

# UAVs Go 'Joint'

Last Fall, the Canadian Chief of the Air Staff, in an outline of the future vision for Air Force transformation, announced that the need for high-quality real-time intelligence will lead the Air Force into an unprecedented focus on multi-sensor-equipped, unmanned aerial vehicles (UAVs). So some may think that a story about UAVs is also about the Air Force, but when you look into it, it's not that simple. For sure, Canada has a recent history in the UAV business and there is aviation industry action and interest, but the Canadian Forces are going about it in a decidedly inter-service manner that promises to optimize any eventual UAV investment to the benefit of all CF users. Indeed, with the choice of vehicles now available, and what's going on around us, the future could be very interesting.

## Canadian History You Ask?

Canadair, now *Bombardier Aerospace*, has been busy with unmanned airborne surveillance systems since 1959. The first saleable product, designated CL 89 (or AN/USD 501) is described as a recoverable missile that could do recce, and was adopted by a number of NATO countries. Some retired Canadian soldiers remember fondly the days when the Drone Troop of the First Locating Battery supported the CL-89 development. But as Canadian government support waned, the successor update (CL-289) was sold off to *Aérospat* and *Dornier GmbH*. This system continues in service today, doing yeoman service in the Balkans for the French and the Germans.

Beyond that, Canadair worked up the radically designed CL-227 Sentinel – the new version, CL-327 Guardian (dubbed 'the Flying Peanut'), was described as one of the most advanced vertical takeoff and

landing (VTOL) surveillance systems designed for intelligence gathering. But of course the Canadian Forces were never able to purchase it. Is this the UAV version of the Avro Arrow?

There are other actors too.

*Meggitt Defence Systems Canada* (formerly *Schreiner Canada*), based in Medicine Hat, Alberta, describes itself as the Canadian Centre of Excellence for towed targets and UAVs. *Schreiner Canada* has been in the targets business for over 20-years and is a world leader in the design, development and manufacturing of free flight aerial, marine and ground-based targetry.

In Montreal, *CAE* is a leading provider of integrated training solutions and advanced simulation and controls technologies to civil aviation and military customers.

*CAE's* Marine Controls was recently acquired, and the renamed division,

known as *L-3 Communications MAPPs*, continues to deliver high-end marine solutions and technologies.

*Micropilot*, north of Winnipeg, has been designing miniature autopilots since 1995 using low cost COTS GPS receivers and micro electro-mechanical rate sensors.

The challenges facing a Canadian UAV manufacturer were featured at the UVS Canada Symposium in 2004 with the story of the "Snow Goose," an intriguing blend of existing technologies applied to fill a niche in the unmanned world. The Ottawa based company *MMIST* came up with this innovative solution to a long-standing US military requirement to deliver leaflets in a hostile area without risking pilots' lives. The "Snow Goose" is described as a cargo container powered by an engine and suspended from a ram-air parachute. It can be guided to a destination hundreds of kilometres away, drop its load of leaflets and carry on to a recovery area, all for a relatively modest cost.

As we are preparing this article, word comes from Toronto that a mini, state-of-the-art, UAV from *Advanced Subsonics Inc.* called "Grasshopper" was demonstrated March 14 and 15 at the CeBIT tradeshow in Hanover, Germany. The Grasshopper UAV system, which is fully networked and operates using standard Internet protocols, was flown in Ottawa, Canada while being fully monitored via the Internet on an identical ground station at the CeBIT show in Hanover, Germany. Visitors to CeBIT were treated to live footage of the flight operations site in both the visible and infrared spectrums from the Grasshopper's stabilized, dual-camera payload. This event has been hailed by UVS Canada as the first UAV project to operate over common Internet Protocols and using NATO's STANAG-4586 standard interface, a collaboration of Canadian partners showing the way to new levels of interoperability for the entire industry.

*CDL Systems*, out of Calgary, can rightfully claim to be a leader in Vehicle Control Station (VCS) software development for use in the control of unmanned vehicles and in the control of remote surveillance equipment in both manned and unmanned applications. *CDL* looks after control for the *Meggitt/Schreiner* targets, for example. Starting in 1998, when they were part of the successful 'Shadow' system introduction into the US Army,



*The "Grasshopper" by Advanced Subsonics Inc. provides tactical information with minimum operator supervision.*



Screen shot of CDL Systems' Vehicle Control Station (VCS) software for STANAG 4586, the NATO UAV Interoperability standard.

CDL also provided the control facilities for the *Alliant Techsystems* tactical UAV Outrider program in the US. And, they are the providers of the control station software for the Grasshopper demo previously noted.

It's impressive stuff, but obviously not the only game in town. Necessity being the mother of invention, it should always be remembered how far advanced the Israeli Defence Force is in the use of UAVs integrated into their military operations. As mentioned, systems are also in service in a number of European armed forces. And of course the US has been exploiting a wide use of robots in many recent operations, in Afghanistan, where we saw armed UAVs being used to attack targets which would otherwise escaped more conventional weapons platforms, and in Iraq where a spectrum of capabilities from theatre through formation and down to unit-level capabilities were deployed.

*Predator B, with maritime/ground radars and EO/IR sensors, can provide the eyes and ears for border surveillance on land and at sea.*

## The Canadian Forces Regain Consciousness

Readers will recall that as part of the CF efforts to make sense out of the post Cold-War world, the *Canadian Forces Experimentation Centre* at Shirley's Bay, near Ottawa, was formed and tasked to look at Joint CF needs, to identify opportunities for inter-service synergy. Using the powerful tools of simulation and modeling, CFEC has established itself as the 'honest broker' to support the development of the concepts, and the acquisition of equipment for our future Forces, working on behalf of the CF staff with the decision making responsibility. The Centre is hooked up internationally via Battle-Lab to exploit the work of others too.

By Fall 2004, the CFEC had conducted a series of simulated and live experiments with UAVs and the information environment that supports their use. This work is founded in the emergence of the synergies embodied in the expression 'C4ISR'.

In order to improve situational awareness and obtain a more timely, informative common operational picture, the CF needs a better intelligence, surveillance and reconnaissance (ISR) and command-and-control capability, as well as processed information and intelligence. Such an improved capability would enhance not only the operational capabilities of the CF and its contributions to multinational operations, but also its ability to support other federal government institutions and other levels of government in domestic defence and security missions.

The first concrete steps in this reawakening took place three years ago in Suffield, Alberta. As reported in the CF newspaper, *The Maple Leaf*, Exercise ROBUST RAM was the background for CFEC Concept Development and Experimentation work involving three UAVs – the Pointer, the Guardian and the I-GNAT – all leased for the exercise from the manufacturers.

The Pointer, produced by *AeroVironment Inc.* is a hand-launched, battery-powered aircraft about the size of a large model airplane, with a daylight TV camera capability and a flight endurance of 90 minutes at 152m; the Guardian, the vertical take-off UAVs produced by *Bombardier*, are currently out of production; and *General Atomics Aeronautical Systems'* ASI I-GNAT (bought by the U.S. in 2003) is about the size of a small Cessna, and can fly at 7,620m for up to 52 hours and carry either the American Lynx Synthetic Aperture Radar, which allows operators to see through clouds for an all-weather capability, or a state-of-the-art EO/IR sensor. As well as a reawakening, the results here were clear enough to support the operational use of the I-GNAT in support of the G8 summit in Kananaskis.

*General Atomics Aeronautical Systems* is also involved in border security. Its Predator B is heavily equipped with surveillance technologies.



In 2003 the focus shifted to the Pacific coast where the Pacific Littoral ISR Experiment (PLIX) was held to employ an Israeli Aircraft Industries Eagle 1 in support of maritime surveillance work out of Tofino, BC. The Israeli team, with CF observer/participants, flew the aircraft a total of 23 hours, split into five flights, each designed to test a different function. The Agate Passage, a U.S. naval ship, and Canadian Coast Guard vessels acted as targets during the experiment.

As reported in the CFB Esquimalt newspaper that summer, a foreign cargo ship unwittingly became a participant in the experiment when the UAV's surveillance equipment captured it polluting the waters off the coast! The ground crew monitoring the sensors detected a dark slick trailing from a passing cargo ship. By flying the UAV closer and using the electro-optic sensor, the group was able to get footage of the pollution, the ship and its name printed on the side of the vessel.

In addition to this unexpected bonus, review of the initial analysis of the Plix results indicates that weather, real world events, system architecture and the relative inexperience of CF personnel in UAV ops adversely impacted on the platform's and team's performance. But that's what they were conducting the experiment for!

Keeping up the pressure, 2004 saw a much more ambitious A(tlantic) LIX, with results in the form of a tonne of data (some 100 gigabytes!) for which the analysis has not yet been completed for release. As previously reported in *FrontLine*, ALIX officially lasted from August 10 to September 16, 2004 and was based on a number of scenarios.

Initially, an ALTAIR UAV, leased from General Atomics and equipped with cam-

eras, radar, redundant sensors and control arrangements, flew out of Goose Bay, with control being passed to a remote operating centre at Telesat Canada in Ottawa. During a flight of some 23 hours, the ALTAIR was directed North to the Arctic, tasked to help find the crash site satellite crash of a foreign satellite (sound familiar?). The UAV was integrated into Exercise Narwhal, a Canadian Forces Northern Region exercise on Baffin Island. Support was provided there to an on-site Joint Force Commander.

The second flight (the peace-support scenario) called for a maritime surveillance and targeting mission in the Gulf of St. Lawrence, in which the ALTAIR UAV transmitted beyond-line-of-sight data and imagery via the Ottawa Remote Operating Centre across the integrated ISR architecture to a Joint Force Commander at MARLANT HQ. It also flew over the Gagetown training area in New Brunswick (coinciding with ARCON 2004, the annual concentration exercise for Army Reserve units in Land Forces Atlantic Area), providing reconnaissance and targeting information to the local ground force commander. Over Gagetown, the ALTAIR operated with another joint forces asset, a Silver Fox Mini UAV flown by a Coyote reconnaissance team. And the info was shared with a Canadian warship en route.

During the third flight (the defence of Canada scenario), the UAV conducted a maritime surveillance, reconnaissance and targeting mission over the Grand Banks. Again, the UAV transmitted the data collected in flight to a Joint Force Commander at MARLANT HQ to enhance his situational awareness and to improve his ability to deploy the forces under his

command. Where possible, the ALTAIR also looked at all points coming and going between scenarios.

## The Environment is 'Joint'

With the CFEC at the helm, the recent CF activities in the UAV business have been fully coordinated at the 'Joint' level. (The exception for the moment occurred with Canada's involvement in the NATO ISAF in Kabul, when an urgent operational requirement for a tactical UAV was raised. In an expedited project, the CF purchased, trained and deployed the SPERWER system from an *Oerlikon Contraves-SAGEM* partnership in a very few months. The SPERWER is now back in Canada for system refurbishment by the contractor, and 'Canadianizing' the support infrastructure before it can be fully exploited. It remains to be seen how best it can be integrated into a Joint CF family of sensors.)

But the most important results coming out of the 'experiments' to date concern the information environment in which the UAV operates. It is crystal clear in the minds of virtually everyone involved, that the UAV is but a means to an end. It can carry sensors and other payloads according to its specific capabilities and limitations, but it's the collection, analysis, and sharing of the information generated that really defines the value of the whole system. The ALIX, for example, was designed to test and demonstrate concepts of 'network-enabled operations'. If everyone involved is seeing the same information, this collaborative environment speeds up decision-making and promotes self-synchronization. So, everything was hooked up via satellite communications and carried on CF networks. A sanitized version of the outputs was also carried via a portal on the CAN-MARNET so that it was available to any agency of the Canadian government who could play a role.

It's a C4ISR challenge, not just a UAV platform derby.

## Meanwhile, Out there...

It's not surprising to learn that, just as Canada has been experimenting, other world users are also moving ahead. A number of innovative American, European and Israeli manufacturers are beavering away to meet the ever-increasing requirement for more and better info, in situations where unmanned assets are ideal.



Eagle multipurpose UAV system.

PHOTO: ISRAEL AEROSPACE INDUSTRIES INC.



Silver Fox mini UAV is prepared for flight.

PHOTO: THALES CANADA INC

An outstanding example, not far from where we sit, involves the US border security authorities who have turned to Israel to provide a system to help control the US-Mexico border. Since last summer, Israel's *Elbit Systems Ltd.* has provided its Hermes 450 unmanned aerial vehicle (UAV), to the Department of Homeland Security's Custom and Border Protection as part of the Arizona Border Control Initiative along the Arizona Mexico border. Equipped with the company's CoMPASS multi-sensor stabilized electro-optical payload, the initiative is intended to provide surveillance along the Mexican border for various homeland security applications, including illegal immigration and drug smuggling.

Under the lease contract, Elbit Systems and *EFW Inc.*, its wholly owned subsidiary based in Fort Worth, Texas, provide Hermes 450 UAVs, ground control stations, and operational and maintenance crews for UAV flight support of border patrol operations. Serving as the eyes of the Hermes 450 UAV, the CoMPASS, developed and manufactured by Elbit Systems subsidiary *Elop Electro-Optic Industries Ltd.* (El-Op), is equipped with a third-generation, forward-looking, infrared sensor, eyesafe laser rangefinder/designator, and night-vision goggle-compatible laser target illuminator. And get this: the Hermes has apparently been doing its thing quite reliably, with a fraction of the crew it takes to support many other UAVs... sounds like something we should look into?

### So What Happens Next?

Readers will recall that the *Advanced Ceramics Research* "Silver Fox" UAV was purchased from *THALES Systems Canada* as part of a collaborative, CF-wide experimentation to permit Canada's navy, air force and army, as well as Defence Research and Development Canada (DRDC), to enhance their understanding about the potential use of mini UAVs in the modern battlespace. The Army took delivery in Gagetown, where it was used in conjunction with the ALIX last summer. This has permitted further concept development work, as well as feeding into the other ISTAR projects on sensor fusion and overall integration with HQ staffs. The proper exploitation of a UAV obviously must take into account the technical and procedural implications of how the 'business' of a HQ works, as well as the infrastructure to support it and such mundane questions as who is responsible for its care and feeding.

According to officials at THALES, the CF will soon purchase more "Silver Fox" mini UAVs for continued trials with the Navy and the Army, so the 'experiments' are by no means over: the support infrastructure, the organizational placement, airspace control, how best to capture a UAV on a ship... there are lots of issues still to work on.

It is understood that the CFEC will finish its part of the analysis of the UAV experiments, and hand off the results to a Joint Project Office. The recent formation of what appears to be a Joint Requirements Office in the Directorate of Air Requirements is seen as clearer focussing on the hard requirements in relation to

the overall C4ISR domain. Where do we want to look: over the hill, around the littoral, over the whole country? This is good news, and one can only hope that it continues in that vein.

The WATCHKEEPER project in the UK is cited as an example we might learn from: this \$2B Cdn project has apparently put some 15% up front in a funded trade-off between a number of competing systems. Concentrating on the total cost of ownership for a system to satisfy a number of information requirements, this may well be vindication for the advocates of the application of modeling and simulation to the front end of a procurement process... and apparently, the term UAV is barely mentioned in the statement of requirements!

### Staying the Course – This Could Get Interesting

As we launch into the next phase of Canada's re-awakening in the UAV business, it's important to keep the outcome in mind. Our country has both a fine history and industrial basis to make a difference in the unmanned business, especially in the support and integration areas and simulation. Who do we partner with? Where do we go to get the best systems experience and support? We are also fortunate to have UVS Canada available as a forum to encourage information exchange between all the people involved, and to broaden the perspective beyond the purely military.

In the Canadian Forces, it seems that the joint approach is the best way to get at what we want, in a manner that also fits our frugal budgets. Let's hope that those involved remain focussed on the information requirements/systems need, versus the temptation to go after any specific platform. This isn't always easy, but in this business, the payoff is big. **FL**



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For a quick look at Canadian UAV history, see Simon Fraser's "Canadian American Strategic Review: DND 101"

[www.sfu.ca/casr/101-0intro.htm](http://www.sfu.ca/casr/101-0intro.htm)

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