IMPLEMENTATION OF ADS-B BY NAV CANADA

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ABOUT NAV CANADA

› Private, non-share capital company
› Second largest ANSP in the world
› 12 million aircraft movements annually
› 18 million square km of airspace
› Regulated by federal government on safety performance
OUR PEOPLE
4,800 employees across the country

OUR SERVICES
› Air traffic control
› Flight information
› Weather briefings
› Aeronautical information
› Airport advisory services
› Electronic navigation aids
To be a world leader in the provision of safe, efficient and cost-effective air navigation services on a sustainable basis while providing a professional and fulfilling work environment for our employees.
OVERARCHING OBJECTIVES

› Safety record: top decile
› ANS customer service charges: bottom quartile, and decline over long term
› Modern, cost-efficient technology: top quartile
› Provide value to our customers: improving operational efficiency through technology and service
› Work environment: among the best in Canada
› Environment: contribute where feasible to reduced aviation footprint
OUR CUSTOMERS (± 40,000)

› Airlines
› Air Cargo Operators
› Air Taxi, Air Charter Operators, Helicopter Operators
› General and Business Aviation (30,000)
CANADIAN AIRSPACE CHARACTERISTICS

› Vast distances
› Climate varies from polar to temperate
› Crossroads of global air traffic flows
› Busiest oceanic airspace in the world
› Unique northern airspace operations
› Stimulus for innovation
RADAR SURVEILLANCE

› 42 radar sites in southern Canada
› 1 million km² of airspace across Baffin Island, Lower Hudson Bay and Great Slave Lake Region

MULTILATERATION

› Tracks/identifies transponder-equipped targets
› Capacity, efficiency and safety improvements
› Wide Area MLAT: Vancouver Harbour, Vancouver Mainland, Fort St. John, Kelowna, Fredericton and Springbank
› MLAT for surface surveillance: Montreal Trudeau, Toronto Pearson and Calgary International
AUTOMATIC DEPENDANT SURVEILLANCE-BROADCAST (ADS-B)

› Supports radar-like separation
› A fraction of installation cost
› Preferred routes, reductions in fuel consumption and GHG emissions
› Hudson Bay implemented January 2009
› Northeast coast of Canada and Greenland: 2011-2012

ADS-B INTEGRATION USING NORTH WARNING SYSTEM

› Eastern portion of Canadian North
› Labrador coast and southern Baffin Island
› Implemented October 2010
› Immediate benefits in Gander Domestic and Oceanic airspace
IMPLEMENTATION PLANNING

› Current operational environment
  • Safety issues
  • Efficiency issues
  • Customer requests
  • Communication systems
  • ATM system capabilities
  • Aircraft equipage

› Opportunities
  • ATM system upgrades
  • Ground infrastructure replacement/upgrade
  • New or improved technology
  • Fleet changes
  • Air traffic changes
IMPLEMENTATION PLANNING

› Identify safety and service objectives
› Identify possible solutions
› Stakeholder identification
  • Operators
  • ATS and technical personnel
  • Regulator
  • Adjacent ANSPs
  • ANSPs that have already implemented
› Stakeholder consultation
  • Confirm objectives and assumptions
  • Consensus on solution
  • Understand and plan for stakeholder change impacts
› Safety Management
  • Integral part of the project planning from beginning
  • Identify safety metrics, requirements and goals
IMPLEMENTATION CONSIDERATIONS

› Telecommunications upgrades may be required

› ATM systems
  • Random versus rotational ATS surveillance data
  • Format and content of ADS-B messages
  • Detecting anomalous position data

› Operators
  • Avionics
  • Flight identification
  • Flight planning
  • Internal operators may be new to ADS-B
IMPLEMENTATION CONSIDERATIONS

› Regulations
  • ATS surveillance versus radar
  • Avionics certification

› Exclusion lists
  • Sharing
  • Internal reporting and actions

› Technical and maintenance personnel
  • Training
  • Different monitoring and performance requirements
ALWAYS KNOW YOUR OBJECTIVE

› What is the service objective?
  • Safety
  • Efficiency
  • Cost effectiveness

› Operational Concept
  • What needs to be improved?
  • What changes will achieve this?

› This leads to a system solution, which in turn defines the required:
  • Communications, Navigation and Surveillance
  • ATM
  • Regulatory framework

› Because.... implementation for the sake of implementation
  • Does not define solutions
  • Likely won’t lead to needed benefits
HUDSON BAY ADS-B PROJECT

Opportunity:
› Long range VHF communications

Objective:
› Improve flight efficiencies for 35,000 flights per year traversing 250,000 square nautical miles of procedural airspace

Solution:
› Enable the application of ATS surveillance separation cost effectively

Requirements:
› Alignment with other early adopters of ADS-B
› Engagement with aircraft operators to encourage ADS-B equipage
› Engagement with Regulator to enable use of ADS-B for separation
EAST COAST/OCEANIC ADS-B PROJECT

Objective:
› Improve safety and flight efficiencies for aircraft in oceanic airspace

Solution:
› Expand ATS surveillance coverage

Requirements:
› ADS-B (cost efficiency)
LESSONS LEARNED

› Stakeholder consultation is critical and must begin early
  • Adjoining ANSPs
  • Aircraft operators
  • Regulator

› The “ATM infrastructure” now includes aircraft

› Some ADS-B avionics may not be suitable
  • Some installations will not support terminal operations
  • Some early installations cannot be used at all for separation
  • Match requirements to ATM services

› Encourage DO-260B equipage
  • Harmonized requirements with United States and Europe
  • Enables Selected Flight Level / Cleared Flight Level comparison
  • Less complexity for airspace adjoining United States’ service areas
Current ATS Surveillance Coverage

Safety & Efficiency
OCEANIC SEPARATION MINIMA

Video removed for emailing
POLAR ROUTES GROWTH

TRAFFIC INCREASE ON POLAR ROUTES
More than 15 times between 2003 and 2016
A joint venture: Iridium Communications Inc., NAV CANADA, ENAV (Italy), Irish Aviation Authority and Naviair (Denmark)

Goal: reduce aircraft separation minima through ADS-B out via Low Earth Orbiting (LEO) satellites

Benefits

› First ever complete pole-to-pole coverage
› Enhanced safety and decreased congestion
› Significant annual fuel savings
› Increased air operations capacity and efficiency
› Reduced emissions and environmental impact
SPACE-BASED ADS-B PROJECT

Opportunity:
› Space-based ADS-B will provide global ATS surveillance coverage

Objective:
› Improve safety and flight efficiencies for aircraft inunsurveilled airspace

Solution:
› Expand ATS surveillance services using space-based ADS-B

Requirements:
› Standard ADS-B equipage
REDUCING NAT VERTICAL CRE

SB ADS-B is expected to reduce the vertical Collision Risk Estimate well below the Target Level of Safety

Comparison of Vertical Collision Risks with and without Surveillance
Gander-Shanwick OCAs

<table>
<thead>
<tr>
<th>Current Operations (ADS-C conformance monitoring)</th>
<th>12.1 fatal accidents in one billion flight hours</th>
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<tbody>
<tr>
<td>SB ADS-B</td>
<td>3.1 fatal accidents in one billion flight hours</td>
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% Reduction - 74%

With Strategic Lateral Offset Procedure (SLOP)
Sources: 2015 NAT ANSP Flight and NAT Central Monitoring Agency (CMA) Data, NAT MWG and Scrutiny Group 2015 data
GLOBAL ATS SURVEILLANCE
SPACE-BASED ADS-B ACTIVITIES

› Development of new separation minima
  • Separation and Airspace Safety Panel (SASP)
  • space-based ADS-B procedural separation using CPDLC
  • ATS surveillance separation for non VHF DCPC environments

› North Atlantic Systems Planning Group (NAT SPG)
  • North Atlantic mainly high seas airspace
  • implementation planning for new procedural minima
  • implementation planning for new ATS surveillance minima

› Canadian Domestic Airspace
  • Regulatory coordination for use in VHF DCPC coverage
  • Exemption for space-based ADS-B procedural minima
EARLY 2019 IMPLEMENTATION

› Aireon constellation expected to be fully operational late 2018
› Operational use of Aireon service in early 2019

Canadian Domestic Airspace

› Northern part of Edmonton FIR and Gander Domestic FIR
› 5 NM ATS surveillance separation within VHF DCPC coverage
› Space-based ADS-B procedural separation using CPDLC

Gander Oceanic Control Area

› Space-based ADS-B procedural separation using CPDLC
QUESTIONS?

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