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Bombardier Dash 8 is utilized for surveillance by Transport Canada.



GUARDIANS OF THE COAST

TRANSPORT CANADA'S NATIONAL AERIAL SURVEILLANCE PROGRAM (NASP)

MARITIME AIR

By Joe Spears

Canada takes a risk-based management approach to ship-source pollution response, and seeks to prevent marine pollution incidents. This prevention and response capability to deal with marine pollution incidents arising from ships is buttressed by the National Aerial Surveillance Program (NASP). Administered by the Canadian Coast Guard from its inception in 1991 until 2003 when Transport Canada took on the responsibility, the NASP is an integral element of Canada's ocean management.

The use of space-based and air assets are a central capability of a little-known element of Canada's ocean management regime – the concept of Maritime Air. This concept seeks to include all the ocean management functions provided by air assets. Maritime Air provides government departments tasked with an ocean management responsibility, with a flexible and rapid response sensor platform (depending on the particular ocean management function

required). The concept of Maritime Air was first used in the defence context as an important element of anti-submarine warfare during the Cold War.

Today, the concept of Maritime Air embraces surveillance, law enforcement, marine domain awareness, fisheries and antipollution and scientific patrols – it is a critical element of marine security and at the forefront of technology and data fusion. Combining the powerful ocean management tool of Maritime Air capabilities with space based assets is clearly the only way to provide cost effective service delivery throughout Canada's massive ocean space. The key is data fusion and real-time downloading of data collected from the sensors. The NASP delivered by Transport Canada is an important pillar of Maritime Air.

Prevention of ship source marine pollution in west coast waters will be the subject of heightened media and public scrutiny, especially in light of the recently commenced National Energy Board hear-

ings that will review, over the next 18 months, the Northern Gateway pipeline project that will transport Alberta oil sands bitumen to tidewater at Kitimat, British Columbia and then on to Indo-Pacific markets by large tankers transiting the Pacific Ocean. While a review of tanker traffic is outside the National Energy Board mandate, such movement is an integral part of this proposed massive infrastructure project. Prevention of ship-source pollution has many elements but we will focus here on Canada's pioneering detection of marine pollution in ocean space.

In 1990, a public review panel, chaired by David Brander-Smith (a well respected Vancouver admiralty lawyer and Queen's Counsel) examined all aspects of pollution in Canadian waters. The resulting report on *Tanker Safety and Spills Response Capability* – commonly referred to as the *Brander Smith Report* – made 107 recommendations, 51 of which focused on specific local regional concerns raised during the public hearing



A continuous, coordinated and intensive aerial and space-based surveillance program, using the most advanced technologies, will be most effective for detecting and deterring polluters.

processes. Recommendation number 3-12 made specific reference to the need for aerial detection and pollution prevention:

“In order to deter polluters, the Canadian Coast Guard [should] carry out a continuous, coordinated and intensive aerial surveillance program over all Canadian waters. This will require deployment of three dedicated surveillance aircraft (East Coast, West Coast, Great Lakes – St. Lawrence) equipped with the latest spill-detection and evidence-gathering technology.”

The conclusion of the report noted that:

“[If] accepted and implemented, Canada will be able to solve its ship-source oil and chemical pollution problem in a relatively short time at a comparatively insignificant cost to industry government and the public. With leadership and commitment from both government and industry, the frequency of marine spills can be greatly reduced and Canada’s capacity to respond effectively to them considerably enhanced.”

Over 20 years has passed since the prevention recommendation was made, and Canada is at the forefront of a marine surveillance program that uses fixed wing aircraft and space-based assets that focus on prevention and detection of ship source pollution. In fiscal year 2005, a record number of pollution patrol hours (1,548) were flown, detecting 78 pollution incidents. As a measure of success, the number of marine

pollution incidents in Canada has decreased, and the success of Transport Canada’s NASP, which partners with other federal government departments, is arguably the envy of the world. Let us examine this highly effective marine pollution and detection program that operates along the world’s longest coastline.

NASP Today

Transport Canada uses two dedicated Dash 8s and a Dash 7 aircraft for surveillance of vessels within waters under Canadian jurisdiction, to enforce pollution prevention regulations. These assets are strategically based in Moncton, New Brunswick and in Vancouver, British Columbia.

During maritime pollution patrols, the crew normally consists of two pilots, an equipment operator, an observer, and for overnight trips or other extended deployments, a flight engineer. The Moncton-based Dash 8 is used to conduct pollution surveillance, ice reconnaissance and maritime security surveillance in the Atlantic, Québec and Ontario Regions. The Vancouver-based Dash 8 is used for similar purposes in the Pacific Region, with the exception of ice reconnaissance due to the nature of the climate.

TC’s Dash 7 is based out of Ottawa, Ontario, and is used primarily for ice reconnaissance, pollution and maritime surveillance patrols in the Arctic. The aircraft also serves as a contingency aircraft when maintenance is being performed on either of the Dash 8s. It is specifically fitted with an all-

round view dome in its fuselage for visual observations. It has undergone an avionics update and is fitted with the MSS6000 suite of sensors. Since 2004, each of the TC surveillance aircraft have also been modified to include a suite of remote sensors specifically designed for oil pollution detection. These sensors allow the surveillance aircraft – operating at sea on a 24 hour basis under demanding weather conditions – to track and identify polluting vessels. The aircraft work in concert with RADARSAT, a satellite imagery system that uses synthetic aperture radar developed by British Columbia-based MDA to detect oil on the ocean surface from space.

The key to the NASP system is integration of the various forms of data that allow high-technology aircraft and satellite systems to detect and prosecute marine pollution. NASP is designed to detect and document ship-related pollution in Canadian waters. Facts and information collected in real time by the system can be used in court as credible evidence for regulatory offences. Additionally, the data collected in real time can be forwarded to ground data centers. Canada is at the forefront of the integration of these sensor and data systems, and the evidence stands up to court scrutiny, allowing for successful prosecutions.

Credible Sensor Data

Sensors that make up Maritime Pollution Surveillance System Components include:

- **Side looking Airborne Radar (SLAR)** is an all-weather radar that detects anomalies on the ocean surface in lowlight or cloudy conditions.
- **Ultraviolet infrared line scanner (UVIR)** is used to analyze an oil slick; it can help prevent false positives.
- **Electro-optical infrared camera system (EOIR)** is a camera that identifies vessels at long distances and low cloudy conditions; can be used in prosecutions.
- **Automatic identification system (AIS)** transponder receiver – this radio system records a vessel’s particular identity and voyage information. The AIS is critical for accurate vessel identification.
- **A data uplink system** – an air-to-ground communications system that maintains a real-time data stream.
- **Geocoded digital camera system** – these video cameras can be used to document pollution incidents and confirm vessel identity and location.

The use of aerial sensors can be very useful for the detection of pollution and its subsequent response and recovery.



PHOTO: SILVESTER LAW, HBMG

The strength of such an integrated surveillance and sensor system allows Transport Canada to increase its 24/7 all-weather surveillance capability to cover broad sections of Canada waters. Vessels cannot hide when patrols do not follow a regular pattern.

Transport Canada works closely with Environment Canada through a memorandum of understanding in the surveillance of marine activities such as pollution, ice reconnaissance and marine security. Federal government departments believe that partnering and multitasking for the aircraft is a cost-effective way to deliver program services. This has led to the creation of the Marine Aerial Reconnaissance Team (MART) that integrates these different elements and expertise. The NASP provides an economical and operational advantage for Transport Canada and Environment Canada by providing timely and accurate information for their operations. It is important to note that this surveillance data can be used by other federal departments that have related mandates such as law enforcement or marine security. The goal is to make each aerial hour as productive possible in providing useful data. Private sector contractors, such as Newfoundland's Provincial Aerospace Limited (PAL), which have been providing air services to the government of Canada, assist this federal requirement for ocean management.

The use of aerial sensors can be very useful for the detection of pollution and its subsequent response and recovery, however, for any real preventative effect to be realized, such a mission must be enthusiastically promoted to gain high visibility.

Most Canadians do not know that the Moncton-based Transport Canada Dash 8 aircraft was used in the Gulf of Mexico during the Deep Horizon oil spill in 2010. The aircraft provided situational awareness by monitoring the oil spill movement in the Gulf of Mexico. Transport Canada aircrews quickly responded to the first request in April 2010 and continued operations for four months. This "Made in Canada" solution has proved itself on the world stage and



PHOTO : L-3 WESCAM

Oil spill recovery image from turret surveillance system.

is a tribute to Canadian firms that developed some of the sensors and integration packages, as well as to the operational readiness of Transport Canada aircrews. Let us hope that this expertise is never needed in Canadian waters to respond to a major spill.

[Canada is] a world leader in using specialized technology [...] and we are confident that our new equipment will act as a powerful deterrent to potential polluters.

- Lawrence Cannon

Supplementing accurate aerial sensor data is another valuable capability. Space-based assets such as RADARSAT combine with aerial data to provide the most accurate and comprehensive information package. The sensors on space assets cover very large areas quickly and cost-effectively and are not weather dependent. Satellite imagery is provided by Environment Canada's Integrated Satellite Tracking Pollution Program (I-STOP). This essentially provides an early warning system to search for anomalies which may signify oil-like substances on the ocean surface. This allows aircraft to be tasked to locations of potential pollution incidents, to identify anomalies and a possible source, and to gather evidence for prosecution. The "mark one eyeball" of a member of the MART team is also a valuable asset.



PHOTO COURTESY OF L-3 WESCAM

Surveillance image shows a tanker has collected surface oil after a spill.

Overall, this integration of data provides a cost effective aerial response and that, coupled with the MART's expertise and vessel intelligence, combines to ensure that this element of maritime air deters and discourages illegal discharges of pollutants at sea and thus protects the marine environment. The system is truly world-class. Other countries with extensive ocean coastlines have examined alternatives. Australia, for example, uses outside contractors in their surveillance program and recently awarded Cobham a contract for marine air surveillance functions through to 2020.

Formerly known as "Coastwatch" under the Customs Service, the mandate is now part of Australia's Border Protection Command, a joint civil/military organization responsible for civil maritime security, however, the Dash 8 craft are still called "Coastwatch" aircraft. This fleet of specialized fixed- and rotary-wing aircraft perform sensor and visual surveillance of Australia's coastline and offshore maritime areas.

Ice Patrols

The Canadian Ice Service of Environment Canada and the Canadian Coast Guard are important partners for the safety of shipping in northern waters. Canada has a long history of working with the United States to defend the safety and security of North America. NORAD, the bilateral aerospace defence organization is over 50 years old and has been recently expanding into the maritime domain. The International Ice Patrol, set up in 1913 and led by the United States Coast Guard, is another element of



June 2010 (Orange Beach, Alabama)
Oil spill clean-up efforts could be seen
from the shores of Perdido Pass as oil
began to wash ashore.

international maritime air. The founding of the International Ice Patrol is an important element of the first International Convention of the Safety of Life at Sea Convention (SOLAS). Through it, the United States Government agreed to continue the overall management of the ice patrol service and the study and observation of ice conditions, including the dissemination of critical information.

Established after the 1912 Titanic tragedy, the International Ice Patrol has 17 member nations, including Canada, and today relies heavily on aircraft and satellite surveillance to track icebergs as they drift via the Labrador Current into North Atlantic shipping lanes off Newfoundland. The Ice Patrol has maintained an enviable safety record, with no reported loss of life or property due to collision with an iceberg outside the established *Limits of All Known Ice* in the vicinity of the Grand Banks. In fact, the creation of the International Ice Patrol was one factor leading to the creation of the USCG.

The IIP relies heavily on USCG aircraft to track and identify icebergs, with the patrol running from March to, in some record years, September. After the second World War, the IIP shifted from surface ships to aircraft for ice reconnaissance. The USCG uses C-130H aircraft using Forward Looking Airborne Radar (FLAR) and Inverse Synthetic Aperture Radar (ISAR). These aircraft, based in Elizabeth City, North Carolina, fly out of St. John's Newfoundland while engaged in IIP duties. Combining these two radar systems, SLAR for detection and FLAR for identification, provides an all-weather capability to detect and classify icebergs. There is a movement to also use space-based assets to provide an accurate picture of iceberg risk for commercial shipping.

Bilateral Cooperation

Canada and the United States have also had a long history of working together on Maritime Air in a non-defence context. The use of Transport Canada aircraft in Gulf of Mexico should not come as any surprise.

Given successful bilateral cooperation we have seen on the Great Lakes with the *Shiprider* program (where joint Canadian and American law enforcement teams embark together on government vessels), the future will likely advance additional cooperative initiatives in the maritime air context. There is a solid foundation and longstanding neighbour relationship between these two countries, with a shared goal of safety and security derived from ocean management.

A 2007 statement from then Minister of Transport, Lawrence Cannon, summarizes the efforts of the NASP:

"We want to send a strong message to would-be polluters around the world that we will do whatever is necessary to protect the health of a marine environment. We are a world leader in using specialized technology to determining polluters and we are confident that our new equipment will act as a powerful deterrent to potential polluters with increased ability to track them."

Domain Awareness

It is clear that, 20 years after the Brander Smith report recommendations, Transport Canada has developed a world-class watchful eye over waterways in its area of responsibility through the auspices of the NASP.

This Dash 7, flown by a Transport Canada aircrew, is conducting aerial surveillance of shipping threats.



Aerial surveillance is widely considered the most effective method for detection of oil spills. The presence of these aircraft on a year-round all-weather basis is a serious deterrent discouraging illegal discharges of pollution at sea. Additionally, these air assets can be readily used in the event of a pollution incident. Marine information in real-time, and an understanding of Canada's marine domain awareness is critically important for making proper ocean management decisions. Accurate maritime domain awareness will become increasingly important in the coming years as marine commerce increases in volume and complexity. Canada remains at the forefront of the Maritime Air concept, and Transport Canada's NSAP is an integral cost-effective element of ocean stewardship. It is and will become an increasingly important pillar of Canada's risk management approach to ship-source pollution in the coming years on the west coast. We will need more Maritime Air surveillance – early and often.

Looking Ahead

From a risk management standpoint, detecting pollution incidents offshore, far from land, buys time to mobilize a proper oil pollution response and salvage capability in a timely fashion and may prevent minor incidents from becoming major.

This will weigh heavily, I expect, in discussions and risk analyses of the Northern Gateway project and the growth in tanker traffic on the west coast of Canada. Canada is at the forefront when it comes to aerial surveillance, and the NASP is an integral part of ocean management and the stewardship of marine resources. **S**

Joe Spears, the Principal of the Horseshoe Bay Marine Group, has worked with the Coast Guard in marine pollution response.