Advanced Integrated Multi-sensing Surveillance (AIMS)

Capabilities for Future SAR and ISR Missions

N. Léchevin; V. Larochelle; S. Roy; K. E. Likuski; T. Rea
DRDC Valcartier

Defence R&D Canada – Valcartier Scientific Literature
DRDC Valcartier SL 2013-011
April 2013

Abstract

This article provides a preliminary performance assessment of the Advanced Integrated Multi-sensing Surveillance (AIMS) system in detecting and identifying targets, whether in an Intelligence, Surveillance and Reconnaissance (ISR) or Search and Rescue (SAR) context. Since the system received airworthiness certification in 2010, two trials have been conducted in 2011 using a NRC-FRL Twin Otter (DHC6) aircraft [3]. A winter trial at Canadian Forces Base Valcartier, Qué., and fall trial in Summerside, PEI, allowed the team to test performance in various natural environments, lighting and weather conditions.

Résumé

Cet article présente une évaluation préliminaire de la performance du système perfectionné de surveillance multicapteur intégré (Advanced Integrated Multi-sensing Surveillance [AIMS]) par rapport à la détection et à l'identification de cibles, dans un contexte de renseignement, surveillance et reconnaissance (RSR) ou de recherche et sauvetage (SAR). Depuis que le système a reçu sa certification de navigabilité en 2010, deux essais ont été menés en 2011 au moyen d'un avion Twin Otter (DHC-6) du Laboratoire de recherche en vol du Conseil national de recherches du Canada [3]. Un essai d'hiver à la Base des Forces canadiennes Valcartier, au Québec, et un essai d'automne à Summerside, à l'Île-du-Prince-Édouard, ont permis à l'équipe de tester la performance dans divers environnements naturels et dans conditions d'éclairage et des conditions météorologiques diverses.

This page intentionally left blank.

ADVANCED INTEGRATED MULTI-SENSING SURVEILLANCE (AIMS) – CAPABILITIES FOR FUTURE SAR AND ISR OPERATIONS

N. Léchevin, V. Larochelle, S. Roy, Captain K.E. Likuski, T. Rea

CONTEXT

Recent progress in active imaging adds a new sensing capability to standard electro-optical systems exploited in airborne applications. Active imaging systems provide their own illumination, enabling target interrogation in absence of ambient light. This capability is complementary to thermal imagers and to passive image intensifier systems. Thermal imagers require thermal contrast to deliver useful imagery to the operator. Passive image intensifiers sometimes cannot provide sufficient contrast in very low-light level conditions (overcast nights) or in degraded visibility conditions (rain, fog or snow). In absence of thermal contrast and in very low-light level conditions, active imaging systems stand out.

The Advanced Integrated Multi-sensing Surveillance (AIMS) system (Figure 1) is, to the best knowledge of the authors, the first airborne, range-gated, active-imaging based technology integrated in an electro-optical multi-sensing gimbal demonstrator [1]. This demonstrator, led by Defence Research and Development Canada − Valcartier (DRDC Valcartier), was developed to significantly improve the all-weather, day and night, Intelligence, Surveillance and Reconnaissance (ISR) and Search and Rescue (SAR) sensing capabilities of the Canadian Forces (CF). The multi-channel, geo-referenced motion imagery capability benefits the CF via demonstrations, trials, experiments and exercises, and ultimately helps the CF shape future procurement efforts.

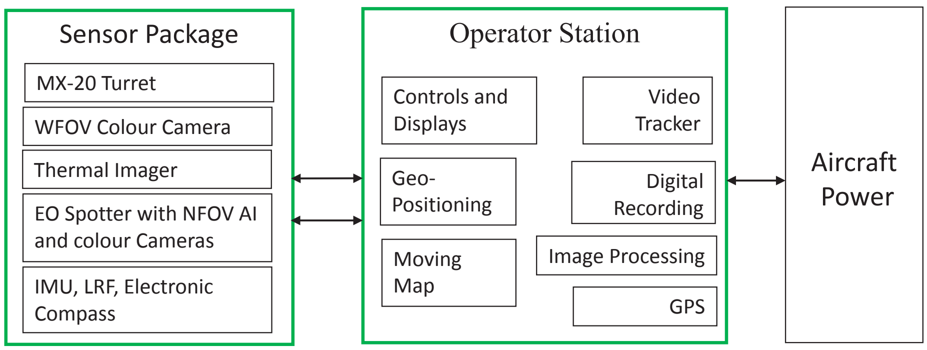
(a) (b)

Figure 1: AIMS system [2] (a) and operator station (b).

This article provides a preliminary performance assessment of AIMS in detecting and identifying targets, whether in an ISR or SAR context. Since the system received airworthiness certification in 2010, two trials have been conducted in 2011 using a NRC-FRL Twin Otter (DHC6) aircraft [3]. A winter trial at Canadian Forces Base Valcartier, Qué., and fall trial in Summerside, PEI, allowed the team to test performance in various natural environments, lighting and weather conditions.

TECHNOLOGY

AIMS sensors consist of an active imager [4], a thermal imager, wide and narrow Field of View (FOV) colour cameras, a laser rangefinder, a GPS and an operator station [5]. The displays allow the operator to understand, process, integrate and control the information flow in a timely and effective manner (Figure 2). With high resolution sensors and accurate pointing, the system can accurately geo-localize targets [6]. Sensor data (audio, video, still imagery), metadata and mission logs are recorded on a network video and recorder playback device and are presented to the operator using a standalone mapping, sensor control and user interface.

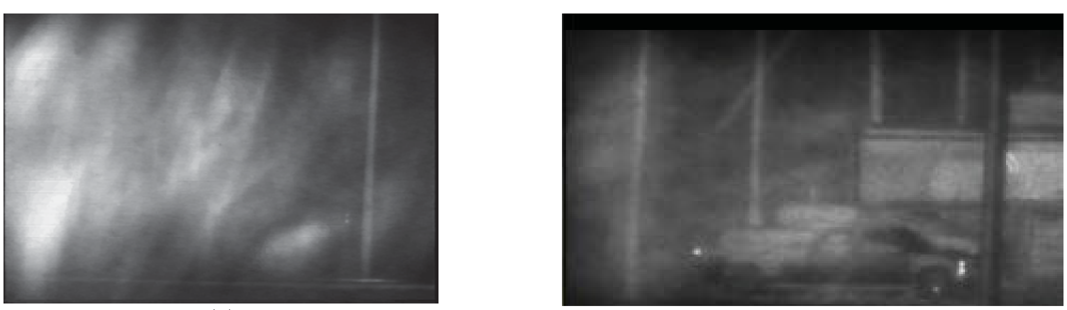


List of abbreviations

AI	Active Imager
EO	Electro-Optical
GPS	Global Positioning System
IMU	Inertial Measurement Unit
LRF	Laser Rangefinder
W/NFOV	Wide/Narrow Field of View

Figure 2: AIMS design concept

Central to the Technology Demonstrator's sensor suite is the active imager, which consists of a visible/near-infrared, narrow, field-of-view, range-gated, intensified camera and a laser diode array illuminator. Advantages of active illumination include surveillance in complete darkness, detection of objects based on their reflectivity contrast, detection of optical sights (binoculars, riflescopes, cameras), and penetration through glass. Further, the active imager range gating controls the camera intensifier to significantly reduce backscattered light caused by aerosols such as fog, smoke, rain, and snow, as shown in Figure 3. Background effects, blooming effect caused by the presence of bright light sources, and potential of being dazzled are also reduced.



(a) (b)

Figure 3: Ground observation of a car at night through snow before (a) and after (b) the activation of range gating.

PERFORMANCE ASSESSMENT

Throughout the two trials, flight conditions (altitude, flying speed, slant distance; day, night and twilight flights) and operating conditions (field of view angle, sensor slant angle) of AIMS sensors suite were varied to assess its performances [7]. Two types of missions were flown, namely, orbital flights centered on various targets and SAR mission flights. The SAR missions involved flying along parallel track patterns that covered a 5 km by 5 km area where the targets were deployed. The targets consisted of such objects as parachutes, letter panels, a 4 m by 5 m aircraft wreck mock-up, debris, seats, boxes (cooler), a 3.15 m by 5.65 m optical resolution target, a vehicle with armed soldiers wearing camouflage battledress, and strobe lights.

Target detection, classification, and identification

Although the sample size of the dataset resulting from the trials is too small to compute empirical conclusions with a satisfactory confidence level, the following three definitions qualify how we assessed performance.

Detection rate: Detection of an object ranges from 0 to 100% as the object fills more and more pixels with sufficient contrast on the specific imager under consideration. The number of pixels required for 100% detection is not sufficient to provide any shape information. An object such as a box can be discriminated from its environment but there is not enough information to classify it as a box, a ball, or a tree.

Classification rate: Classification of an object ranges from 0 to 100% as the shape of the object becomes more and more defined for the specific imager under consideration. Thus, classification would be solely based on shape, which requires that a sufficient number of pixels are available to well-define the object’s outline. Moreover, the main variations in time and space of the shape of an object should be detectable, thus enabling the classification of such objects as dynamic/static objects, or animate/inanimate objects. For instance, the three sizes of white letter sequences on the black panel can be differentiated. Human being can be considered as a class but there is not enough information to identify a human as a military person with a battledress and gun or as a civilian.

Identification rate: identification of an object will range from 0 to 100% as more details about the object are revealed for the specific imager under consideration. The details could include identifying features such as its colour scheme, the presence of specific structures, or the ability to read a name of other identifying text. Identification of the soldier is achieved when such features as the battledress, snowshoes, rifle, helmet, and walkie-talkie can be recognized.

Quantitative analysis

Quantitative analysis establishing correlations between Measure of Performances (MOPs) like sensor resolution or geo-positioning accuracy and operating variables (e.g., slant distances, FOV angle) has been carried out with the optical resolution target, complying with theoretical estimates and with the ground sample distance. This distance corresponds to the diffraction limit angle and represents the resolution lower bound of the active imager.

Winter trial nighttime flights, performed under clear sky, provided the characterization lower bounds (slant range) for the targets presented in Table 1, where AI and IR stands for the active imager and the infrared imager, respectively. Empty rows correspond to missing data.

Table 1: Discrimination limits for various targets characterized at night.

Targets	**Detection range (m)**	**Identification range (m)**
Life jacket retroreflectors	≥ 8350 m (AI) ≥ 2500 m (IR)	
Aircraft parts	5433 m (AI)	1726 m (AI) 5277 m (IR)
Letter panel	4500 m (AI)	1646 m (AI) 2456 m (IR)
Soldier	5433 m (AI) 5277 m (IR)	2234 m (AI) 2369 m (IR)
Seats	5433 m (AI) 4211 m (IR)	3431 m (AI) 3472 m (IR)

Reading letters such as aircraft registration signs may be central to identifying targets in nighttime tactical mission and search and rescue operations, or ship identification. Signs of 15-cm and 30-cm height were stuck on the wing, fuselage, and on the elevator of the aircraft wreck mock-up. Black panels with white letters of various sizes (10.2 cm, 17.8 cm, and 35.6 cm) were also deployed. As shown in Figure 4, 30-cm registration signs located on the rudder can be read with AI at an altitude of 4090 ft (1246 m) and a slant distance of 1627 m. It should be noted that only C, J and part of A letters remained fixed on the elevator. The other letters were removed.

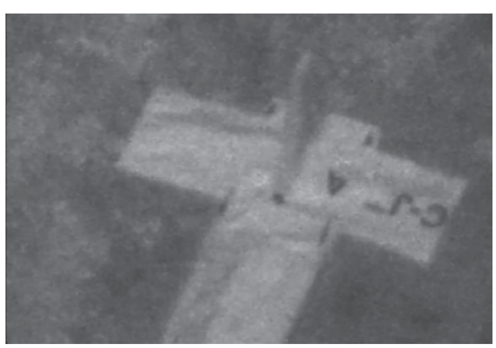


Figure 4: Aircraft registration signs revealed at night by the active imager [8].

Figure 5(a) shows that 17.8-cm and 35.6-cm white letters can be read on a black panel at an altitude of 7084 ft (2159 m) and a slant distance of 2456 m (nighttime). The 10.2-cm letters cannot be clearly read, although it is still possible to classify these white objects as being letters. For comparison purpose, Figure 5(b) shows the same panel displayed by the narrow FOV visible camera used in passive mode before twilight (slant distance =1994 m). Results are similar in both cases (active mode at night and passive mode at twilight).

(a) (b)

Figure 5: Letter panel displayed by (a) the active imager [9] and (b) the narrow FOV visible camera (passive mode) [10].

The letters cannot be read using the IR imager under the same conditions, as shown in Figure 6. Attempts to read the letters at 19h40 (twilight time) led to the same result despite a possible greater thermal contrast.

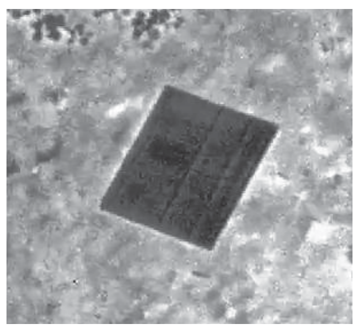
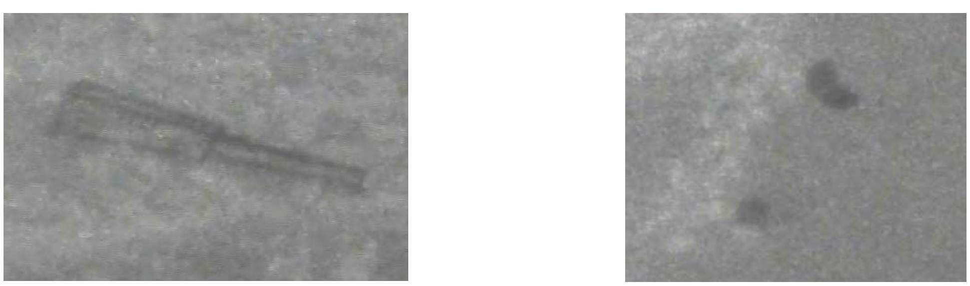


Figure 6: Letter panel displayed by the infrared image [11].

A set of black pipes, a 1-m^2 metal, two seats, strobe lights and a red can were deployed to represent a mock-up of a burned aircraft. It has been found that every object can be identified at a distance greater than or equal to 3 km, as shown in Figure 7. The strobe lights can be detected at a slant distance greater than 6 km whether AIMS active imager is in passive or active mode (Figure 8).



(a) (b)

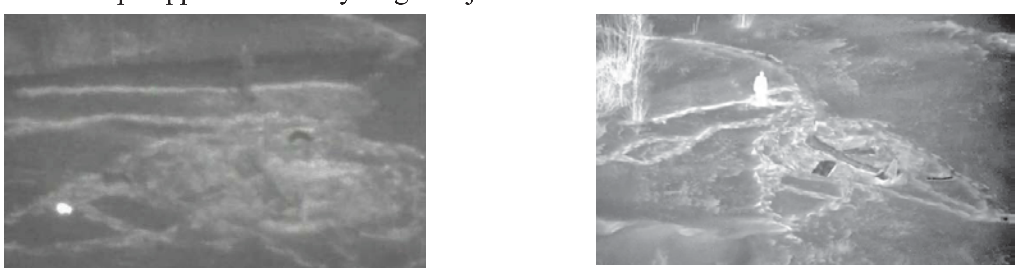
Figure 7: Black pipes (a) and two seats (b) displayed by the active imager at night

Figure 8: Strobe light and other elements of the burned aircraft mock-up displayed by the active imager at night [12].

Qualitative analysis

Effective operator training is central to achieving fast detection of objects. This training includes understanding the object signature in various contexts, and accounting for such factors as the type of terrain and cover, temperature, lighting conditions. Indeed, complementary information obtained from the combined exploitation of the infrared and active imagers should be fully leveraged.

Figure 9 suggests how to benefit from the use of both imagers by noticing that the life jacket retroreflector can be clearly detected using the active imager at night, at a distance of 2741 m, while thermal contrast such as those entailed by footprint in snow, the soldier, and the aircraft mock-up wings are clearly displayed by the infrared imager at night. In Figure 9(a), the retroreflector tape appears as a very bright object.



(a) (b)

Figure 9: Aircraft wreck mock-up displayed at night by the active imager (a) and by the thermal imager (b) [13].

One of the targets included two soldiers with winter camouflage (white) and personal small arms. The active imager is sensitive to reflectivity contrast at its illumination wavelength (860 ± 5 nm) such as that resulting from the white battledress and the black weapons, and we clearly identify the two rifles in Figure 10(a). The contrast is lower in the thermal image, although the FOV angle is larger than that of the active imager. Warm parts such as the head and gloves of each soldier can be identified. Due to a very low ambient temperature, -23ºC, the thermal contrast between the rifle and the background make it extremely difficult to identify the rifle at a slant distance of 1840 m and an altitude of 1556 m (Figure10(b)).

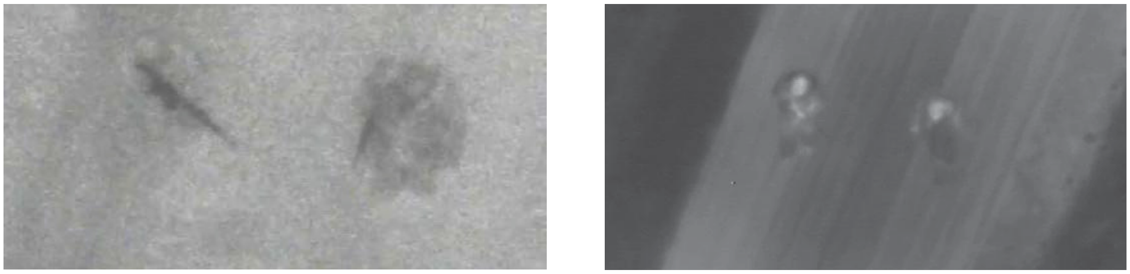

(a) (b)

Figure 10: Two soldiers at night with winter camouflage and small arms displayed by the active imager (a) and the thermal imager (b) [14].

Three points are worth mentioning: First, reflectivity contrast may result from the type of textile and not necessarily from its colour. Indeed, it has been shown that, given a type of textile, a high reflectance is obtained at 860 nm regardless of the colour of the textile [15]. Second, the position and orientation of the sensors with respect to a target may affect the appearance since thermal and reflectivity contrasts of the environment change with the viewing slant angle. Finally, object identification is facilitated when using video (kinetic images) as opposed to using a still image as shown in the figures of this article. Over multiple video frames, the human brain tends to average out random noise in the raw data. Many real-time noise reduction techniques are available, but it is beyond the scope of this article.

Interestingly, targets of opportunity, detected while flying near or over the trial area, helped assess AIMS detection and identification capabilities. For instance, a bird formation flying at low altitude was detected, at night, using the IR imager, at a slant distance of 3.1 km. Owing to the range gating, which is tuned to assess ground opportunity targets, the bird formation remained undetected with the active imager. However, a single bird flying over a water area has been detected by the active and infrared imagers at a slant distance of 2.1 km. A group of three slow moving animals was detected in a field using the infrared imager at a slant distance of 3 km. The active imager could clearly display a reflective object attached to each animal (most likely cows). The reflective objects are likely to be a small identification tags attached to the ear of each cow. We have also observed a family of beavers at ranges beyond 1.5 km, and were able to identify them by the shape of their tails (IR) and when they were looking towards us from the retroreflections in their eyes (Active mode), while clearly resolving the two eyeballs.

HOW MAY AIMS IMPACT TARGET SEARCH?

SAR-type missions with AIMS

A parallel track pattern has been adopted to search at nighttime a set of four targets deployed over the trial areas (aircraft wreck mock-up, parachutes, burned aircraft, vehicle with two armed soldiers). This pattern has been selected for its simplicity. Several track spacing values were selected depending on such experimental parameters as the flight altitude as well as AIMS sensor FOVs and looking angles.

It would be highly desirable to assess the lateral range function [16] of AIMS, particularly that of the thermal imager. This assessment would be done in a closed loop with an operator working in a SAR mission target detection context. The best sweep width could then be determined, thus defining the track spacing characterizing a standard SAR pattern. The lateral range function is the cumulative probability that an object will be detected in the sensor field of view at a specific range.

The lateral range function of AIMS is central to allocating available searching effort, determining the search pattern parameters, and computing the probability of detection over a given area and then the probability of success of the search mission. As the determination of the AIMS-operator lateral range function remains to be done, the sweep width has been set to the maximum detection range. This range corresponds to the FOV width of the sensor given a prescribed FOV angle and flight altitude. The coverage factor, which is the ratio of the sweep width to the track spacing, was set to 1.4 to ensure sufficient margin between two consecutive passes in case of drift.

The track spacing used to define SAR patterns is typically twice as much as the visibility horizon, resulting in spacing equal to 10 nm (18.5 km) for night searches [17]. However, active imaging in search missions is limited by its small field of view angles. For instance, assuming a slant angle of 30°, a FOV angle of 0.47°, and a flight altitude of 10 kft gives a sweep width of 50 m. Consequently, the active imager cannot realistically be used for target detection unless the likelihood that the search object is contained within the known boundaries of a very small area is very high.

The thermal imager was thus used for night search with a FOV angle of 22°. The wide FOV color camera was also used for daytime target search. Target assessment was carried out with the colour narrow FOV imager and the IR imager smaller FOV angles for daytime missions, and with the thermal imager and the active imager smaller FOV angles for nighttime operations.

Lessons learned

Detecting an object of potential interest, whether at night or at day, is a strenuous task.

First, the area displayed on the monitor, which depends on the sensor slant angle and the aircraft altitude, was deemed too large to achieve an efficient target search with a reasonable workload for the operator. For instance, a sensor slant angle and a flight altitude set to 30° and 3 kft, respectively, result in a search area of 645 m by 1422 m displayed on AIMS monitors (FOV angle of 20°). Higher altitudes (5 kft, 7kft, and 9 kft) were flown, giving rise to larger areas to be scanned on monitors.

Second, the speed at which an object remains on the monitor is also a factor that may impede the detection process. For instance, the Twin Otter aircraft, flying at a speed of 120 kt (61.7 m/s), took 23 s to fly over a longitudinal FOV length of 1422 m (altitude of 3 kft, sensor looking angle of 30°, FOV angle of 20°). The ground moved too quickly on the monitor to be properly evaluated.

Interestingly, the active and the infrared imagers significantly enhance target and terrain assessment at night by adjusting, in real time, the FOV angles of both imagers. In so doing, the aircraft altitude remains unchanged throughout the mission, therefore resulting in pattern flights that are more time efficient and less hazardous than those followed when using para flares. Indeed, target and terrain assessment is frequently carried out by means of para flares, if conditions permit. Para flares are dropped from 4500 ft above ground level (AGL) and burn for 5 min. The time needed for the aircraft to descend for target assessment (1000 ft AGL) or for terrain assessment (2000 ft AGL) is such that only 1 to 2 minutes remain available for actual target identification [17].

CONCLUSION

The exploitation of active and IR imaging provides complementary information that tends to improve target assessment, thus contributing to enhance situational awareness. The active imager is best used for target identification and confirmation rather than for target search, owing to the narrow laser field of illumination and intensified camera limited FOV.

Active imaging is efficient in recognizing and identifying, at night, objects and signs of various sizes at ranges up to 10 km. The active imager excels at detection of reflective objects, as well as objects with high contrast at the illumination wavelength. This capability allows reading at night the registration number on the wing of a wreck, or a ship, for example. Indeed, the use of even small retroreflective tapes on life jackets, for instance, is highly recommended, should an active imager be integrated as a search tool into the future fixed-wing SAR aircraft. However, except when detecting optical sights or retroreflectors in daylight, the active imager is limited; it is suited to improving the night time detection and identification capabilities of thermal imagers.

While we have performed preliminary search concepts of operations (CONOPS), comparing imager types and FOV settings, a method for sweeping the search area with sensors (forward mode, auto mode) as well as (near-) optimum flight conditions such as the aircraft altitude and speed as well as the type of search pattern remains to be defined.

WAY AHEAD

To assess the effectiveness of AIMS-operator system with a view towards proposing near-optimal CONOPS and flight patterns, we recommend that statistically significant experiments be undertaken. Measures of effectiveness should include the lateral range function, false alarm and misclassification rate, time for target detection, classification, and identification, and evaluation of the operator's workload during a target search mission.

Interestingly, the NRC-FRL is leading, in collaboration with DRDC Valcartier, a three-year project [18] that aims at conducting an extended statistical analysis of the in-flight operation of an electro-optical multi-sensing system like AIMS used to detect a class of targets that are typical of SAR missions.

Regarding degraded night weather conditions, preliminary results have shown that range-gated active imaging is quite efficient through snow and rain. Furthermore, recent tests conducted with the presence of various types of dust and smoke in the aerosol chamber at DRDC Valcartier have shown that one can obtain detection and identification range improvement compared to low-light level cameras, and even better than IR sensors in low thermal contrast conditions.

Further experiments should be conducted to assess long-range performance (between 10 km and 20 km) and low-visibility performances by testing AIMS sensors in actual dust conditions. To this end, trials involving tactical scenarios with AIMS installed onboard a CC130 Hercules aircraft by means of the Rapid Mount Airborne Sensor System (RMASS) [19] are planned in 2013-2014 (Figure 11).

Figure 11: Preliminary phase of RMASS and AIMS systems integration on the DND CC-130 training Hercules at CFB Trenton.

Although conceived in 2004, and tested starting in 2010, AIMS performances could be improved in the near future. Imaging technologies evolve at a very fast pace. For instance, in 2012, Obzerv Technologies, the manufacturer of the tested active imaging system, advertised an active imager of similar size with four times the power as that embedded in the AIMS turret, while drawing substantially less power and generating less heat. Similarly, fleets of stabilized turrets are now standardized around digital products, thus offering superior HD resolution and very low noise.

Acknowledgement

The authors would like to acknowledge Ramesh Srinivasan, Marc Alexander, and their crew members at the NRC-FRL in Ottawa for contributing in every aspect of the planning and execution of the flight trials mentioned in this article.

List of abbreviations

AIMS	Advanced Integrated Multi-sensing Surveillance
CF	Canadian Forces
CFB	Canadian Forces Base
CONOPS	Concept of Operations
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance
FOV	Field of View
ISR	Intelligence, Surveillance and Reconnaissance
MOP	Measure of Performance
SAR	Search and Rescue

Notes

[1] See for instance V. Larochelle, S. Roy, L. Forand and N. Léchevin, AIMS/Northern Watch TDPs, NATO SET156-RTG86 meeting, Québec, Canada, November 6-8, 2012; G.R. Fournier, Sources et Systèmes Laser au RDDC Valcartier, http://goo.gl/UBZHO (accessed March 5, 2013).

[2] Delivered to DND by Wescam (MX-20 turret).

[3] National Research Council Flight Research Laboratory.

[4] Delivered to DND by Obzerv Technologies.

[5] Delivered to DND by Thales Systems Canada.

[6] AIMS-ISR software delivered to DND by CarteNav Solutions.

[7] G. Toussaint, S. Doyle, E. Vincent, and V. Larochelle, Measures of Effectiveness for Search and Rescue: Airborne Integrated Multi-sensor System, Spring 2008, The Canadian Air Force Journal.

[8] Altitude of 1232 m and slant distance of 1627 m (Time 20h39; 2011/09/28).

[9] Altitude of 2160 m and slant distance of 2456 m (Time 22h41; 2011/09/29).

[10] Altitude of 1550 m and slant distance of 1991 m (Time 18h11; 2012/09/28).

[11] Same flight conditions as in Figure 5.

[12] Altitude of 2113 m and slant distance of 6024 m (Time 19h48; 2011/02/15).

[13] Altitude of 914 m and slant distance of 2741 m (time: 01h25; 2011/02/15).

[14] Altitude of 1757 m and slant distance of 1840 m (Time:18h44; 2011/02/15).

[15] J.A. Herweg, J.P. Kerekes, E.J. Ientilucci, and M.T. Eismann, Spectral variations in HSI signatures of thin fabrics for detecting and tracking of pedestrians, Active and Passive Signatures II, Edited by G.C. Gilbreath and C. T. Hawley, Proc. Of SPIE, Vol. 8040, 2011.

[16] J. Frost, The theory of search – a simplified explanation, Report by Soza & Company Ldt and Office of Search and Rescue US Coast Guard, 1998, http://goo.gl/JhHbh (accessed March 5, 2013).

[17] 1 Canadian Air Division, Standard Manoeuvre Manual – Search and Rescue (SAR) Operations – CC130 Hercules Aircraft, SMM 60-130-2605, DND, Canada, (2009).

[18] The determination of AIMS lateral range function and other MOEs will be carried out under the "Evaluation and statistical analysis of EO/IR sensor performance for CONOPS development" National Search and Rescue Secretariat New Initiatives Fund research project conducted by Dr. Jocelyn Keillor (National Research Council-Institute of Aerospace Research) from 2012 to 2015.

[19] RMASS, which is a DND sponsored project, is a sensor deployment and observation platform designed for the CC-130 aircraft.

DOCUMENT CONTROL DATA

(Security classification of title, body of abstract and indexing annotation must be entered when the overall document is classified)

1. ORIGINATOR (The name and address of the organization preparing the document. Organizations for whom the document was prepared, e.g. Centre sponsoring a contractor's report, or tasking agency, are entered in section 8.) Defence R&D Canada – Valcartier 2459 Pie-XI Blvd North Quebec (Quebec) G3J 1X5 Canada	2. SECURITY CLASSIFICATION (Overall security classification of the document including special warning terms if applicable.) UNCLASSIFIED (NON-CONTROLLED GOODS) DMC A REVIEW: GCEC JUNE 2010

3. TITLE (The complete document title as indicated on the title page. Its classification should be indicated by the appropriate abbreviation (S, C or U) in parentheses after the title.)

Advanced Integrated Multi-sensing Surveillance (AIMS): Capabilities for Future SAR and ISR Missions

4. AUTHORS (last name, followed by initials – ranks, titles, etc. not to be used)

Léchevin, N.; Likuski, K.E.; Rea, T.; Larochelle, V.; Roy, S.

5. DATE OF PUBLICATION (Month and year of publication of document.) April 2012	6a. NO. OF PAGES (Total containing information, including Annexes, Appendices, etc.) 20	6b. NO. OF REFS (Total cited in document.) 19

7. DESCRIPTIVE NOTES (The category of the document, e.g. technical report, technical note or memorandum. If appropriate, enter the type of report, e.g. interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.)

Scientific Literature

8. SPONSORING ACTIVITY (The name of the department project office or laboratory sponsoring the research and development – include address.)

Defence R&D Canada – Valcartier
2459 Pie-XI Blvd North
Quebec (Quebec)
G3J 1X5 Canada

9a. PROJECT OR GRANT NO. (If appropriate, the applicable research and development project or grant number under which the document was written. Please specify whether project or grant.)	9b. CONTRACT NO. (If appropriate, the applicable number under which the document was written.)
10a. ORIGINATOR'S DOCUMENT NUMBER (The official document number by which the document is identified by the originating activity. This number must be unique to this document.) DRDC Valcartier SL 2013-011	10b. OTHER DOCUMENT NO(s). (Any other numbers which may be assigned this document either by the originator or by the sponsor.)

11. DOCUMENT AVAILABILITY (Any limitations on further dissemination of the document, other than those imposed by security classification.)

UNLIMITED

12. DOCUMENT ANNOUNCEMENT (Any limitation to the bibliographic announcement of this document. This will normally correspond to the Document Availability (11). However, where further distribution (beyond the audience specified in (11) is possible, a wider announcement audience may be selected.))

UNLIMITED

13. ABSTRACT (A brief and factual summary of the document. It may also appear elsewhere in the body of the document itself. It is highly desirable that the abstract of classified documents be unclassified. Each paragraph of the abstract shall begin with an indication of the security classification of the information in the paragraph (unless the document itself is unclassified) represented as (S), (C), (R), or (U). It is not necessary to include here abstracts in both official languages unless the text is bilingual.)

This article provides a preliminary performance assessment of the Advanced Integrated Multi-sensing Surveillance (AIMS) system in detecting and identifying targets, whether in an Intelligence, Surveillance and Reconnaissance (ISR) or Search and Rescue (SAR) context. Since the system received airworthiness certification in 2010, two trials have been conducted in 2011 using a NRC-FRL Twin Otter (DHC6) aircraft [3]. A winter trial at Canadian Forces Base Valcartier, Qué., and fall trial in Summerside, PEI, allowed the team to test performance in various natural environments, lighting and weather conditions.

Cet article présente une évaluation préliminaire de la performance du système perfectionné de surveillance multicapteur intégré (Advanced Integrated Multi-sensing Surveillance [AIMS]) par rapport à la détection et à l'identification de cibles, dans un contexte de renseignement, surveillance et reconnaissance (RSR) ou de recherche et sauvetage (SAR). Depuis que le système a reçu sa certification de navigabilité en 2010, deux essais ont été menés en 2011 au moyen d'un avion Twin Otter (DHC-6) du Laboratoire de recherche en vol du Conseil national de recherches du Canada [3]. Un essai d'hiver à la Base des Forces canadiennes Valcartier, au Québec, et un essai d'automne à Summerside, à l'Île-du-Prince-Édouard, ont permis à l'équipe de tester la performance dans divers environnements naturels et dans conditions d'éclairage et des conditions météorologiques diverses.

14. KEYWORDS, DESCRIPTORS or IDENTIFIERS

AIMS; advanced integrated multi-sensing; surveillance; ISL; SAR; MX-20; field of view; GPS; image processing

Defence R&D Canada

Canada's Leader in Defence
and National Security
Science and Technology

R & D pour la défense Canada

Chef de file au Canada en matière
de science et de technologie pour
la défense et la sécurité nationale

DEFENCE R&D DÉFENSE

www.drdc-rddc.gc.ca