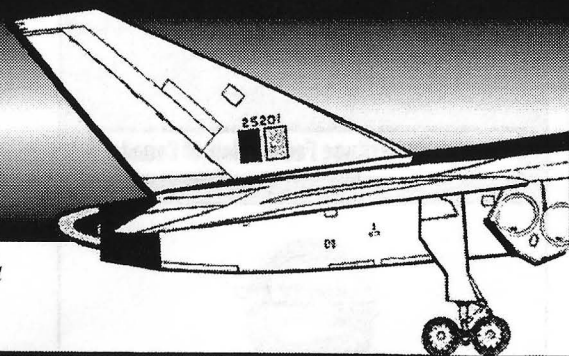


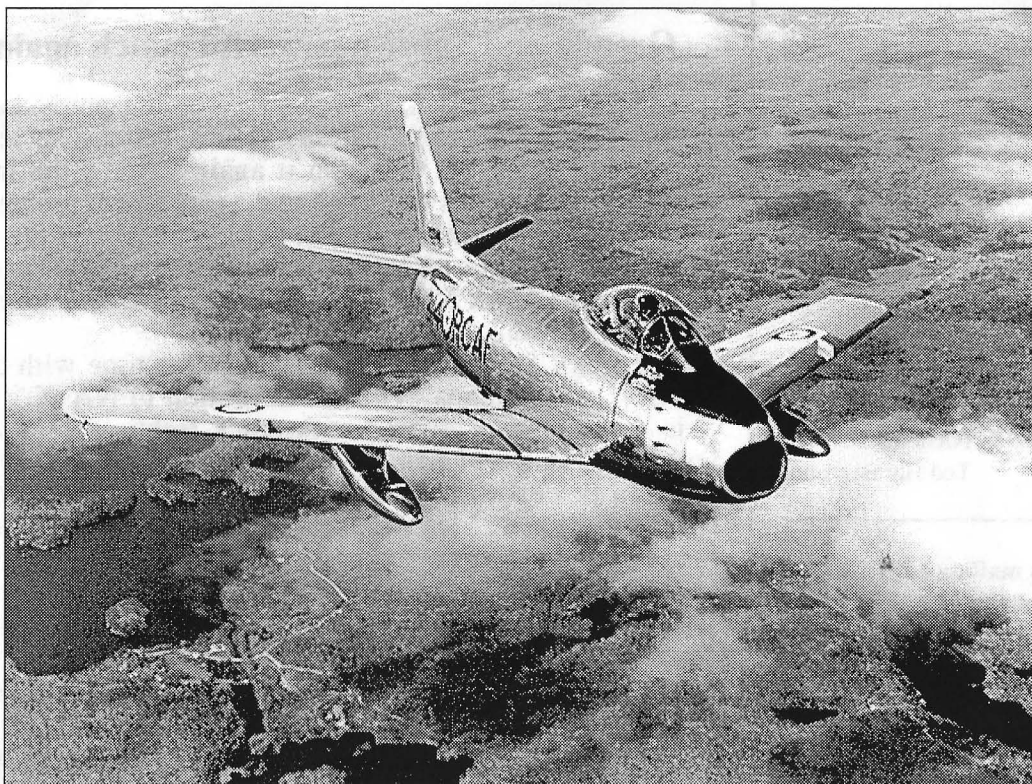
# Pre-Flight



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Canadair Sabre Mk 5 number 23314 served with 434 Bluenose Squadron

## **The Orenda Years** **( Part Two )**

### **Orenda and the 747**

On February 9, 1969, the Boeing 747 made its maiden flight. Accompanying the jumbo jet was a Canadair Sabre 5, powered by an Orenda 10, Serial No. 1603. Engine No. 1603 was sold to the RCAF in April 1954 and saw service in Canada and with No. 1 Air Division in Europe before being purchased by Boeing. A spare engine, No. 1208, built in September 1953, was overhauled by Orenda and was installed in the Sabre 5 at Boeing. It too accompanied the 747 in its months of flight trials.

**Founded 1989**

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Legal Consultant Jerry Faivish  
Editorial Consultant John Thompson

PRE-FLIGHT Nicholas Doran  
Ted Harasymchuk

**President's mailing address:**

1951 Rathburn Rd., E.  
Unit 199  
Mississauga ON L4W 2N9  
905-624-4909

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**Aerospace Heritage  
Foundation of Canada  
P.O. Box 246, Etobicoke D  
Etobicoke ON M9A4X2  
(416) 410-3350  
www.ahfc.org**

## Orenda-powered Sabre Speed Records

May 18, 1953 Pilot Jacqueline Cochran, flight consultant, Canadair Ltd. 100 km closed course, Muroc, California, 652 mph.  
World record.

May 23, 1953 Pilot Jacqueline Cochran. 500 km course, Muroc, California. 590.952 mph.  
World record.

June 3, 1953 Pilot Jacqueline Cochran. 15 km course, Muroc, California. 670 mph.  
World record.

April 11, 1954 Pilot S/L Robert Christie, RCAF. Vancouver to Ottawa, 2,315 miles. 3 hours, 46 minutes. 575 mph.

## Orenda and Sabre a powerful match against "iron"

"Canadian warriors have tested it, slashing practice swaths through the European heavens, and say it has met those tests ...They are prepared, if need be, to match it against iron---the iron from which metaphorical curtains are fashioned." (Jet Age, Summer 1954) The F-86 Sabre is a jet interceptor. Its cutting edge was the Orenda engine, which gave it faster takeoff, higher ceiling, greater speed---advantages that made the Mark 5 Sabre the most effective operational fighter plane in Europe in 1952.

The Mark 5 Sabre was in service at the time with the R.C.A.F.'s 1 Air Division, Canada's chief contribution to NATO's defence forces. This division was aligned with crack fighting units of the U.S. Air Force and France's i Armee de l'Air to form the 4th Allied Tactical Air Force, a powerful segment of the Allied Air Forces Central Europe. Headquartered at Metz, France, the division controlled four wings of three squadrons each. Each squadron comprised 20-odd aircraft and divisional personnel exceeded 4,000. Sabres were located at North Luffenham, England; Grostenquin, France; Baden-Soellingen and Zweibrucken, Germany. The Sabre 5 provided an interim solution to the challenge presented by Soviet air strength derived from Russia's apparently plentiful MIG 15s.

The equivalent of "10,000 or 12,000 screaming horses" travelled from a railway siding at Malton in summer 1954, as Orenda engines, housed in metal containers made their way from Malton to Montreal to be installed in Canadair's Sabre 5 sweptwing fighters. From Montreal, some 200 young pilots delivered the Orenda-equipped Sabres in convoys to the NATO bases in Europe via the Arctic perimeter, or what was called the "Northern Bridge" by Prime Minister Mackenzie King in 1941. The itinerary took the convoys from St. Hubert to Goose Bay, to Greenland, then to Iceland and finally to their destination. The Canadians were not alone in their task. Pilots from Britain and the U.S. flew the fighter convoys to bring Canadian production to Europe.

## Operation Prairie Pacific: Canadians see their planes in action

At Winnipeg Airport on August 13, 1953, 25,000 people watched as five CF-100 interceptors powered by Orenda turbojets, five F-86 Sabres and five T-33 Silver Star trainers took off on an 80,000 mile operation that would take them to cities, towns and villages and ➤



## **Operation Prairie ... *cont'd.***

including farming communities watched the jets in their flypasts over the rural areas. One achievement of Operation Prairie Pacific was that of the accompanying ground crews, who kept the aircraft serviceable throughout the tour. Operation Prairie Pacific proved that RCAF jets can receive expert attention in emergencies far from home base. Even in 1953, individual air shows were not uncommon. Neither were cross-country nor intercontinental jet flights. But never before had any air force attempted a cross-country, mobile display of jet fighters, interceptors and trainers, all with the "Made in Canada" label, of the scale and scope of Operation Prairie Pacific.

### **The Iroquois**

In March 1953, the RCAF issued a requirement for a supersonic allweather interceptor aircraft to replace the CF-100. Avro responded with a design study of a series of delta-wing aircraft of varying sizes and weights. The Liberal government, represented by Minister of National Defence Brooke Claxton, proposed that the government invest nearly \$27 million in the development of the aircraft, spread over a period of five years. Engines for this plane would be the most suitable ones found in either the United States or Britain. Avro was awarded a design and development contract in March 1954 and the design of the plane, designated the CF-105, began the following May.

In 1953 also, a decision was made to begin the design of an engine to power the CF-100 replacement. In the beginning, the project, known as PS (Project Study) 13 had no military sponsorship; it was a private venture of A.V. Roe Canada. This engine posed many challenges in aerodynamic, thermodynamic and mechanical design, as well as in manufacturing technology. The US Air Force (USAF) became interested in the PS-13, now called the Iroquois, for some of their aircraft, including the B-52 bomber. The Arrow itself also interested them, provided it was fitted with the Iroquois.

In Canada, an RCAF study on available engines concluded that the Iroquois was more advanced in design and concept than any engine being developed in Britain or the United States. "In fact," said the report, "the PS-13 is the only engine likely to be available on time to give the CF-105 its required performance." Much discussion at high government levels about supporting development of the engine followed, with praise for the technical competence of the design team from then Minister of National Defence Ralph Campney. He believed that by developing this engine, Canada would remain in the forefront of jet engine technology.

The PS-13 was about 19 feet long and 4 feet wide. It was rated at 19500 lbs dry thrust and at up to 26000 lbs with afterburner, a total of 52000 lbs from both engines. On November 1, 1957, dry thrust runs of over 20000 lbs were demonstrated. More titanium was used in construction of the engine than any other at that time, and Orenda pioneered methods for machining and welding this material. Through advances made also in lubrication design, the engine consumed only ten times more oil than a 200-hp automobile engine of the day. By November 1957, the Iroquois had completed 3200 hours of development running, including a 100-hour endurance test and a 20000 lb static run. On November 13, it was flight-tested on a B47 bomber on loan from the USAF.

Meanwhile development continued on the Arrow. On March 25, 1958, fitted with J-75 engines, the first Arrow took off, with test pilot Jan Zurakowski at the controls. The flight lasted 35 minutes, achieving a speed of 250 knots and a maximum altitude of 11,000 feet. After another flight and minor adjustments, the Arrow was flown supersonically on April 3, 1958. In the 65-minute flight, the plane achieved a speed of Mach 1.1 at an altitude of 40,000 feet.

By the end of 1958, fourteen development Iroquois engines had been built, 6700 hours of test running had been completed, 22 of them on the B47 flying test bed. A further 96 engines were on order. On February 20, 1959, a day known as Black Friday, the Arrow and Iroquois programs were cancelled by the government. Only five Arrows, fitted with J-75 engines, had flown. The first Arrow to be powered by Iroquois engines was ready for taxi trials when the project was cancelled. The aircraft and the engine were deemed to be of no further value and were ordered destroyed. The dream of a great industry and a great country leading the world in aerospace development was over.

### **1909 to 1959: 50th Year of Flight Aircraft Engines, Then and Now**

Canada's latest jet aircraft engine produces 10 times more power than the country's first jet engine of just over a decade ago, and is hardly to be compared with the engine used in the first official British Commonwealth flight 50 years ago at Baddeck, Nova Scotia. Powering the Silver Dart on that first flight on February 23, 1909, was a 35-horsepower, eight-cylinder, vee-shape, water-cooled piston engine. Today, the equivalent of over 60,000 horsepower is available in the Orenda Iroquois turbojet engine, two of which provide the power for the Avro Arrow interceptor. One Iroquois weighs 4650 lbs, more than the combined weight of the Silver Dart, its engine, pilot and fuel.

## **50th Year of Flight ... cont'd.**

Actually, jet power is measured in pounds of thrust developed. The Iroquois develops over 20,000 lbs of thrust. This compares with 2600 lbs of thrust in Canada's first jet engine, The Chinook, which first ran in 1948. Both jets were designed and developed in Canada by Orenda Engines Limited of Malton, Ontario. The Silver Dart's engine was the product of Glenn Curtiss, an early designer builder of planes and engines who achieved considerable prominence in the U.S. aircraft industry. The development of the jet engine industry in Canada is seen in brief descriptions of engines produced by Orenda, the only company designing jets in Canada. **The Chinook** marked Canada's entry into the field of engine design and development. First ran March 17, 1948 at 2600 lbs thrust, was later developed to over 3000 lbs thrust. A few were built as a forerunner to the Orenda series.

### **The Orenda.**

First ran February 10, 1949, at 6075 lbs thrust. First production models were rated at 5800 lbs thrust, eventually developed to 7275 lbs, at the same time showing a weight decrease from 2685 lbs to 2430 lbs after six years. Production ceased in June, 1958. A total of 3,794 engines were built in six different models. The Orenda series of engines power the Canadian-designed CF-100 interceptor and Canadian-built Sabre. In addition to service with the Royal Canadian Air Force, these aircraft are also front-line planes with Belgian, West German, South African and Colombian air forces.

### **The Iroquois.**

First ran December 15, 1954. Designed for speeds faster than sound, it was the most powerful production engine known in the western world at the time it entered production. Two Iroquois power the Avro Arrow interceptor, each engine capable of delivering over 20,000 lbs of thrust. Orenda Engines Limited is the only company in Canada doing design and development work in the gas turbine aero engine field. Until January 2, 1955, the company operated as the Gas Turbine Division of A.V. Roe Canada Limited, and today is a wholly-owned subsidiary of that company. Located at Malton, Ontario, northwest of Toronto, Orenda employs a total of some 5,000 persons. Among them is found virtually every engineering, production and technical skill existing. Orenda's engineering department includes design and development offices, an experimental manufacturing shop, engine test houses, a high altitude tunnel, a variety of test "rigs," laboratories, and a flight test

establishment. The laboratories are fully equipped for metallurgical, mechanical, fuel systems, instrument and aerodynamics investigations. Orenda's modern production plant was designed for flexibility and sudden expansion in case of national emergency. Covering over 800,000 square feet of manufacturing and warehouse space, it was planned to allow rapid change from one engine model to another or the manufacture of two or more models concurrently. The plant has one of the forest machine shops and tool rooms on the North American continent. Orenda Industrial Limited, a wholly-owned subsidiary of Orenda Engines Limited, was established in May, 1958, to handle activities other than gas turbine which Orenda might undertake. Initially, the company is handling the sale and servicing of a broad range of British electrical and diesel products in Canada and the United States. To handle the U.S. business, Orenda Industrial Inc., of New York, a subsidiary of Orenda Industrial Limited, was announced simultaneously.

### **Lance Missile Lightweight Launcher**

The Lance missile was an Army battlefield surface-to-surface missile that could be moved into position, aimed and fired by only six people. Designed to replace the Honest John, and possibly Little John rockets, it complemented tube artillery and extended the division commander's capability for conventional or nuclear supporting fire. Lance was the first Army missile to use prepackaged, storable liquid propellants. It also used a simplified, inertial guidance system and control concept. In 1963 Hawker Siddeley Canada was selected as subcontractor for design and manufacture of the lightweight launcher. A team of Orenda engineers went to LTV Aerospace's Missiles and Space Division in Michigan, to develop the complex specifications for the first launcher that did not weigh more than the missile it launched and was air droppable by parachute, complete with missile.

Delivery of the first engineering model launcher was made in June 1964. Following a rigorous test program both at Malton and at various U.S. Army Proving Grounds, a missile design change was made. The changes resulted in a substantial re-design of the launcher. The first of a number of tactical prototype launchers was delivered in February 1966. Further test programs including mechanical, environmental, field and firing tests were carried out. After continued development of the launchers, Orenda was awarded a contract for the first Production Buy. In January 1967, the whole Launcher operation was moved to the original High Altitude Test Facility at Malton. New production equipment and machinery were installed.



Manufacture began in the following May. The contract was completed some two years later.

### **Famous names in Orenda's history**

#### **Alliott Verdon Roe**

Alliott Verdon Roe was born in Manchester in 1877. During a sea voyage as a marine engineer, he became fascinated by the flight of birds, especially the effortless gliding ability of the gull and the albatross. He was determined to achieve this feat by mechanical means and spent all his spare time making and studying flying models. He built his first aircraft in 1906, a fragile biplane, powered by a 24 hp Antoinette engine, which he named the Roe 1. He tried out his invention at the Brooklands race track, and in June 1908, he made a few short flights, becoming the first man to fly a British designed and built aircraft in England. In 1909, he completed and flew a triplane, powered by a 9 hp JAP motorcycle engine. This craft was mounted on four small wheels, the front pair steerable. Lightness and rigidity were combined with the use of thin, curved sheet metal and hollow rivets. The machine's patented control was the first system to combine longitudinal and lateral control in a single lever by tilting or warping a large front elevator. In 1909, his small tractor triplane flown at Lea Marshes in East London proved his theory that the Wright brothers of the United States were on the wrong track with their front elevator type of craft. His plane was controlled through the variation of angle of main and tail planes. Also in 1909, he and his brother Humphrey set up a manufacturing firm in Manchester. His innovative ideas and his instinct for design and proportion for flying machines brought continuing success, and with it the first order from the British army for a dozen biplanes in 1912. The first cabin biplane, built in 1912, won the British Duration Record the same year with 7 1/2 hours of nonstop flying.

In the following year Roe designed and built the 504, model, which in improved form was used in the Royal Flying Corps throughout World War I. In the 1920s and 1930s, hundreds of these sturdy little biplanes were built, and the Avro 504K became the standard primary trainer in the RAF. Alliott Verdon Roe left the firm in 1928. A year later he was knighted for his pioneer work in aviation. He died at his home in Hampshire in 1958, having witnessed the entire span of aviation from the Wright Brothers to the Concorde.

#### **Harry G. Hawker**

Harry Hawker, born in 1889, left school in Melbourne, Australia at the age of 12 to become an apprentice mechanic. By the age of 15, he was test

driving cars for his employer. When he was 16, he saw one of the first airplanes to be displayed in Australia. That event set his career path in aviation. In 1911, he was employed as a mechanic with Thomas Sopwith in England. Sopwith was operating a flying school at the Brooklands race track, near London. Hawker, displaying a natural talent for flying, earned his pilot's certificate by 1912. He soon was representing the Sopwith company at the many flying exhibitions and air races then becoming so popular with the public. In doing so he broke many of the existing records for height, speed and endurance. In August 1914, England entered World War I, and the young aircraft industry had to produce planes by the hundreds. Hawker's job was testing new and untried models of aircraft, especially the Sopwith Camel, which became famous at the Western Front. Hawker's mechanical aptitudes earned him a place with the small group of men responsible for new aircraft designs.

At the end of the war, the London Daily Mail offered a prize worth about \$50,000 for the first non-stop crossing of the Atlantic Ocean. The Sopwith company decided to enter, and in just six weeks designed and built a special aircraft, the Atlantic, powered by a single Rolls-Royce Eagle engine. The competitors had to crate and ship their aircraft to Newfoundland, considered the best starting point to take advantage of westerly winds over the ocean. Hawker and his navigator, Kenneth Mackenzie-Grieve, uncrated and assembled their machine in record time and took off well ahead of the other contestants. At first, it was smooth flying, but in mid-ocean their engine began to overheat and they were forced to 'ditch.' They were reported missing, and after five days, were presumed dead. King George V sent a telegram of sympathy to the pilot's wife, Muriel. The telegram was premature! Hawker and his navigator had been lucky enough to ditch near a Danish steamer, which had picked them from the water. The steamer had no radio, however, and the news could not be passed on until the ship reached Scotland. By the time he had returned safely to London, Harry Hawker was a celebrity.

When the aircraft industry went into its post-war slump, the Sopwith Aircraft Company was forced to sell off its assets. The company was later reformed under the name H.G. Hawker Engineering Limited, to honour the man who had contributed so much. Hawker continued to fly, and had entered another air race, the Aerial Derby of 1921. In a test flight before the race, his plane crashed and he was killed. He was only 32 years of age. H. G. Hawker Engineering continued to design military aircraft, many of them with names beginning with the letter 'H'.

## **Hawker ... cont'd.**

The Hurricane was vital to victory in the Battle of Britain. The Hunter, a graceful jet fighter, saw service in 10 Air Forces around the world. In 1935, the Hawker Aircraft Company had joined Armstrong Whitworth, Gloster Aircraft and A. V. Roe as one of the founding members of the Hawker Siddeley Group.

### **John Davenport Siddeley**

John Davenport Siddeley was one of the founders of the British automobile industry. In his early adult years, in the 1890s, the first motorcars were being produced, mainly in France, Germany and the USA. Motoring, or touring, was catching on as a great sport among the upper classes. Many small carriage-making firms were turning out their own version of the 'horseless carriage,' using the newly invented and still unreliable gasoline engine. Companies exchanged engines, chassis parts and personnel, and promising design ideas were soon copied by others.

John Siddeley founded the Siddeley Autocar Company in Coventry, England, in 1902, and for two years produced cars based on a Peugeot design, with a vertical-standing engine and a side chain drive. He also produced a restyled version of one of the Wolseley Motor Company cars. In 1905, he joined Wolseley as General Manager. The former general manager, Herbert Austin, had been in conflict with his directors by stubbornly insisting on horizontal engine designs and resigned to form his own company. With Siddeley now in charge and using his own designs, cars produced in 1905 and 1906 were known as Wolseley-Siddeleys, or just Siddeleys.

In 1909, Siddeley joined the Deasy Motor Car Company, also of Coventry, a company that had been importing and modifying the Martini car from Switzerland. After some radical design changes and improvements, the company operated as the Siddeley-Deasy Motor Manufacturing Co. from 1912 to 1919. In 1919, Siddeley-Deasy amalgamated with Armstrong-Whitworth, an engineering firm that had been producing cars of their own design in Newcastle since 1906. With John Siddeley as chairman and managing director, Armstrong Siddeley Motors produced a series of elegant and luxurious cars. Production was modest, about 1000 cars a year, intended for upper class customers. (A sporty 1934 coupe was advertised as suitable "for the daughters of gentlemen.") John Siddeley received a knighthood in 1934. Armstrong Siddeley Motors joined the Hawker Siddeley Group in 1935.

After World War II, a new line of cars was marketed, with the names of famous aircraft as Hurricane, Lancaster and Typhoon. One famous car produced in the 1950s, the Star Sapphire, was favourably

compared with the Rolls-Royce. The company ceased production in 1960. John Siddeley died in 1953, but his name lived on in the world of engineering for many years.

### **Sir Thomas Sopwith**

Sir Thomas Sopwith, whose name probably is best known in association with the Sopwith Camel, was head of the Hawker Siddeley Group of Britain when A. V. Roe Canada was flying to the forefront in Canadian aviation. He became interested in flying in 1906. He bought his first plane, a 40 hp monoplane, shortly after racing his car at Brookland, England, which was also being used as an airfield. Four years later he obtained his pilot's certificate and took up his first passenger in a new biplane. He soon started building biplanes, based on an order from the British War Office for twelve, and during World War I produced many successful aircraft: "Prep" tri-plane, the Camel, Snipe, Dolphin, Salamander. These aircraft were major contributors to Britain's eventual air supremacy through the war years.

After the war, Sir Thomas teamed with Harry Hawker to form H.G. Hawker Engineering Co. to develop such military aircraft as the Fury, the Hart and the Nimrod. In 1935, Hawker Engineering bought the Armstrong Siddeley group and established the Hawker Siddeley Group. A year later the company started work on the famous Hurricane, a monoplane fighter that played a major role in Britain's success in the Battle of Britain. The Hawker Siddeley Group produced 40,000 aircraft during World War II. In 1941, the company developed the first British jet aircraft, the Meteor, the only Allied jet used operationally during the war.

## **END OF PART TWO**

Part Three of A.V. Roe Canada will continue with the Sir Thomas Sopwith Laboratory

## *Members Matter*

Members, this is your second issue of Pre-Flight for 2012, a bit late, it continues the story of *The Orenda Years*.

I am processing your membership renewals. Some of you will receive your 2012 membership cards with this issue along with requested tax receipts.

I thank those who have sent in their membership renewal early, this makes my job so much easier; processing 50 renewals is easier than 5 or 10 at a time.

At the time of writing, I can't update you in regards to CASMuseum position. Please check their web site for up-to-date information. [www.casmuseum.org](http://www.casmuseum.org)

*Nick*