



CANADA AVIATION AND SPACE MUSEUM AIRCRAFT

AVRO CANADA CF-100 MK 5D CANUCK
RCAF / CAF SERIAL'S (18757) 100757 & (18785) 100785



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Canada Aviation and Space Museum Volunteers

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Introduction

The Avro Canada CF-100 was an all weather fighter nicknamed the *Canuck*; compatriot Royal Canadian Air Force (RCAF) F-86 *Sabre* pilots good-naturedly called it the “Clunk” or the “Lead Sled” compared to their own lighter mounts. It was the first jet fighter completely designed and built in Canada. While Canada had manufactured over 16,000 aircraft for military needs before and during the Second World War, almost all were of British or American design and built under license. Due to Canada’s small population size and relatively small tax base, Canada was somewhat dependent upon foreign governments towards obtaining aircraft to meet Canadian requirements. The CF-100 was the earliest aircraft designed and built specifically for Canadian military needs during the turbulent Cold War era. This monograph describes several aspects of the Avro Canada CF-100 *Canuck* in four parts as follows:

Part 1. CF-100 Design History and Development;

Part 2. Aircraft Weapons and Systems;

Part 3. CF-100 Operational Squadrons and Employment; and

Part 4. The Museum Exhibit History.¹



CF-100 serial number 100785, on the final flight of a Canadian Armed Forces (CAF) Canuck, is seen over Ottawa just prior to touching down at the National Aviation Museum. (CF Photo REC82-926 via CASM)

Cover Photo Caption:

The National Aviation Museum’s Avro Canada CF-100 Mark (Mk) 5D Canucks, CAF serial numbers 100785 and 100757, both from No. 414 Black Knight Squadron, repose adjacent to the Museum. Aircraft ‘785 had been painted black in 1981 to commemorate the original CF-100 Mk 1 prototype for 414 Squadron’s CF-100 “Close-out” ceremonies. (CASM Photos 35-032-34 and 20393)

¹ The author had the opportunity of flying the CF-100 (serial number 15666) while working with AETE in March of 1968 despite the fact that this author was a Navy pilot. The opportunity arose as he was just completing icing trials at the National Research Council’s National Aeronautical Establishment (NAE). The flight was most interesting as the Maxaret anti-lock braking system failed on the landing roll-out requiring the use of the emergency braking system to stop the aircraft. All in all it was a most enjoyable aircraft to fly.

Early Days

The Canadian desire to be less militarily dependent of other nations and still meet domestic aircraft requirements began to materialize when Roy Dobson (later Sir Roy Dobson), then managing director of the British aircraft company A.V. Roe of Manchester, England met Fred Smye. At the time Smye was the director of aircraft production at Victory Aircraft, a Canadian government-owned company in Malton, Ontario. Victory Aircraft was, at the time, manufacturing the *Lancaster*, *York* and *Lincoln* bombers. Dobson and Smye both believed that Canadians should have their own aircraft industry including design and development. With the Second World War coming to an end and aircraft production winding down, the Canadian government wanted out of the aircraft business and was only too happy to turn over the Victory Aircraft plant to private enterprise.

Initially Dobson and Smye had only wanted to acquire a small portion of the Victory Aircraft facility at Malton on a rental-purchase basis but after negotiations with the Honourable C.D. Howe, then Canada's wartime Minister of Munitions and Supply, they ended up with the entire assets of Victory Aircraft. The new company, A.V. Roe Canada Ltd., later to be known as Avro Canada, took possession of the Victory Aircraft facilities on 1 December 1945. Initial work was of the "bread and butter" variety in order to keep the remaining former Victory Aircraft workers busy. Meanwhile in Ottawa Air Vice-Marshal W. A. Curtis was stressing the requirement for a jet trainer and a fighter which could operate in the Canadian Arctic. The trainer program was abandoned leaving Avro Canada to work on a jet airliner (to emerge in due course as the C-102 *Jetliner*²).

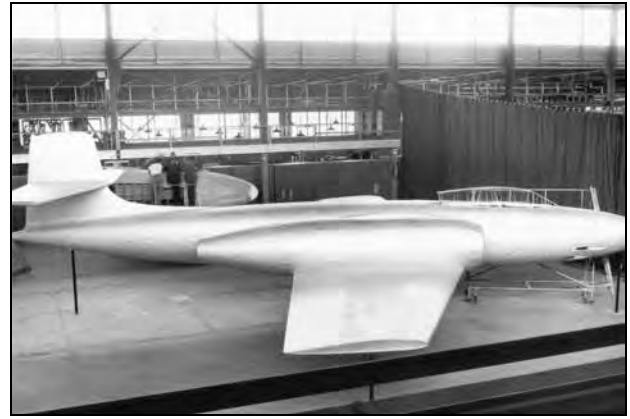
A parallel development program was the need to design and manufacture a state-of-the-art Canadian-designed turbojet engine. In the latter stages of the Second World War the Canadian government had become interested in the development of jet engine technology which was being undertaken in the United States as well as Germany and England. A small Canadian Government owned research organisation, called Turbo-Research Limited, was established to design and build a gas turbine engine. Sir Roy Dobson had heard about this development program and offered to bring the Crown Corporation into the Avro family. The government agreed. By this time Turbo-Research had successfully designed a prototype turbojet engine, called the *Chinook*. This first such engine designed and developed in Canada was first run in March 1948. It was the start of development into one of the most reliable and successful jet engines of the time. Christened the *Orenda* it was subsequently installed in both the Canadair built F-86 *Sabre* as well as the twin engine equipped Avro CF-100 *Canuck*.

As noted above, Avro Canada initially concentrated its efforts on building a jet powered airliner for potential use by Trans-Canada Air Lines (TCA) but soon began the early draft work of three design configurations to meet military specifications for the company designated XC-100 project. These specifications were oriented at a radar equipped, all weather fighter capable of meeting the potential threat posed by Soviet bombers flying over the North Pole to attack targets in North America. In 1945, the Honourable C.D. Howe rose in the House of Commons to declare that the only solution for Canada was to build a defensive fighter aircraft that could intercept and destroy the best bombers in the world regardless of weather conditions. A newly recruited Avro Canada employee, formerly of the British de Havilland Aircraft Company, by the name of John Frost became the senior project engineer for what would eventually become the CF-100.

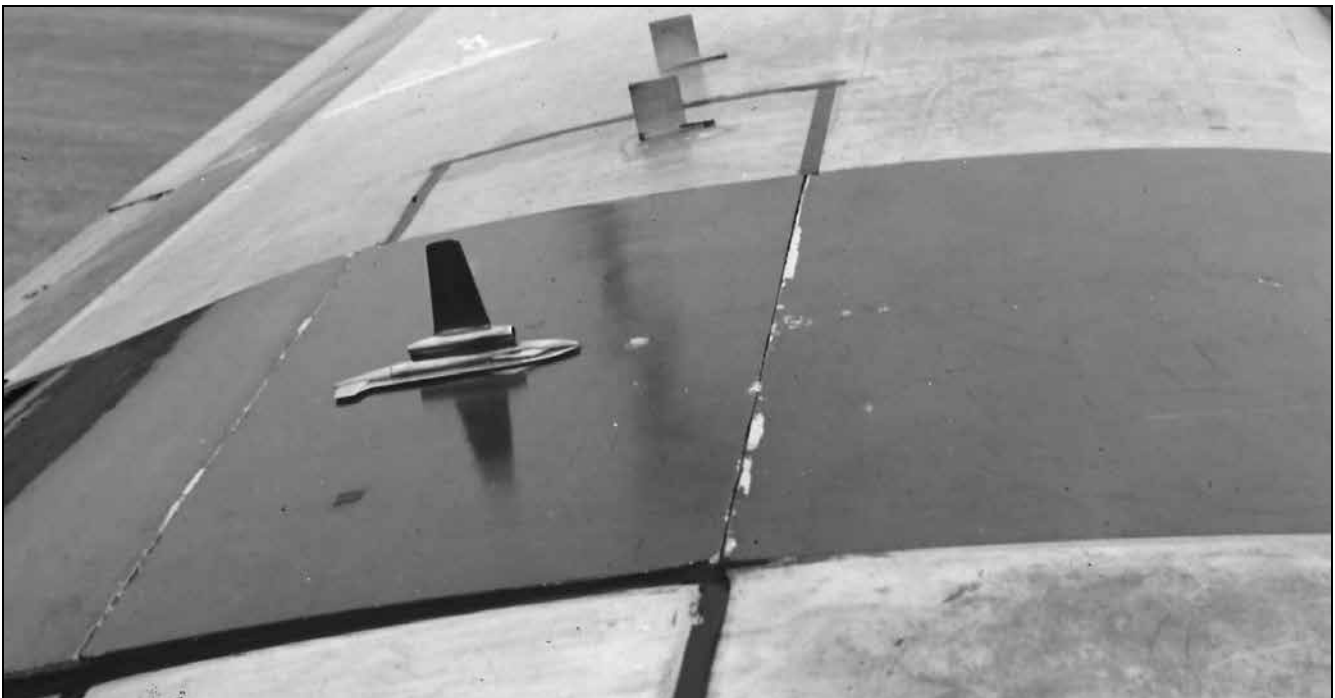
² Significantly the Avro C-102 was the first jet airliner in North America, the second in the world after the British de Havilland *Comet*, and it racked up an impressive series of jet airliner "firsts". Most notably these included; the first international (North American) flight, first official "jetmail" flight in North America, first US inter-city flight, and the first budgeted USAF order (tentative) for a jet transport / navigational trainer. Although the *Jetliner* never entered into production, the prototype was later used extensively as a photo / chase aircraft for the CF-100 weapons testing flights. In December 1956, after some 500 hours of flight time, the *Jetliner* was ordered by Fred Smye to be grounded and dismantled. The nose section was all that was saved and remains in the possession of the Canada Aviation and Space Museum (CASM).



The XC-100 wooden mockup is well advanced in its construction on 3 June 1947. This original design layout of the engine nacelles are slightly higher and positioned further aft above the wings than on subsequent production aircraft. The nacelle repositioning modifications led to later structural problems with the nacelle ring supports. (CASM 28861)



The completed XC-100 mockup is seen in the Avro plant on 16 June 1947 with personnel examining the wooden nose and cockpit mock-up in the background. The large fin fillet was dispensed with on the prototype and production aircraft. The original design specs called for provision of four Aden cannons in the nose as shown here. (CASM 28900)



High-speed aerodynamic model testing was required to verify the new jet's design layout; however, at the time the only facilities existing were limited to low subsonic speeds. The National Research Council of Canada opted to undertake a program of model testing using a system devised by the National Advisory Committee for Aeronautics (NACA) called the "wing-flow technique". A RCAF P-51D Mustang aircraft, serial 9551 CK-O, was acquired and both wings were modified with a new inboard shaped profile. Instrumentation and balancing mechanisms were installed in the wing ammunition bays of the Mustang. Here a half-shape of a scaled CF-100 model is positioned on the port wing for a high subsonic speed test. (NRC Photo via Bill Upton Collection)

On 19 January 1950, the first CF-100 Mk 1 prototype was ready for flight with Gloster Aircraft Company chief test pilot, Canadian-born Bill Waterton at the controls. Avro Canada hired Waterton as he had extensive experience flying high-performance jet aircraft in Britain. After a take-off run of only 457 m (1500 ft), and powered initially by two Rolls-Royce RA.2 *Avon* jet engines due to the unavailability of the new *Orenda*, the CF-100, in a glossy black paint and white lightning stripe scheme, registered 18101 FB-D, was airborne for a successful first flight. The second prototype aircraft, 18102 FB-K, similarly painted and also powered by *Avons* takes to the air in July. Both aircraft conduct a long series of flight trials and demonstrations. It would be almost another year before the first *Orenda* powered CF-100 would take to the air.

The *Orenda* Engine

No summary history of the CF-100 would be complete without outlining the background to the development of the *Orenda* engine. It was recognized, for its size, as one of the finest and most powerful engine of its day. This is significant as engine technology lagged high speed airframe technology in the period under discussion. It powered not only the CF-100 but also was later installed on the Canadair *Sabre* 5 and 6 production models. The *Orenda* turbojet was a derivative of the *Chinook* engine and was developed in less than a year to meet the initial RCAF specification for an engine of 28.9 kN (6500 lbf) thrust. As noted, they were the most powerful engine to be built when measured by power to weight ratio and, in later versions, produced 33.8 kN (7600 lbf) of thrust. Over its life, which ended with a final delivery in July 1958, 4,000 engines were built.

While Canada had surprised the world when word of the *Orenda* engine spread throughout the aviation industry, the engine had still not been thoroughly flight-tested. Towards the North American Aviation Project NA-167, an early version of the *Orenda* engine was initially taken to the United States for testing in a North American F-86A *Sabre* which had to be suitably modified to accept it. This *Sabre*, bearing United States Air Force (USAF) serial number 49-1069, and redesignated as the F-86J, performed its first flight of a series with the *Orenda* at Edwards Air Force Base (AFB), California during October 1950. Dobson was not happy with this single engine testbed approach, as any failure of this unproven engine could be catastrophic. Therefore, he insisted that two *Orenda* engines be mounted on the outboard pylons of a Canadian-made Avro *Lancaster* bomber testbed aircraft. This proved to be a wise decision as, shortly thereafter, a forging component in a ground based test engine failed and all testing was stopped until the forging flaw was corrected. To have mounted this engine in a single engine F-86 *Sabre* aircraft with the possibility of an engine failure would undoubtedly have set the engine development program back, and may even have led to its cancellation.



With the Merlin engines running, Avro-built Lancaster Mk X serial FM 209, as the first Orenda engine testbed, taxis out for a test flight. (CASM Collection 3676)



Some of the cowlings around the diverse engines have been removed during a period of ground maintenance on the Lancaster Orenda testbed. (CASM Collection 3601)

After successful flight testing in the modified *Lancaster* powered by two *Orenda* and two conventional *Merlin* piston engines, the *Orenda*-powered F-86J was then transferred from California to the Malton facilities in Toronto for continued flight-testing. Data produced from these trials encouraged Canadair Limited in Montreal to proceed with a new prototype testbed for the proposed *Orenda* 10-powered variant of the Canadair CL-13 *Sabres*. The 100th *Sabre* produced by Canadair, a Mark 2, serial number 19200, was rolled out in 1952 and afterwards was rolled back in to be modified as an engine testbed. Designated as the sole *Sabre* Mark 3 variant, this special aircraft now incorporated an *Orenda* 3 engine and acquired the project name “Experimental *Orenda* Prototype”. In May and June 1953, the powerful *Sabre* Mk 3 was flown to four world records by famed aviatrix Miss Jacqueline Cochran at Edwards AFB. Also in this aircraft she became the first woman to exceed the speed of sound. These successful accomplishments with the two *Orenda*-powered *Sabre* testbeds helped pave the way for the installation of the *Orenda* in the CF-100.



This modified North American F-86J Sabre, USAF serial 49-1069, powered by an early prototype of the Orenda engine, holds short at Malton in April 1952 with a TCA North Star on final. Avro Canada's Mike Cooper-Slipper was the designated Orenda-powered Sabre test pilot for these series of flight evaluations.



The unpainted Canadair Sabre Mk 3 Experimental Orenda Prototype (E.O.P is seen on the vertical fin) RCAF serial 19200, with an Orenda 3 engine installed, is seen posed on the ramp at Canadair in July 1952. Note the lack of the standard gun blast port panels on the nose. (Canadair via Bill Upton Collection)

The first flight of an *Orenda* powered CF-100 took place on 20 June 1951 and was the first all-Canadian designed, developed and manufactured jet interceptor. It is claimed that Avro's test-pilot Jan Zurakowski, who would go on to fly the legendary Avro CF-105 *Arrow* supersonic fighter dived a CF-100 Mk 4 through the sound barrier becoming the first straight-winged jet powered aircraft to do so. The stage was now set for the contracted manufacture of aircraft and the subsequent deployment of the CF-100 to RCAF interceptor squadrons.

CF-100 *Canuck* Specifications

The development of the CF-100 evolved from the prototype Mk 1 to the production Mk 5 versions of the aircraft. The specifications outlined below are for the Mk 5 version, two examples of which are currently in the CASM's collection, as this was the final and most successful model of the aircraft.

Length:	16.51 m (54 ft 2 in)
Wingspan:	17.42 m (57 ft 2.6 in)
Wingspan with Rocket Pods:	18.54 m (60 ft 10 in)
Wing Area:	54.90 sq m (591 sq ft)
Chord (Root):	4.24 m (13 ft 11 in)
Chord (Tip):	2.2 m (7 ft 2.5 in)
Tailplane Span:	7.62 m (25.0 ft)
Height:	4.42 m (14 ft 6 in)
Engines:	<i>Orenda 11</i>
Armament:	58 unguided folding fin aerial rockets (FFARs)
Cruising Speed:	411 knots (760 km/h / 472 mph)
Maximum Speed:	481 knots (890 km/h / 554 mph)
Service Ceiling:	13,716 m (45,000 ft)
Maximum Ceiling:	16,154 m (53,000 ft)

Development Challenges

The story of the CF-100 development work would be incomplete without a brief discussion of the initial engine design location in the airframe and the effect this installation had on the main wing carry-through structure which almost brought the aircraft development program to an ignominious end.

Early in the production design of the aircraft a decision was made to move the engines further forward. At the same time the engines were lowered in the airframe to reduce the drag characteristics at high sub-sonic speeds. This required major engineering changes to the main wing carry-through structure. This re-engineered carry-through structure absorbed the flight loads and transmitted them to the engine cowls and skins riveted to the wing underpinnings. The first indications of a problem, induced by high G-loadings, caused buckling of the aluminum skins adjacent to the point of highest stress concentration. This buckling had first been experienced by test pilot Bill Waterton when he flew the first prototype aircraft on its third flight. Very early in the test program it was obvious that the re-designed wing root area which had been modified to accept the relocation of the engines left something to be desired. This was worrisome and considerable engineering re-work was required before the aircraft could continue the test program. The solution to the problem was eventually found but not before two years had passed, setting the test program back considerably. There were additional setbacks caused by the requirement to have all components made in Canada.

Crawford Gordon Jr. was sought out by the Honourable C.D. Howe to stabilize the overall management of the CF-100 program and establish a production plan to see these aircraft delivered to the Royal Canadian Air Force. Canada had joined NATO in 1949, and, by June 1950, with war erupting in Korea, a renewed sense of urgency developed regarding production of these aircraft. Ultimately, Gordon found himself heading up a defence budget of \$5 billion. The most contentious and difficult challenge he faced was sorting out the ongoing development and production of the Avro CF-100 and the *Orenda* engines. With the Korean conflict escalating rapidly, and only a handful of early test and pre-production CF-100s flying in Canada, the Canadian government ordered the production of 124 CF-100 aircraft to be delivered at a rate of 5 aircraft per month. Another aircraft order increase was placed in February 1951 with an accelerated delivery schedule. By the time the new production aircraft started to roll off the assembly line and enter RCAF service in 1953, the emergency situation that had initially dictated the rapid production and delivery of CF-100s was over.

The CF-100 Early Variants

A total of 692 CF-100 *Canuck* aircraft³ were built for the RCAF and the Belgium Air Force. Avro Canada started with the Mk 1 and, as earlier noted, over the lifetime of the aircraft type completed their service with a fifth version designated the Mk 5. In a sense the Mk 1 to Mk 4 variants were primarily development aircraft but the Mk 3 was used extensively for pilot and navigator training. As the aircraft evolved and was improved it would be allocated a different Mark number. The first Mk 1 prototype aircraft, following its extended testing career, was retired in 1965 and later scrapped. The second prototype aircraft, destined to be the first CF-100 delivered to the RCAF, was destroyed in a fatal crash on 5 April 1951, the first of the type to do so. The first of the *Orenda* engine equipped CF-100 pre-production aircraft was designated as the Mk 2. A simple distinguishing feature of the early Mk 1 to Mk 3 CF-100s was the 2-piece framed canopy compared to the single-piece canopy design employed on the later Mk 4 and Mk 5 versions.

³ Of these aircraft, fifty-three examples of the Mk 5 model were delivered to the Belgium Air Force in December 1957.



The first prototype CF-100 Mk 1, RCAF serial number 18101 FB-D, during an early test flight in March 1950. Note that the white "CF-100" logo had been applied to each side of the nose once the flight evaluations started.



The second CF-100 Mk 1 prototype, RCAF serial 18102 FB-K photographed from the Avro Orenda Lancaster testbed in December 1950, testing the first installation of wingtip fuel tanks. This aircraft had the RCAF heraldic crest on the nose.



This pre-production Mk 2 aircraft, RCAF 18103, seen at left, was the primary CF-100 to be powered by the *Orenda* engine, here revealed by the removed right hand nacelle panels. The first flight of this all-Canadian jet aircraft occurred on 20 June 1951. Although all of the Mk 2s were formally retired by June 1958, the ten produced served several purposes. Three were used in performing accelerated flight trials at the Central Experimental and Proving Establishment (CEPE). Two were converted to the training version with dual flight controls (as the Mk 2T) and another four were converted to the Mk 3T trainer version. The last, 18112, was used as the prototype for the Mk 4.



The Mk 3, powered by *Orenda* 8 turbojets, first flew in October 1952 and was the first model to attain operational status in the RCAF. It could easily be identified by a small bulge located behind the nose-wheel door. This bulge covered a retractable container that housed eight 0.50 in (12.7 mm) Browning machine guns guided by an APG-33 gun-laying radar in the nose. The machine guns and associated ammunition were housed in an innovative self-contained weapons package and could be easily be removed and re-armed as a complete package. This simple but effective technology reduced re-armament turn-around time significantly.



The CF-100 Mk 4 was different than the Mk 1 thru 3. It added wingtip pods holding fifty-eight 70 mm (2.74 in) diameter unguided folding-fin aerial rockets (FFARs) in addition to eight 0.50 calibre machine guns all controlled by a Hughes MG 2 fire-control system and APG-40 radar. The aircraft was recognized by the US Air Force as being (at the time) the most potent interceptor platform in the world. Three Mk 4B's were the first Canadian designed and manufactured jet aircraft to traverse the Atlantic when they were sent to the UK for Royal Air Force (RAF) performance evaluations at Boscombe Down. While there, they were magnificently displayed by Avro

Canada's renowned test pilot Jan Zurakowski at the 1955 Society of British Aircraft Constructors (SBAC) flying display and exhibition show at Farnborough, England.

The CF-100 Mk 5 Versions



The Mk 5 version of the CF-100 was arguably the most successful version produced. For a time, the RCAF Avro Canada CF-100 Mk 5 *Canuck*, partnered with the USAF Convair F-102A *Delta Dagger*, were the two front-line air defence interceptors of North America. Numerous modifications and enhancements had been introduced as the CF-100 evolved since its introduction as the Avro Model XC-100 in 1949 six years earlier. The first production Mk 5 was flown in October 1955 and, following testing by the Central Experimental and Proving Establishment (CEPE), placed in service in December 1956. It was a different CF-100 in the sense that it was also an offspring of Avro Canada's high altitude research. The outer

wings were initially thought to have been engineered to absorb air loads caused by a 112 cm (44 in) wing extension. Also the aircraft was lightened due to removal of the wing anti-icing system. These enhancements along with the addition of wing vortex generators allowed an increase in ceiling (at a weight of 15,196-kg (33,500 lb) from (11,278 to 12,192m (37,000 to 40,000 ft). The wing extensions were introduced with some difficulty and this manifested itself as wing structure failures. There were two major accidents. Both of these accidents were attributable to high G loadings, low level turbulence, or a combination of both. In the first case, a No. 433 Squadron CF-100 was on a demonstration flight at Kinross AFB, Michigan. F/L Marshall and USAF Lt Degenovi lost their lives when the right wing detached. In the second case F/O Sparrow and F/O Sheffield while performing a demonstration flight at a London, Ontario air show pulled such high G, estimated at 7.3 G, that caused both wings to come off. Apparently, aircrew were generally unaware that the wing extensions reduced the amount of G that could be encountered without structural failure. An aircrew educational program was undertaken and there were no subsequent failures of this type.



On schedule to the day originally planned, the last CF-100 manufactured, a Mk 5, serial number 18792, is seen being ceremoniously rolled out of one of the Avro Aircraft hangars in December 1958. Parked on the tarmac nearby is the Canuck's supposed successor, the supersonic Avro CF-105 Arrow. In less than two months, and without warning, the Arrow project was unceremoniously terminated and almost all hardware was scrapped. The nose section of the first production Arrow, serial number 25206, along with the wings of Arrow '203 and an Orenda Iroquois engine remain on static public display in the CASM.

By the mid-1950s the era of front-line supersonic military fighters and interceptors was heralded with numerous such aircraft coming off the production lines throughout the world. Unfortunately Canada's contribution to this effort nearly ceased to exist following the cancellation of the Avro Canada CF-105 *Arrow*. By the early 1960s, the subsonic CF-100s interceptors required a replacement. The RCAF and government accountants agreed that acquisitions of 56 Boeing and Michigan Aerospace Research Center (BOMARC) surface-to-air anti-aircraft missiles and 66 early-model USAF McDonnell F-101 *Voodoo* interceptors were adequate towards the task of protecting possible ingress routes over the Canadian northern regions from Soviet bomber attack. To be truly effective, the BOMARC missiles and *Voodoos* were intended to be equipped with nuclear weapons, although such items were supposedly prohibited, per US policy, from being stored on Canadian soil. Without such weapons these acquisitions were regarded as somewhat ineffectual replacements. Canadian air defence would rely upon older technology and second-hand equipment for decades to come. RCAF personnel proved themselves second-to-none with what they were forced to use, going head-to-head numerous times in annual military exercises against nations with larger military budgets and more modern, up-to-date equipment.

By the early 1960s, the RCAF *Sabres* and *Canucks* deployed to Europe were being replaced by the Mach 2 capable, Canadair-built CF-104 *Starfighters*. Originally conceived for the USAF as an air superiority fighter, the primary role of the Canadian CF-104s was offensive tactical nuclear strike, but they were utilized mostly as bombers and reconnaissance aircraft for operations in the European theatre. All of these changes eventually spelled the demise of the CF-100 in most of its established roles.

One role that the older, sub-sonic CF-100s could do exceptionally well was that of Electronic Warfare (EW). In the mid-1950s, the RCAF began using some C-119 *Flying Boxcars* (equipped with radar emitters and serving as training targets) and the CF-100s in the electronic countermeasures role at RCAF Station *St. Hubert*, Quebec. By April 1959, the Electronic Warfare Unit (EWU) was officially established due to the success of these training operations. The modified CF-100 Mk 5 aircraft assigned to the EWU were therefore redesignated as the Mk 5C. Aircraft modifications included the addition of chaff dispensing pods under the wings and installation of a group of airborne radar jamming equipment with associated sensors and antennae on the rear fuselage. For this new variant, the former CF-100 navigator/airborne intercept officer would now be known as the navigator/electronic warfare officer controlling all of the passive and aggressive ECM equipment and related activity of the aircraft. The 112 cm (44 in) wing extensions of the original Mk 5 were dispensed with in order to permit the carriage of large wingtip fuel tanks to improve range and endurance, and overall heavier loads. The unit's CF-100s moved to RCAF Station *Bagotville* in November 1959, leaving the EW modified C-119s at *St. Hubert*.



Four RCAF CF-100 Mk 5Cs and a C-119 of the Electronic Warfare Unit perform a flypast over their former *St. Hubert* base in June 1961. (Canadair via Bill Upton Collection)



CF-100 Mk 5C 100780 of No. 414 EW Squadron. Note the faded remnants of the pre-unification style "RCAF 780" markings on the rear fuselage. (Bill Upton Collection)

A number of Mk 5 air defence fighters and former electronic warfare Mk 5Cs were later modified into a dedicated electronic counter-measures (ECM) platform, thus becoming the ultimate service model of the CF-100 *Canuck* series, the Mk 5D. The CF-100 Mk 5D was employed principally as a training electronic warfare asset of NORAD assigned to No. 414 *Black Knight* squadron. They performed their new tasks alongside some EW modified Canadair CT-133 *Silver Star* and Dassault CC-117 *Falcon* aircraft, at CFB *North Bay* from August 1972 until their formal retirement in 1981. This unit was the last military operator of the CF-100 *Canuck* series. During their latter years of service some of these particular CF-100 EW aircraft had been reserialled in the CAF-era 100*** range, with the 'last three' being carried over from their original serial number.

Distinguishing this particular version from the earlier EW equipped CF-100s, the Mk 5D incorporated an updated and varied suite of EW equipment carried externally and some internally in the ventral gun pack bay. Several of the external features (seen in the photo of CAF 100504 at below left) included new blade antennae on the upper and lower nose cone and a single unit under the central fuselage. Prominent EW pods were located on the upper and lower rear fuselage, and a special cooling package for the EW equipment was also located in the ventral (former rocket pack) bay. Large chaff dispenser pods were mounted on pylons under each wing. Similarly to the Mk 5C, the wingtip extensions were removed and wingtip fuel tanks replaced the rocket pods found on the earlier Mk 5 aircraft.



The only other dedicated NORAD EW unit operating in the East Coast region at the time was the 134th Defense Systems Evaluation Squadron (DSES) of the Vermont Air National Guard (ANG) with their complement of fifteen Martin EB-57B Canberra electronic countermeasures aircraft and three non-ECM, dual controlled B-57C trainers. Oftentimes the CF-100 Mk 5Ds of No. 414 Black Knight squadron and the EB-57Bs of the 134 DSES trained and exercised air defence forces together in mock combat scenarios. At right, Black Knight 'kill' markings are proudly displayed on these EB-57s at Burlington, Vermont in October 1981 just prior to the retirement of both of these aircraft types from service. Just 30 years before, early variants of both of these aircraft of similar planform had competed for the coveted contract as the USAF's new light tactical bomber. The Canberra readily won that contest. (Bill Upton Photos)

Ironically, for an aircraft type that was supposed to be replaced in RCAF service by the advanced Avro Canada CF-105 *Arrow*, and later to be supplanted by the BOMARC surface-to-air missiles, the old "Clunk" design managed to actually outlive these proposed more modern replacements by quite a few years!

Part 2 - Aircraft Weapons

Ventral Machine Gun Pack



Machine gun pack with 100757 (Bill Upton Photo)

For early operational CF-100 versions, design specifications for the aircraft called for a lower fuselage mounted gun pack consisting of eight 12.7mm (0.50 in) Colt-Browning machine guns with 200 rounds of boxed ammunition per gun. These were mounted in a self contained weapons package (see photo at left). This novel idea meant that an aircraft could be re-armed very quickly as the entire gun pack could be lowered to the ground and replaced by a fresh one in a matter of minutes. The re-loading of conventional wing or fuselage mounted guns required the feeding of ammunition belts into separate ammunition boxes for each gun - a tedious and time consuming

process. The testing of this new gun pack design was not without problems. One aircraft lost an engine due to ingesting bullet fragments as a result of faults with the ammunition used. Another aircraft shot off its own nose wheel door because of vibrations from the guns firing which made the nose wheel door extend into the air stream. Gun packs were fitted to all Mk 3 and 4 versions while the Mk 5 versions were fitted with wingtip rocket pods for offensive and defensive use.

Ventral Rocket Pack



CF-100 Mk 4, 18112 FB-S fires a brace of unguided rockets during flight tests of the ventral pack.

In the early CF-100 design a ventral rocket pack would extend and retract behind the machine gun pack. After a long test program with the Mk 4 prototype aircraft, engineers were not able to overcome severe vibrations, which induced pitch stability issues as well as airframe cracking induced by these vibratory stresses. As a consequence of these particular armament difficulties a decision was made to curtail the ventral armament program and install wingtip rocket pods for the definitive version of the CF-100, the Mk 5.

Wingtip Rocket Pods



FFARs are launched from wingtip pods of FB-D

Early testing of wingtip fuel tanks installed on the second of the Mk 1 prototype aircraft determined that the aircraft was more stable with these tip tanks installed. This led to the conclusion that rocket pods could be installed in the same location. The pods were designed to carry twenty-nine unguided FFARs, a version of a weapon - called *Mighty Mouse* - commonly used by US military aircraft. The pods were designed so that all rockets could be fired quickly. Also, the pods themselves could be jettisoned at all speeds and altitudes without damage to the aircraft. These pods incorporated frangible glass fibre nose cones and tails. The central tube was constructed of metal that

housed reinforced paper tubes. When fired, the blast from the first rocket was deemed sufficient to burst the nose and tail sections off the pod itself. The center section was ejected from the aircraft employing compressed air. The total weight of each loaded rocket pod was 487 kg (1,073 lb).

Missiles

In 1947, shortly after the CF-100 program was initiated, it was recognized that guided missiles would be the offensive weapon of the future. The Canadian Defence Research Board, which had recently been incorporated into government scientific circles, was tasked with the development of a supersonic air-to-air guided missile for the CF-100. This program was called *Velvet Glove*. It was undertaken with available technologies. Contributing to this work was the engineering expertise from the UK and the Americans. There was an important caveat however. If either of these two countries could develop a superior missile there would be no obligation to acquire the Canadian weapon. In Montreal, Canadair's somewhat secretive Special Weapons Division, later known as the Missiles & Systems Division, was assigned as the prime contractor to produce and test the *Velvet Glove* missile airframes while Canadian Westinghouse Electric was selected as the prime electronics sub-contractor.



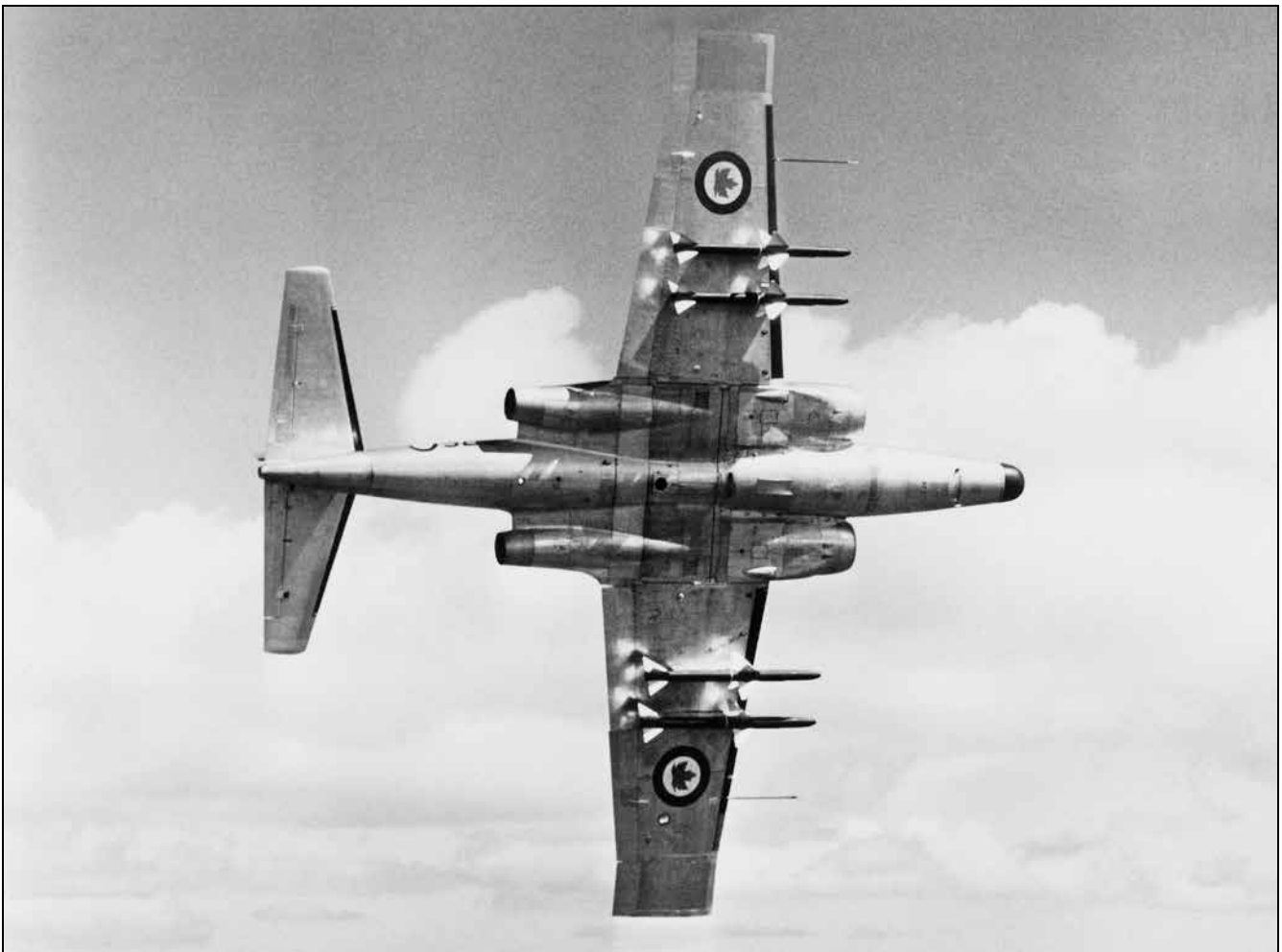
CEPE's CF-100 Mk 3A test aircraft, serial 18117, with four Velvet Glove mockup missiles on under-nacelle pylons in November 1953. The inboard mounted missiles flank the ventral gun pack, the ports of which are visible just forward of the missile's heads. This aircraft evaluated the missile jettison and launch dynamics prior to actual test firings. On 15 October 1954, this aircraft crashed upon takeoff from CEPE Uplands at Ottawa.



CF-100 Mk 4B serial number 18229 at the Avro Canada facilities is fitted out with four Velvet Glove missiles on their dedicated underwing pylons. In the photo at right, the already cramped cockpit now incorporates additional installations for the Velvet Glove (V.G.). In the right hand corner is the special launcher pylon ("V.G. EXP.-PYLON") umbilical release controls on a bracket. Below and inboard against the windscreen is the "V.G. MISSILE CONTROL/FIRE CONTROL" and the "JETTISON" controls panel.

The *Velvet Glove* missile employed semi-active homing using a pursuit course. The design called for the mounting of four underwing hard points on which could be installed four missiles. Considerable effort was dedicated to this development program. Most of the work was completed under the auspices of the Canadian Armament Research and Development Establishment (CARDE) at Valcartier, Quebec. The first CF-100 aircraft to be equipped was CF-100 serial number 18117, a Mk 3 operated from the CEPE then located at Uplands airport in Ottawa. The program was terminated when it was found that the Douglas *Sparrow* II missile developed by the Americans was a superior weapon. It was the missile of choice to be employed with the Avro CF-105 *Arrow* supersonic interceptor, then in the early development stages.

A limited number of *Sparrow* IID (Douglas 1242D) missiles were similarly assembled and tested at Canadair's Missile & Systems Division which had by then become the only fully equipped guided missile fabrication and advanced test facility in Canada. Several CF-100 Mk 5M launch aircraft were actually allocated to Canadair for the *Sparrow* II development, test and evaluation program being conducted by the CEPE *Ultra West* detachment at US Naval Air Station Point Mugu, California in 1958.



This CF-100 Mk 5M (18323) along with sister "Clunks" 18300 and 18301 (all former Mk 4Bs) were the Avro Canada Malton-based Sparrow IID trials installation aircraft, performing development of the missiles and associated fire control system. This particular aircraft carries four Sparrow missiles on the wing hardpoint stations. It also incorporates engine nacelle exhaust extensions for the Orenda Simplified Reheat (afterburner) Unit trial installation for the Orenda 11R engines in support of the proposed CF-100 Mk 6 program. The Mk 6 variant proposal was subsequently dropped in 1957 in favour of the developing Avro CF-105 Arrow.



Another proposal for a missile installation for the CF-100 (and the later Avro CF-105 *Arrow*) had the lighter weight Hughes *Falcon* air-to-air missile paired on the underwing hardpoints of the CF-100. For incorporation in the CF-105 design, eight *Falcon* missiles were to be carried within the *Arrow's* weapons pack. A trial installation of *Falcon* missiles was performed on CF-100 Mk 4B RCAF serial number 18478 belonging to No. 432 AW(F) Squadron located at RCAF Station *Bagotville*, Quebec.

Bombs



Preproduction CF-100 Mk 2T 18105 FB-S of the CEPE with the underwing hardpoints carrying 227kg (500lb) bombs in an effort to determine the capabilities of the Canuck as a ground attack aircraft. Due to structural limitations, this weapon-carrying concept for the CF-100 proved incapable of being used operationally.

The above summarizes some of the development and weapon test activity of the standard CF-100 aircraft versions (Mk 1-5). As a general rule the Mk 3 version was used for pilot/navigator conversion which was undertaken at the recently built RCAF Station *Cold Lake*, Alberta. Following conversion on the Mk 3 version, aircrew would enter operations employing the Mk 4. However, it is generally accepted that the most successful of all of the CF-100 variants was the Mk 5.

The End of the “Clunk” Saga



The only three-engined CF-100 was 100760, a Mk 5 aircraft loaned in 1967 to United Aircraft of Canada (later to become Pratt & Whitney Canada) as a flying testbed for their new JT15D series of turbofan engines destined for small business jets. This last flying CF-100 was finally retired on 28 June 1982. (NRC via Bill Upton Collection)



This is truly the end of the line. CF-100 Mk 5, 100767, initially assigned to AETE, is seen being dismantled at Mountain View, Ontario in July 1990. It had been the sole CF-100 dedicated to the Airborne Sensing Unit of Air Transport Command, carrying a variety of cameras and infrared line-scanning sensors until retired in 1975. (Bill Upton Photo)

Part 3 - CF-100 Operational Squadrons and Employment

There were thirteen commissioned CF-100 squadrons in the Royal Canadian Air Force / Canadian Armed Forces between 1956 and 1974. This number must be qualified, as there were several squadrons and test units that were commissioned for shorter periods of time. All are listed below:

Unit/Squadron	Identifier Code	Name	Call Sign	Location(s)	Period
CEPE	"FB" "FC" "PX"			Uplands	varied
AAED	"PX"			Cold Lake	1954 - 1958
WPU	"HY"			Cold Lake	varied
RAF Eval.	"CV"			England	1955
No. 3 AW(F) OTU	"JF"		Black Ball	North Bay Cold Lake Bagotville	Nov 52 – Dec 64
409 AW(F)	"LP"	<i>Nighthawk</i>	Cudgel Hotel Golf	Comox	Nov 54 – Mar 62
410 AW(F)	"AN"	<i>Hamlet</i>	Cougar	Uplands	Dec 48 – Nov 61
413 AW(F)	"AP"	<i>Tusker</i>	Jumbo	Bagotville	Aug 51 – Dec 61
414 AW(F)	"AQ"	<i>Black Knight</i>	Halfback Yogi	North Bay Comox	Nov 52 – Jun 64
416 AW(F)	"AS" (not worn)	<i>Lynx</i>	Punchbowl	St Hubert	Sep 52 – Feb 62
419 AW(F)	"UD"	<i>Moose</i>	Chopstick	North Bay	Mar 54 – Dec 62
423 AW(F)	"NQ"	<i>Eagle</i>	Handcuff	St Hubert Grostenquin, France	Jun 53 – Dec 62
425 AW(F)	"BB" (not worn)	<i>Alouette</i>	Frogman Blacksheep	St Hubert	Oct 54 – Oct 62
428 AW(F)	"HG"	<i>Ghost</i>	Davenport	Uplands	Jun 54 – Jun 61
432 AW(F)	"DL"	<i>Black</i>	Rhino	Bagotville	Oct 54 – Oct 61
433 AW(F)	"FG"	<i>Porcupine</i>	Gigolo North Bay	Cold Lake	Nov 54 – Aug 61
440 AW(F)	"KE"	<i>Bat</i>	Rhubarb	Bagotville Zweibrücken, Germany Baden-Soellingen, Germany	Oct 53 – Dec 62
445 AW(F)	"SA"	<i>Wolverine</i>	Ukulele	North Bay Uplands Marville, France	Apr 53 – Mar 63

RCAF CF-100 *Canuck* Operations in North America and Europe

North America - Air Defence Command

Air Defence Command (ADC) was formed in June 1951, having been known previously as the Air Defence Group since 1948. With the rise of Soviet military might after the war and their proliferation of manufacturing potent new fighters and bombers aimed at Western Europe and North America, Canada's continental air defence became a priority. By late 1954, there were nine 16-aircraft CF-100 all-weather fighter AW(F) squadrons, and the AW(F) Operational Training Unit (OTU), all being equipped with the CF-100 Mk 4 variant, assigned to the RCAF's Air Defence Command to counter the Soviet threat. The principal task for most of these units was the defence of the major industrial areas and cities in the south-eastern portion of Canada and possible ingress routes through Canadian airspace towards targets in the United States. The east-coast sector had two squadrons assigned to each of the designated RCAF Stations while the west-coast sector had one each along with the OTU. In the order they were formed, these comprised:

445 Squadron (April 1953)	425 Squadron (October 1954)
423 Squadron (June 1953)	432 Squadron (October 1954)
440 Squadron (October 1953)	409 Squadron (November 1954)
419 Squadron (March 1954)	433 Squadron (November 1954)
428 Squadron (June 1954)	No. 3 OTU (November 1952)

The first four of these established ADC units were later transferred to NATO and No. 1 Air Division in Europe via a series of trans-Atlantic ferrying operations known by the code name, "Nimble Bat".



CF-100 18434 of "Operation Lookout" seen with special white wingtip pods carrying sensors and cameras. In the corrosive environment of the coastal areas, oxidization became very apparent on the polished skins of these particular Canadian aircraft. To help remedy this situation and preclude further damage, the local USAF unit graciously repainted the affected Canucks in the USAF's flat grey paint scheme. (George Skinner Photo)

At the height of the Cold War and associated development of Intermediate Range Ballistic Missiles (IRBM) and Intercontinental Ballistic Missiles (ICBM), information was required towards a method of detecting the launch, re-entry and type of Soviet missiles. This data would go towards the design and development of supplementary sensor systems for the secretive Lockheed U-2 spyplane and other reconnaissance assets of the time. "Operation Lookout" of the early 1960s was a co-operative project involving the RCAF, Defence Research Board (DRB), Canadian Armament Research and Development Establishment (CARDE) and the Advanced Research Projects Agency (ARPA) of the US Department of Defense (DoD). From January 1960 to the spring of 1964, three RCAF CF-100 Mk 4Bs, sporting special instrumented wingtip pods, were assigned and operated from Ascension Island, Eleuthera and Patrick AFB, Florida, all located within the US Air Force Eastern Test Range. They were positioned to chase and to

measure the infrared emissions from missile and rocket launches, and returning ICBM nose cones off the coast of the United States towards the development of an effective missile detection system. Chased targets included the launches of US Air Force *Thor* IRBMs, *Minuteman*, *Atlas*, and *Titan* ICBMs along with the US Navy's submarine-launched *Polaris* Fleet Ballistic Missile, rocket launches of terrestrial satellites like *Telstar* and *Tiros*, and interplanetary explorers like *Ranger* and *Mariner*. The Project Mercury manned missions were also covered. None were more satisfying to be assigned to than the time RCAF pilot F/L Gordon Brown and his navigator F/L George Skinner flew their CF-100 Mk 4B, RCAF 18439, on a specialised mission in early 1962. On 20 February, they were airborne to pace the launch phase of the Project Mercury-Atlas 6 mission, more famously known as *Friendship 7*, the historic first US manned orbital space flight, piloted by NASA Astronaut John H. Glenn, Jr.

Europe and NATO No. 1 Air Division (1956-1963)



Camouflaged Mk 4B CF-100s of 423 (Eagle) Squadron, at St. Hubert, Quebec, prepare to deploy on Operation "Nimble Bat II" in February 1957.

Separate "Nimble Bat" operations from November 1956 to August 1957 saw four CF-100 Mk 4B all-weather fighter squadrons replacing a similar number of RCAF day fighter Canadair *Sabre* squadrons in the European theatre as part of No. 1 Air Division. Avro Canada painted all of the *Canucks* destined for deployment to Europe prior to their departure in a typical NATO disruptive camouflage scheme of Dark Sea Grey and Dark Green upper surfaces with Medium Sea Grey applied on the undersides. In November 1956, the CF-100s of No. 445 Squadron, Uplands, flew Operation "Nimble Bat I" replacing *Sabres* from No. 410 Squadron of No. 1 Wing, Marville, France. During February 1957, 423 Squadron, St. Hubert, replaced 416 Squadron of No. 2 Wing at Grostenquin, France in "Nimble Bat II". With

Operation "Nimble Bat III", in May 1957, 440 Squadron from Bagotville, took over from 413 Squadron, No. 3 Wing in Zweibrücken, Germany, and the fourth and final "Nimble Bat" switch took place in August 1957 when 419 Squadron, North Bay, replaced 414 Squadron, No. 4 Wing at Baden, Germany. Once in-theatre, these four CF-100 squadrons became associated with the 4th Allied Tactical Air Force in the defence of central Europe along with the USAFE's 12th Air Force and the French Tactical Air Force. While in Europe, Scottish Aviation Limited at Prestwick, Scotland, was contracted for the local CF-100's major repairs, overhauls and painting.

These Canadian Mk 4Bs were definitely nimble, being able to take up to 7.3 Gs in official or mock air combat exercises against other NATO fighters, or "bouncing" unsuspecting friendly rivals, even besting the Belgians with their less manoeuvrable CF-100 Mk 5s. The Canadians made good use of their radar in these encounters in the oftentimes-heavy overcast prevalent in the European skies. The CF-100's all-weather and day/night capability put them to good advantage over the day fighters of the era that had to return to base as twilight approached, but this was particularly paramount to their official duty on Zulu Alert status during the night. When on alert with their associated air and ground crews, two fully armed CF-100s, would be scrambled from their strategically located shelters within two minutes of the detection of a potential enemy aircraft.

Canadair Limited had been awarded a contract in August 1959 to manufacture 200 single-seat CF-104 *Starfighters* destined for the tactical nuclear strike and reconnaissance roles to replace the remaining *Sabres* and CF-100s in squadron service in Europe. That, coupled with the adoption of the second-hand CF-101 *Voodoo* aircraft and BOMARC anti-aircraft missiles, it was seen to be only a matter of time before the air defence CF-100 variants at home and in Europe were deemed to be surplus to current needs. All of the CF-100 squadrons of No. 1 Air Division were officially disbanded on 31 December 1962. These aircraft were not returned to Canada, but were ferried to the UK where they were all unceremoniously melted down into scrap metal at Scottish Aviation.

The Avro Canada CF-100 *Canuck* was withdrawn from frontline RCAF service in the spring of 1962. By October of that same year, the CF-100 OTU was officially closed.

Part 4 - History of the Museum's CF-100's

Historical Background

The Canada Aviation and Space Museum has two Mark 5D Avro Canada CF-100s in inventory. Aircraft (RCAF) CAF serial number (18785) 100785 is currently on long-term loan to the Canadian Warplane Heritage collection in Hamilton, Ontario. It is painted overall gloss black with a white lightning stripe accent in order to resemble the first prototype *Canuck*. This was done just prior to October 1981 in order to commemorate the retirement of the CF-100 from active CAF duties. This aircraft, along with sister *Canuck* serial 100784 painted in the disruptive camouflage colours representing the European CF-100 squadrons of No. 1 Air Division, carried out a cross-Canada service ending tour. At the conclusion of the tour, 100785 had the distinction of performing the final CAF *Canuck* flight when it was delivered by a crew from No. 414 Squadron to the National Aviation Museum, in Ottawa for permanent static display on 10 February 1982.

The second aircraft on display in the Canada Aviation and Space Museum is the final incarnation of the type, the EW variant Mk 5D, (RCAF) CAF serial number (18757) 100757, still in the natural metal finish scheme it sported while in RCAF/CAF service. The following provides summary information on the history of both aircraft during their RCAF/CAF careers.

In May 2010, a third CF-100 Mk 5 airframe, RCAF serial number 18752, was acquired by the CASM with the intention of mounting it on a pedestal in front of the recently refurbished Museum's main entrance building. This stripped-down aircraft had the distinction of being the former gate guard of Base Headquarters at CFB *Ottawa*, in Uplands, mounted there in honour of the RCAF's 60th anniversary in April 1984. It, too, had initially served time with No. 414 Squadron, ending its flying career assigned to No. 433 Squadron.

Both of the principal display aircraft served primarily with 414 Squadron. The battle honours of this former Second World War Squadron include: Defence of Britain 1942-43, Fortress Europe 1942-44, Arnhem 1943, Biscay 1943, Dieppe, France and Germany 1944-45, Normandy 1944, Rhine. The squadron was originally commissioned at Croydon, England, on 13 August 1941 as 414 Army Co-operation Squadron flying Westland *Lysanders*. On 28 June 1943 the squadron changed names to 414 Fighter Reconnaissance Squadron and was based at a number of airfields in England and on the continent. The squadron was disbanded at Luneberg, Germany, on 7 August 1945. After absorbing elements of No. 14 Photographic Squadron, 414 Photographic Squadron was commissioned at RCAF Station *Rockcliffe*, Ontario on 1 April 1947 and subsequently was disbanded 1 November 1950.

On 1 November 1952, 414 Fighter Squadron re-formed at RCAF Station *Bagotville*, Quebec and subsequently went to 4 Wing Baden-Soellingen 24 August 1953. The Squadron deactivated 14 July 1957 and reformed at RCAF Station *North Bay*, Ontario on 5 August as No. 414 All-Weather Fighter Squadron with the squadron identifier AQ. The squadron was equipped with the Mark 5 variant of the CF-100 and was nicknamed the *Black Knights* after the insignia in their squadron crest and bore the squadron motto *Totis Virbis* (With all our might). Their mascot incorporated a genuine suit of armour that was purchased in England and named "Sir Cedric".

The squadron disbanded on 30 June 1964, reforming at RCAF Station *St Hubert*, Quebec on 15 September 1967 as No. 414 Electronic Warfare Squadron. In August 1972, 414 Squadron moved to CFB *North Bay* and remained there until 1992, when the squadron was split in two with one part going to CFB *Comox*, B.C. as 414 Composite Squadron and the other part going to Greenwood, Nova Scotia as 434 Composite Squadron. No. 414 changed its name to Combat Support Squadron in 1993 where it was equipped with the Canadair CT-133 *Silver Star*.

History of Museum's CF-100 - Serial Number (18757) 100757



CF-100 Mk 5D 100757 performs a low overshoot to RWY 27 at Rockcliffe upon delivery to the National Aviation Museum in October 1979. (CASM Photo 14091)



100757 backtracks beside the Museum by Canadian Armed Forces 414 Squadron crew of Major R. A. "Punch" Walker and Major P. A. Growen. (CASM Photo 13848)

Records for (18757) 100757 provide the following details of RCAF/CAF service.

Manufacturer:	Avro Canada Ltd. Malton, Ontario.	
Construction No.:	657	
Registration:	(18757) 100757	
Engines:	Orenda 11 (Port)	Serial No.: 3918
	Orenda 11 (Starboard)	Serial No.: 3475

Aircraft History:

First flight, Malton, Ontario:	14 June 1958
RCAF serial 18757 taken on strength:	25 August 1958
414 Sqdn. North Bay, Ontario:	28 August 1958
3 OTU Bagotville, Quebec:	22 December 1959
414 Sqdn. North Bay, Ontario:	28 April 1961
6 RD Mountain View, Ontario:	26 June 1961
3 OTU Bagotville, Quebec:	16 October 1962
6 RD Trenton, Ontario:	13 August 1963
AMDU Mountain View, Ontario:	13 February 1964
414 Sqdn. Uplands, Ontario:	30 March 1972
414 Sqdn. North Bay, Ontario:	10 August 1972
AMDU Mountain View, Ontario:	15 November 1972
414 Sqdn. North Bay, Ontario:	18 November 1974
AMDU Mountain View, Ontario:	29 September 1976
Flown to National Aviation Museum, Rockcliffe, Ontario:	26 October 1979

Total flight time hours amounted to 1964.3 hours.



Major Walker and Major Growen present the aircraft logs to Dr. David Baird, Director of the National Museum of Science and Technology. (CF Photo REC79-1219 via CASM)



Spotted on the Rockcliffe tarmac, aircraft 100757 reposes just after being formally delivered from the AMDU Mountain View, Ontario to the Museum. (CASM Photo 13848)



One of the last occasions that this aircraft was to be seen on static outside public display was in July 1995. (Bill Upton Photo)

Although never carried by this CF-100 variant, a ventral machine gun pack, fabricated in 1955 by Avro Aircraft Limited consisting of eight Colt-Browning guns and ammunition boxes, was placed on static public display next to aircraft '757' in the CASM's Jet Island display area in 2010. It is hoped that sometime in the future, some of the *Velvet Glove* and *Sparrow* missiles from the Museum's collection shall also be similarly displayed to complete an arrangement of the major defensive weapons carried by the CF-100 interceptor variants.

History of Museum's CF-100 - Serial Number (18785) 100785



100785 in flight still with much of its complement of EW gear performs an overflight of CFS Falconbridge in the fall of 1981. (CF Photo IOC81-83)

Service records for (18785) 100785 provide the following details:

Manufacturer:	Avro Canada Ltd. Malton, Ontario.	
Construction No.:	685	
Registration:	(18785) 100785	
Engine:	Orenda 11 (Port)	Serial No.: 3509
	Orenda 11 (Starboard)	Serial. No.: 4137

Aircraft History:

First Flight, Malton, Ontario:	09 December 1958
RCAF serial 18785 taken on strength:	13 August 1959
414 Sqdn. Uplands, Ontario:	12 August 1959
Storage, AMDU Trenton, Ontario:	26 November 1959
Converted to Mk 5D at de Havilland Canada:	01 June 1964
414 Sqdn. Uplands, Ontario:	03 July 1964
6 RD Trenton, Ontario:	09 May 1967
414 Sqdn. St. Hubert, Quebec:	02 December 1967
AMDU Trenton, Ontario:	08 March 1971
414 Sqdn. Uplands, Ontario:	18 August 1971
414 Sqdn. North Bay, Ontario:	10 August 1972
AMDU Trenton, Ontario:	05 June 1973
414 Sqdn. North Bay, Ontario:	27 June 1973
AMDU Trenton, Ontario:	29 July 1974
414 Sqdn. North Bay, Ontario:	17 February 1975
Painted black in colours similar to prototype CF-100:	1981
Flown to National Aviation Museum, Rockcliffe, Ontario:	10 February 1982
Total flight time hours amounted to 5269.3 hours.	
Loaned to Canadian Warplane Heritage, Hamilton, Ontario:	01 August 1996



With all but its nose EW warfare antennae removed, specially painted and marked CF-100 Mk 5D 100785 is seen crewed by Capt. R. Pennock and Capt. R.G. Chester enroute to a final landing at the National Aviation Museum. (CF Photo REC82-928 via CASM)



100785 banks to get in the landing pattern for the runway at Rockcliffe. (CF Photo REC82-929 via CASM)



The 414 Squadron crew prepares to disembark from '785 for the last time. (CF Photo REC82-915 via CASM)



CF-100 Mk 5D serial number 100785 is temporarily parked outside of the Museum following its arrival in February 1982. In May, this aircraft, along with Canadair CP-107 Argus 10742, was formally presented to the Museum, these becoming the 100th and 101st aircraft acquired for the National Aeronautical Collection. (CASM Photo 15145)



100785 languished on outside static public display for quite a number of years. At one time it was proposed that it be loaned to the US Air Force Museum at Dayton, Ohio. In the end another Canuck was chosen thereby freeing up '785 to be assigned on temporary loan to the Canadian Warplane Heritage Museum near Hamilton, Ontario. (Bill Upton Photo)

History of Museum's Original CF-100 – RCAF Serial Number 18434

This is the short history of the Museum's first CF-100 allocated for static display – in the end, that never was.

CF-100 Mk 4B, bearing RCAF serial 18434, was first assigned to the RCAF Air Defence Command (ADC) on 23 August 1955, eventually being sent to serve with No. 409 AW(F) Squadron, at Comox, BC on 31 October 1956. After spending the summer months of 1959 at RCAF Station *Lincoln Park*, in October of that year this aircraft was transferred to the CEPE Detachment at Ancienne Lorette (Quebec City), QC towards modifications and preparations for a special assignment to CARDE in "Operation Lookout".



Newly polished to a mirror finish, RCAF 18434 of the CEPE CARDE Detachment located at Ancienne Lorette, Quebec is seen at altitude and in close formation with an accompanying CF-100 on a ferry flight to Florida in April 1960. (George Skinner Photo)

From January to August 1962 at least 17 missions based out of Patrick AFB, Florida, were conducted by this aircraft in "Operation Lookout", tracking missile and rocket launches originating from nearby Cape Canaveral.

In early 1964, following the "Operation Lookout" assignment, and while still detached to Patrick AFB, aircraft 18434 was next tasked to NASA and the University of Maryland for a series of test flights. It carried the *Nimbus* weather satellite's infrared (IR) scanner/camera on tests over Florida, the Caribbean and the US West Coast.



*CEPE's CF-100 18434, now in the overall FS 16473 aircraft grey paint scheme due to skin salt corrosion problems, is seen being readied to carry the NASA *Nimbus* weather satellite's infrared (IR) scanner in February 1964. The black-painted housing for the IR scanner can be seen suspended below the center fuselage in the photo of the aircraft taxiing out from Patrick AFB, Florida for a test run. (George Skinner Collection)*

Following the NASA *Nimbus* scanner test flights, this somewhat corroded and 'foreign-painted' aircraft returned to Canada and was immediately transferred to No. 6 Repair Depot (6RD) located at Mountain View, Ontario for storage purposes. There, per the aircraft's official record cards, it was earmarked to be; *"...prepared for extended storage pending delivery to Rockcliffe at a later date for the Museum"*.

In 1969, J. A. Griffin's ultimate reference book, *Canadian Military Aircraft Serials and Photographs 1920-1968*, was published by the Canadian War Museum. This exemplary work set the standards for recording aircraft registration and serial number information and has been the "go-to" book for researchers and historians of Canadian military aircraft ever since. In Chapter 12, entitled National Aeronautical Collection, he recorded that Avro CF-100 4B bearing registration 18434, and having served with 409 and 439 Squadrons, was indeed part of the famed Collection.

CF-100 Mk 4B, RCAF serial number 18434, was again mentioned as being "housed" in the Canadian National Aeronautical Collection in an article on the CF-100 published in the periodical, *Air Enthusiast Quarterly Four*, in 1977, written by, then, National Aviation Museum Curator, Mr. R. W. Bradford. On page 166 of this publication's article, Mr. Bradford states in part that;

"...a surprising number of surviving examples can be found in museums and preserved by various organisations around the country. The Canadian National Aeronautical Collection at Rockcliffe houses Mk 4B serial 18434."

Aviation researcher and author, Jeff Rankin-Lowe mentions in his forthcoming 2nd edition of his popular reference book, *The Aircraft of the Canadian Armed Forces*, regarding the entry for CF-100 serial number 18434/100434;

"...was also reported in the National Aviation Collection in 1980."

Later, in 1981, author Ron D. Page published his commendable work on the history of the CF-100 in his book, *Avro Canuck CF 100 All Weather Fighter*, mentioning on page 189 under the heading "End of Saga" that;

"There are a number of aircraft preserved in museums, such as 18434, a Mark 4B, at the Canadian National Aeronautical Collection at Rockcliffe, which flew in with only one or two hours to spare on the engines."

After it had completed numerous and somewhat secretive missions towards gathering information to study and act upon in an attempt to relieve potential Cold War-tensions, and a uniquely special assignment to NASA, this aircraft was deemed to be too corroded and damaged for further use. Therefore, it was ultimately not accepted for static display purposes by the Museum. By early 1970, the Museum had begun looking to obtain a later Mk 5 variant instead of having the older Mk 4B. In May 1972, aircraft 18434 was transferred to the AMDU Detachment, also located at Mountain View, for 'robbing purposes'. Finally, in March 1974, this historic CF-100 was put up for disposal and was sold to the Crawford Metal Corporation in Belleville for scrapping. The Museum opted towards acquiring the popular, and then current, Mk 5D variant of the big Avro fighter.

Summary

As this monograph is written in 2011 the CF-100 remains the only jet fighter aircraft to be designed, built and operated by Canadians. The long Cold War period was fraught with political turmoil. This turmoil between the Soviets and the West (NATO) had, as a front line, the Canadian North. This required an all weather, radar equipped aircraft manned by a crew of two, with excellent fuel reserves as well as with two engines for reliability purposes. The CF-100 was the right aircraft at the right time appropriately for the mission of guarding Canada's northern frontier. It served the Canadian public well.

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Photos courtesy the Hawker Siddeley Canada Collection of the CASM unless otherwise noted.