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# IMPLEMENTATION OF ADS-B BY NAV CANADA

Carole Stewart-Green  
Manager, ATS Regulatory Coordination

Serving a world in motion  
[navcanada.ca](http://navcanada.ca)



# ABOUT NAV CANADA

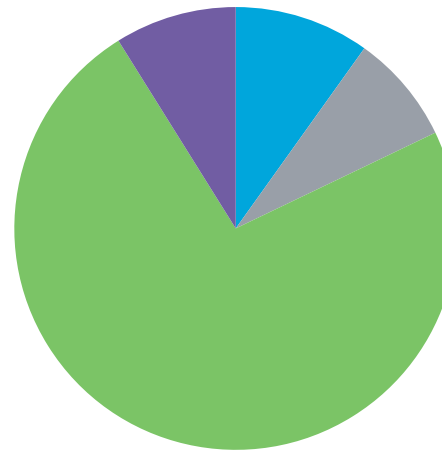


- › Private, non-share capital company
- › Second largest ANSP in the world
- › 12 million aircraft movements annually
- › 18 million square km of airspace
- › Regulated by federal government on safety performance



## OUR PEOPLE

4,800 employees across the country



- Technical Operations
- Engineering
- Operations
- Support Functions

## OUR SERVICES

- › Air traffic control
- › Flight information
- › Weather briefings
- › Aeronautical information
- › Airport advisory services
- › Electronic navigation aids

# OUR MISSION STATEMENT



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

### NAV CANADA Facility Map

ACC	7	○
Tower	41	●
FSS	55	●
FIC	8	●
CARS	51	●
Maintenance Centre	31	●



**USE FOR REFERENCE PURPOSES ONLY**

0 100 200 300 400 500 Nautical Miles

— Flight Information Region (FIR) boundaries

— Gander Oceanic Delegated Control Airspace (ODCA)

Aklavik	Fort Good Hope	Hay River	Qikiqtarjuaq
Arctic Bay	Fort Liard	Igloolik	Resolute Bay
Arviat	Fort McPherson	Kimmiut	Sachs Harbour
Baker Lake	Fort Resolution	Kugaaruk	Taloyoak
Cambridge Bay	Fort Simpson	Kugluktuk	Tuktoyaktuk
Cape Dorset	Gamèti (Rae Lakes)	Nauyaat	Tulita
Chesterfield Inlet	Grise Fiord	Pangnirtung	Ulukhaktok (Holman)
Clyde River	Hall Beach	Paulatuk	Wrigley
Coral Harbour		Pond Inlet	

## RADAR SURVEILLANCE

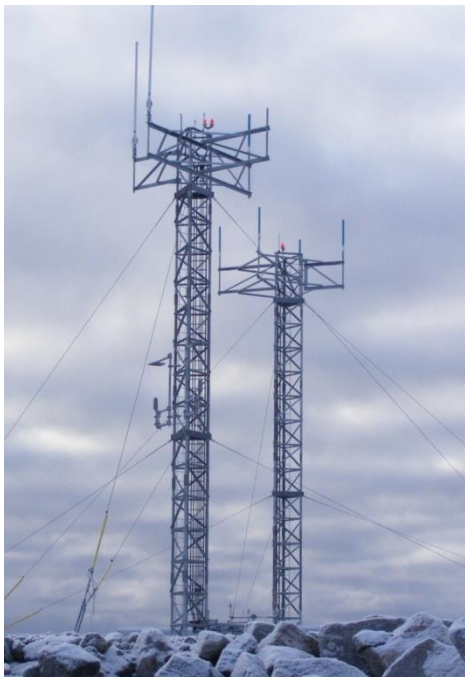
- › 42 radar sites in southern Canada
- › 1 million km<sup>2</sup> of airspace across Baffin Island, Lower Hudson Bay and Great Slave Lake Region



## 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 ATIS 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



Issue: ~~Surveillance~~ Efficiency



# Northern Radar Program

# 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



**Hudson Bay ADS-B 2009**

# **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)



**East Coast/Oceanic ADS-B**

# 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



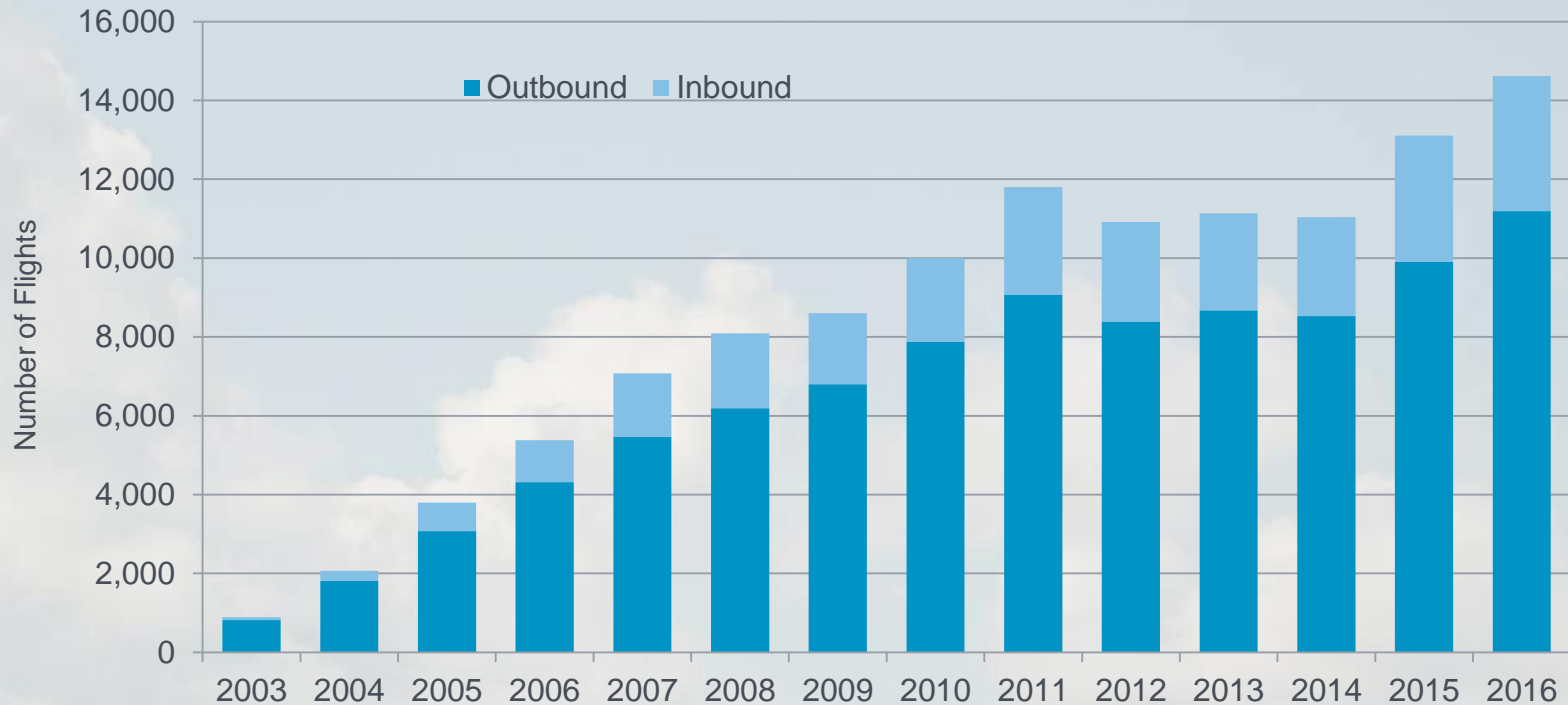
**Current ATSS for Safety & Efficiency**

# OCEANIC SEPARATION MINIMA

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# 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 in unmonitored 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

Current Operations  
(ADS-C conformance monitoring)

12.1 fatal accidents in one billion flight hours

SB ADS-B

3.1 fatal accidents in one billion flight hours

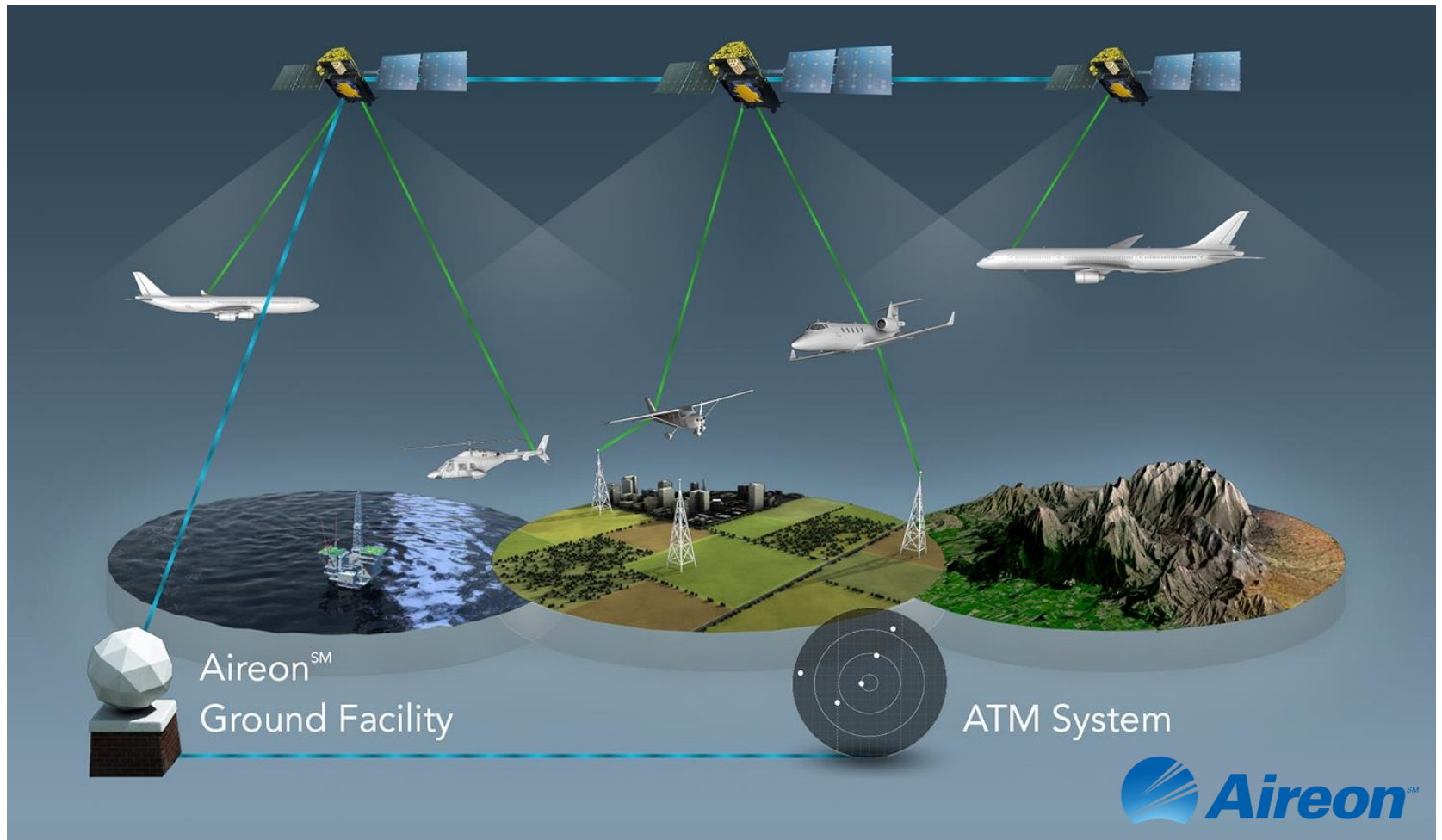
% Reduction

**-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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