced without prior written permission. Opinions expressed in Pre-Flight do not necessarily reflect those of AHFC. Cash donations over \$25.00 and "gifts-in-kind" will be acknowledged by a receipt for income tax purposes. For more information on AHFC and how to support its activities, please write to:

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From Orenda's President

In 1955, Crawford Gordon, then president of A.V. Roe Canada, said, "In many ways we have been pioneers-and not the least of this pioneering has been in the creation of ever-enlarging opportunities for Canadian skills. This is a direct result of the establishment of A.V. Roe Canada Limited by Sir Roy Dobson and the Hawker Siddeley Group, whose experience in the fields of aircraft and aero-engines provided the base without which we never could have come this far this fast. As for our future, it is bound up inextricably with the future of our country. We are so confident of that future that we have large expansion programs underway to meet the challenge of tomorrow. In that way, I think we illustrate how well all of us know that the first ten years recorded here, with all the pride we do take in them, are still just the beginning.

"But yesterday, today and tomorrow, none of it was, is or will be possible without the people who work here.. the men in the shop ...the office staffs ...the test pilots ...supervisors...engineers...the hundreds and now thousands of single individuals who are ultimately and inevitably responsible for the success of our Group and the contribution we are making to Canada's security and her peacetime development."

A.V. Roe and Hawker Siddeley are now only brand names on someone else's products, but they will always be a large part of the foundation upon which Canada's Aerospace Industry has been built. And Orenda, one of the offspring of the union of A.V. Roe and Hawker Siddeley, continues to contribute to the growth of the industry as a wholly incorporated subsidiary of Fleet Aerospace Corporation.

Orenda's name was coined from the Indian word denoting source of power; it is clear that Orenda will continue as a source of power for the next fifty years. Orenda's strength will come from the ideas, designs and inventions of its people, as it did throughout its first 50 years. But in what kind of future will these ideas take root?

If we look at the aero-engines made over the past 50 years, we may have some clues to that future. Fifty years ago, 24 companies were building aircraft engines. Today three large companies and at least four smaller companies are still in business. Those companies have figured out that, to stay in business, they must work together as an industry, while they work alone to develop their own businesses. All indications are that those companies will continue to find ways of cooperating-producing new designs for specific market needs rather than competing for the same markets, as they did historically.

Fifty years ago the business was 100 percent military. Today the commercial markets represent more than 50 percent of the business, and as people continue to travel more, we will see that segment of the aerospace business grow.

For over forty of the last fifty years, we had an East-West political threat. People and technology did not move across those political boundaries. With the easing of tensions between East and West, we will see the business expand globally, with technology, designs and markets appearing where people are motivated and eager, and where the financial and natural resources support innovation.

Orenda lost its position as a mainstream manufacturer in the late 1950s, when the Arrow was cancelled and the industrial turbine initiative stalled. However, much progress has been made since then. Orenda redefined its role as a service organization, supporting other manufacturers with manufacturing and repair and overhaul expertise. More recently, the development of a light piston engine aimed at aviation markets will take Orenda back into the mainstream. Well into the 21st century, the Orenda name will be the power behind light and general aircraft and the company will maintain its traditional place in the gas turbine business in support of others.

As they have throughout Orenda's history, technologies will change. We will see greater use of complex materials, both ceramic and composite. We will see greater use of non-traditional fuels, especially those made from renewable resources, and we will see greater use of computer technology in the manufacture and repair of parts.

The future, of course, depends on people. Sir Frank Whittle, applying an ancient Greek principle, developed Britain's first jet engine in the 1930s. From this engine came the industry in which we participate today. There are still other ancient principles with applications still to be discovered. It remains to be seen if we have a Whittle amongst us who can do the same thing for propulsion technology.

We should celebrate the fifty years gone by and Orenda's remarkable achievements in those years. We should also continue to foster the environment that will make the next 50 years just as eventful.

Richard A Neil

In the beginning ... A.V. Roe Canada

Although Orenda celebrates its fiftieth anniversary in 1996, it really had its beginnings in 1943. In that year, Sir Roy Dobson, the managing director of A.V. Roe Manchester and the man behind the famous Lancaster bomber, decided to pay a visit to Canada, along with Sir Frank Spriggs, managing director of Hawker Siddeley. The purpose of their visit was to check out aircraft production at a Crown corporation, Victory Aircraft Limited, where superior Lancasters were being built for the war effort. They were met by Fred Smye, director of aircraft production at Victory and escorted on a tour of the existing aircraft companies in Ontario.

As the tour progressed, Dobson hinted that he thought Canadians should have their own self-sufficient aircraft industry. Fred Smye grabbed the idea and from that moment on, believed that it could be done.

The government was anxious to get out of the aircraft business as soon as possible after the war ended. In the early summer of 1945, when the war in Europe was over, Sir Roy reached an agreement with C.D. Howe, Minister of Munitions and Supply under the Liberal government of Prime Minister Louis St. Laurent. They agreed that Hawker Siddeley would take over Victory Aircraft on a rental-purchase plan. Contracts for production of Lincolns and Lancasters would at first be the business base for the company. On August 1, 1945, Fred Smye moved into an office in Malton, having resigned his government job.

Before the agreement could be signed by Hawker Siddeley, however, the war in Japan ended and the government cancelled all contracts for Lancasters and Lincolns.

In England, contracts were also being cancelled and many considered the timing wrong to take on a company across the ocean, whose prospects now seemed very dim.

Other circumstances besides the cancellation of the order for Lancasters and Lincolns conspired against Fred Smye and Sir Roy Dobson. Aircraft plants in early summer 1945 had employed 80,000. By the fall of that year, only 8,000 were employed in the industry and that number was rapidly decreasing. The industry in Canada did not look promising.

Smye and Sir Roy Dobson persisted. Dobson met with C.D. Howe who gave him a chance to back out of the agreement, since prospects for the aircraft industry in Canada now appeared grim.

Sir Roy was considered crazy to persist. "The really amazing thing," said Fred Smye, several years later, "is that here was a man (Sir Roy Dobson) at the peak of his career, riding the crest, with everything to lose, and he was willing to gamble it all on his belief in this country's future. All he worried about was how much of the Victory plant we could handle."

Sir Roy and Smye had further discussions with J.P. Bickell, then the president of Victory Aircraft, and J.S.D. Tory, a well-known lawyer and Victory director. These talks focused on how it should be done.

After much discussion and many meetings, the deal was concluded.

A.V. Roe Canada Limited was formed on December 1, 1945 and took possession of Victory Aircraft.

A small part, the office building and the first bay, was the beginning. After a meeting between Sir Roy and C.D. Howe, however, they got "the whole damn thing."

It was not a promising beginning. Some areas had an almost ghost-town atmosphere. At one time, 9,600 people had worked day and night in the war effort; armed guards had patrolled the fences, and one Lancaster a day had rolled off the line. Now machines and tools stood exactly where they had been left when contract cancellations stopped all work. On December 1, 300 survivors of Victory Aircraft became A.V.Roe Canada Limited employees.

New management of the company found jobs for these 300 employees to keep them busy: storing Lancasters, making forms for plastic hairbrushes, fenders for trucks and tractors, designing an oil furnace, and dozens of other small jobs, all clearly unrelated to the dream of an all-Canadian aircraft industry.

Then the future began. Sir Roy Dobson was the first president. Fred Smye became assistant general manager. Edgar Atkin came from Avro Manchester as chief engineer. Jim Floyd, who had worked in design teams for the Avro Anson, the Lancaster and the York joined Atkin. The first directors meeting was held, financing was arranged to buy the property and for working capital, and A. V. Roe Canada Limited was on its way to becoming a world leader in the aircraft and jet engine industry.

Orenda

Orenda was originally a small government organization called Turbo Research Limited, established by the National Research Council in 1944 to direct gas turbine research in Canada. In 1944, World War II was still in full battle and the need for more advanced fighter aircraft was the driving force.

This small company, with a cold-test laboratory in Winnipeg and design office in Leaside, had a jet engine at the design stage and the government was faced with a decision: either put a lot more money into production of a prototype jet engine or close the company down.

Sir Roy Dobson of A.V. Roe Canada offered to take on Turbo-Research as part of his company. His offer was accepted and in early 1946, the Turbo Research team became a part of A.V. Roe Canada and moved to Malton to continue with their engine design.

The growth of a company, the growth of an industry

After the war, the RCAF, although officially fed up with war and overloaded with surplus war materials,

asked A.V. Roe to work on the design of a training plane and a twin-jet fighter which would be powered by the engine Turbo-Research had been working on. Late in 1946, the RCAF cancelled design work on the trainer and revised its ideas about what Canada's first homegrown jet fighter should be. The engine on which Turbo-Research had been working was called the Chinook ("Warm wind of the West"). It too was almost scrapped as specifications were drawn up for a more powerful engine, the Orenda, to power the fighter aircraft. Paul Dilworth, head of the gas turbine group, thought the Chinook would provide invaluable training for people who had never built an engine, and work on the Chinook continued.

The first Chinook ran on March 17, 1948, two weeks before the end of the government's fiscal year. Its progress to completion had been plagued by threats of government funding cuts, and the race to get the engine out of assembly on time involved even the assistant general manager.

The Orenda had its first official run on February 10, 1949. This engine was the company's first major project to be tested before some of the most important people in Canadian government and the RCAF. This engine proved to be one of the most successful turbojets ever made. At the same time the Orenda was being developed, work was proceeding apace on the Avro Jetliner, in which TCA (Trans-Canada Airlines, now Air Canada) had expressed an interest. Design work on this jet-powered, civilian transport plane had begun in September 1946. In Spring 1947, TCA accepted the design produced by Jim Floyd and his engineering staff of less than 40 people. On July 25, 1949, the Jetliner was ready for final inspection, less than three years from concept to finished product, a record that has since been called phenomenal. On August 10, the Jetliner, powered by four Rolls Royce Derwent engines, flew for an hour.

The third Avro Canada project was the twin jet fighter CF-100, a plane that could operate in the vast frigid ranges of the Canadian north, day or night, all-weather, long-range, heavily armored. Preliminary design on the CF-100 began late in 1946, under Edgar Atkin, chief engineer. In June 1947, John Frost came from De Havilland to be the project engineer. With all this activity, A.V. Roe Canada had to grow to keep up with production of the Orenda and the Jetliner, and the CF-100 continued in development.

By the end of 1949, A.V. Roe had doubled the number of employees from 1000 two years earlier. New machinery and equipment was brought in and new space allotments were made between the crowded gas turbine and aircraft people.

"On January 19, 1950, powered by two Rolls Royce Avons, the CF-100 took off on its first flight. Attending this breathtaking event were a group of government representatives headed by Defence Minister Brooke Claxton, Chief of Air Staff W.A. Curtis and several RCAF officers. The plane jumped into the air in less than 500 yards, climbed, flew for 40 minutes, and came down, braking to a full stop within 450 yards of touchdown.

In June 1951, the first flight of a CF-100, powered by Orenda engines, was made successfully. On October 17, Minister of Munitions and Supply C.D. Howe at a ceremony at A.V. Roe Canada said: "It is my privilege today to deliver to the Royal Canadian Air Force a CF-100 military aircraft equipped with twin Orenda engines. The airplane and its engines were designed, developed and built in Canada by Canadian workmen using Canadian materials. Not only is this the first aircraft to be completely designed, developed and produced in Canada, but the Orenda engine is the first airplane engine to be designed, developed and produced in this country.

"The aircraft as it stands before us is a notable Canadian achievement, marking as it does a new milestone in Canada's industrial advancement." Work on the new engine production plant in Malton had begun in 1951. Three years later, on December 2, 1954, two new companies were announced, with A.V. Roe Canada as the parent company. Noting that Canada had emerged in a very short time as one of the world's four leading nations in air power, Crawford Gordon, President and General Manager of A.V. Roe Canada forecast an ever-enlarging future for Canada's aircraft industry and for A.V. Roe Canada Limited as its largest enterprise.

Walter McLachlan, who had joined the gas turbine division in 1953, was named to head Orenda Engines, and Fred Smye became vice-president and general manager of Avro Aircraft. At the same time, A.V. Roe acquired Canadian Steel Improvements Limited, making engine forgings. In September 1955, the company grew even larger with the acquisition of Canadian Car and Foundry. Can-Car was a leading manufacturer of railroad rolling stock as well as of aircraft and parts.

In its first ten years in Canada, Hawker Siddeley had permanently invested over \$16 millions of capital in this country's economy. All earnings were re-invested in the further development of the company, and A.V. Roe Canada Limited, with its four diversified companies, became one of the largest single British industrial developments in Canada with 5.4 million feet of floor space and 22,000 employees.

Orenda's Engines

In its first decade, Orenda was a world leader in jet engine design, development and production. Following are highlights from those years.

The Chinook - first at Orenda, first in Canada

The TR4 Chinook ("Warm Wind of the West"), the first engine built by Orenda, was the first gas turbine engine to be completely designed and developed in Canada. Work on the Chinook was begun by the team at Turbo Research and moved with that group to A.V. Roe Canada in 1946.

In September 1946, the RCAF almost cancelled the Chinook when it ordered specifications for a more powerful engine. Paul Dilworth, who was the head of the gas turbine group at the time, convinced the RCAF that the Chinook would provide invaluable training for people who had never built an engine, and work on the Chinook continued. In March 1948, twenty-one months after the cost estimates had been delivered, the first engine was assembled and delivered to the test house. In the next twenty months, the engine logged over 1000 hours of test bed running. Four sets of parts were made and three engines were actually built and tested, each attaining a thrust of 3000 lb. The Chinook, weighing 1250 lb., had a 9-stage axial compressor of 4.5, 1 pressure ratio, a single-stage turbine, and six combustion chambers.

Nearly two years later, in January 1950, all work on the engine was stopped. The Chinook was never intended for quantity production. The program did provide for the development of engineering and manufacturing skills, the establishment of shop facilities and of subcontract sources capable of producing the high quality of workmanship demanded by this new type of engine.

The Orenda

In late summer 1946, the RCAF requested what had now become the Gas Turbine Division of A.V. Roe Canada, to design and develop a turbojet engine with a thrust equal to that of the largest engines then on the drawing boards of any British or American companies. The engine had to be dependable in flight, with endurance life, and it had to be competitive, both in performance and in cost. The program requirements were clearly specified: efficiency in production; the ability to handle design changes in reasonable time periods; ever-lower production costs; alertness in properly applying and using new technological advances in materials, processing, production and manufacturing techniques.

Cobalt, nickel, chromium, and tungsten, all available in Canada, were essential materials in the manufacture of the engine. They were required in the special high-temperature steel alloys used on the "hot-end" parts of the engine. The engine incorporated a 10-stage axial compressor, driven by a single-stage turbine and six separate combustion chambers. In appearance it resembled a large Chinook.

This engine, designated TR-5, and later called the Orenda, first ran on the test bed in February 1949, thirty months after design work had begun. In July 1950, a Lancaster bomber was converted into a flying test bed with two Orenda engines providing power.

The engine was unveiled to the public in 1950 at the Canadian National Exhibition. To the amazement of those at this event, the engine had a dry thrust rating greater than any other engine in production in Britain and in the United States.

In October that year, another prototype Orenda was used to power an F-86A Sabre aircraft.

The first production model, the Orenda 2, was to be used in the CF-100 all-weather fighter aircraft designed and built by the Aircraft Division of A.V.Roe Canada. In April 1951, a US F-86 Sabre with an Orenda Series 11 engine flew from Minneapolis to Toronto in one hour and eight minutes. The first Orenda-powered CF-100 flew in June 1951. In February 1954, the one-thousandth Orenda was tested and handed over to the RCAF. In July 1958, the last one was handed over.

Ramping up for Orenda production

When the Orenda plant officially opened in September 1952, only 30 Orendas have been built. By February 1955, the company had passed the 2,000 mark.

One of the major challenges facing Orenda was the Personnel to produce the engines.

In January 1952, Direct production workers numbered less than 200. Within a year, that number shot up by 500 percent.

The assembly shop requirements were filled by automotive mechanics and aircraft mechanics trained by the RCAF during World War II.

The machine shop, with so much equipment of the latest design and some machines, like the Bullard Manau Trols which were relatively unknown in Canada, presented a greater challenge. To meet this challenge an extensive operator training program was undertaken in the plant.

Intake of parts and materials increased from around \$500,000 a month in April 1952 to more than \$6,000,000 a year later, an increase of 1200 percent.

Setting up the supply network to meet demand provided the Procurement Department with a gigantic task because few Canadian manufacturers were able to supply parts and materials of type and in quantities required. With capital assistance from the government and the cooperation of manufacturers in Canada, the U.S. and Britain, sources of supply were eventually established. A total of more than sixty major sub-contractors had to be organized. Many of these built new plants in Canada or expanded existing facilities to provide the necessary parts or materials.

The manufacture of jet engines involves steady design modification for increased performance. This constant development of an engine while in production is essential and perpetual change is the order of the day. As Walter McLachlan, who headed up Orenda Engines, said, "You skinny the engine down and run it until it breaks somewhere, fix that part, run it until it breaks somewhere else, fix it, run it again."

In the first three years of the Orenda production program, over 4,000 design changes were introduced into production engines, each change bringing its own individual problems of supply and, as can be expected, incorporation.

With the Orenda, in spite of the challenges of establishing a new industry, peak production was reached within seven years, including the introduction of two new models.

A.V. Roe Canada and the Canadian economy

A.V. Roe Company Limited played a major part in fueling the economy of this country, both financially and through employment in the industry. For example, in the development of the CF-100 and the Orenda engine, the company worked with many subcontractors and suppliers. On the production procurement funds received from the Department of Defence Production for component parts, 55 percent was passed along to other Canadian companies. About 50 percent of that went to subcontractors; the other half went to suppliers of finished parts, equipment and raw materials.

In 1946, in the postwar aircraft industry slump, the industry's working strength was less than 1,000 people. In only six years later, Avro employed 15,000 workers. The company's subcontractors employed another 15,000 people.

END OF PART ONE

Part Two of A.V. Roe Canada will continue with Orenda and the 747!