



ANS Planning: NAV CANADA

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SERVING A WORLD IN MOTION

About NAV CANADA



- Private, non-share capital company
- 2nd largest ANSP by traffic
- 12 million aircraft movements annually
- 18 million square km of airspace
- Regulated by Federal Government on safety performance

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

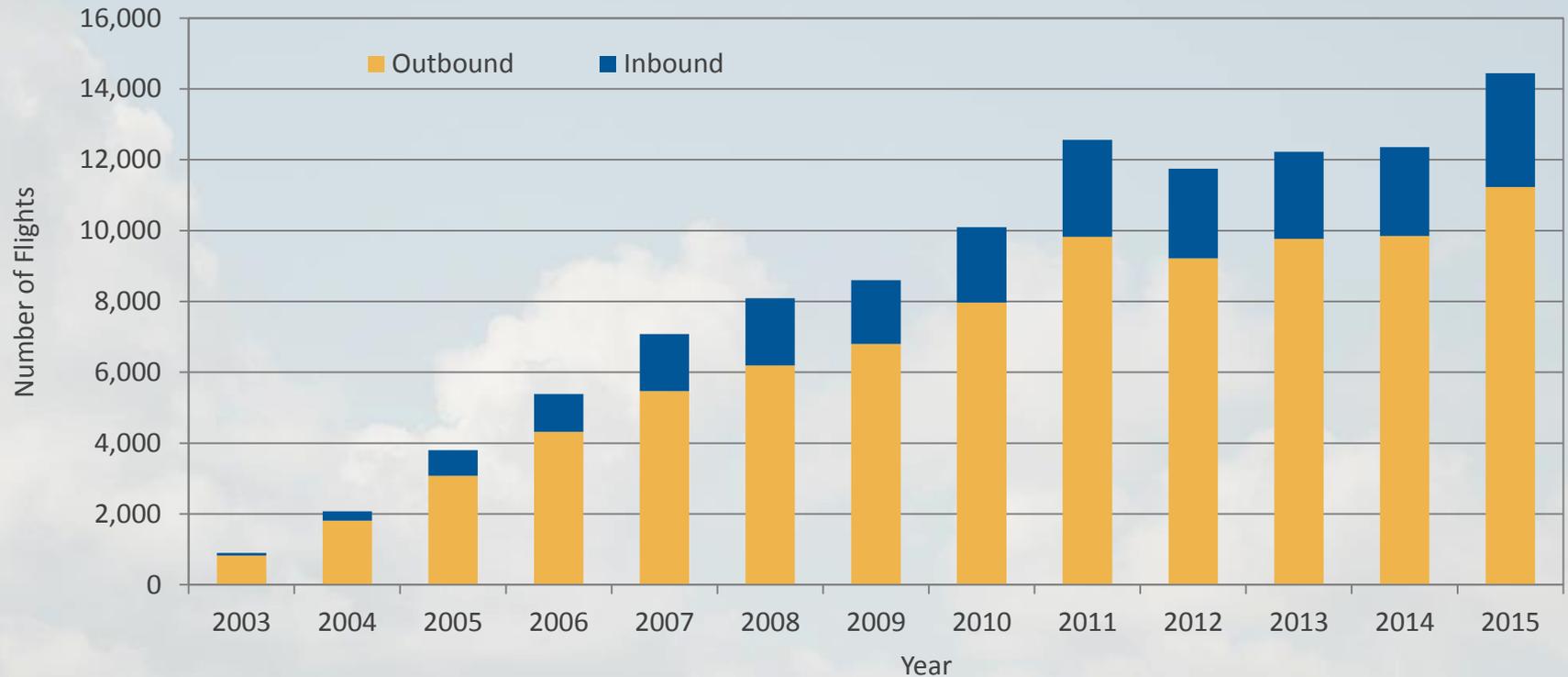


- Vast distances
- Climate varies from polar to temperate
- Crossroads of global air traffic flows
- Busiest oceanic airspace in the world
- Unique northern airspace operations
- Stimulus for innovation

Polar Routes Growth

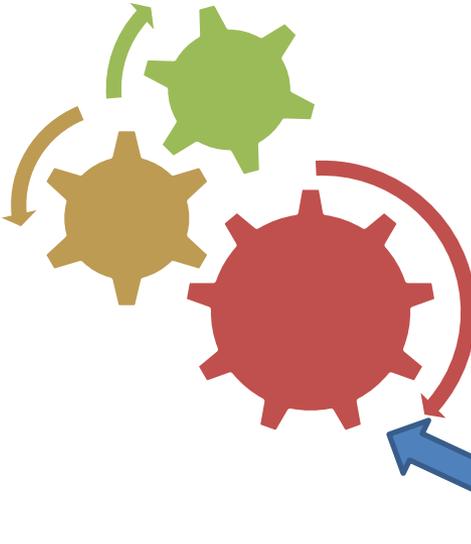
TRAFFIC INCREASE ON POLAR ROUTES

More than 15 times between 2003 and 2015



Planning Relationships

Customer &
Stakeholder
Consultations





Customer fuel savings

1997-2015 2016-2020*

\$5 B

\$3 B

1997-2020
\$8 B

GHG emissions savings



1997-2015 2016-2020*

13 M
tonnes

8 M
tonnes

1997-2020
21 M
tonnes



* forecasted achievable

Achieved (1997-2015)

Projected (2016-2020)

Radar Surveillance

- 42 Radar Sites in Southern Canada
- 1M 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 in: 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 installed cost
- Preferred routes, reductions in fuel consumption & GHG emissions
- Hudson Bay implemented January 2009
- North East Coast-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



Aireon LLC is a joint venture between Iridium Communications Inc., NAV CANADA, ENAV of Italy, the Irish Aviation Authority and Naviar of Denmark.

The goal of this initiative is to reduce aircraft separation minima through ADS-B (out) via Low Earth Orbiting (LEO) satellites.

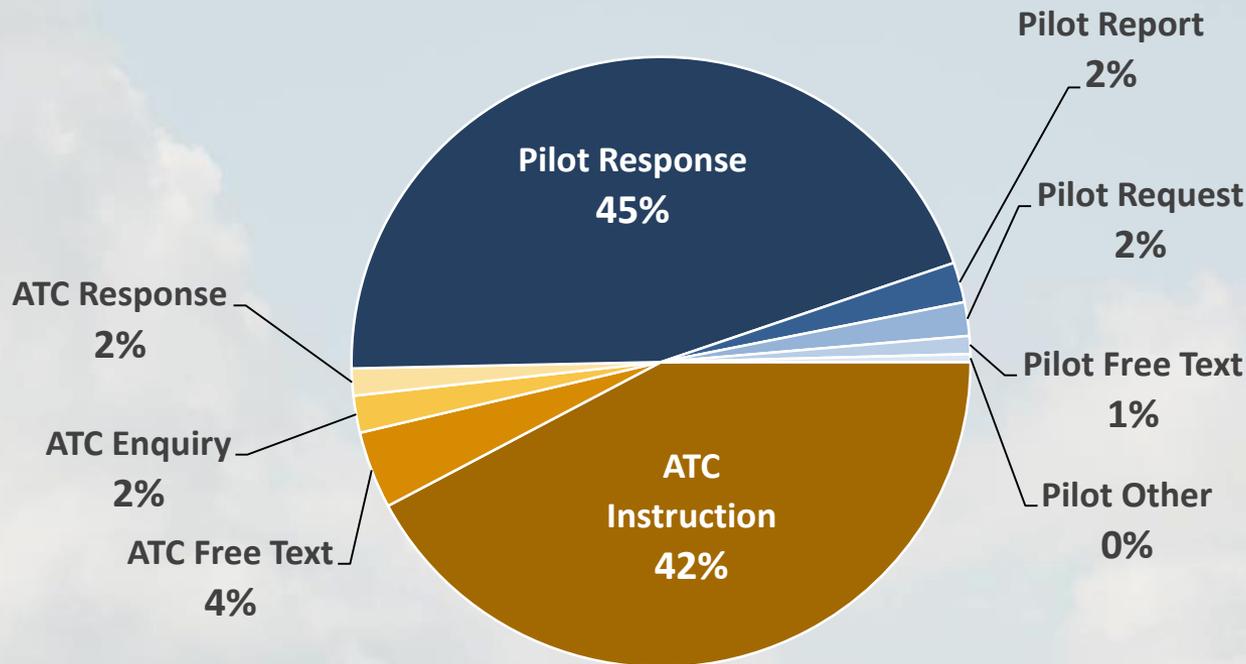
Benefits

- First ever complete pole-to-pole coverage
- Significant annual savings
- Enhanced safety and decreased congestion
- Increased air operations capacity and efficiency
- Reduced emissions and environmental impact



Controller-Pilot Data Link Communications

CPDLC Messages | Domestic



556,000

**DOMESTIC
MESSAGES**

in FEBRUARY 2016

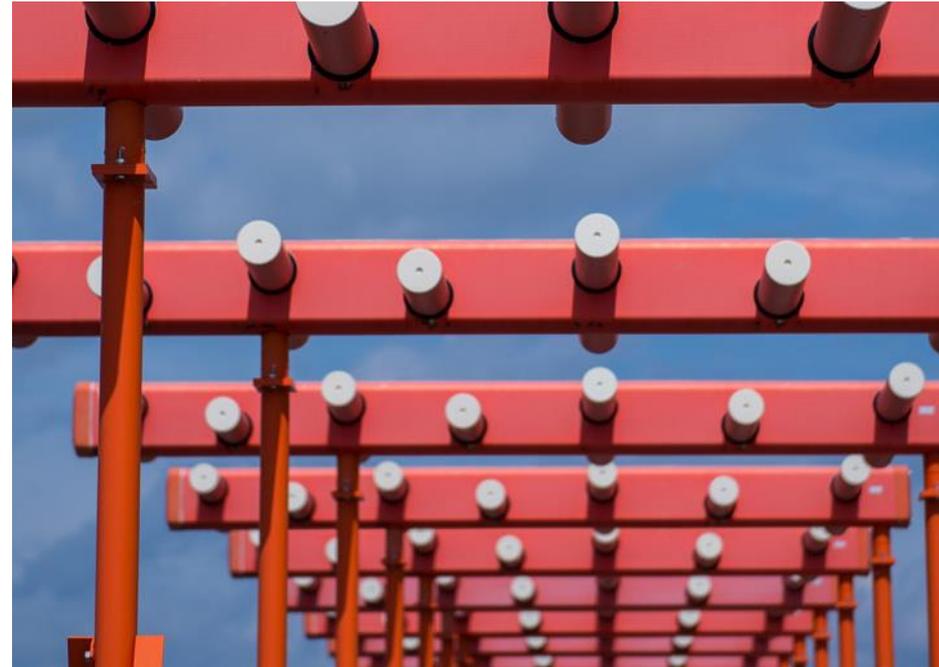
Includes 258,000
Automated and System
Messages

16%

Over
FEBRUARY 2015

Fully functional in all domestic flight information regions above flight level 290

More Modernization



- New Flight Inspection Aircraft and System
- Upgraded/expansion weather cameras and automated weather observation system

Electronic NAVAIDS Upgrades

- 120 Distance measuring Equipment Units (DME)
- 95 Instruments Landing Systems (ILS)

Required Navigation Performance (RNP)

“Short turn” approaches feature constant descent and reduced track miles

Total Benefits to 2020

- 351,000 mt CO₂e
- CAD \$132 M in avoided fuel costs



Area Navigation (RNAV)

Uses GNSS and space-based systems and improves airport accessibility and enroute efficiency

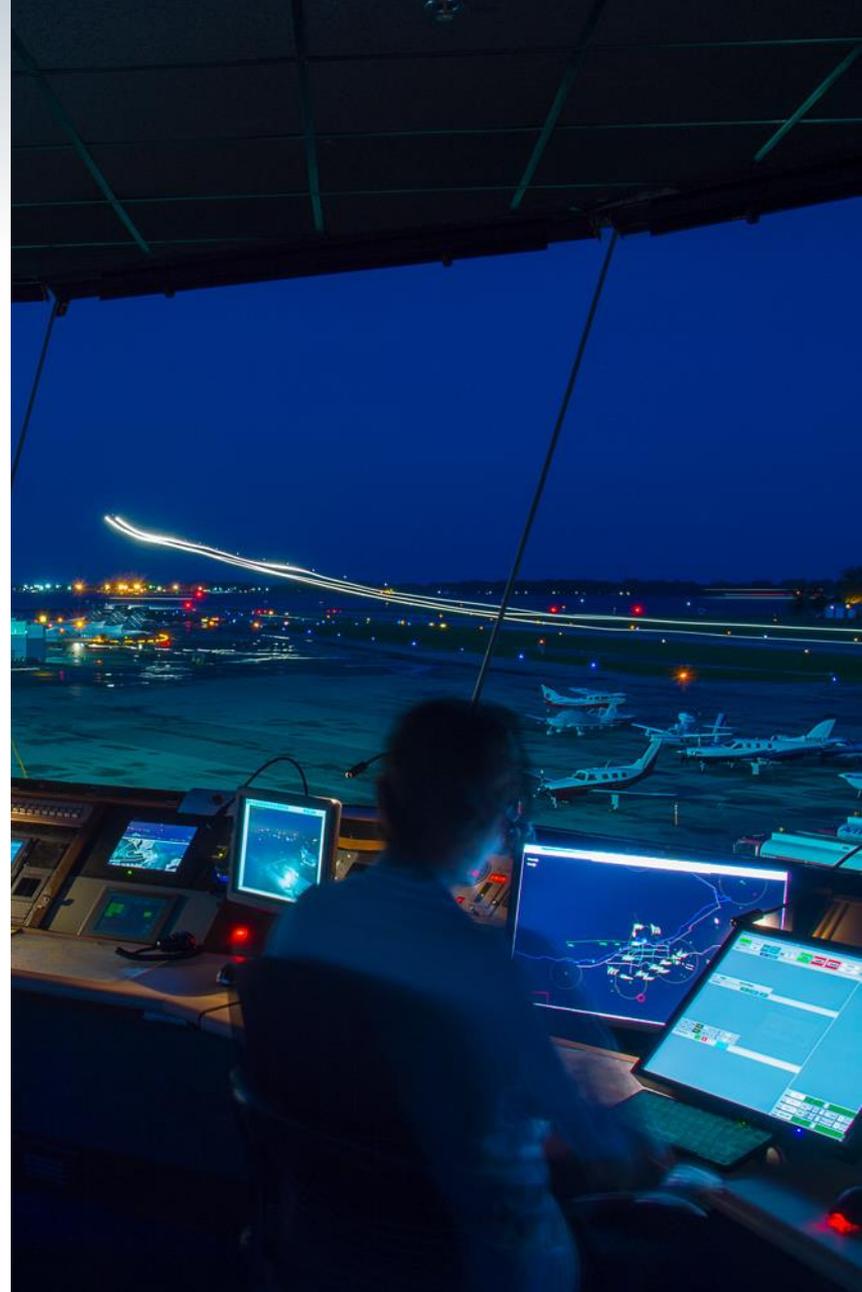
Total Benefits to 2020

- 2,124,000 mt CO₂e
- CAD \$605 M in avoided fuel costs

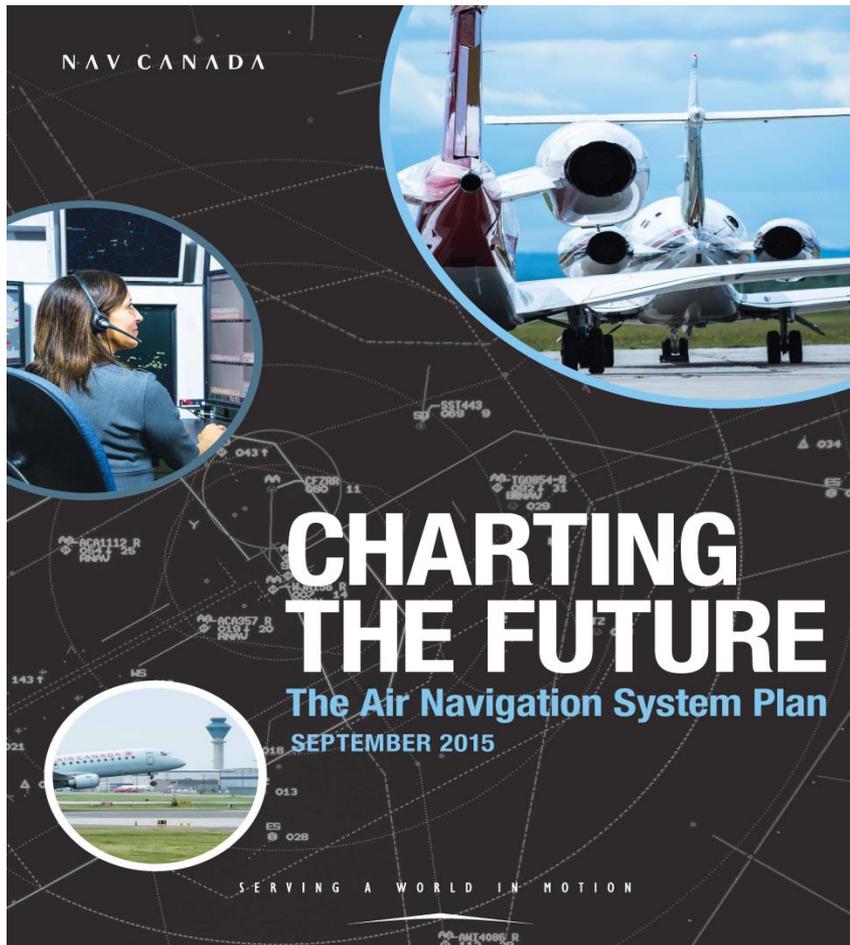




- World-leading safety record
- Service charges have not increased in nearly 12 years
 - 32 % below inflation (real rate decrease)
 - 35 % below old Air Transportation Tax
 - 5 % above original levels set in 1999
- Innovative technology development, with global sales
- Domestic system modernization
- Aireon, a global game changer



NAV CANADA's ANS Plan

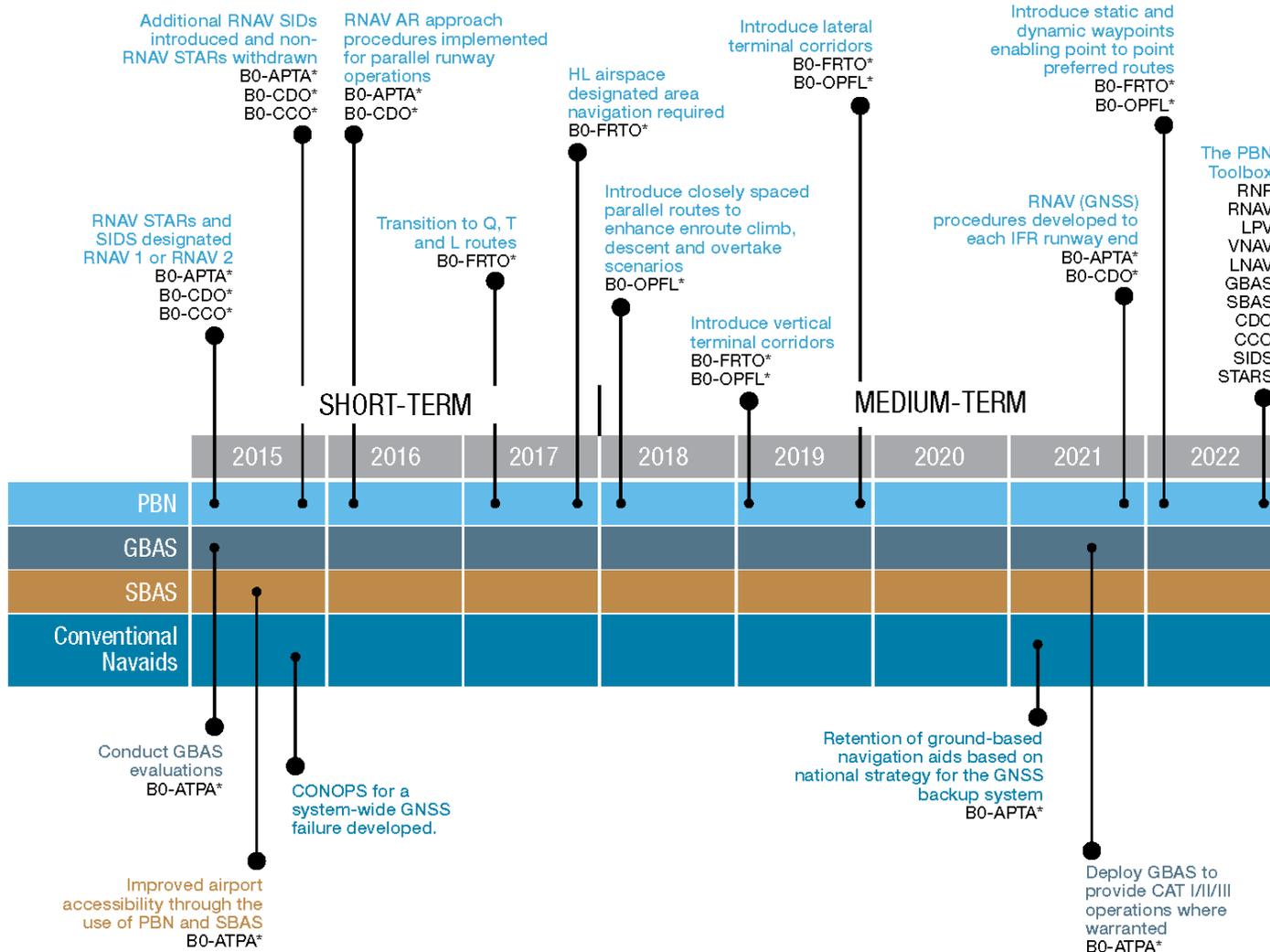


- Our projected plans for development
- Initiatives aimed at meeting customers' requirements
- Generates further stakeholder discussions
- Mapped to ASBU Modules

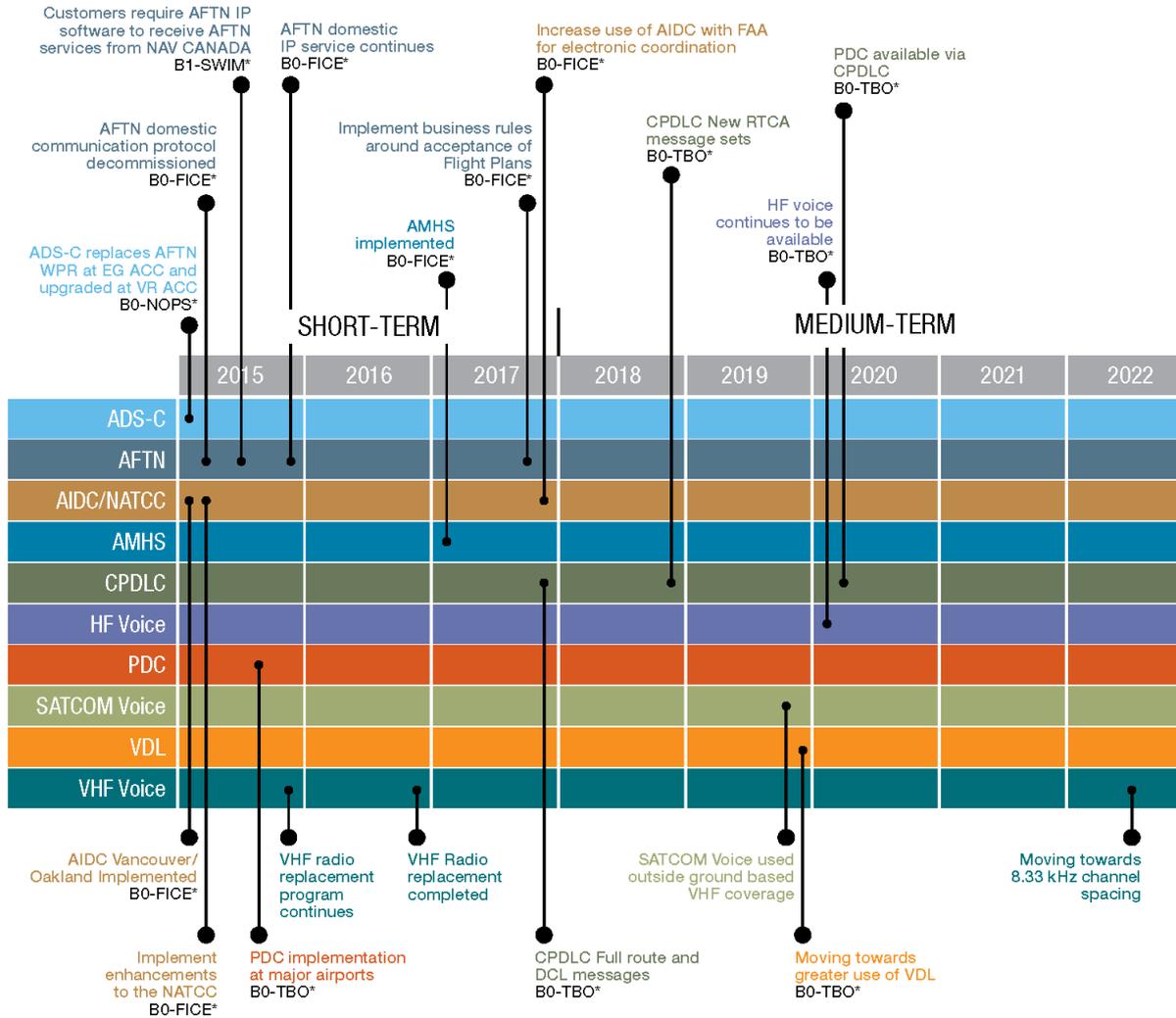
ANS Plan Structure

- Performance Based Navigation (PBN)
- Communications
- Surveillance
- Air Traffic Management
- Aeronautical Information Management (AIM)
- Aviation Weather

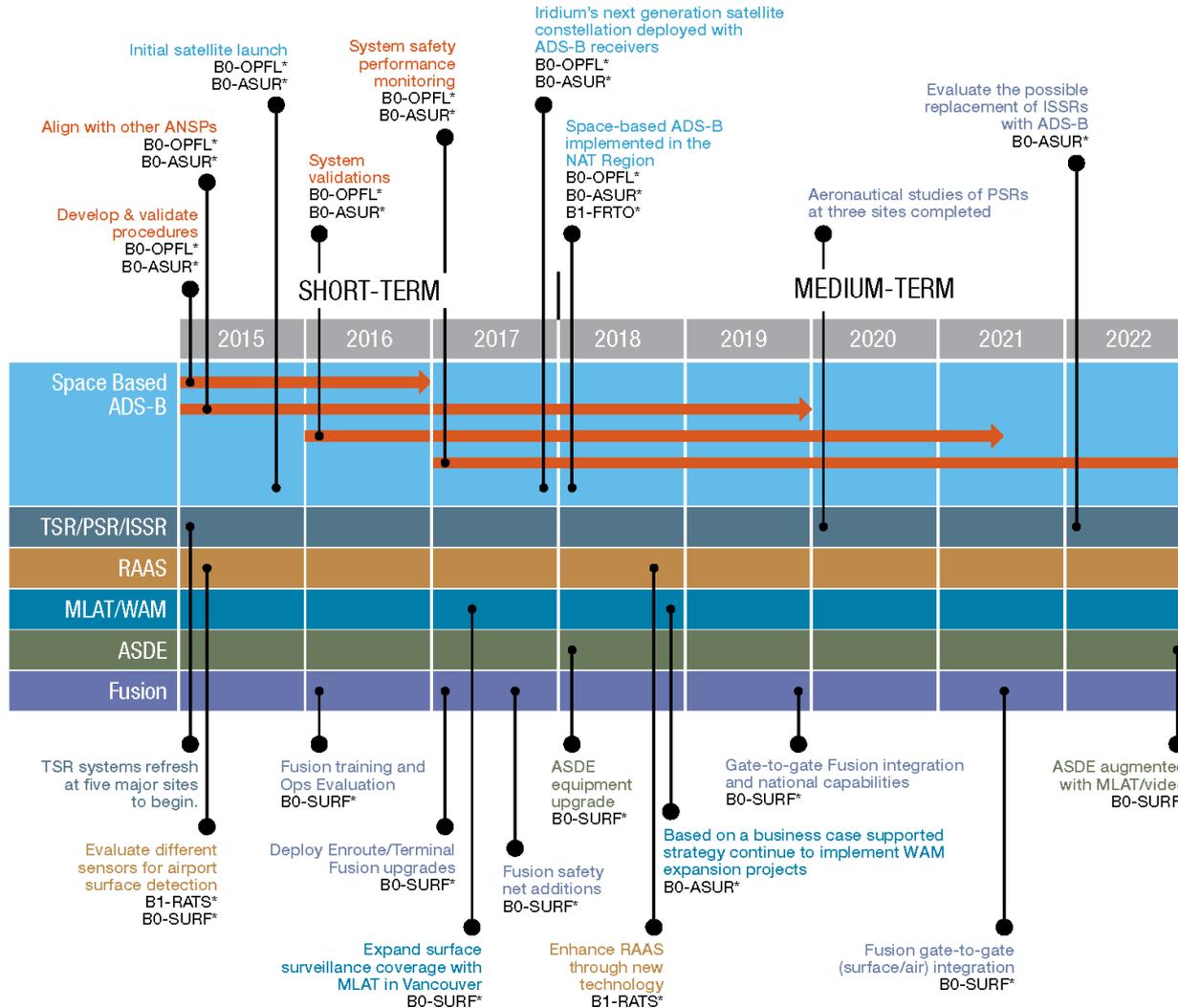
PBN



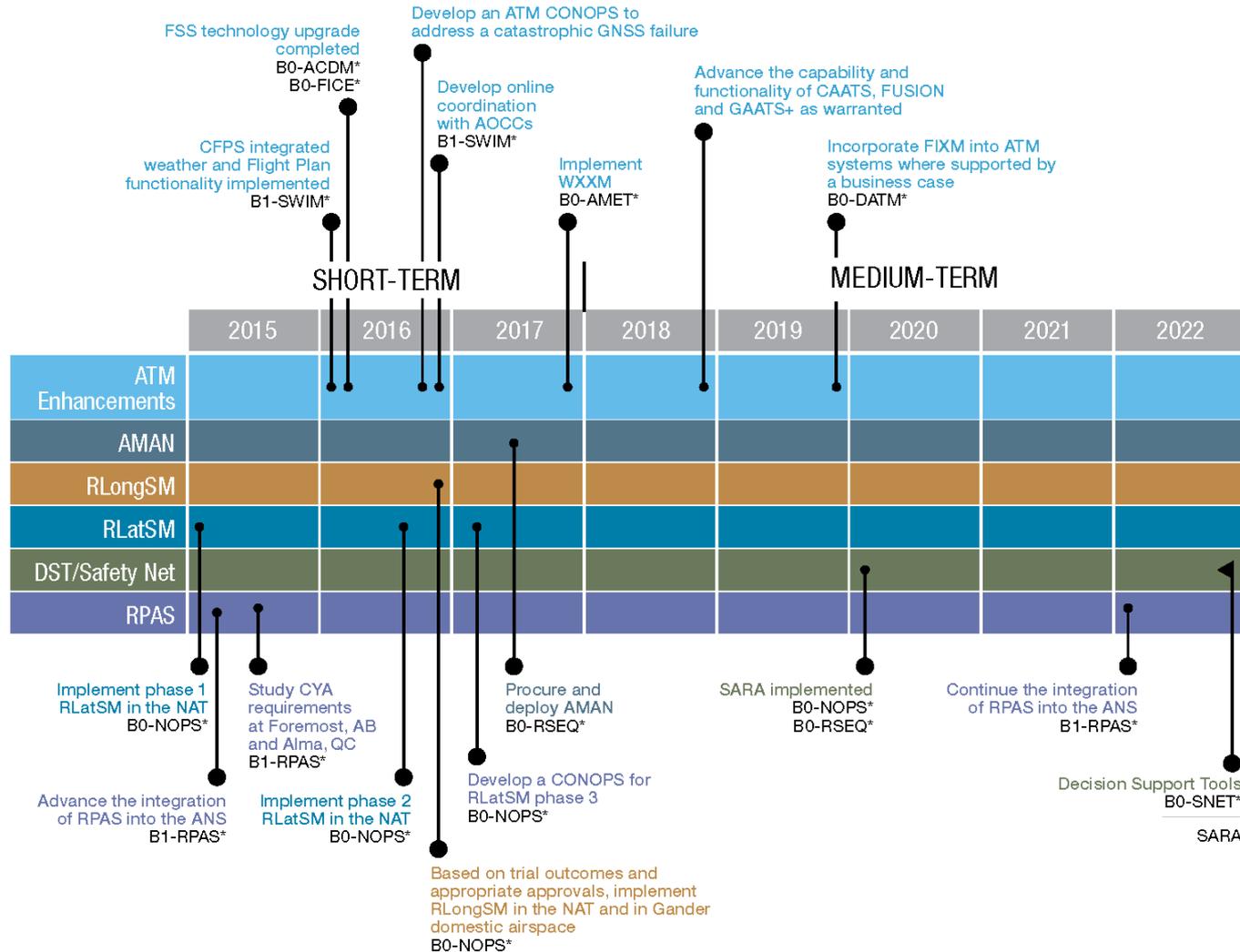
Communications



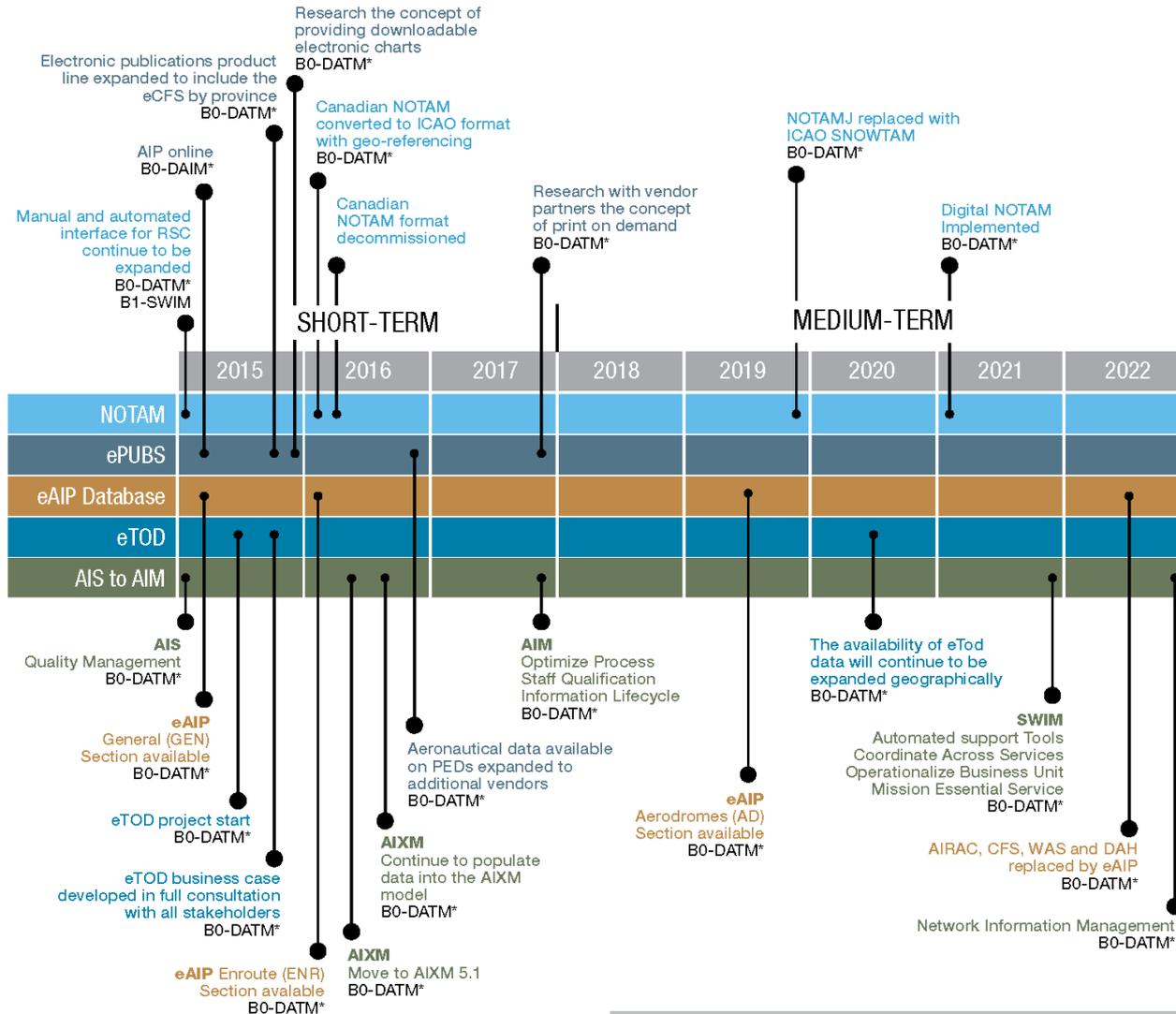
Surveillance



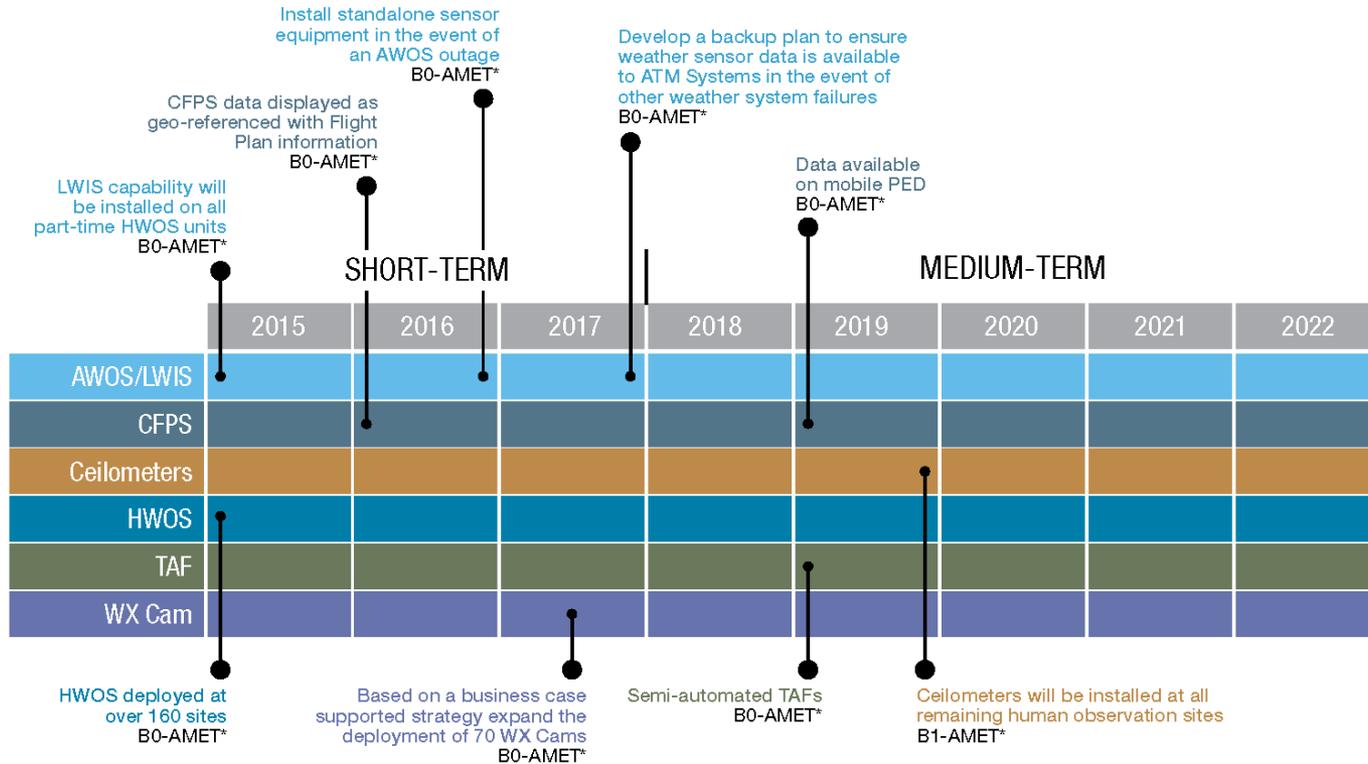
Air Traffic Management



Aeronautical Information Management



Aviation Weather



Linking to Regional and Global Planning

- Our consultative and planning processes remain the same
 - customer and system performance requirements drive our initiatives
 - moving to global, rather than Canadian, requirements and provisions
- Element level descriptions allow direct correlation between ASBU Modules and applicable initiatives in our ANS Plan
- ANRF for each Module based on the ANI/WG forms
 - reviewed with subject matter experts
 - determines implementation status of ASBU Elements
 - identifies national initiatives outside ASBU framework
 - supports coordination with Transport Canada for reporting to ICAO
 - will support completion and maintenance of NAM ANP Volume III

ASBU Implementation - Block 0

Module	Elements	Need Analysis				Implementation Status (if Element is needed)			
		Not Started	In Progress	Need	N/A	Planning	Developing	Partially Implemented	Implemented
Performance Improvement Area 1: Airport Operations									
ACDM	1. Airport CDM procedures			✓			✓		
	2. Airport CDM tools			✓			✓		
	3. Collaborative departure queue management	X							
APTA	1. PBN Approach Procedures with vertical guidance (LPV, LNAV/VNAV minima, using SBAS and Baro VNAV)			✓				✓	
	2. PBN Approach Procedures without vertical guidance (LP, LNAV minima, using SBAS)			✓				✓	
	3. GBAS Landing System (GLS) Approach procedures		✓						
RSEQ	1. AMAN via controlled time of arrival to a reference fix			✓			✓		
	2. AMAN via controlled time of arrival at the aerodrome			✓			✓		
	3. Departure management			✓		✓			
	4. Departure flow management	X							
	5. Point merge	X							
SURF	1. A-SMGCS with at least one cooperative surface surveillance system			✓				✓	
	2. Including ADS-B APT as an element of A-SMGCS			✓				✓	
	3. A-SMGCS alerting with flight identification information			✓				✓	
	4. Airport vehicles equipped with transponders			✓					✓
WAKE	1. New PANS-ATM wake turbulence categories and separation minima	✓							
	2. Dependent diagonal paired approach procedures for parallel runways with centrelines spaced less than 760 meters (2,500 feet) apart	✓							
	3. Wake independent departure and arrival procedures for parallel runways with centrelines spaced less than 760 meters (2,500 feet) apart	✓							
	4. Wake turbulence mitigation for departures procedures for parallel runways with centrelines spaced less than 760 meters (2,500 feet) apart	✓							
	5. 6 wake turbulence categories and separation minima	✓							

ASBU Implementation - Block 0

Module	Elements	Need Analysis				Implementation Status (if Element is needed)			
		Not Started	In Progress	Need	N/A	Planning	Developing	Partially Implemented	Implemented
Performance Improvement Area 2: Globally Interoperable Systems and Data									
AMET	1. WAFS			✓					✓
	2. IAVW			✓					✓
	3. TCAC forecasts			✓					✓
	4. Aerodrome warnings			✓				✓	
	5. Wind shear warnings and alerts			✓				✓	
	6. SIGMET			✓					✓
	7. Other OPMET information (METAR, SPECI and/or TAF)			✓					✓
	8. QMS for MET	X							
DATM	1. Aeronautical Information Exchange Model (AIXM)			✓		✓			
	2. eAIP			✓			✓		
	3. Digital NOTAM		✓						
	4. eTOD			✓				✓	
	5. WGS-84			✓		✓			
	6. QMS for AIM			✓					✓
FICE	1. AIDC to provide initial flight data to adjacent ATSU's	X							
	2. AIDC to update previously coordinated flight data	X							
	3. AIDC for control transfer	X							
	4. AIDC to transfer CPDLC logon information to the Next Data Authority							✓	

ASBU Implementation - Block 0

Module	Elements	Need Analysis				Implementation Status (if Element is needed)			
		Not Started	In Progress	Need	N/A	Planning	Developing	Partially Implemented	Implemented
Performance Improvement Area 3: Optimum Capacity and Flexible Flights									
ACAS	1. ACAS II (TCAS version 7.1)			✓				✓	
	2. Auto Pilot/Flight Director (AP.FD) TCAS				✓				
	3. TCAS Alert Prevention (TCAP)				✓				
ASEP	1. ATSA-AIRB	X							
	2. ATSA-VSA	X							
ASUR	1. ADS-B		✓						
	2. Multilateration (MLAT)			✓				✓	
FRTO	1. CDM incorporated into airspace planning			✓					✓
	2. Flexible Use of Airspace (FUA)			✓					✓
	3. Flexible route system			✓					✓
	4. CPDLC used to request and receive re-route clearances			✓			✓		
NOPS	1. ATFM			✓					✓
OPFL	1. ITP using ADS-B	X							
SNET	1. Short Term Conflict Alert implementation (STCA)			✓					✓
	2. Area Proximity Warning (APW)			✓					✓
	3. Minimum Safe Altitude Warning (MSAW)			✓					✓
	4. Medium Term Conflict Alert (MTCA)			✓					✓

ASBU Implementation - Block 0

Module	Elements	Need Analysis				Implementation Status (if Element is needed)			
		Not Started	In Progress	Need	N/A	Planning	Developing	Partially Implemented	Implemented
Performance Improvement Area 4: Efficient Flight Paths									
CCO	1. Procedure changes to facilitate CCO			✓				✓	
	2. Route changes to facilitate CCO			✓				✓	
	3. PBN SIDs			✓				✓	
CDO	1. Procedure changes to facilitate CDO			✓				✓	
	2. Route changes to facilitate CDO			✓				✓	
	3. PBN STARs			✓					✓
TBO	1. ADS-C over oceanic and remote areas			✓					✓
	2. Continental CPDLC			✓					✓



Thank you so much Midori!

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S E R V I N G A W O R L D I N M O T I O N