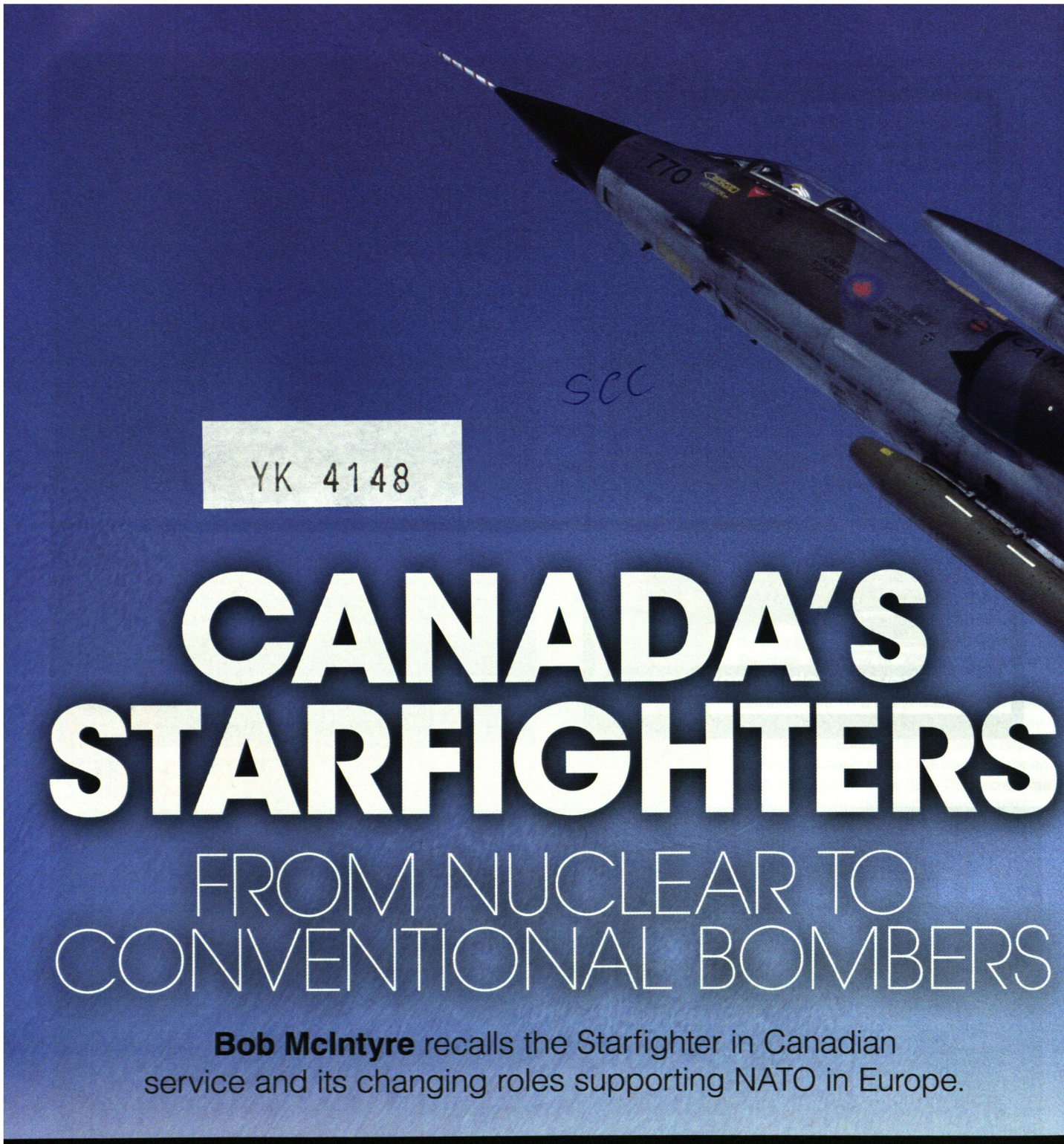

CANADA'S STARFIGHTERS

FROM NUCLEAR TO CONVENTIONAL BOMBERS

Bob McIntyre recalls the Starfighter in Canadian service and its changing roles supporting NATO in Europe.

The United States Air Force never operated the F-104G Starfighter in squadron service, but Lockheed did a superb sales promotion in selling this variant to other countries. Germany was the first to commit, followed by Canada on July 2, 1959 to replace the F-86 Sabre. The Starfighter was originally referred to as the CF-111, but this was changed before it entered service to the more appropriate CF-104.

Competition for the selection had involved the F-105 Thunderchief, Draken, F-4 Phantom II, Mirage IIIC, Buccaneer, Northrop N-156 (F-5A), Super Tiger and G.91. The F-105 was the RCAF's first choice but the costs of building the Thunderchief in Canada eliminated it from contention. The Mirage lacked the strike (nuclear)-reconnaissance capability of the F-104, the Buccaneer and the G.91 were deemed too slow, the N-156 had not yet flown and the Super Tiger had been cancelled by the US Navy.

Each CF-104 was originally estimated at CAD$1m per aircraft but ended up at CAD$1.9m for 200 single-seaters and 38 two-seaters which gave a total cost of CAD$463,762,000. It was announced on August 14, 1959 that Canadair would build the single-seaters in its Cartierville plant in Montréal with Orenda in Toronto manufacturing the General Electric J79 engines, both under license. The two-seaters would come from Lockheed and be designated CF-104D (originally they were to be called CF-113s). To make space for the second seat on the Ds, the autopilot and Vulcan cannon options were eliminated for extra fuel and to relocate electronic equipment normally carried behind the pilot.

Although designed as a high altitude, day interceptor, Canada planned to use the CF-104 as a nuclear strike bomber based in Europe for its NATO commitment. The CF-104 was well suited to this role due to its small radar return, excellent acceleration, reasonable range and stability as a low-level platform. If called to action, a CF-104 would have carried one nuclear bomb; either a B57 which could be

Main photo: **A 439 Sqn CF-104 in April 1984 when it was used by Canada in the conventional ground attack role. The peak of RCAF Starfighter operations in Europe was in the 1960s when there were eight squadrons.** Peter R Foster

Right: **Canadair's first CF-104 12701 after roll-out at its Cartierville plant on March 27, 1961.** Canadair

set to produce a blast from five to 20 kilotons, a B28 (70-350 kilotons) or a B45 (one megaton).

Lockheed modified a USAF F-104A (s/n 56-0770) to become the CF-104 prototype. It had 25% more fin/rudder area and new flight control systems and the aircraft first flew in this configuration on September 1, 1960. The production CF-104s' internal structure was substantially strengthened to increase airframe life due to the higher loads at low levels. The CF-104's Autonetics R-24A North American Search and Ranging Radar (NASARR) was optimised in the air-to-ground mode versus the G's F-15A-41B radar (also built by Autonetics) being for both air-to-ground and air-to-air. A Litton inertial navigation system (INS) and bombing computer was tied into the radar and a data link. The CF-104s were delivered without the M-61 Vulcan rotary cannon, thus increasing internal fuel capacity by 101.5 Imp gal (461 litres).

ROLL-OUT

The first Canadair-built CF-104 (designated CL-90 by Canadair), s/n 12701, was rolled out from the Cartierville plant on March 27, 1961. It was the first F-104 to be built by another company under a licensing agreement. The contract required the first two aircraft to be performance tested by Lockheed and the following day 12701 was airlifted by a C-130B Hercules to the company's facility at Palmdale, California. Test pilot Ed Brown made the first flight on May 26. The first Lockheed-built CF-104D, 12631 was next to fly on June 14. Aircraft 12702 arrived in California on May 18 and first flew on September 14.

Initial flight testing at Canadair commenced on August 14, 1961. Bill Kidd flew 12703 and Glen 'Snake' Reeves 12704 two hours later. Ten aircraft had been rolled out by Canadair by this time and within six months the company was producing Starfighters at a rate of one every two working days, or 11 per month. Initial deliveries were to Cold Lake, Alberta, an ideal location as terrain and weather closely simulated Europe where the bulk of the Starfighters were to be based. ▶

Above: **The sleek lines of the Starfighter are shown to good effect.** Bob McIntyre

Below: **A two-seat CF-104D carrying four external tanks. Note the extended speedbrakes on the rear of the fuselage.** International F-104 Society

The first of many CF-104 crashes occurred on November 25, 1961 when Canadair test pilot Bruce Fleming ejected from 12712 on its maiden flight. The second accident on January 16 the next year came on the first Starfighter delivery flight to Cold Lake, when during a planned refuelling stop at Duluth, Minnesota, 12703 undershot the runway causing extensive damage to its underside. Had the production line been closed, it would have been a write-off. However, it was airlifted to Canadair and inserted into the production line and finally delivered on May 3, 1962. Due to the accident, it was Lockheed that delivered the first Starfighter by air to Cold Lake, with CF-104D 12635 on the same day as the crash. It was not the first Starfighter to arrive at the base as 12709 was airlifted in by a C-130B on September 6, 1961 for use as a maintenance trainer but it didn't conduct its first flight until 1965.

The first Canadair delivery finally took place on March 1, 1962 with 12707. The first unit to receive the new type was the newly formed 6 Strike/Reconnaissance Operational Training Unit (6 ST/R OTU), responsible for training all RCAF Starfighter pilots. Prior to transitioning to the CF-104, students took a three month F-86 course at Chatham, New Brunswick, covering low-level navigation training, followed by a 24-week course on the 'thing' – three specially modified Douglas C-47s with CF-104 nose cones equipped with its navigation and NASARR radar systems. After the C-47 training, pilots would accumulate 90 hours on the Starfighter.

When the F-86 retired, low-level training shifted to the CF-116 (also referred to as the CF-5), although one course received this experience in the T-33 Silver Star prior to the arrival of the CF-5s.

Left: **CEPE CF-104 12705 with five BL755 cluster bombs.** CEPE

Below: **The all-silver metal finish was replaced by a dark green scheme as illustrated on this aircraft that is about to land at Leeuwarden Air Base in the Netherlands on April 6, 1978.** Eric Tammer

A CF-104 deploys its drag chute on landing. International F-104 Society

The other unit at Cold Lake to receive the CF-104 was the Central Experimental and Proving Establishment (CEPE). It was initially assigned the first five single-seaters, 12701-705, and two-seat 12652. CEPE's main tasks were evaluation and acceptance of all new RCAF types, simulator acceptance and weapons testing. The following four months, April to July 1962, saw Canadair deliver 63 single-seaters to Cold Lake. Pilot training became feverish as the first deliveries to Europe were about to begin.

Squadrons were assigned to nuclear strike, with the exception of 1 Wing, which also had a reconnaissance role. For this, CF-104s would carry the VICON photo-recce system pod, containing four Vinton 70mm cameras. An automatic exposure control ensured optimum photographs, regardless of weather and lighting conditions.

The first aircraft to arrive in Europe was 12721 for 427 Sqn on October 11, 1962. This aircraft served as a ground maintenance trainer for the next two-and-a-half years. The first Starfighter for flying duty was 12792 which arrived at 3 Wing via a C-130B on October 14 the same year. By January 1, 1963 some 19 CF-104s had arrived, including 12721. All initial European deliveries from Canadair were via 435 Sqn C-130Bs. Nose cone, tip tanks, wings and empennage were removed prior to loading. The final single-seat CF-104, 12900, rolled off the production line on June 20, 1963 undertook its maiden flight on September 4 and was delivered to Europe on January 10, 1964. Aircraft 12855 was actually the last CF-104 delivery on January 14, 1964.

Although 200 Canadair CF-104s were scheduled to be delivered to the RCAF, 198 actually made it. Besides the loss of 12712, aircraft 12803 was also lost during production test flying, Jack Lumsdaine ejecting safely. Each RCAF Starfighter squadron was assigned 18 aircraft.

No.2 Wing at Grostenquin was disbanded in February 1964, with 421 Sqn moving to 4 Wing and 430 Sqn going to 3 Wing. During March 1967, the Air Division was reorganised into six squadrons, with 434 and 444 Sqns being disbanded. As nuclear stockpiles were no longer permitted on French soil, the Marville operation was closed and 1 Wing, with 439 and 441 Sqns, moved to Lahr in West Germany.

During Canada's centennial year, 1967, the RCAF chose to celebrate by making an attempt at the altitude record of 113,892ft (34,714m), held by the Soviets. Rather than use an operational aircraft, the RCAF modified Lockheed-built CF-104 prototype 12700, which had been donated to the RCAF and used as a travelling ground exhibit. Lighter than the production CF-104, it carried only instrumentation necessary for the flight. Intake inlet cones were extended to better position the shock wave across the intakes at high Mach numbers. The electrical system was modified, as was the pressurisation system, and the aircraft was stripped of all external paint except for the serial number on the tail and the red 'X' of CEPE, which by 1967 had been redesignated Aerospace Engineering Test Establishment (AETE). Over a two-week period, several attempts were made. During the third flight of the day on December 14, Lt Col Bud White accelerated to Mach 2.4 and zoomed to an altitude of 100,110ft (30,513m), short of the Soviet record, but a new Canadian record. With no future operational use, 12700 has since been displayed at the National Air Museum in Ottawa.

On February 28, 1968 the air force, navy and army were restructured into the Canadian Armed Forces. Surviving Starfighters were ►

INITIAL COMPOSITION OF NUMBER 1 AIR DIVISION

Wing	Base	Squadron	Transition Date
1 Wing	Marville, France	439 Sqn 'Sabre Toothed Tiger'	March 1964
	Marville, France	441 Sqn 'Silver Fox'	September 1963
2 Wing	Grostenquin, France	421 Sqn 'Red Indian'	December 1963
	Grostenquin, France	430 Sqn 'Silver Falcon'	September 1963
3 Wing	Zweibrücken, West Germany	427 Sqn 'Lion'	December 1962
	Zweibrücken, West Germany	434 Sqn 'Blue Nose'	April 1963
4 Wing	Baden-Soellingen, West Germany	422 Sqn 'Tomahawk'	July 1963
	Baden-Soellingen, West Germany	444 Sqn 'Cobra'	May 1963

A CF-104 of 421 Sqn flies past Hohenzollern Castle in the southwest of Germany. DND

An impressive line-up of 441 Sqn Starfighters and pilots taken at Baden-Soellingen in November 1985. CAF

A CF-104D taxies in after a Maple Flag sortie at Cold Lake in 1983. Bob McIntyre

re-serialled 104701-104900. The original Canadian Starfighter unit, 6ST/R OTU at Cold Lake became 417 Strike/Reconnaissance Operational Training Squadron on March 11 the same year. No.3 Wing at Zweibrücken was disbanded in May 1969, with 427 Sqn transferred to Baden-Soellingen, and 430 Sqn to Lahr.

The Canadian Government announced on September 19, 1970 that the country's contribution to NATO would be reduced to three CF-104 squadrons – two for strike (421 and 441 Sqns) and one for recce (439 Sqn), under No.1 Canadian Air Group.

SWITCH TO CONVENTIONAL ROLE

The strike squadrons lost their nuclear role and the last Quick Reaction Alert was held on December 31, 1971. Recce was also dropped for the CF-104s. Nos 439 and 441 Sqns moved to Baden-Soellingen in July 1970 to join 421 Sqn where RCAF Starfigher operations were now solely concentrated. The three squadrons converted to the conventional attack role. Starfighters were modified to carry conventional bombs and rockets and an M-61 Vulcan cannon was installed. They also received self-protective radar warning receivers, a computer aiming sight and their all-silver finish was replaced by an overall olive green. This lasted until 1977 when a camouflage featuring two tones of grey and a green was applied. Starfighters in RCAF service were never fitted with air-to-air missiles; the aircraft's speed being relied upon to get it safely away from enemy fighters.

Pilot retraining included low-level

FLYING THE STARFIGHTER

Lt Col Dan Dempsey (ret.) was a pilot on 439 and 441 Sqns (in the latter unit's case as its Training Flight Commander) based at CFB Baden-Soellingen, West Germany. He told *Aviation News*: "The Starfighter was revered by all those who flew it during the Cold War in Europe, in part because of the legendary status it enjoyed as one of Kelly Johnson's designs but mainly because it was simply a joy to fly. Its high wing loading made it extremely stable at high speed, low level and what it lacked in turning ability due to its short wingspan it made up for with breathtaking acceleration. There wasn't much that could match the Starfighter's speed on the deck in full afterburner. In short, flying it was simply exhilarating, notwithstanding the unforgiving challenges of the low-level environment."

He continued: "There is no question that the 104's most viable role was a nuclear strike fighter bomber within NATO's deterrent force. The Canadians were among the first to deliver a 24/7, all-weather day and night nuclear strike capability with the 104, thanks to the aircraft's finely tuned ground mapping radar and excellent training. Given its very small radar cross section and the carriage of a single 'special weapon' on its centreline, a Starfighter ingressing at high speed at tree-top level would have had an excellent chance of making it to its target in the Warsaw Pact.

"With the Canadian Government's decision to abandon the nuclear strike role at the end of 1971, a quantum shift took place in the RCAF as the Starfighter was converted into a conventional weapons platform. In this instance, its short wingspan immediately became a liability in terms of the number of conventional weapons that could be carried. So too did its range with conventional weapons replacing external [pylon] fuel tanks. Strength in numbers and a change in tactics now became the name of the game. Canadian pilots handled the transition well and practised weapons deliveries of a variety of bombs and eventually the superb Canadian-designed CRV-7 rocket became the weekly norm. So too did practice strafing with the fighter's impressive 20mm Vulcan Gatling gun. In short order, Canadian pilots became very adept at virtually all types of low-level conventional weapons missions, including offensive counter air interdiction, battlefield air interdiction and even close air support, although the latter along with air defence were clearly its least viable roles due to the aircraft's large turning radius at combat speeds. Whether operating independently or as part of a larger NATO package, CF-104 pilots were very well trained and highly confident in their ability to deliver their weapons on time and on target, including in NBCW (nuclear, biological, chemical weapons) conditions.

"Those of us fortunate enough to have flown the Starfighter during the Cold War enjoyed a special camaraderie that lives on to this day. None of us will ever forget her and the uniquely beautiful sound that emanated from her J-79 engine. It was, and remains, music to our ears."

Right: **Latterly CF-104 operations in Europe were concentrated at Baden-Soellingen where these three Starfighters from 439 Sqn were based when photographed in 1984.** Peter R Foster

DISPLAYING THE STARFIGHTER

The first CF-104 display team in Canada began during its centennial year, 1967, with the formation of the Centennaires, consisting of nine Canadair Tutors, plus a single CF-104 and a single CF-101 Voodoo. The next year a four-ship Starfighter team was established though it only flew for the one season. In 1970 to 1971 a ten-ship display consisted of four CF-5s plus a solo and a similar arrangement for the CF-104s.

From 1972 to 1975 there was the five-aircraft 'Deadeye Whiskies'. Due to budgets cuts it was reduced to two and renamed the 'Deadeye Zips'. A third CF-104 was added in 1977. In 1978, there was no official Starfighter team, but a four-aircraft display was informally put together called the 'Deadeye Blues'. The Deadeye Zips returned with a five-ship for 1979 and 1980, which was the last year of a Canadian-based Starfighter team.

Initially in Europe, the RCAF did not have a CF-104 team, with just flypasts at selected airshows and events. However, during 1976, 439 Sqn fielded the 'Tiger Romeos' with five aircraft. Due to increased demand for CF-104 appearances, each of the three squadrons would have their own teams in 1977. Added were 421 Sqn's 'Red Indians' which used a single aircraft in 1977 and then five for the first half of 1978. The 'Check Whiskey' team of 441 Sqn displayed with five Starfighters. These teams were disbanded from mid-1978 due to a new round of budget cuts which mandated there was to be only one Starfighter team in Europe named the 'Canadian Reds' – the first official 1 CAG Starfighter demo team using five aircraft. The team was renamed '1 CAG Starfighters' the following year and flew as such until May 22, 1983 when aircraft 12813 crashed at the Rhein-Main Air Base airshow. The pilot ejected safely, however a family of five was killed in their car by the falling aircraft, ending the team.

navigation, weapons delivery (bombs, rockets and cannon), attack tactics and air combat manoeuvring. Although their role had changed, it was mid-1974 before the single-seat CF-104s received cannons. The first aircraft, 104895, was modified by Lockheed in Ontario, California. It was delivered to AETE at Cold Lake, where it was promptly lost during an air gunnery test on March 19 that year after ingesting a buckle plate from its gun, causing an engine failure.

Between 1971 and 1973, 44 CF-104s were sold to Denmark and Norway, each receiving 22 aircraft. Northwest Industries in Edmonton, Alberta, received a three-year CAD$17m contract in October 1978, to extend the life of some 78 Starfighters. The European-based aircraft were airlifted two at a time, once a month. The Starfighters were stripped of paint, X-rayed, landing gear and rubberised fuel cells replaced and extensive re-wiring completed.

"Lt Col Bud White accelerated to Mach 2.4 and zoomed to an altitude of 100,110ft..."

The Starfighter's safety record was controversial. The RCAF had 114 write-offs and 37 fatalities out of 238 aircraft. While it appears to be a high loss ratio, the role in which it operated should be examined. It was heavily utilised, operated at extremely low altitudes in often foul weather, in airspace infested with birds, rolling terrain, numerous antennae and many other high-speed aircraft. Engine problems, controlled flight into terrain (CFIT) accidents, mid-air collisions and bird strikes caused the majority of RCAF write-offs.

As for the remaining units, 417 Sqn at Cold Lake disbanded in June 1983. More than 750 students had passed through the 75 courses with the final pilot graduating in November 1982. Only 25 CF-104s remained on base at the closing ceremony; there had been 99 at the peak of Starfighter operations. Eleven were ferried en-masse to Baden-Soellingen, the first and only time any CF-104 actually flew to Europe. The remaining aircraft were either flown to Mountain View, Ontario, for storage or became ground displays. Less than three years later, the last CF-104 was phased out at Baden-Soellingen.

The RCAF retired the Starfighter in March 1986. A few were scrapped. The bulk went to Turkey. Most were flown but a few non-flyable examples were delivered by C-130 to provide spares. So ended the CF-104 in RCAF service. Many in Canada fondly remember the Starfighter for its distinctive engine howl and sleek design. AN

Below: **Three of the five CF-104s used by the '1 CAG Starfighters' display team taking off at the Mildenhall Air Fete in 1982.** Key Collection

Right: **This CF-104 received a special paint scheme to mark the end of 417 Sqn at Cold Lake in 1983. The unit was responsible for training pilots on the type and its ramp can be seen in the background.** CAF