CASE STUDY

DEPLOYING SPACE-BASED ADS-B TO INCREASE EFFICIENCY IN OCEANIC, REMOTE & TERRESTRIAL AIRSPACE

NAV CANADA is a private not-for-profit company that provides air traffic control, airport advisory services, weather briefings and aeronautical information services in Canadian domestic and international airspace. With operations from coast to coast, NAV CANADA is responsible for managing 12 million aircraft movements a year in over 18 million square kilometres of airspace. NAV CANADA is a founding partner in the Aireon joint venture to deliver the first-ever space-based global air traffic surveillance system.

CURRENT AIR TRAFFIC SERVICES SURVEILLANCE LIMITATIONS

NAV CANADA has made enhancements in air traffic surveillance coverage in recent years. The first implementation of Automatic Dependent Surveillance-Broadcast (ADS-B) in Canada was in January 2009 in the airspace over Hudson Bay. With no existing radar, there had been a surveillance gap of 850,000 square kilometers. NAV CANADA installed five ADS-B ground-based receivers at various locations around the shores of the Bay to close that gap and provide coverage. Additional ADS-B receiving stations were then installed along the east coast of Labrador and Nunavut in 2010 and Greenland in 2012 to provide additional coverage, including into Oceanic airspace. 4.1 million square kilometers of airspace are currently surveilled with ground-based ADS-B.

Despite the increases in air traffic surveillance coverage, NAV CANADA continues to have a significant amount of airspace without surveillance, notably in the Northern portions of Canada and over the North Atlantic Ocean (NAT).

FUTURE PLANS FOR SPACE-BASED ADS-B

Space-based ADS-B will cost-effectively provide coverage for these important strategic areas, while also offering substantially improved safety and efficiency for NAV CANADA's customers.

NAV CANADA will use space-based ADS-B to improve operators' flexibility to change routes and altitudes to maximize flight efficiency. The effectiveness of ground-based safety nets is also being improved, since real-time ATS surveillance data can now be used to provide an immediate alert to the air controller if a flight is not operating within its protected profile.

NAV CANADA will implement Aireon's space-based ADS-B technology in its North Atlantic operations. Using the real-time ATS surveillance data and current communication capabilities, the initial goal is to apply 15 nautical mile (NM) longitudinal and lateral separation between surveillance-identified aircraft communicating via Controller-Pilot Data Link Communications (CPDLC). A phased approach may be taken to achieve that goal, based on the number of aircraft approved under the

new Required Communications Performance criteria for using CPDLC.

Space-based ADS-B is also being used in northern Canadian airspace where procedural rules requiring separation of 1,000 feet vertical, 60 NM lateral or 10 minutes in trail still apply. NAV CANADA will apply 15 NM longitudinal and lateral separation between surveillance-identified aircraft communicating via CPDLC in its northern domestic airspace.

Where flights operate with direct controller-pilot communications over VHF, the standard separation minimum of 5 NM will be applicable.

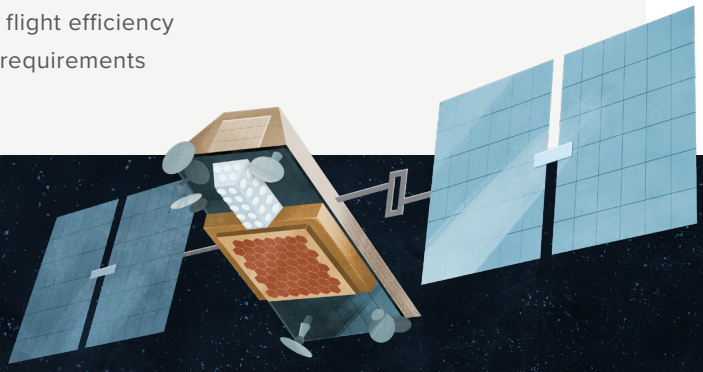
Domestically, NAV CANADA is also assessing the potential to use space-based ADS-B to provide back-up capability for radar and terrestrial ADS-B and even avoid replacement of existing ground-based surveillance infrastructure in some areas.

THE BENEFITS

Space-based ADS-B will bring significant efficiencies in airspace managed by NAV CANADA. In the North Atlantic alone, operators are anticipated to save over 125 million liters of fuel annually with Aireon's global, real-time air traffic surveillance data, which translates to a reduction of greenhouse gas emissions of over 320,000 metric tons annually.

ADDITIONAL BENEFITS INCLUDE:

- More efficient "domestic-like" flight trajectories in oceanic and remote airspace
- Improved situational awareness, conflict detection and reaction/resolution
- More flexibility in emergency situations
- Enhanced Search and Rescue capabilities in remote areas
- A surveillance source separate from the communications (CPDLC) network sources
- More complete and accurate reporting of aviation occurrences, allowing better management of safety risk and better support of the Safety Management System (SMS)
- More predictable and efficient flight profiles
- Improved profiles for opposite direction and crossing traffic
- Improved ability to climb/descend and vary speed to maximize flight efficiency
- Potential savings from reduction in ground-based surveillance requirements



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