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## Northern Network

Nav Canada prepares for next steps in bringing ADS-B coverage to major intercontinental air routes

A major evolution in air traffic control technology is underway in the vast reaches of Canada's northern airspace. Nav Canada is pioneering the use of satellite-based surveillance on high-altitude and oceanic routes, enhancing ATC coverage for some of North America's most important international air corridors.

Airlines are praising Nav Canada's efforts with Automatic Dependent Surveillance-Broadcast (ADS-B), a GPS-based system that is widely regarded as the successor to radar. The nation's ATC service provider is setting an aggressive deployment schedule, but is also consulting with its airline customers to ensure enough are ready at every step. As more carriers are certified to use ADS-B, Nav Canada is defining airspace where equipped aircraft will be given priority.

Canada is well suited to ADS-B surveillance. Its sheer size makes radar coverage too costly in many areas, but it is also crossed by busy air traffic flows that would benefit from efficiency and safety gains through improved surveillance. ADS-B offers a way to achieve these goals at a relatively low cost; an equivalent radar site would be about 12 times more expensive than an ADS-B installation.

Nav Canada began deploying the system over the Hudson Bay region, a crossroads for several international routes where there was a "natural gap" in radar coverage, says Nav Canada CEO John Crichton. This ADS-B network has been operational for about a year , using ground stations manufactured by Sensis Corp.

While around 70% of aircraft flying over Hudson Bay are equipped for ADS-B, only 50% have actually been certified to participate in the program. International airlines have to gain approval from their own national aviation authorities to use the system. Crichton expects that by the end of this year almost all aircraft will be equipped, and 80% actually certified.

**Nav Canada has installed four ADS-B towers like this one in southern Greenland. Beside the ADS-B tower (left) is a telecommunications tower built by TELE Greenland.** *Credit: NAV CANADA*

The main benefit offered by ADS-B in this case is reduced separation between aircraft. Because controllers can obtain accurate position data, they can use 5-nm separation instead of the 80 nm. required in nonradar airspace. This means more aircraft can be handled in the same airspace at once. In addition, controllers can offer airlines route flexibility and approve altitude-change requests more readily.

At the moment, Nav Canada is using reduced separation on a limited, or tactical, basis, when it has two or more ADS-B certified aircraft in sequence. From November, it will start giving priority to equipped aircraft between Flight Levels 350 and 400. This will allow controllers to offer reduced separation more regularly, with nonequipped aircraft able to use these flight levels only when ADS-B traffic permits.

Cathay Pacific Airways is one carrier that has been certified. Its aircraft cross the Hudson Bay area on polar routes from Hong Kong to U.S. destinations, and on flights from Anchorage and Vancouver to the Eastern Seaboard. The airline is a big proponent of ADS-B, and it sees tremendous potential in Nav Canada's program, says Cathay's manager of international operations, Owen Dell.

"We want to be operating in a surveillance environment," Dell says. "Anywhere air traffic control can see us, it means we're getting more efficient and safer operations." Because pilots can obtain altitude-change approvals more frequently, they can fly closer to optimum flight profiles and reduce fuel burn.

Canada and Australia—which also has a huge area of airspace to cover—are among the first countries to implement ADS-B, Dell says. Nav Canada is "really stepping up to the plate with ADS-B," and it is "really pleasing that ATC providers are finally starting to catch up on the technology that is in the cockpit."

The Hudson Bay system is already providing significant benefits to airlines, says Peter Cerda, regional director of operations and infrastructure for the International Air Transport Assn. (IATA). He says Nav Canada is not overstating the estimated annual savings of C$195 million ($187 million) in airline fuel costs, or the emissions reduction of 547,000 metric tons of carbon dioxide. "These are quite significant numbers," Cerda observes.

Nav Canada initially wanted to introduce ADS-B prioritized airspace last year, but was forced to delay the deadline because not enough aircraft had gained certification from their national regulators. More than 400 aircraft from 17 airlines have now been approved, and this number should almost double by summer. Cerda says major U.S. carriers are in the process of gaining approval from the FAA, and airlines in Europe and Asia are also expected to be certified soon.

IATA is supportive of the priority-handling concept, says Cerda. It does mean a disadvantage for airlines not equipped, but the only alternative would be waiting for these carriers to catch up. "Our position is that we need to move as quickly as possible to implement enhancements that benefit our members," he says.

Air Canada, naturally, is one of the largest users of the Hudson Bay airspace. The airline has been pushing ADS-B as a way for Nav Canada to provide surveillance at a fraction of the cost of radar, which should help keep navigation fees down, says Brian Harkness, the airline's manager of advanced technology and ATC coordination.

The only downside for airlines is the initial cost of upgrading avionics on older aircraft, Harkness says. Air Canada's Boeing 777s and Airbus A330s already have the necessary equipment to use ADS-B. However, its 767s would have to be retrofitted, and the airline has decided such a step is not worth the cost for a fleet that it intends to eventually phase out.

When the Hudson Bay airspace does become prioritized, Air Canada's 767s will have to fly below the ADS-B altitude levels, or ask for special permission to use this airspace if there is no conflict with ADS-B equipped aircraft. This means the 767s will have to carry extra contingency fuel. Air Canada's narrow-body domestic fleet will also not be retrofitted for ADS-B, as they seldom fly over the Hudson Bay.

Despite the potential headaches for the 767s, the fuel savings anticipated for the rest of the international fleet means ADS-B still has a cost saving for Air Canada. Initially, the airline will not reduce the fuel load on flights over the Hudson Bay. But the savings will come from smaller top-ups at their destinations, Harkness says.


**ADS-B sensors are installed by helicopter at one of the Greenland ground stations.** *Credit: NAV CANADA*

The Hudson Bay deployment is only the beginning of the ADS-B program. Nav Canada is also introducing coverage off its northeastern coast, to allow surveillance of aircraft using the busy North Atlantic track system. This involves the installation of ADS-B ground stations in several locations on the Canadian coastline, as well as in southern Greenland. Coverage will extend 250 mi. east of Greenland.

These sites will allow coverage for aircraft on the northern sections of the Atlantic track system, primarily those heading to the West Coast or the U.S. Midwest. Depending on winds, however, there are some days when all westbound transatlantic flights would be on the northern tracks covered by ADS-B.

The big advantage to airlines is that they can enter a surveillance environment up to 2 hr. earlier as they fly west across the Atlantic. This means they can request optimum routes and preferred higher altitudes sooner, saving fuel.

Nav Canada began operational use of the five East Coast ADS-B sites last month, but testing and certification on the four Greenland sites is still underway. The full system should be operational by November.

Farther south, oceanic coverage could be extended off the coasts of Newfoundland and Nova Scotia by installing a ground station on an offshore oil rig. “We’re negotiating with the oil companies to make sure it can be done, but we’re optimistic that it will happen,” Crichton says.

ADS-B equipage on the offshore routes is expected to increase at about the same rate as for the Hudson Bay network, Crichton says. There will also be a need to keep unequipped aircraft “on different tracks or tactically separated in some way” in the offshore ADS-B system.

While the Hudson Bay deployment was an improvement, it is the North Atlantic system that will be Nav Canada’s “really big statement” on ADS-B, Harkness says. Combining existing radar coverage and the two ADS-B networks, many of Air Canada’s westbound transatlantic flights will be under ATC surveillance for more than half their journeys.

Eventually, the goal is to have ADS-B coverage all the way across the Atlantic. Such a project would be a collaboration with the ATC providers in Iceland, Denmark and the U.K. The organizations have already begun discussions “to try to build a North Atlantic surveillance bridge,” Crichton says. “In principle, everybody wants to do it, so I would think it would [move ahead] sooner rather than later . . . what we’re talking about is the logistics of how to do it.”

Nav Canada is also looking farther northward, and intends to extend ADS-B beyond the Hudson Bay network and into the Arctic. There was a tentative timeline to achieve this in 2014, but Crichton stresses that Nav Canada has not committed to this project yet. “We’re going to do a business case analysis of that, and consult with our customers—if the business case is there, we’ll go ahead and do it.”

Harkness points out that additional ADS-B deployments should not add to airline cost—at least for those carriers that have already equipped and been certified for the Hudson Bay or North Atlantic networks. So the only expense for carriers will be indirect, if Nav Canada passed through the infrastructure cost to its customers. But this should not be unbearable, as the price tag for ADS-B will be far cheaper than for radar.

IATA's Cerda says Nav Canada is one of the most progressive ATC organizations when it comes to involving carriers in investment decisions. "They understand that airlines are a key stakeholder and customer, and they believe [modernization] needs to be done in a collaborative setting."

This means the stakeholders discuss what the benefits are going to be, and how quickly airlines can be ready, Cerda says. "An [ATC provider] can tell us they can have new technology tomorrow, but they may not have any aircraft ready to use it tomorrow."