


This Alpha Jet displays its under-wing stores: two fuel tanks, an A100 Erijet pod and an air combat manoeuvring instrumentation pod.
All photos Henri-Pierre Grolleau





The success story of Discovery Air Defence (DA Defence) can be traced back to the early 2000s when three Canadian CF-18 Hornet pilots, Didier Toussaint, Paul Bouchard and Dave Jennings, decided to create their own company, Top Aces Consulting. These highly-experienced fighter weapons instructors foresaw the growing importance of private companies in threat simulation, electronic warfare and target towing.

Canadian Competition

The three pilots had a vision: purchase advanced trainers or fighter aircraft to train Canadian frontline squadron aircrews at a lower cost. They intended to provide aggressor-type training at an affordable cost with privately-owned assets flown by contractor pilots and maintained by civilian engineers. Between 2000 and 2004, the three entrepreneurs acted as consultants in an effort to develop their company. In 2004, the Canadian Department of National Defence (DND) gave them the opportunity to demonstrate the wisdom of their approach after it published a request for proposal (RFP) to fill the void left by the withdrawal of the CT-133 Silver Stars of the Royal Canadian Air Force's 434 Combat Support Squadron, in 2000, and of 414 Combat Support Squadron, in 2002. This RFP was split into four sub-contracts for four Canadian provinces, with bases to be set up in Halifax, Nova Scotia; Bagotville, Quebec; Cold Lake, Alberta; and Victoria, British Columbia.

"The Alpha Jet was a key part of our success story," said Didier Toussaint. "It undoubtedly was the aircraft we needed and, because of the quality of our proposal, we won in one go the four sub-contracts of the

Arctic Alpha Jet Aggressors

Discovery Air Defence is taking a preminent role in a highly competitive market on both sides of the Atlantic. Henri-Pierre Grolleau reports



The fleet was later reduced to two, however, when the requirement fell down to the current 1,000 hours per annum.

In 2007/2008, the number of Alpha Jets progressively grew to the current inventory of 21 aircraft, including five as maintenance spares. These advanced trainers take part in numerous deployments each year to better match the Royal Canadian Air Force CF-18 squadron training requirements. Top Aces was the first civilian operator to be cleared to operate as an embedded tactics asset with US Air Force aggressors: they fly in mixed formations with F-16s to increase the size of the Red Air force during Maple Flag exercises, at Cold Lake.

In 2007, Top Aces was taken over by Discovery Air, a large Canadian company with a fleet of over 160 aircraft and a workforce of 850 employees, and became Discovery Air Defence. In 2013, the firm purchased American company Advanced Training Systems International (ATSI) and its fleet of A-4N and TA-4J Skyhawks then based in Mesa, Arizona. It also operates seven A-4Ns from Wittmund, Germany.

1 Bagotville Operations

In Bagotville and Cold Lake, Alpha Jets are mainly used as aggressors for the CF-18 pilots. Alpha Jet formations are normally composed of two aircraft, each with two drop tanks and one air combat manoeuvring instrumentation (ACMI) pod. One aircraft is also fitted with a jamming pod. About a

Interim Contracted Airborne Training Service, or ICATS. We took a lot of risks, investing all our personal savings and mortgaging all our properties, but our effort proved successful. Everything happened very fast and we began revenue flights in August 2005, initially with only eight aircraft. These ex-Luftwaffe Alpha Jets had been sourced on the US civil market where they were registered as experimental aircraft. They are now all registered in Canada and every single modification they are subjected to needs a double approval, from the DND on one side, and Transport Canada, the national civil aviation authority, on the other.”

For Top Aces, the Dassault Dornier Alpha Jet’s main advantage is its simplicity. Toussaint said: “It’s perfectly designed and easy to fly. Conversion training requires only three weeks and ten flying hours for an experienced pilot, with a CF-18 Hornet background for example. All our aircraft have been fitted with Martin-Baker Mk10L zero/zero ejection seats instead of the outdated Stencel types used by the Luftwaffe. Their instrument panels are fully night vision goggles compatible and, for electronic warfare training, our Alpha Jets can be fitted with pods provided by the DND.”

Fast Expansion

Top Aces rapidly grew and secured new contracts from the DND. In 2006, the company won the market for electronic warfare and target towing for the training of Royal Canadian Navy warships on both the east and west coasts, off Halifax, Nova Scotia, and Esquimalt, British Columbia. This was a significant boost and four IAI 1124 Westwinds were purchased for the role, effectively replacing the CE-144 Challengers previously used by 414 and 434 Squadrons.

1 DA Defence aircrews are qualified in the use of night vision goggles and they regularly operate at night. 2 DA Defence engineers at work on an Alpha Jet. The company’s engineering department has quickly mastered all Alpha Jet maintenance procedures.



THREE ALPHA JET STANDARDS

To better meet the Royal Canadian Air Force’s needs, DA Defence Alpha Jets have been heavily modernised, with three successive standards designed in-house by DA Defence engineers since 2004:

- **Legacy airframes:** the original Alpha Jet A aircraft were first upgraded by Top Aces with a modern flight management system (FMS) which replaced the outdated Doppler navaid system used by the Luftwaffe. The legacy airframes retain the Larzac 04-C6 engines.
- **Plus jets:** the rear cockpit of these aircraft has been improved with an FMS too, allowing the rear and front cockpits to be linked. These jets are fitted with the updated Larzac 04-C20 turbofan engines which deliver nearly 10% more thrust. Their instrument panels have been treated to allow the use of ANVIS 9 night vision goggles.
- **Cyprus jets:** this standard has benefited from an even more impressive upgrade programme, with the introduction of two touch screens, new radios, two GPS receivers for precision approach capabilities and a traffic collision avoidance system. They are also equipped with updated Larzac 04-C20 engines, but are not yet ANVIS-compatible.

These three standards are all capable of carrying the ACMI, jamming and threat simulation pods, and chaff dispensers. They all retain the head-up display that was fitted to Luftwaffe Alpha Jets for the close air support/light attack role. The communication/radionav facilities, which were fairly minimal initially (with only one very high frequency (VHF) radio, a tactical air navigation system (TACAN) and an identification friend or foe on the Alpha Jet sourced in the United States), were progressively expanded and now include two VHF omnidirectional range/instrument landing systems, two ultra high frequency (UHF) radios and two VHF radios on all airframes.

DA Defence Alpha Jets are supposed to be equally split between the four bases in Halifax, Bagotville, Cold Lake and Victoria, but in practice this is seldom the case. For example, all heavy maintenance is performed at Bagotville, which means that a higher number of airframes are in Quebec. Alpha Jets also routinely travel to distant locations in Canada and in the United States to interact with Canadian forces wherever needed.

David Whittall, Deputy Chief Pilot, explained: “The Alpha Jet is really, really supportable. It is a simple and robust beast and sortie rates are always remarkable. Its amazing cross-country endurance is a key advantage too. We frequently fly to distant places during exercises like the yearly Trident Fury on the west coast, cooperating with EA-18G Growlers from Naval Air Station Whidbey Island, or to San Diego, flying out with US Marine Corps AV-8B Harriers during the deployment of two Canadian warships as part of a US Task Group training campaign.” In the winter, Canadian fast jets and ships travel down south for better weather and DA Defence Alpha Jets follow them. Florida is a common destination, with the aircraft operating from Naval Air Station Key West and Eglin, Homestead and Tyndall Air Force Bases.



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third of all CF-18 missions launched from Bagotville are supported by DA Defence Alpha Jets.

Steven Nierlich is one of the DA Defence pilots in Bagotville. He explained: “Missions are first briefed with our 425 Squadron colleagues. We always do face-to-face debriefs. If we have the manpower, the ACMI system will be used in real time for kill removal. Normally, we only debrief using recorded ACMI data on dedicated ‘bricks’. ACMI undoubtedly is a great training tool.”

The Alpha Jet offers much improved capabilities on the T-33 previously used in the jamming/adversary role, according to DA Defence pilot Leath Greenwood. He said: “The T-33 lacked overall performance against the CF-18. It took ages to climb up to 30,000ft. A clean T-33 could turn tight, but not as tight as an Alpha Jet. In Bagotville, we provide two aircraft every day so that they can have two Hornets and two Alpha Jets against the Blue Air, with the Red Air Hornets simulating Su-27s and us MiG-21s. Often, they don’t have the assets and we fly as the only Red Air. Occasionally, we put in a more robust show, with four Alpha Jets and four CF-18s against up to eight other CF-18s. That’s serious fighting.”

414 Squadron

Discovery Air Alpha Jets routinely fly with electronic warfare operators (EWOs) in their backseats. In Canada, the Ottawa-based 414 Electronic Warfare Support Squadron – the ‘Black Knights’ – has been the dedicated EW unit since it stood up again in 2007. Major Aaron Novecosky, 414 Squadron Deputy Commanding Officer, explained:

“Our personnel spend a lot of time away from home, travelling to bases as required to provide first-class service to our ‘customers’ from the Royal Canadian Air Force and the Royal Canadian Navy. As part of the ICATS contract, our EWOs primarily fly in Alpha Jets and occasionally in Westwinds. Experienced EWOs typically fly anything between 60 to 110 hours a year, while the more junior aircrews log from 40 to 70 hours yearly. Tasking is usually provided at least two to three weeks in advance, and we have local representatives at each operating location to smooth operations and assist with priorities and planning.”

The 414 Squadron EWOs are truly part of the Alpha Jet crews. “In Canada, all EWOs belong to the Air Combat Systems Officer [ACSO] occupation which grew from the old navigator trade,” continued Major Novecosky. “As such, we not only man the jamming systems, but we also help the pilots with the navigation and communications. In the Cyprus-standard Alpha Jets, we have a fully up-to-date flight management system with independent GPS and moving map. We can do our own programming and navigation in the back. Our ACSO colleagues mainly fly in Sea King helicopters and Aurora long-range patrol aircraft as well as other specialty aircraft like the Buffalo or Hercules for search and rescue or air-to-air refuelling. We are the only ACSOs flying fast jets in Canada, so we have no trouble recruiting young EWO candidates. They have to be aware, however, that being with us has some drawbacks: we are a small community, with only nineteen EWOs within the squadron, and we spend a lot of time away from Ottawa.”

A Wide Array of Pods

To carry out its missions, the DA Defence Alpha Jets currently operate with four types of externally-carried EW payloads, all provided by the Canadian DND:

- **A100 Erihammer pods, produced by Ericsson in Sweden;**
- **ALQ-167 jammer pods, borrowed from the US Navy;**
- **AST-6 and AST-502 threat simulating pods used to replicate hostile radar signals;**
- **ALE-503 large capacity chaff dispensers.**

The A100 is the most common system. It is flown on nearly all missions from Bagotville and Cold Lake against CF-18 Hornets. The AST-6 proves particularly useful to simulate search radars and missile seekers when operating against ships. The ALQ-167 is the preferred jammer against ships. “Scenarios are decided by the customer with greater or lesser levels of details,” explained Major Novecosky. “Within each mission, there is a jamming plan. In effect, we are a supporting agency and we provide the level of jamming required by the customers to reach their training objectives and we strictly follow the plan agreed with the CF-18 leader or the ship’s training officer. Here, at Bagotville, about a third of the Hornet missions are supported by 414 Squadron, and we provide noise, deception or denial jamming. Sometimes, they just say ‘I want to see this particular effect’, choosing, for example, to see velocity deception.

“Within the A100 pod, we have a basic radar warning receiver which allows the operator to detect blue radar signals to change jamming modes/parameters in real



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- 1 A pair of DA Defence Alpha Jets manoeuvre at high altitude. The lead aircraft is painted in the arctic blue colour scheme.
- 2 During a snow shower, David Whittal pre-flights his Alpha Jet prior to a training sortie. DA Defence pilots and engineers are used to operating in severe weather conditions.
- 3 An orange-painted air combat manoeuvring instrumentation pod seen from rear cockpit of the Alpha Jet photo-ship.

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time to suit the scenario and the training requirement. The pod is fitted with three jamming antennas, with 120° coverage in the forward hemisphere and 120° on each side from just ahead of the wings and to the rear. The pod sits low under the wing; we have some fuselage masking, but not enough for the jamming to be ineffective. In any case, most of the jamming is performed in the forward hemisphere, during the interception prior to the merge.

“It is the age-old game of measures versus counter-measures in technology and tactics. The A100 pod is an ageing system that entered service many years ago. It was first used by the CT-133 Silver Stars. It remains effective, however: if you inject jamming into a tactical scenario, you still provide a representational threat that the blue forces must contend with. We do not provide an exact replica of any particular threat, but like

other dissimilar aggressors, we still provide valuable training.”

Flying the Alpha Jet

All DA Defence pilots seem to agree that the Alpha Jet is the ideal aircraft for the job. Nierlich said: “The combination of overall performance, fuel endurance and reliability makes it perfect for our needs. The Alpha Jet is a joy to fly. It’s a pilot’s dream. It handles remarkably well. It talks to you. When you push it too far, it buffets and stops turning. It’s very safe though and I have never departed from controlled flight. It proves ideal for adversary training. Here in Bagotville, Hornets are most of the time flown with two or three external drop tanks and the CF-18 is very draggy with such a mission load. As a result, the Alpha Jet equals or beats the loaded CF-18 at lower altitudes in the air-to-air role, typically at

15,000ft [4,573m] and below. If they fight our fight, we will win. If they fight a more aggressive fight, at higher altitude and in the vertical, we will lose. Even when limiting ourselves to 5g manoeuvres with drop tanks, the Alpha Jet’s rate of turn is impressive at its 240kts [445km/h] corner speed. Its turn circle is small, and it is a very tough fight for the CF-18 pilot. I can’t square the corner as I would in a Hornet, however.

“We all come from the CF-18, so by just looking at them, we know how much energy they have. Sometimes, I even encourage the young Royal Canadian Air Force fighter pilots and give them advice and tips on the radio. For example, I might tell them, ‘hey, it’s a good time to threaten and exploit the vertical’. During my very first Alpha Jet trip as part of the ICATS programme, I found myself flying against an experienced American exchange pilot flying a CF-18. It was his first



experience at fighting the Alpha Jet. We spent five minutes neutral, spiralling down from 30,000ft [9,144m] down to the hard deck at 8,000ft [2,438m], with neither of us gaining any significant advantage. Needless to say he was rather surprised.”

Nierlich still flies CF-18s with 425 Squadron at Bagotville as a reservist, meaning he sometimes flies his CF-18 against his DA Defence Alpha Jets colleagues. He said: “I primarily use the Hornet’s APG-73 Doppler radar to build up situational awareness. I attempt to arrive with an angular spread with an advantageous position, trying to exploit the CF-18’s on-board sensors’ performance, allowing a better beyond visual range [BVR] to within visual range transition to achieve a combination of oblique and vertical manoeuvres, exploiting the CF-18’s excellent high angle of attack capability. When flying

a clean aircraft, the CF-18 has the edge against the Alpha Jet, however.”

Excellent Endurance

The Alpha Jet’s range is a huge bonus, especially for operations in North America where diversions are more often than not quite far away. Nierlich said: “We can fly up to three hour-long missions when fitted with two external bags and an ACMI pod, or 2hrs 45 mins when carrying an additional A100 jammer. We are always the first out and the last back as the Hornet is a fairly fuel-critical aircraft. In the event of a 1-v-2 ACM/BFM training flight, I would fly with the drop tanks empty. I would only get about 0.15 Mach [100kts/185km/h] more after removing them anyway. The difference between C6 and C20-powered aircraft is noticeable, so we usually fit the A100 to the C20-equipped airframes. On a hot day on a short runway, with all four pylons

loaded, we look carefully at the charts. Within Discovery Air Defence, we take all the steps required to minimise any operational risks.”

Nierlich explained how the introduction of the traffic collision avoidance system (TCAS) on the Cyprus-standard jets (see panel) has brought new capabilities: “The TCAS is a great capability enhancer for BVR scenarios, in terms of both situational awareness and flight safety. The CF-18s’ Mode 3C IFF is used to accurately display their TCAS position on our screen and we have a 360° bird’s eye view of the situation around us. Once we get into the merge, the TCAS refreshing rate is not fast enough, however, and we stop relying on it after the BVR to visual transition, post merge.”

Supporting the Navy

DA Defence Alpha Jets operating out of Halifax and Victoria spend a lot of time



1 simulating fighter bomber attacks and anti-ship sea-skimming cruise missile strikes to train Royal Canadian Navy ships' companies in anti-air warfare tactics. "For larger exercises, Bagotville and Cold Lake-based Alpha Jets are drafted in to reinforce the local guys," explained Nierlich. "We mainly fly missile profiles, with a Westwind as a 'launch' platform. Sometimes, one of our Alpha Jets will play an interceptor defending the fleet so that the fighter controllers on board the ships can guide it to engage the incoming package. We have also performed a lot of radar and sensor calibration flights recently, supporting the on-going Halifax-class frigate life extension programme.

"We all praise the Alpha Jet for the maritime role. For those missions, having a twin-engine aircraft is a huge advantage, especially when flying at midnight, at a very low level over the sea 100 nautical miles offshore, in the middle of January in the Canadian winter. I had an engine failure a while ago, and one of my colleagues suffered another engine stoppage after foreign object damage ingestion. If we had been operating single engine fighters, we would have had to eject. Alpha Jet endurance is also a big bonus in the maritime role."

With the Army

The Canadian Army soon recognised the value of the Alpha Jet for the training of its Joint Terminal Attack Controllers (JTACs, known as forward air controllers in Europe). There again, the advanced trainer twin is proving its worth.

"The army always want a lot of time on station, and the Alpha Jet gives them exactly that, like an A-10 would," continued Nierlich. "From Bagotville, I mainly train with the army units based in Valcartier, a huge army base just north of Quebec City. Their JTACs need to hone their skills and we simulate close air support assets day and night. We fly with night vision goggles, an infrared pointer and binoculars. They ask us to be a Tornado GR4, a Mirage 2000D, an A-10C or even a Reaper UAV and we will simulate releasing JDAM precision weapons or Paveway laser-guided bombs from high or medium altitude. Alternatively, we can fly a gun strafing profile, or a show of force down low.

"We 'sparkle' the target with our infrared pointer, just like a Sniper pod would do. We have a drop capability for BDU-33 training bombs, although we have not been tasked to release them as yet. We often fly during complex exercises and I completed a sortie during which they were shooting live artillery over considerable distances. We also support the JTAC School instructors and students from Gagetown, New Brunswick, when they deploy to Fort Sill in Kansas, for live training. We then fly out of Sheppard Air Force Base. Alternatively, we fly out of Salina, in Kansas, when JTACs operate in the Smoky Hill Air National Guard firing range. This usually involves a three jet detachment, including one spare."

Maintenance

To safely operate a fast jet type as a contractor, reliable technical support is

essential and this is where the Top Aces/ DA Defence story gets really impressive. In just a couple of years, the company managed to develop a robust technical infrastructure and build experience while respecting stringent rules imposed by both the DND and Transport Canada. The main goal was to be able to look after the Alpha Jets autonomously without having to outsource maintenance. Francis Laroche, Flight Line Operation Lead at Bagotville, explained: "There was not a lot of Alpha Jet expertise in North America and most of the maintenance was initially subcontracted to other companies. After a couple of years, Top Aces created its own air maintenance organisation to handle Alpha Jet maintenance within the company with a dedicated team of engineers.

"We had some difficulties initially. Here is one example: we are in North America where everything is done in imperial units while all data in the Alpha Jet is in metric measurements. This meant we had problems sourcing tools and we had to set up a network of suppliers. All maintenance manuals were in German and had to be translated. Since these early days, the Alpha Jet has proved incredibly reliable and easy to support. It is a cleverly designed aircraft, simple yet very advanced."

The DA Defence hangar in Bagotville was a hive of activity during the author's visit, with two Alpha Jets in deep maintenance. Alpha Jet maintenance is done at 250-hour, 500-hour and 1,000-hour intervals, with depot-level overhauls every ten years. Philippe La Haye, Inspection Lead at Bagotville explained: "All heavy checks are now performed in-house here. Everything is done here, but some components are overhauled by other maintenance and repair organisations. The company has just turned ten years old, so we are conducting a lot of ten-year depot-level inspections at the moment."

Engine Test Cell

In 2013, DA Defence set up the Bagotville Repair Shop for engines and avionics with the aim of being self-sufficient. The engine test cell/overhaul facility is managed by David Baron, a former Armée de l'Air engine specialist who ended his service career with the Patrouille de France display team, explained: "We bought a Larzac test bench in Germany and began carrying out the 500-hour inspection in-house. Here, engines are dismantled and their modules checked and repaired as needed. Our test cell is extremely modern, and all data is monitored in real time to fine-tune the engine. For more complex overhauls, Larzacs are sent to a company in Montreal which has the necessary resources to repair compressor and turbine blades."

With more than ten years of experience with the Alpha Jet, DA Defence has undoubtedly become a key player in the contracted air training business. The company keeps expanding abroad and will continue to do so for the foreseeable future. In the meantime, it will have to win another big contract as the ICATS programme is due to be offered for tender again in 2016 for the 2017-2031 timeframe. DA Defence has proved to be a reliable service provider and is very well positioned to win again.



1 A Discovery Air Alpha Jet leads a 425 Squadron CF-18 Hornet. The Hornet is equipped with two drop tanks.
2 The 500-hour inspections for the Snecma Larzac are carried out in-house by Discovery Air Defence engineers at the Bagotville Repair Shop.