Duncan Aviation ADS-B and FANS 1/A + Seminar

Dulles, VA
9/22/2016

ADS-B and Mandates Overview
Mark Francetic, Duncan Aviation

ARINC Direct Datalink and FANS CPDLC
Erin Santiago, ARINC Direct

Mandates Made Easy
Ed Borger, Honeywell

FDF and FANS
Andrea Duggan, Satcom Direct

L-3 is a FAN of ADS-B, are you?
Joel Gibbons, L-3 Aviation Products

Proline 4 and 21 Mandates Compliance
Scott Brooks, Rockwell Collins

2013 NextGen Implementation Plan
FAA

2015 NextGen Implementation Plan
FAA

DUNCAN AVIATION

ADS-B

Automatic Dependent Surveillance-Broadcast

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Get the latest NextGen developments at
www.duncanaviation.aero/nextgen

ADS-B Solutions

Duncan Aviation and SAFRAN Engineering are developing an AML STC on the following models:

- Challenger 601-3A/3R, Learjet 60, Gulfstream G100 & G200 and the Textron 800-Series aircraft

Benefits

Acronyms

- **ADS-B** Automatic Dependent Surveillance Broadcast
- **ARINC** Aeronautical Radio Inc
- **CASA** Civil Aviation Safety Authority
- **GNSS** Global Navigation Satellite System
- **FDE** Fault Detection and Exclusion
- **NAC** Navigation Accuracy Category
- **NAC** (p) Navigation Accuracy for Position
- **NIC** Navigation Integrity Category
- **NUC** Navigation Uncertainty Category
- **SA** Selective Awareness
- **SPI** Special Position Indication (Ident)
- **LOA** Letter of Approval

Do I have ADS-B?

Mandates

ADS-B Out DO-260/260A Dec 12, 2013
- Hudson Bay, Hong Kong, Australia & Singapore

LINK 2000+ Europe date moved to Feb 5, 2020

TCAS II Airworthiness Directive (2012-02-08) Mar 13, 2015

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ADS-B Out DO-260B United States & Worldwide Jan 1, 2020

FANS 1/A+
- ICAO North Atlantic (NAT) region
- FL360-390, two tracks in OTS Feb 7, 2013
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Three Levels of DO-260?

Approved Systems

Part Number Specific
- Honeywell TRA-67A
- ACSS XS-950*
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United States ADS-B

- STCs are being revised daily, including those by Rockwell Collins, Freeflight, CMD Flight Solutions & L-3 Business Aviation Services. Garmin has an AML for Part 23 aircraft that are approved for DO-260B-out
- The FAA mandates in AC 20-165A that all ADS-B systems require an STC
- Rockwell Collins has the TDR-94D system (-500/-501) that meets all of the US mandates for ADS-B out

Benefits

- Aircraft with ADS-B get priority over non-ADS-B-equipped aircraft
- No need for position reports
- More flexible continuous routes to flight levels
- Reduced runway incursions
- Improved safety in areas that previously had no surveillance coverage

History & Development

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- RVSM established a baseline by providing highly accurate separation **vertically**

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Documents

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- Singapore CAAS Advisory Circular AC AOC-21(0)
- Hong Kong AIC 09/11
- Australia CAO 20.18-2009
- United States AC-90-114, AC20-165a, AC20-172a, 14CFR91.225
- EASA AMC20-24, ETSO-2C112a

Three Levels of DO-260?

DO-260

- Tested but position accuracies did not meet predicted forecast

DO-260A

- Developed to add accuracy missing from DO-260. It usually incorporates upgraded GPS WAAS receivers. Installed & tested by airlines, but the results were still outside the range of desired accuracies

DO-260B

- Incorporates GPS accuracies from DO-260A but adds position forecast (from position & velocity) to predict and broadcast position. Adds cockpit annunciators and procedures

DO-260B

- United States, Jan 1, 2020
- Is the world-wide standard
- Uses the advantages of ADS-B DO-260 and DO-260A but requires parameters and addresses latency and annunciation issues

DO-260

- Hudson Bay, now in effect
- Australia, Dec 12, 2013. Any flight operating at or above FL290 in or through Australian airspace
- Hong Kong, Dec 12, 2013 for ATS routes M771 and L642 and by Dec 2014 for entire Hong Kong FIR
- Indonesia, Dec 12, 2013. Any flight operating at or above FL290.
- Singapore, Dec 12, 2013. Any flight operating at or above FL290.

DO-260B

- Europe, June 8, 2016 for new production aircraft*
- Europe, June 8, 2020 for all retrofit aircraft*

*** Amendment to regulation No 1207/2011 approved Aug 6, 2014**

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LEARN WHAT'S NEXT WITH
NEXTGEN
www.DuncanAviation.aero/nextgen

FAA NextGen

The FAA began implementing NextGen in 2009, starting with ADS-B, and plans to have the infrastructure operational by the end of 2014. The mandate for ADS-B Out compliance is Jan. 1, 2020. On May 27, 2010, the FAA published new rules (14 CFR §92.225 and §91.227) mandating airspace and avionics performance requirements after Jan. 1, 2020. AC 20-165A (Nov. 2012) provides guidance for the installation and airworthiness approval of ADS-B Out systems in aircraft. The mandated avionics perform the ADS-B Out function, which transmits the precise location and other information about the aircraft to ground stations and ADS-B-In-equipped aircraft.

FAA NextGen

The mandate does not require ADS-B In equipment, which would enable other services available with ADS-B. Flight decks of aircraft outfitted with ADS-B In can take advantage of data broadcast services for graphical and text-based weather, traffic advisories and other aeronautical information.

The ADS-B mandate requires ADSB-Out avionics when operating in designated airspace, and aircraft owners have less than 5 years to equip their aircraft. The ADS-B rule, like current transponder operating requirements, specifies that operators have ADS-B Out avionics installed and operating in order to fly their aircraft in the busiest airspace.

Transponder Evolution

Used as a baseline for ADS-B upgrades

- Mode A transponder
- Mode C transponder
- Mode S transponder
- Flight ID transponder/system
- EHS transponder/system
- ADS-B (DO-260, DO-260A, DO-260B)

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ADS-B Specifics

- Class A, B & C airspace
- All airspace at and above **10,000 feet** Mean Sea Level (MSL) over the contiguous United States and the District of Columbia
- Within **30 nautical miles** of airports listed in 14 CFR §91.225, from the surface up to **10,000 ft MSL**.
- For Class E airspace over the Gulf of Mexico from the U.S. coastline out to **12 nautical miles**, at and above **3,000 ft MSL**.
- Neither current transponder nor RVSM maintenance requirements have changed or been affected by the ADS-B rule.
- FAA Technical Service Orders (TSOs) describe the equipment specifications approved for ADS-B operations. The ADS-B rule states that avionics must meet the standards of either TSO-C166b (for **1090MHz ES** link equipment) or TSO-C154c (for **978MHz UAT** link equipment). TSO-C166b is required in Class A airspace and either link can be used in all other airspace.

DO-260B ADS-B Parameters

A. Position
- Latitude and longitude

B. Horizontal velocity
- Set from the position source in the air
- Set from HDG, ground speed or track in ground mode

C. Source Integrity Level (SIL)
- Set at installation from the position source
- Can change if alternate source is selected

D. SIL Supplement
- Programmed at the transponder during installation
- Based on source sampling rate from the position source

E. Navigation Integrity Category (NIC)
- Defines the error integrity of the position source

F. Navigation Accuracy Category for Position (NACp)
- Defines the accuracy of the position source

G. Navigation Accuracy Category for Velocity (NACv)
- Defines the velocity accuracy of the position source

H. Geometric Altitude
- Defines the geometric altitude of the position source

DO-260B ADS-B Parameters

I. Geometric Vertical Accuracy (GVA)

- Sets the vertical accuracy of the position source

J. Heading Source

- True of magnetic heading from the aircraft source

K. Ground Track Angle

- Used for systems that do not have a heading source

L. Altitude Source

Can be derived from the following:

- Pressure Altimeter (TSO-C10)
- Air Data Computer (TSO-C106)
- Encoder or digitizer (TSO-C88)

This source must be from the same source that is sent to the transponder & if the aircraft is RVSM-certified, this altitude source must be used

M. Barometric Altitude

- Set from the aircraft barometric source

N. TCAS Status

- Set from TCAS II source
- TCAS I system not required for this status message

DO-260B ADS-B Parameters

O. System Annunciation

- Must visually display the status of the ADS-B system
- Must use **at least two** annunciators
  - A. ADS-B failure
  - B. Position source or interface failure

P. ICAO Address

- Programmed from **the tail number** of the aircraft through the 24-bit address

Q. Flight ID

- Set as **the aircraft registration** or the **Flight ID code**

R. Vertical Rate

- Set from **the source** at installation
  - A. No accuracy status message required
  - B. Hybrid, blended, GNSS or barometric

S. Air vs. Ground mode

- Aircraft **length and width** code
- Air or ground status

Flight Manual Changes

- Must describe the annunciators used for ADS-B and how to respond to malfunctions
- Explain how to disable ADS-B equipment
- Leave on ADS-B systems in taxi operations to facilitate ground movements

Operators who meet the **Australian** requirements for ADS-B operations must indicate ADS-B capability in the flight notification (ATS flight plan) of all approved ADS-B-equipped aircraft when planning to operate in **Australian** airspace.

Do I have ADS-B?

GNSS TSO

- Other systems can be approved but must show FDE, SA, barometric confirmation and must be approved through ground and/or flight test.
- C-145a, C-146a, or C196 or later versions

Message Format

- ICAO Annex 10, Volume III & IV Amendment 85
- DO-260, DO-260A or TSO C188 or TSO-C166a
- DO-260B or TSO C166b

Do I have ADS-B?

Transmitter Characteristics

- ATSO-C1004b
- ATSO-1C74c
- TSO-C112d and compliant with RTCA/DO-181e
- ETSO-C112b
- ED73B or DO-181e
- ATSO C1005b

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Do I have ADS-B?

- HPL to ADS-B transmitter on same interface as GNSS position data
- Suitable barometric encoder
- Flight ID installed and tested
- Tested with results to verify

Do I Have ADS-B?

- Do I have a statement of compliance in my AFM or POH?
- Do I have flight crew training?
- Has my MEL been revised to show ADS-B system dispatch capability?
- Has it been tested recently?

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Transponder Compliance

- ARINC 718A
- TSO-C112
- EUROCAE ED-73B
- JTSO-2c112a
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SB503 must be added to fix Flight ID reporting, 737-400 only

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- Aircraft v
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FAA Exceptions For ADS-B

- Reference regulatory document #FAA-2015-0971
- Allows air carriers an exception for implementation for up to 4 years (December 31, 2024) from 14 CFR 91.227
- The exception is meant to help with the scheduling of the aircraft and to allow the manufacturers time to develop new sensors for the air carrier fleet
- Each air carrier must apply and be approved under this program prior to August 1, 2018
- ADS-B transponders must still be installed and operational by January 1, 2020
- Each GPS sensor or MMR must be evaluated by its TSO under the program to see if it qualifies

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ARINCDirect FANS CPDLC and DCL Overview

Duncan Aviation ADS-B and FANS 1/A+ Seminar
September 22, 2016

ARINCDirect FANS CPDLC and DCL Overview

- Future Air Navigation System FANS 1/A+
- ICAO GOLD Document
- Components of FANS 1/A+
- Coverage Maps
- Mandates and Requirements
- FANS CPDLC DCL
- DCL Requirements
- DCL Airport Rollout Schedule
- ARINCDirect Support
- ARINCDirect FANS Testing

FANS 1/A+

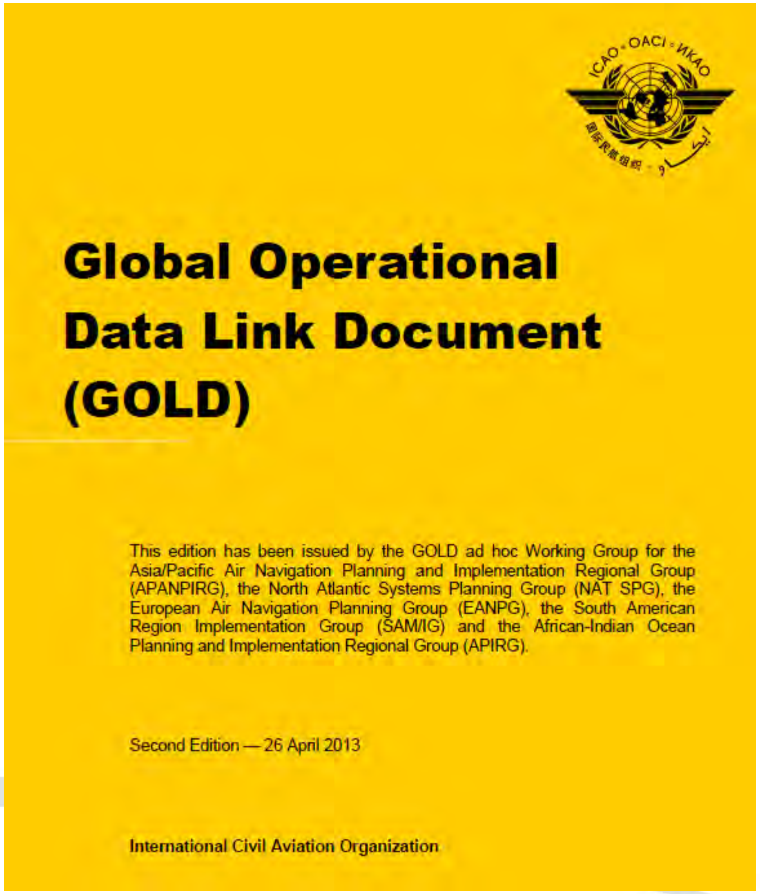
Future Air Navigation System 1/A+

- FANS 1/A is the suite of software upgrades that implement CPDLC, ADS-C, AFN and AOC communications over ACARS protocols. FANS 1 was originally developed by Boeing, while FANS A was developed by Airbus. The two systems are functionally identical so standardization efforts changed the naming convention to FANS 1/A.
- FANS 1/A+ added the message latency timer function
- Three components:
  - Air Traffic Facilities Notification (AFN) – aircraft logon to ATC Center
  - Controller Pilot Data Link Communication (CPDLC) – data link messaging for communications between air traffic controllers and crews
  - Automatic Dependent Surveillance – Contract (ADS-C) –contract based position reporting
- Via data link over VHF (VDL Mode A or VDL Mode 2) or SAT (Inmarsat or Iridium)
- Currently mandated for use in the North Atlantic Track (NAT) structure

GOLD Document

Global Operational Data Link Document

- ICAO's GOLD Document is a worldwide, collaborative effort to standardize Data Link procedures. It is the result of the progressive evolution of two documents:
  - The FANS 1/A Operations Manual, prepared initially by the informal South Pacific Air Traffic Services Coordinating Group (ISPACG); and
  - The Guidance Material for ATS Data Link Services in North Atlantic Airspace, produced by the North Atlantic FANS Implementation Group (NAT FIG), on behalf of the North Atlantic Systems Planning Group (NAT SPG)
- Current: Second Edition dated 26 April 2013
- Next edition planned release November 2016


Global Operational Data Link Document (GOLD)

This edition has been issued by the GOLD ad hoc Working Group for the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG), the North Atlantic Systems Planning Group (NAT SPG), the European Air Navigation Planning Group (EANPG), the South American Region Implementation Group (SAM/IG) and the African-Indian Ocean Planning and Implementation Regional Group (APIRG).

Second Edition — 26 April 2013

International Civil Aviation Organization

Rockwell Collins

CPDLC

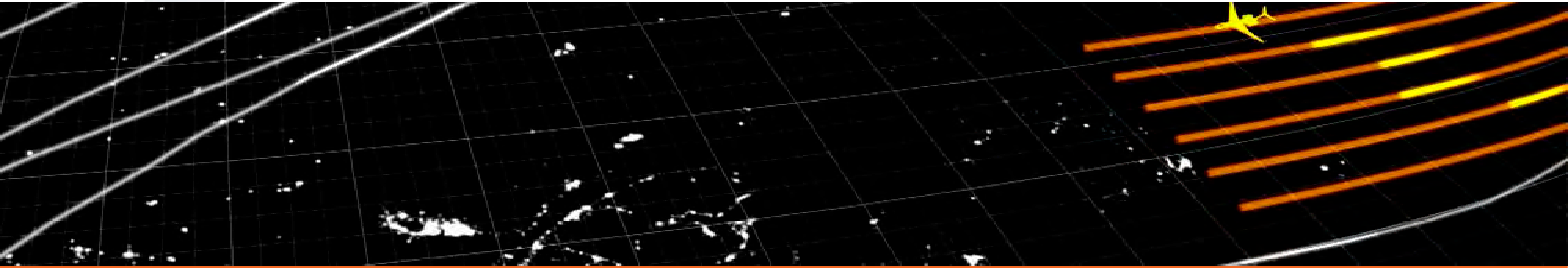
Controller Pilot Data Link Communication

- CPDLC is a means of communication between controller and pilot, using text messaging via data link for Air Traffic Control (ATC) communication. The CPDLC application has three primary functions:
  - the exchange of controller/pilot messages with the controlling ATC authority
  - the transfer of ATC authority over that aircraft and downstream clearance delivery
  - or the opportunity of adjacent ATC centers to view the aircraft reports
- Pre-defined message set, with free text if required
- Replaces verbal ATC instructions and crew requests over radio frequencies reducing frequency congestion
- Communication via data link significantly reduces receive and read back errors

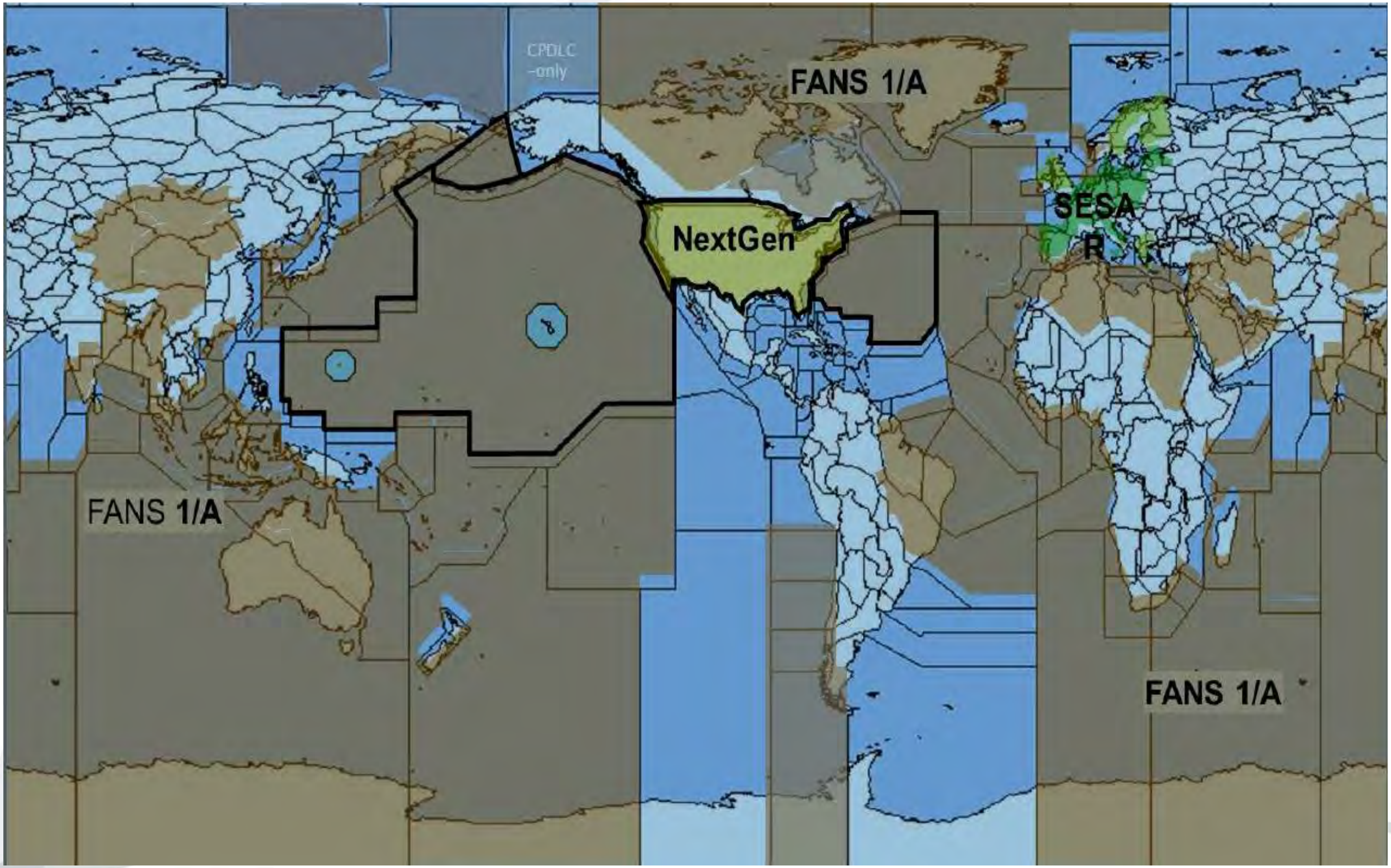
ADS-C

Automatic Dependent Surveillance - Contract

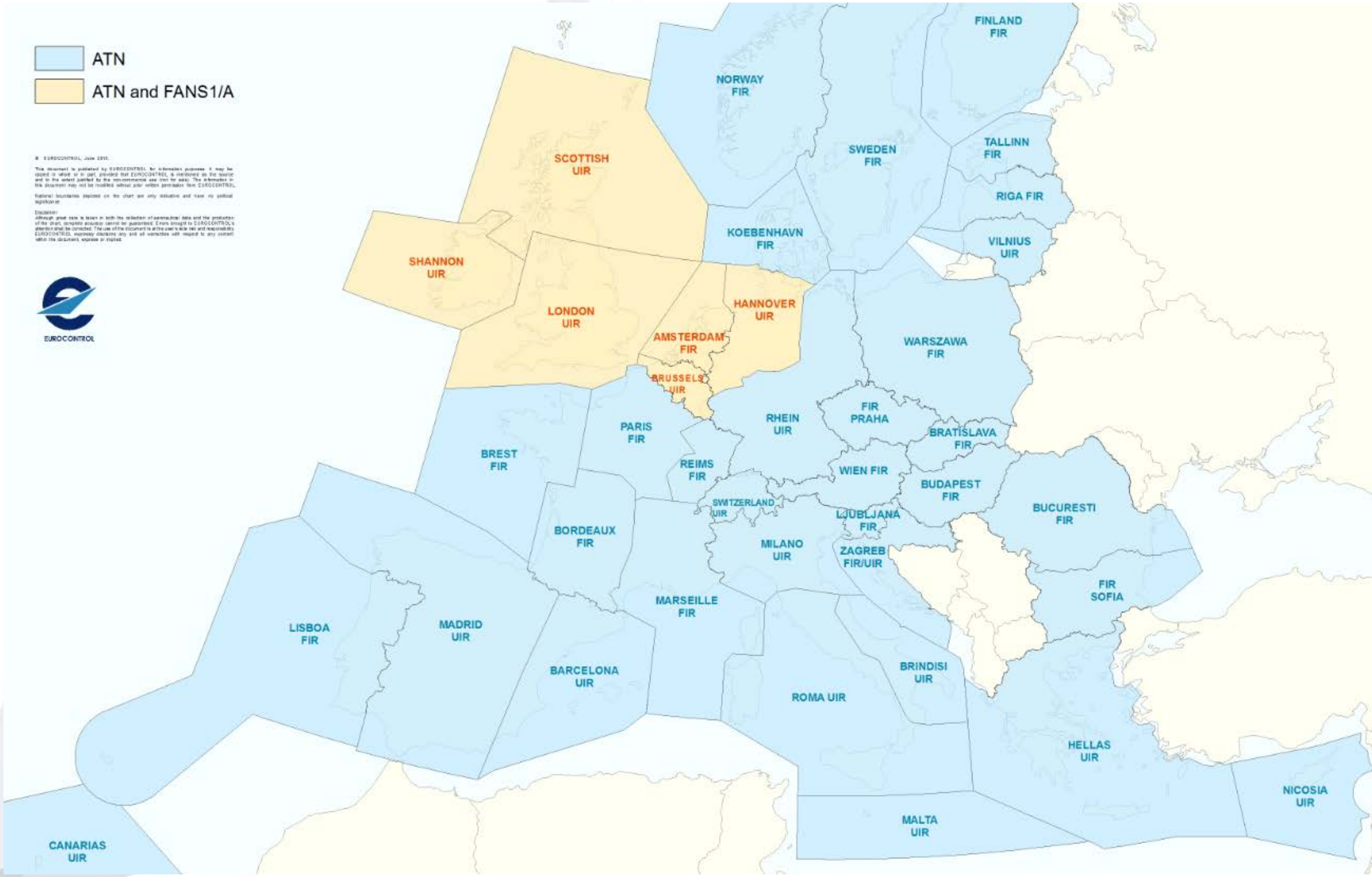
- ADS-C is a contract between a ground ATC system and the aircraft using various systems on board the aircraft to automatically provide aircraft position, altitude, speed, intent, and meteorological data
- ATC establishes the reporting period and information requested in the ADS-C Contract and up to 5 ATC Centers can monitor the aircraft simultaneously
- Avionics report contracts as established by ATC with no intervention from the flight crew
- Replaces position reports by HF radio reducing frequency congestion
- Types of ADS-C reports: Periodic, Demand, Event and Emergency



Current Enroute FANS Coverage



FANS Coverage in Europe



Rockwell Collins

FANS CPDLC Mandates

Phase 2A - Current

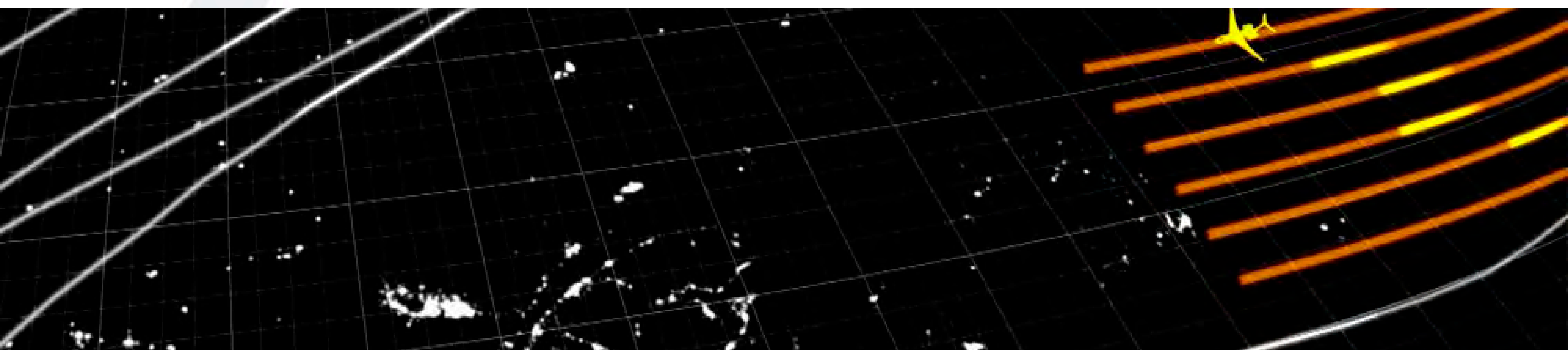
As of Feb 2015 FL 350-390 on all North Atlantic (NAT) Tracks

Phase 2B

Dec 2017 FL 350-390 within NAT Region

Phase 2C

January 2020 - Above FL 290 within NAT Region



Rockwell Collins

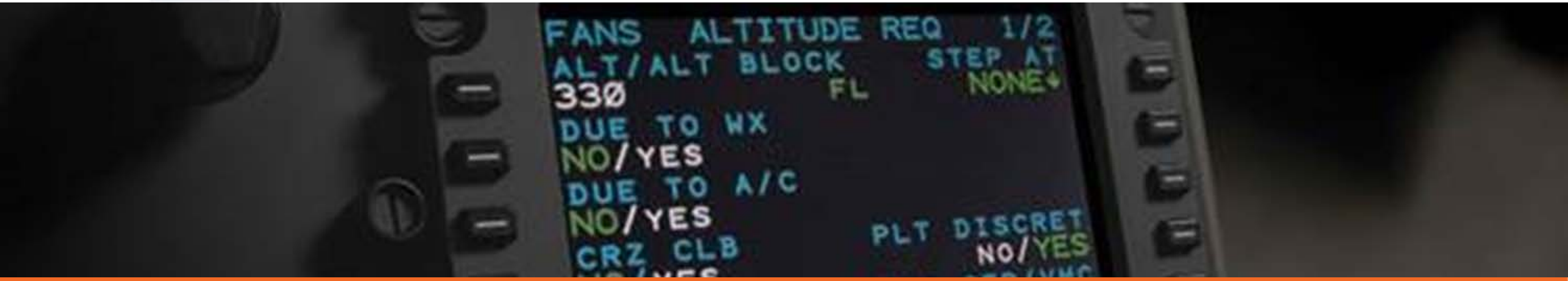
FANS Requirements

- Equipment Requirements:
  - VHF (VDL Mode A or VDL Mode 2)
  - HF (HFDL) or;
  - Satcom (Inmarsat, Iridium, or MTSAT)

- FAA approved FANS CPDLC training

- Letter of Authorization for US based operators conducting FANS 1/A operations outside of the United States

- ICAO Flight Plan filing with required equipment codes and information



Rockwell Collins

Equipment/Flight Plan Requirements for FANS 1/A+

Must be FANS CPDLC/ADS-C Capable with LOA → File ICAO Flight Plan → Indicate equipage in field 10 and 18 of the flight plan

- Item 10a of the ICAO Flight Plan:
    - "J2" for FANS CPDLC HFDL
    - "J3" for FANS CPDLC VDL Mode A
    - "J4" for FANS CPDLC VDL Mode 2
    - "J5" for FANS CPDLC SATCOM (Inmarsat)
    - "J6" for FANS CPDLC SATCOM (MTSAT)
    - "J7" for FANS CPDLC SATCOM (Iridium)

- Item 10b of the ICAO Flight Plan:
    - “D1“ ADS-C with FANS Capabilities

- Indicate aircraft tail number in Field 18 remarks REG/

Rockwell Collins

FANS CPDLC DCL
Departure Clearance

- Departure Clearance Service (DCL) provides automated clearance delivery for initial and revised departure clearances
- CPDLC message elements for the following:
    - Flight plan route
    - Initial and requested altitude
    - Beacon code assignment and
    - Departure frequency
- FANS Logon to CPDLC DCL Capable Tower via VDL Mode A or Mode 2
- DCL rolling out to 56 airports across the US throughout 2016
- No LOA required for US registered aircraft
- Flight Plan filing codes and Field 18 remarks DAT/ required
- DCL does not replace PDC

Current DCL Rollout Schedule

Key Sites			
Site Name	Site ID	ARTCC ID	IOC
Boise (Non-CPDLC)	BOI	ZLC	05/10/15
KS 1: Salt lake City	SLC	ZLC	08/07/15
KS 2: Houston Intd	IAH	ZHU	09/03/15
KS 3: Houston Hobby	HOU	ZHU	09/10/15
NAP – NAP Intgr Compl	N/A	ZLC/ZT	09/30/15

Group A			
Site Name	Site ID	ARTCC ID	IOC
New Orleans	MSY	ZHU	01/21/16
Austin	AUS	ZHU	02/04/16
San Antonio	SAT	ZHU	02/19/16
Los Angeles	LAX	ZLA	03/10/16
Las Vegas	LAS	ZLA	03/25/16
San Diego	SAN	ZLA	04/07/16
John Wayne	SNA	ZLA	04/25/16
Burbank	BUR	ZLA	05/06/16
Ontario	ONT	ZLA	05/18/16
San Francisco	SFO	ZOA	06/08/16
Oakland	OAK	ZOA	06/23/16
San Jose	SJC	ZOA	07/06/16
Sacramento	SMF	ZOA	07/20/16
Reno (Non-CPDLC)	RNO	ZOA	07/25/16
Phoenix	PHX	ZAB	08/10/16
El Paso (Non-CPDLC)	ELP	ZAB	08/29/16
Seattle	SEA	ZSE	09/19/16
Portland	PDX	ZSE	09/19/16
Albuquerque	ABQ	ZAB	09/27/16
Dallas Love	DAL	ZFW	10/10/16
Dallas FTW	DFW	ZFW	10/24/16
Will Rogers (Non-CPDLC)	OKC	ZFW	10/24/16
Honolulu (Non-CPDLC)	HNL		11/03/16
Anchorage (Non-CPDLC)	ANC		11/10/16

Group B			
Site Name	Site ID	ARTCC ID	IOC
Louisville	SDF	ZID	02/10/16
Cincinnati (Non-CPDLC)	CVG	ZID	03/29/16
Indianapolis	IND	ZID	03/07/16
Columbus (Non-CPDLC)	CMH	ZID	03/11/16
Memphis	MEM	ZME	03/25/16
Nashville	BNA	ZME	04/13/16
Adams Field (Non-CPDLC)	LIT	ZME	04/17/16
Denver	DEN	ZDV	05/03/16
Atlanta	ATL	ZTL	05/19/16
Charlotte	CLT	ZTL	06/02/16
Greensboro (Non-CPDLC)	GSO	ZTL	06/07/16
Orlando	MCO	ZJX	06/30/16
Miami	MIA	ZMA	07/29/16
Ft Lauderdale	FLL	ZMA	08/12/16
Tampa	TPA	ZMA	08/29/16
St Louis	STL	ZKC	10/03/16
Kansas City	MCI	ZKC	10/17/16
Tulsa (Non-CPDLC)	TUL	ZKC	10/17/16
Minn-St Paul	MSP	ZMP	11/07/16
Eppley Field (Non-CPDLC)	OMA	ZMP	11/07/16
Jacksonville (Non-CPDLC)	JAX	ZJX	11/07/16
Palm Beach (Non-CPDLC)	PBI	ZMA	11/14/16
San Juan	SJU	ZMA	12/12/16

Group C			
Site Name	Site ID	ARTCC ID	IOC
Newark	EWR	ZNY	02/12/16
J F Kennedy	JFK	ZNY	02/25/16
La Guardia	LGA	ZNY	03/14/16
Teterboro	TEB	ZNY	03/24/16
Westchester	HPN	ZNY	04/12/16
Philadelphia	PHL	ZNY	04/22/16
Boston	BOS	ZBW	05/13/16
Providence (Non CPDLC)	PVD	ZBW	05/13/16
Bradley	BDL	ZBW	06/10/16
Albany (Non-CPDLC)	ALB	ZBW	06/15/16
Detroit	DTW	ZOB	06/30/16
Cleveland	CLE	ZOB	07/13/16
Pittsburgh	PIT	ZOB	07/29/16
Buffalo (Non-CPDLC)	BUF	ZOB	07/29/16
Balt/Wash	BWI	ZDC	08/16/16
Dulles	IAD	ZDC	08/30/16
Reagan	DCA	ZDC	09/19/16
Andrews (Non-CPDLC)	ADW	ZDC	10/03/16
Chicago Midway	MDW	ZAU	10/24/16
Chicago O'Hare	ORD	ZAU	11/07/16
Milwaukee	MKE	ZAU	11/07/16
Raleigh/Durham	RDU	ZDC	11/07/16

TDLS Sites Color Key
CPDLC DCL Site
Enhanced PDC Only Site
Site Operational
Site Operational (PDC Only)

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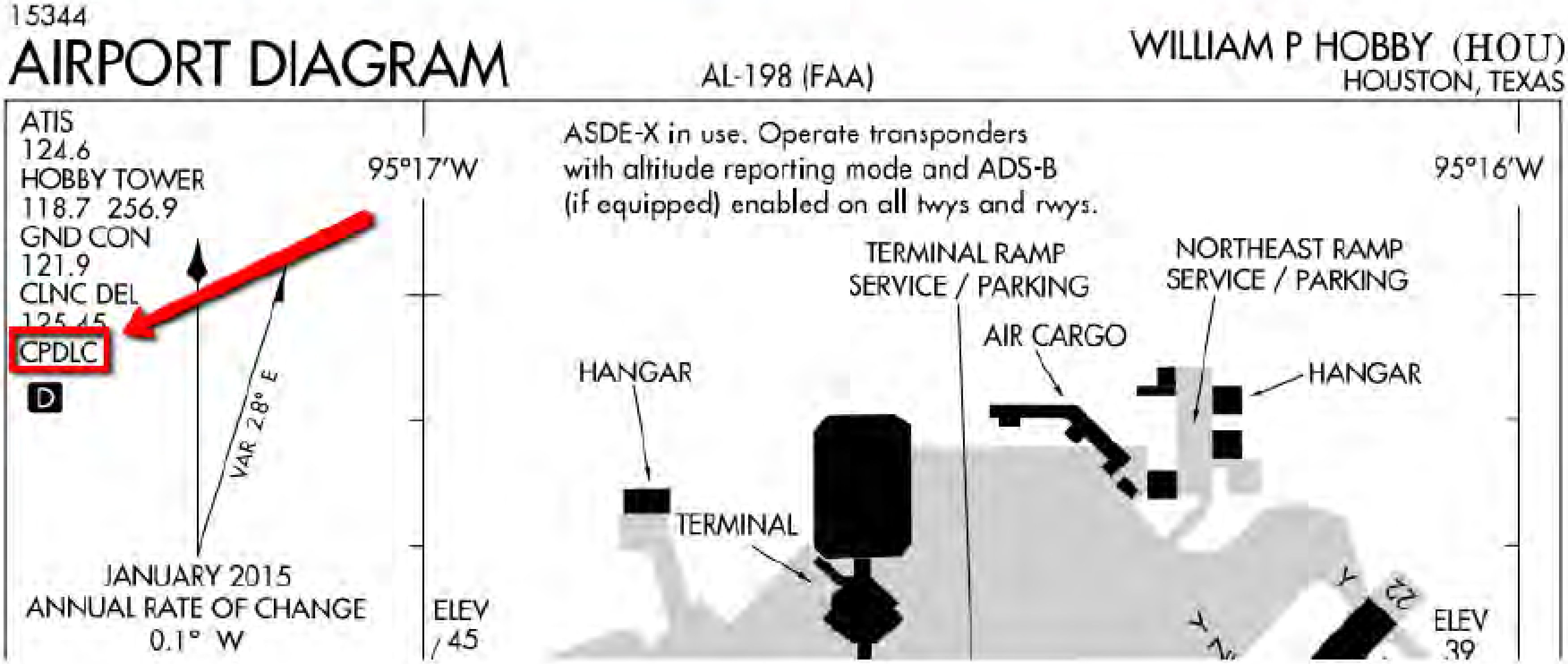
How is a CPDLC capable airport depicted?



* This sample is using charts produced by the National Charting Office (NACO).

Equipment and FPL Requirements for DCL

1. Must be FANS 1/A VDL Mode 2 equipped to use Data Comm*
2. File an ICAO 4444 Flight Plan
3. Indicate Equipage in Fields 10 and 18
4. Contact ARINCDirect with any questions

- Depending on your equipage item 10a of the ICAO Flight Plan may indicate:
  - "J3" for FANS CPDLC VDL Mode A and, or
  - "J4" for FANS CPDLC VDL Mode 2
- Indicate DCL and PDC preferences in Field 18 DAT/
  - E.g. 1FANS2PDC (no spaces allowed)

** Presently the FAA does not recognize Satcom as media for DCL*

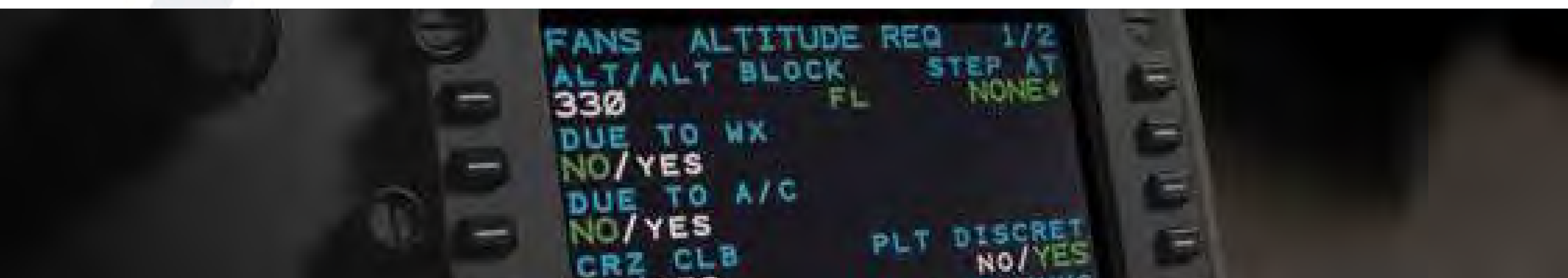
ARINCDirect Supports FANS CPDLC, ADS-C & DCL

- FANS CPDLC, ADS-C and DCL flight plan filing codes and required information are stored as defaults in the ARINCDirect customer account for flight plan filing
- Troubleshooting and technical support for FANS CPDLC, ADS-C and DCL issues
- FANS CPDLC, ADS-C and DCL logs for troubleshooting
- FANS training through our partnership with Kobev International
- LOA assistance for US based operators
- Manual FANS testing for training and troubleshooting purposes
- Automated FANS testing available 24/7 from anywhere in the world

Rockwell Collins

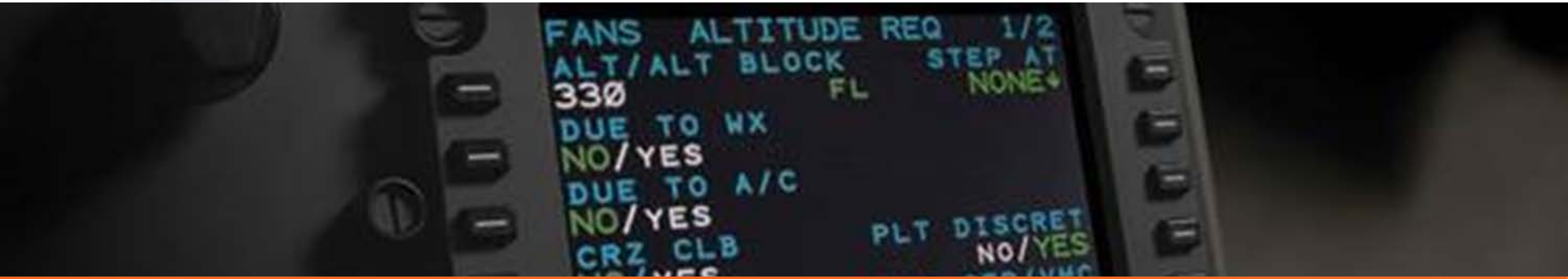
ARINCDirect FANS CPDLC Testing

- ARINCDirect is the only service provider that provides in house FANS Testing
- FANS Testing for ARINCDirect customers is *Free of Charge*
- Customers can test for new installations, training purposes, refresher before trips and for troubleshooting any FANS issues
- FANS Testing is done over the live network via VHF or Satellite data link so data link issues can also be identified
- Two types of testing: Manual and Automated



ARINCDirect FANS Testing - Manual

- ARINCDirect has 4 manual test stations simulating ATC
- The manual stations are capable of testing AFN Logon, CPDLC Messaging, ADS-C Contracts, Free Text Messages, Handoffs and Emergencies
- Testing can be done over VHF (VDL Mode A or VDL Mode 2) or SATCOM (Iridium or Inmarsat)
- All FANS testing is done over the live VHF or Satellite network and can be done one the ground or in the air
- Logs for testing can be provided as needed by customers for troubleshooting CPDLC or ADS-C issues



ARINCDirect FANS Quick Check System

- ARINCDirect has 2 automated test stations: ARDC and ARDD
- The FANS Quick Check System is available 24/7 from anywhere in the world
- The automated test stations are capable of testing AFN Logon, CPDLC Messaging and ADS-C Contracts
- Upon successful logon, the automated test stations establish ADS-C, send a CPDLC Message and automatically terminate the connection after 5 minutes or when terminated by the crew
- Testing can be done over VHF (VDL Mode A or VDL Mode 2) or SATCOM (Iridium or Inmarsat)

ARINCDirect FANS Testing Contact Information

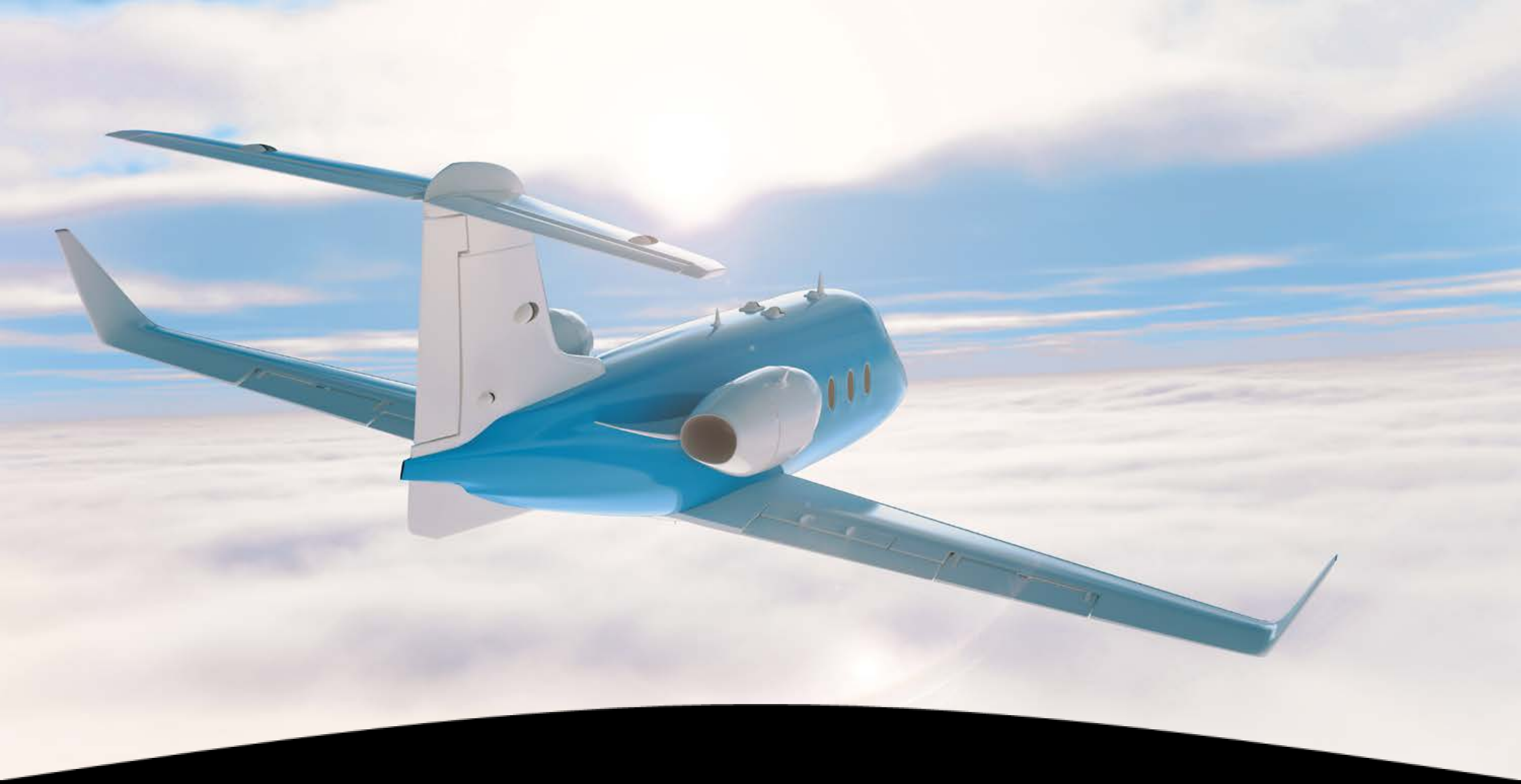
Main Contact: Erin Santiago

Tech Support Group Phone: 410.266.2990

Email: ADFANS@arinc.com

Questions?

Erin Santiago
esantiag@arinc.com
410-266-2990
410-573-3179



Possibilities of Mandates….
Made Easy

Sept 22, 2016
Dulles, Virginia

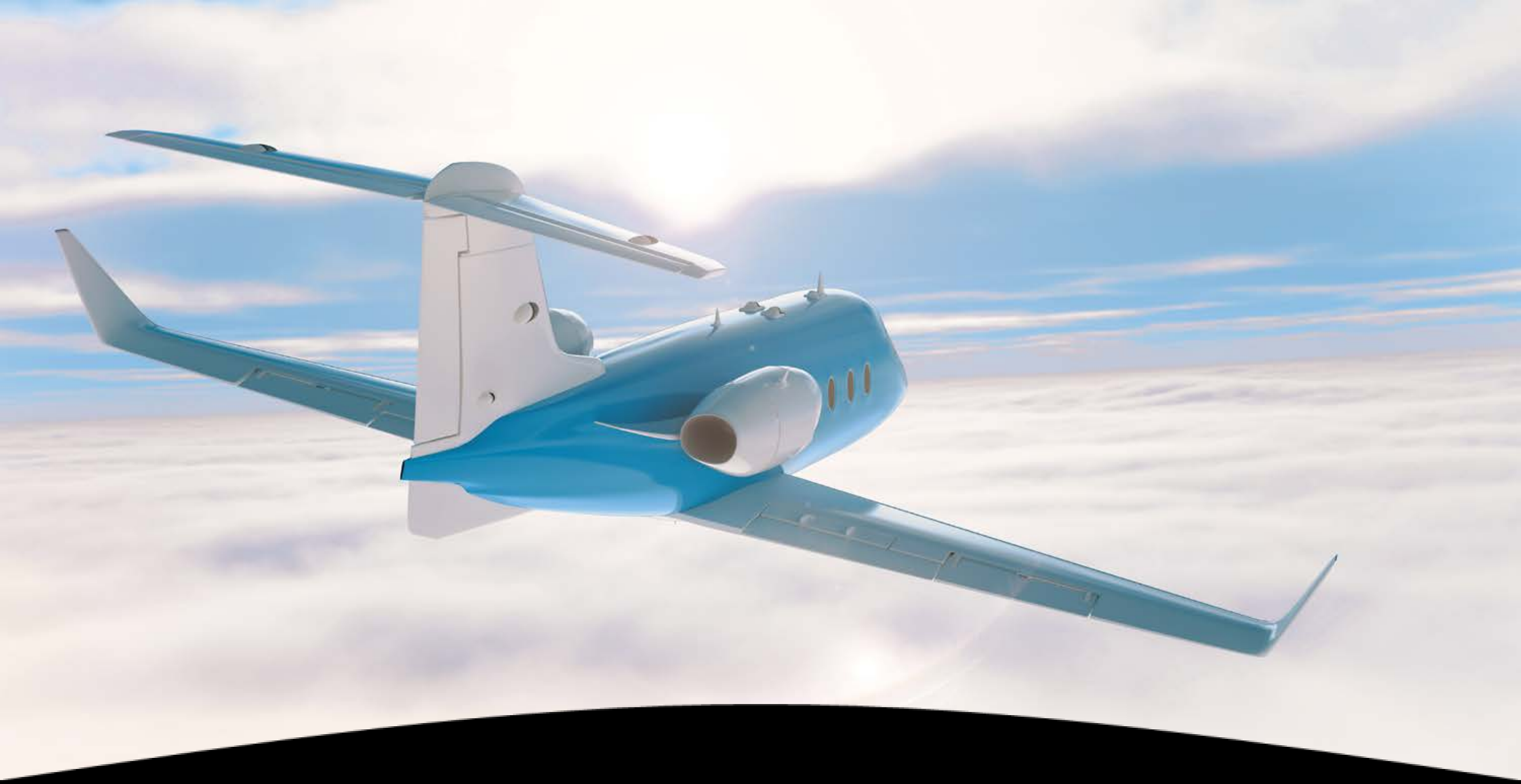
Honeywell

Overview

Honeywell

- **What can you expect today?**
  - Solutions for FANS, PM-CPDLC, ADS-B & TCAS on Honeywell equipped aircraft.
  - Most of us know about these, but staying on top of the various implementation deadlines, geographical requirements and aircraft exemptions can be confusing.

- **Agenda:**
  - Datalink
    - FANS 1/A+
    - PM-CPDLC
    - Datalink Recording
  - ADS-B
  - TCAS 7.1
  - Q&A



Datalink Overview

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What is Datalink - Overview

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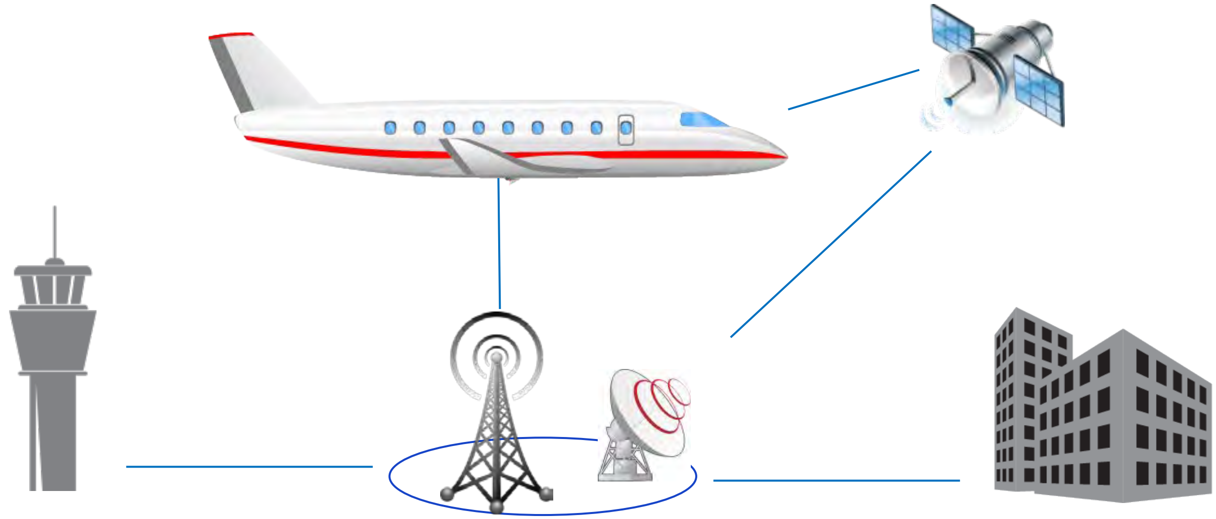


Air Traffic Control (ATC)

- Controller Pilot Datalink Communications (CPDLC) is "text messaging" pilot and ATC for aircraft control instead of using voice communication
- Pilot can request and/or acknowledge changes to aircraft speed, altitude and route using standard ATC phraseology
- Functionality contained in Flight Management Computer and/or Communications Management Unit

Aircraft Operation Center (AOC)

- Automated Messages / Reports
  - OOOI Information
- Weigh and Balance
- Weather Services
- Flight Plan Uplink
- Gate Information, etc.

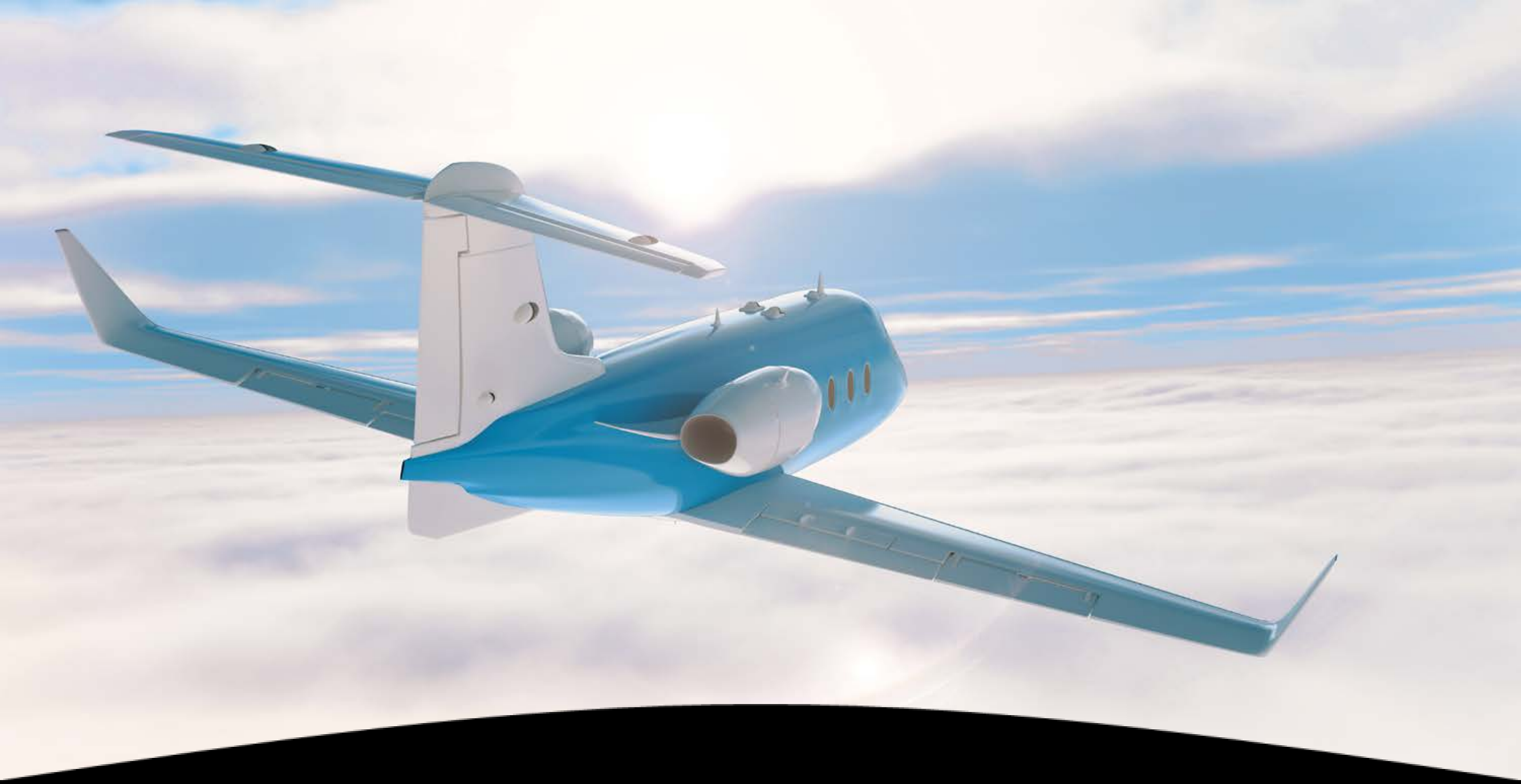
CPDLC is "text messaging" between the pilot and ATC

FANS 1/A⁺ vs. PM-CPDLC

Honeywell

FANS 1/A+	PM-CPDLC
• Future Air Navigation System (FANS1/A+)	• Link2000+ ATN B1 PM-CPDLC (FANS B)
• Oceanic regions and Remote regions: North Atlantic, Canada, <u>NextGen-CONUS</u>	• <u>European Airspace</u>
• Existing ACARS Network	• Newer ATN Network protocol
• VHF, HF and Satellite sub-networks	• VHF VDL Mode 2 radios
• Supports Automatic Dependant Surveillance – Contract (ADS-C)	• European Mandate for FL 285+ (unless exempt)

2 Versions of CPDLC



FANS 1/A+

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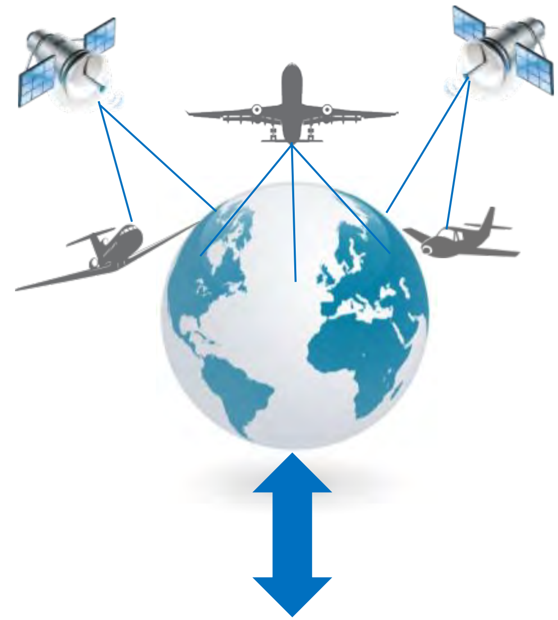
FANS 1/A^{+} Benefits

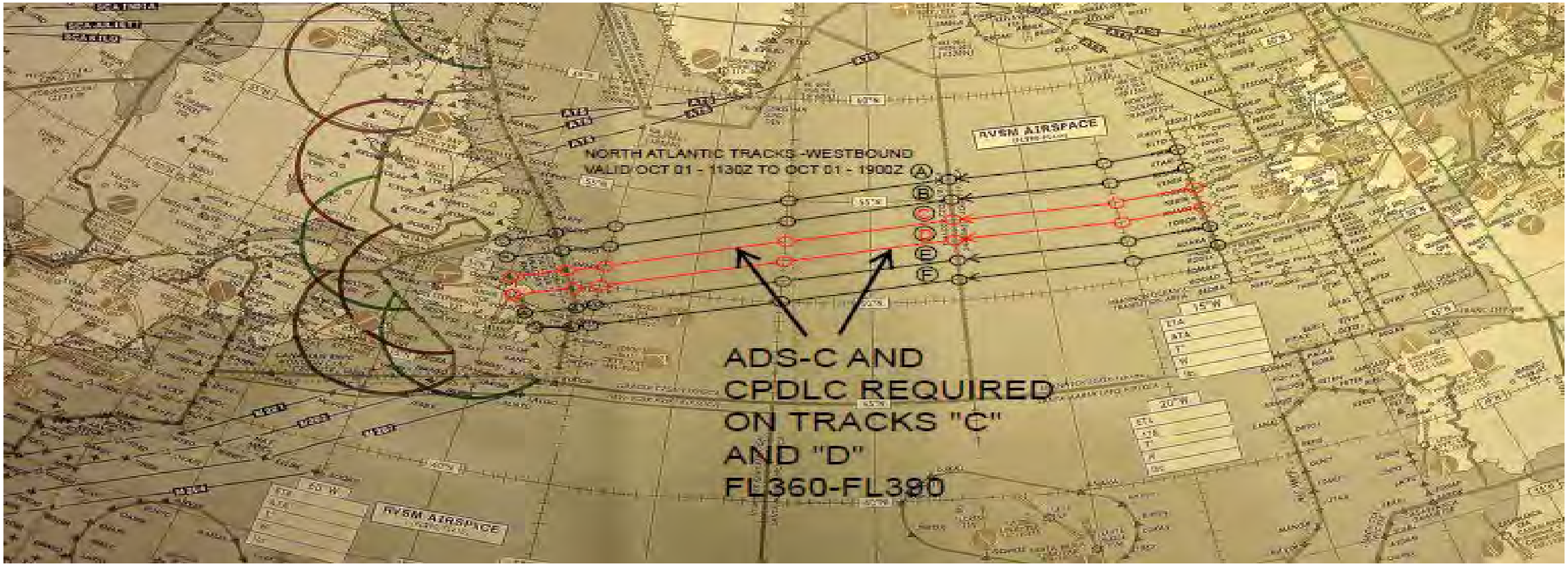
Honeywell

- Preferred, more direct oceanic routing
- Fewer delays on the ground while awaiting clearance
- Fully automated oceanic position reporting (ADS-C)
- Increased safety - improved controller awareness of aircraft position
- Reduced separation allowing more aircraft in the NATS Airspace
- Reduction in gross navigational errors (GNE)
- Route clearances automatically made in flight plan



FANS 1/A+ North Atlantic Tracks

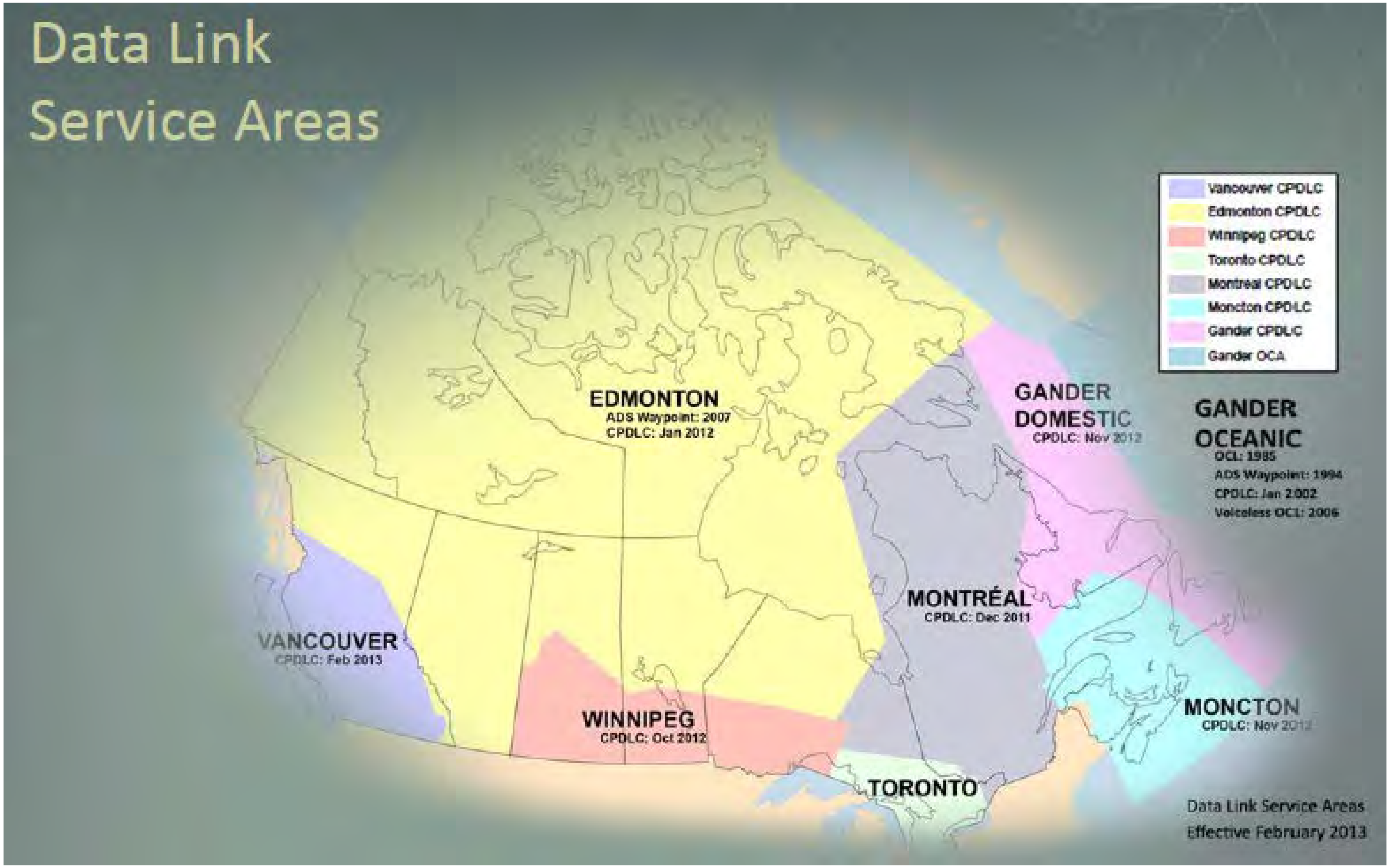
Honeywell



Phase	Dates	Region	Flight Levels
Phase 1	Feb 2013	Center 2 Tracks	FL 360-390
Phase 2A	5 Feb 2015	NATS Tracks OTS	FL 350-390
Phase 2B	7 Dec 2017	ICAO NAT Region	FL 350-390
Phase 2C	30 Jan 2020	ICAO NAT Region	Above FL 290

Nav Canada – FANS 1/A+ Operational

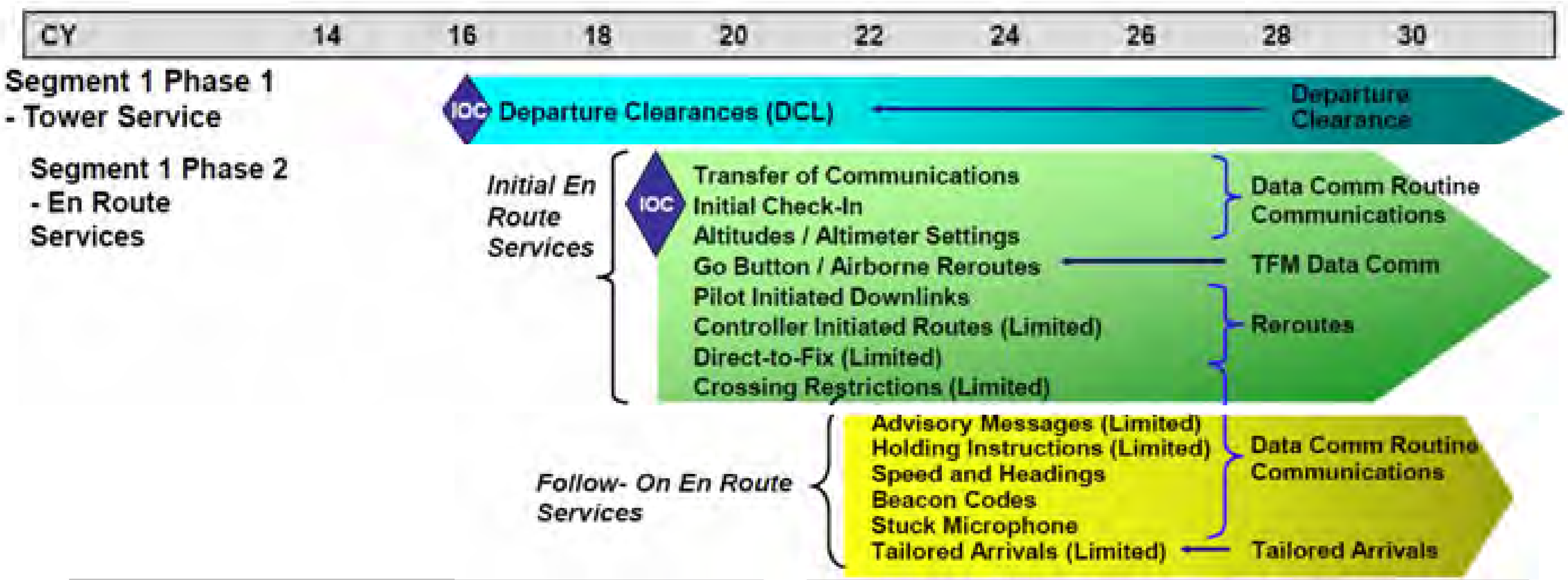
Honeywell



FANS Fully Operational in Canada

FAA NextGen FANS 1/A+ Deployment

Honeywell



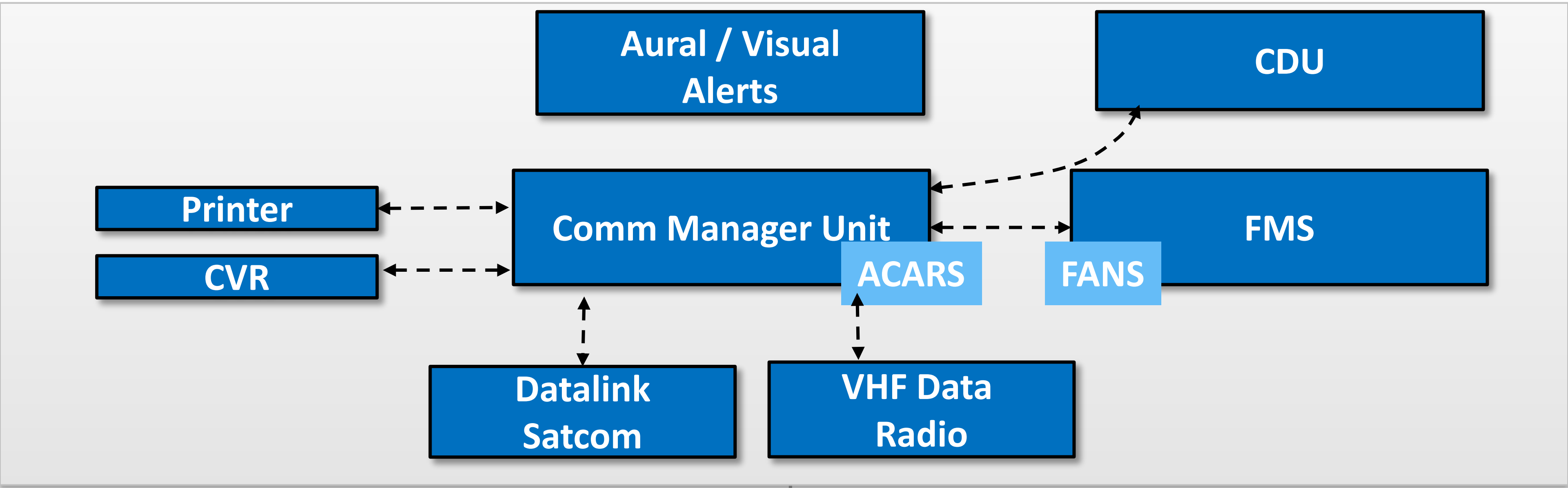
- **Segment 1 Phase 1: DCL**
  - Trial Sites – Newark & Memphis
  - 51 Airports from 2016-18
- **Incentive Program**
  - Goal: 80% Equipage
  - 8 Airlines signed up

- **Radios**
  - VDL Mode 2
  - Mode 0, A Accommodated
- **Segment 1 Phase 2: En Route**
  - Timing decision in process

FANS 1/A+ CPDLC Coming to a US Airport

FANS Solution

Honeywell

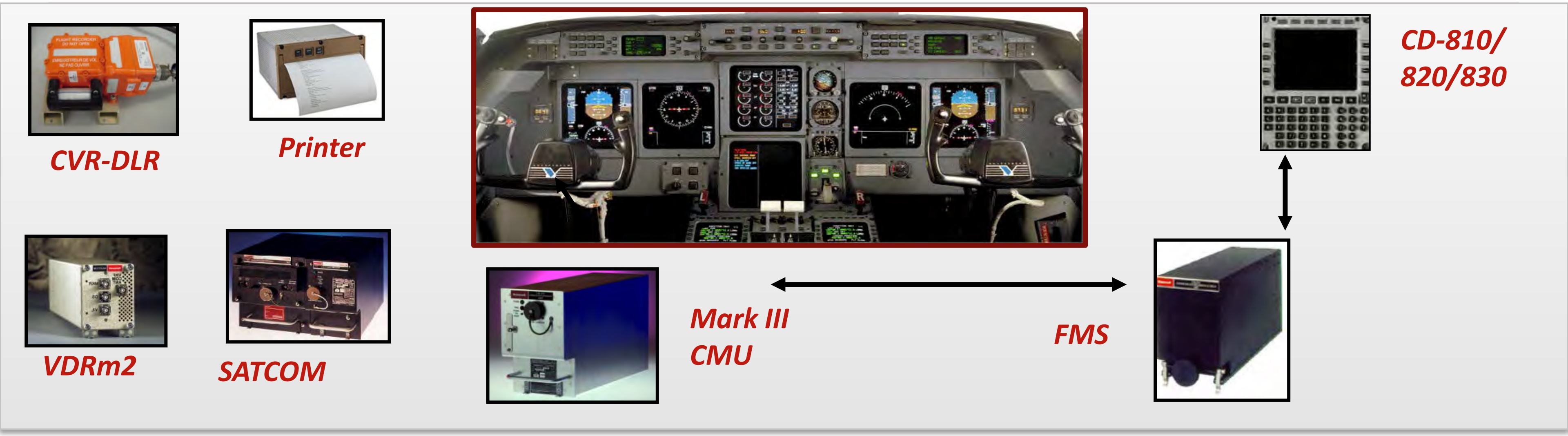


- **Fully Integrated System tested end to end**
- **Integrates with existing Flight Management Computers**
- **Integrates with Existing Control Display Units**

- **FMS providing aircraft guidance is same FMS providing navigation**
- **FANS operation available if either FMS 1 or FMS 2 fail**

FANS is an Integrated System Solution

Honeywell Integrated System Solution



Product	Required/Option	Model
Flight Management System	Required	FMS6.1 based on A/C type
FMS 6.1 FANS Upgrade	Required	FANS “mini” load
Cockpit Display	Required	CD-810/820/830
Mark III - Communication Management Unit Aircraft Personality Module	Required	7519200-921 964-0465-001
SATCOM Level D	Required	MCS3000/6000/7000/HD710
VHF Data Radio Mode 2	Required	7026201-803/804
Aural and Visual Alerting	Required	External Discretes
Cockpit Voice Recorder with DLR	Required	LW: 980-6044-003 HFR5: 680-6032-001
Printer – TW5	Recommended Option	42904111

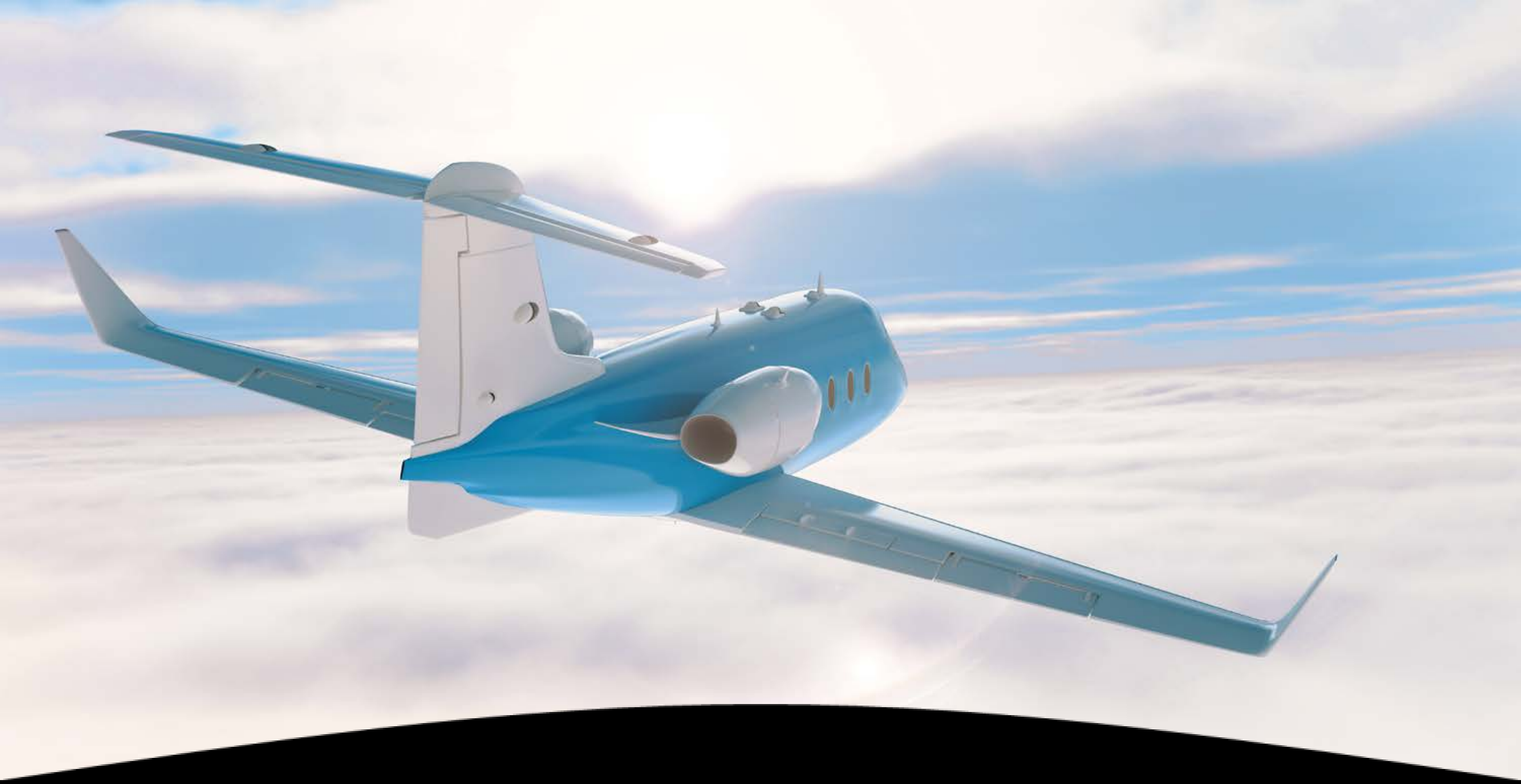
Honeywell FANS solutions

Honeywell

- **EPIC**
  - Available
- **Honeywell FANS solutions:**
  - Using integrated CMU MK III / FMS solution :

Aircraft	Planned Availability
Gulfstream G-V	Available
Gulfstream G-IV	Available
Gulfstream G-IVSP	Available
Falcon 900EX	Available
Falcon 900C	Available
Falcon 900 A/B	Available
CL601	Available

- **Other A/C upon request**
- **Check with your OEM for specific certification dates**



PM-CPDLC / Link 2000+

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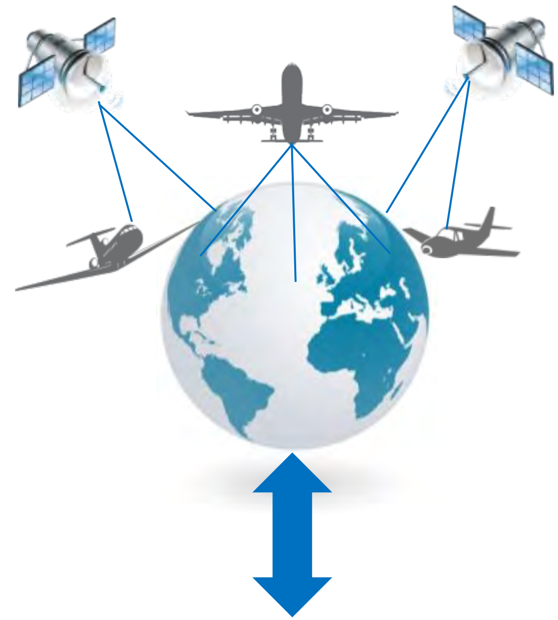
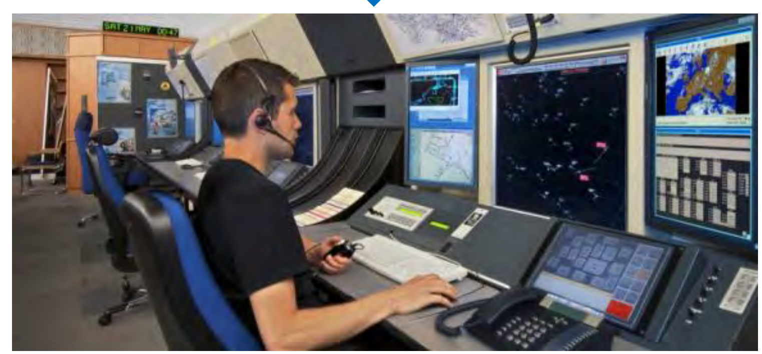
PM-CPDLC (Link 2000) Benefits

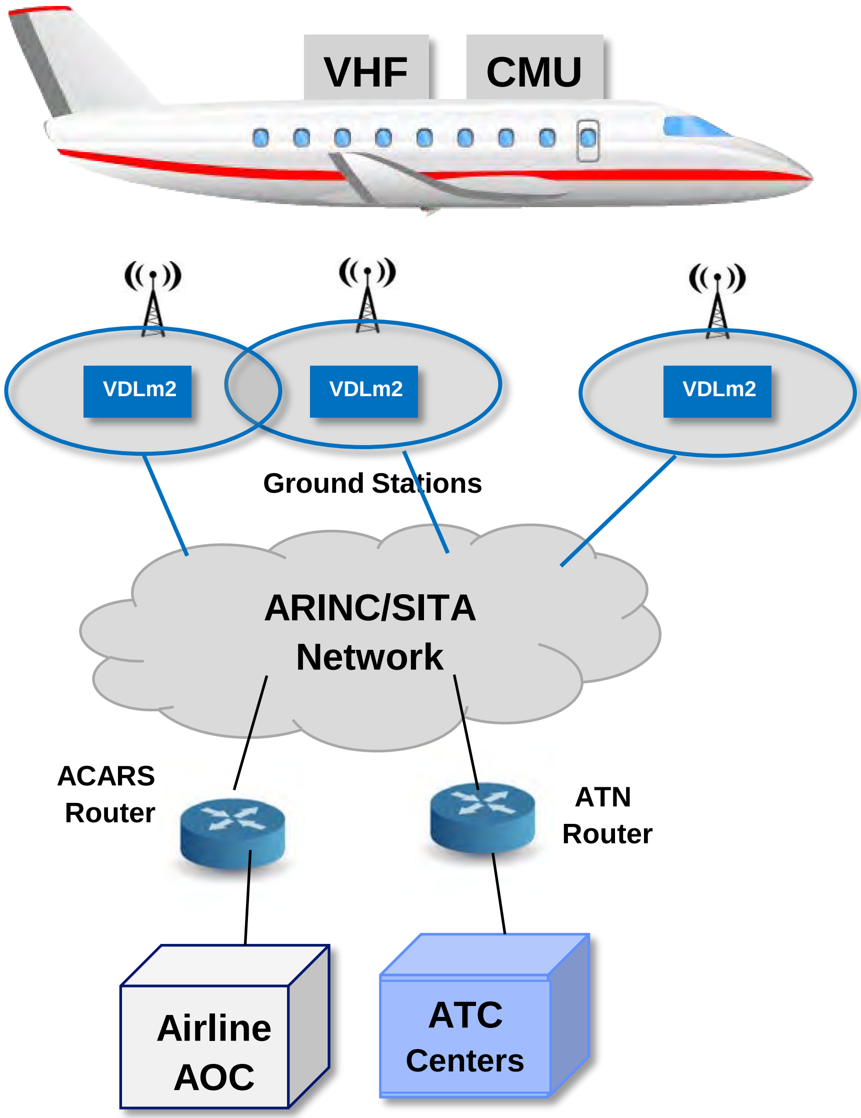
- Increased safety - improved controller awareness of aircraft position
- Reduced separation allowing more aircraft in the Airspace
- Reduction in errors
- Route clearances automatically made in flight plan
- Mandates initially set to go into effect in 2015/2017





PM-CPDLC Overview

Honeywell



- **Automates Routine tasks**
  - Microphone checks
  - Clearances, handoffs
- **Avionics**
  - Radios –VHF VDL mode 2 only
  - Comm Mgt Unit (CMU), FMS
- **Network / Ground Stations**
  - VDL mode 2
  - ATN network
- **Service Agreements**
  - ATC ←→ARINC/SITA

New Network and Avionics Deployment

There Has Been an Extension to 2020 – Why?

Honeywell

- **Unresolved Issues within PM-CPDLC / ATN Network**
  - Delays in Ground Station Network Roll-out
  - Technical Issues
  - Interference, coverage
  - Channel Congestion
  - Radio Issues/Lost Connections → *Provider Aborts and Network Delays*

http://ec.europa.eu/transport/modes/air/single_european_sky/doc/implementing_rules/2014-04-23-easa-datalink-report.pdf

- **Loss of confidence Pilots and Controllers –**
  - Many Major Airlines have stopped Avionics upgrades

- **EASA / SESAR / European Commission Engaged**
  - SESAR JU VDL mode 2 study launch in January 2015
  - Honeywell Consortium Partner

Crash Protected Recorders

Honeywell

- **Data Link Recording**
  - Records CPDLC Messages on the Cockpit Voice Recorder
- **FAA Mandate**
  - CVR is required to perform recording of datalink messages *if datalink system is installed on or after* the below dates:
    - Part 135: December 2010
    - Part 91: April 2012
- **EASA – Europe**
  - new delivered aircraft with CVR, operating in the EC
    - 8 Apr 2014
  - Unclear - retrofit proposed for 2016 (ICAO)
- **90 Day Beacons**
  - Forward Fit: March 2015
  - Retrofit: 2018-20 proposed

6518883

Crash Protected Recorders

Honeywell

- Models:
  - LW-CVFDR-717 Combi (A717)
  - LW-CVFDR-429 Combi (A429)
  - LW-FDR FDR
  - LW-CVR CVR

LW RECORDERS FAMILY

- Replaces Legacy HON AR FDR /CVR/Combi(s)
- CVR – Data Link Recording - 2hrs
- FDR – 25Hrs @1024words/sec
- Platforms:
- Dassault
- Other BGA
- Helo

90 Day Beacon Forward Fit
March 2015

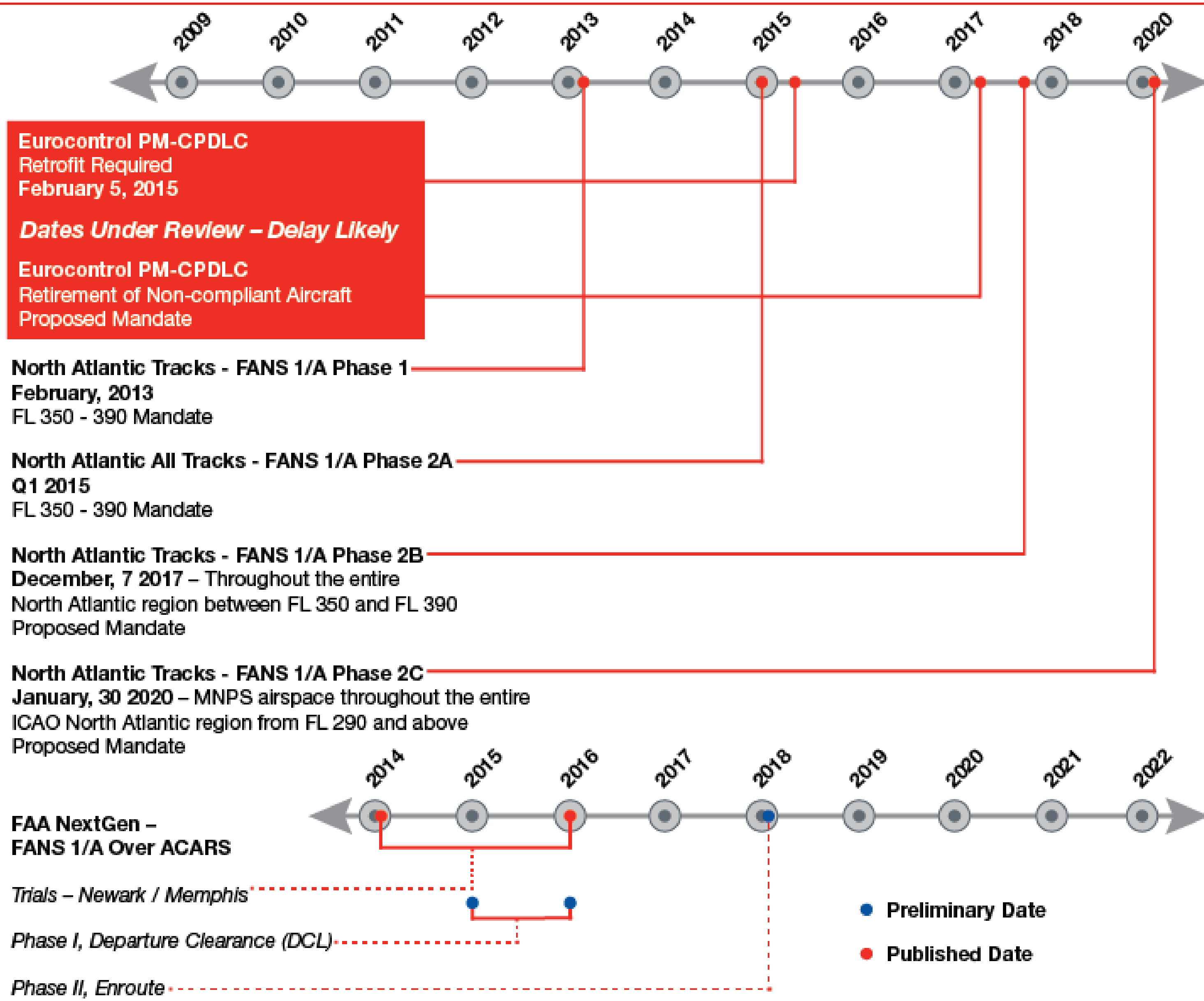
HFR5 FDR & CVR

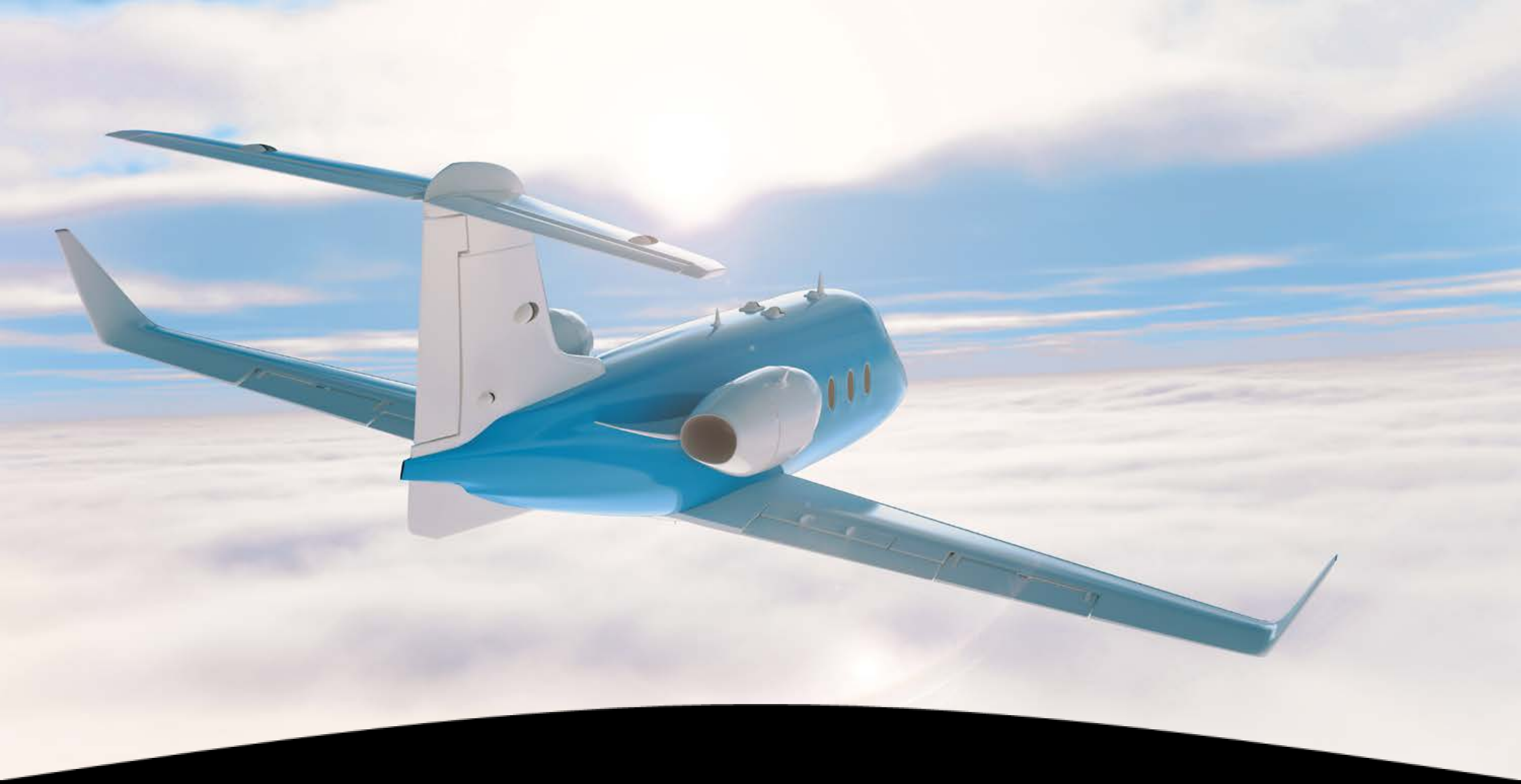
- Airbus SA-A318,A319,A320,A321 Airbus LR-A330, A340
- All Boeing (except 787)
- UAL installing HFR5-V via STC
- Global Express HFR5-V

90 Day Beacon (FF)
March 2015

FANS-1/A, PM-CPDLC Timeline Summary

Honeywell





ADS-B Overview

Honeywell

Why ADS-B

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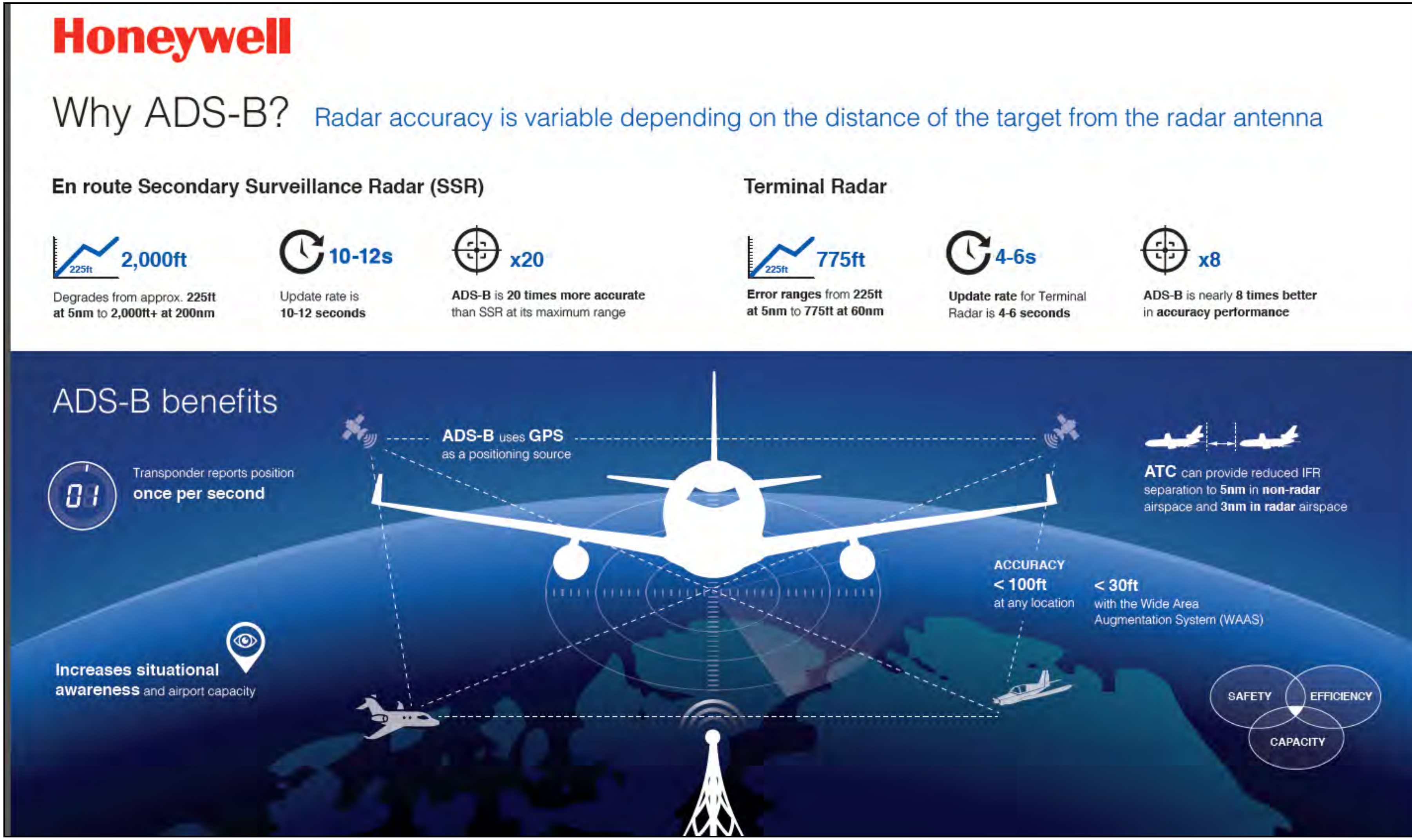


Honeywell – Epic and PII

Honeywell

- XPNDR Upgrade (Epic and PII)
  - ✓ TSO-C166b, TSO-C112d, and TSO C169a (DO-260B)
- GNSSU Upgrade – TSO-C145b or TSO-C146b (RA Aware)
  - ✓ Epic - VIDLG upgrade or MAU GPS Module Upgrade
  - ✓ Primus II – Honeywell older HG2021GD02 GNSSUs – replace
  - ✓ HG2021GD03 GNSSU firmware upgrade
  - ✓ KGS-200 “bolt-on”
  - ✓ Require Active Antenna
- Controller Upgrade
  - ✓ Epic – Display Software
  - ✓ Primus II Radio Management Unit – CRT Units have to be replaced / LCD Units software upgradeable
- Primus II Communication Unit Upgrade
  - ✓ Comm Module - Upgrade
  - ✓ Cluster Module - Upgrade
  - ✓ Strap Module - replace
- FMS Upgrade
  - ✓ Require true heading, magnetic heading, magnetic heading status, vertical speed parameters delivered to XPNDR
  - ✓ Epic – Version 7.1
  - ✓ NZ-2000 (IC600/800) – Version 6.1
  - ✓ 3rd Party FMS

Honeywell Mode S Transponders ADS-B Out Status

Honeywell

AESS

TRA-100B

MST-100B

Apex Module
KXP-2290

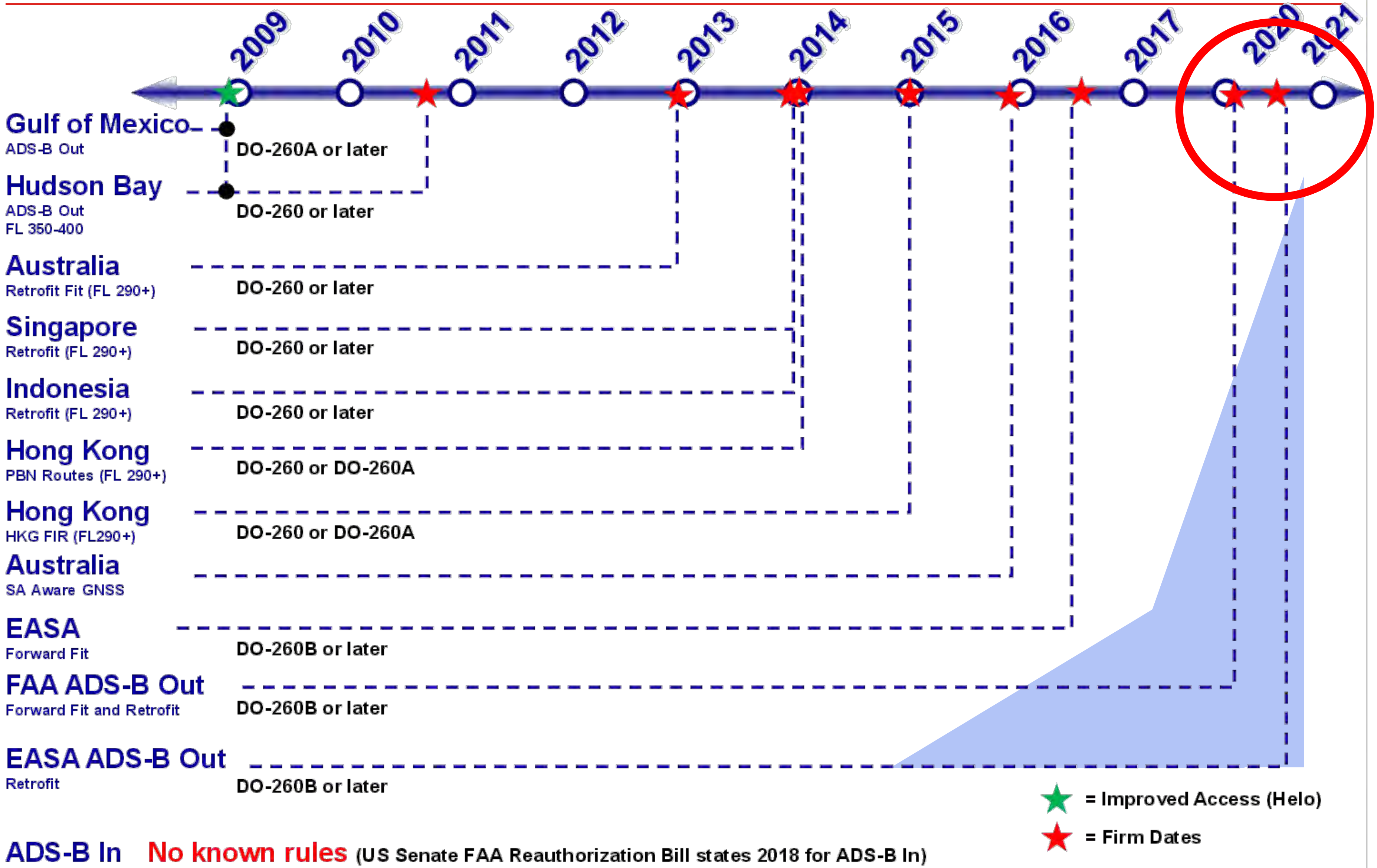
Epic Module

Primus II

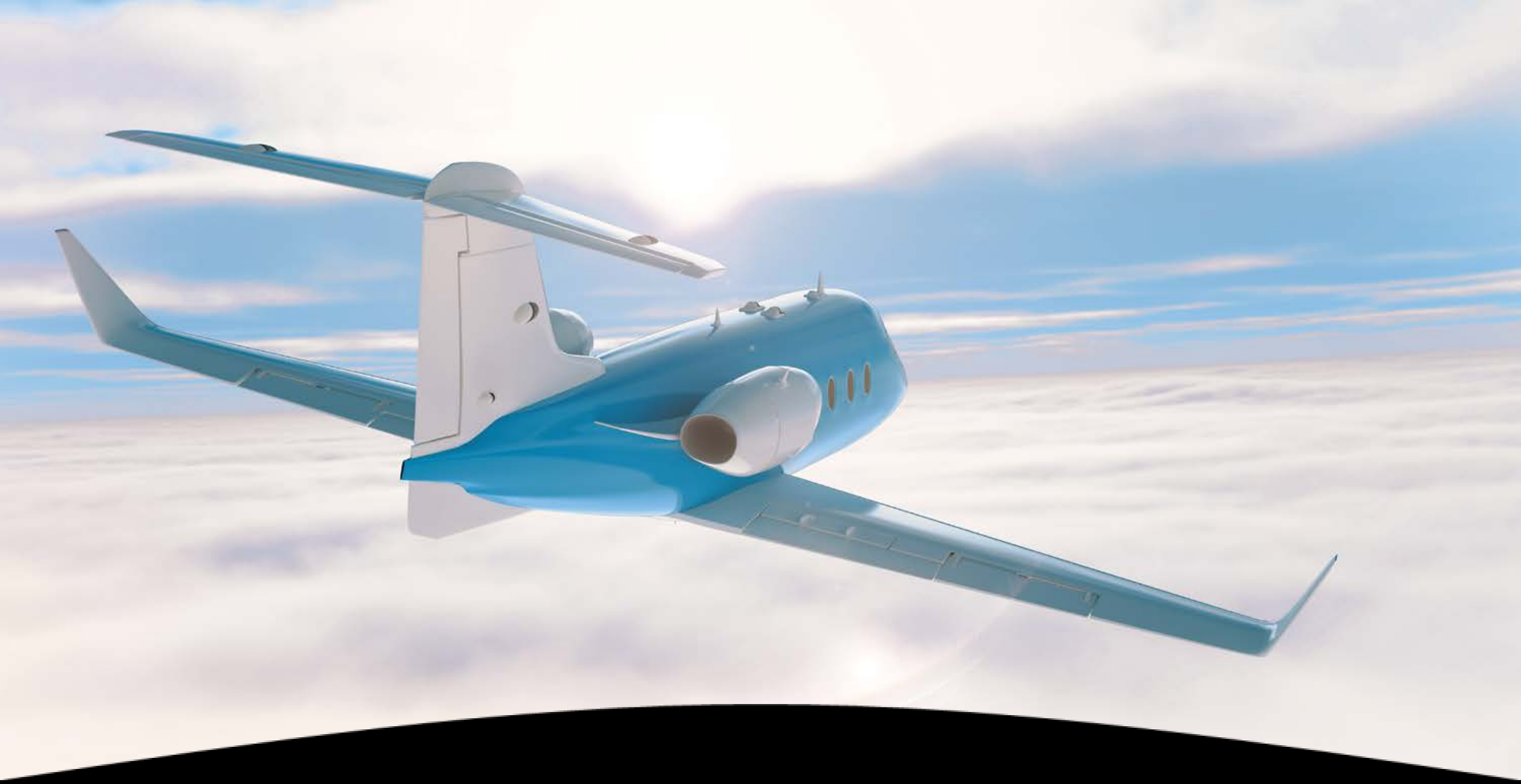
KT-73 Panel Mount

Timeline

Honeywell



**Note – Australia and FAA Mandates Also Require "SA Aware" GPS Receiver (i.e. WAAS)*



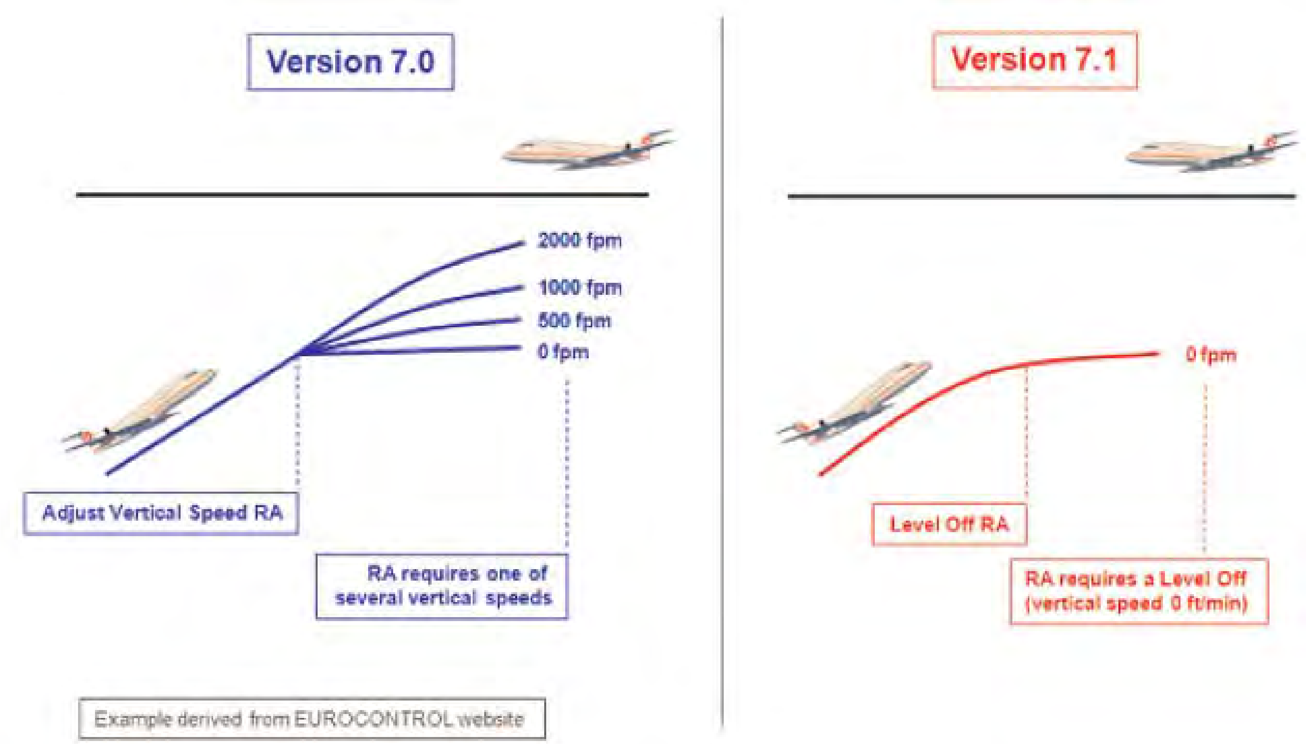
TCAS Overview

Honeywell

TCAS Change 7.1 – Adjust Vertical Speed

Honeywell

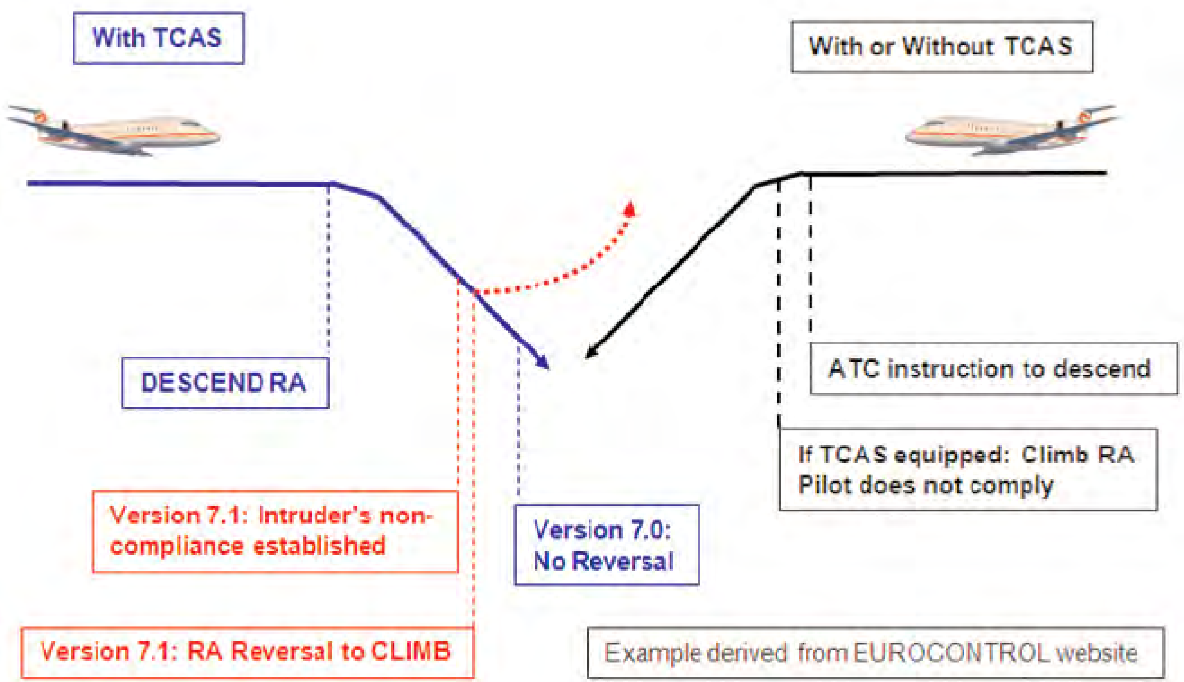
- **"Adjust Vertical Speed, Adjust" (AVSA) Resolution Advisory (RA) was determined to be confusing, and there is a history of some pilots not responding as intended**
- **The solution in Change 7.1 is to replace the four AVSA RAs with a single "Level Off, Level Off" RA.**



TCAS Change 7.1 – TCAS Reversals

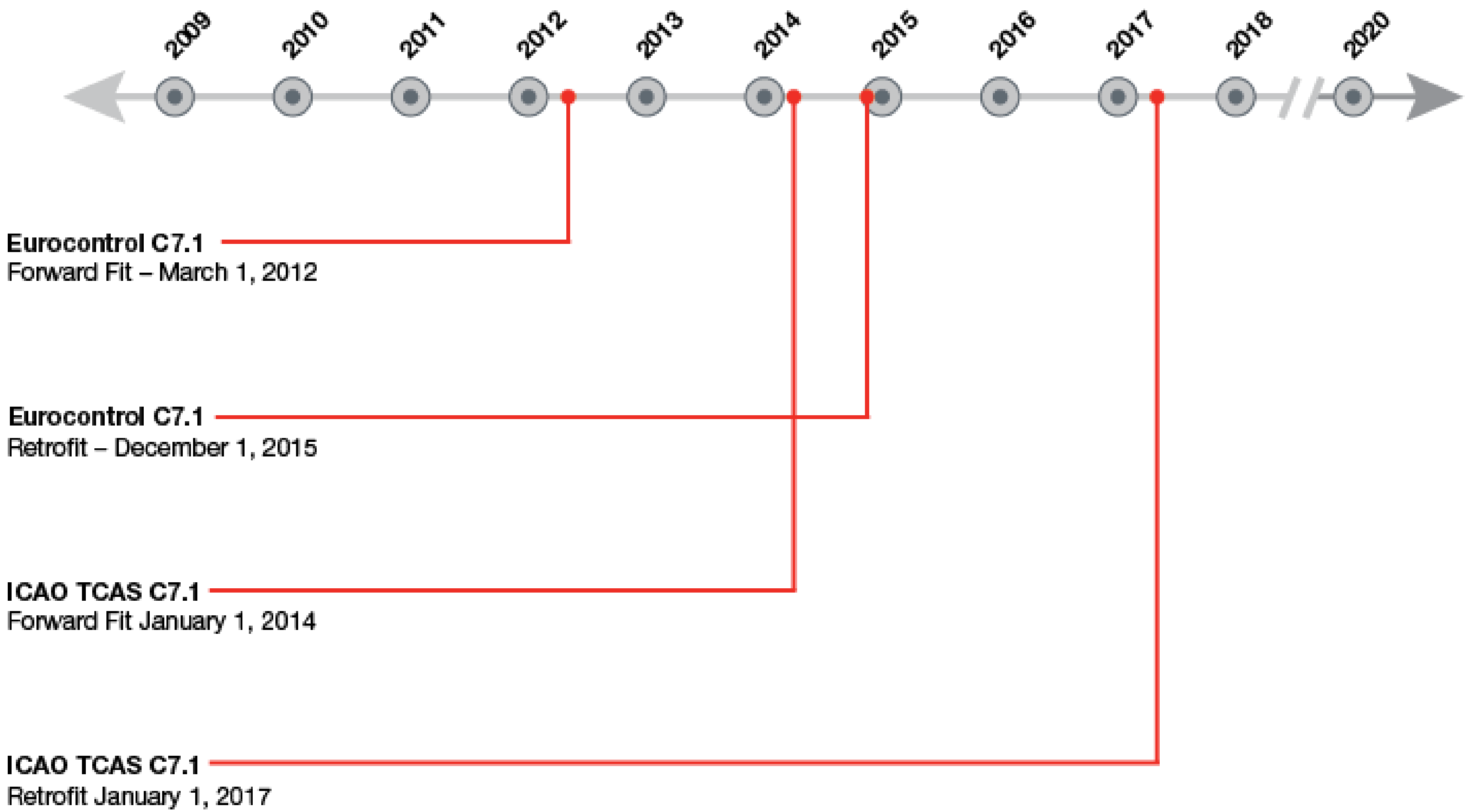
Honeywell

- **TCAS reversals were introduced in 7.0 to adapt to changing situations where the original guidance became the wrong thing to do if one of the pilots did not follow the RA or was instructed by ATC to perform a particular maneuver**
- **Change 7.1 improves this reversal logic to address late issuance of reversal RAs and potential failures to initiate reversal RAs**



TCAS Change 7.1 Regulatory Timeline

Honeywell



FAA TCAS C7.1 – No Proposed Regulation

● **Firm Date**

TCAS 7.1 Honeywell Solutions

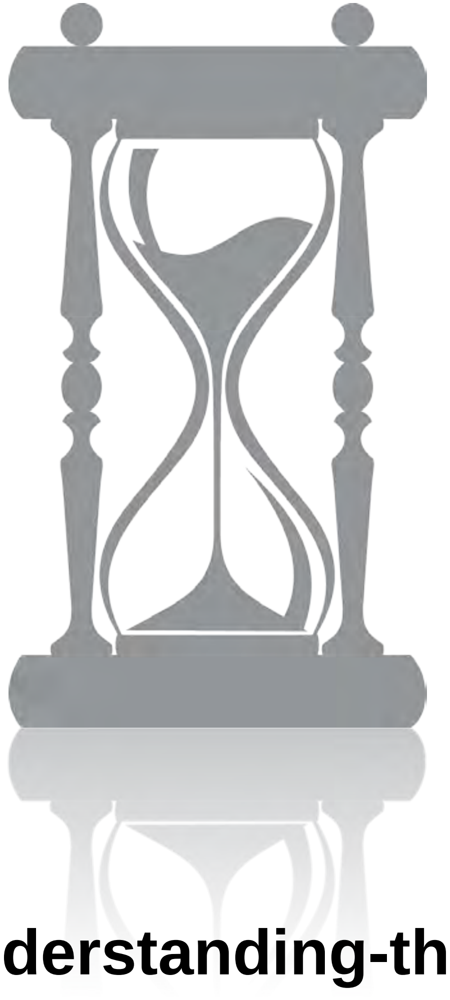
Honeywell

Product	Old PN	New PN	Availability
TPA-100B (6MCU)	940-0300-001	940-0351-001	Available Now
TPA-100B (4MCU)	940-0400-001	940-0451-001	Available Now
TPA-81	066-50000-XXXX	940-0351-001	Upgrade to TPA-100B
TPU-67	066-01146-1111	066-01146-2121	Available Now
TPU-67	066-01146-1211	066-01146-2221	Available Now

Sales Bulletins Currently in place 2016

TPU 67 is not ADS-B 'IN' capable

Time is running out….. Don't be late to Mandates.



Questions?

Visit: http://aerospace.honeywell.com/news/understanding-the-mandates-landscape





GEORGE PIZZULLO

GoDirect Cabin Services

Honeywell

HONEYWELL GODIRECT HAS A FULL COMPLIMENT OF SERVICES AGREEMENTS:

- Iridium
  - Iridium
  - Iridium CERTUS in negotiation
- Inmarsat
  - “Classic” Aero-I, H, H+ (voice & ACARS)
  - Swift64
  - SwiftBroadband, including Streaming Services
  - Ka (Inmarsat Gx, Jx by Honeywell)
- ViaSat
  - Ku-band “Yonder”, Ka-band “Excede”
- VHF networks (ACARS)
  - ARINC
  - SITA
- ATT

Honeywell

HONEYWELL GODIRECT SERVICES

Cockpit Services

Datalink Communications

Worldwide Flight Planning

Weather Information

Air Traffic Services

Flight Sentinel

Cabin Services

GoDirect Access

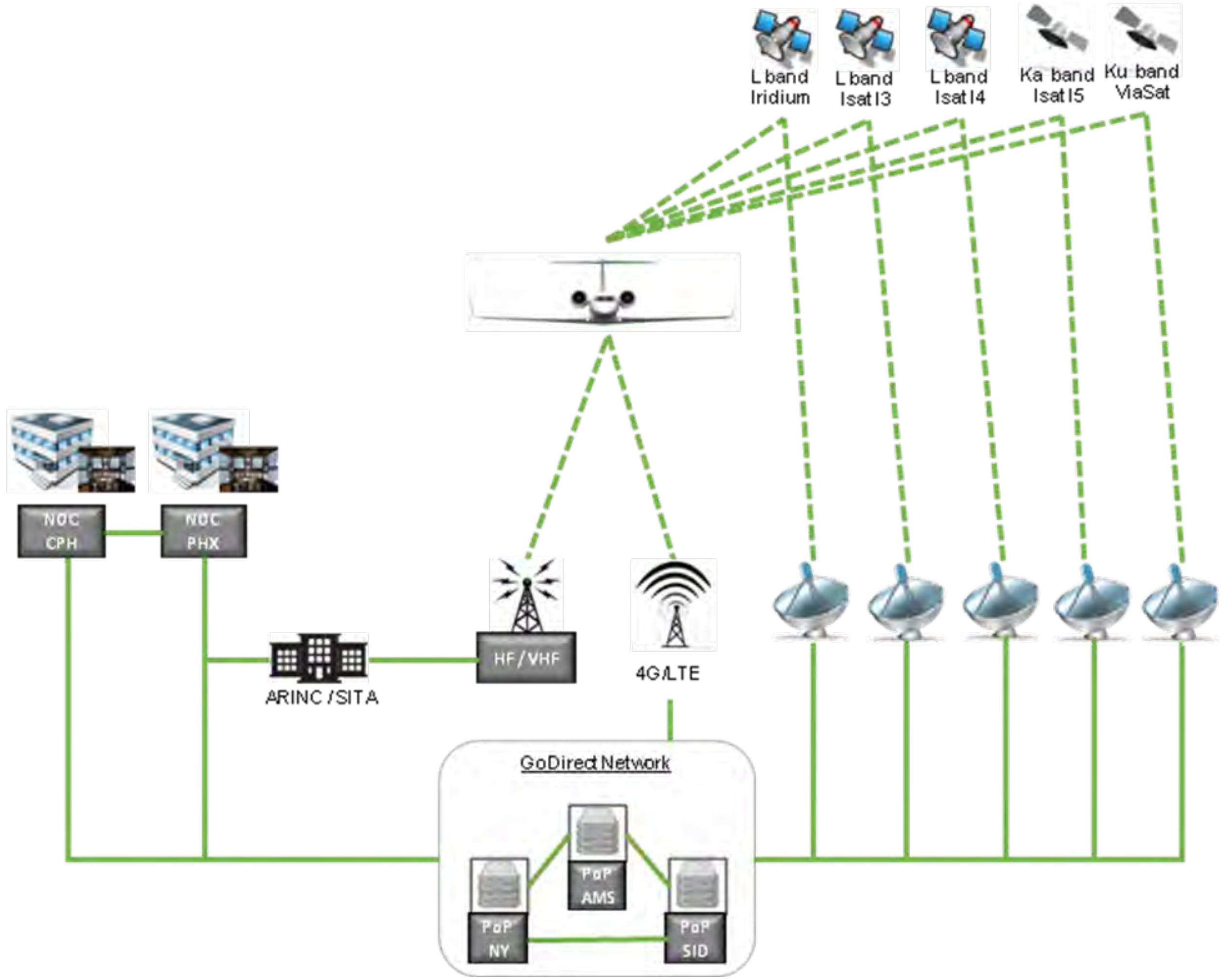
GoDirect Media

GoDirect Filtering

GoDirect Portal

GoDirect Routing

GoDirect Global Number



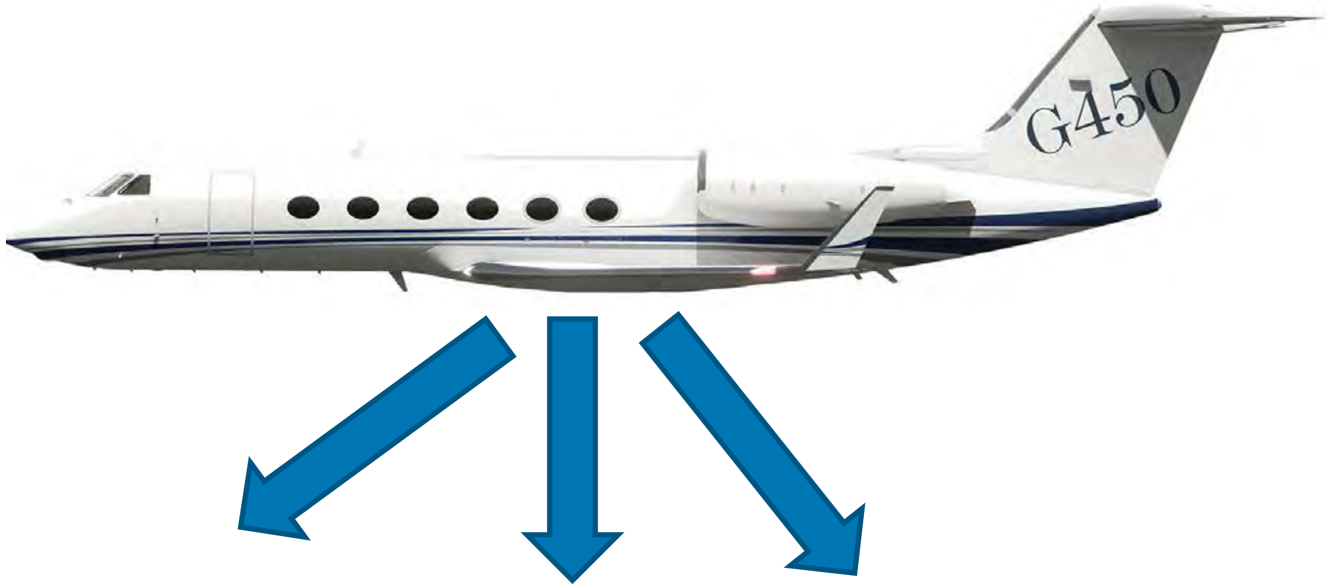
Honeywell GoDirect has the most comprehensive services offering that includes only the most compelling links with a secure world wide network to increase passenger experience and reduce latencies

FULLY INTEGRATED CABIN NETWORK OFFERING

Honeywell GoDirect can offer a fully integrated offering that provides flight departments with the information they need to fulfill mission needs

Honeywell

TAILORED SOLUTIONS DELIVERING ON NEEDS



Crew:
GoDirect Network App
GoDirect Tool Kit App

Passengers:
GoDirect Access
GoDirect Media

Operations:
GoDirect Portal
GoDirect Filter
GoDirect Network

Honeywell GoDirect Integrated Systems Enables Tailored Solutions to meet a Flight Departments Broad Range of Needs

Honeywell

FlightDeck freedom® and FANS

Andrea Duggan

Satcom Direct

Mid-Atlantic Regional Manager

Agenda

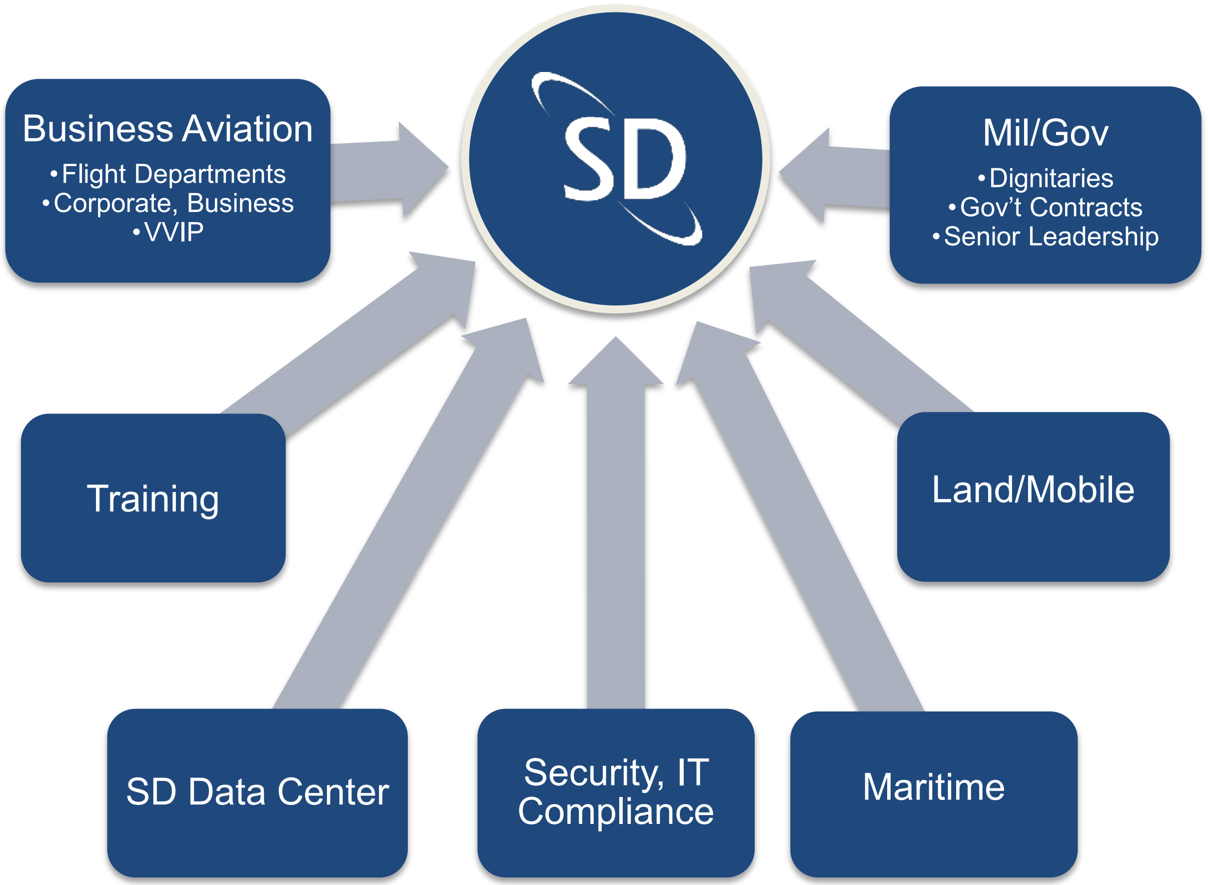
- SD Overview
- FlightDeck Freedom (FDF)
- FDF and FANS
- Unique to FDF
- APG & FDF
- FD 360
- SD Tracker
- SD Pro

SD Overview

Company Overview

SATCOM DIRECT – SINCE 1997

- By the Numbers:
  - 297 Employees
  - 10 Countries
  - 17 Offices
- Business Sectors:
  - Military / Government
  - Business and Private Aviation
  - Land / Mobile
  - Maritime
  - Security and IT / Corporate Compliance
  - Data Solutions: SD Data Center
  - Training



Where We Lead

- Largest Business Aviation service provider worldwide
- 100% of US Government Senior Leadership aircraft
- Solutions on more than 7,000 aircraft worldwide

We've become more than SATCOM

SD Pro	Flight Operations Management Platform
FlightDeck freedom	Flight Deck Datalink
3G	3G / LTE Private Data Network
globalVT	GSM/CDMA MVNO
SmartSky Networks	Air to Ground
SDR Satcom Direct Router; SD WiFi Hub	Hardware
SD Training; Satcom Direct AeroIT Certified	AeroIT Certification and Industry Training

Our New Brand

- Represents our evolution as a company over the past 18 years
- Beyond SATCOM
- Global Connectivity
- Company name is unchanged
- Customer and solutions focus is unchanged
- Call us SD

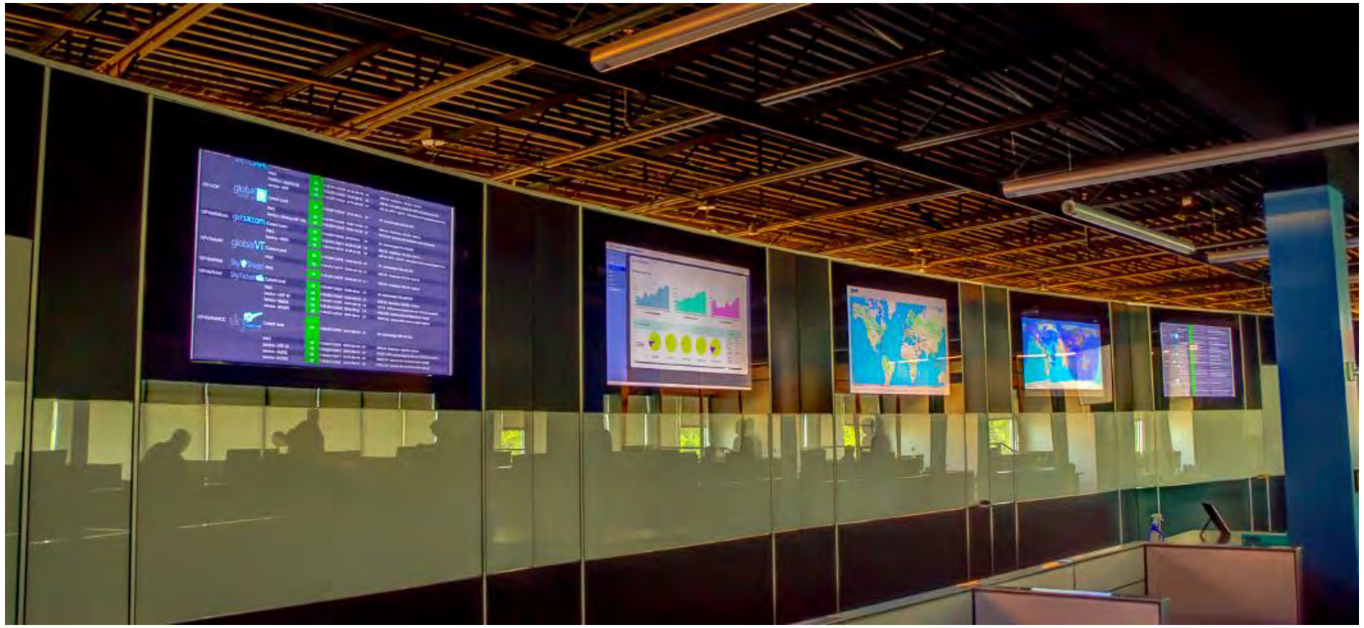
New Global Headquarters

- LEED Certified
- 24/7 Network Operations Center
- Testing and Validation Lab
- Research and Development Center
- Customer Events
- Private Tours

SD Network Operations Center

ACTIVATIONS AND 24/7 SUPPORT

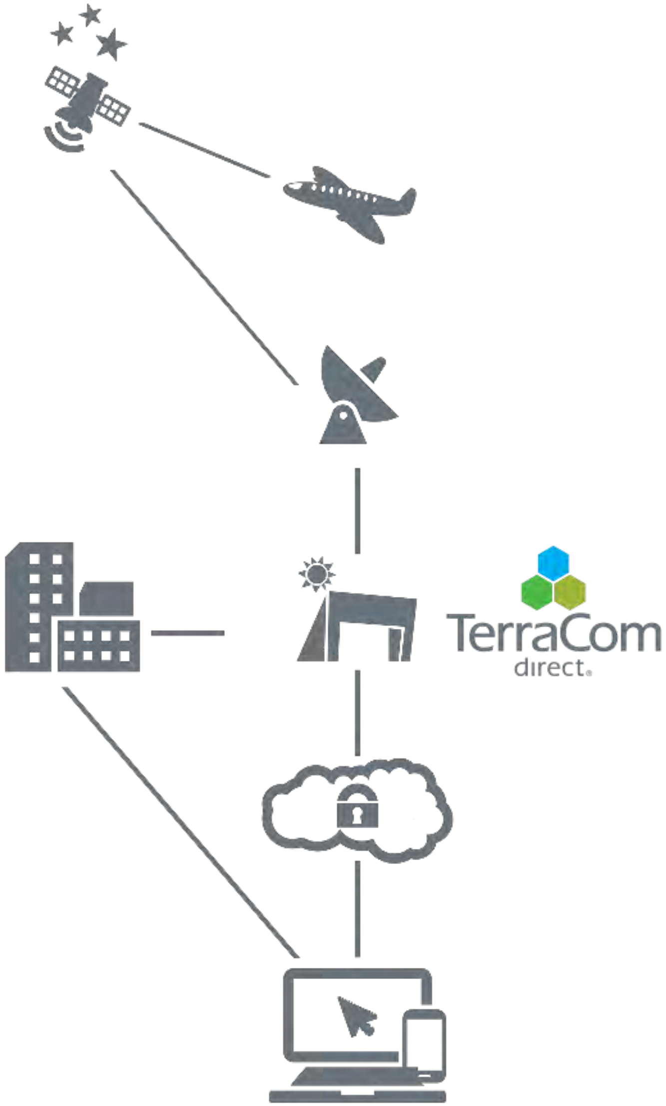
- Proactively monitoring network outages
- Tracking weather
- Monitoring failed authentications through our networks
- Flight monitoring
- Global support team certifications include but not limited to
  - Cisco CCNA's
  - CompTIA Network+, AeroIT, Security +
  - A&P
- Currently employing over 45 support employees globally to ensure rapid responses to our customers



SD Data Center

TERRACOM DIRECT

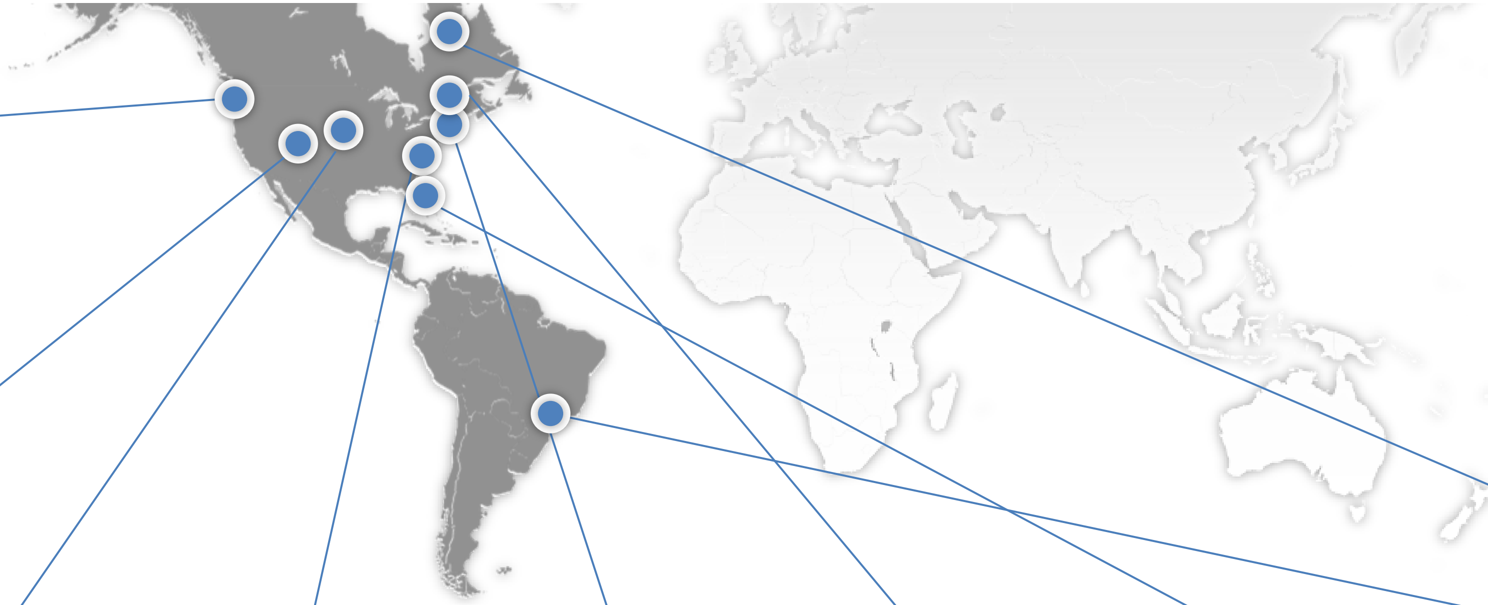
- Stand-alone, purpose built 25,000 sq. ft. structure
- All critical infrastructure is concurrently maintainable (N+1)
- Bunkered secured facility
  - 8” steel reinforced poured concrete / tilt wall construction
  - Wind rate to 160+ mph sustained wind, Cat 5 hurricane
  - Meets industry standards for safety, security and reliability
- Best in class IT services, tailored to aviation



SD Mobile Training and Hospitality Lab

- Equipped with multiple SATCOM systems and the latest SD technology
- Provides customers and flight departments with training on supporting and troubleshooting airborne connectivity networks and updates on new SD products and features
- Travels to customer locations for on-site use (North America)
- Try the latest technology for your aircraft without ever leaving the ground

Global Sales, Support and Training – 24/7



Seattle, WA
FlightDeck Freedom Ops
Sales
Support

+1 321.777.1435

Denver, CO
Sales
Support
Product Development Center
+1 720.328.7205

Little Rock, AR
Dassault Programs
Sales
Support

+1 321.525.4620

Savannah, GA
FlightSafety/ Gulfstream Lab
Sales
Support

+1 912.508.1661

Alexandria, VA
US Government Contracting
Acct Mgt
Support

+1 703.549.3009

Ottawa, Canada
Sales
Support

+1.613.800.0926

Melbourne, FL
World HQ
Training Lab, NOC
SD Store
Sales
Secured Data Ctr.
+1 321.777.3000

São Paulo, Brazil
Embraer Programs
Sales
Support

+55.11.2538.9068

Montreal, Canada
Bombardier Programs
Sales
Support

+1.514.900.3009

Global Sales, Support and Training – 24/7

Farnborough, UK
Training Lab
Sales
Support
+44.1252.554.460

Geneva, Switzerland
Sales
Support
+41225180345

Moscow, Russia
Sales
Support
+1.321.626.3545

Dubai, UAE
Sales
Support
+971.442.11991

Hong Kong, PRC
Sales
Support
+852.5364.0279

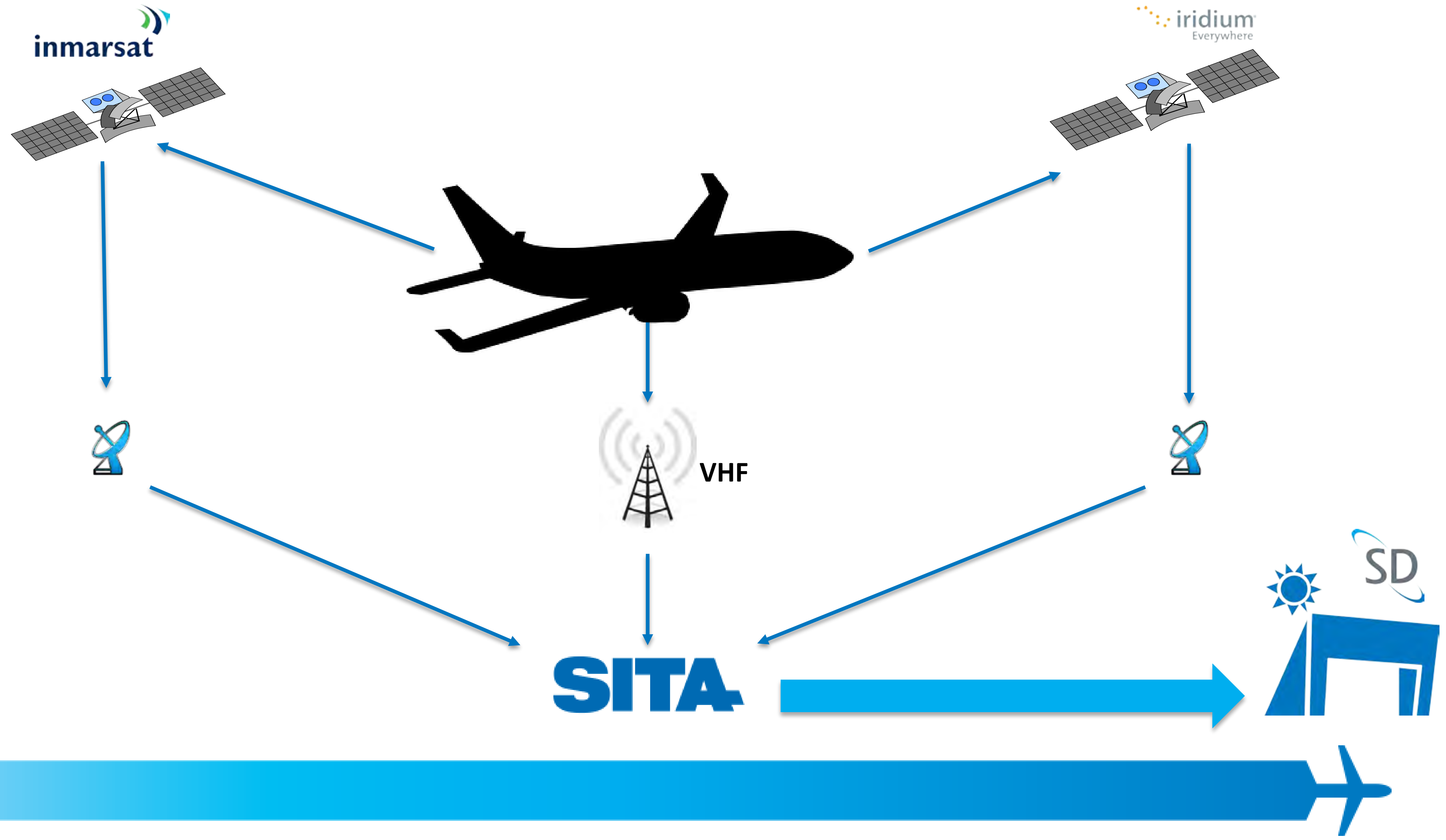
Melbourne, Australia
Sales
Support
+44 7738 717 938

Kuala Lumpur, Malaysia
Sales
Support
+1.321.525.8072

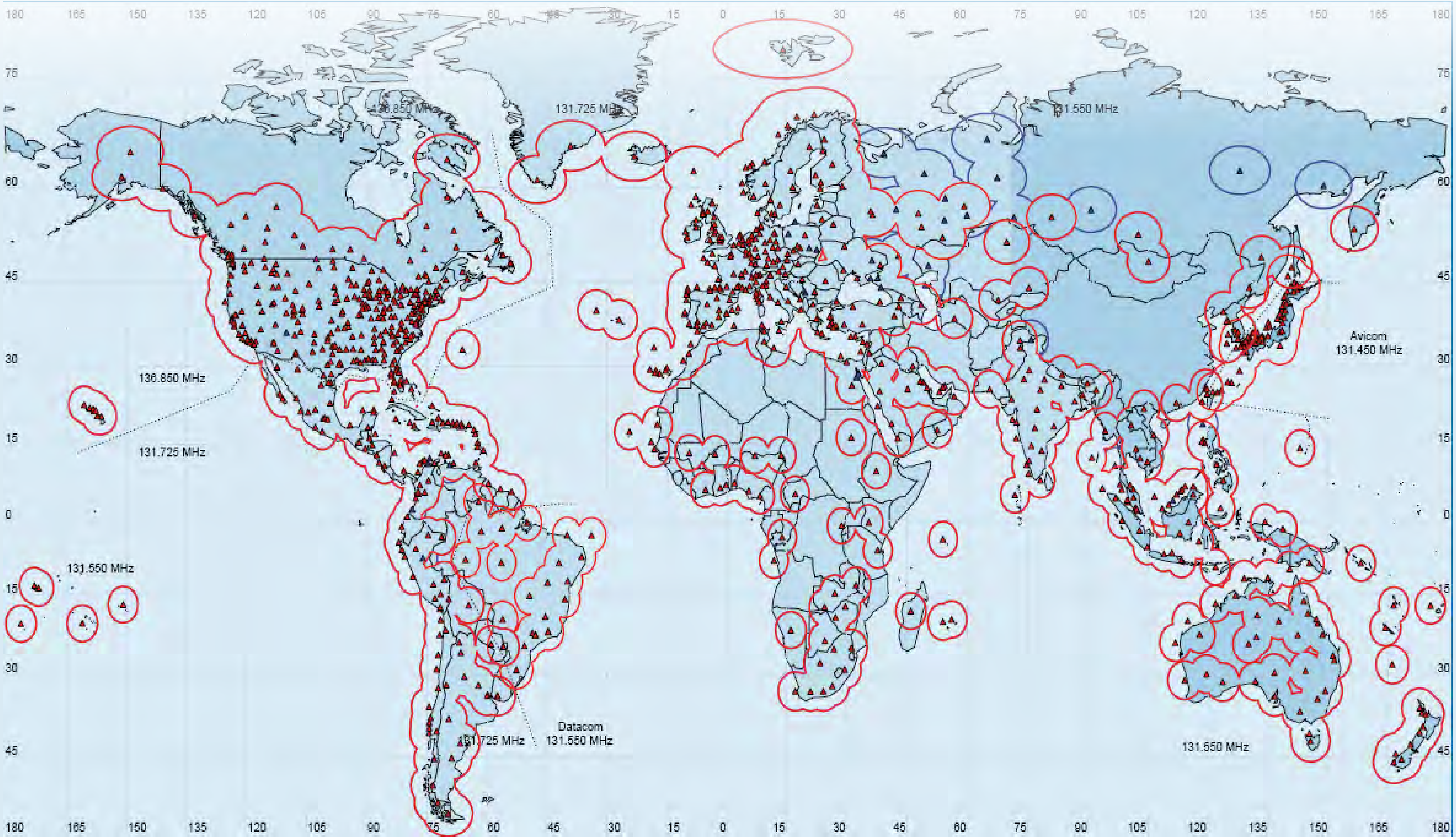
Cape Town, South Africa
Sales
Support
+27.282.368.6983

FlightDeck freedom®

The Datalink Network



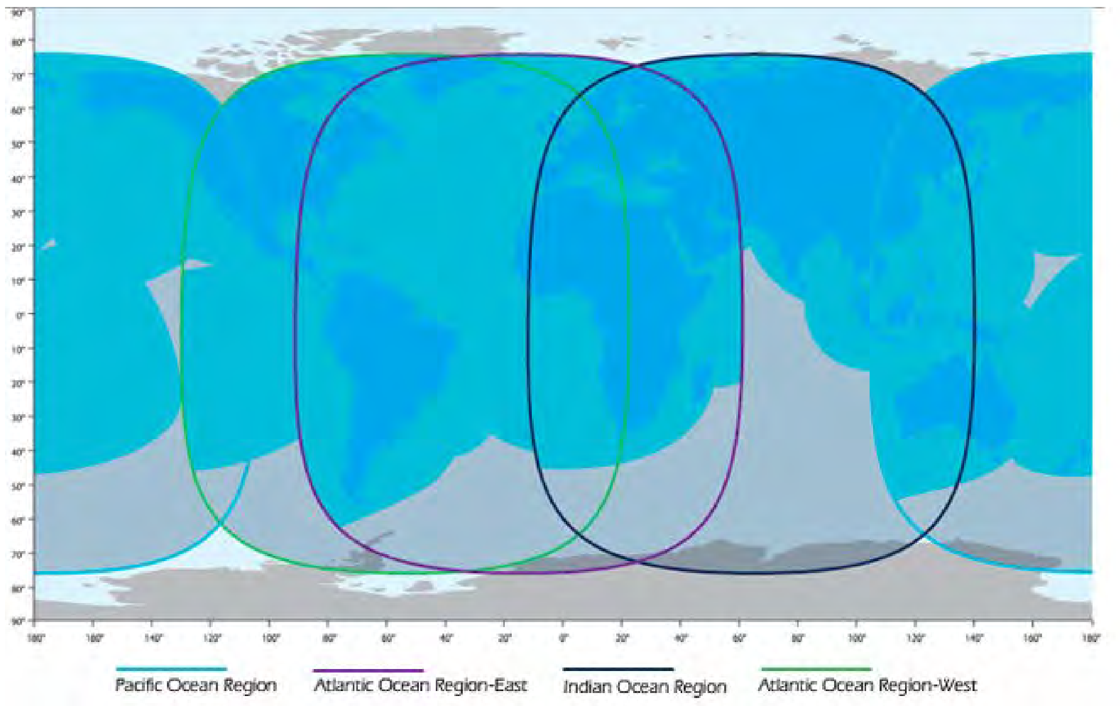
SITA VHF Coverage

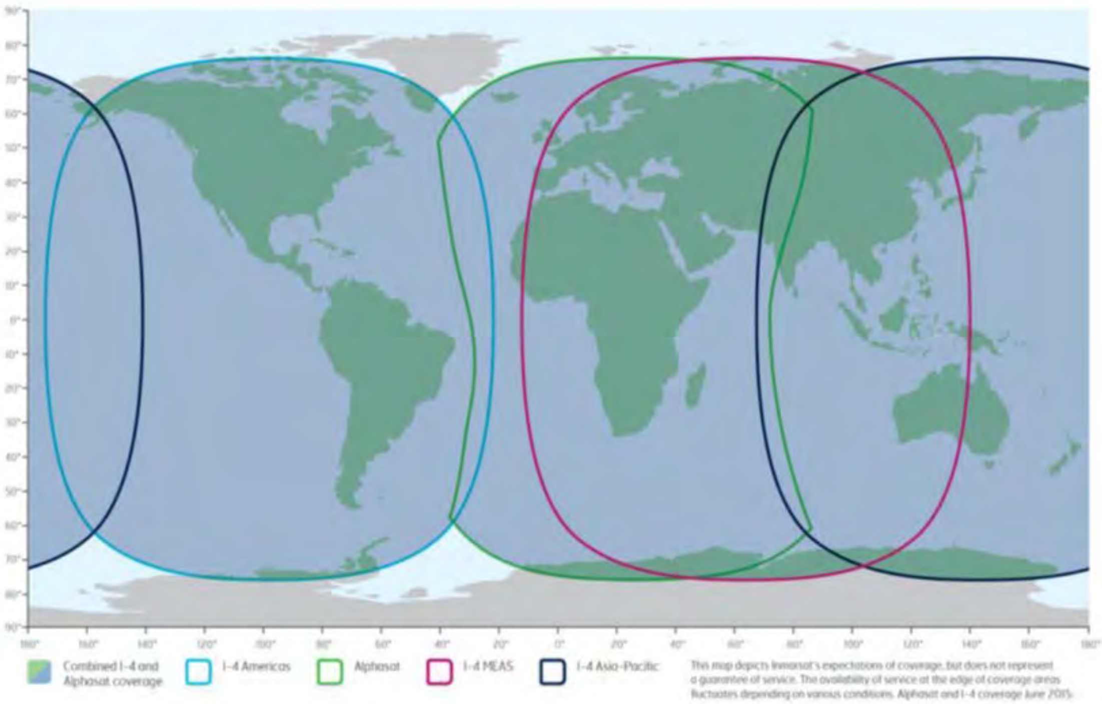


Inmarsat Coverage

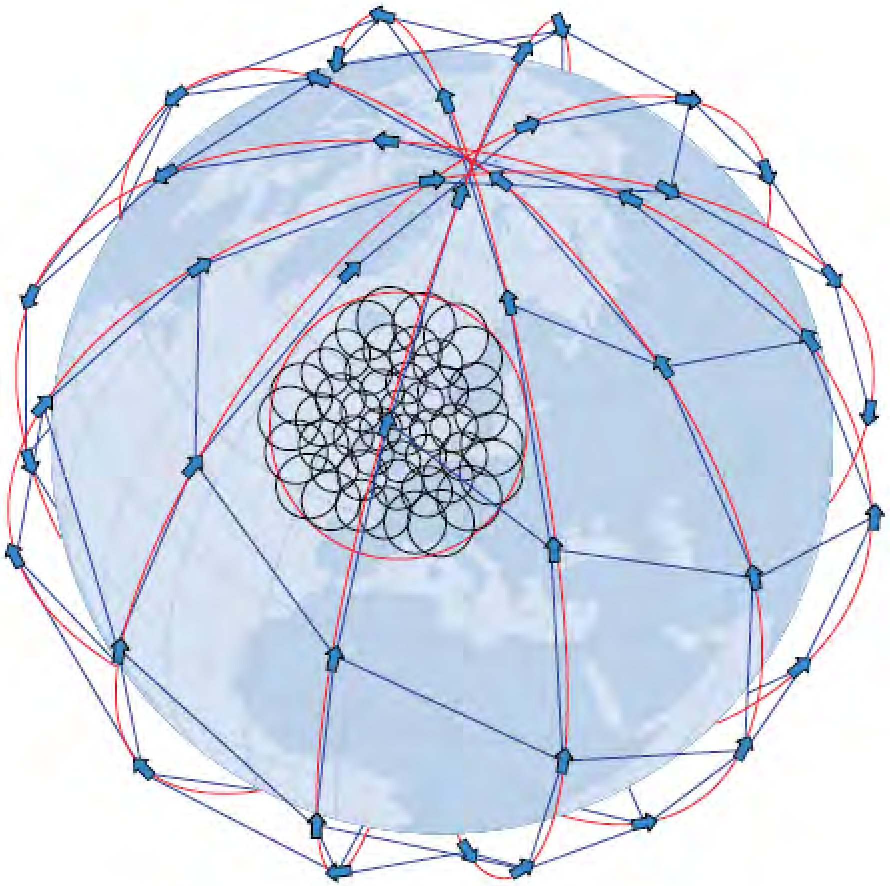
I-3 Coverage

I-4 coverage





Iridium Coverage



Included Services

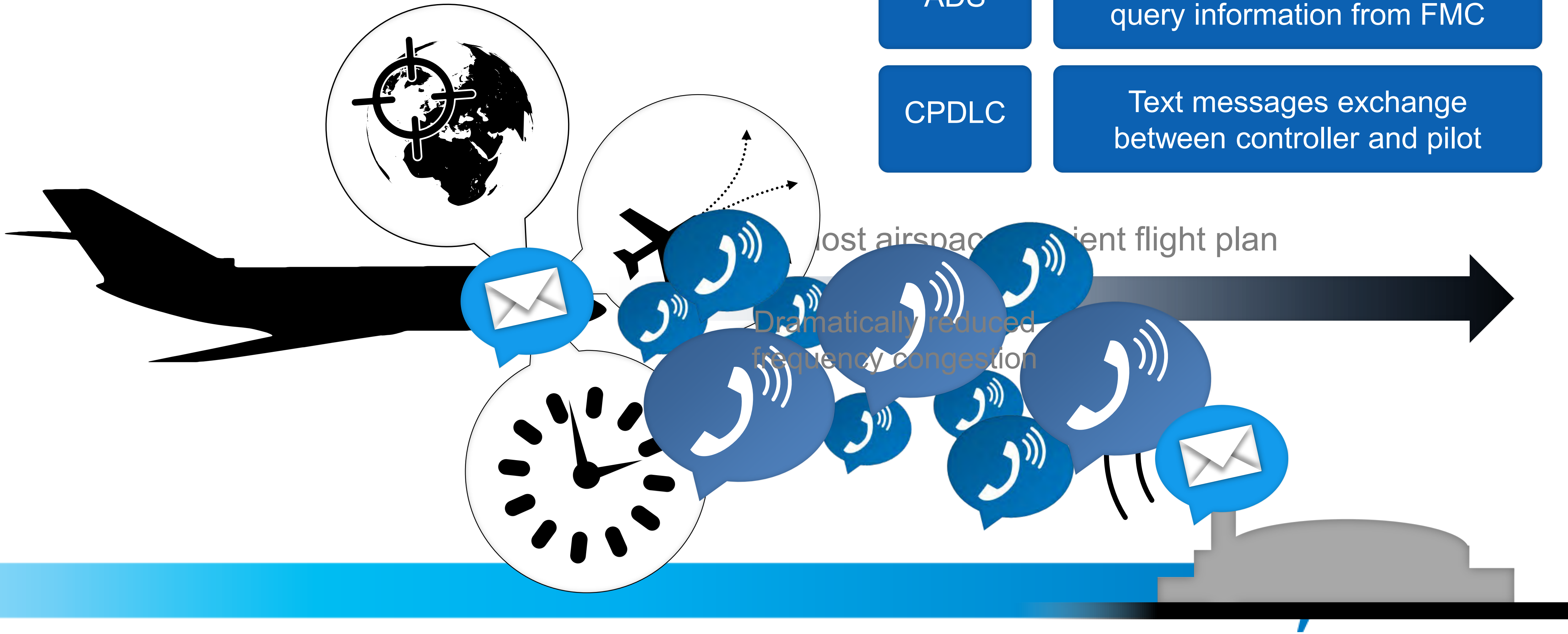
FDF Datalink Capabilities

Flight Plan Uplink to FMS	• **20+ trip planners supported** • Flight plan winds
Weather	• Terminal weather • SIGMETS • Winds aloft • Graphical weather
Air Traffic Control	• **Digital ATIS** • **Pre-departure clearances** • **Oceanic clearances**
Movement Reports	• Takeoff / landing times
Text Messages	• To email addresses, fax • Aircraft unique email address, i.e. **N321SD@FDFMail.com**
Flight Tracking	• Weather overlay • VHF and sat coverage • **Tracking via mobile device** • **GeoFence**
Cabin Services Status	• **Satellite network updates** • **Phone / internet usage** • **Outage notifications**
FANS & Link 2000+	• **ADS – C** • **CPDLC**

FDF and FANS

Future Air Navigation System

ADS	Allows ATC to automatically query information from FMC
CPDLC	Text messages exchange between controller and pilot



FANS Certification Testing

- STC Certification Testing now available
- Testing performed through SITA
- Requires advance notice to schedule with SITA
- One-time Fee:
  - Current FDF customers: $1500
  - Non-FDF customers: $2500
- Typically billed to the OEM or install facility conducting the testing/STC.

FANS Test Station

- System verification
- Crew familiarization
- Test Logon Process
- Test CPDLC functionality
  - Free-text messages
  - Altitude request
  - Speed requests
- No coordination required
- Worldwide use for testing and training

SD satcom direct

Technical Information Letter

TIL-FDF-005-R1

FANS Aircraft Equipment Testing Procedure

Overview

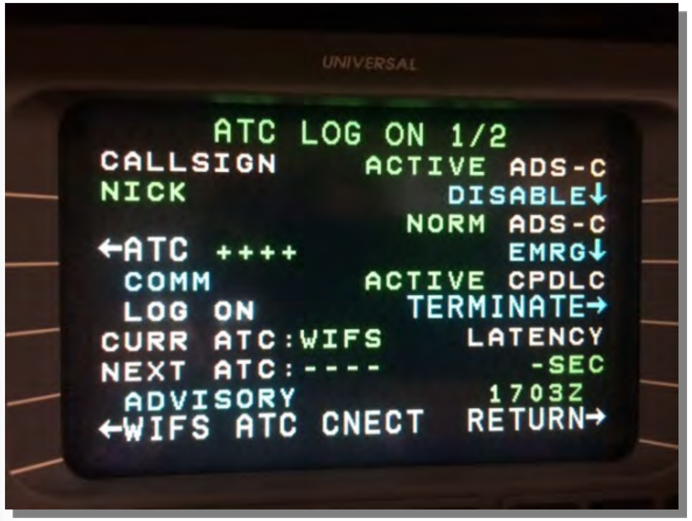
This Technical Information Letter outlines the procedures required to utilize Satcom Direct's FANS test station for the purpose of validating FANS equipment.

Created By

Name	Date
David Buchart	03/10/2015

Record of Revisions

Revision	Date	Revised By	Description of Revision
1	7/27/2015	David Buchart	Added note for altitude request



FANS Reference Card

satcom direct.

FlightDeck freedom

FANS/CPDLC Reference Guide

Country/Administration	FIR / OCA / CTA	Log On Code	FANS	ATN/CPDLC	Remarks
Algeria	Alger ACC	DAAA	Trial		8
Angola	Luanda	FNAN	Trial		8
Australia	Brisbane	YBBB	Y		3, 18
Australia	Honiara	YBBB	Y		
Australia	Melbourne	YMMM	Y		3, 18
Australia	Nauru	YBBB	Y		18
Austria	Wien ACC	LOVV		Y	
Brazil	Atlântico	SBAO	Y		
Cabo Verde	SAL Oceanic	GVSC	Y		
Canada	Edmonton FIR/CTA	CZEG	Y		
Canada	Gander OCA	CZQX	Y		1, 9
Canada	Gander FIR/CTA (Domestic)	CDQX	CPDLC Only		
Canada	Moncton FIR/CTA	CZQM	CPDLC Only		
Canada	Montreal FIR/CTA	CZUL	CPDLC Only		
Canada	Toronto FIR/CTA	CZYZ	CPDLC Only		
Canada	Vancouver FIR/CTA	CZVR	CPDLC Only		
Canada	Winnipeg FIR/CTA	CZWG	CPDLC Only		
Chad	N'Djamena	FTTT	Y		
Chile	All FIRs (SCFZ, SCEZ, SCTZ, SCIZ, SCCZ)	SCEZ	Y		
China	Beijing	ZBAB	Y		

- For quick reference on the flight deck
- List of active regions & ATS facilities
- Definitions of services provided
- Special operating procedures or requirements

PDC, DCL, & ATIS Reference Card

satcom direct.

FlightDeck freedom.

FDF PDC, DCL, and ATIS Airports

United States		PDC	DCL	ATIS	TWIP
ABQ	Albuquerque International	X	X	X	
ACY	Atlantic City	X			
ADW	Andrews AFB	X		X	X
ALB	Albany International	X		X	
ANC	Anchorage International (PANC)	X		X	
ATL	Atlanta Hartsfield International	X	X	X	X
AUS	Austin Mueller Municipal	X	X	X	
BDL	Windsor Locks Bradley International	X	X	X	
BLV	Scott AFB			X	
BNA	Nashville International	X	X	X	X

United States (continued)		PDC	DCL	ATIS	TWIP
LTS	Altus AFB			X	
MCF	MacDill AFB			X	X
MCI	Kansa City International	X	X	X	X
MCO	Orlando International	X	X	X	X
MDW	Chicago Midway	X	X	X	X
MEM	Memphis International	X	X	X	X
MIA	Miami International	X	X	X	X
MKE	Milwaukee Mitchell International	X		X	X
MSP	Minneapolis Saint Paul International	X	X	X	X
MSY	New Orleans International/Moisant Field	X	X	X	

- PDC Airports
- DCL Airports
- Digital ATIS Airports
- Terminal Weather Information for Pilots

Proposed DCL Deployment Schedule

DCL Deployment Schedule

Key Sites			
Site Name	Site ID	ARTCC	IOC
KS 1: Salt Lake City	SLC	ZLC	08/07/15
KS 2: Houston Intcl	IAH	ZHU	09/03/15
KS 3: Houston Hobby	HOU	ZHU	09/10/15

TDLS Color Key	
CPDLC DCL Site	(green)
Site Operational	(blue)

Goup A			
Site Name	Site ID	ARTCC	IOC
New Orleans	MSY	ZHU	01/21/16
Austin	AUS	ZHU	02/04/16
San Antonio	SAT	ZHU	02/19/16
Los Angeles	LAX	ZLA	03/14/16
Las Vegas	LAS	ZLA	03/28/16
San Diego	SAN	ZLA	04/11/16
John Wayne	SNA	ZLA	04/25/16
Burbank	BUR	ZLA	05/09/16
Ontario	ONT	ZLA	05/23/16
San Francisco	SFO	ZOA	06/14/16
Oakland	OAK	ZOA	06/28/16
San Jose	SJC	ZOA	07/13/16
Sacremento	SMF	ZOA	07/27/16
Phoenix	PHX	ZAB	08/17/16
Albuquerque	ABQ	ZAB	08/31/16
Portland	PDX	ZSE	09/22/16
Seattle	SEA	ZSE	09/22/16
Dallas Love	DAL	ZFW	10/13/16
Dallas Fort Worth	DFW	ZFW	10/27/16

Group B			
Site Name	Site ID	ARTCC	IOC
Louisville	SDF	ZID	02/10/16
Indianapolis	IND	ZID	03/07/16
Memphis	MEM	ZME	04/04/16
Nashville	BNA	ZME	04/18/16
Denver	DEN	ZDV	05/09/16
Atlanta	ATL	ZTL	05/23/16
Charlotte	CLT	ZTL	06/07/16
Jacksonville	JAX	ZJX	06/28/16
Orlando	MCO	ZJX	07/13/16
Miami	MIA	ZMA	08/03/16
Fort Lauderdale	FLL	ZMA	08/17/16
Tampa	TPA	ZMA	08/31/16
Palm Beach	PBI	ZMA	09/15/16
St Louis	STL	ZKC	10/06/16
Kansas City	MCI	ZKC	10/20/16
Minn.-St Paul	MSP	ZMP	11/10/16

Group C			
Site Name	Site ID	ARTCC	IOC
Newark	EWR	ZNY	02/12/16
John F Kennedy	JFK	ZNY	02/25/16
LaGuardia	LGA	ZNY	03/14/16
Teterboro	TEB	ZNY	03/28/16
Westchester	HPN	ZNY	04/11/16
Philadelphia	PHL	ZNY	04/25/16
Boston	BOS	ZBW	05/16/16
Bradley	BDL	ZBW	06/14/16
Detroit	DTW	ZOB	07/06/16
Cleveland	CLE	ZOB	07/20/16
Pittsburgh	PIT	ZOB	08/03/16
Balt/Wash Int'l	BWI	ZDC	08/24/16
Dulles	IAD	ZDC	09/08/16
Wash. Reagan	DCA	ZDC	09/22/16
Raleigh Durham	RDU	ZDC	10/06/16
Midway	MDW	ZAU	10/27/16
O'Hare	ORD	ZAU	11/10/16

Other Helpful Reference Information

- Datalink Oceanic Clearance: Procedures specific to aircraft having a designated Oceanic Clearance Request page (623 capable avionics).
- 623 Reference Card

Information Short Codes *(Enter short code in free-text message address field)*

F____	Text Message to Fax Number	NOTAM____	NOTAMS [1]
NATE	North Atlantic Tracks (eastbound)	TWIP____	Terminal Weather Info for Pilots (Microburst, Thunderstorms) [2]
NATW	North Atlantic Tracks (westbound)		

Communications and Support Short Codes *(Enter short code in free-text message address field)*

DIALED	Last Calls Dialed Via Inmarsat	S64	Swift 64 Congestion
FDF	FlightDeck Freedom® (Datalink) Support	SATINFO	Satellite System Status
FDFDATA	Last Datalink Messages Sent	SD	Satcom Direct® Technical Support
GON	Global One Number(s)	TEST	Test Message/Automated Response
PING	OneView & DIRECTV® PING request	YONDER	Yonder®/BBML Support

Unique to

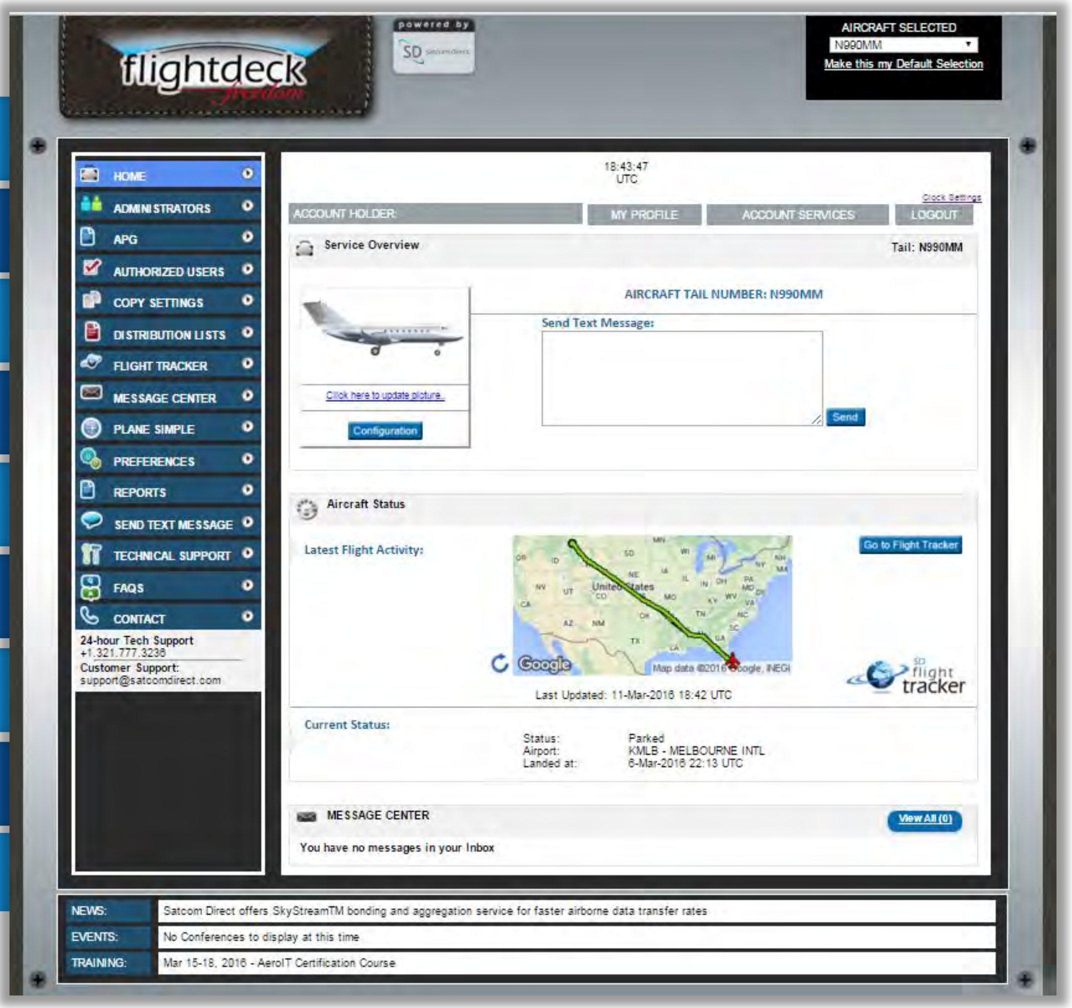
FlightDeck freedom®

Trip Planning and Flight Support Providers

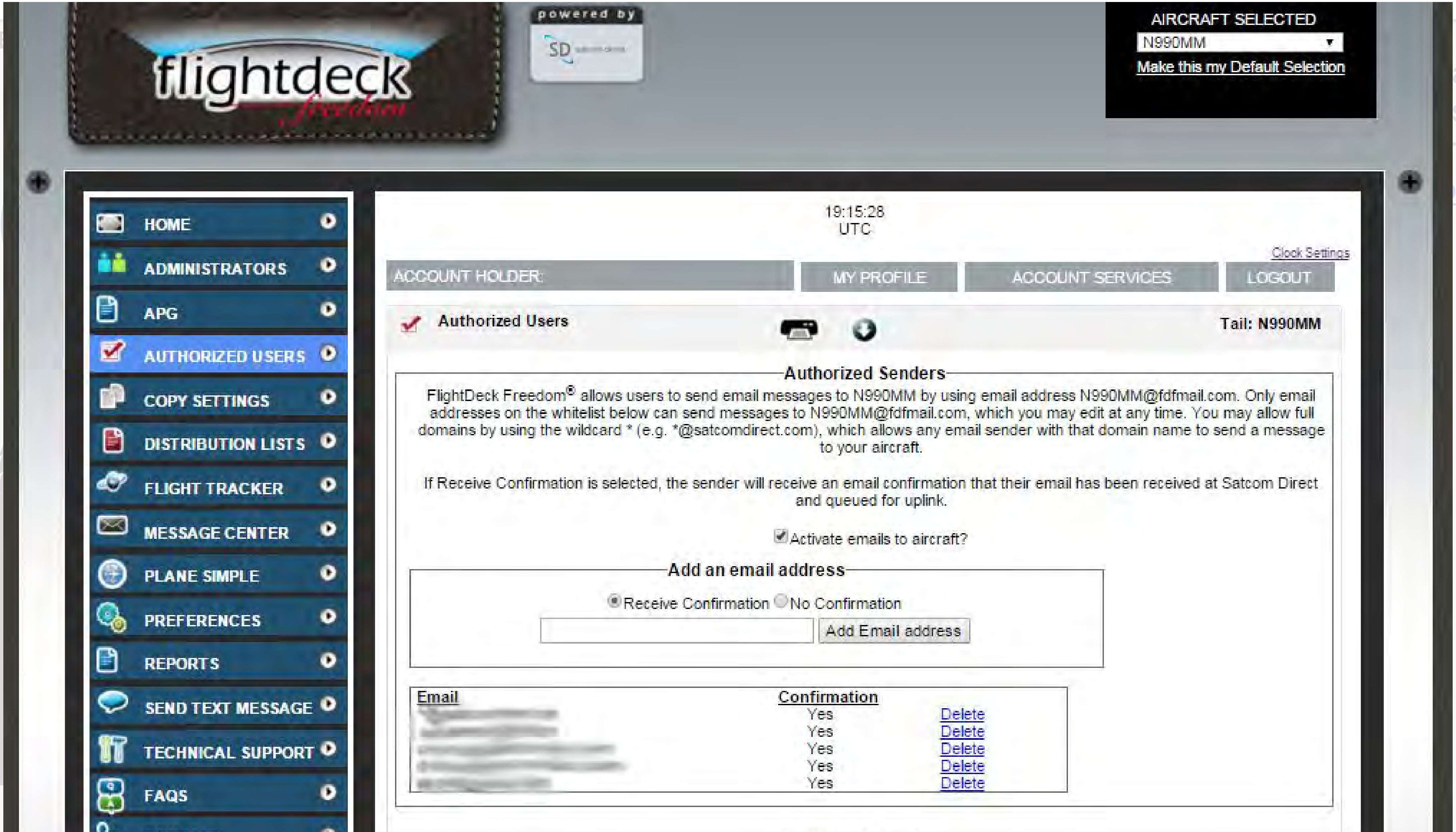
- aeroFLIGHT SOLUTIONS
- AIR SUPPORT
- APG
- AVPLAN TRIP SUPPORT
- COLT International
- FLIGHTWORX
- FltPlan.com
- HADID INTERNATIONAL SERVICES
- Honeywell
- INTERNATIONAL TRIP PLANNING SERVICES, LLC
- JEPPESEN
- JETEX FLIGHT SUPPORT
- LIDER
- NAVTECH
- Presidium Aviation, Inc.
- SignumAviation
- SKYPLAN
- UAS International Trip Support
- UNIVERSAL Weather & Aviation, Inc.

FlightDeck Freedom Portal

- Send message to / from aircraft
- Manage aircraft distribution lists
- Manage takeoff / landing reports
- Copy settings for fleet of aircraft
- Access to SD Global Flight Tracker
- Setup short codes
- Designate authorized users
- Specify message preferences
- Access network service notifications



Communicating with the Aircraft



Outage Notifications

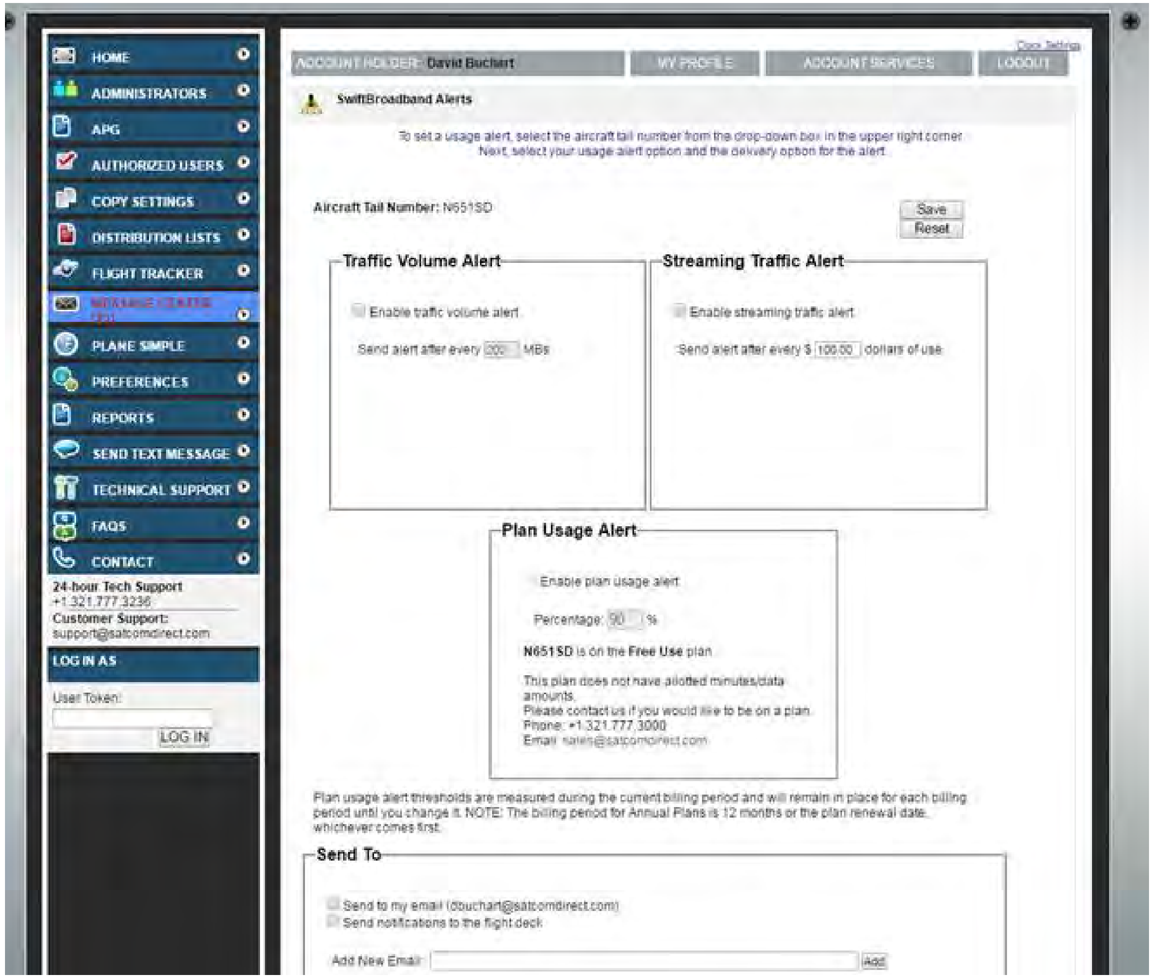
Service Notifications (Planned/Unplanned Outages, Service Impacts)

Automatically send service notifications to the aircraft for the following services:

- [x] FlightDeck Freedom
- [x] Inmarsat Voice
- [ ] Iridium
- [x] MPDS
- [ ] OneView
- [x] SwiftBroadband
- [ ] Swift 64
- [ ] Yonder

Monitor SD Cabin Services

- Monitor cabin services selections
  - Notify flight deck when a certain number of SBB MB are used
  - Notify flight deck when a certain percentage of plan is used
  - Satcom Logon/Logoff status
- Helps control cost
- GeoFence Messages

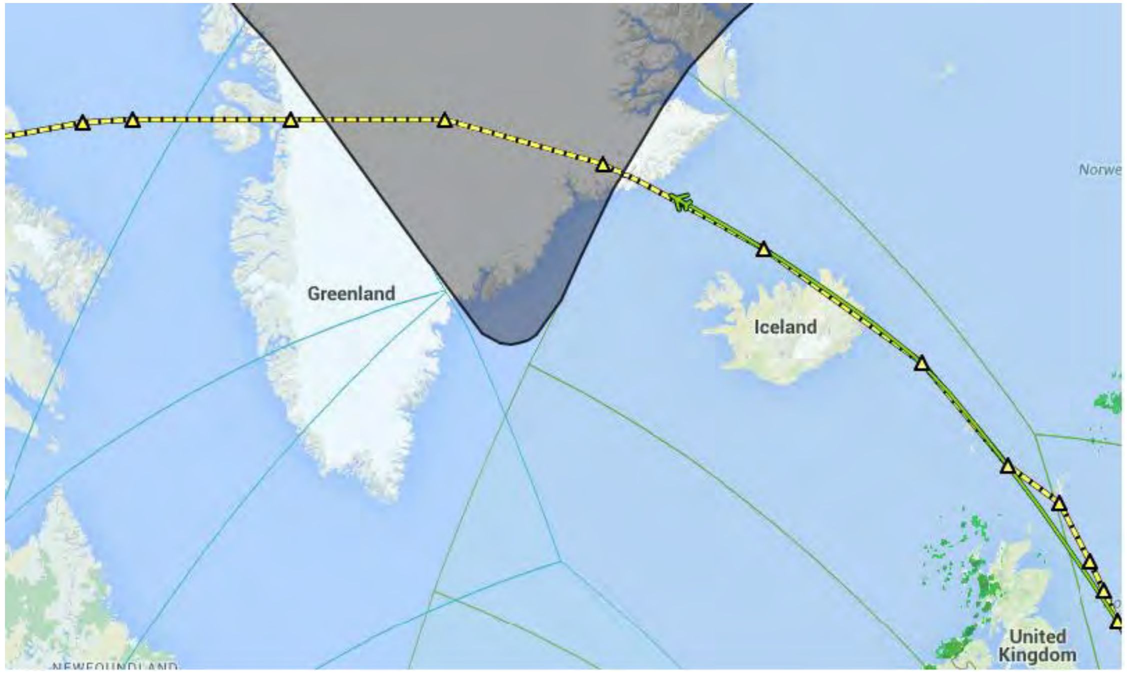


SD GeoServices - GeoFence

- Uplink messages to aircraft when A/C enters a defined geographic region
  - Exit message
- Areas of VHF restriction
- Comm security issues
- Customer defined regions

Example: I4 Coverage "Greenland Gap" alert

SUBJECT: SATCOM DIRECT ALERT FOR N1234
I4 GREENLAND GAP
APPROACHING BOUNDARY OF I4 COVERAGE AREA.
SBB WILL BECOME UNAVAILABLE. ENSURE SATCOM
IS LOGGED ON TO I3 SATELLITES FOR CONTINUED
DATALINK/CPDLC USE.



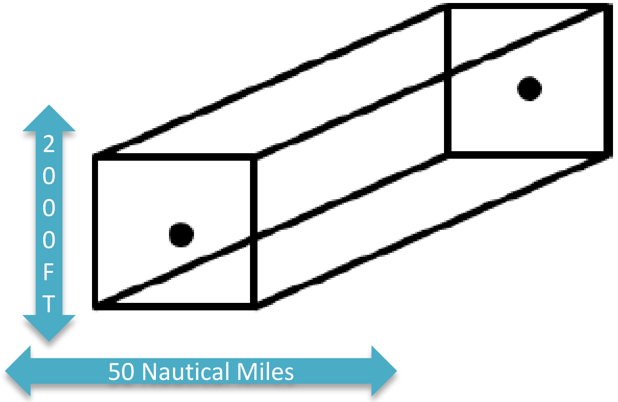
Active GeoFence Alerts

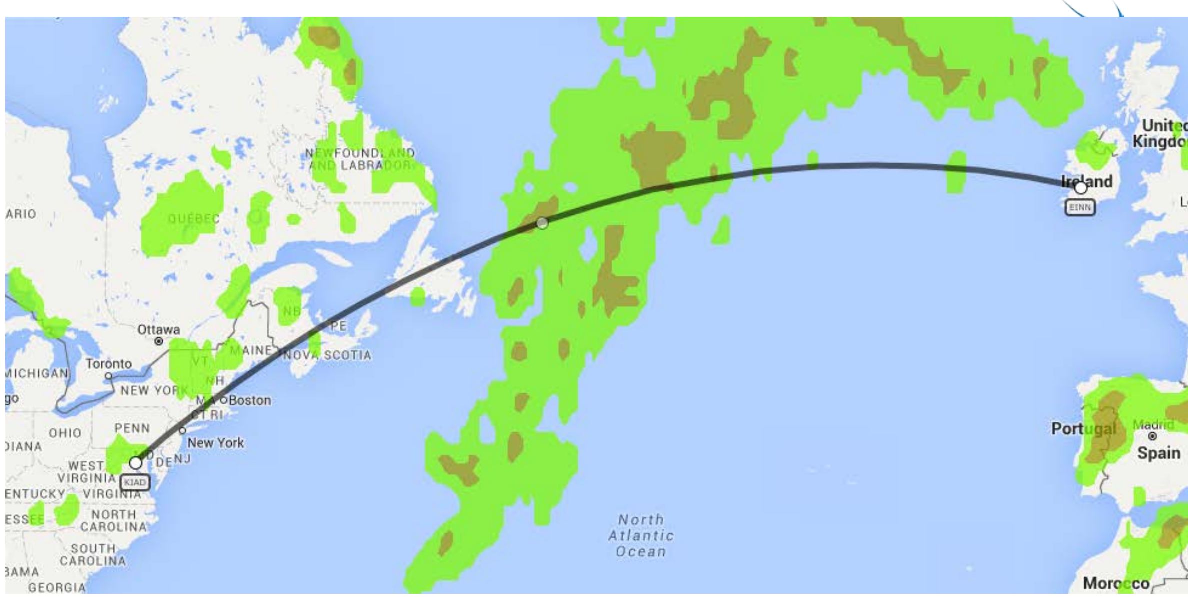
GeoFence	Service Type	Region	Summary
China SAS	SwiftBroadband	China	Alerts SwiftBroadband customers when entering/exiting region where traffic is routed to China access station (SAS)
China VHF	FlightDeck Freedom	China	Alerts select EPIC equipped aircraft of limitations within coverage region
DirecTV OneView US Coverage	DirecTV OneView	Continental US	Alerts DirecTV OneView customers when re-entering US coverage area
I4 Coverage Gap	SwiftBroadband	North Atlantic	Alerts SwiftBroadband customers of service limitations due to gap in I4 satellite coverage
Japan AFIS	FlightDeck Freedom	Japan	Alerts AFIS equipped aircraft of limitations within coverage region
SITA Pacific	Collins Proline FlightDeck Freedom	SE Asia & Pacific Ocean	Alerts customers of limitations when entering/exiting coverage region
3G service	SDR 3G Wi-Fi	Various Regions	Alerts customers with SDR and 3G Wi-Fi of excessive data rates
Yonder Coverage	ViaSat Yonder	Worldwide	Alerts ViaSat Ku customers when leaving or entering coverage region

SD Route Alerts

Route evaluated

- When flight plan received
- At takeoff
- Every 5 minutes
- Landing ends monitoring





Route

- Turbulence
- Thunderstorms
- Volcanic ash / eruptions
- Convective SIGMET
- Icing
- USA TFR

Airport

- Tornado
- Severe hail
- Lightning
- Ceiling, visibility, fog
- Wind gusts

Route Alerts

EXAMPLE OF A PREFLIGHT EVALUATION

Route Alert Notification:
Your flight plan U2972 KDCA-KHPN has been evaluated and the following alerts are present along your route.

SEGMENT: STIKY-OOD
ROUTE ALERT: Moderate Turbulence, FL240, Valid Time 03/10/16 2300Z

SEGMENT: SOUND-GWENY
ROUTE ALERT: Moderate Turbulence, FL125, Valid Time 03/10/16 2300Z END OF NOTIFICATION

Route Alerts

EXAMPLE OF AN INFLIGHT EVALUATION

Route Alert Notification:
New alerts have been triggered along the following segments in your route.

SEGMENT: SOUND-GWENY
ROUTE ALERT: Moderate Turbulence, FL125, Valid Time 03/10/16 2200Z
END OF NOTIFICATION

Route Alerts – FDF Portal

Hazards to monitor

Preflight Alerts

Airport:

- [x] Tornado
- [ ] Lightning
- [x] Sev Hail
- [ ] Any Hail
- [x] Winds > 40 KTS

Route:

- [x] Turbulence: Moderate or greater
- [x] Thunderstorm
- [ ] Convective SIGMET
- [x] Volcanic Ash
- [ ] Lightning
- [x] Icing: Severe

In-Flight Alerts

Airport:

- [x] Tornado
- [x] Lightning
- [x] Sev Hail
- [x] Any Hail
- [x] Winds > 40 KTS

Route:

- [x] Turbulence: Severe
- [x] Thunderstorm
- [ ] Convective SIGMET
- [x] Volcanic Ash
- [ ] Lightning
- [x] Icing: Severe

Do not send alerts:

15 Minutes prior to ETA

Unless a selected event occurs at destination or alternate airport

- [x] Tornado
- [x] Lightning
- [x] Sev Hail
- [ ] Any Hail
- [x] Winds > 40 KTS

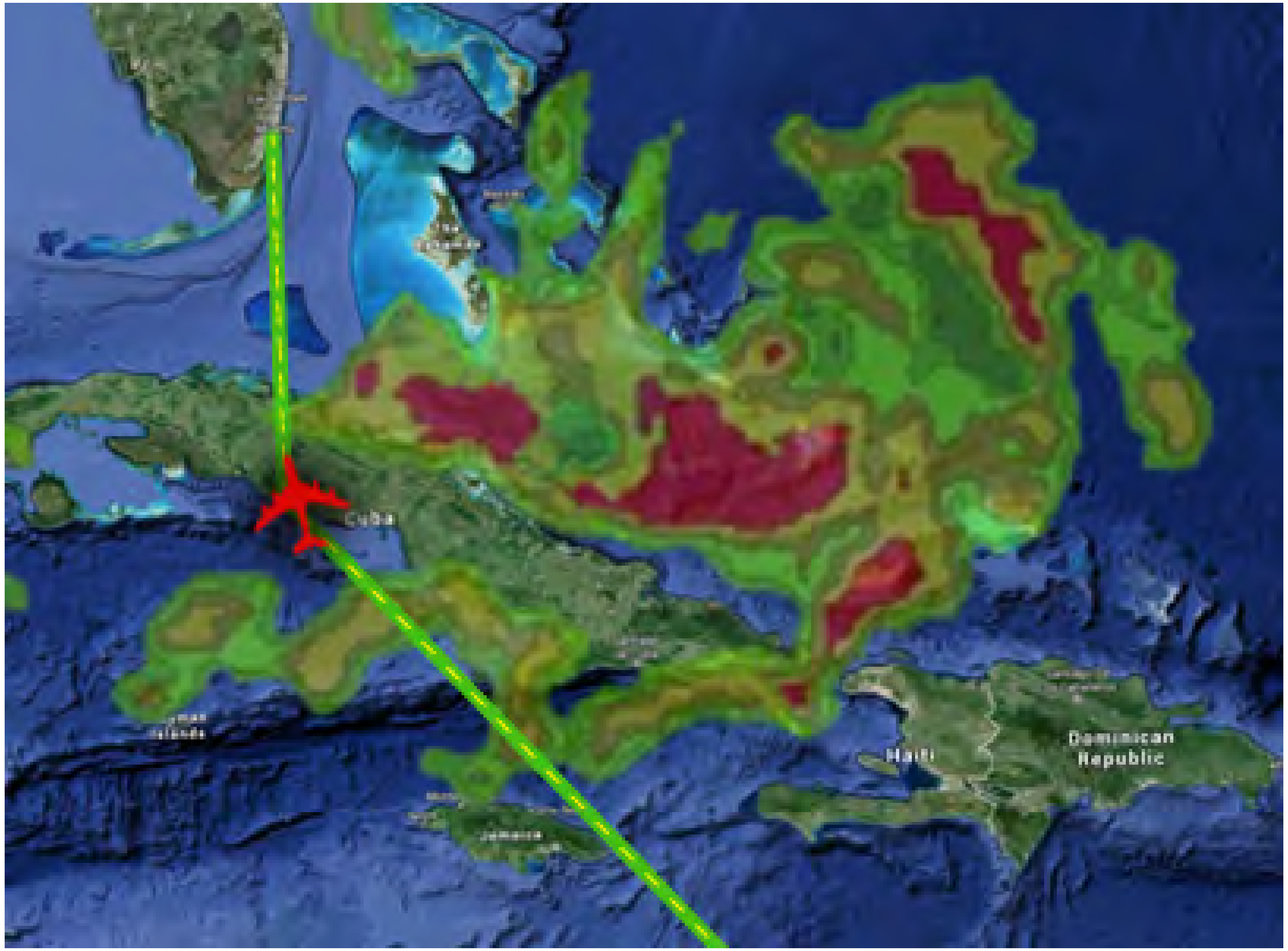
Why SD Route Alerts?

Efficiency

- Passenger Comfort
- Diversion Planning
- Reduce WX deviation.

Safety

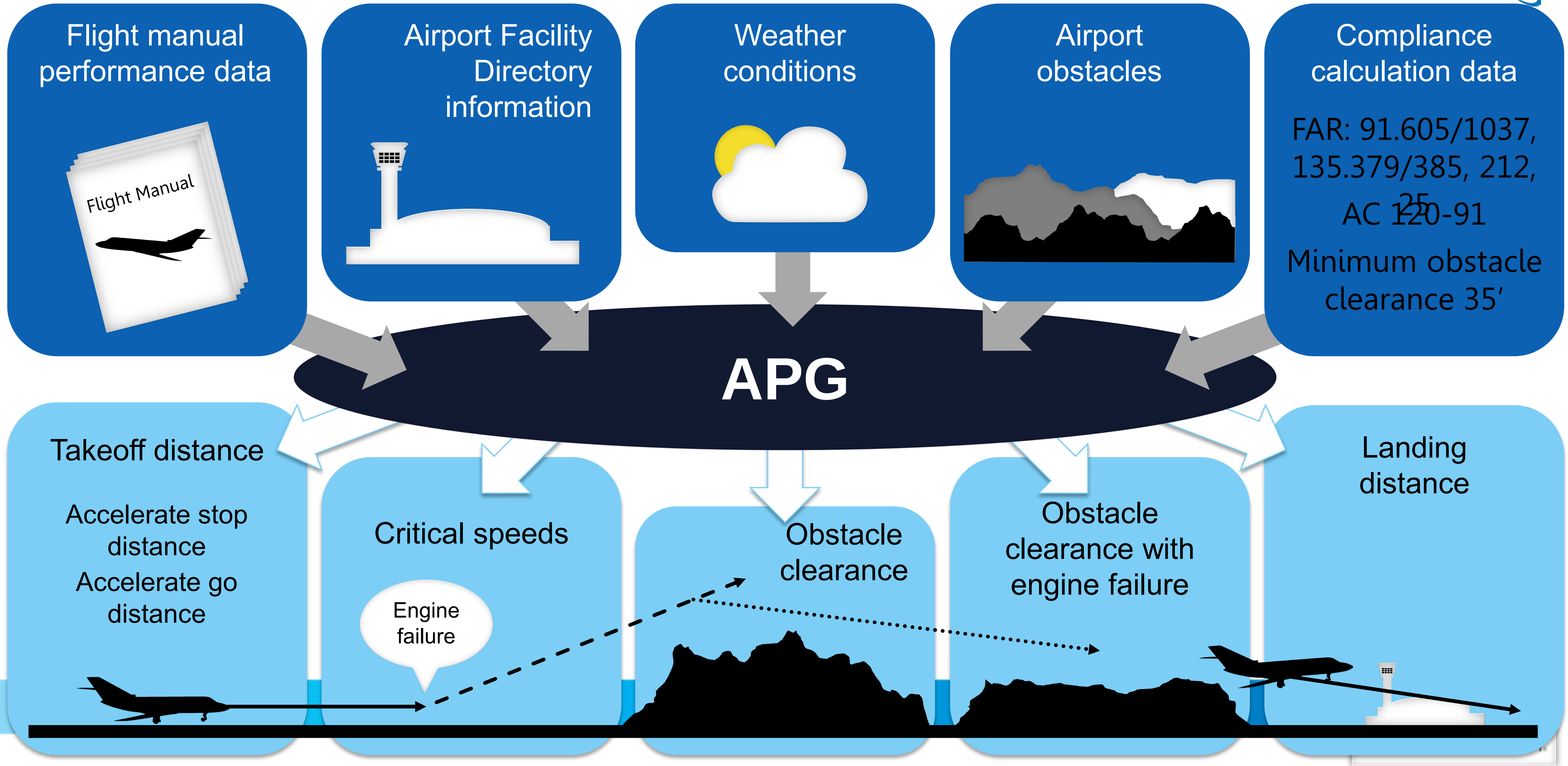
- Situational Awareness
- Reduces risk
- Reduced crew workload
- Avoid hazardous weather events



APG & FDF

FlightDeck freedom®

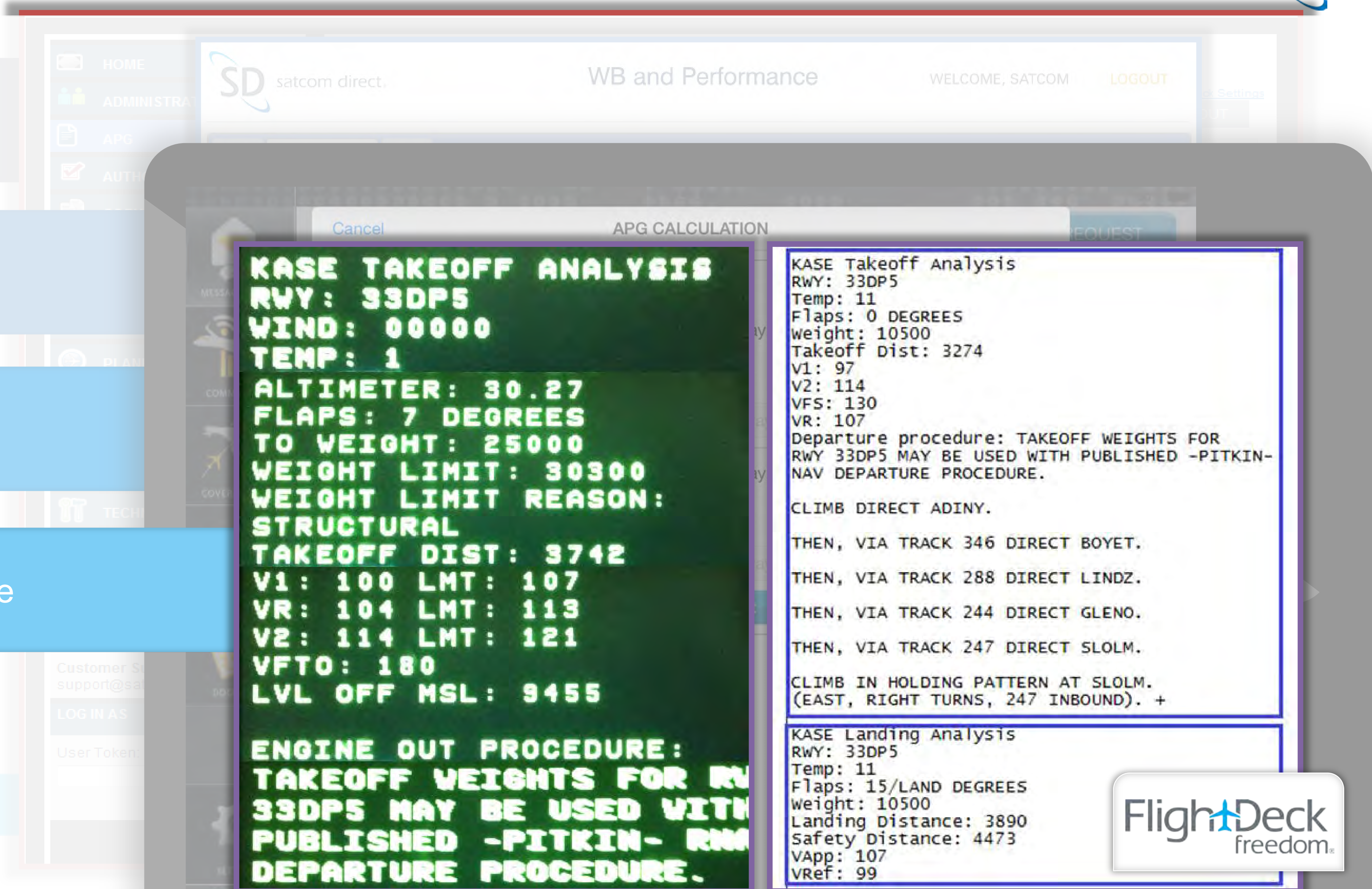
APG



Flight manual performance data
Flight Manual
Airport Facility Directory information
Weather conditions
Airport obstacles
Compliance calculation data
FAR: 91.605/1037, 135.379/385, 212,
25
AC 120-91
Minimum obstacle clearance 35′
APG
Takeoff distance
Accelerate stop distance
Accelerate go distance
Critical speeds
Engine failure
Obstacle clearance
Obstacle clearance with engine failure
Landing distance

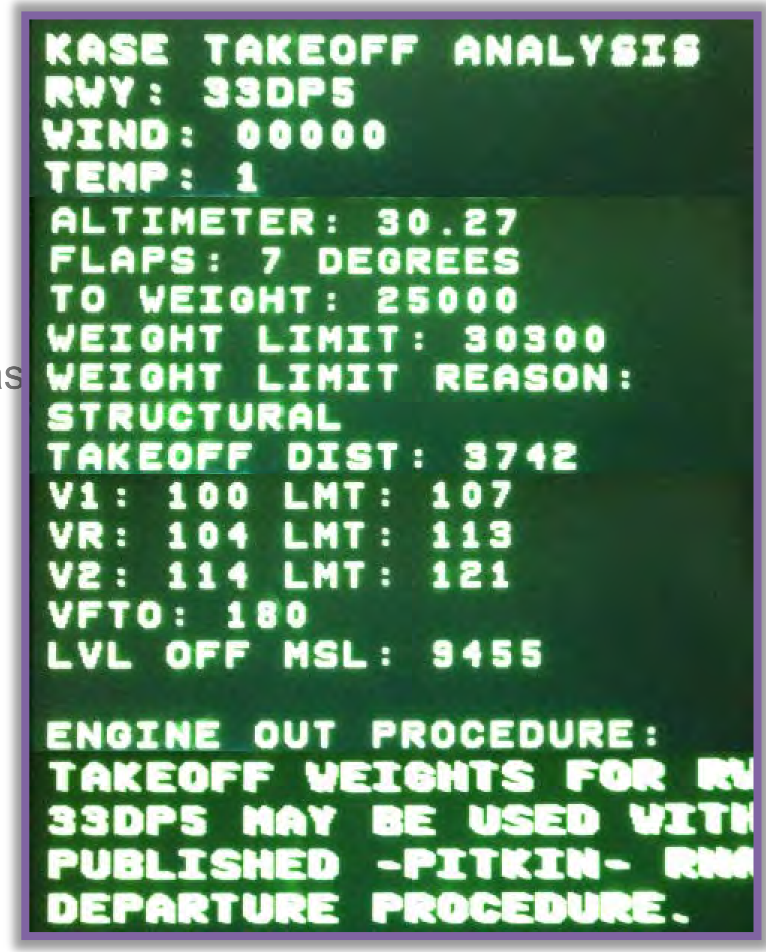
APG

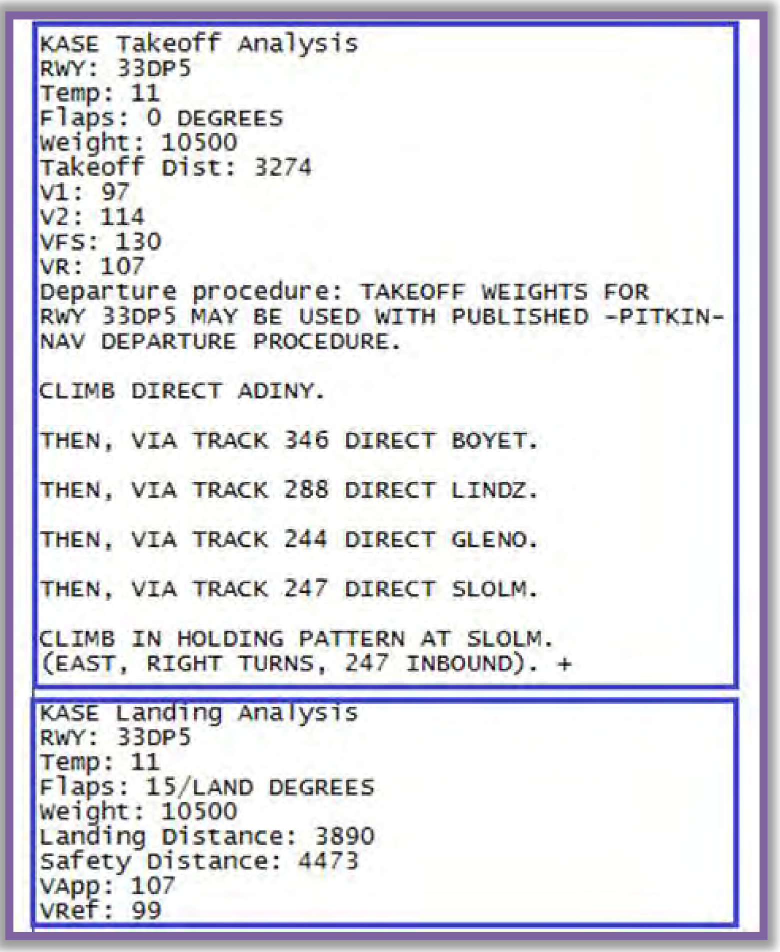
- FDF portal
- APG interface
- iPad interface
- APG request & response



Runway Analysis using datalink

- Point calculation
  - Takeoff calculation for current conditions
  - Emergency procedure included
  - Landing calculation for current conditions
  - Takeoff / landing calculation dependent on phas of flight





KASE Takeoff Analysis
RWY: 33DP5
Temp: 11
Flaps: 0 DEGREES
Weight: 10500
Takeoff Dist: 3274
V1: 97
V2: 114
VFS: 130
VR: 107
Departure procedure: TAKEOFF WEIGHTS FOR
RWY 33DP5 MAY BE USED WITH PUBLISHED -PITKIN-
NAV DEPARTURE PROCEDURE.

CLIMB DIRECT ADINY.

THEN, VIA TRACK 346 DIRECT BOYET.

THEN, VIA TRACK 288 DIRECT LINDZ.

THEN, VIA TRACK 244 DIRECT GLENO.

THEN, VIA TRACK 247 DIRECT SLOLM.

CLIMB IN HOLDING PATTERN AT SLOLM.
(EAST, RIGHT TURNS, 247 INBOUND). +

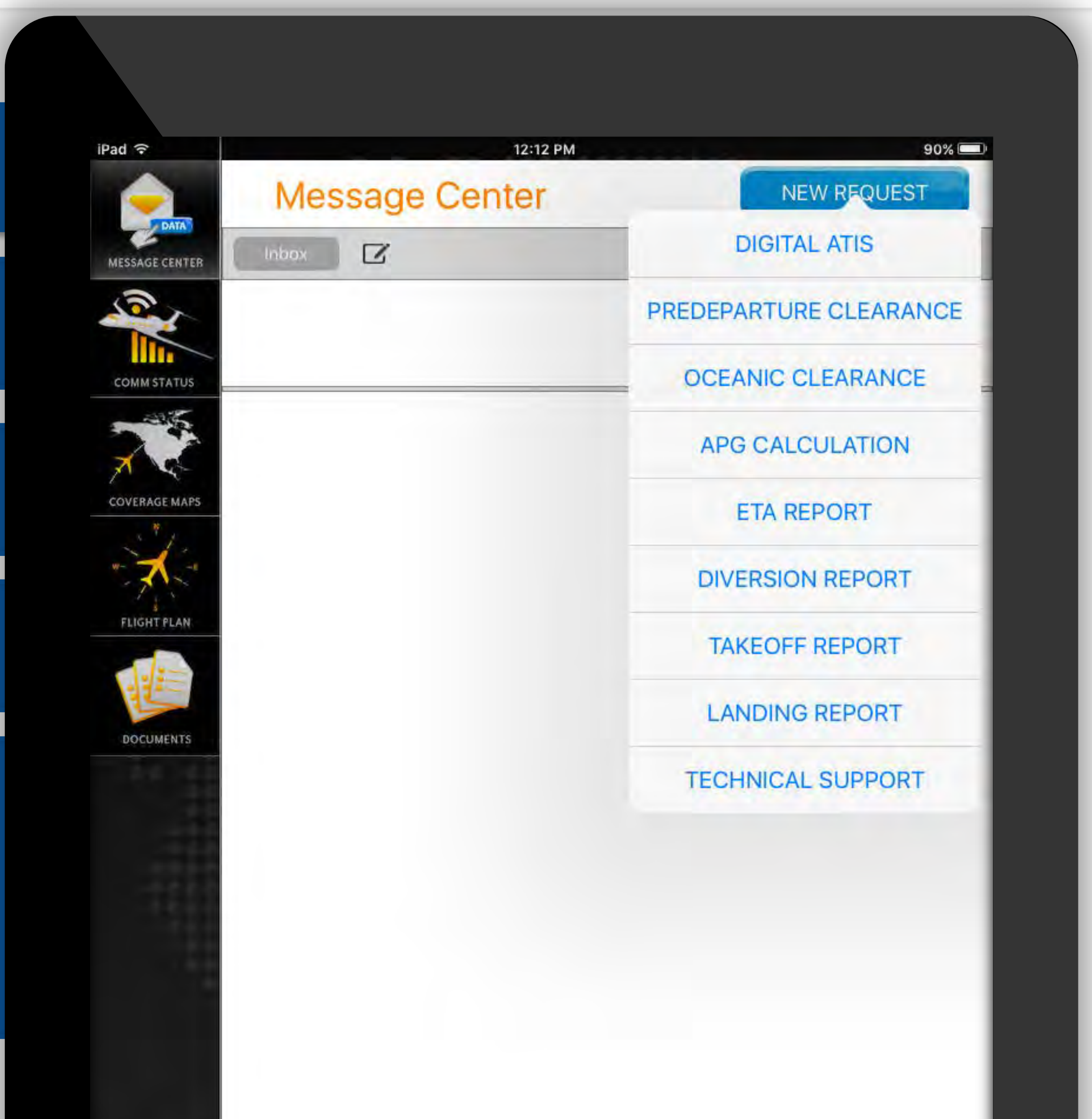
KASE Landing Analysis
RWY: 33DP5
Temp: 11
Flaps: 15/LAND DEGREES
Weight: 10500
Landing Distance: 3890
Safety Distance: 4473
VApp: 107
VRef: 99

FD360 iPad Application

FlightDeck 360

Message Center

- Extension of datalink capabilities
- Additional tool for VLJ
- Email messages to FlightDeck 360
- Real time requests
- Pre-departure clearances
- Aircraft movement messages updated flight tracking



Oceanic Clearances

Clearances can be delivered via FD360 in North Atlantic airspace

SD Flight Tracking

FlightDeck freedom®

Tracking Data Sources

FAA & UK Radar Data

Coverage
- FAA radar-controlled airspace
- Canadian radar-controlled airspace

Types of data
- Takeoff / landing reports
- Filed flight plans
- Position reports every minute
- Diversions & ETA updates

FlightDeck freedom

Coverage
- VHF
- Inmarsat I3 / I4 / SwiftBroadband
- Iridium

Types of data
- Takeoff / landing reports
- Filed flight plans
- Position reports every minute
- Diversions & ETA updates

ViaSat Ku-band

Coverage
- Within Ku coverage areas

No delay in data transmission
All transmissions secure

Types of data
- Position reports every minute
- Planned route and ETE
- ETA may not be provided
- Unique SD algorithms used for takeoff / landing reports

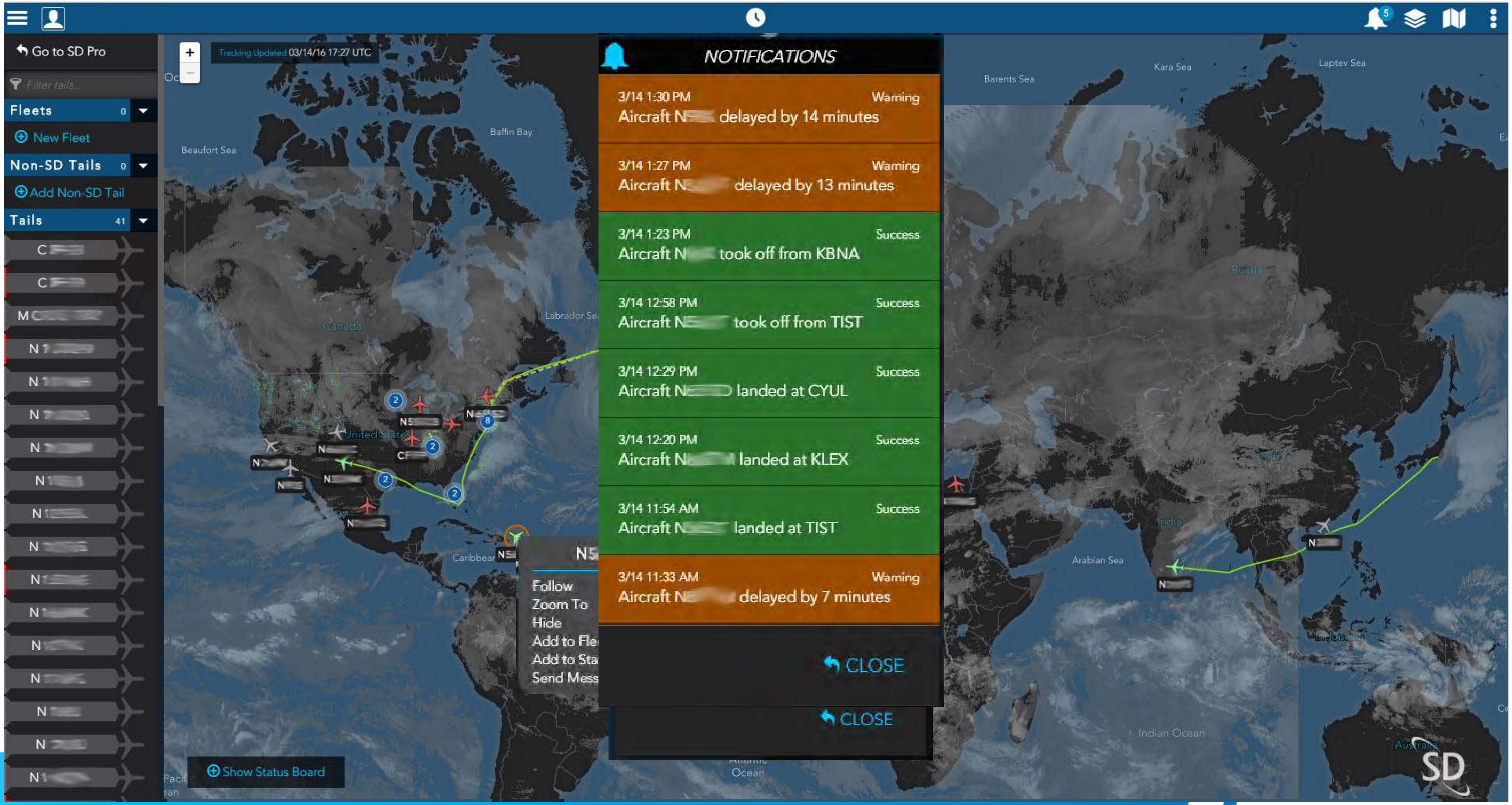
inmarsat SwiftBroadband

Coverage
- Worldwide

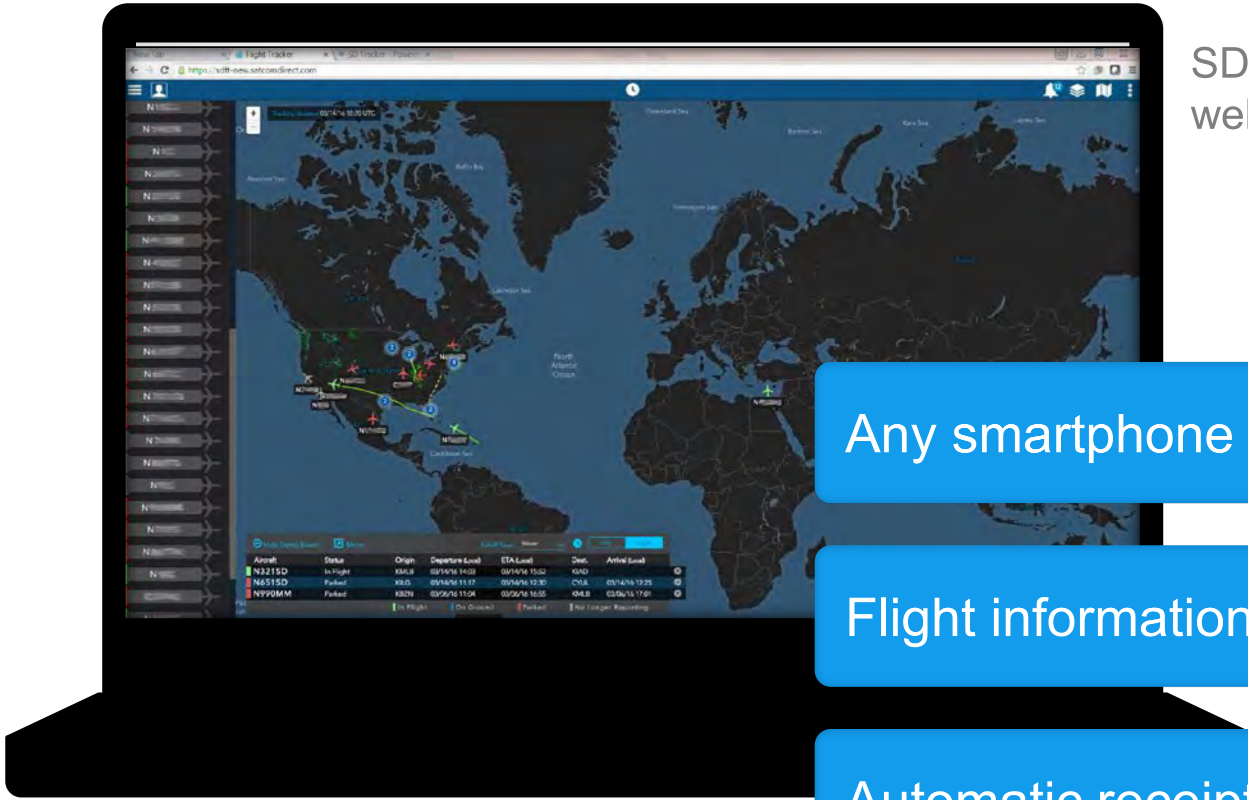
No delay in data transmission
All transmissions secure

Types of data
- Position reports
- Unique SD algorithms used for takeoff / landing reports

SD Flight Tracker

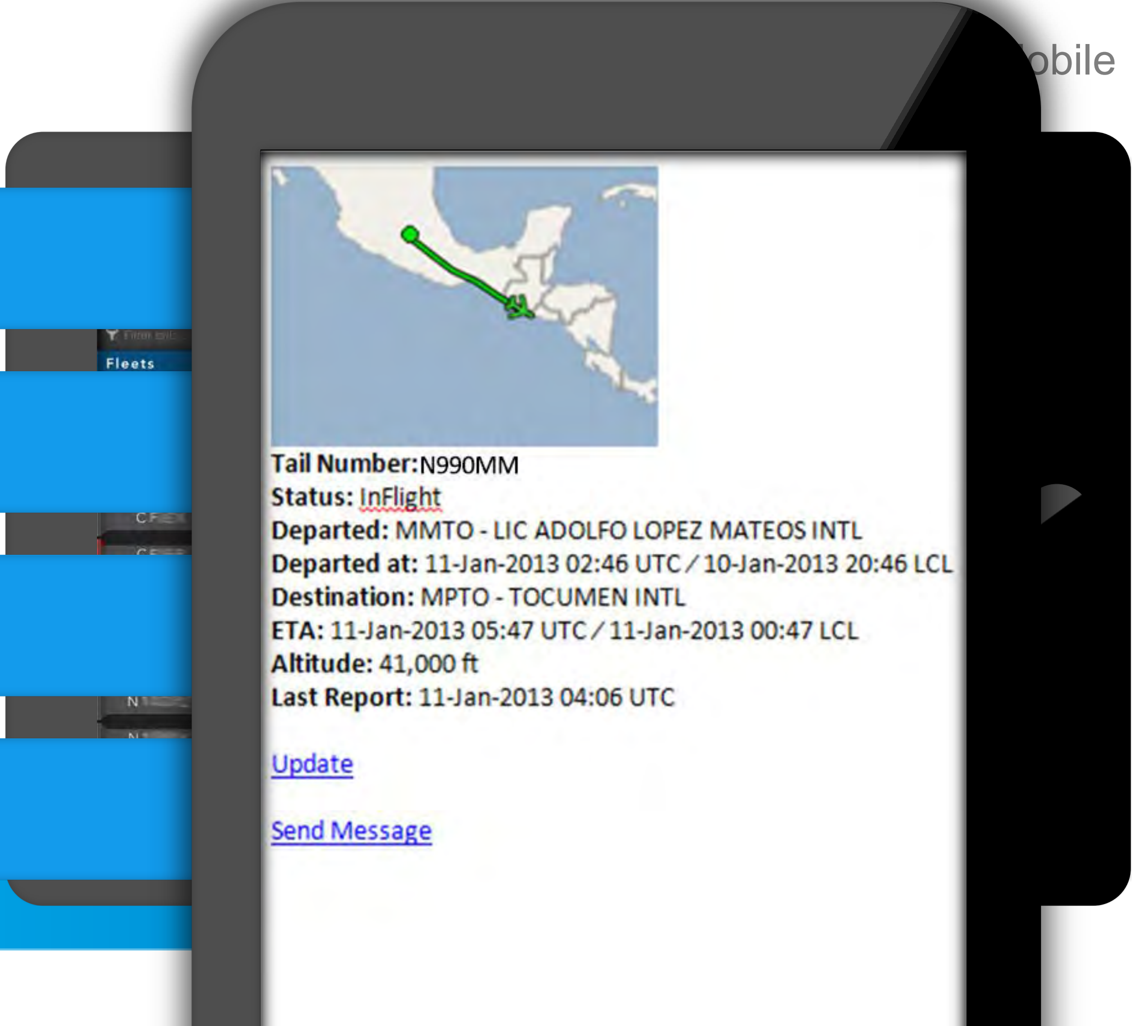


Flight Tracker Options



SD Flight Tracker on the web

obile



- Any smartphone
- Flight information
- Automatic receipts
- Authorized trackers

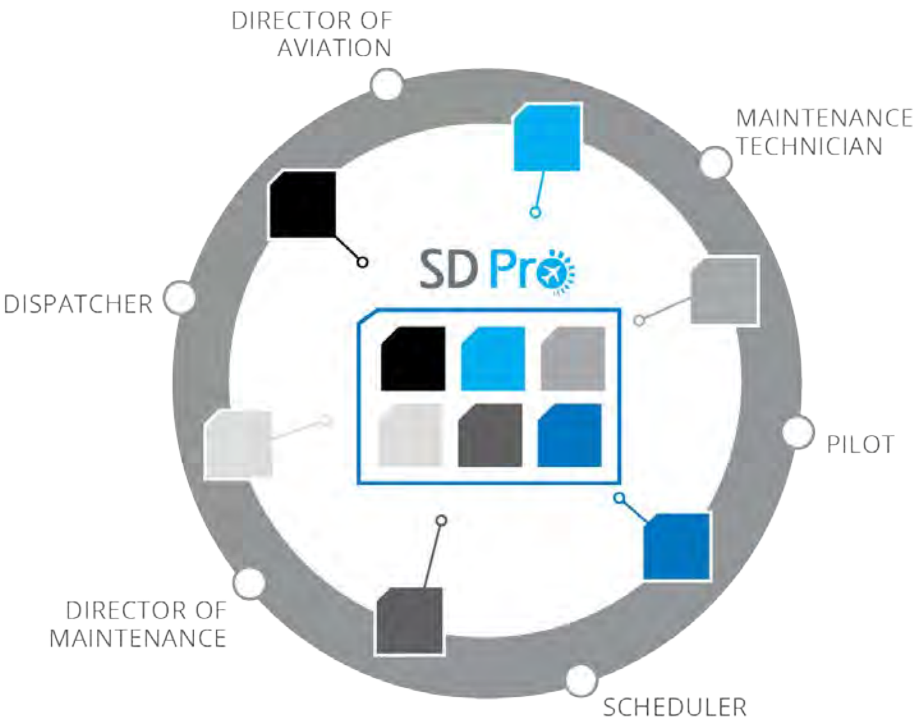
SD Tracker Mail

SD Pro is an integrated flight operations management platform

SD Pro

THE INTEGRATED FLIGHT OPERATIONS MANAGEMENT PLATFORM

- Single user interface for Business Aviation
- Keeps flight department in sync with aircraft
- One Platform – Multiple Modules
- One Data Center
- Provides Accuracy
- Provides Efficiency
- Reduces Complexity
- Standardizes the flight department



SD Pro

ONE PLATFORM – ACCURATE, INTEGRATED, REAL-TIME

CONNECTIVITY

SDR VIEWER

SD FLIGHTLOGS

SD FLIGHT TRACKER

MAINTENANCE VIEWER

SCHEDULER VIEWER

TRIP SUPPORT SERVICE

More modules are in development

SD Pro Modules

Module	Description	Integration Partners
SD FlightLogs℠	Auto-captures flight data and cycle events, in real-time, reducing manual user input. Provides visibility of flight log information to the entire flight operation. Data capture powered by FlightDeck Freedom® (FDF) and the SDR™.	Powered by SD
Scheduler Viewer	Provides trip information including trip legs and maintenance scheduled events, calendar and crew info. Integrates with scheduling partners PFM and AircraftLogs.	AIRCRAFTLOGS.COM Aviation Data Management Systems; PFM Professional Flight Management
SD Flight Tracker	Real-time flight tracking including departures, destinations, ETA, altitude, and speed information. At-a-glance status view shows weather overlays including NEXRAD and worldwide satellite imagery.	Powered by SD
Maintenance Viewer	Performance feed from maintenance providers. Includes engine hours, cycles, and times. Integrates with maintenance partners Gulfstream CMP® and Flightdocs™.	Gulfstream MyCMP™; Flightdocs
Connectivity	Displays devices connected, along with connectivity status of datalink, internet, SDR™, voice, Global One IPTM, AeroX®, AeroXR®, and Global One Number®, plus alerts of outages. Tracks voice and data usage by month, flight and duration.	Powered by SD
Trip Planning	Connects to Universal Weather and Aviation trip planning and trip support services via a web-based version of uvGO.	UNIVERSAL Weather & Aviation, Inc.
SDR™	Shows status of the onboard Satcom Direct Router (SDR™) including available networks and connection status as it automatically switches between providers. Tracks device connectivity and usage, also available via the SDR mobile application. The SDR is a powerful source of aircraft data, enabling the full functionality of SD Pro.	Powered by SD

SD FlightLogs℠

REVOLUTIONIZES HOW AIRCRAFT MOVEMENT DATA IS CAPTURED

- Replaces paper flight logs
- Real-time auto capture of data
- Third party vendor integration with maintenance and scheduling software
- Reduces human error
- Creates electronic history of aircraft
- Smart alerts when inconsistencies are present

Come Visit SD

MORE THAN JUST SATCOM

Thank you

SD World Headquarters

TerraCom Datacenter

SD Global Connectivity


AS DIVERSE AS AVIATION ITSELF
L3
Aviation Products
ACSS • Aviation Recorders • Avionics Systems • Display Systems • Electronic Systems Services

L-3 Aviation Products

is a  Of  + 

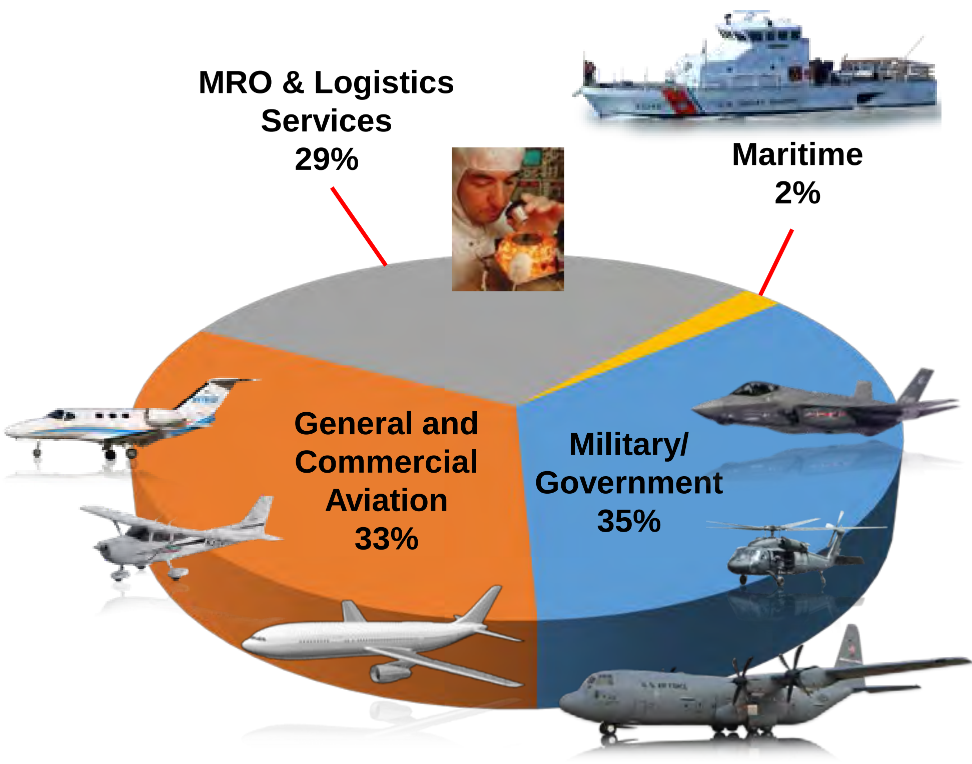
Joel D Gibbons
L-3 Aviation Products
Aftermarket Avionics Sales
Northeast Region
616-871-4424 Mobile
616-285-4322 Office
Joel.Gibbons@L-3com.com

Presentation Agenda

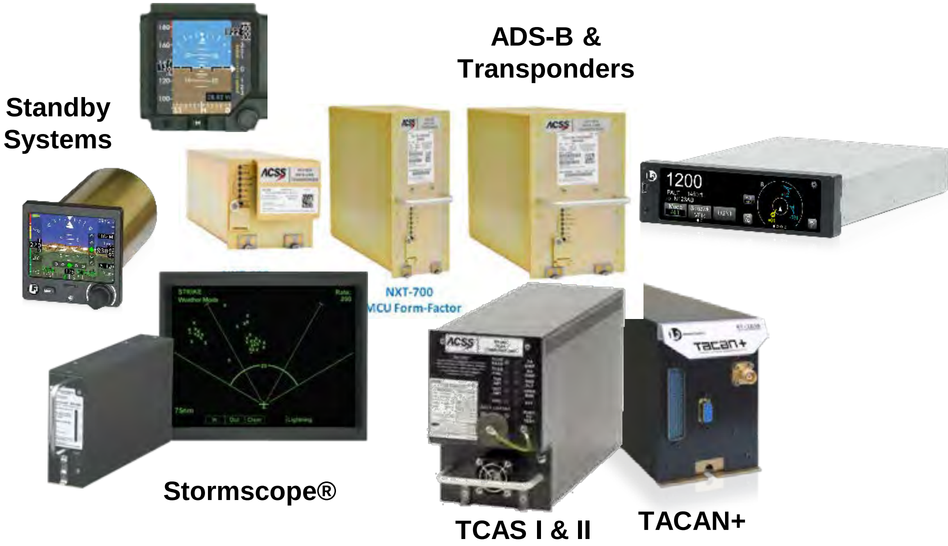
1. L-3 Aviation Products Sector Overview
2. ADS-B/DO-260B
3. TCAS II Change 7.1
4. FANS/CPDLC Data Link Recording
5. Q & A, Games, Story Time, Short Nap

Aviation Products At A Glance

- Comprised of five aerospace focused business units:
  - Aviation Communication & Surveillance Systems (ACSS)
  - Avionics Systems
  - Aviation Recorders
  - Display Systems
  - Electronic System Services
- ~1,500 employees
- 13 locations worldwide
- Market Diverse
- Actively investing for the future



What Does L-3 Make?



Integrated Avionics

Flight Displays / Processors

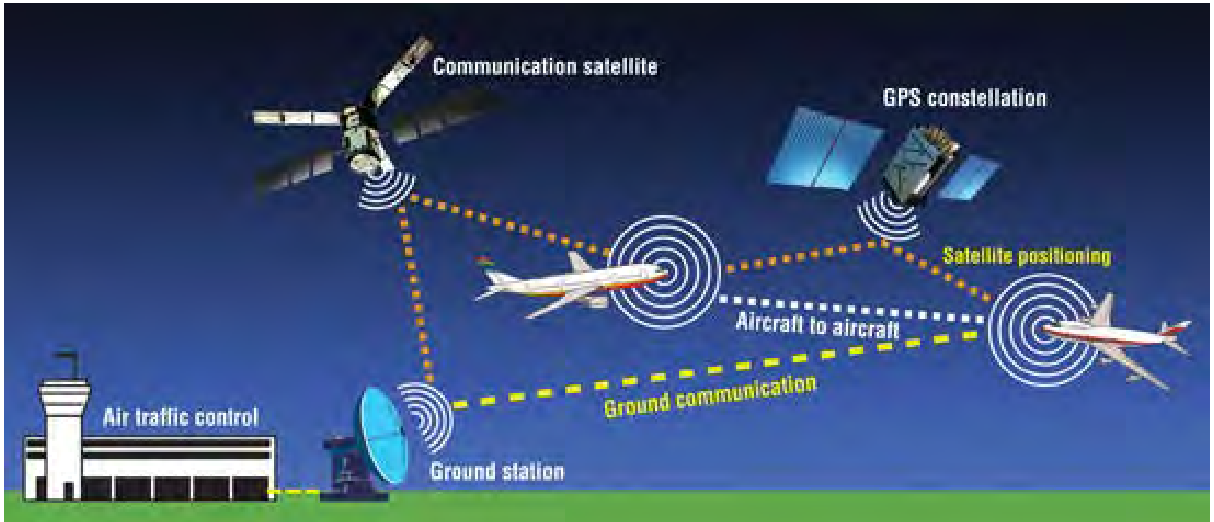
Flight Data & Cockpit Voice Recorders

Avionics/Electronics Repair & Overhaul

LRUs & Controllers

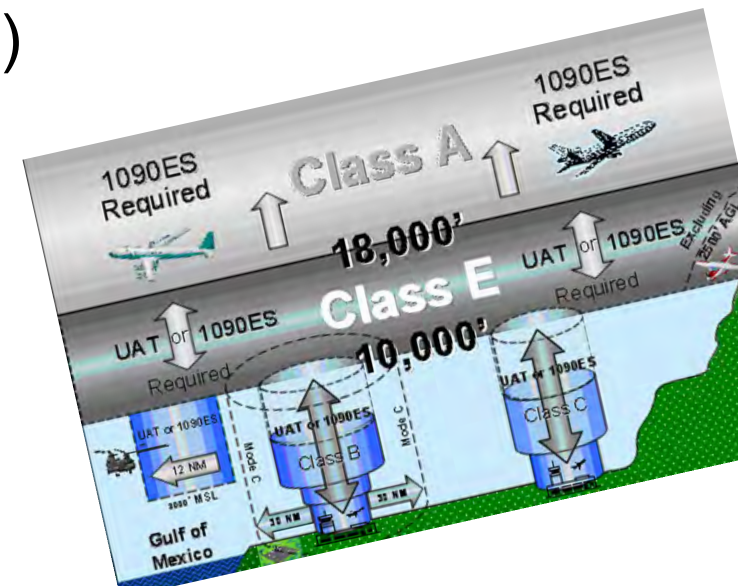
What is ADS-B?

- ADS-B, which consists of two different services, "ADS-B Out" and "ADS-B In", will be replacing radar as the primary surveillance method for controlling aircraft worldwide. In the United States, ADS-B is an integral component of the NextGen national airspace strategy for upgrading/enhancing aviation infrastructure and operations. Mandated equipage date of Dec 31, 2019.
  - ***Automatic*** - Periodically transmits information with no pilot or operator input required
  - ***Dependent*** - Position and velocity vector are derived from the Global Positioning System (GPS)
  - ***Surveillance*** - A method of determining position of aircraft, vehicles, or other asset
  - ***Broadcast*** - Transmitted information available to anyone with the appropriate receiving equipment



ADS-B Mandate Schedule

- DO-260B Mandates
  - Europe – June 8, 2016 New production aircraft*
  - Europe – June 8, 2020 Retrofit aircraft
  - United States, Dec 31, 2019
- Current Deployments
  - Australia (Operating above FL 290)
  - Indonesia (Operating above FL 290)
  - Singapore (Operating above FL 290)
  - Canada – Hudson Bay
  - USA - Gulf Of Mexico

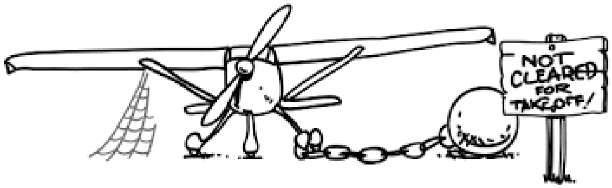


ADS-B Benefits

- Improved safety and efficiency for ADS-B equipped aircraft operating within the worldwide airspace system (reduced runway incursions, continuous routes to flight levels, reduced separation)
- No subscription fees for ADS-B, ADS-R, TIS-B, or FIS-B services
- See what ATC sees with access to traffic information from TIS-B, ADS-R, and ADS-B
- Flight Information Service - Broadcast (FIS-B) transmits flight information and weather information such as:
  - NEXRAD
  - METARs
  - TAFs
  - Winds Aloft Forecasts
  - Temps Aloft Forecasts
  - TFRs
  - NOTAMs
  - AIRMETs
  - SIGMENTs

Why should I equip now?
It's 3 years away!

1. Get the benefits NOW!
2. Will the FAA delay the ADS-B mandate? NO!
3. Let's do the Math



- 120,000 Aircraft
- 30 months = 4,000 aircraft a month
- 500 Avionics Shops = 8 ADS-B installs a month per shop
- Install times 15-30hrs
- But wait…I want to use MY shop! (installation options will become limited, as shops are already starting to book 3, 6, even 12months in advance)

AOPA Senior Vice President of Government Affairs Jim Coon. "There are more than 81,000 certified single-engine piston-powered airplanes on the FAA's registry…" – currently 3% of these aircraft are equipped

ADS-B Solutions for Every Aircraft

LYNX® MULTILINK SURVEILLANCE SYSTEM

NXT™ 700 ADS-B XPDR

- L-3’s innovative and affordable solutions for ADS-B
- L-3’s solutions addresses ADS-B needs across the entire market fixed wing, rotorcraft, large, and small

NXT-600
“RCZ” Form-Factor

NXT-700
2MCU Form-Factor

NXT-800
4MCU Form-Factor

L-3 ADS-B Solutions

NXT-600
"RCZ" Form-Factor

NXT-700
2MCU Form-Factor

NXT-800
4MCU Form-Factor

Model	NGT-9000	NXT-600	NXT-700	NXT-800
Market	Business and Military	Business, Regional, and Military	Business, Regional, and Military	Air Transport
Size	5.75"X1.5"X8.5"	RCZ-852 and XS-950	¼ ATR Short	4MCU
Weight	3.0 lbs	5.0 lbs	5.5 lbs	8.6 lbs (AC) 7.8 lbs (DC)
ADS-B Compliance	**DO-260B MOPS DO-282B MOPS (UAT)**	**DO-260B MOPS**	DO-260B MOPS	**DO-260B MOPS**

NGT Lynx® and NXT Capability

NGT-9000
ADS-B Wx & Traffic Display

NGT-9000 +
Active Traffic (TAS), TWAS, Diversity, ATAS

NXT-600
"RCZ" Form-Factor

NXT-700
2MCU Form-Factor

NXT-800
4MCU Form-Factor

L-3 NGT-9000 for aircraft at any altitude

It's a lot more than just a transponder

- AML/STC is in place for Part 23 Class I, II, and III aircraft and Part 27 Helicopters
- Presently working on STCs for Part 25 and 29 aircraft (although STC may not be needed per FAA memo and approved pairing is in one box)
  - Sub-TCAS II aircraft

- **All in one:**
  - Mode S 1090 ES In/Out
  - UAT (978) In
  - Internal GPS/WAAS
  - Resistive split touch screen
  - MFD and PFD interfaces
  - WiFi Capable, Current apps:
    1. ForeFlight
    2. Wing X Pro
    3. Sky Radar
    4. FltPlanGo
    5. FlyQ
  - Panel mount or
  - Remote mount

NGT-9000 Traffic solutions

- **<u>Field Upgradable Traffic Options</u>**
  - *Embedded Active Traffic (+/TAS)*
    - *Will detect and provide an audio alert for any traffic equipped with a transponder*
    - *NGT-9000 traffic display changes color and automatically returns to traffic page*
    - *Requires active traffic antenna*
  - *ATAS (ADS-B based Audio Traffic Alerting System)*
    - *Provides traffic alerting at ALL altitudes*
    - *Few false alerts because is the use of ADS-B*
- **<u>Reduced Weight</u>**
  - Replaces most SkyWatch processors increasing your useful load

NGT-9000 TAWS

- **Field Upgradable TAWS Option**
  - *eTAWS (embedded Terrain Awareness and Warning System)*
    - *Will detect and provide an audio alert for terrain and obstacle clearance world wide*
    - *NGT-9000 traffic display changes color and automatically returns to terrain page when alerts and warnings appear*
    - *Simply software upgrade at a great price*
- **<u>Reduced Weight</u>**
  - Replaces most Landmark systems increasing useful load

You don’t like your wings fixed? That’s okay with us!

- Lynx ADS-B has an AML-STC for
  - Robinson R22, R44, R 66
  - Enstrom 280, 480, F-28, TH-28
  - MD 369, 500N, 600N
  - Bell: 47, 206, 407, 427, OH-13, OH-58
  - Airbus (Eurocopter): AS350, AS344, B-105, EC120, EC130, EC135, EX130, EX135, Gazelle, SA341, SA342
  - Sikorsky: 269
  - Agusta-Bell: AB-102


NXT-700 ADS-B
Available October 2016
For Business Jets

FEATURES

DO-260B Certified Replacement Transponder

Form fit compatible with current retrofit ARINC 735B/735A/735 TCAS II systems.

Quick installation and less downtime by utilizing existing mounting rack and connector (¼ ATR short)

Interoperability testing to date include the following…

ACSS TCAS 3000SP™, TCAS 2000™, T2CAS® and T3CAS™
Rockwell RCI TTR-920/921, TTR-2100, TTR-4000
Honeywell TPU-67A & B, TPA-100B, TPA-100 A and B

Interfaces with TPU-67A & B TCAS II Processors (KFS-578A/PS-578A/PS-550 Control)
Or CD-674C control
Or CTA-81A/81D Control
Or RMS-555 Radio Management System

NXT™ 700
ADS-B XPDR

FEATURES

Cockpit configurations remain - no additional control heads are needed

AML STC is expected in October 2016, EASA and Transport Canada validation to follow

Software upgrades to the NXTs are performed through on-wing software loads

NXT™
700
ADS-B XPDR

Optional WASS/GPS NXG-900 available 1Q17

978 MHz UAT, ADS-B In providing Free Weather (FIS-B)

Wi-Fi Interface Module to mobile applications (Android, IOS, Windows)

NXG
900

PLATFORMS

Hawker Beechcraft 125 series, 400 series, 800 series

Gulfstream II, IIB, III, GIV, GIVSP, G300, G400, V, 1124/1125

Cessna Citation 550/S550/560/650

Falcon 50/50EX, 20/200, 10/100, 900 A/B, 900EX / C / LX / DX / EASy

Learjet 31, 35, 36, 36A

Bombardier 600/601, CL-604; DHC-8

Saberliner

NXT™ 700 ADS-B XPDR

NXT-700 Pricing

Catalog $38,975
2016 Promotion $30,533
2016 Trade-in on MST-67A $5,000

2017 Promotion to expire and Trade-In to diminish

NXG-900 Pricing

GPS WAAS Receiver	$9,937
ARINC743 GPS Antenna	$2,547


NOW
IS A
GOOD TIME
FOR TCAS
CHANGE
7.1
Our TCAS Platforms:
Citation Mustang
Citation Sovereign
Citation X
Citation XLS
Embraer Legacy
Embraer Phenom
Falcon 2000
Falcon 7X
Falcon 900
Global 5000
Gulfstream 350
Gulfstream 450
Gulfstream 500
Gulfstream 550
Hawker Horizon
Learjet 40
Learjet 40XR
Learjet 45
Learjet 45XR
L3
Aviation Products

TCAS II Change 7.1 Overview

- Change 7.1 provides specific, clear and concise RA commands resulting in faster reaction time improving avoidance performance.
  - Introduces improvements to the current reversal logic to address late issuance of reversal RAs and potential failures to initiate reversal RA's.
- Change 7.1 reduces the probability of a mid-air collision in European Airspace from 1 in every 3 years to 1 in every 12 years
- Easy Installation - Change 7.1 is most likely a wing loadable software upgrade for most
- Change 7.1 Mandates - If you intend to fly your aircraft in European or Hong Kong Airspace, you must comply with the Change 7.1 Mandate.
  - ***Retrofit* Dates To Remember…**
    - **Europe (EASA) – December 1, 2015 – NOW REQUIRED**
    - **ICAO Countries- January 1, 2017**
    - All civil turbine powered transport aircraft with more than 19 passenger seats (or MTOW above 5,700 kg/12,566 lbs)

Deployment & Part Numbers

Description	Change 7.1 Part Number
TCAS II	4066010-914
TCAS 2000	7517900-10020, -55020, -71020
TCAS 2000 (Military Version)	7517900-56120
TCAS 2000 +MASS	7517900-20003, -65003
T2CAS (Non-Airbus)	9000000-10309, -55309, -20309
T2CAS (Airbus)	9000000-11414
T2CAS + MASS	9000000-TBD
TCAS 3000	9003000-10005, -55005, -65005
TCAS 3000 SP	9003500-10905, -55905, -65905
TCAS 3000 SP with A3 Sensitivity	9003500-12907, -58907, -68907

FANS (CPDLC) Overview

- CPDLC "Controller Pilot Data Link Communication"
  - A component of Future Air Navigation System (FANS)
  - Digital text-based communication between Air Traffic Control and Pilots
  - Currently used in areas where VHF and HF communications are unavailable or unreliable
    - Specific Oceanic Routes
    - Isolated Land Routes
  - Works with different datalink networks, equipment types, and service providers:
    - Iridium, Inmarsat, VHF Data Link (VDL Mode 2)
  - **When a FDR & CVR is required and when CPDLC capable data link systems are installed, message-set data must recorded!**

CPDLC Data Recording Requirements

- When is data link recording required?
  - FAA
    - "All airplanes or rotorcraft required by this section to have a cockpit voice recorder and a flight data recorder, that install datalink communication equipment on or after December 6, 2010 (FAR 135.151h) or April 6, 2012 (FAR 91.609j), must record all datalink messages as required by the certification rule applicable to the aircraft."
      - If datalink system is installed on or after the above dates, the CVR is required to perform recording of datalink messages
      - Reference Advisory Circular AC20-160 for means of compliance and message-set requirements
      - Rule clarification - FAA Info Document # 10016

L-3 CPDLC Data Recording Solutions

The FA 2100 and FA5000 series solid state recorders are capable of OMS and CPDLC data link recording:

Model	FA2100 Series SSCVR	FA5000 Series SSCVDR
Type	Solid State Cockpit Voice Recorder	Solid State Cockpit Voice and Data Recorder
Recording Time	120 minutes audio 120 minutes data link	120 minutes audio 120 minutes data link
Channels	4 channels audio	4 channels audio
Data Link Capability	**ARINC 429 OMS/CPDLC**	**ARINC 429 OMS/CPDLC**
Regulatory	EUROCAE MOPS ED-56A	EUROCAE MOPS ED-112
Certification	TSO-C123a	TSO-C123b
Power	115 VAC / 28 VDC	115 VAC / 28 VDC

Where are L-3 Recorders Found?

AIRBUS	A300 / A330 / A340 A320 Family, A350 A380
ATR	42 / 72
AVIC	ARJ 21
BEECHCRAFT	**C 90 / 200 / 350 / B1900** **400 / PREMIER** **HAWKER**
BOEING	737 / 757 / 767 / 747 / 777 / BBJ
BOMBARDIER CRJ	100 / 200 / 700 / 900 CONTINENTAL / **604** **LEAR 31 / 45 / 60 / 85**

CUSTOMER	AIRFRAME
CESSNA	**ALL TYPES** **CITATION X**
DORNIER	DO 228/328
EMBRAER	135 / 145 / 170 /190 **PHENOM / MLJ**
GULFSTREAM	**G IV / G V**
HARBIN	Y-12
PIAGGIO	**P-180**
PILATUS	**PC 7 / 9 / 12 / 21**

90 Day Under Water Locator Beacons

- The FAA implemented TSO C-121b and is expected to withdraw TSO C-121 and 121a at the end of 2015
  - This change requires all newly manufactured Underwater Locating Beacons/Devices (ULB/Ds) to comply with a 90-day minimum duration.

- EASA is considering a Notice of Proposed Amendment that would require operators to transition to the 90-day variant as well.
  - We believe EASA will adopt the recommendation in 2016, and require compliance by 2018.

- L-3 has developed a 90-day retrofit kit for each of our fielded products which enable customers to transition their recorders to the new standard in the field.
  - Service Information Letter **SIL L-3AR 2015-0005**

Questions?

Joel Gibbons
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Aftermarket Avionics Sales – Northeast Region
616-871-4424 Mobile
616-285-4322 Office
Joel.Gibbons@L-3com.com

Pro Line 4 & 21 Mandates

Sean Lynch
Regional Sales Manager
Northeast U.S.

June 23, 2016

The information provided herein indicates the expected mandates and air navigation services in global airspace. This information is intended to be accurate, however, the appropriate civil aviation authorities and air navigation service providers (ANSPs) should be consulted for current regulatory requirements and status.

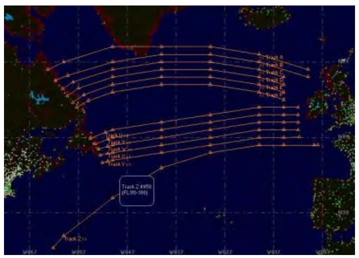
Rockwell Collins
Building trust every day

Mandate Agenda

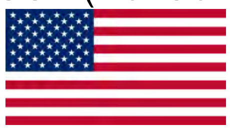
- WAAS
- Data Communication
  - FANs 1/A
  - Link 2000+
- ADS-B
- TCAS 7.1
- Planning

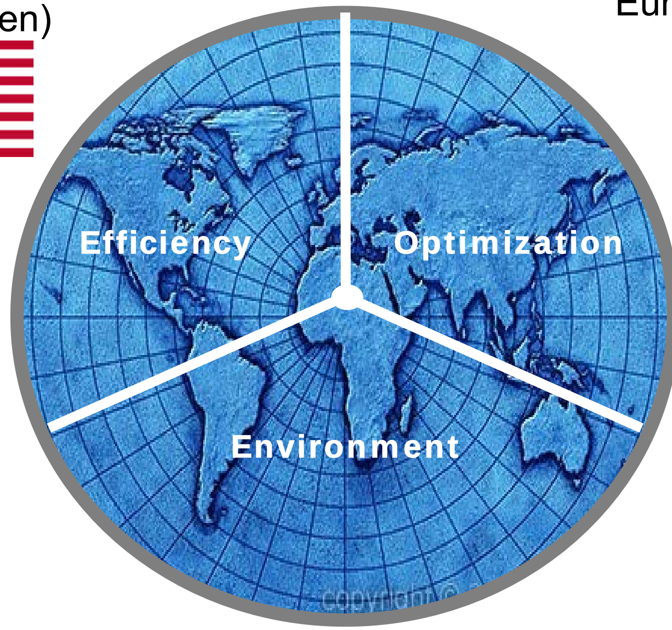
NextGEN is restructuring how airspace is managed

2015	2016	2017	2018	2019	2020	2021+
RNP WAAS/LPV	FANS 1/A TCAS 7.1	FANS Phase 2b	LAAS GLS	FANS Phase 2c ADS-B-Out Link 2000+	PBN ADS-B in ATC Datacom	

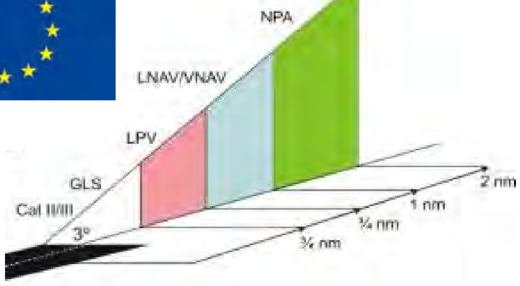


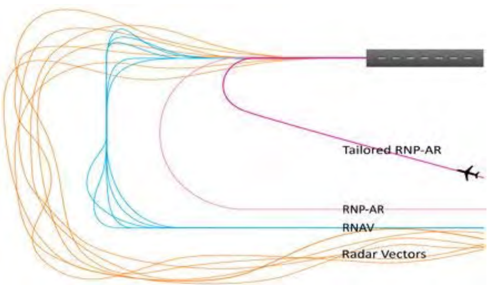
USA (NexGen)

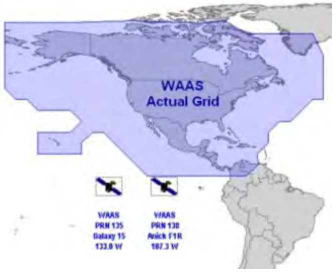


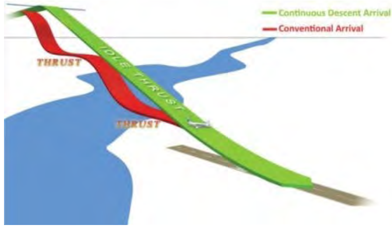


Europe (SESAR)









Airspace Management - Best Equipped/Best Served

Rockwell Collins WAAS LPV Solution

GPS-4000S

Equips Airplane for SBAS

GPS Primary Means Navigation

<u>Value in advance of FMS v 4.0</u>

Simpler RNAV Procedures

(no preflight RAIM check)

Better Availability

Enhanced Mission Flexibility

and Efficiency

+

Enables LPV Approaches

Improved Airport Access

<u>Additional Value</u>

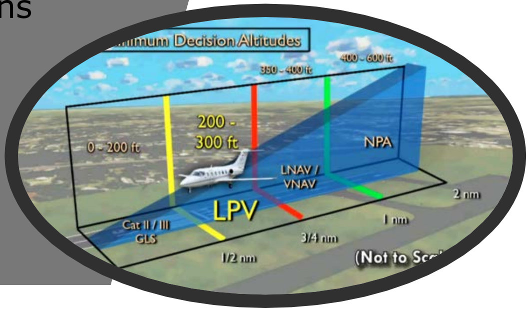
Faster Data Loading

Increase Database Mem.

GPS Primary Means

XYZ Approaches

Step Down Fixes



Package of Upgrades for the NextGen / SESAR Space Based Navigation and Air Traffic Management

Benefits of FMS 4.x and WAAS GPS

- Faster Data loading
  - FMS database loads faster. You can load multiple FMC's simultaneously.
- Increase Mem
  - Doubles the available memory. New Type 7 "accuracy enhanced" database.
- XYZ Approach
  - Multiple approaches of the same type into a single runway end. Older FMS software is not capable of handling multiple procedures.
- GPS Primary Means
  - GPS no longer supplemental to VOR/DME/ILS. FMS 4.0 RNP capabilities baseline to NEXTGEN.
- Step Down Fixes
  - Allows for VNAV path adjustments to between the FAF and the runway end. Efficient routing when obstacles are a factor.
- No RAIM checks
  - Mitigates the need for pre flight RAIM checks. Enhanced GPS fault detection and exclusion.
- Improved Accuracy and Availability (GPS)
  - FMS lateral and vertical position accuracy greatly improved. Augmentation reduces odds of a "NO GPS" situation.
- Localizer Precision with Vertical Guidance (LPV)
  - WAAS FMS 4.0 enables a precision GPS approach capability. ILS equivalent minima and available at a large number of airports.

WAAS FMS & LPV Certification list

- Available on all Rockwell Collins Pro Line 4 and 21 platforms with the exception of the Premier 1
    - Evaluating best path forward on the Premier 1

- Pricing will vary by platform, Single FMS/Dual FMS, Single GPS or Dual GPS etc.

- Pretty much everything moving forward will assume WAAS FMS capable for road map

Datalink

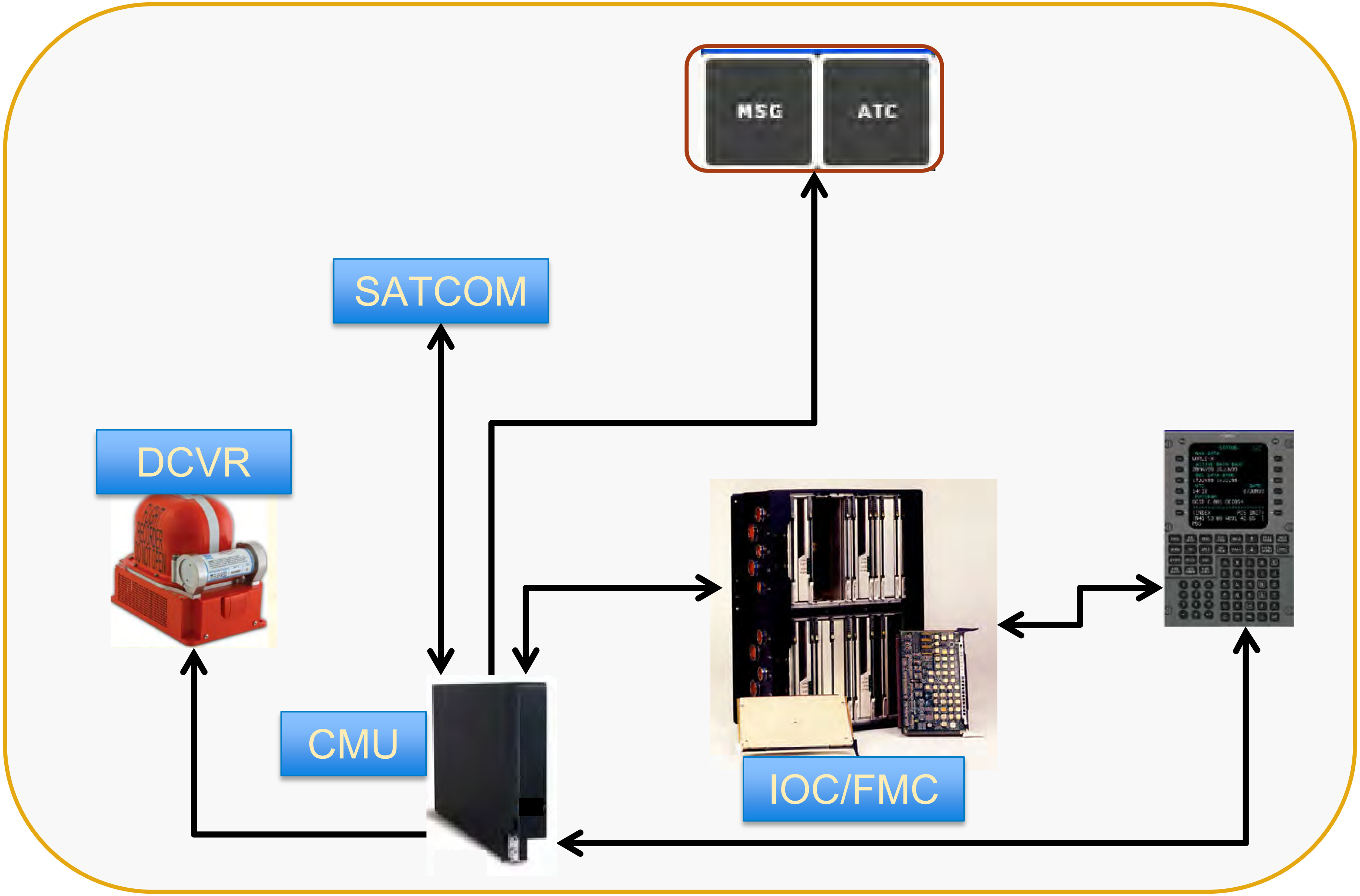
FANs 1/A

- FANS 1/A = CPDLC + ADS-C
- Crew to ATC text messaging via satellite communications (CPDLC)
- Automatic aircraft position & heading reporting via satellite communications (ADS-C)
- Oceanic Airspace
- U.S. testing departure clearance using FANS 1/A

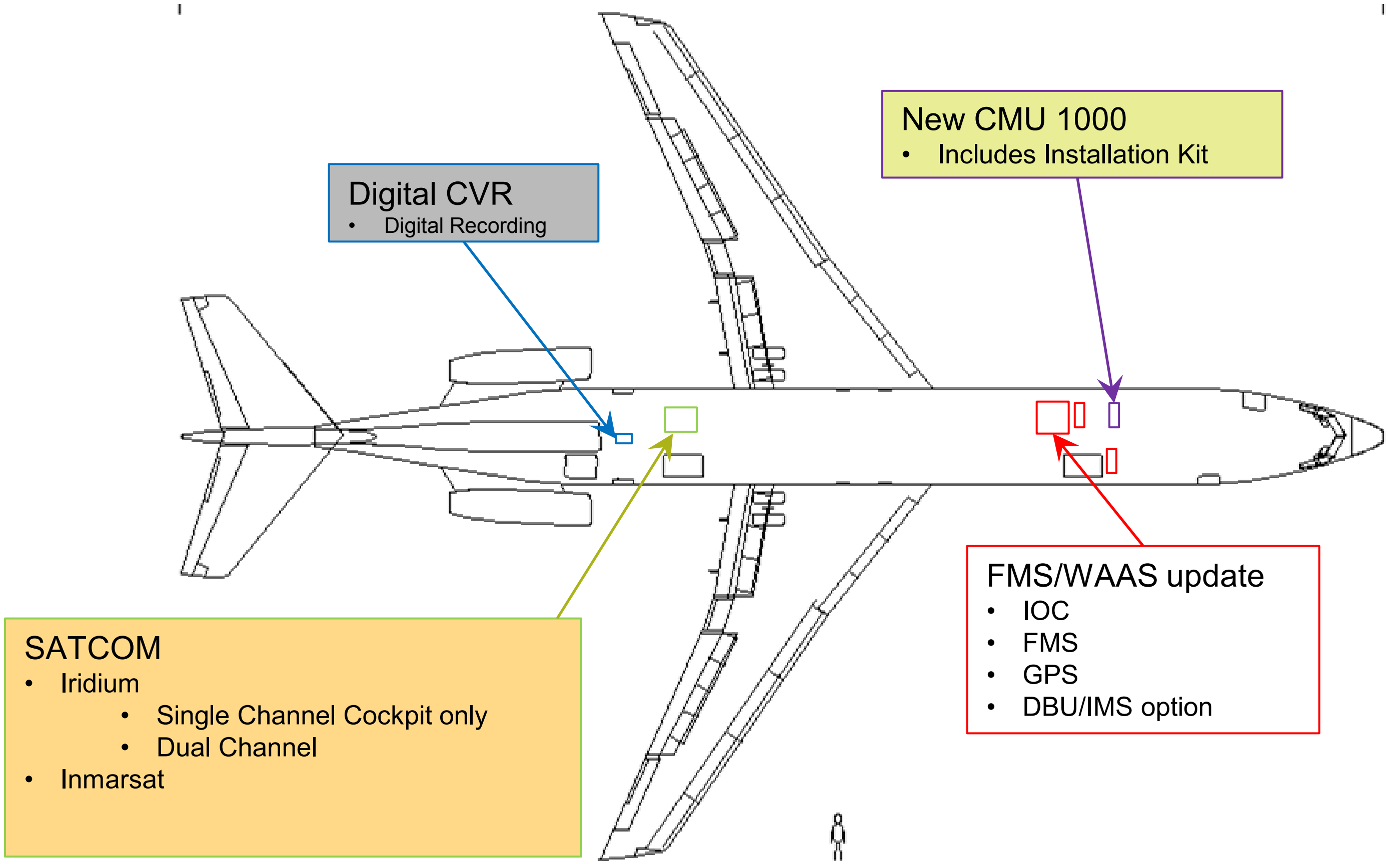
ATN Link 2000+

- Eurocontrol's program that address's ATC congestion issue in Europe.
- Provide controllers and pilots with a second communication channel: air/ground data link.
- Implements a Protected Mode CPDLC for data integrity

Rockwell Collins Aftermarket FANS Solution



The basic component involved in a FANS 1A update on Pro Line 4 or 21 include, CMU 1000 Data link unit, minimum of FMS 4.0. DCVR to record CPDLC message and SATCOM qualified for ICAO safety service and FANS 1/A.



Rockwell Collins

FANS Certification list

Aircraft Type	Certification Path	Availability
Challenger 300	Bombardier SB	Nov 2016 (Pro Line 21 Advance)
Challenger 605	Bombardier SB	Available (Pro Line 21 Advance)
Challenger 604	Rockwell Collins FAA STC BA SB	Available
Falcon 50EX	Dassault STC / Rockwell Collins Product	Available
Falcon 2000/2000EX	Dassault STC / Rockwell Collins Product	Available
Challenger 850	Partner identified	Mid 2016 for TC STC. FAA STC Next
Gulfstream G200	Offer Submitted	TBD
Gulfstream G150	Offer submitted	TBD
Hawker 900/800	Evaluating	TBD

Link 2000+ Aftermarket Certification list

Fusion Platforms

- Global 5000/6000, Legacy 500/450, G280
  - Available through Aircraft OEM Service bulletins

Pro Line 4 and 21 platforms

- Put on hold due to mandate slip
- Continue to evaluate by platform

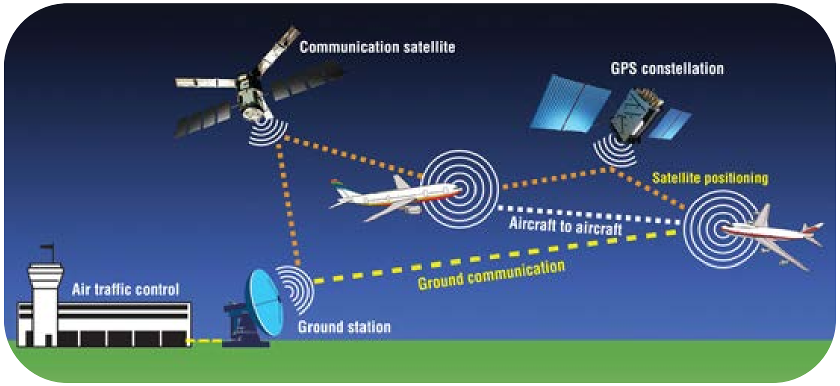
ADS-B Out

ADS-B is a vital enabler of the NextGen plan

Why Automatic Dependent Surveillance- Broadcast (ADS-B)?

- Enabler of air traffic control procedures to increase airspace capacity and efficiency
- Allows surveillance deployment where previously not possible. i.e.: Gulf of Mexico
- Lower cost, more accurate and more frequently updating surveillance infrastructure
- Provides vehicle for safety services to the cockpit
- Provides widespread unprecedented pilot situational awareness

U.S. Mandate Jan 1, 2020



Courtesy FAA.gov

ADS - B Certification List

- Textron; Cessna Pro Line 21, Hawker Pro Line 21, Beechcraft Pro Line 21
  - Releases happening throughout the upcoming year.
  - Premier 1/1A still being planned

- Bombardier
  - Challenger 300, 350, 605, 650 via OEM service bulletin
  - Challenger 604
  - CL 850 third party or Rockwell Collins
  - Lear 60XR; Evaluation
  - Lear 60; Third party STC

- Gulfstream
  - G200 & G150 OEM Service Bulletin
  - GIV with Pro Line 4 Radios, Gulfstream STC
  - G100 and Astra will be third party STC

- Dassault Falcon
  - Falcon 900, 50, 50EX, 2000, 2000EX and more will be available through the upcoming year via Dassault STC.

- Fusion platforms will have OEM service bulletin available
- Significant number of additional dealer STC are being developed

Rockwell Collins Air Space Modernization Bundles

- IFIS Upgrade (Charts, Graphical WX, Geo Political Boundaries
- WAAS LPV
- SVS
- ADS-B

- Hawker- Pro Line 21 Hawker 50/800XP/850XP
- Hawker 900 – Est April 2017
- King Air 350 (Pro Line 21 King Air C90GTi/x, B200, 200GT, 250, 350, 350iPL21 Equipped)

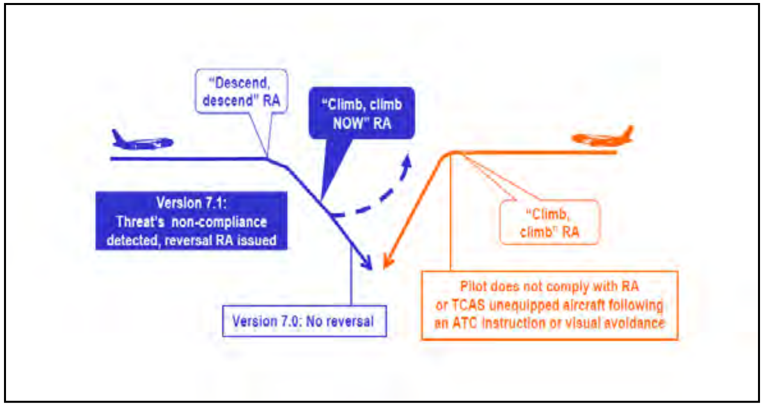
TCAS 7.1- Address Safety Issues

An airliner near-collision over Japan in 2001 and an actual airliner at FL350 over Germany in 2001 led efforts to update TCAS II

Resolution Advisory (RA) Reversal capability:

Crew of one A/C involved in TCAS RA fails to comply "Traffic! Climb!"

- TCAS of other A/C can issue reversal RA command to avert collision

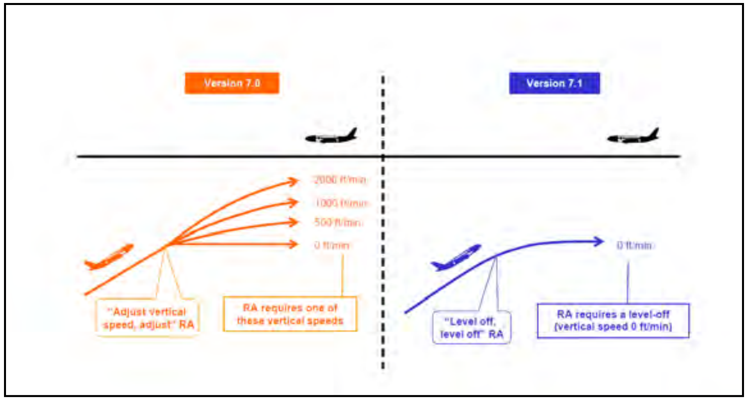


Courtesy of Eurocontrol Website

Level off Callout

Issue a "level off" callout in lieu of "Adjust Vertical Speed-adjust"

- Mitigates ambiguous aural cue to climb or descend



Courtesy of Eurocontrol Website

No published U.S mandate to date

TCAS 7.1 Certification

Aircraft Type	Certification Path	Availability
Challenger 300	TCAS Service Bulletin / AML	Now
Challenger 605	TCAS Service Bulletin / AML	Now
Challenger 604	TTR 2100 AML STC	Now
Falcon 50EX	TTR 4100 AML STC	Now
Falcon 2000 / 2000EX	TTR 4100 AML STC	Now
Challenger 850 / CRJ 200	TTR 2100 AML STC	Now
Gulfstream G200	TTR 921 AML STC	Now
Gulfstream G150	TCAS Service Bulletin / AML	Now
Hawker 800	TCAS Service Bulletin / AML	Now
Lear 60XR	TCAS Service Bulletin / AML	Now
Lear 60	TTR 921 AML STC	Now

* There is a very limited number of TTR 921s available.

Obsolescence & Maintenance Management

Providing proactive obsolescence management to help operators manage maintenance budgets through life cycle

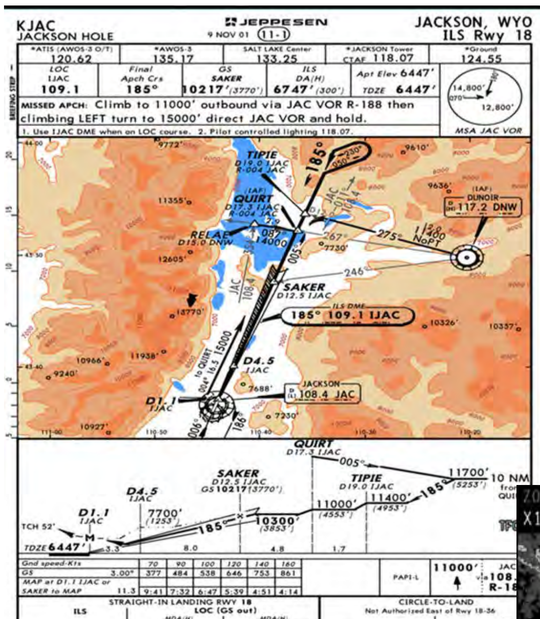
- AHRS
- CRT Display
  - PFD/MFD **(Flight plan)**
  - RTU
  - RMIs
  - Etc.

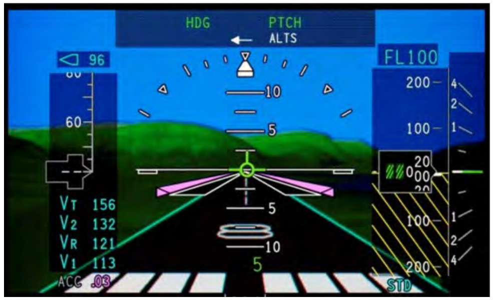
- 1st generation computers
  - FMS/Database
  - DBU (Floppy Drives)

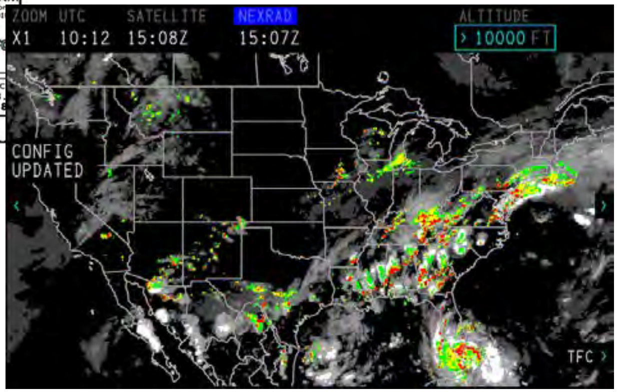
- Equipment life Cycles will Continue to get shorter

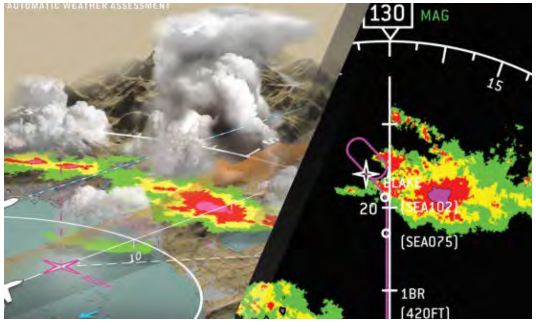
Operational Efficiencies & Safety Enhancements

SVS, Airport moving map, Weather Radar create a safer and more efficient environment









Pro Line 4 & 21 Mandates

Sean Lynch
Regional Sales Manager
Northeast U.S.

June 23, 2016

The information provided herein indicates the expected mandates and air navigation services in global airspace. This information is intended to be accurate, however, the appropriate civil aviation authorities and air navigation service providers (ANSPs) should be consulted for current regulatory requirements and status.

Rockwell Collins
Building trust every day

Airspace Modernization NextGen

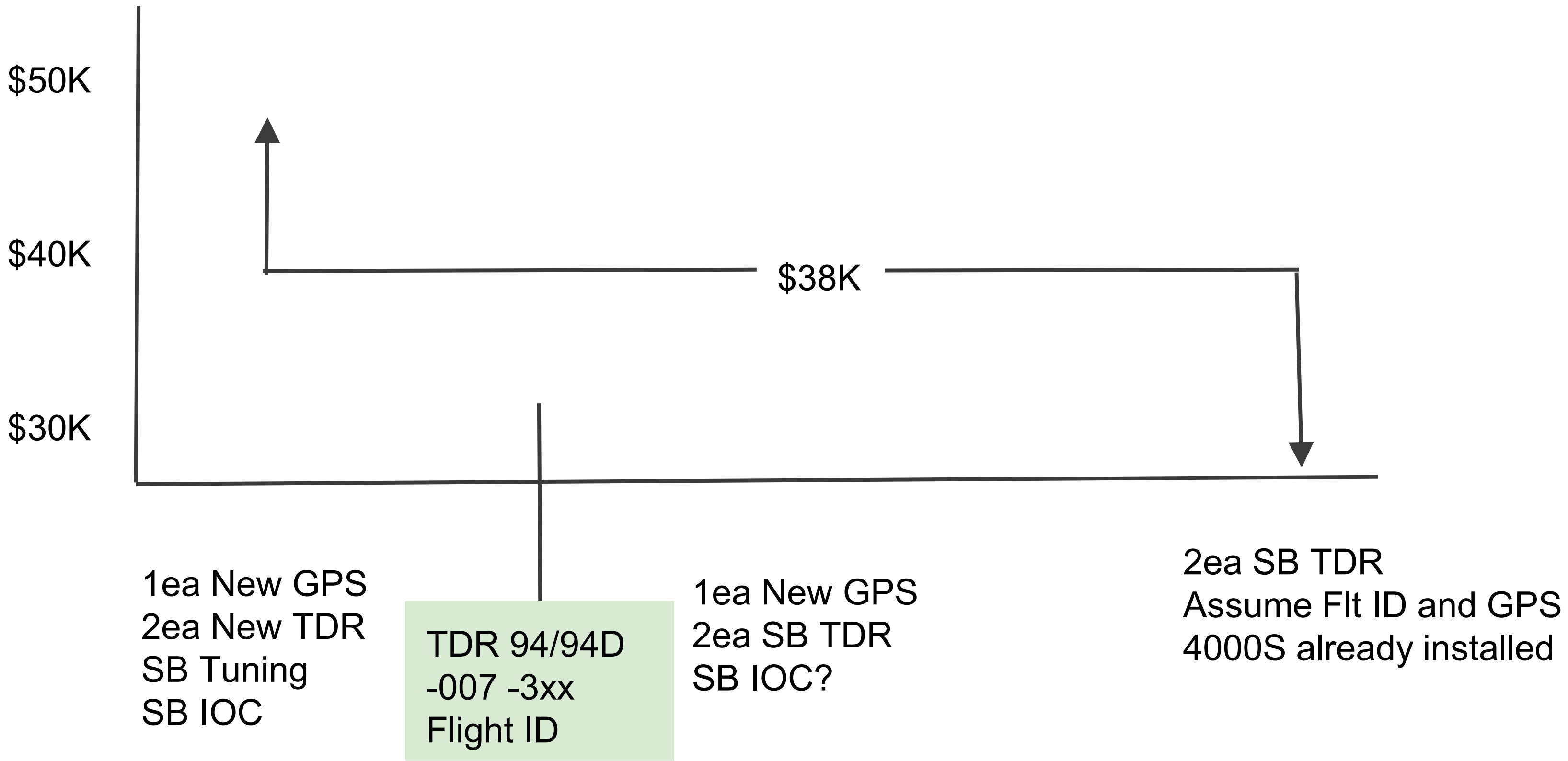
Making the aircraft and airspace more efficient, from taxi, take off through to arrival

5 major areas to focus on

- GPS (Global Positioning System)
  - **WAAS (SBAS)**
  - *LAAS*
- FMS (Flight Management System)
  - RNP (Required Navigation Performance)
  - PBN (Performance Based Navigation)
  - LPV
- CMU (Data Link)
  - FANS (Fans Domestic trials are scheduled to start)
  - Link 2000+
- TDR/TTR (Transponder/TCAS for ADS-B)
  - Of the estimated 20,000 TDRs to update it would take more than 300 units a week starting Jan 2015
- AFD/EFD (Displays)
  - Map Data display
  - RNP/PBN

- ADS-B In

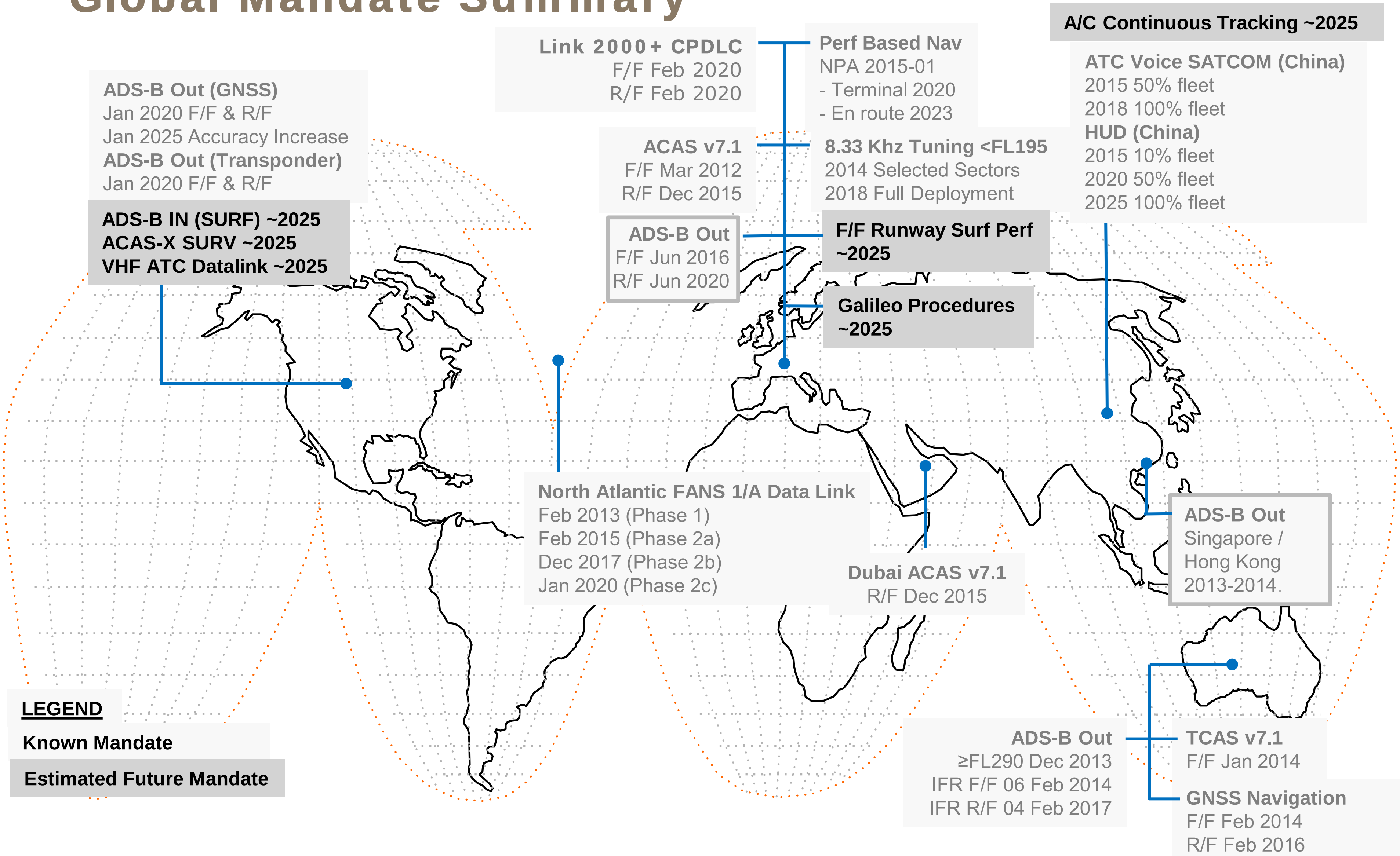
ADS-B Budgetary Equipment Pricing gauge for Pro Line 4 and Pro Line 21 systems



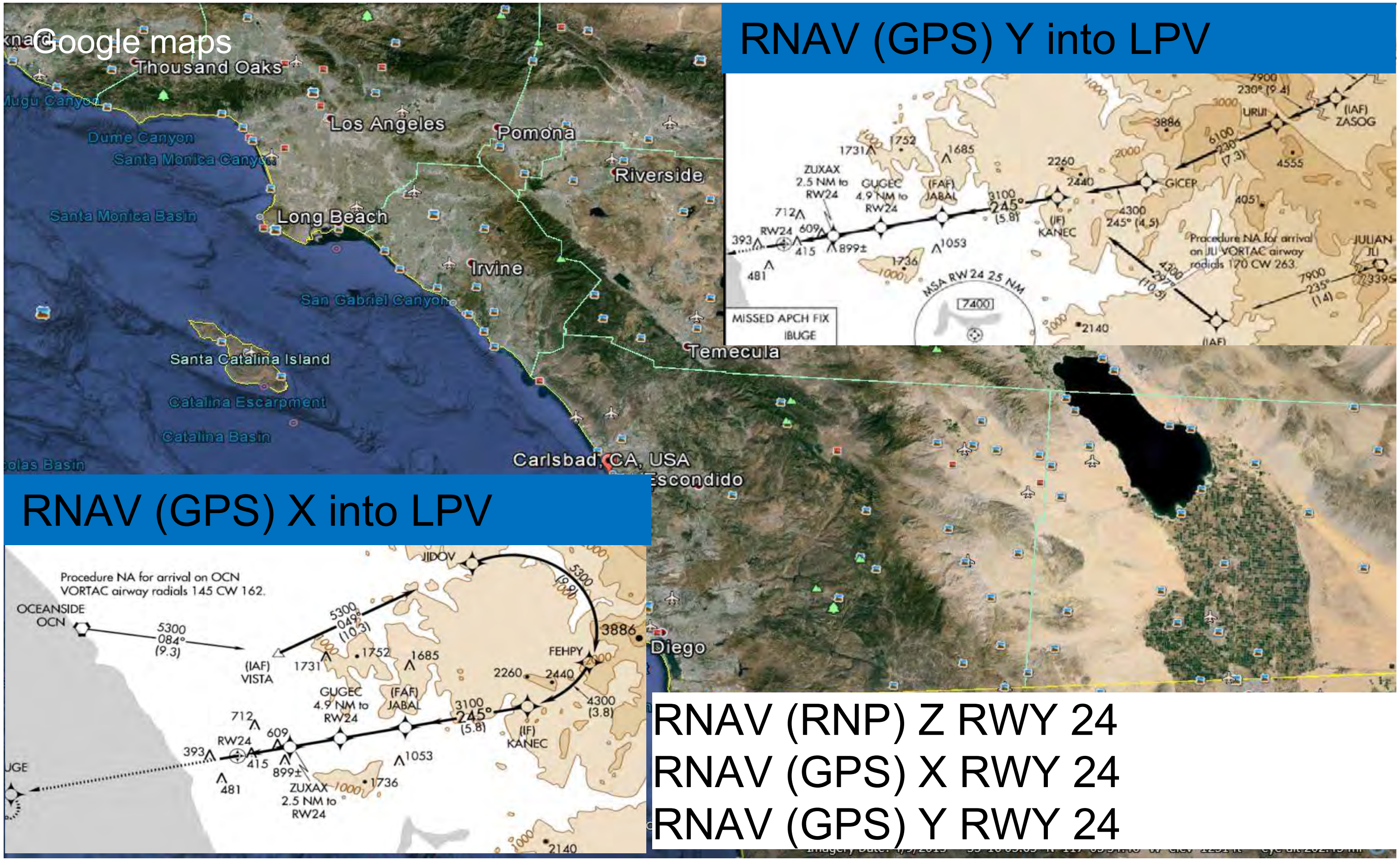
> These estimated prices are Rockwell Collins equipment only and do not include labor, STC cost or third party parts that are required for final certification

> Equipment cost may vary based on the specific configuration of your aircraft. These values are for budgetary purposes and do not constitute a commitment

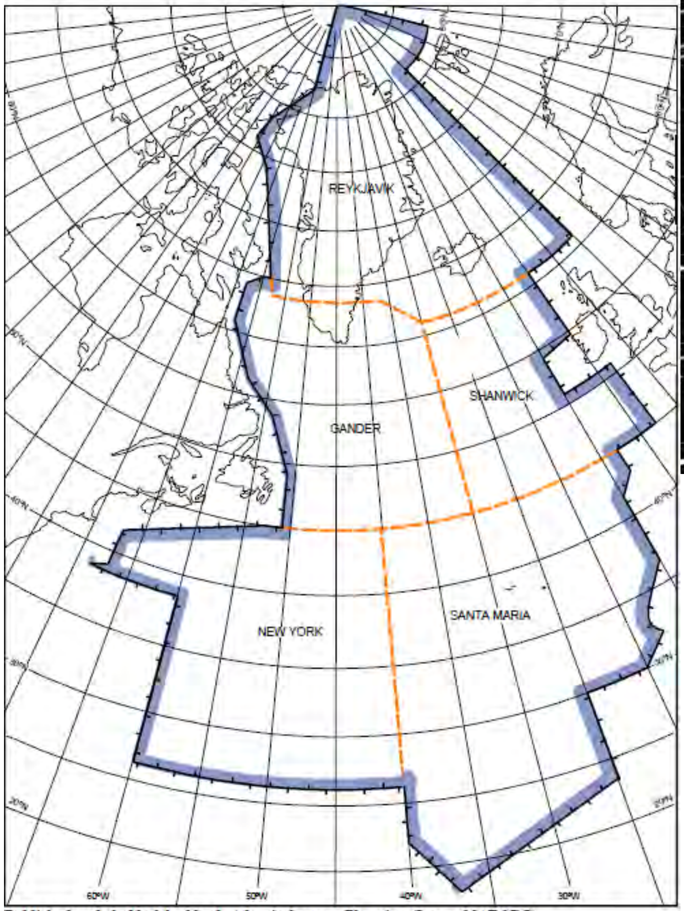
Global Mandate Summary



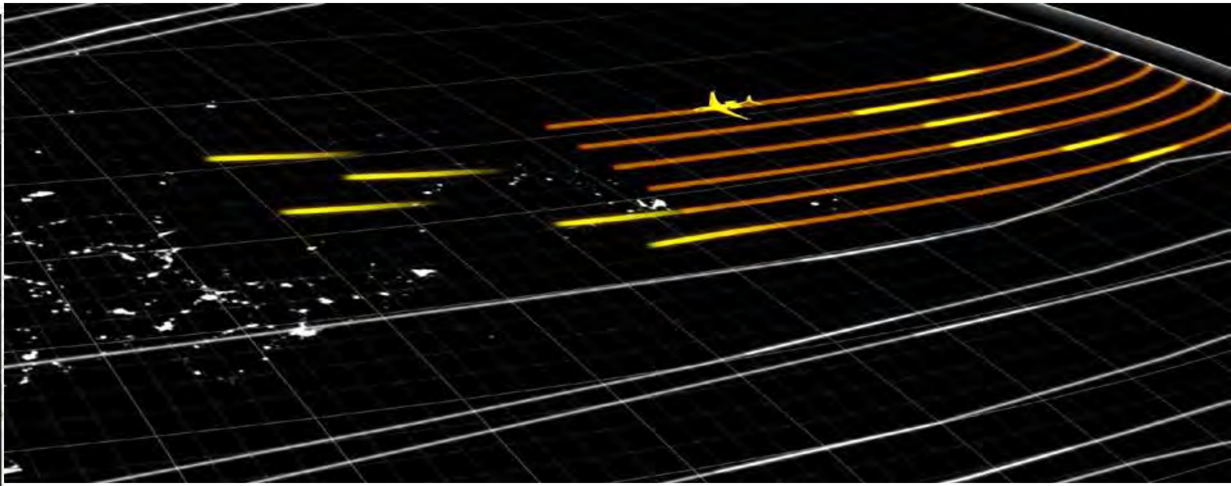
With FMS 4.x there is more than just LPV, Primary means, RNP, RF Legs and expanded database that includes access to more approaches and runway ends then ever before



Airspace Crossing the Atlantic



Published on behalf of the North Atlantic Systems Planning Group (NAT SPG) by the European and North Atlantic Office of ICAO



North Atlantic Tracks (NAT) FANS 1/A Data Link

Feb 2013 NAT OTS FL360 to FL390 (Phase 1) ✓

Feb 2015 NAT OTS FL350 to FL390 (Phase 2a) ✓

Dec 2017 NAT Region FL350 to FL390 (Phase 2b)

Jan 2020 NAT Region FL290 & Above (Phase 2c)

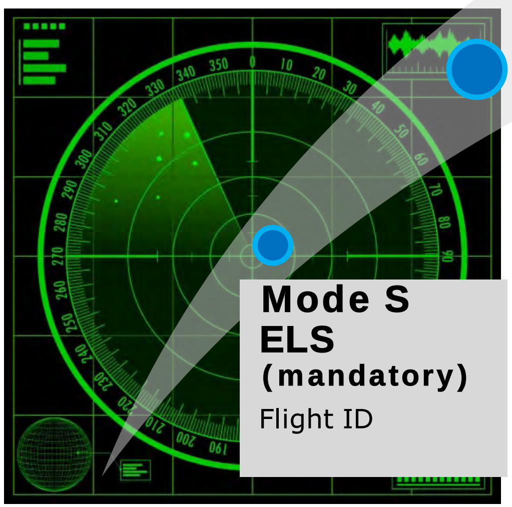
Phase 2b/2c will progressively close North Atlantic airspace to non-FANS 1/A” aircraft

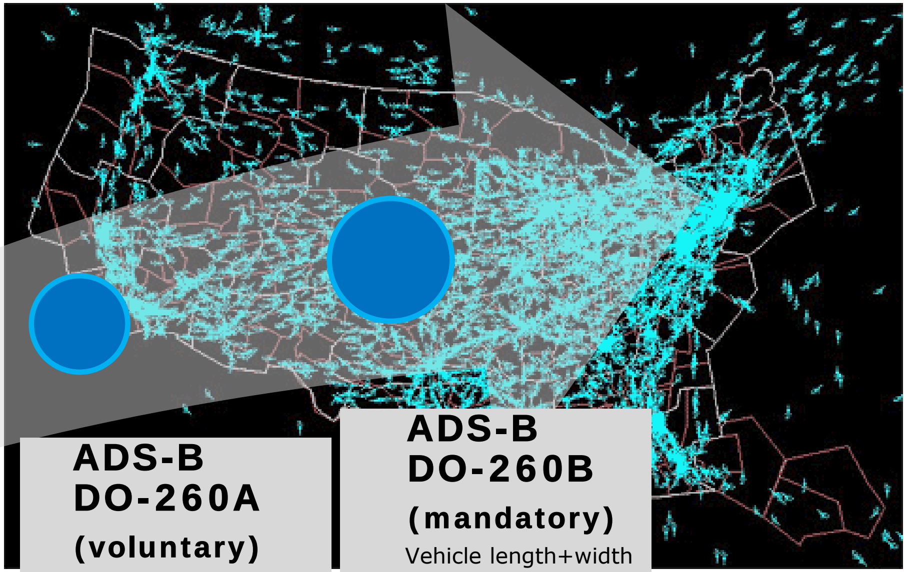
With the increase of air traffic in ADS-B out is a critical function enabling aircraft to be tracked with more accuracy than ever before providing the tools to increase traffic density through tighter spacing, without compromising safety.

TDR-94(D)
-501

GPS-4000S

FLT ID/EhS





Mode S ELS (mandatory)
- Flight ID

Mode S EHS (mandatory)
- Hdg, Roll
- TAS/IAS/GS/VS
- TK, TKE, Mach
- Sel ALT

ADS-B DO-260 (voluntary)
- 24bit ID
- Position and quality
- Baro Altitude
- Velocities
- Flight ID

ADS-B DO-260A (voluntary)
- 24bit ID
- Position and quality
- Baro Altitude
- Velocities
- Flight ID
- Emer code
- SPI / GS

ADS-B DO-260B (mandatory)
- Vehicle length+width
- GPS Antenna offset
- Velocity accuracy
- System Design Assurance
- UAT/1090ES capability
- Aircraft category
- Emerg code
- NIC / NACp / NACv
- GPS altitude
- TCAS status

EASA Retrofit Mandate is June 2020

Federal Aviation Administration

NextGen Implementation Plan

JUNE 2013

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FROM THE ADMINISTRATOR

June 2013

Dear Members of the Aviation Community:

Many years from now when we reflect back on our move to NextGen, we will take pride in being a part of the largest aviation infrastructure project in history. We will look at 2012 as a pivotal year during which we delivered actual benefits to the flying public.

We are excited by preliminary numbers from our new procedures into metropolitan Washington, D.C. Aircraft are flying new routes named to honor our troops and commemorate September 11. We have created more direct routes, cut flight miles and reduced costly level-offs with these procedures. We anticipate fuel savings of $2.3 million per year — and even more savings across the country as more users take advantage of NextGen. In Seattle, as part of our Greener Skies initiative, airlines are using precision routes to shave four to eight minutes off flight times, providing projected annual savings of more than $13 million.

With NextGen, we are creating a foundation that enhances safety, saves passengers' time and better protects the environment by reducing aircraft exhaust emissions. Measures of NextGen performance and progress can be tracked at the NextGen Performance Snapshots website.

This year, we are operating in a very challenging fiscal environment, the impact of which could continue into the future. The Budget Control Act of 2011, also known as sequestration, cut $637 million from the FAA budget this fiscal year and contains a provision for 10 years of across-the-board cuts in federal spending.

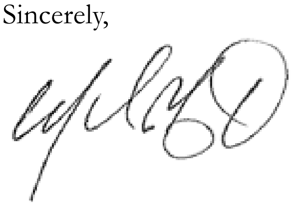
Despite the potential uncertainty associated with these cuts, our number one priority at the FAA will always be safety. We are striving to be even smarter about how we enhance safety in all of our programs. We continue to gather and share operational data to identify and address potential hazards and mitigate issues before they occur.

Our goal as an agency is to manage our national airspace in the most efficient and cost effective way possible, and NextGen plays a central role in this effort. We also want to empower our employees to work smarter and to enhance productivity.

As the entire world moves to satellite-based navigation, it is vital that we work to advance global collaboration. We need to improve the harmonization and interoperability of new technology with international aviation standards and procedures to improve safety and efficiency on a global basis.

So many of the benefits we are seeing from NextGen are due to the hard work and collaboration of the entire aviation community. I want to thank all our stakeholders for their support and partnership. As we move forward with NextGen, the FAA is committed to continue working with our stakeholders to reach the common goal of ensuring that America's aviation system, the largest in the world, remains the safest.

Sincerely,



Michael P. Huerta

FAA Administrator

WHY NEXTGEN MATTERS

The movement to the next generation of aviation is being enabled by a shift to smarter, satellite-based and digital technologies and new procedures that combine to make air travel more convenient, predictable and environmentally friendly.

As demand for our nation's increasingly congested airspace continues to grow, NextGen improvements are enabling the FAA to guide and track aircraft more precisely on more direct routes. NextGen efficiency enhances safety, reduces delays, saves fuel and reduces aircraft exhaust emissions. NextGen is also vital to preserving aviation's significant contributions to our national economy.

NEXTGEN PROVIDES A BETTER TRAVEL EXPERIENCE

- NextGen means less time sitting on the ground and holding in the air. NextGen technology and procedures are shaving crucial minutes off flight times, which translate into money saved and a better overall experience for the traveling public and aviation community.
- NextGen enables the sharing of real-time data about weather, the location of aircraft and vehicles and conditions throughout the National Airspace System. We get the right information to the right people at the right time, helping controllers and operators make better decisions and improve on-time performance.
- NextGen is better for the environment. Flying is becoming quieter, cleaner and more fuel-efficient. Operators are beginning to use alternative fuels and new equipment and procedures, reducing our adverse impact on the environment. More precise flight paths are also helping limit the numbers of people impacted by aircraft noise.

NEXTGEN PRESERVES AVIATION'S ECONOMIC VITALITY

- Our nation's economy depends on aviation. NextGen capabilities in place today are the foundation for continually improving and accommodating future air transportation needs while strengthening the economy locally and nationally with one seamless, global sky.
- Airports are economic engines for the communities they serve, bringing visitors and commerce. NextGen is providing increased access, predictability and reliability, enhancing airport operations across the country.

NEXTGEN ENHANCES SAFETY

- The FAA's top priority is ensuring safe skies and airfields, and NextGen innovation and improvements are delivering just that. NextGen is providing air traffic managers and pilots with the tools to proactively identify and resolve weather and other hazards.
- NextGen enables us to better meet our national security needs and ensure that travelers benefit from the highest levels of safety.

TABLE OF CONTENTS

As NextGen surveillance and navigation capabilities become familiar and widespread, they are delivering significant benefits. Reductions in distance flown, fuel consumption and aircraft exhaust emissions create value for airports, aircraft operators, communities and passengers.

New this year to the NextGen Implementation Plan, this chapter describes NextGen benefits for the tens of thousands who use general aviation.

This chapter provides a big-picture overview of the improvements NextGen will offer during the next decade through every phase of flight.

More traffic management advances in the air and on the airport surface are on the way. Step by step we are approaching a tipping point at which 20th century systems and technology will give way to those of the 21st.

Appendix A helps stakeholders translate NextGen capabilities into bottom-line benefits. It outlines how aircraft operators and airports can take advantage of NextGen capabilities by investing in specific equipment.

Appendix B provides an overview of the FAA's work plans for delivering operational improvements along with timelines and locations when available.

Federal Aviation Administration
Office of NextGen
800 Independence Avenue, SW
Washington, DC 20591

nextgen@faa.gov

Photo Credits: page 94

EXECUTIVE SUMMARY

NextGen provides a better travel experience with less time sitting and holding on the ground or in the air.

The NextGen Implementation Plan provides a roadmap of the FAA's ongoing transition to NextGen, which is improving the way we fly.

NextGen integrates new and existing technologies, policies and procedures to reduce delays, save fuel and lower aircraft exhaust emissions to deliver a better travel experience. The NextGen Implementation Plan provides an overview of the benefits aircraft operators and passengers are receiving from recent NextGen improvements; it also highlights future benefits that will result from NextGen.

While the thrust of our work focuses on U.S. airports, airspace and aircraft, the FAA actively engages with global aviation partners to ensure operators receive benefits anywhere in the world.

NEXTGEN TODAY

NextGen is demonstrating continuing momentum in 2013 in its drive to make U.S. aviation operations safer and more efficient. Metroplex, for example, is our fast-track effort to implement satellite-based procedures and airspace improvements to reduce fuel consumption and emissions in the airspace around metropolitan areas with several airports. As of January, we had eight active metroplex areas in various phases of development. By this summer, we anticipate that north Texas and Houston will enter the implementation phase, joining Washington, D.C., where new procedures are already in place.

We are also advancing Automatic Dependent Surveillance–Broadcast (ADS-B), the NextGen successor to radar for tracking aircraft. By February 2013 we had deployed more than 500 of about 700 ADS-B ground stations. This year, the FAA is continuing to work with industry to develop the best approach for aircraft operators to equip for NextGen. Our ADS-B work is driven by the fact that aircraft flying in designated airspace must be equipped to broadcast their position to the ADS-B network by January 1, 2020.

As promised, we continued to publish a significant volume of satellite-based precision arrival and departure procedures in addition to high- and low-altitude routes. These procedures are designed to save fuel, reduce emissions, increase flexibility in the National Airspace System and facilitate more dynamic management of air traffic.

We continue to collaborate with the aviation industry to find ways to implement NextGen and create new benefits. The FAA Modernization and Reform Act of 2012 authorizes the FAA to establish an avionics equipage financial incentives program. We are actively engaging with industry to assess options that could attract additional investment in NextGen technologies and training. Additionally, the FAA accepted the newly established Surface Operations Office's concept of operations for collaborative decision making among air traffic controllers, flight crews, air carrier managers and airports.

NEXTGEN BENEFITS

NextGen provides numerous benefits for the American people, the aviation community, our environment and the economy.

To illustrate the impact of NextGen improvements we're making today, the NextGen Performance Snapshots website tracks NextGen performance metrics and highlights success stories.

As we measure today's performance, we also look forward to tomorrow's benefits. Our latest estimates indicate that by the end of the NextGen mid-term in 2020, NextGen improvements will reduce delays by 41 percent compared with what would happen if no further NextGen improvements were made beyond what we have done already.

These delay estimates are in addition to the benefits we expect from new and expanded runways.

We also estimate 16 million metric tons in cumulative reductions of carbon dioxide emissions through 2020. For the same period, we estimate 1.6 billion gallons in cumulative reductions of fuel use.

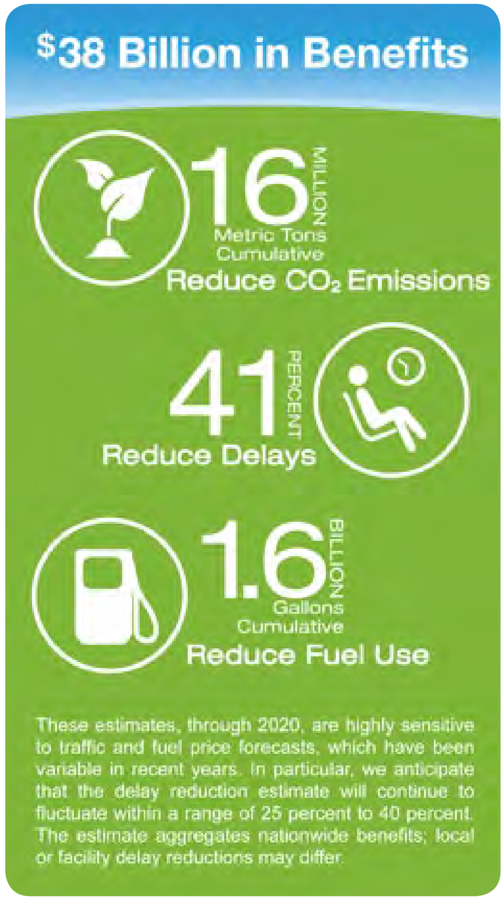
Delay reduction, fuel savings and other efficiency improvements will provide an estimated $38 billion in cumulative benefits to aircraft operators, the traveling public and the FAA. This notable increase from last year's estimated $24 billion in cumulative benefits is primarily the result of the Department of Transportation's decision to increase the dollar value of passenger time savings — the first time it has done so in a decade.[1]

MAKING A DIFFERENCE FOR GENERAL AVIATION

NextGen is providing major benefits to the general aviation community. The Wide Area Augmentation System (WAAS) has improved general aviation access to more than 1,500 airports in all kinds of weather with no costly investment in ground infrastructure.

Tens of thousands of general aviation aircraft are already equipped with WAAS receivers, which improve the availability, accuracy and integrity of GPS signals. Pilots are taking advantage of WAAS technology to fly approach procedures using Localizer Performance with Vertical Guidance (LPV) to altitudes as low as 200 feet before having to see the runway to land. The FAA has published 3,123 WAAS LPV approaches as of May 2013 and expects to publish 5,218 by 2016.

ADS-B enhances the safety of general aviation. Aircraft owners who equip with an ADS-B transceiver and a cockpit display will be able to see the location of nearby aircraft, thus improving their situational awareness.



In addition, pilots can receive weather and other aeronautical information from FAA broadcasts through their ADS-B transceivers, enhancing their situational awareness of in-flight hazards and helping to prevent accidents.

OPERATIONAL VISION

The FAA's vision for operational capabilities in the next decade includes fundamental improvements at every phase of flight. Common weather and system status information will dramatically improve flight planning. Technologies such as ADS-B and Data Communications, combined with Performance Based Navigation (PBN), will increase safety and capacity and save time and fuel, decrease aircraft emissions and improve our ability to address noise.

With NextGen, we continue to advance safety as we look to increase air traffic and introduce new types of aircraft, such as unmanned aircraft systems and commercial space vehicles. The aviation community continues to rely on Safety Management Systems (SMS) to continue to minimize risk as we bring together a wave of new NextGen capabilities. SMS are integrated safety cases and other proactive forms of management that allow us to assess the safety risk of all proposed changes. Policies, procedures and systems on the ground and on the flight deck enable NextGen improvements. We make the most of technologies and procedures in use today as we introduce innovations that will fundamentally change air traffic automation, surveillance, communications, navigation and the way we manage information.

In addition to the advances we develop through NextGen transformational programs and implementation portfolios, operations in the next decade will depend on coordination with and support from FAA specialists on safety, airports, the environment, policy development and the other building blocks of modern air traffic management. FAA information and management systems must keep these activities synchronized as we move forward through the next decade and beyond. We use a strategic Environmental Management System approach to

[1] In order to assess the full cost of delay, the Department of Transportation (DOT) considers the value of air travelers' time. From 2003 to 2011, this was estimated by DOT at $28.60 per hour. In the Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis, DOT increased that value for 2012 to $43.50 per hour.

integrate environmental and energy objectives into the planning, decision making and operation of NextGen. In addition to this effort, we are working with industry through the Continuous Lower Emissions, Energy and Noise program to advance noise and emissions reductions while improving energy efficiency.

NEXTGEN AHEAD

We have reached major NextGen milestones. PBN is providing greater operational flexibility. Surface data sharing is improving situational awareness and efficiency at airports. ADS-B is being used to control live traffic in areas such as the Gulf of Mexico, where radar coverage is not possible. In the years ahead, we will build on these and other NextGen technologies and procedures to offer additional capabilities. In the pipeline are airport safety and efficiency gains, airspace efficiency improvements and better use of Special Activity Airspace typically reserved for the military.

Future improvements are not limited to domestic airspace. Air traffic control automation enhancements and new ADS-B-enabled procedures will permit more aircraft to take advantage of optimal fuel-saving altitudes when flying over the ocean. Being able to spend more flight time at desired altitudes will potentially enable aircraft to carry less fuel, increase payload capacity, improve in-flight planning and improve the passenger experience through reduced exposure to turbulence.

Soon NextGen will provide better weather information, which will help reroute aircraft and reduce delays. Future NextGen weather detection and forecast capabilities will improve air traffic planning and collaboration by making vital weather information available earlier and with more accuracy. By making the same information available to everyone at the same time, NextGen will also create a common weather picture throughout our national airspace. Toward this end, we are collaborating with the National Oceanic and Atmospheric Administration on leading-edge scientific research to improve airspace safety and efficiency.

WHY NEXTGEN MATTERS

NextGen provides benefits to everyone — passengers, operators, recreational pilots and airports. NextGen offers a better travel experience, with fewer delays, more predictable trips and enhanced safety. People who live near airports may experience less aircraft noise and fewer emissions. NextGen will increase the predictability and reliability of airport operations, enhancing the role of airports as economic engines for the communities they serve. NextGen is vital to preserving aviation's significant contributions to our national economy.

INTRODUCTION

THE NEXTGEN TRANSFORMATION

Smart satellite-based and digital technologies enable NextGen.

NEXTGEN DEFINED

The era of the Next Generation Air Transportation System, or NextGen, is upon us. The FAA, in collaboration with industry, is deploying NextGen procedures and technology on the ground, in the air, at air traffic control facilities and in the cockpit. So, too, is the agency writing and enacting the policies that govern these advances.

These improvements represent a widespread, transformative change in the management and operation of the way we fly. NextGen capitalizes on new and existing technologies, including satellite navigation and digital communications, to enhance safety, reduce delays, save fuel and reduce aviation's adverse environmental impact. Airports and aircraft throughout the United States are growing more connected, enabling the continuous sharing of real-time information to provide a better travel experience.

Those reaping the benefits of NextGen today include air carriers that take advantage of precision routing to get into the airport more quickly and efficiently, which reduces fuel burn, saves money and decreases aircraft exhaust emissions. They include general aviation pilots and other small-aircraft operators who have greater access to more airports nationwide — particularly in poor weather conditions — thanks to enhanced satellite navigation capabilities. They include air traffic controllers, who now have a wider array of tools at their disposal to help them make the critical decisions necessary to wring more efficiency out of the world's busiest airspace system. And they include the flying public, who are enjoying shorter flight times and fewer delays.

These advances are coming at a crucial time for our nation's economic health. As recently as 2009, civil aviation contributed $1.3 trillion annually to the national economy and accounted for 5.2 percent of the gross domestic product. It generated more than 10 million jobs, with earnings of $394 billion.[1] Given the economic challenges faced by the country today, it is imperative that we continue to protect and expand this vital economic engine. Without NextGen, the National Airspace System (NAS) will not be able to sustain anticipated growth. The NextGen investments we are making now help ensure that aviation will continue to be a significant contributor to U.S. economic recovery today and into the future.

As more NextGen capabilities become available over the next several years, the overall value of the benefits they provide will increase. Our latest estimates show that between now and 2020, the end of the NextGen mid-term:

- NextGen improvements will reduce delays by 41 percent compared with what would happen if no further NextGen improvements were made beyond what we have done already. These delay estimates are in addition to the benefits we expect from new and expanded runways.
- We will cumulatively save 1.6 billion gallons of fuel between now and 2020, reducing carbon dioxide emission by 16 million metric tons.
- Delay reduction, fuel savings and other efficiency improvements will provide $38 billion in cumulative benefits to aircraft operators, the traveling public and the FAA. This 56 percent increase over last year's estimate is primarily the result of the Department of Transportation's

[1] "The Economic Impact of Civil Aviation on the U.S. Economy," FAA, August 2011.

(DOT) decision to increase the dollar value of passengers' time lost to delay. From 2003 to 2011, the value of passenger's time was estimated at $28.60 per hour. In the Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis, DOT increased that value for 2012 to $43.50 per hour.

THE NEXTGEN IMPLEMENTATION PLAN

The NextGen Implementation Plan is one of the FAA's two primary outreach vehicles for updating the aviation community, Congress, the flying public and other stakeholders on the progress we have made, and providing a summary overview of our plans for the future. The other is the NextGen Performance Snapshots, a website launched in 2012 to track NextGen performance metrics. The Plan, particularly the appendices, describes how the FAA intends to implement NextGen and provides the aviation community with the information it needs to take advantage of NextGen capabilities. It further offers our international partners a summary of our planning timelines in support of the agency's global harmonization efforts.

Updated annually, this Plan both draws upon and informs a number of FAA planning documents, including the NAS Enterprise Architecture;[2] the FAA's Capital Investment Plan; Destination 2025, the agency's strategic vision; and other internal documents.

This year, the FAA is pleased to introduce the next generation of the Plan, an electronic document available in e-book and PDF formats. The move to an exclusively electronic format helps conserve natural resources while complying with the Obama Administration's directive to reduce printing costs, and it capitalizes on advances in mobile technology. Throughout this year's Plan, you will find links to supplemental information on the FAA public website — including articles and fact sheets — that provide greater levels of detail on specific topics, as well as links to regularly updated material, such as the publication of Performance Based Navigation procedures, so readers will have ongoing access to the most current information the agency has to offer. For our e-book readers, access to Appendix B is through an online portal that takes full advantage of the capabilities offered by today's tablet computers.

The NextGen transformation is as important and massive a technological undertaking as any upon which the U.S. aviation community has ever embarked. Read on to learn how NextGen is making a difference and giving the world new ways to fly.

[2] The NAS Enterprise Architecture is a robust, comprehensive planning tool used by the FAA to understand the interdependencies of capabilities on systems, procedures and policies and to ensure their alignment.

NEXTGEN TODAY

DELIVERING OPERATIONAL IMPROVEMENTS

Aircraft operators are partnering with the FAA to demonstrate the value of NextGen capabilities.

NextGen continues to gain momentum in 2013 in its drive to develop and implement systems and procedures that make U.S. aviation operations safer, more efficient and friendlier to the environment.

- As of January, the FAA's Optimization of Airspace and Procedures in the Metroplex (OAPM) program had eight active teams in various phases of development. OAPM is the FAA's fast-track initiative to implement Performance Based Navigation (PBN) procedures and airspace improvements to reduce fuel consumption and aircraft exhaust emissions in some of the United States' busiest airspace. During 2013, the first three sites (Houston, north Texas and Washington, D.C.) will complete their designs and enter the implementation phase.
- The Automatic Dependent Surveillance–Broadcast (ADS-B) program continues steady deployment of ground stations. As of February, the FAA had installed more than 500 ADS-B ground stations, of which 445 were operational, providing traffic and weather information to properly equipped aircraft and supporting air traffic control separation services at 28 Terminal Radar Approach Control (TRACON) facilities. Making use of GPS and Wide Area Augmentation System technology, ADS-B is the NextGen successor to ground radar for tracking aircraft in the National Airspace System (NAS). The FAA believes that its publication during 2011 and 2012 of technical standard orders (TSO), advisory circulars (AC) and supplemental type certificates will stimulate aircraft equipage in 2013.
- En Route Automation Modernization (ERAM) deployment is on track under its revised baseline to complete initial operating capability this year and operational readiness in 2014 at all 20 en route air traffic control centers. ERAM is the new automation platform for the centers, which control high-altitude traffic. Further software development will make ERAM a foundation for important NextGen capabilities, such as Data Communications (Data Comm) and System Wide Information Management (SWIM).
- The FAA is considering operational and financial incentives to tilt the business case for aircraft owners and operators toward equipping their aircraft to use NextGen capabilities and gain NextGen benefits. The FAA Modernization and Reform Act of 2012, the agency's four-year reauthorization act, allows for the establishment of an avionics equipage financial incentive program.
- The FAA's newly established Surface Operations Office conducted an eventful first year of work in 2012, winning stakeholder consensus on and initial agency acceptance of a Surface Concept of Operations (ConOps) using the collaborative decision making process among air traffic controllers, cockpit crews, airline managers and airports. The office then worked to validate and refine the ConOps through a series of simulations.

The FAA awarded the Data Comm Integrated Services contract, which will provide for data communications between airport towers and appropriately equipped aircraft in 2016. With this contract, all six NextGen transformational programs (ADS-B, SWIM, NextGen Common Support Services–Weather, Collaborative Air Traffic Management Technologies, National

Airspace System Voice Switch and Data Comm) were under way.

Descriptions of advances include metrics established by the FAA after extensive consultations with the NextGen Advisory Committee (NAC). These metrics focus on post-implementation operations at locations where the agency has deployed NextGen systems and capabilities. They are reported on the FAA's new NextGen Performance Snapshots website.

PUTTING IT TOGETHER IN THE METROPLEX

The rapidly expanding OAPM program, commonly referred to as Metroplex, grew out of the FAA's response to the 2009 RTCA[1] NextGen Mid-Term Implementation Task Force. One of the broad-based study group's most prominent concepts was to pursue near-term, relatively straightforward NextGen advances that would take advantage of equipment already installed on aircraft.

This idea led to a combination of airspace redesign and the development of area navigation (RNAV) arrivals and departures within metroplexes — geographic areas with multiple airports and complex, sometimes conflicting flight operations. RNAV procedures are the most basic types of PBN, requiring only performance-based sensors or procedures, such as GPS or triangulation using Distance Measuring Equipment, for which most aircraft already are equipped. By structuring the RNAV routes and Metroplex airspace redesign to minimize noise impacts, environmental management techniques may enable more expeditious environmental reviews. Specialists representing all interested parties — including the FAA, airlines and airports — study each metroplex and propose improvements. Design and implementation follow to validate the recommended procedures, evaluate the designs, conduct environmental and safety reviews, and publish and implement the procedures.

In the two years since Metroplex teams launched studies of Washington, D.C., and north Texas, the program has gotten under way at six additional areas — Houston; Charlotte, N.C.; Atlanta; Northern California; Southern California and south central Florida. The Phoenix team completed its study in April 2013.

At first, the FAA intended to streamline 21 metroplexes and finish work at all of them by the end of Fiscal Year 2016. Following a schedule review in 2011, however, the FAA found that neither it nor the aviation community would have enough personnel in 2013 to staff the Metroplex teams and stay on the initial schedule. The agency reduced the number of metroplexes to 13 and lengthened some of the new project schedules. Five of the original 21 metroplexes were combined into two and are among the 13. Five others were already conducting Metroplex-like work and are continuing this effort independently.

Here is how the 21 original metroplexes were reprioritized into 13, limiting the scope of work over the near term:

- Atlanta; Boston; Charlotte; Chicago; Houston; Memphis, Tenn.; Northern California; north Texas, Phoenix, Southern California and Washington, D.C. — 11 metroplexes in all — remained unchanged.
- Cleveland and Detroit were combined into a single metroplex, Cleveland/Detroit. Orlando, Fla., south Florida and Tampa were combined into a single south central Florida metroplex.
- Denver, Las Vegas, Minneapolis-St. Paul, New York/Philadelphia and Seattle continue their independent activities.

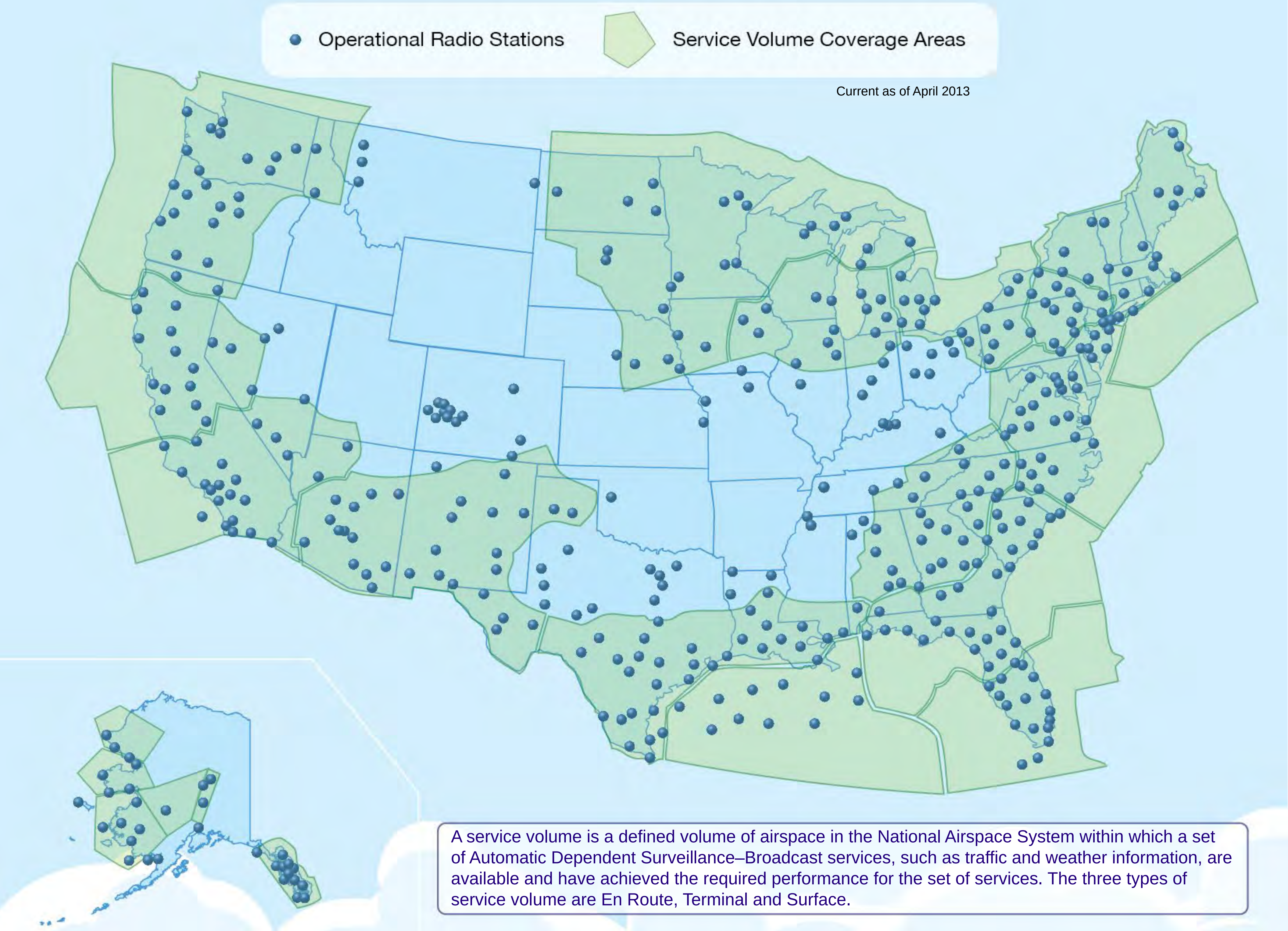
Work at each metroplex (study through implementation phases) is expected to take between 27 and 42 months depending on the complexity of the site. For Houston, an expedited process is underway, and should require 24 months from study through implementation. Houston is scheduled to complete implementation this year.

Ten projects will be finished by the original target, the end of FY 2016; Boston, Cleveland/Detroit and Memphis will be completed in 2017.

The eight Metroplex studies completed by the end of 2012 estimated substantial potential savings from RNAV approaches and departures and airspace redesign — as much as 30 million gallons of fuel and 298 thousand metric tons of carbon dioxide emissions per year.

[1] RTCA, Inc. is a private, not-for-profit corporation that develops consensus-based recommendations regarding communication, navigation, surveillance and air traffic management system issues. RTCA functions as a Federal Advisory Committee and includes roughly 400 industry and academic organizations from the United States and around the world. Members represent all facets of the aviation community, including government organizations, airlines, airspace users, and airport associations, labor unions, aviation services and equipment suppliers.

Surveillance and Broadcast Services



A service volume is a defined volume of airspace in the National Airspace System within which a set of Automatic Dependent Surveillance–Broadcast services, such as traffic and weather information, are available and have achieved the required performance for the set of services. The three types of service volume are En Route, Terminal and Surface.

Improved Airport Surface and Airspace Operations in 2012

Although RNAV is the PBN category that is central to Metroplex, the full range of PBN procedures remains the mainstay of NextGen attempts to reduce fuel consumption and engine emissions. The FAA tracks the current status of Metroplex and PBN projects at the Performance Based Navigation Initiatives website.

As study activity at the Metroplex sites has progressed, it has benefited from a new application of the FAA's mammoth Aviation Safety Information Analysis and Sharing (ASIAS) database. When safety data are available before Metroplex studies begin, airspace and procedures designers can take safety "hot spots" and issues into account before they begin their design work, rather than having to make safety fixes afterwards.

As an example of this safety-from-the-start strategy, Northern California metroplex designers relied on an analysis of Terrain Awareness and Warning System (TAWS) alerts near Mount Diablo to propose a new route so pilots would not receive as many TAWS alerts. Also, in the Burbank and Van Nuys areas, where there are numerous Traffic Alert and Collision Avoidance System (TCAS) alerts, the Southern California metroplex team changed a route so that large, scheduled-service aircraft could avoid general aviation traffic.

In May 2012, the south central Florida study team began its work with a package of ASIAS information about TAWS and TCAS alerts, missed approaches, risk of runway overruns, high-energy approaches and other irregularities. In the future, ASIAS safety analyses will be expanded to include additional topics.

In addition to generating metrics, the ASIAS program conducts its own studies of selected issues each year in depth. The Metroplex program will leverage insights gained from studies of RNAV departures and arrivals. The FAA is prioritizing ASIAS study areas to match the Metroplex schedule so airspace and procedure designers can incorporate lessons learned from investigating safety issues.

ADS-B, ERAM ON THE MOVE

The ADS-B program stayed on pace to complete deployment of about 700 ground stations early in 2014. It also reached a milestone in 2012 in its work with "national builds" of ADS-B equipment configurations. Engineers install and test initial configurations at key sites and resolve whatever problems they find. The resulting national-build configuration with the key-site improvements is common to all sites.

For ADS-B, the FAA did national-build testing at air traffic control facilities that use all three of the agency's latest facility automation systems — Houston Center, which uses ERAM; Southern California TRACON, which uses the Common Automated Radar Terminal System; and New Orleans Tower, which uses the Standard Terminal Automation Replacement System.

When the FAA published the ADS-B Out rule in 2010, the agency released TSOs to set a minimum performance standard for design and production approval of specific aircraft equipment for ADS-B Out, and ACs to provide guidance on how to install and use this equipment. Based on the stability of these key documents enabling the manufacture, installation, and operation of ADS-B Out avionics for the past two years, the FAA was able to issue supplemental type certificates to approve changes in aircraft type design. The agency believes these documents will increase industry competition to design and produce ADS-B Out avionics and establish price stability, beginning this year.

The FAA continues to develop policy regarding ADS-B In avionics, from which operators will be able to draw significant benefits. ADS-B Out avionics receive positioning data from GPS satellites, process them and transmit the aircraft's position to the ground. Ground stations send data on the aircraft's position to controller displays on the ground and to cockpit displays on aircraft that are equipped with ADS-B In. ADS-B In also will enable cockpit display of nearby ADS-B Out aircraft positions.

The policy issue is whether and when the FAA should mandate equipage with ADS-B In, as it did with ADS-B Out. In September 2011, an Aviation Rulemaking Committee (ARC) supported development of a variety of ADS-B In capabilities, flight trials to validate benefits, and early development of equipment standards and regulatory guidance for ADS-B In avionics. The committee did not support an ADS-B In equipage mandate, arguing that the immaturity of ADS-B In applications at the time — and uncertainties about achievable benefits and costs — left users unable to come up with a business case for equipage in the near term. In addition, the ARC commented that FAA policy, equipment standards, certification and operational approval guidance, procedures and ground automation were not defined well enough for users to invest.

Five months later in the FAA reauthorization act, Congress required the agency to launch by February 2013 an ADS-B In rulemaking that would mandate ADS-B In equipage by 2020 for aircraft operating in capacity-constrained airspace, at capacity-constrained airports or in "any other airspace deemed appropriate by the Administrator."

In response, the FAA established a cross-agency FAA rulemaking team to develop a Rulemaking Action Plan, the document that begins a rulemaking. In this case, the plan would cover or include ADS-B In. The plan would provide analyses of what the rulemaking team is proposing, why the proposal is necessary and what issues might arise.

The FAA also re-engaged the ARC to consider the congressional requirement and continued its own analysis — with aviation community feedback — of the economic benefits to be achieved through an ADS-B In rule. The ARC submitted recommendations in November 2012. The FAA continues to consider the potential rulemaking.

Programs with United Airlines and JetBlue Airways to demonstrate ADS-B benefits continue. United is operating In-Trail Procedures (ITP) on routes over the Pacific Ocean using aircraft equipped with ADS-B Out and ADS-B In. Flight crews of these aircraft are aware of the location, speed and identity of other aircraft in the demonstration program and thus know when to request from controllers a climb to a more fuel-efficient altitude. JetBlue's demonstration involves operating ADS-B-equipped aircraft on north-south routes off the United States' East Coast to increase capacity or regain efficiency during radar outages. The FAA will gain important performance data from each carrier.

Other ADS-B activities during 2012 include expanded coverage over the Gulf of Mexico; an agreement to install as many as three ground stations in Mexico; and agency approval for baselined program activities from 2014 through 2020, improving the program's stability. In April, an FAA-sponsored experimental ADS-B payload flew for the first time on a SpaceLoft-6 reusable suborbital launch vehicle to an altitude of more than 70 miles from Spaceport America near Las Cruces, N.M. The payload, ADS-B Out equipment designed for unmanned aircraft system and general aviation applications, transmitted as expected during the entire flight. GPS-populated ADS-B messages transmitted from the payload were received by FAA ADS-B ground stations in New Mexico and Texas.

NextGen makes flying safer, more efficient and friendlier to the environment.

Moving forward under a new schedule, ERAM was in continuous operation at seven centers — Albuquerque, N.M.; Denver; Los Angeles; Minneapolis; Oakland, Calif.; Salt Lake City and Seattle — by January 2013. Thirteen of the 20 en route centers had achieved initial operating capability, and three more were planned in the first quarter of 2013.

All automation systems met the International Civil Aviation Organization's (ICAO) November 15 target for implementing ICAO 2012, the updated, harmonized flight planning format that enables filers and air navigation service providers to benefit from NextGen and other countries' compatible advances worldwide.

In 2012, the FAA began developing advanced ERAM software that will enable the system to support NextGen capabilities, starting with data communications for aircraft preparing for departure. The agency already has developed a pre-departure reroute capability and is embedding it in deployed ERAM systems. The agency will implement the capability once all 20 centers are operating ERAM seamlessly.

FOCUS ON EQUIPAGE INCENTIVES

The FAA and its stakeholders have known since NextGen's inception that developing and deploying NextGen systems and procedures will not by itself transform the NAS. Airlines and other operators will have to equip their aircraft, develop procedures and train flight deck and maintenance personnel to take advantage and reap the benefits of NextGen capabilities. FAA analyses show ample long-term economic returns from making this investment, but conditions in the near term are uncertain. NextGen economic value depends on the rate advanced capabilities of both government and industry are deployed across the NAS; more rapid capability penetration produces a higher net present value.

The 2009 RTCA Task Force recommended that the FAA consider operational and financial incentives to improve the case for equipage. In 2011, the NAC recommended further work on such incentives, and the FAA has begun acting upon these recommendations.

In implementing NextGen, the FAA has sought to provide opportunities for NextGen-capable aircraft to receive better services and derive benefits directly from operations that use these capabilities. In a variety of operational environments, however, a "critical mass" capability level is needed before benefits can be attained. Critical mass is the percentage of aircraft in a particular airspace or at a particular location that must be NextGen-equipped to make a NextGen improvement usable as the primary mode of operation. Short of critical mass, operators lack a reasonable expectation of benefits and are less likely to invest in equipage.

How can the FAA adapt its operations to make equipage more beneficial to the operator? In 2012, continuing cross-agency efforts to pursue operational incentives — referred to in years past as the "best-equipped, best-served" concept — highlighted a potential answer to this question: Aircraft Priority Access Selection Sequence (AirPASS). Operating with AirPASS, aircraft with targeted NextGen capabilities would receive priority for such operations as takeoffs, approaches, reroutes and releases from temporary flight restrictions. AirPASS advances the service concept that if you have the proper equipment, training, certifications and procedures (both in the air and on the ground) an aircraft is eligible for priority handling relative to flights without these capabilities. Depending on how AirPASS is applied, aircraft without the targeted NextGen capability might temporarily receive a reduced level of service. AirPASS might also reduce airspace efficiency temporarily. But as more aircraft become NextGen-capable, aggregate benefits to operators and the NAS will increase.

In December 2011, the FAA tasked a cross-agency group to identify a selection of AirPASS candidates that could be implemented within about two years. The group considered many possibilities and narrowed them down to a Top 10. After a widely attended aviation community meeting provided feedback in March 2012, the FAA began implementation planning and execution studies for the following scenarios:

The FAA's NextGen research facilitates the safe introduction into the NAS of remotely piloted unmanned aircraft systems.

- Deconflicting airport operations and reducing weather minimums at New York LaGuardia and John F. Kennedy airports, and at Chicago O'Hare and Midway airports.
- Paired Simultaneous Offset Instrument Approaches (SOIA) at San Francisco, pending safety analysis. SOIA procedures enable aircraft to fly dual approaches to runways spaced less than 2,500 feet apart in marginal weather conditions when pilots must rely on their instruments, as well as when visibility is good.
- ADS-B East Coast offshore routes to relieve congestion on mainland north-south routes.
- ADS-B ITP in the South Pacific and beyond, facilitating fuel-saving altitude changes on trans-Pacific flights.

The FAA plans to implement these operational incentives and will issue a report on this work.

Regarding financial incentives, the FAA reauthorization act encourages the public-private partnership (PPP) concept, by which the agency would seek to leverage and maximize the use of private-sector capital for financing equipage of commercial and general aviation aircraft. The FAA's role could be to guarantee private-sector loans.

The FAA immediately established a cross-agency work group to examine PPP options, ways to reduce risks to the government, the extent of industry interest in the program and whether loan guarantees would succeed in speeding the adoption of avionics equipage.

The work group drafted and fine-tuned qualified avionics equipment — base levels of NextGen equipage geared to capabilities needed for applications in two categories of airspace, Metroplex and Other, which PPP loans could finance. The work group conducted public meetings in May and August 2012 and posted market surveys in June and September 2012 to secure feedback from stakeholders.

The goal of an equipage incentive program would be to encourage deployment of NextGen-capable aircraft in the NAS sooner than would occur otherwise. Specifically, the FAA would aim to increase the speed of adoption of base levels of NextGen equipage, which would accelerate delivery of NextGen benefits by reducing the time of mixed-equipage operations.

A key question before the work group is whether operators would take advantage of a loan guarantee program. In public meetings and in one-on-one exchanges, users have emphasized to the work group that they need to better understand the program's structure and the resultant operational benefits.

The FAA lacks complete authority to grant a loan guarantee. The FAA reauthorization act permits the agency to establish an avionics equipage incentive program, but federal credit laws require agencies to obtain specific authority to guarantee loans in an appropriations act.

Operators can review benefits from equipping for specific NextGen capabilities in Appendix A, "Foundational Avionics Enablers."

ENVIRONMENTAL STEWARDSHIP

The FAA's strategic goals include the development and operation of an aviation system that reduces environmental and related energy impacts to levels that promote sustainability without constraining growth. The primary environmental and energy issues that influence the capacity and flexibility of the NAS are aircraft noise, air quality, climate, energy and water quality. The FAA must manage and mitigate these environmental and energy challenges for NextGen to realize its full potential.

"Environmental Stewardship: A NextGen Priority" on the NextGen implementation website has more about the FAA's continuing development of aviation and environmental policy, the Environmental Management System, the Aviation Environmental Design Tool, advances in technology development and alternative fuels and FAA reauthorization act provisions on the FAA and the environment.

PERFORMANCE BASED NAVIGATION EXPANDS

The many elements of PBN, mainstays of NextGen implementation from the start, continued to grow during 2012. "Performance Based Navigation Expands" on the NextGen implementation website has more about developments in Area Navigation, Required Navigation Performance and Wide Area Augmentation System/Localizer Performance with Vertical Guidance developments.

In May 2013, the FAA launched the PBN Dashboard, a web-based tool that provides deployment and usage data on every RNAV and RNP airport procedure in the NAS. This operational information will support analysis of current PBN performance and aid in developing new procedures.

NextGen improvements promote environmental sustainability without constraining growth.

MOVEMENT ON THE SURFACE

The FAA established the Surface Operations Office in July 2011 in response to an industry recommendation that the agency create a single point of contact for stakeholders regarding surface operations. A small organization focused more on collaboration than control, the office works with the established FAA-industry Surface Collaborative Decision Making Team (SCT), which had already developed a ConOps for a collaborative surface effort. SCT members include representatives of the FAA, the National Air Traffic Controllers Association, industry associations, airlines and airport authorities.

The surface office, SCT members and other stakeholders conducted an initial validation phase for the ConOps between July 2011 and February 2012, coming up with more than 150 refinements. The FAA accepted the ConOps in April 2012. In June, the surface office launched a second validation phase, this one centered on monthly Human-in-the-Loop simulations that continued into 2013.

The ConOps focuses on improved predictions of capacity and demand at individual airports, more frequent updates from airlines on departure schedules for each of their flights, information sharing so all stakeholders are aware of an impending imbalance between capacity and demand, imposition of queue management when such an imbalance is imminent and a new position — departure reservoir manager (DRM) — to manage the queue at such times. Airlines also provide and share an "earliest off block" time for each flight, so the DRM can optimize queue lengths when there is a demand-vs.-capacity imbalance during over-capacity peaks.

As the 2012-2013 simulations validate and refine the ConOps further, the surface office will compile the simulation results and establish requirements for surface capabilities that will be carried out as part of the FAA's next major surface initiative, Terminal Flight Data Manager (see NextGen Ahead).

An earlier surface concept, Collaborative Departure Queue Management, has proven its value in recent years through increasingly complex automated surface management demonstrations at Memphis and Orlando. During 2012, the FAA and FedEx, whose major hub is at Memphis, conducted a Surface Trajectory Based Operations demonstration during the carrier's overnight push, a hub-and-spoke operation that constitutes the busiest time of day at the airport. Collaborative Departure Scheduling automation assigned slot times to departing aircraft based on exchanging airport capacity and aircraft readiness information between the NextGen prototype surface system and FedEx ramp operations automation over a prototype data network.

SAFETY FOR UAS, SURFACE OPERATIONS

In 2012, the FAA took on a new safety challenge — devising a plan to safely accelerate the integration of civil unmanned aircraft systems (UAS) into the NAS by September 30, 2015. Congress established this requirement in the FAA reauthorization act.

In response, the FAA created a UAS Integration Office, bringing together specialists in aviation operations and safety as a portal for everything related to civil and public use of UASs in the NAS. The office achieved the first milestone among Congress's UAS requirements — streamlining the process for public agencies to operate UASs in the NAS.

Significant progress also included the development of a UAS ConOps defining how the integration of UASs affects and is affected by NextGen capabilities, enabling technologies and operational improvements into the 2020s. Operational scenarios consider various UAS types in all classes of airspace. Combined with the FAA's Integration of Civil UAS in the NAS Roadmap, the ConOps enables UAS stakeholders to view the transition from today's accommodation of UAS operations to integration in all phases of flight.

Another FAA reauthorization act provision requires the agency to incorporate into the NextGen Implementation Plan its strategy for installing systems that alert air traffic controllers and/or flight crews of potential runway incursions. This strategy is documented in two Operational Improvements (OI) — Improved Runway Safety Situational Awareness for Controllers and Improved Runway Safety Situational Awareness for Pilots — in the Improved Surface Operations heading published in Appendix B of this document as well as in the 2012 update to the Implementation Plan. The FAA discussed these OIs in a separate report to Congress.

A successful demonstration at

Ground vehicles equipped with ADS-B enhance safety on the airport surface as part of a demonstration project at Boston.

Boston in 2012 improved safety on the airport surface and will be followed up this year at Chicago O'Hare, Denver and San Francisco. In the demonstration, the FAA and the Massachusetts Port Authority (Massport) collaborated to equip airport ground vehicles — snowplows, operations vehicles, emergency vehicles and the like — with ADS-B transceivers so these vehicles can determine their positions from GPS signals. Like aircraft, the ground vehicles show up on tower controllers' displays. Aircraft flight crews, vehicle drivers, airport operators and anyone else with ADS-B In equipment can track the ground vehicles as well.

The FAA and Massport are working under a five-year Memorandum of Agreement by which 37 vehicles had been equipped by December 2012. In October 2012, the airports at Chicago, Denver and San Francisco received approval for FAA Airport Improvement Program grants by which each will equip as many as 75 ground vehicles.

"Safety in Numbers for NextGen" on the NextGen implementation website has more about 2012 developments in the Aviation Safety Information and Sharing program and other safety initiatives.

NEXTGEN OVER THE OCEAN

Late in 2012, the FAA launched a one-year operational trial of a system aimed at removing a potential bottleneck from oceanic preferred-route procedures demonstrated in recent years as part of the Atlantic Interoperability Initiative to Reduce Emissions (AIRE).

As developed through AIRE, the original procedure enables flight crews to consult with their airline's flight operations center (FOC) to determine whether a revised route, adapting to weather and other real-time variables, would enable them to reduce fuel consumption and emissions. The potential bottleneck comes into play if the revised route might conflict with other traffic. In that event the FAA control center, equipped with Advanced Technologies and Oceanic Procedures (ATOP) conflict probe capabilities, would have to deny the pilot's request for a revision.The FOC and the pilot would go back to square one.

The new approach to oceanic preferred routes is the Oceanic Conflict Advisory Trial (OCAT), which gives the FOC access to web-based ATOP data drawn from the latest conflict probe algorithms. The FOC can judge on its own whether its preferred clearance change appears to be free of conflicts with other flights. After the FOC has done whatever trial-and-error work is necessary and found an acceptable change, the flight crew can request the change and the FAA control center can consider it under existing procedures.

> *NextGen benefits depend on operators equipping their aircraft, developing procedures and training their personnel.*

With its launch over the Pacific Ocean, OCAT is available to participating airlines throughout the vast airspace of the Oakland Oceanic ATOP flight information region, the world's largest. At nearly 19 million square miles, it covers about 9.7 percent of the Earth's surface. OCAT developers cite studies showing that 58 percent of trans-Pacific flights could have better routes, but less than one percent of Oakland-controlled flights seek them through the Dynamic Airborne Reroute Procedure, the current method of proposing reroutes.

During 2012, the Asia and Pacific Initiative to Reduce Emissions, or ASPIRE, increased from four to 10 the number of city pairs available for environmental best practices developed in demonstrations between 2008 and 2011. These city pairs offer a variety of improvements in gate-to-gate operations, including reduced separation, more efficient flight profiles and PBN arrivals.

INTERNATIONAL HARMONIZATION

From the beginning of NextGen, the FAA has placed a high priority on collaborating with other government agencies and international organizations in the development and implementation of air traffic management (ATM) advances worldwide. International collaboration advanced significantly in 2012. The FAA, the Single European Sky ATM Research (SESAR) effort, government agencies and industry worldwide developed the ICAO's Aviation System Block Upgrades concept to maturity. The FAA and SESAR also reached new levels of collaboration under the 2011 United States-European Union memorandum of cooperation. "Collaboration You Can Depend On" on the NextGen implementation website has more.

MAKING A DIFFERENCE FOR GENERAL AVIATION

IMPROVED ACCESS, ENHANCED SAFETY

With more than 3,400 NextGen approach procedures at small airports, general aviation pilots experience improved levels of access and safety.

NextGen is providing major benefits to the general aviation community with greatly improved access to more than 1,500 airports during periods of low visibility. The next phase of NextGen implementation will enable the FAA to track aircraft more precisely and beam vital traffic and weather information to the cockpit at no additional charge to the user beyond the cost to equip.

WIDE AREA AUGMENTATION SYSTEM BENEFITS

Tens of thousands of general aviation aircraft are already equipped with Wide Area Augmentation System (WAAS) receivers, which improve the availability, accuracy and integrity of GPS signals. WAAS capability can improve GPS signal accuracy to within three feet laterally and six feet vertically. Pilots of WAAS-equipped general aviation aircraft are the primary users of Localizer Performance with Vertical Guidance (LPV) approach procedures. LPV procedures enable them to descend to altitudes as low as 200 feet before having to see the runway to land. These altitudes, by which decisions to land or go around must be made, are as low as those provided by Category I conventional Instrument Landing System (ILS) approach procedures.

By March 2013, the FAA had published 3,123 of these WAAS-enabled LPV procedures at more than 1,500 airports. The agency plans to publish 5,218 by 2016. The latest information is on the FAA's Satellite Navigation Program website.

Of the procedures published so far, more than half are at general aviation and regional airports that have no ILS. The FAA has also published more than 400 Localizer Performance (LP) procedures that employ WAAS for lateral guidance but without the added safety benefit of vertical guidance. These approaches are needed at runways where obstacles or other infrastructure limitations prevent the FAA from publishing a vertically-guided approach.

A comprehensive FAA study completed in 2012 found that of the 2,900 airports primarily used by general aviation, 800 do not have ILS systems but do have LPV and LP approaches. In order to qualify for these types of approaches, an airport must have at least 3,200 feet of paved runway. About 57 percent of airports that meet this requirement already feature LPV procedures.

About 65 percent of general aviation aircraft that fly under instrument flight rules in the National Airspace System have WAAS receivers installed. These receivers are certified under the supplemental type certificate (STC) method, which covers either a model of aircraft or an individual aircraft. An additional 3,300 business jets/turboprops have WAAS receivers under STC approval. Many other instrument-flight-capable general aviation aircraft have panel-mounted GPS receivers and moving map displays, which have enhanced safety over the past decade. Thousands of general aviation pilots also use non-FAA certified, portable GPS receivers for situational awareness.

The widespread and growing availability of WAAS approach procedures and the high equipage rate in the general aviation fleet is making it possible for the FAA to retire some ground-based navigation aids from service, including Nondirectional Beacon (NDB) and VOR types of equipment. Many general aviation aircraft owners have removed the now obsolete avionics needed to fly an NDB procedure and the FAA continues to shut down NDBs on the ground. Pilots of aircraft equipped to fly LPV procedures can take advantage of lower minimums than are available with NDB approaches.

If both ILS and WAAS approaches are available, some pilots might prefer to fly the LPV procedure because it utilizes a signal that is more stable and consistent than ILS transmissions. To read more about how general aviation operators are using WAAS today, see "WAAS Happening!" in the September/October 2012 issue of FAA Safety Briefing magazine.

ADS-B BENEFITS

As WAAS procedures continue to provide immediate benefits for general aviation, the FAA has also set the stage for major new benefits with a network of ground-based Automatic Dependent Surveillance–Broadcast (ADS-B) radio transceivers. By February 2013 the FAA had already installed more than 500 radio stations, 445 of which were in operation. We will add approximately 290 more to complete nationwide coverage by 2014. The FAA has mandated that aircraft flying in most controlled airspace be equipped with ADS-B Out — the ability to broadcast their position to the ADS-B network — by January 1, 2020. ADS-B Out avionics use onboard navigation equipment to derive an aircraft's position, which is then broadcast for air traffic control services and for use by other aircraft. The roughly once-per-second broadcast rate is not only automatic, but also depends on equipment on the aircraft for air traffic surveillance to occur — thus the cooperative and dependent nature of ADS-B.

General aviation aircraft owners who decide to equip with optional ADS-B In reception and display capability as well as the mandated ADS-B Out transmission capability will be able to see the location of nearby ADS-B Out aircraft via air-to-air reception or by relay from the ground. In addition, ADS-B In can display the location of transponder-equipped aircraft tracked by ground-based radar surveillance when this information is relayed from the ground to the cockpit, thus providing situational awareness of nearby aircraft that are not yet equipped with ADS-B Out.

NextGen has improved access to more than 1,500 airports during periods of low visibility.

Additional benefits are available to general aviation aircraft owners who decide to equip their aircraft for ADS-B In even though this capability is not required by the current FAA mandate. In addition to receiving traffic information, general aviation aircraft equipped with ADS-B In-capable Universal Access Transceivers (UAT) operating on a frequency of 978 megahertz (MHz) can receive and display weather and other aeronautical information from FAA broadcasts. This information will enhance pilots' situational awareness of inflight hazards and help prevent accidents.

Three types of FAA broadcast services provide benefits to pilots of ADS-B In-equipped aircraft:

- Traffic Information Service-Broadcast (TIS-B): This air traffic advisory service provides the altitude, heading, speed and distance of aircraft flying within a 15 nautical mile (nm) radius and within plus or minus 3,500 feet of the receiving aircraft's position. A general aviation aircraft equipped with ADS-B In can receive these data directly from other aircraft broadcasting on the same ADS-B Out frequency. In addition, the FAA relays air traffic control radar traffic information over TIS-B, so that general aviation pilots can see aircraft equipped with a transponder flying nearby even if those aircraft are not equipped with ADS-B Out.
- Automatic Dependent Surveillance-Rebroadcast (ADS-R): ADS-R takes position information received on the ground from UAT-equipped aircraft and rebroadcasts it on the 1090 MHz frequency, which is primarily used by jet aircraft. Likewise, ADS-R rebroadcasts 1090 MHz data to UAT users. In concert with TIS-B, ADS-R provides all ADS-B In-equipped aircraft with a comprehensive airspace and airport surface traffic picture. ADS-R delivers traffic data within a 15 nm radius and plus or minus 5,000 feet relative to the receiving aircraft's position.
- Flight Information Service-Broadcast (FIS-B): This service broadcasts graphical weather to the cockpit based on what ground-based weather radar is detecting. In addition, FIS-B broadcasts text-based advisories including Notice to Airmen messages and reports on everything from significant

weather to thunderstorm activity and temporary flight restrictions. UAT-equipped general aviation aircraft can receive this information at altitudes up to 24,000 feet.

TIS-B, ADS-R and FIS-B services are already available in many parts of the United States, and are expected to make ADS-B In an attractive option for general aviation. Aircraft owners and operators now have the option of being early adopters of ADS-B technology and to be among the first to take advantage of its benefits years before the ADS-B Out mandate takes effect.

The FAA released ADS-B Out technical standard orders and the availability of rule-compliant avionics is increasing. The agency also completed advisory circular guidance so the general aviation community can install required avionics.

Optional ADS-B In avionics are also starting to appear on the market for situational awareness applications and flight information services.

NextGen traffic and weather information will also be available for display on some mobile devices at a time when many general aviation pilots own and use tablet computers. Due to technical requirements, however, complete TIS-B and ADS-R reports will only be broadcast to the cockpits of general aviation aircraft equipped to meet the mandate and reporting their position over ADS-B Out.

The FAA is also exploring the possibility of having standards for battery-powered ADS-B Out transmitters that can be used on gliders and general aviation aircraft certificated without an electrical system. Additionally, the FAA is working with industry to define the requirements for ADS-B systems to provide pilots with a low-cost traffic alerting capability. This ADS-B In traffic alert application would use ADS-B data to identify conflicting traffic nearby and to issue an alert to the pilot. The pilot would then look out the window to visually acquire the traffic being called out. The FAA conducted simulations of Traffic Situational Awareness with Alerts avionics in 2012 to set the stage for flight testing in 2013.

UNLEADED FUEL FOR PISTON-POWERED AIRCRAFT

The FAA has been working closely with the Environmental Protection Agency, environmental groups and industry stakeholders — including aviation associations, aircraft and engine manufacturers and fuel suppliers — to facilitate the development of unleaded fuel for piston-powered aircraft. The goal of the effort is to make available by 2018 an unleaded alternative to 100 octane low-lead fuel. In addition to the obvious environmental concern

Improving General Aviation Airport Access with NextGen Precision

The FAA continues to deploy procedures that improve access to many general aviation airports in almost all weather conditions. Localizer Performance with Vertical Guidance (LPV) are precision GPS approaches, enhanced by Wide Area Augmentation System signals, that provide vertical guidance as low as 200 feet above the runway for equipped aircraft.

LPVs are operationally equivalent to Instrument Landing Systems (ILS) approaches but require no costly infrastructure or maintenance. As of March 2013, there were more than 3,000 LPVs at 1,500 airports in the United States, almost three times the number of ILS approaches.

Many instrument-capable general aviation aircraft have GPS receivers and moving map displays.

of operating with fuel that contains lead, the use of lead-containing fuel creates significant long-term challenges to the continued viability of the piston-powered general aviation fleet in the United States.

In 2012, the FAA received the final report from the Unleaded Avgas Transition Aviation Rulemaking Committee, a government and industry group. The rulemaking committee provided recommendations on how the agency might address the challenges of transitioning piston-powered aircraft to unleaded aviation gasoline. One of the key challenges is developing an alternative fuel that both low- and high-performance piston-powered aircraft can use safely. Lead has been used as an additive to fuel because it enables high-performance aircraft engines to operate smoothly without experiencing damaging "knocking" that could lead to engine failure.

The FAA is making investments to support the development of a practical and safe alternative fuel. However, this new fuel is unlikely to be a drop-in solution, meaning changes might be required to current engine and aircraft designs and operating instructions. One key objective is to come up with a single fuel that can meet almost all needs of both low- and high-performance piston-powered aircraft. This is because the market for fuel for piston-powered general aviation aircraft is much smaller than that for jet-powered aircraft, so it is not clear whether the economics of niche marketing could support the delivery and use of more than one type of fuel.

In response to the rulemaking committee, the FAA established the Fuels Program Office in 2012 to oversee the transition to unleaded fuel. This office enables the FAA to centralize aviation fuel expertise in one office that can more effectively support industry initiatives and the associated fuels certification projects relating to unleaded aviation gasoline.

OPERATIONAL VISION

NEXTGEN IN THE NEXT DECADE

By the dawn of the next decade, NextGen improvements will offer benefits at every phase of flight.

The best way to convey how the FAA envisions airspace system operations in the mid-term, which ends in 2020, is by showing what an aircraft operator will experience through all phases of flight, including improved safety, increased capacity and efficiency, and better environmental performance. As we transition to this state over the next several years, operators and the flying public will continue to reap the benefits of NextGen. The mid-term system, in turn, will provide a foundation for the further evolution of the airspace system in the long term.

SAFETY

With NextGen, we must continue to advance safety as traffic grows and new types of operations, such as unmanned aircraft systems and commercial space flights, continue to increase. Further reductions in the accident rate are needed as overall traffic increases, and achieving those reductions depends on targeted initiatives and an all-encompassing approach to safety that is documented in accordance with the Safety Management System.

NextGen is taking an unwavering approach to safety management. The FAA strives to identify problems as early as possible by analyzing trends, and we are putting into place preventive measures before any accident can occur. Safety information sharing and analysis tools are evaluating data from operators, FAA systems and international databases to monitor the effectiveness of safety enhancements and identify where new safety initiatives are needed.

ENVIRONMENT

NextGen will accelerate efforts to improve aviation's environmental and energy performance to sustain growth and create opportunities for added capacity. We will use a strategic Environmental Management System approach to integrate environmental and energy objectives into the planning, decision making and operation of NextGen. We will realize emissions, energy and noise benefits from advanced systems and procedures, but more improvements will be needed than we can achieve through operational enhancements alone.

A major NextGen initiative, the Continuous Lower Energy, Emissions and Noise (CLEEN) program, helps accelerate the development and certification of promising new engine and airframe technologies and sustainable alternative fuels. We expect successfully demonstrated CLEEN technologies will enter into service in the mid-term. We also expect that the effort on sustainable alternative fuels, aided by the government-industry Commercial Aviation Alternative Fuels Initiative, will meet some civil jet fuel supply needs by the end of the mid-term. This contribution will continue to grow, improving air quality and reducing net carbon dioxide emissions while aiming to achieve carbon-neutral growth by 2020, using 2005 as the baseline.

This mid-term system makes the most of today's technologies and procedures while introducing systems and procedures that fundamentally change air traffic automation, surveillance, communications, navigation and how we manage information.

In addition to the advanced systems and procedures we develop through the NextGen transformational programs and solution sets, the mid-term system depends on coordination with and support from FAA specialists on safety, security, airports, the environment, policy development and other building blocks of a modern air traffic management system. FAA information and management systems will keep all these activities synchronized as we close in on the mid-term, reach it and then build on that foundation.

Key ground infrastructure and avionics are included here in tables for each of the flight phases. Additional information, including FAA's National Airspace System (NAS) Enterprise Architecture information and other documents, are available on the FAA's NextGen website, www.faa.gov/nextgen.

While operators who adopt NextGen avionics will receive the greatest benefit in this time frame, we will still accommodate lesser-equipped aircraft. Appendix A discusses the investments operators and airports must assess to support these operations. Through international collaboration on standards, we are making sure that avionics developed to take advantage of NextGen and other advanced infrastructures worldwide will be interoperable.

FLIGHT PLANNING

Flight planners in the mid-term will have increased access to relevant information on the status of the NAS through a common network-enabled information source. Operators will have access to current and planned strategies to deal with congestion and other airspace constraints. New information will include scheduled times of military, security or space operations in special activity airspace. It will describe other airspace limitations, such as those imposed by current or forecast weather or congestion. It also will provide airport status information, such as closed runways, blocked taxiways and out-of-service navigational aids. Shared information will enable users to plan their flight operations according to their personal or business objectives. Updates will show when changes in airspace system status impact individual flight-planning objectives. Operators will plan their flights with a full picture of potential limitations on the ground and in the air along the intended flight trajectory.

An outcome of this planning process will be an electronic representation of the operator's intended flight profile, updated when conditions change in a way that may affect the flight's trajectory. Both operators and air traffic managers will have access to the same real-time information, shared via a secure communications network. This information will provide each group with improved situational awareness for planning as well as for predicting conflicts so they can be resolved. Improvements in calculated arrival times will enhance system-wide planning processes. Accomplishing this will give controllers automated information on airport arrival demand and available capacity to improve sequencing and to balance arrival and departure rates. Air traffic managers will be able to apply lessons learned to future operations by analyzing a full day's worth of data or more.

These advances will accommodate operator preferences and improve the use of resources. For operators, these advances will mean more efficient traffic management and enhanced environmental performance by improving the ability to adjust schedules before and during flight. For air traffic managers, these advances will mean more comprehensive situational awareness, including knowledge of user intent, and the capability to manage flights either in groups or individually.

FLIGHT PLANNING	Key Ground Infrastructure
	• Common Support Services–Weather (CSS-Wx) • Data Communications (Data Comm) • En Route Automation Modernization (ERAM) • Modernized Aeronautical Information Management System (AIM) • NextGen Weather Processor (NWP) • System Wide Information Management (SWIM) • Terminal Flight Data Manager (TFDM) • Traffic Flow Management System (TFMS)

PUSH BACK, TAXI AND DEPARTURE

As the time for the flight approaches, the flight crew will receive the final flight path agreement as a data message. Data communications will provide pre-departure clearances that allow amendments to flight plans. Collaborative decision makers may determine the actual push back time. When the aircraft taxis out, the flight crew's situational awareness will be improved by flight deck displays depicting aircraft progress on a moving map that indicates the aircraft's position on the airport surface. At busy airports, the displays will also show the position of other aircraft and vehicles operating on the surface. In the tower, improved ground systems, such as surface-movement displays, will enable controllers to manage the use of taxiways and runways more efficiently. They will be able to choose the best runway and taxi paths based on the departing aircraft's intended flight path and the status and positions of all other aircraft on the airport surface and in the terminal area.

These flight deck and tower displays are important safety tools that will help prevent runway incursions and other surface conflicts, especially when visibility is low. More efficient management and the ability to revise departure clearances using data

PUSH BACK, TAXI AND DEPARTURE

Key Ground Infrastructure

- Automatic Dependent Surveillance–Broadcast (ADS-B) ground stations
- Airport Surface Detection Equipment–Model X (ASDE-X)
- CSS-Wx
- Data Comm
- Integrated Departure and Arrival Coordination System
- Modernized AIM
- NWP
- Satellite Based Augmentation System (SBAS)
- Standard Terminal Automation Replacement System (STARS)
- SWIM
- TFDM
- TFMS

Avionics

- ADS-B In and Out, with associated displays like Cockpit Display of Traffic Information (CDTI)
- Area Navigation (RNAV) and Required Navigation Performance (RNP)
- Data Comm

communications will mean fewer radio transmissions, shorter wait times, fewer departure delays and reduced fuel consumption and emissions. Weather information will be integrated into decision making tools for surface management.

Departure performance will be improved with the use of multiple departure paths from each runway end with greater precision provided by Area Navigation (RNAV) and Required Navigation Performance (RNP) procedures. Multiple departure paths will enable controllers to place each aircraft on its own separate track while avoiding known constraints, thunderstorms and other severe weather near the airport.

The FAA will take advantage of increased surveillance and navigation accuracy, as well as improved understanding of wake vortices, to allow aircraft to operate simultaneously, either independently or with reduced separation, on closely spaced parallel runways. These adjustments mean airports will gain capacity for existing runways. Together, these capabilities will enhance safety, improve environmental performance and reduce operators' delays and fuel costs.

More precise departure paths will optimize system operations for entire metropolitan areas, reducing delays by allowing each airport to operate more independently. This will improve the separation of arrival and departure flows in and out of airports near one another and in some cases provide more efficient access to both commercial and general aviation airports in congested metropolitan areas. These precise departures also can be designed to support airports that are now limited by terrain and other obstacles or during periods of reduced visibility. Precise paths will reduce flight time, fuel burn and emissions. They might also decrease the impact of aircraft noise on surrounding communities.

CLIMB AND CRUISE

As the aircraft climbs into en route airspace, enhanced processing of surveillance data will improve position information and enable the flight crew and controllers to take advantage of reduced separation standards. Because the flight crew will be able to monitor the position of other aircraft from its own aircraft's flight deck, air traffic controllers will be able to assign some spacing responsibility to the flight crew as the aircraft climbs to its cruising altitude. The flight crew will determine the necessary spacing for a designated aircraft operating in the desired flight path. The aircraft will be able to easily merge behind that aircraft into the overhead stream with minimum maneuvering.

Data communications will provide both routine and strategic information to the flight crew and automate some routine tasks for

CLIMB AND CRUISE

Key Ground Infrastructure

- ADS-B ground stations
- Advanced Technologies and Oceanic Procedures
- CSS-Wx
- Data Comm
- ERAM
- NWP
- Time Based Flow Management (TBFM)
- TFMS

Avionics

- ADS-B In and Out, with associated displays like CDTI
- Data Comm, including integration with the Flight Management System
- Future Air Navigation System in oceanic airspace
- RNAV and RNP

pilots and controllers. Controllers will be able to clear more aircraft to fly direct or via preferred routes and altitudes to save fuel and time. Fewer radio conversations also will reduce radio-frequency congestion and the possibility of misunderstandings. When weather prompts the rerouting of many flights, clearances will be delivered automatically to the controller and uplinked to aircraft equipped to receive data communications. This will make the rerouting process much more efficient and reduce pilot and controller workload.

If weather poses potential problems, or there are possible conflicts with other aircraft, security or military airspace restrictions or other constraints along the aircraft's planned flight path, automation will identify the hindrance and provide recommended changes in trajectory or speed. If the aircraft is equipped for data communications, the controller will send the pilot the proposed change via a data message. Pilot and controller will negotiate the change, in coordination with the flight operations center. Changes will be loaded into both ground and aircraft systems. Improved weather information, integrated into controller decision support tools, will increase controller and pilot efficiency and greatly reduce their workload.

At times, traffic delays, airspace restrictions or adverse weather will require additional changes to the flight path agreement. When rerouting is needed, controllers will be able to assign offsets to the published route. These offsets, tailored to each flight, will be a way of turning a single published route into a "multi-lane highway in the sky." Use of offsets will increase capacity in a section of airspace. Because the clearance to fly a new route will be issued and accepted using data messaging, complex reroutes can be more detailed than those now read by controllers over the radio then read back by pilots for confirmation. Not having to rely on voice transmissions eliminates one source of potential communication error and also reduces frequency congestion.

In oceanic operations, air traffic managers will provide aircraft entering oceanic airspace with an optimized trajectory. Airspace entry will be specified by track entry time and the intended trajectory. As wind and other weather conditions change, both individual reroutes and changes to the entire route structure will be managed via data communications.

DESCENT AND APPROACH

Key Ground Infrastructure

- ADS-B ground stations
- ASDE-X
- Data Comm
- CSS-Wx
- NWP
- SBAS
- STARS enhancements
- TBFM
- TFDM
- TFMS

Avionics

- ADS-B In and Out, with associated displays like CDTI
- Enhanced Flight Vision System (EFVS)
- Data Comm
- RNAV and RNP
- Vertical Navigation

DESCENT AND APPROACH

NextGen capabilities will provide a number of improvements to terminal area operations that save fuel, increase predictability and minimize maneuvers such as holding patterns and vectors used to absorb delays, and could reduce noise. Enhanced traffic management tools will analyze flights approaching an airport from hundreds of miles away to calculate scheduled arrival times and to optimize performance. These advances will improve the flow of arrival traffic to maximize use of existing capacity. Improvements in calculated arrival times will enhance system-wide planning processes. Controllers will gain automated information on airport arrival demand and available capacity, enabling them to improve sequencing and balance arrival and departure rates.

Information such as proposed arrival time, sequencing and route and runway assignments will be exchanged with the aircraft via a data communications link so that a final flight path can be determined. This path will ensure the flight, clear of potential conflicts, will experience an efficient arrival, adding to the overall efficiency of the NAS.

With the improved precision of NextGen systems, separation between aircraft can be safely reduced. Suitably equipped aircraft will be able to fly precise vertical and horizontal paths, called Optimized Profile Descents, from

LANDING, TAXI AND ARRIVAL

Key Ground Infrastructure

- ADS-B ground stations
- ASDE-X
- CSS-Wx
- Data Comm
- Ground Based Augmentation System (GBAS)
- Integrated Departure and Arrival Coordination System
- Modernized AIM
- SBAS
- STARS enhancements
- SWIM
- TBFM
- TFDM
- TFMS

Avionics

- ADS-B In and Out, with associated displays like CDTI
- EFVS
- Data Comm
- GBAS

cruising altitude down to the runway. These paths, which could include inter-arrival spacing by the aircraft, will allow for more efficient transitions from cruise to the approach phase of flight at high-density airports. Controllers will be able to use multiple precision paths that maintain flows to each runway, through RNAV and RNP arrivals. These arrivals will reduce fuel use, emissions and potentially the number of people exposed to noise.

Today, the alignment of arrival and departure routes does not always allow for the most efficient use of airspace. By redesigning airspace, new paths can be used to provide integrated arrival and departure operations. The FAA will provide users with better options to manage departure and arrival operations safely during adverse weather. This will maintain capacity that otherwise would be lost. For example, poor visibility dramatically reduces the capacity of closely-spaced runways, prompting delays that ripple throughout the airspace system. NextGen capabilities will allow the continued, safe use of closely-spaced runways during low visibility by providing better-defined path assignments and appropriate separation between aircraft.

LANDING, TAXI AND ARRIVAL

The expanded opportunity to use runways in low-visibility conditions is due to new closely spaced parallel procedures. Before the flight lands, the assigned runway, preferred taxiway and taxi path to the assigned parking space or gate will be available to the flight crew via data communications. A ground system that recommends the best path, based on the arriving aircraft's type and parking assignment and the status and position of all aircraft on the airport surface, will enable this capability.

Flight deck and controller displays will monitor aircraft movement and provide traffic and incursion alerts, using the same safety and efficiency tools as employed during departure operations. This will reduce the potential for runway incursions. Surface and vehicle movement information will be shared among air traffic control, flight operations centers and the airport operator. Airport and airline ramp and gate operations personnel will know each inbound aircraft's projected arrival time at the gate. Having an accurate gate arrival time is expected to save airlines money because they won't have to dispatch staff to the gate early and have them wait. Operators will be able to coordinate push backs and gate arrivals more efficiently.

AIRFIELD IMPROVEMENTS

Existing runway capacity will increase through the mid-term with more precise routing and separation of departing and arriving aircraft. Throughput rates will be similar during almost all weather conditions. Updated procedures for closely spaced parallel operations will allow simultaneous arrivals. Airports may be able to site new runways with greater flexibility and make better use of existing runways. Overall, airports will balance surface, gate and terminal capacity with the improved runway capacity afforded by NextGen. Planned airfield improvements that are expected to come online in the next several years include:

NEW RUNWAYS

- Columbus (Ohio)

RUNWAY EXTENSIONS

- Anchorage
- Atlanta
- Fort Lauderdale
- San Antonio

AIRFIELD RECONFIGURATION

- Chicago O'Hare
- Philadelphia

NextGEN

Federal Aviation Administration

Integrated Flight Planning

Operators and traffic managers have immediate access to identical weather information through one data source.

Streamlined Departure Management

RNAV and **RNP** precision allows multiple departure paths from each runway. Departure capacity increased.

Efficient Cruise

RNAV, **RNP** and **RVSM** utilize reduced separation requirements increasing airspace capacity. Aircraft fly most optimal path using trajectory-based operations considering wind, destination, weather and traffic. Re-routes determined with weather fused into decision-making tools are tailored to each aircraft. **Data Communications** reduce frequency congestion and errors. **ADS-B** supported routes available for equipped aircraft.

Streamlined Arrival Management

Arrival sequence is planned hundreds of miles in advance. **RNAV** and **RNP** allows multiple precision paths to runway. Equipped aircraft fly precise horizontal and vertical paths at reduced power from descent point to final approach in almost all types of weather. Time and fuel are saved. Emissions and holding are reduced.

Surface Traffic Management

Automation optimizes taxi routing. Provides controllers and pilots all equipped aircraft and vehicle positions on airport. Real-time surface traffic picture visible to airlines, controllers and equipped operators. Surface movement management linked to departure and arrival sequencing. **ADS-B** and **ASDE-X** contribute to this function. Taxi times reduced and safety enhanced.

Enhanced Predeparture Clearances

Pilots and controllers talk less by radio. **Data Communications** expedite clearances, reduce communication errors. Pilot and controller workloads reduced.

Surface Traffic Management

Runway exit point, assigned gate and taxi route are sent by **Data Communications to** pilots prior to approach. Pilot and controller workload reduced and safety improved.

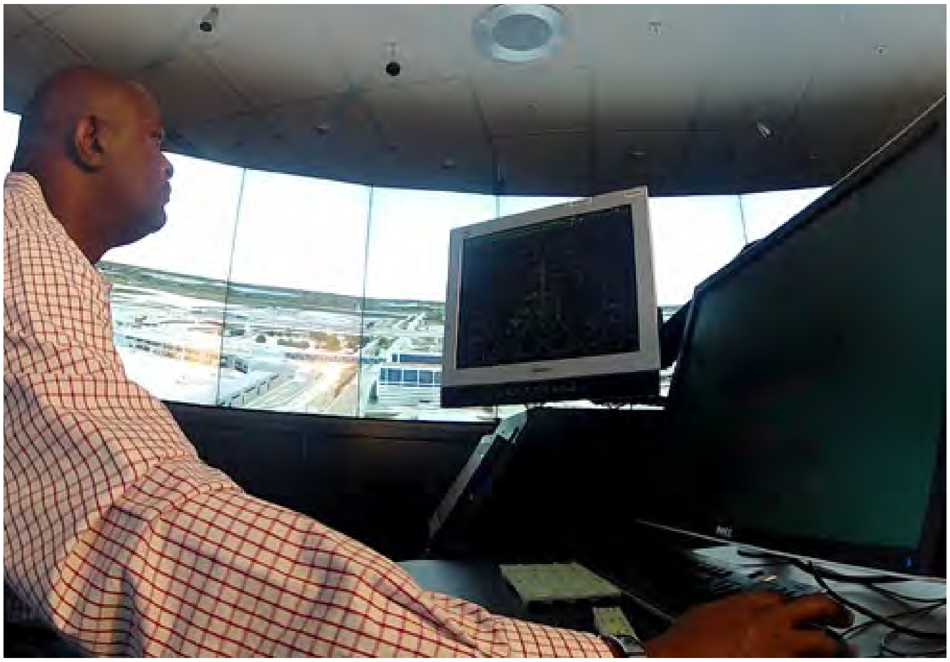
NextGen PHASES OF FLIGHT

www.faa.gov/nextgen

April 2013

NEXTGEN AHEAD

WORKING TOWARD TOMORROW



Consistent, real-time data sharing is a cornerstone of future NextGen capabilities.

For the past several years, NextGen capabilities and NextGen procedures designed for specific locations have been improving predictability, throughput and efficiency. At the same time, they have been contributing to fuel savings and improving the environmental performance of aircraft engines and design to reduce the impact of noise and emissions. The FAA is applying lessons learned from these successes to inform policy and regulations that will smooth the way for broader applications nationwide. Wider availability of NextGen capabilities will provide NextGen benefits to more commercial and general aviation operators, making it easier for them to develop the business case for equipage.

FROM THE GROUND UP

Advances in sharing real-time information about the movement of aircraft and vehicles on the airport surface are not only improving safety through enhanced situational awareness, but are also making gate, taxiway and runway traffic management more predictable and efficient. This translates to reduced delays, fuel use and aircraft exhaust emissions. The FAA's near-term benefits strategy to provide improved surface capabilities has led to a number of successful implementations, such as data sharing from Airport Surface Detection Equipment–Model X, which tracks the movement of aircraft and equipped vehicles on the airport surface. We are also seeing benefits from initiatives, such as departure queue management at New York John F. Kennedy, as well as demonstrations, such as Collaborative Departure Queue Management at Memphis, which allocate available departure capacity among aircraft operators. Building on these successes, the FAA and aviation community collaborators — including air carrier and airport operators, aviation associations and air traffic controllers — have developed the U.S. Airport Surface Collaborative Decision Making (SCDM) Concept of Operations. SCDM leverages real-time data sharing among all surface stakeholders, coupled with highly accurate operational data from flight and airport operators, to better understand and manage demand on the surface in accordance with defined procedures and policies.

The FAA's surface efficiency and safety improvement strategy also involves new traffic flow management and planning and terminal air traffic control (ATC) capabilities. One system that will assist us in that planning is the Terminal Flight Data Manager (TFDM). TFDM will optimize surface operations and the movement of aircraft off the airport surface and into the high altitude stream of air traffic. TFDM will provide an initial surface management capability at select airports and ATC facilities starting in 2015, adding more as the program continues. Additional TFDM capabilities are planned for 2017, including transitioning to electronic flight data exchange, which will make transferring flight data between towers and Terminal Radar Approach Control (TRACON) facilities more efficient. TFDM will also integrate surface surveillance and flight data and provide a scheduler/sequencer capability that integrates TFDM with the Traffic Flow Management System and Time Based Flow Management tools.

Another ATC automation improvement, the Integrated Departure/Arrival Capability, will maximize the use of runways to enhance the efficiency of arrivals and departures. In 2014 we will begin deploying this tool, which will enable tower controllers to assign slots in the overhead traffic stream to departing aircraft. Currently, those slots are assigned by controllers at the en route air traffic control center serving the departing airports, necessitating frequent phone calls between the center controller and tower controllers at multiple airports during heavy traffic periods. With the new automation tool, tower controllers will determine the best use of the available slots in the overhead stream and coordinate the departure of aircraft based on departure readiness. Better utilization of openings in the overhead stream will enable more precise scheduling for aircraft to push back from the gate, further improving overall system efficiency.

Wider availability of NextGen capabilities and associated benefits makes the business case for aircraft equipage.

In a joint effort with the European Organization for the Safety of Air Navigation (EUROCONTROL), the FAA is re-categorizing wake standards that will reduce the necessary arrival separation between various classes of aircraft. This effort identifies changes to the International Civil Aviation Organization's aircraft weight categories for improved throughput at capacity-constrained, high-density airports, while maintaining or improving wake safety. New wake turbulence categories have been proposed that more accurately group similar aircraft based on their wake turbulence characteristics, resulting in closer arrival separation for certain aircraft types without sacrificing safety. The re-categorization will result in changes to FAA Order 7110.65 to reflect the new separation standards, which began with a fall 2012 key site implementation at the Memphis TRACON, eventually resulting in improved terminal automation for closer arrival spacing.

RIGHT INFORMATION, RIGHT TIME, RIGHT PLACE

To further improve safety and efficiency in the National Airspace System (NAS), increased situational awareness and collaboration among flight planners, controllers and flight crews has to begin before the plane ever leaves the ground. Access to accurate aeronautical information is essential for effective individual flight planning and for the overall management of the NAS. The FAA's goal is to provide information related to changes in NAS status affecting safety, security and efficiency that is consistent and as complete as possible.

The ability to take advantage of special use airspace (SUA) when it is not in use by the military or otherwise unavailable to civil aviation will provide additional flexibility for air traffic planners. The FAA is working to improve consistency, timeliness and accessibility of SUA activation schedule and airspace configuration information so that NAS users will have better information for planning. With these improvements, planners will be able to make better predictions of how scheduled SUA use will affect planned flight routes and thus airspace capacity. We plan to make this capability available in 2015.

Equally vital to flight planning is having real-time information about restrictions on the use of airspace and runways. The FAA has already digitized the delivery of Notices to Airmen (NOTAM). We are working to tailor individual flight delivery by providing only those NOTAMs that affect the flight based on its planned trajectory. The initial implementation includes distribution from a single authoritative source to flight operations centers and will be available for use NAS-wide in 2015.

SMARTER ROUTES FOR A SMARTER NAS

The FAA is supporting the use of Performance Based Navigation (PBN) air traffic procedures to provide greater flexibility in the NAS and to facilitate more dynamic management of air traffic. PBN relies on the performance capabilities of the aircraft and employs sensors, such as GPS, to meet airspace requirements. The most basic form of PBN is Area Navigation (RNAV), which provides aircraft with the ability to fly more direct routes and procedures that save fuel, reduce aircraft exhaust emissions and make more efficient use of available airspace. With the addition of Required Navigation Performance (RNP), an onboard performance monitoring and alerting capability, aircraft can fly procedures that are contained within a tightly defined corridor of airspace. The proven benefits of available PBN procedures have led to a nationwide policy of RNAV throughout the NAS, and a combination of RNAV with RNP in places where the added precision that RNP procedures provide increases the capacity, throughput and safety of existing airport resources. The FAA is working with the aviation community to determine where RNP procedures will provide the most benefits.

The FAA has enlisted the assistance of a third-party vendor to supplement our development of RNP procedures for airports across the country. This vendor will be responsible for designing, implementing and maintaining 10 RNP procedures, two each at five airports: Anchorage, Alaska; Buffalo, N.Y.; Dayton, Ohio; Milwaukee, Wis.; and Syracuse, N.Y. The FAA will closely monitor the work and make sure necessary safety and environmental steps are taken. Procedures at all five airports are scheduled to be completed by the end of January 2014.

Two new capabilities will provide improvements for aircraft flying over the ocean. Automation enhancements to the FAA's Oceanic Automation System (Ocean21) will enable more aircraft to take advantage of optimal fuel-saving altitudes. Currently, traffic density and traditional separation requirements combine to limit altitude changes that would provide better fuel economy and ride quality, and take advantage of more favorable winds. With a new climb and descend capability, controllers will be able to clear aircraft to ascend or descend to their desired altitude between aircraft flying at an intermediate altitude (see Fig. 1) using Ocean21's conflict probe, which determines if there is adequate separation available for the maneuver. This capability will be available when the aircraft involved are equipped with Automatic Dependent Surveillance–Contract (ADS-C) to take advantage of the Climb/Descend Procedure (CDP). With ADS-C, the aircraft's navigation system verifies the aircraft's position using GPS signals.

While ADS-C CDP is an ATC automation enhancement, another means of accomplishing oceanic enroute climb and descend capability is with the Automatic Dependent Surveillance–Broadcast (ADS-B) In-Trail Procedures (ITP) application. ADS-B ITP depends on information derived from the flight deck of ADS-B-equipped aircraft and relayed by the flight crew to the controller. The application will enable aircraft equipped with ADS-B and appropriate onboard automation to climb and descend through altitudes where current separation standards would prevent desired altitude changes.

Preferred routing in oceanic airspace will enable aircraft to spend more flight time at desired altitudes, which, in turn, will potentially require them to carry less fuel, decrease fuel burn, increase payload capacity, improve in-flight planning and improve the passenger experience through reduced exposure to turbulence. Implementation of automation enhancements for ADS-C CDP and ADS-B ITP is planned for 2015.

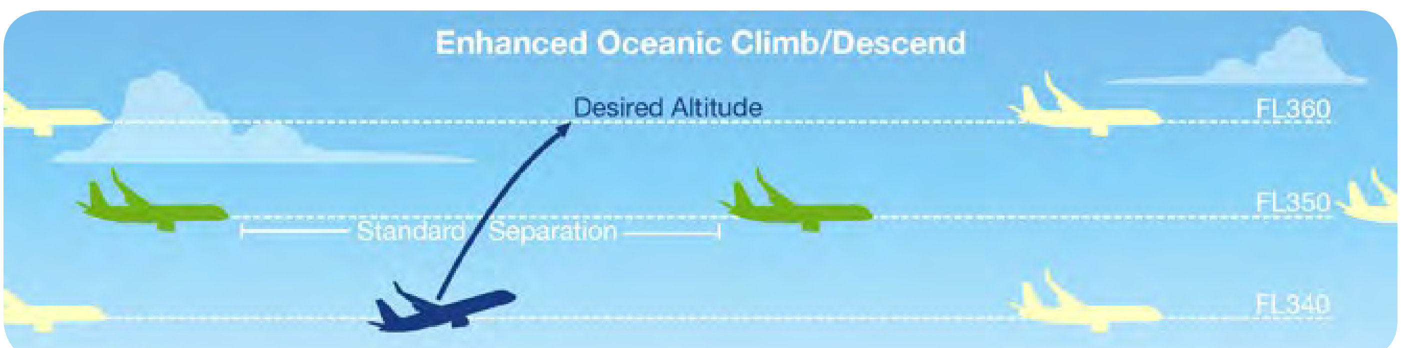


Fig. 1

SAFETY FIRST FOR EVERYONE

The FAA is developing new equipment for general aviation aircraft that will reduce the chance of mid-air collisions. Similar to a tool that commercial airlines have long used, Traffic Situational Awareness with Alerts (TSAA), builds upon ADS-B situational awareness capabilities to warn pilots of ADS-B-equipped aircraft if they come too close to another aircraft in flight. TSAA flight tests are scheduled to be completed in spring 2013. The technical standard order, which describes the requirements for building TSAA equipment, will be published in spring 2014.

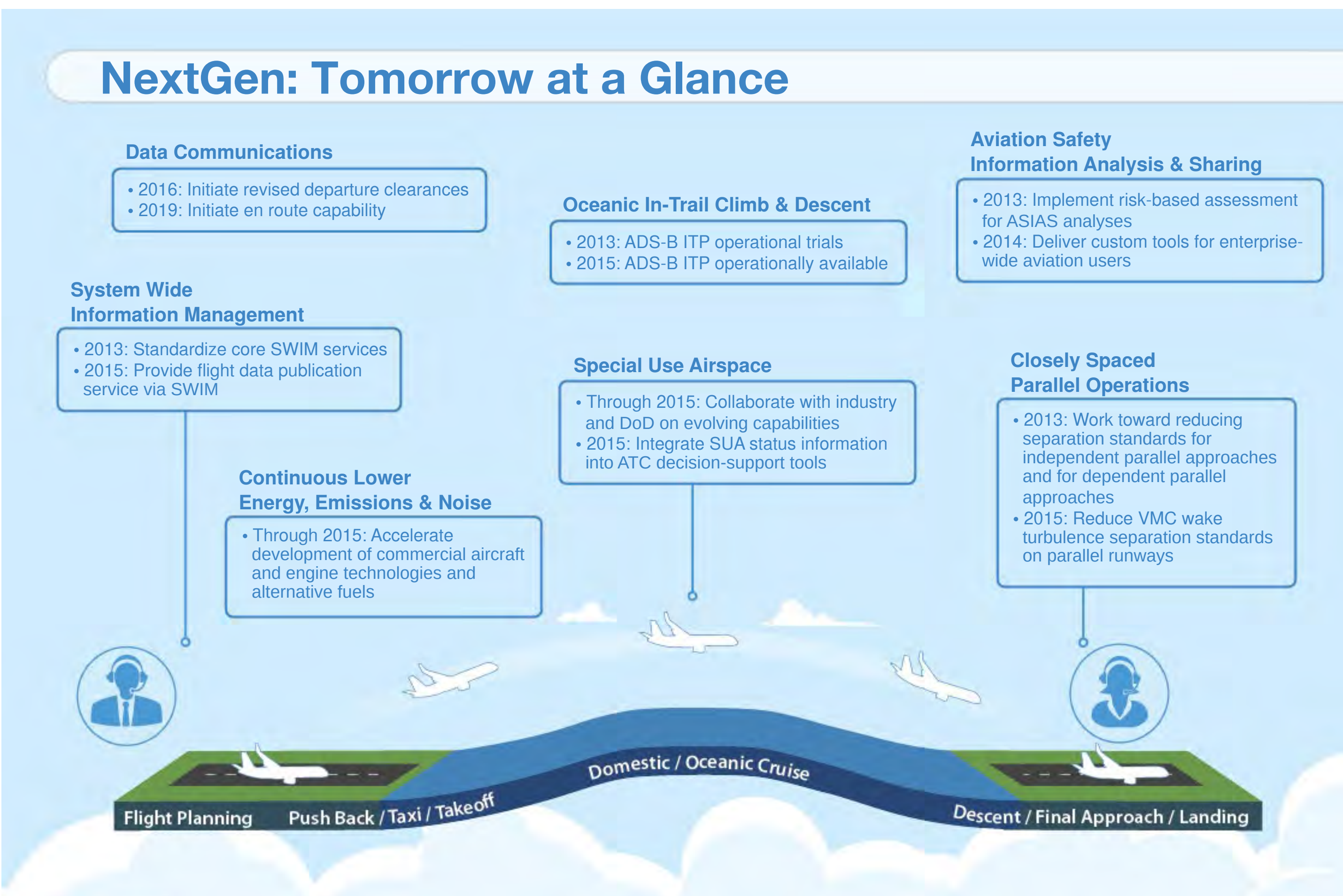
WEATHER OR NOT

Most flight delays can be attributed to poor weather. NextGen weather detection and forecast capabilities will improve air traffic planning and collaboration by making vital weather information available earlier and with more accuracy, and by making the same information available to everyone at the same time, creating a common NAS weather picture. In collaboration with the National Oceanic and Atmospheric Administration (NOAA), the FAA will align leading-edge scientific research with long-term NextGen requirements to provide incremental, near-term improvements to NAS safety and efficiency. These interim capabilities include improved detection and forecasting of in-flight icing, turbulence, and ceiling and visibility. Specifically, in 2014 we expect to introduce an improved Graphical Turbulence Guidance capability that provides flight planners with turbulence forecasts at all levels of flight, including mountain-wave turbulence, which is created when strong winds flowing toward mountains are pushed upward. A new capability that forecasts in-flight icing potential for air traffic in Alaska is scheduled for release in 2015, and a gridded, national Ceiling and Visibility Forecast is expected to be available by 2016. These weather tools will initially be available to NAS users through NOAA via the web-based Aviation Digital Data Service portal.

Beginning in 2016, NextGen Common Support Services–Weather (CSS-Wx) will disseminate via System Wide Information Management weather information used by various FAA ATC planning tools, with new categories of aviation weather information generation through the NextGen Weather Processor (NWP). CSS-Wx will be the single disseminator of weather information for the FAA, modernizing the two-way interface with NOAA for effective and efficient exchange of information, and implementing international standards for exchange of information with other government agencies, the aviation community and international partners.

The NWP will establish a common weather processing platform that will replace legacy FAA weather processors and host new capabilities, such as weather translation. Using FAA and NOAA radar and sensors and NOAA forecast models, the NWP will create standardized, aviation-specific weather information, providing a measurement of the constraint that weather will place on NAS operations. The NWP translation function takes textual, graphical and digital weather observations, analyses and forecasts from FAA and external sources and automatically produces standard weather information. This translated weather information will enable consistent, optimized decision making. Planners will use the translated information to assess weather-related impacts on traffic flows and individual aircraft trajectories. We expect these capabilities to be fully operational NAS-wide in 2016.

Additional details on the capabilities discussed in this chapter and other implementation activities can be found in Appendix A and Appendix B.



APPENDIX A

NEXTGEN INVESTMENTS FOR OPERATORS AND AIRPORTS

To take advantage of NextGen benefits, aircraft operators can determine which capabilities make sense for them and equip their aircraft accordingly.

NextGen benefits depend on FAA ground systems, space-based systems, improvements in aircraft engine, airframe and fuel technologies, advanced avionics capabilities and airport infrastructure. This appendix outlines the operator and airport investment opportunities through an overview of existing and planned capabilities, the benefits these capabilities enable and which technologies and equipment can take advantage of specific NextGen capabilities.

We use the term enablers in this appendix to describe the technologies required for an aircraft, operator or airport to implement a NextGen capability. Each enabler is defined by a set of performance and functional requirements that allow for market flexibility whenever possible. We provide guidance for operators in satisfying these requirements and deploying the enablers through advisory circulars (AC) and technical standard orders (TSO). Enablers are linked to operational improvements and capabilities that provide benefits and build on current equipage.

For each enabler, icons provide a quick look at key information.

- Target Users: Target users for each enabler can include air carriers, business jets, general aviation fixed-wing aircraft, and rotorcraft. These categories represent generalized modes of operation and may not apply to every civil or military operator. The FAA does not limit NextGen capabilities to targeted user groups. In addition to specified user groups, some users may still find it worthwhile to invest in a particular enabler to meet their operational objectives.
- Target Areas for Implementation: The general strategy for deployment can be nationwide, in oceanic areas or in metroplexes. Metroplexes are areas with large- and medium-hub airports and satellite airports.
- Maturity: An enabler may be available for operator investment, in development (including standards development) or in concept exploration.

Detail concerning operational improvements, and the FAA's implementation plan for each improvement, is provided in Appendix B.

This appendix explores several new developments, notably:

- Performance Based Navigation (PBN): In coordination with the International Civil Aviation Organization (ICAO) PBN Study Group, the FAA developed general criteria for advanced Required Navigation Performance (RNP). Additionally, the FAA began work with RTCA Special Committee (SC)-227 to develop navigation standards for Trajectory Operations.
- ADS-B: The FAA developed technical standards and

installation guidance for In-Trail Procedures (ITP) in oceanic airspace using ADS-B In. The FAA is working with industry to prepare guidance for interval management and traffic situational awareness and alerting.

- Data Communications (Data Comm): The FAA published installation guidance on dual stack data communication capabilities in 2012. Dual stack aircraft have both Future Air Navigation System (FANS) 1/A+ and Aeronautical Telecommunication Network (ATN) Baseline 1 data link systems installed with the goal of seamless operations. The FAA is working with industry to revise installation and operational guidance for ATN Baseline 2, currently planned in 2014.
- Low-Visibility Operations: An Enhanced Flight Vision System (EFVS) enabling rule is planned for 2013, along with supporting installation and operational guidance.
- Flight Deck Enhancements: Electronic Flight Bags (EFB) continue to play a larger role in NextGen flight operations. The FAA published updated operational guidance in 2012.
- Aircraft Engine, Airframe and Fuel Technologies: The agency has partnered with industry to accelerate development of new aircraft and fuel technologies and demonstrate performance gains and environmental benefits. Also, the FAA plans to study the performance of electric engines in light sport aircraft.
- Airport Enhancements: The FAA continues to evaluate existing arrival and departure procedures at airports with multiple or closely spaced runways. The goal is to safely reduce separation to improve arrival capacity, especially during low-visibility conditions.

NEXTGEN CAPABILITIES

NextGen capabilities are usually grouped by functionality, for example PBN. FAA support for NextGen equipage usually takes the form of standards development, ACs, TSOs and/or project-specific policy. A snapshot of avionics enablers, schedules, capability overviews and guidance is provided, together with the target users, target areas and maturity icons.

PBN

PBN encompasses a set of enablers with a common underlying capability of constructing a flight path that is not constrained by the location of ground-based navigation aids. Area Navigation (RNAV) is a method of navigation that permits aircraft operation on any desired flight path within the coverage of ground- or space-based navigation aids, within the limits of the capability of self-contained aids, or a combination of these. PBN defines RNAV system performance requirements in terms of the accuracy, integrity, continuity and functionality needed for operations in a particular airspace environment. FAA advisory material and rules identify performance requirements through navigation specifications. Guidance materials and rules may also identify which navigation sensors and equipment operators may use to meet performance requirements. The FAA works to define navigation specifications with a sufficient level of detail to facilitate global harmonization with the ICAO PBN Manual, Document 9613.

The RNAV designation refers to navigation accuracy, but can designate other performance and functional requirements. The FAA publishes RNAV Q-routes, T-routes, arrival procedures and departure procedures. For example:

- RNAV 2 requires sustaining an accuracy of two nautical miles (nm) for 95 percent of the flight time during the operation. The FAA uses RNAV 2 for en route operations.
- RNAV 1 requires sustaining an accuracy of one nm for 95 percent of the flight time. The FAA uses RNAV 1 for arrivals and departures.

As of January 2013, the FAA had published a combined total of 851 RNAV Standard Instrument Departures (SID), Standard Terminal Arrivals (STAR) and RNAV routes. A current inventory of RNAV procedures may be viewed on the FAA's Instrument Flight Procedures Inventory Summary website.

Icon Legend	
Target Users	Air Carriers
	Business Aviation
	General Aviation
	Rotorcraft
Target Areas	Nationwide
	Metroplex Areas or Major Airports
	Oceanic
Maturity	Available
	In Development
	In Concept Exploration

Overview of Aircraft Operator Enablers						
Avionics Enablers	Aircraft and Operator		Capability Overview	Target Users	Target Area	Maturity
	Guidance	Schedule				
Performance Based Navigation (PBN)						
Required Navigation Performance (RNP) 10	Order 8400.12C	Complete	Reduces oceanic separation			
RNP 4	Order 8400.33	Complete	Further reduces oceanic separation in conjunction with Future Air Navigation System (FANS) 1/A			
Area Navigation (RNAV) 1, RNAV 2	Advisory Circular (AC) 20-138C, AC 90-100A	Complete	Enables more efficient routes and procedures			
RNP 1 with Curved Path	AC 20-138C, AC 90-105	Complete	Enables precise departure, arrival and approach procedures, including repeatable curved paths			
Vertical Navigation (VNAV)	AC 20-138C, AC 90-105	Complete	Enables defined climb and descent paths			
Localizer Performance with Vertical Guidance (LPV)	AC 20-138C, AC 90-107	Complete	Improves access to many airports in reduced visibility, with an approach aligned to the runway			
RNP Authorization Required (AR) Approaches	AC 20-138C, AC 90-101A	Complete	Improves access to airports in reduced visibility with an approach that can curve to the runway; improves procedures to separate traffic flows			
Advanced RNP, RNP 0.3, RNP 2	AC	2014	Enables more accurate and predictable flight paths for enhanced safety and efficiency			
Trajectory Operations Navigation	AC, Technical Standard Order (TSO)	2015	Enhances PBN capabilities			
Alternative Positioning, Navigation and Timing	AC, TSO	2018	Provides GPS-independent alternative position, navigation and timing capability			

RNAV 1 is the mainstay in the terminal area, except where obstacles or airspace conflicts demand the improved performance provided by RNP 1. When a navigation specification includes requirements for onboard performance monitoring and alerting, or additional functionality, the FAA designates the application as RNP.

The FAA is expanding the use of RNP where beneficial, and one of the foreseen benefits is advanced RNP 1 with a defined curved path. Flying precise curved path Radius-to-Fix (RF) legs increases the consistency of aircraft tracks. RF leg application is an option where beneficial for SIDs, STARs, RNP and RNP Authorization Required (AR) approach operations. However, only RNP AR approach operations can apply an RF leg segment in the final approach segment (FAS). Expanding the use of the RF leg may help deconflict arrivals and departures in metroplexes and provide more efficient routing. The FAA plans to implement RF legs where they provide the highest operational benefit to the National Airspace System (NAS).

Many aircraft are able to use barometric altitude through the Flight Management System (FMS) to obtain vertical guidance and fly a defined vertical path. This aircraft capability is called barometric vertical navigation (baro-VNAV). Advisory vertical guidance helps the pilot maintain an optimum descent profile while complying with an air traffic control (ATC) clearance. However, the pilot is still responsible for complying with all procedure-defined altitude restrictions by referencing the primary barometric altitude source. By accounting for vertical guidance capabilities in the design of arrival and departure procedures, traffic flows can be planned more efficiently.

To access runways requiring instrument approach procedures, three approach minima capabilities offer different advantages and costs: RNP, Localizer Performance with Vertical Guidance (LPV) and RNP AR. The most basic performance capability, RNP 0.3, is a non-precision GPS approach. It is identical to the Lateral Navigation (LNAV) line of minima on RNAV (GPS) instrument approach charts. Adding vertical guidance with either baro-VNAV or Satellite Based Augmentation System (SBAS) can enable use of the LNAV/VNAV approach minima line. The Wide Area Augmentation System (WAAS) is the FAA's implementation of SBAS.

The FAA can publish LPV approaches to airports without incurring the need for Instrument Landing System (ILS) radio-navigation infrastructure and the associated maintenance costs. Likewise, RNAV (GPS) approaches are not subject to the ILS challenges of siting the localizer and glideslope antennas and do not require ground traffic to hold outside of an ILS critical area. LPV procedures can be implemented at many locations where an ILS installation is not feasible. An RNAV (GPS) instrument approach offering LPV minimums uses SBAS. LPV approaches typically offer the lowest approach minimums, using SBAS to enable decision altitudes as low as a conventional Category I ILS approach procedure.

With more advanced systems and procedures, operators are eligible for RNP AR approaches. RNP AR instrument approach procedures are designated as RNAV (RNP) approaches. These are the most demanding type of PBN operations, using very precise lateral paths — down to 0.1 nm accuracy — and can include the application of RF leg segments in the FAS. With proper aircraft equipment, operators may obtain approval to fly these procedures. This approval includes RNP AR training, database validation and operating procedures. RNP AR instrument approaches enable access at airfields with more demanding obstacles or traffic constraints. A complete listing of all RNAV (GPS), and RNAV (RNP) and LPV approaches may be viewed at the FAA's Satellite Navigation Program website.

Most air carrier aircraft can support RNAV operations and RNP, and half can support RNP AR approaches. The heart of the PBN capability in the air carrier community is the FMS function, which generally uses multi-sensor inputs to define aircraft positions. Depending on the installation, these inputs come from Distance Measuring Equipment (DME), from the Global Navigation Satellite System (GNSS) using either GPS or GPS incorporating WAAS, from VOR or from inertial guidance. For RNAV 1 and RNAV 2 capabilities, the FAA only provides DME facilities (for use with inertial input) and GNSS. DME-only navigation has coverage limitations and will not be supported on every published procedure. Most air carrier aircraft can support RNAV operations and RNP, and half can support RNP AR approaches.

In the general aviation community, PBN enablers are typically implemented in a GNSS navigator installed in an aircraft's instrument panel. These systems have become increasingly complex and capable, integrating other types of navigation, voice communication and uplinked weather information. Most of these installations can support RNP, and those equipped with WAAS can support LPV approaches. Some configurations on general aviation aircraft may be upgradeable to RNP with curved path capability.

Operational advantages provide the primary motivation for equipping with PBN enablers. Operators who equip obtain direct efficiency and access because of the new routes, procedures and approaches. The FAA is not planning to retain the full legacy ground structure, so a further incentive for PBN capability will come through less optimal services to non-equipped aircraft.

Advanced RNP operations include a set of new capabilities that will enable increased use of RF legs without the stringent requirements for RNP AR. We envision procedures with scalable accuracy values as low as 0.3 nm and criteria for RNP 2 en route operations. For helicopters, we are developing material for RNP 0.3 departure and en route operations in congested environments, taking advantage of the slow speed and high maneuverability of the rotorcraft.

As the NAS moves to a trajectory operations-based construct, new requirements will be allocated to aircraft navigation systems. The widespread use of trajectory operations will require aircraft navigation systems to perform to a new degree of standardization. The FAA is working with industry stakeholders to determine new performance standards for trajectory operations.

The FAA is exploring means to reduce the existing VOR network and a limited number of secondary surveillance radar facilities. Alternative Positioning, Navigation

Overview of Aircraft Operator Enablers						
Avionics Enablers	Aircraft and Operator		Capability Overview	Target Users	Target Area	Maturity
	Guidance	Schedule				
Automatic Dependent Surveillance–Broadcast (ADS-B) Capabilities						
ADS-B Out	AC 20-165A, AC 90-114, TSO-C166b, TSO-C154c	Complete	Enables improved air traffic surveillance and automation processing			
Airborne/ Ground Cockpit Display of Traffic Information (CDTI), ADS-B In	AC 20-172, TSO-C195	Complete	Improves awareness of other traffic			
In-Trail Procedure (ITP), ADS-B In	AC 20-172A, AC 90-114 CHG 1, TSO-C195a	Complete	Improves oceanic in-trail climb/ descent			
Interval Management, ADS-B In	AC, TSO	2015	Displays along-track guidance, control and indications, and alerts			
ADS-B Traffic Situational Awareness and Alerting, ADS-B In	AC, TSO	2014	Displays and alerts crew to airborne conflicts independent of Traffic Alert and Collision Avoidance System alerting			
Closely Spaced Parallel Operations, ADS-B In	AC, TSO	2017	Provides guidance information for aircraft participating in paired approaches to closely spaced runways			
Advanced Flight Interval Management	AC, TSO	2017	Provides higher performance along-track guidance, control and indications, and alerts for terminal operations			

and Timing would provide a means to reduce GPS dependency.

ADS-B

There are many ADS-B enablers, with different cost and benefit implications. The most basic participation with ADS-B is ADS-B Out. ADS-B Out avionics broadcast an aircraft's position and other data. Ground receivers and other aircraft within range can receive these broadcasts and use them for their own applications. ADS-B Out enables the next generation of air traffic surveillance. Using ground receivers across the country, controllers will receive and process precise ADS-B broadcasts to provide air traffic separation and advisory services. Aircraft operating in Class A airspace — from 18,000 feet mean sea level (MSL) to and including Flight Level 600 — must broadcast position data with a Mode S, 1090 Extended Squitter (1090 ES) solution to comply with the ADS-B Out rule. For aircraft operating below 18,000 feet MSL, broadcasting position with either 1090 ES or the Universal Access Transceiver (UAT) can satisfy the mandate.

Automatic Dependent Surveillance–Rebroadcast (ADS-R) takes position information received on the ground from UAT-equipped aircraft and rebroadcasts it on the 1090 megahertz (MHz) frequency, which jet aircraft primarily use. ADS-R rebroadcasts 1090 MHz data to UAT users. In concert with Traffic Information Services–Broadcast (TIS-B), ADS-R provides all ADS-B In-equipped aircraft with a comprehensive airspace and airport surface traffic picture. ADS-R delivers traffic data within a 15 nm radius and plus or minus 5,000 feet relative to the receiving aircraft's position.

Building on the ADS-B Out capability, operators can integrate ADS-B avionics with different controls and displays to implement ADS-B In enablers. The most basic enablers provide enhanced situational awareness, improving the ability of the flight crew to identify where aircraft are around them and the direction in which those nearby aircraft are headed. This technology works in the air or on the ground, but coverage issues and the availability of quality airport surveys may limit the ground capability. This basic type of display is referred to as a Cockpit Display of Traffic Information (CDTI). The CDTI may be a new display or it may be integrated with a conventional Traffic Alert and Collision Avoidance System (TCAS) traffic display. CDTI provides a graphic display of the relative position of other aircraft and surface vehicles equipped with ADS-B.

Another set of ADS-B In enablers uses ADS-B data for speed or timing guidance, typically maintaining spacing from another aircraft. This includes algorithms for oceanic ITP. Beyond these lie advanced alerting to improve airport safety and reduce the risk of collision for aircraft without TCAS. Eventually the FAA expects ADS-B to be integrated with other capabilities to support access to closely spaced runways in almost all weather conditions, and to enable airspace with separation similar to visual operations today.

In air carrier aircraft, we expect operators to implement ADS-B as upgrades to the Mode S transponder and aircraft displays. Operators will be able to upgrade or replace this equipment to support ADS-B as well as its original function. The various ADS-B In capabilities reflect different levels of integration with the controls and displays in the cockpit. Situational awareness is available using side console-mounted displays that are not integrated. Instrument panel-mounted displays that are not integrated can provide along-track guidance. Long-term capabilities will require integration with other navigation data and eventually migrate to flight displays as benefits are substantiated.

UAT also provides access to weather and other FAA aeronautical data services. ADS-B In capabilities for general aviation will use displays similar to those for air carriers.

By providing early benefits, the agency is encouraging operators to equip portions of their fleets with ADS-B before the ADS-B Out rule goes into effect on January 1, 2020. As the operators experience these benefits, they will have an incentive to accelerate and expand ADS-B equipage to the rest of their fleet.

For air carriers, this strategy uses memorandums of agreement in which each party provides in-kind contributions critical to the success of the project. Each agreement is unique, reflecting the specific operator's business model, route structure and existing avionics infrastructure, among other factors. For general aviation operators, deployment of traffic and weather information, uplinked over the UAT, will enhance benefits and motivation to equip. This information will be provided by two no-cost broadcast services, TIS-B and Flight Information Services–Broadcast (FIS-B). The FAA is also evaluating additional locations where surveillance may be expanded by employing ADS-B.

In September 2011, the ADS-B In Aviation Rulemaking committee recommended implementation of ADS-B In capabilities for suitably equipped aircraft by 2017. The FAA will incorporate these recommendations into its planning for NextGen, and the plan for developing guidance and standards is reflected in the ADS-B enabler table.

In last year's NextGen Implementation Plan, we explored concepts for ADS-B Surface Indications/Alerts and we scheduled a TSO and AC for 2016. Surface Indications/Alerts are now targeted for after the high-value Advanced Flight Interval Management concepts are complete. Where the current Interval Management would provide spacing on a single arrival stream, Advanced Flight Interval Management would allow more consistent spacing for merging from various directions and flight paths.

Overview of Aircraft Operator Enablers

Avionics Enablers	Aircraft and Operator Guidance	Aircraft and Operator Schedule	Capability Overview	Target Users	Target Area	Maturity
Data Communications						
FANS 1/A (Satellite Communications)	AC 20-140A, AC 120-70B	Complete	Provides oceanic data communications and surveillance, transfer of communications			
FANS 1/A+ [VHF Digital Link (VDL) Mode 2]	AC 20-140B, AC 120-70B, TSO-C160a	Complete	Provides domestic data link clearances			
Aeronautical Telecommuni-cation Network Baseline 2	AC	2015	Provides clearances, terminal information, and Initial Trajectory Operations			

We are also continuing research on use of ADS-B for paired approaches to parallel runways, where aircraft stay close enough together to avoid wake while maintaining safe separation.

DATA COMMUNICATIONS

Data Comm allows some communications to move off the voice channel and provides a verifiable record, reducing communication errors. It also allows increased air traffic efficiency by reducing the time spent on routine tasks, such as communications transfers. The FAA deployed data communications as part of the FANS program in oceanic airspace. Boeing and Airbus developed integrated communication and navigation capabilities (FANS 1 and FANS A, respectively), providing a pilot-controller data link and the ability to send surveillance data from the aircraft to the ATC system through Automatic Dependent Surveillance–Contract. Operators targeted these navigation and communication capabilities primarily for oceanic airspace, where they provided the greatest initial benefits, enabling a safe reduction in separation between aircraft from 100 nm to 50 nm and later to 30 nm.

The FAA updated its data communications plans in response to an RTCA NAC recommendation to not require domestic use of a latency timer. This is reflected as FANS 1/A instead of FANS 1/A+.

As the FAA moves forward with deploying a domestic ATC data link system, it is important to make use of the FANS capabilities installed within some fleets, particularly widebody air carriers conducting international operations. The domestic program will use an adaptation of FANS appropriate for high-density, surveilled environments through FANS 1/A over VHF Digital Link Mode 2. These aircraft will be able to receive departure clearances and airborne reroutes. This enabler builds on pre-existing FANS 1/A capabilities, adapting them for domestic operations.

ATN was developed through ICAO to provide a more universally capable and reliable ATC data communication system. Earlier versions of ATN provided interim capabilities. Europe has a mandate for ATN Baseline 1 (Link 2000+), which operators can retrofit into aircraft without modification of the navigation system. The desired capability for full participation in continental U.S. airspace will be the second version, called ATN Baseline 2. RTCA SC-214 and the European Organization for Civil Aviation Equipment Working Group-78 are jointly developing standards to define the safety, performance and interoperability requirements for air traffic services supported by data communications. Data communications will also need to accommodate still evolving navigation, surveillance, and aeronautical information service requirements to support the air-ground functional integration. Finalizing these requirements may impact the schedule for ATN Baseline 2 criteria. Both Europe and the United States plan to implement ATN Baseline 2 with a larger set of operational services for all phases of flight.

Operators of fleets that fly internationally have adopted FANS 1/A for oceanic and remote area applications. The FAA is evaluating potential operational incentive scenarios in which aircraft may receive more rapid or efficient departure reroutes during inclement weather.

Overview of Aircraft Operator Enablers

Avionics Enablers	Aircraft and Operator Guidance	Aircraft and Operator Schedule	Capability Overview	Target Users	Target Area	Maturity
Low-Visibility Operations						
Head-Up Display (HUD)/ILS	Order 8400.13D	Complete	Reduces minimums at qualifying runways			
Enhanced Flight Vision System (EFVS)	AC 20-167, AC 90-106	Complete	Uses enhanced flight visibility to continue approach below minimums			
	AC	2014	Expands operational use of EFVS			
Ground Based Augmentation System Landing System III	Project-specific policy	2016	Provides autoland in very low visibility			

Overview of Aircraft Operator Enablers						
Avionics Enablers	Aircraft and Operator		Capability Overview	Target Users	Target Area	Maturity
	Guidance	Schedule				
Flight Deck Enhancements						
Flight Information Service–Broadcast	TSO-C157a, TSO-C154c	Complete	Provides weather and aeronautical information in the cockpit			
	TSO	2015	Provides Universal Access Transceiver link-specific requirements for weather and aeronautical information to the cockpit			
Electronic Flight Bag (EFB)	AC 20-173, AC 120-76B, AC 91-78	Complete	Allows electronic access to paper products			
Synthetic Vision Systems	AC 20-167	Complete	Provides an electric means to display a synthetic vision image of the external scene topography to the flight crew			
Airborne Access to System Wide Information Management, or SWIM	AC 20-177	Complete	Provides flight crews with access to SWIM over non-aeronautical frequency bands			
Airborne Collision Avoidance System (ACAS-X)	AC, TSO	2020	Improves airborne collision avoidance performance with fewer nuisance alerts			

FLIGHT OPERATIONS CENTERS

The FAA will define technical requirements for the communications infrastructure that will enable data exchange. This will include the requirements enabling external users to connect to the FAA's System Wide Information Management (SWIM) security gateway allowing the exchange of FAA and Flight Operations Center (FOC) data. In the near term, new flight planning capabilities will allow the operator to provide a prioritized list of trajectory options for each flight. Taking into account operator flight priorities, the FAA's traffic flow management automation will use these lists to determine flow assignments. Collaboration between the FAA and the operator during the flight planning process will become increasingly sophisticated and leverage new automation and data exchange capabilities. The flight operations centers will manage the exchange of their trajectory option sets and regularly re-evaluate them based on their specific business model. FOCs will also provide flight priority information when traffic management initiatives are required because of volume or weather conditions.

The continuing evolution of flight planning support tools and communications infrastructure to support FOC air traffic management and cockpit decision making will continue to ensure safe and efficient operations.

Airborne Access to SWIM (AAtS) enables in-flight aircraft access to information available through SWIM. AAtS extends these capabilities to the cockpit through third party communication vendors, providing Internet access on the flight deck, for example on an EFB. Although AAtS aircraft guidance is complete, AAtS implementation is still in development.

LOW-VISIBILITY OPERATIONS

The FAA is supporting several different capabilities for operators who need to access an airport during low visibility — when the cloud ceiling is below 200 feet above the runway or visibility is less than one-half mile. At many airports, the FAA has approved the use of a head-up display (HUD) on a precision approach to lower minimums. A HUD provides critical flight and navigation data on a transparent screen directly in front of the pilot, allowing simultaneous viewing of primary flight display information, navigation information and the extended scene. When a HUD is integrated with a suitably qualified precision approach system, the FAA has approved operations to 100 feet above the runway before the flight crew acquires the runway environment with natural vision. The use of a qualified HUD when flying to a suitable ILS facility will reduce the required runway visual range (RVR) visibility for the approach and will increase access compared with non-equipped aircraft. The accuracy of these ILS facilities has been verified for this type of operation. In addition, the airport must have the equipment to measure and report the current RVR visibility. The FAA is increasing the number of airports with RVR to expand this capability.

When a HUD is integrated with suitably qualified EFVS, the FAA has approved operations to 100 feet above the runway before the flight crew acquires the runway environment with natural vision. EFVS affords a high level of access, providing a visual advantage to the flight crew for seeing required visual references using EFVS technology. With enhanced flight vision, access is allowed that otherwise would be denied because of low-visibility conditions. Existing rules allow approaches to straight-in landing operations below decision height, or minimum descent altitude, using EFVS. The FAA will release a notice of proposed rulemaking for EFVS in 2013.

Another enabler is the Ground Based Augmentation System (GBAS) landing system. This system uses differential corrections to GPS to support all categories of precision approach. Although the FAA is not deploying Category I GBAS, a non-federal system was approved for use within the NAS in September 2012 and has been installed at several airports based on user requests. The current FAA GBAS program is researching use of this technology to support Category III operations in accordance with baseline ICAO standards. This capability can service multiple runways at an airport with a single system and does not require critical area taxi restrictions. While there are only a few GBAS Category I approaches, new aircraft are being manufactured with the basic capability to reduce the costs of transiting from ILS to GLS Category III when it is mature. The FAA moved implementation from 2014 to 2016 due to the need for further research to mature this technology. EFVS has been adopted by the high-end business community and HUD has spread to the air carrier fleet providing improved service. While not mandated, the low-visibility enablers allow aircraft equipped with this capability to gain airport access while non-equipped aircraft cannot.

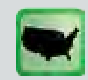
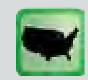
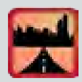
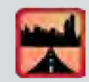
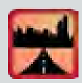
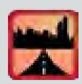
Current Equipage Levels of Available Enablers*

Enabler	Air Transport	Air Taxi	Helicopter
RNP 10 - Oceanic	90%	8%	N/A
RNP 4	90%	8%	N/A
RNAV 1	96%	57%	19%
RNAV 2	98%	72%	23%
RNP 1 with Curved Path	50%	6%	3%
VNAV	68%	34%	N/A
LPV Approach	<1%	N/A	N/A
RNP AR Approach	50%	10%	3%
ADS-B Out (rule compliant)	2%	N/A	N/A
Airborne/Ground CDTI, ADS-B In	2%	0%	0%
ITP, ADS-B In	<1%	0%	0%
FANS 1A (SATCOM)	10%	12%	N/A
FANS 1A+ (VDL Mode 2)	2%	12%	N/A
HUD/ILS	17%	<1%	<1%
EFVS	2%	12%	0%
EFB	9%	36%	12%

* The reported number represents the upper bound of all aircraft under the holder's authorized operations specifications. These equipage levels are sensitive to fleet composition changes.

FLIGHT DECK ENHANCEMENTS

FIS-B provides terrestrial-based weather data and real-time NAS status information to aircraft equipped with the ADS-B-enabled UAT link or by use of other FIS-B links, e.g., XM Weather, Sirius and appropriate displays. These data are primarily intended to improve safety of operations for general aviation aircraft. FIS-B is the more generic use of data link communications providing graphical and/or textual weather and aeronautical information to and from aircraft, along with a cross-link service. Various operational domains are supported, including pre-flight, surface operations, terminal and domestic en route. Terrestrial and satellite links support global operations. AAtS functionality is also envisioned. AAtS enables aircraft systems to access data to support collaborative decision-making and ensure a common understanding of status of airspace, systems and weather. The airborne access may be through an installed

Foundational Avionics Enablers					
Metroplex			General		
Enablers	Target Users	Target Area	Enablers	Target Users	Target Area
ADS-B Capabilities*					
ADS-B Out			ADS-B Out		
Recommended PBN					
RNAV 1, RNAV 2			RNAV 1, RNAV 2		
RNP 1 with Curved Path			LPV		
VNAV			* See requirements in 14 CFR 91.225 and 14 CFR 91.227		
RNP AR Approach					

system or an EFB. AAtS must be used to support collaborative decision making to qualify under the NextGen avionics incentive program. For more information on installation of non-required telecommunication equipment, see AC 20-177, Design and Installation Guidance for an Airborne System for Non-Required Telecommunication Service in Non-Aeronautical Frequency Bands.

EFB devices can display a variety of aviation data or perform basic calculations, e.g., performance data and fuel calculations. In the past, much of this information was provided via printed documentation, and calculations were performed manually based on data provided to the flight crew by flight dispatch. EFBs also have the ability to send and receive graphical and textual information for use on the flight deck.

ACAS-X is a family of collision avoidance systems. ACAS-X_A is intended to fill the role of current TCAS, serving as a collision avoidance system for large transport and cargo aircraft. ACAS-X_O is intended for specific flight operations of those same users when normal separation may result in excessive nuisance alerts, such as closely-spaced parallel operations.

Synthetic vision displays, which electronically show external topography, are gaining popularity among flight crews.

EQUIPAGE LEVELS

The Equipage Level table summarizes current equipage levels of mature avionics enablers among air transport operators [14 Code of Federal Regulations (CFR) part 121 operators], air taxis (14 CFR part 91K and 135 operators) and helicopters (14 CFR part 135 operators). The high penetration of PBN enablers reflects the maturity of those capabilities, which have been delivered in various forms for more than 10 years. While the general aviation fleet continues to experience significant adoption of advanced technologies, especially with WAAS avionics, precise equipage numbers are difficult to obtain and are not included. The equipage numbers on the preceeding page are based on documented operational approvals for air carriers, air taxi and helicopters, and are normalized to the subset of the fleet applicable to the operation.

FOUNDATIONAL AVIONICS ENABLERS

The FAA has evaluated available enablers and identified those that provide the most NAS benefits when a high level of participation is achieved.

The metroplex foundational enablers were selected for providing the greatest impact on metroplex operations and presume high levels of equipage. The general foundational enablers target the minimum NextGen capabilities outside of metroplex areas. Both capability levels are displayed above. These recommended avionics will be updated when additional enablers become available. Operators may elect to use any of the other enablers, which provide benefit but do not require high levels of participation.

Overview of Aircraft Operator Enablers						
Enablers	Operator or Airport		Capability Overview	Target Users	Target Area	Maturity
	Guidance	Schedule				
Aircraft Engine, Airframe and Fuel Technologies						
Drop-In Alternative Jet Fuel Blends with Jet A	ASTM standard D7566	Complete	Expands jet fuel specification to allow use of Jet A blended with up to 50% of Synthetic Paraffinic Kerosene from Fischer-Tropsch or Hydroprocessed Esters and Fatty Acids processes			
Electric Propulsion	ASTM standard	2014	Enables certifiable electric propulsion technology with zero fuel burn and lower noise for light sport aircraft			
Additional Drop-In Alternative Jet Fuels	ASTM standards alcohol-to-fuel pathways	2014	Expands jet fuel specification to allow use of Jet A blended with up to 50% of alternative jet fuels from novel processes and feedstocks e.g. alcohol-to-jet and pyrolysis			
	ASTM standards pyrolysis	2015				
New Airframe Technologies	Technology available for product development	2015	Provides demonstrated and certifiable airframe technologies with lower fuel burn, emissions and noise			
More Efficient Engines	Technology available for product development	2015	Provides demonstrated and certifiable turbine engine technologies with lower fuel burn, emissions and noise			

AIRCRAFT ENGINE, AIRFRAME AND FUEL TECHNOLOGIES

In partnership with industry, the Continuous Lower Energy, Emissions and Noise program accelerates the development of new certifiable aircraft technologies and alternative jet fuels. Drop-in alternative jet fuels research continues with the intent of developing a range of ASTM International-approved fuels that provide improved environmental performance without compromising safety or requiring changes in aircraft, engines or fuel-supply infrastructure.

ASTM International has approved for commercial use alternative jet fuels consisting of Jet A blended with up to 50 percent synthetic paraffinic kerosene from the Fischer-Tropsch process (approved in 2009) or Hydroprocessed Esters and Fatty Acids process, formerly known as Hydroprocessed Renewable Jet biofuel (approved in 2011). Developers are beginning to test additional advanced alternative jet fuels in support of eventual ASTM approval. ASTM approval for alcohol-to-jet fuel pathways is targeted for 2014 and pyrolysis is targeted for 2015.

Operator investment is limited to purchasing alternative jet fuel blends as they become available in commercial quantities. We expect air carriers to sign long-term fuel purchasing agreements to help facilitate deployment of these alternative fuels.

Operators are also mulling other technical advances that will provide both performance gains and environmental benefits. Operators may retrofit some new certified airframe and engine technologies on existing aircraft to speed technology insertion into the fleet, while other new technologies such as the high bypass ratio geared turbofan and open-rotor engines will await future generations of aircraft.

AIRPORT ENHANCEMENTS

Airports are active participants in NextGen implementation across the NAS. While many investments in NextGen technologies are the responsibility of the FAA or aircraft operators, airports will also have opportunities to advance NextGen.

Overview of Airport Enablers						
Avionics Enablers	Operator or Airport		Capability Overview	Target Users	Target Area	Maturity
	Guidance	Schedule				
Airport Enhancements						
Geographic Information System	AC 150-5300-16,-17, -18	Ongoing	Provides detailed geospatial data on airports and obstructions			
ADS-B for Surface Vehicles	AC 150/5220-26	Complete	Provides ADS-B squitter equipage for surface vehicles operating in the movement area	Airport rescue firefighting equipment, snowplows and inspection trucks		

PBN instrument flight procedures are a key component of NextGen because they can improve the efficiency of airport arrivals and departures. For general aviation operators and some regional air carriers, LPV approach procedures can provide Category I minimums. Business jet operators and air carriers are more commonly equipped for RNAV and RNP, which can support RNP AR approach minimums. The FAA may opt for an incremental phase out of many of the ILS Category I installations by 2025, as both LPV and RNP provide more cost-effective and flexible instrument approach procedures. The FAA continues to evaluate ground-based augmentation system technology, which could boost existing ILS Category II and Category III installations at airports throughout the NAS.

Airports have the key role of discussing with their users the need for new or additional PBN procedures. A hub airport may serve air carriers that are actively seeking to expand the use of RNAV or RNP procedures, while a general aviation airport may benefit from new LPV approach procedures. An airport can request that the FAA initiate the consideration and design of these procedures. Airports can facilitate the aeronautical survey and obstruction-mitigation and runway-lighting actions that may be needed to achieve lower minimums. The surveys and obstruction mitigation could be eligible for Airport Improvement Program (AIP) funds.

The FAA is reviewing the use of Light-Emitting Diode (LED) obstruction lights and approach lights with aircraft using EFVS or Night Vision Imagery technology relying on an infrared signature. Current LED fixtures have not provided this infrared signature. The same issues may be present in LED high intensity runway edge lights. For these reasons, per Program Guidance Letter 12-02, LED obstruction lights, LED approach lights and LED high intensity runway edge lights are not AIP-eligible at this time.

Surface surveillance and management is another key area for airport involvement in NextGen. In 2011, the FAA completed installation of Airport Surface Detection Equipment–Model X (ASDE-X) at 35 airports. The agency aims to install enhancements to airport surface detection equipment, known as the Airport Surface Surveillance Capability (ASSC), at eight other civil airports between 2014 and 2017. At these facilities, airports can install ADS-B Out squitters on airport-owned vehicles that regularly operate in the movement area. Squitters would broadcast vehicle positions to ATC, aircraft equipped with ADS-B In and the airport operations center. This would improve situational awareness and safety, particularly during construction projects and winter weather events. ADS-B Out vehicle squitters could be AIP-eligible.

The FAA continues to research the need and technology options for non-movement area surface surveillance, particularly in support of NextGen surface traffic management concepts that are also still in development. For airports not receiving ASDE-X or ASSC, the FAA is also researching low-cost technologies and systems that could provide a surface surveillance capability.

Some airports have elected to install surveillance systems to complement those the FAA has installed and provide coverage of non-movement areas. There is an overall increase in situational awareness when airports monitor surface operations more precisely. These systems can also support departure queue management concepts. Departure queue management cannot eliminate delays, but it does shift delays from the runway to the ramp or gate area where aircraft can wait with engines off. The FAA is continuing to develop departure queue management options, with operational use expected in a few years.

The FAA recognizes and appreciates the efforts of airports and vendors to develop systems and tools to improve surface situational awareness. The results to date show substantial promise, but challenges with data sharing and distribution have emerged. As a result, the FAA requests that airports considering investments in surface surveillance technologies work in coordination with the FAA during the system design phase. The FAA is refining policy and processes to enable improved access to NAS data to support emerging surface operational concepts under NextGen. The agency has streamlined approval processes to give aviation users access to appropriate NAS data through the NAS Enterprise Security infrastructure. With advance coordination, vendor systems can be designed with an architecture that is compatible with emerging FAA surface operational plans.

Because new runway and taxiway infrastructure is critical to capacity and efficiency, the continued transition of airport layout plans into the Airport Geographic Information System (GIS) application will improve the airport planning process. Airport GIS can also provide the accurate geospatial data needed for surface moving maps and new instrument flight procedures. The FAA is also proceeding with research to revise the separation standards for Closely Spaced Parallel Operations (CSPO) on parallel runways. The revisions to CSPO standards will be incremental throughout the remainder of the decade and beyond to incorporate both existing and new technologies. There may also be dependencies on PBN implementation and aircraft equipage rates. Changes like this may give airports greater design flexibility by allowing better use of existing runway layouts

The FAA is continuing to evaluate existing arrival and departure procedures at airports with multiple or closely spaced runways. Our goal is to safely reduce the separation between aircraft as they approach closely spaced parallel runways. This reduction will improve the arrival capacity on those runways especially during poor-visibility conditions. Analyses of independent and dependent runway standards, including blunder and wake analyses, are ongoing. A blunder is when an aircraft veers off its path during approach. Blunder analyses consider the necessary separation distance required for independent approaches to parallel runways in case of blunders.

The current lateral separation standard for independent (concurrent) arrivals applies to runways spaced 4,300 feet or more apart. In 2011, the FAA completed blunder analyses and determined that lateral runway separation can be reduced for independent arrivals on parallel runways spaced closer than 4,300 feet apart. Using specific procedural and systems criteria, this standard could be reduced to 3,600 feet if approved through the FAA's Safety Management System (SMS) process. An expected update to FAA Order 7110.65 will reflect these changes once the SMS processes are complete. Additionally, an ongoing analysis of dependent approaches aims to reduce the current 1.5 nm-staggered separation for approaches to parallel runways spaced 2,500 feet or more apart, up to the independent runway separation standard.

Today, there are 16 parallel runway pairs at eight airports — Boston, Cleveland, Newark, Memphis, Philadelphia, Seattle, San Francisco and Salt Lake City — spaced less than 2,500 feet apart that are authorized for 1.5 nm-dependent staggered approaches, per FAA Order 7110.308. Work will continue through 2015 to authorize additional runway pairs at additional airports for this procedure. Also in 2015, the FAA plans to reduce dependent staggered separation behind Heavy aircraft (capable of takeoff weights greater than 255,000 pounds) and Boeing 757 aircraft operating on closely spaced parallel runways.

In 2011, the FAA completed its evaluation of RNAV approaches, including RNP and WAAS LPV in place of ILS approaches for parallel runways. Changes to ATC procedures to allow combinations of RNAV and ILS approaches for dependent approaches on runways spaced at least 2,500 feet apart and for independent approaches were published in 2011. In 2012, FAA performed the safety analysis to allow RNAV approaches for dependent staggered approaches.

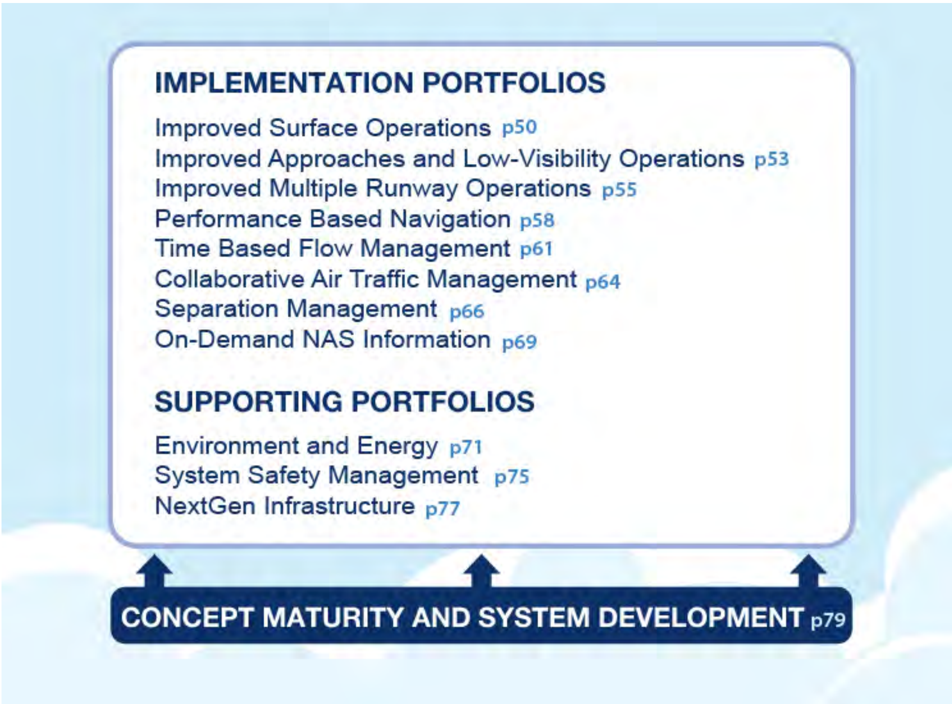
In 2015, the FAA expects to reduce wake turbulence separation standards during favorable wind conditions for departures on parallel runways during visual conditions. The FAA is continuing to work with ICAO to update the wake separation standards based on analysis of wake generation, wake decay and the effects experienced when an aircraft comes into contact with wake turbulence. The new separations will increase capacity while maintaining or enhancing safety by considering aircraft type-specific leader-follower aircraft pairings.

INTERNATIONAL HARMONIZATION

As the FAA and its international counterparts advance respective airspace modernization efforts, collaboration is essential to ensure functional integration. The agency is actively engaged in the harmonization of equipment standards and technology deployment. The ICAO Global Air Navigation Plan, which provides an approved framework to implement capabilities that maximize return on investment, informs our work. "Collaboration You Can Depend On" on the NextGen implementation website has more.

APPENDIX B

DELIVERING NEXTGEN



NextGen is transforming the National Airspace System (NAS) through a number of operational improvements. We implement each improvement through a series of capabilities, or increments, that provide individual benefits and combine to provide a transformative change in the way we operate the NAS. In this appendix, we have summarized our work plans to deliver operational improvements along with timelines and locations when available.

Work is progressing to deliver related capabilities in eight implementation portfolios and two portfolios with supporting activities that address safety and environmental and energy considerations. See the graphic above for a list of the portfolios.

For each of the implementation portfolios, you will see a timeline for operational improvements (OI) and their related increments, a description of OIs and increments, and selected implementation work activities that support the OIs. We have also listed which budget line item(s) fully or partially fund those work activities. The NextGen Infrastructure portfolio provides information about systems that serve as enablers for various capabilities and also includes information about airport improvements that will increase capacity and efficiency.

Successful implementation of these capabilities may depend on changing systems such as the FAA's Telecommunications Infrastructure, or implementing systems such as Automatic Dependent Surveillance — Broadcast. Development and implementation can also be affected by other internal and external factors, such as program interdependencies, realignment of priorities or concept validation work. This means we may have to adjust the timeline or the scope of a capability.

In the course of development and as capabilities become more refined, we have changed the name of some capabilities to more accurately reflect the improvement they will provide. As operational improvements mature, we have moved some capabilities from one portfolio to another to better manage interdependencies. The implementation dates for some increments have also shifted. These changes are indicated in footnotes and marked with open bars on the timelines in affected portfolios.

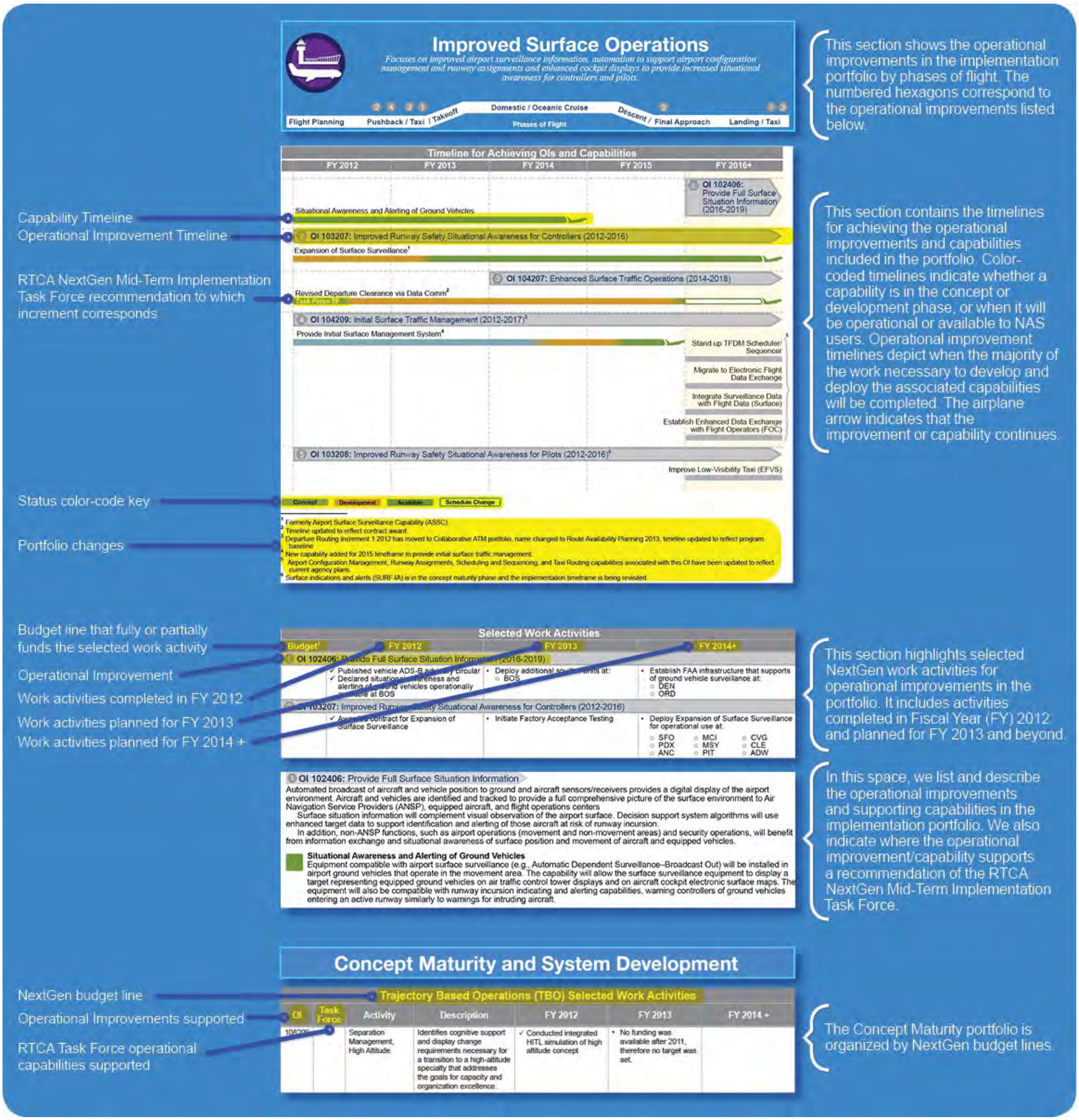
The capabilities displayed in the implementation portfolio timelines depict our current plans through 2015. Detailed planning for post-2015 capabilities scheduled for deployment through the end of the NextGen mid-term in 2020 and beyond, is ongoing. Additionally, some increments are in concept development and we have not yet determined when these capabilities will be available. While these increments are shown in the implementation portfolio timelines as becoming available in 2016 or later, preliminary work to further develop those increments is ongoing.

The FAA is using a segment planning approach, which offers additional insight into the development and implementation of capabilities in the 2016 time frame and beyond while facilitating lower-level program planning. While the degree of uncertainty is higher, the segment planning approach guides the agency's concept maturity work.

Before we implement a NextGen capability in the NAS, we complete a lengthy and complex process of development. Once we have conceived a concept for developing a needed capability, the FAA matures and validates that concept through research, modeling, simulated and operational demonstrations, Human-in-the-Loop testing and other activities. This concept validation work often leads to a decision to implement a certain capability. In that case, we add the capability, or increment, to one of the implementation portfolios. In some cases, our pre-implementation work does not validate the proposed concept or benefit, that is, the proposed capability does not provide benefit to the NAS, and development stops.

The Concept Maturity and System Development portfolio includes pre-implementation activities, funded by the NextGen capital budget, for several operational improvements and some work that is not yet directly associated with an implementation portfolio. Some activities support more than one operational improvement.

HOW TO READ PORTFOLIOS



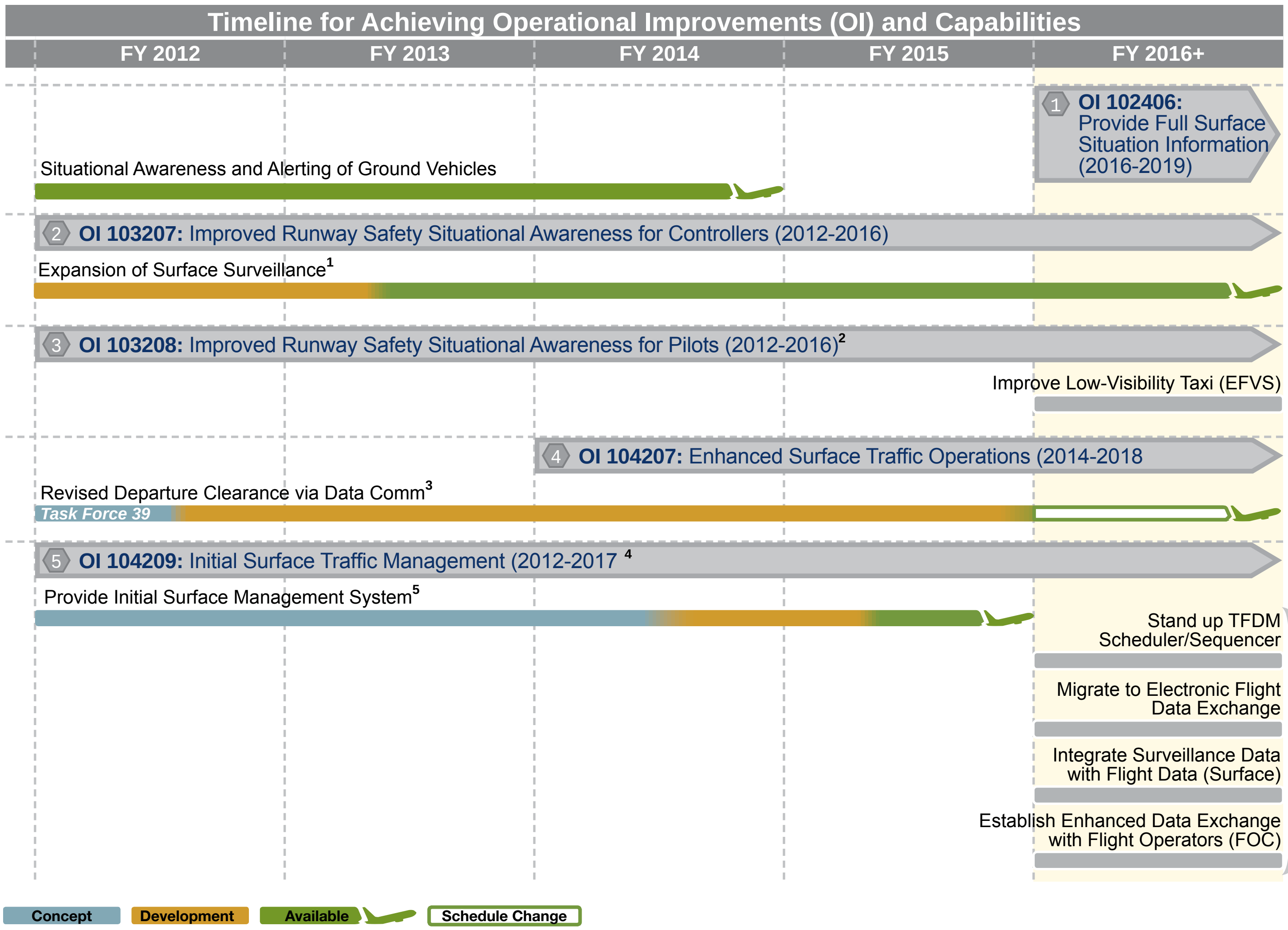
Selected NextGen Capabilities by Portfolio for Implementation in 2012-2013

This map shows the location of selected NextGen capabilities implemented in 2012 and capabilities we plan to deliver in 2013.

NAS-Wide
Collaborative Airspace Constraint Resolution
RNAV (GPS) Approaches
ASIAS Collaboration Capabilities
MSP
RNAV SIDs and STARs at Single Sites
External Surface Data Release
BOS
Situational Awareness and Alerting of Ground Vehicles
ZBW
Transition to PBN Routing for Cruise Operations
New York Metropolitan Area
Large-Scale Redesign of Airspace Leveraging PBN
MKE
External Surface Data Release
Philadelphia Metropolitan Area
Large-Scale Redesign of Airspace Leveraging PBN
ZNY
Transition to PBN Routing for Cruise Operations
ORD
External Surface Data Release
Chicago Metroplex
OAPM
New Jersey Metropolitan Area
Large-Scale Redesign of Airspace Leveraging PBN
MDW
External Surface Data Release
EWR
GBAS Category I Non-Federal System Approval
PCT
ATPA
Additional 7110.308 Airports
SDF
ATPA
MEM
RNAV SIDs and STARs at Single Sites
Wake Re-Categorization Phase 1 – Aircraft Re-Categorization
Charlotte Metroplex
OAPM
A80
ATPA
Atlanta Metroplex
OAPM
Houston Metroplex
OAPM
MIA
RNAV SIDs and STARs at Single Sites

Improved Surface Operations

Focuses on improved airport surveillance information, automation to support airport configuration management and runway assignments and enhanced cockpit displays to provide increased situational awareness for controllers and pilots.



1 Formerly Airport Surface Surveillance Capability (ASSC).

2 Surface Indications/Alerts is in the concept maturity phase and the implementation time frame is being revisited.

3 Timeline updated to reflect contract award

4 Departure Routing Increment 1 2012 has moved to Collaborative ATM portfolio, name changed to Route Availability Planning 2013, timeline updated to reflect program baseline.

5 New capability added for 2015 time frame to provide initial surface traffic management

6 Airport Configuration Management, Runway Assignments, Scheduling and Sequencing, and Taxi Routing capabilities associated with this OI have been updated to reflect current agency plans.

Improved Surface Operations

Selected Work Activities			
Budget	**FY 2012**	**FY 2013**	**FY 2014+**
1 OI 102406: Provide Full Surface Situation Information (2016-2019)			
Supported by ADS-B	✓ Published vehicle ADS-B advisory circular ✓ Declared situational awareness and alerting of ground vehicles operationally available at ○ BOS	• Deploy additional squitter units at ○ BOS	• Establish FAA infrastructure that supports ground vehicle surveillance at ○ DEN ○ ORD
2 OI 103207: Improved Runway Safety Situational Awareness for Controllers (2012-2016)			
Supported by ADS-B	✓ Awarded contract for Expansion of Surface Surveillance	• Initiate factory acceptance testing	• Deploy Expansion of Surface Surveillance for operational use at ○ SFO ○ MCI ○ CVG ○ PDX ○ MSY ○ CLE ○ ANC ○ PIT ○ ADW
4 OI 104207: Enhanced Surface Traffic Operations (2014-2018)			
Supported by NextGen Data Comm	✓ Achieved final investment decision for Data Comm tower service	• Complete Revised Departure Clearance trials procedures and training development	• Deploy revised DCL via Data Comm for operational use to suitably equipped operators
5 OI 104209: Initial Surface Traffic Management (2012-2017)			
Supported by NextGen TFDM	✓ Completed installation of DDUs at ASDE-X and ASDE-3/ multilateration locations. Provided data dissemination capability at ○ DEN ○ MSP ○ MDW ○ SLC ○ MKE ○ ORD ✓ Published FAA Order 1200.22E	• Complete documentation in support of an initial investment decision for TFDM	• Complete documentation in support of a final investment decision for TFDM • External Surface Data Release - Publish to NEMS from all sites that have ASDE-X and ASSC • Provide Initial Surface Management System to selected sites

Descriptions of OIs and Capabilities

1 OI 102406: Provide Full Surface Situation Information

Automated broadcast of aircraft and vehicle position to ground and aircraft sensors/receivers provides a digital display of the airport environment. Aircraft and vehicles are identified and tracked to provide a f ll comprehensive picture of the surface environment to air navigation service providers (ANSP), equipped aircraft, and fli ht operations centers.

Surface situation information will complement visual observation of the airport surface. Decision support system algorithms will use enhanced target data to support identification and alerting of hose aircraft at risk of runway incursion.

In addition, non-ANSP functions, such as airport operations (movement and non-movement areas) and security operations, will benefi from information exchange and situational awareness of surface position and movement of aircraft and equipped vehicles.

Situational Awareness and Alerting of Ground Vehicles
Equipment compatible with airport surface surveillance, e.g., Automatic Dependent Surveillance–Broadcast (ADS-B) Out, will be installed in airport ground vehicles that operate in the movement area. The capability will allow the surface surveillance equipment to display a target representing equipped ground vehicles on air traffic control tower displays and on aircraft cockpit electroni surface maps. The equipment will also be compatible with runway incursion indicating and alerting capabilities, warning controllers of ground vehicles entering an active runway similarly to warnings for intruding aircraft.

2 OI 103207: Improved Runway Safety Situational Awareness for Controllers

At large airports, current controller tools provide surface displays and can alert controllers when aircraft taxi into areas where a runway incursion could result. Additional ground-based capabilities, including expansion of runway surveillance technology, e.g., Airport Surface Detection Equipment–Model X (ASDE-X), to additional airports, will be developed to improve runway safety.

Task Force: Surface

Expansion of Surface Surveillance
Nine airports using the Airport Surface Detection Equipment–Model 3 (ASDE-3)/Airport Movement Area Safety System for situational awareness and surveillance of the airport surface, and not scheduled to receive ASDE-X, will receive the Airport Surface Surveillance Capability (ASSC). ASSC receives inputs from multilateration system sensors, ADS-B, and Airport Surveillance Radar/Mode Select terminal radars. This will provide a fused target position of all transponder-equipped aircraft and ADS-B-equipped ground vehicles on the airport surface movement area, as well as aircraft flying w thin five miles of the airport, for display in the airport cont ol tower. The ASDE-3 primary surface radar will be decommissioned after ASSC installation.

In Concept Exploration | **In Development** | **Available** at least one site

Descriptions of OIs and Capabilities

3 OI 103208: Improved Runway Safety Situational Awareness for Pilots

Runway safety operations are improved by providing pilots with improved awareness of their location on the airport surface as well as runway incursion alerting capabilities. Additional enhancements may include cockpit displays of surface traffic, e.g., vehicles and aircraft and the use of a cockpit display that depicts the runway environment.

Improve Low-Visibility Taxi (EFVS)
The FAA and industry are partnering to develop a taxi benefit for airc aft equipped with certified enhanced vision systems. Currentl , Enhanced Flight Vision System (EFVS)-equipped operators can use their EFVS only for approved situational awareness and safety while on the ground. Some operators have requested that they be authorized taxi benefits when their company s weather minimums are lower than an airport's weather operating minimums and if their aircraft are equipped with EFVS. The FAA is evaluating the feasibility of this request in concert with other activities related to improved low-visibility surface operations.

4 OI 104207: Enhanced Surface Traffic Operation

Terminal automation provides the ability to transmit automated terminal information, departure clearances and amendments and taxi route instructions via Data Communications (Data Comm), including hold-short instructions.

Revised DCL via Data Comm
A Departure Clearance (DCL) Data Comm capability will allow controllers to rapidly issue departure clearance revisions, due to weather or other airspace issues, to one or more aircraft equipped with Data Comm. The use of Data Comm for this type of capability has both safety and efficiency benefits over the current voice- sed method of communications between controllers and pilots. This initial implementation of DCL is planned for radios and Future Air Navigation System messaging as the link scheme.
Task Force: Data Communications for Revised Departure Clearance, Weather Reroutes and Routine Communications (39)

5 OI 104209: Initial Surface Traffic Managemen

Departures are sequenced and staged to maintain throughput. ANSP uses automation to integrate surface movement operations with departure sequencing to ensure aircraft meet departure schedule times while optimizing the physical queue in the movement area.
Task Force: Surface

Provide Initial Surface Management System
This increment will provide an initial surface situational awareness capability to FAA facilities outside of the Air Traffic Control Tower (ATCT), specifically in the Traffic Management Unit for Terminal Radar Approach Control, Air Route Traffic Control Centers or Air Traffic Control System Command Cente . This capability will provide improved knowledge of surface congestion in these facilities, and improved coordination of air traffic control and Traffic Flow Management actions across several facilities. It is envisioned to include a display of the current surface situation, e.g., using ASDE-X data.

Stand Up Terminal Flight Data Manager Scheduler/Sequencer
This capability generates and displays a projected runway schedule showing arrival and departure demand, improving departure schedule integrity. It provides Traffic Flow Management constraints to tower controllers, such a Expected Departure Clearance Times. This capability also generates and disseminates flight state da a.

Migrate to Electronic Flight Data Exchange
This capability provides for the introduction of Electronic Flight Strip capability in the ATCT, including updated flight coordinatio with Terminal Radar Approach Control, and potentially also including the replacement of the interface with En Route Automation Modernization. It replaces paper flight strips and several prot type electronic flight strip implementations

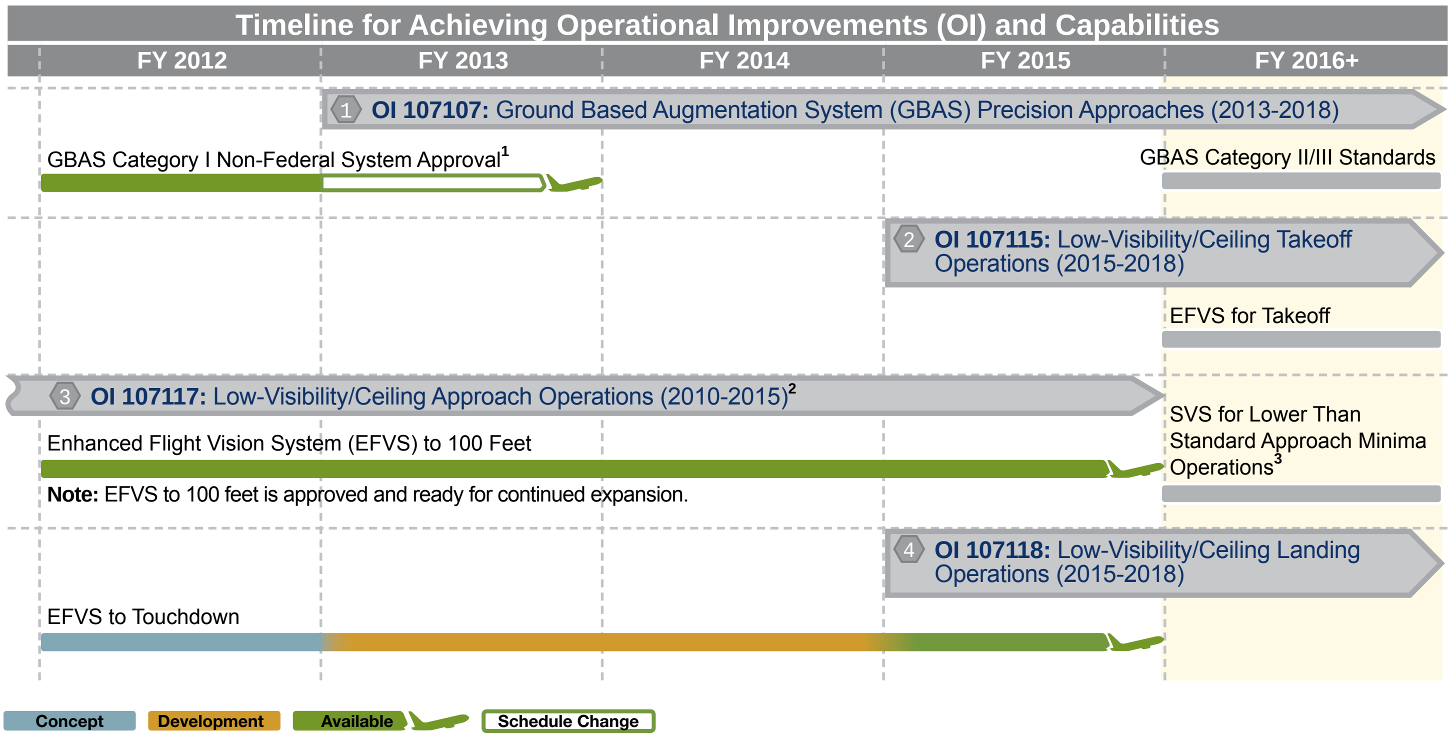
Integrate Surveillance Data with Flight Data (Surface)
This capability is intended to integrate surface surveillance functionality (e.g., ASDE-X, Airport Surface Surveillance Capability), including safety logic, onto a more capable platform. This will include the integration of full flight plan informati n with surveillance data, and also provide the basis for Surface Traffic Management

Establish Enhanced Data Exchange with Flight Operators (FOC)
This increment will provide architecture, data standards, and policy for FAA to exchange data with flight operators. AA will make surface flow management data and plans available to flight oper ors. In return, flight operators will make updated flight-speci information, including updates of pushback readiness times and parking locations available to FAA. Policy and procedures will govern how the information is shared, how the data can be used, and how flight operators participate. Exact data to be exchang d will be determined by the Collaborative Decision-Making process.

In Concept Exploration | **In Development** | **Available** at least one site

Improved Approaches and Low-Visibility Operations

Outlines ways to increase access and flexibility for approach operations through a combination of procedural changes, improved aircraft capabilities and improved precision approach guidance.



[1] Dependent on system acceptance by Houston Airport System.
[2] LPV Approaches has moved to Performance Based Navigation portfolio, name changed to RNAV (GPS) Approaches.
[3] Dependent on input from industry.

Selected Work Activities

Budget	FY 2012	FY 2013	FY 2014+
1 OI 107107: Ground Based Augmentation System (GBAS) Precision Approaches (2013-2018)			
Supported by NextGen Flexible Terminal Environment	✓ Declared GBAS Cat I system operationally available at ○ EWR	• Declare GBAS Cat I System operationally available at ○ IAH	
3 OI 107117: Low-Visibility/Ceiling Approach Operations (2010-2015)			
Supported by Operations Appropriations	✓ Completed NPRM for EFVS to 100 feet	• Publish NPRM for EFVS to 100 feet	• Disposition public comments from NPRM for EFVS to 100 feet • Begin drafting final rule for EFVS to 100 feet
4 OI 107118: Low-Visibility/Ceiling Landing Operations (2015-2018)			
Supported by Operations Appropriations	✓ Completed NPRM for EFVS to touch down	• Publish NPRM for EFVS to touch down	• Disposition public comments from NPRM for EFVS to touch down • Begin drafting final rule for EFVS to touch down

Descriptions of OIs and Capabilities

1 OI 107107: Ground Based Augmentation System (GBAS) Precision Approaches

GPS/GBAS support precision approaches to Cat I and eventually Cat II/III minima for properly equipped runways and aircraft. GBAS can support approach minima at airports with fewer restrictions to surface movement and offers the potential for curved precision approaches. GBAS may also support high-integrity surface movement requirements.

GBAS Category I Non-Federal System Approval
GBAS provides local corrections to GPS to improve accuracy, integrity, and availability of the navigation service. GBAS is designed and being implemented to enable GBAS Landing System precision instrument approaches to Category (Cat) I, and eventually Cat II/III, minima for multiple runways. This includes runways not served by Instrument Landing Systems (ILS). The GBAS systems design for Cat I use in the National Airspace System was approved in 2009 and will serve as an incremental step toward the development of a Cat III approach. GBAS Cat I is being implemented as a non-federal system on a per-airport request basis. The GBAS Cat I increment involves government-industry partnerships and is anticipated to result in service provision at the first airport in 2012

GBAS Category II/III Standards
GBAS is intended to provide precision approach service to Cat II/III minima without the need for critical area protection, and offer the potential for increased flexibility in approach design and highly accurate approach guidance to the runwa . Similar to GBAS Cat I, GBAS Cat II/III provides improved low-visibility access and increases operational efficiency and single- and multiple runway capacity through the use of GBAS ground stations. The FAA plans to develop Cat II/III standards for ground and avionics equipment and publish procedures for each runway end receiving GBAS service. The standards for GBAS Cat II/III are being developed in harmony with International Civil Aviation Organization standards.

2 OI 107115: Low-Visibility/Ceiling Takeoff Operations

Leverages same combination of head-up display, Enhanced Flight Vision System (EFVS), Synthetic Vision System (SVS) or advanced vision system to allow appropriately equipped aircraft to take off in low visibility conditions.

EFVS for Takeoff
EFVS for low-visibility takeoff operations and for authorization of increased operational benefit, beyond situational awareness an safety, for equipped users. Such authorization, if approved, would allow EFVS-equipped operators to use enhanced vision systems to meet takeoff visibility requirements, as well as depart from some runways with reduced infrastructure, e.g., no centerline lighting.

3 OI 107117: Low-Visibility/Ceiling Approach Operations

The ability to complete approaches in low-visibility/low-ceiling conditions is improved for aircraft equipped with some combination of navigation derived from augmented Global Navigation Satellite System (GNSS) or ILS and other cockpit-based technologies or combinations of cockpit-based technologies and ground infrastructure.

Enhanced Flight Vision System (EFVS) to 100 Feet
The ability to conduct an approach and land in low-visibility conditions depends largely on the type of approach and the aircraft's capability. Infrared sensor technology currently is used in EFVS to provide pilots with an enhanced visual image and allow them to see, in certain low-visibility conditions, the visual references necessary to continue descending below Decision Altitude/Decision Height (DA/DH) or Minimum Descent Altitude (MDA) on an instrument approach procedure. Under 14 CFR Part 91.175, the FAA already allows EFVS to be used in lieu of natural vision to descend below DA/DH or MDA down to 100 feet above the runway touchdown zone on an instrument approach procedure. In order to descend below 100 feet, however, the visual references must be identified using natural vision

The FAA is engaged in rulemaking to enhance the benefits of having EFV capability by allowing commercial operators to dispatch and begin instrument approaches in more low-visibility conditions than currently authorized.

Synthetic Vision System (SVS) for Lower Than Standard Approach Minima Operations
The FAA is evaluating various concepts for allowing SVS technology to be used to conduct instrument approach procedures with lower-than-standard minima (Cat II, special authorization (SA) Cat I, SA Cat II) or in lieu of certain ground infrastructure.

4 OI 107118: Low-Visibility/Ceiling Landing Operations

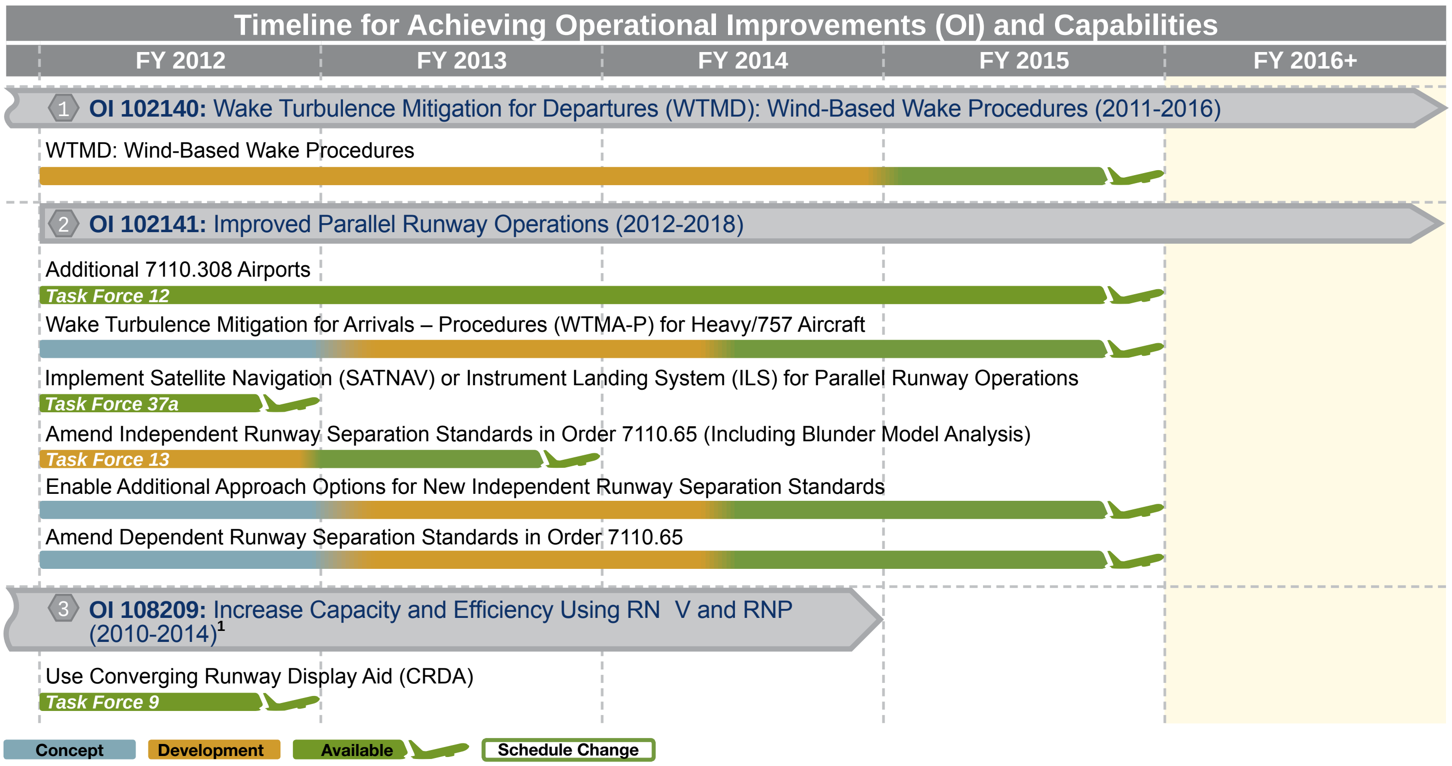
The ability to land in low-visibility/low-ceiling conditions is improved for aircraft equipped with some combination of navigation derived from augmented GNSS or ILS and head-up guidance systems, EFVS, SVS, advanced vision system and other cockpit-based technologies that combine to improve human performance.

EFVS to Touchdown
EFVS will allow improved access, with a greater assurance of landing without needing to execute a missed approach. The FAA continues to work with RTCA on concepts, standards and criteria to support the use of EFVS all the way to touchdown. The FAA also is engaged in rulemaking activity that would permit EFVS to be used to touchdown. Under specific visibility conditions, author zed users could utilize the enhanced visual image to touchdown, which will further increase access to runways in low-visibility conditions.

In Concept Exploration | **In Development** | **Available** at least one site

Improved Multiple Runway Operations

Improves runway access through the use of improved technology, updated standards, safety analysis and modifications to air traffic monitoring tools and operating procedures that will enable more arrival and departure operations.



[1] Formerly OI 104109: Current Arrival/Departure Sequencing

Selected Work Activities

Budget	FY 2012	FY 2013	FY 2014+
1 OI 102140: Wake Turbulence Mitigation for Departures (WTMD): Wind-Based Wake Procedures (2011-2016)			
Supported by NextGen Flexible Terminal Environment	✓ Reviewed safety risk management document	• Initiate controller training in preparation for WTMD operational prototype demonstration at ○ IAH • WTMD Installation at ○ SFO	• Complete Data Collection of WTMD at ○ IAH ○ SFO ○ MEM • WTMD operationally available at ○ IAH
2 OI 102141: Improved Parallel Runway Operations (2012-2018)			
Supported by NextGen Flexible Terminal Environment	✓ Reviewed safety risk management document on proposed standards for independent runway separation ✓ Expanded the application of FAA Order 7110.308 at ○ EWR ○ SFO ✓ Completed Blunder Model Revision	• Complete document change proposal for reduced standards for dual simultaneous independent parallel instrument approaches in Order 7110.65 • Complete safety study for reduced separation standards for simultaneous dependent parallel approach • Investigation of next Order 7110.308 sites: ○ LAS ○ PHX • Complete safety assessment for WTMA-P for Heavy/B757	• Review safety risk management document on proposed standards for simultaneous dependent parallel approach • Complete Safety Analysis for reduced separation standards for simultaneous independent parallel approaches – dual with offset • Complete Safety Analysis for reduced separation standards for simultaneous independent parallel approaches – triples
3 OI 108209: Increase Capacity and Efficiency Using RN V and RNP (2010-2014)			
Supported by Operations Appropriations	✓ Developed CRDA training program for air traffic control specialist		

Descriptions of OIs and Capabilities

1 OI 102140: Wake Turbulence Mitigation for Departures (WTMD): Wind-Based Wake Procedures

Procedures are developed at applicable locations based on the results of analysis of wake measurements and safety analysis using wake modeling and visualization. During peak-demand periods, these procedures allow airports to maintain airport departure throughput during favorable wind conditions. A staged implementation of changes in procedures and standards, as well as the implementation of new technology, will safely reduce the impact of wake vortices on operations. This reduction applies to specific types of aircraft and is bas d on wind transporting an aircraft's wake away from the parallel runway's operating area.

WTMD: Wind-Based Wake Procedures
Changes to wake rules are implemented based on wind measurements, allowing more closely spaced departure operations procedures to maintain airport/runway capacity. Procedures are developed at applicable locations based on the results of wake measurements and safety analyses using wake modeling and visualization. During peak demand periods, these procedures allow airports to maintain airport departure throughput during favorable wind conditions. A staged implementation of changes in procedures and standards, as well as the implementation of new technology, will safely reduce the impact of wake vortices on operations. This reduction applies to specific types of aircraft and is based on wind transporting an aircraft's wake away from the parallel runway's operating area.

2 OI 102141: Improved Parallel Runway Operations

This improvement will explore concepts to recover lost capacity through reduced separation standards, increased applications of dependent and independent operations, enabled operations in lower-visibility conditions and changes in separation responsibility between air traffic control and the flight dec

Task Force: Runway Access

Additional 7110.308 Airports
This increment provides airports with maximum use of closely spaced parallel runways by authorizing participating aircraft to operate at reduced lateral and longitudinal spacing on dependent, instrument approach procedures to runways with centerline spacing less than 2,500 feet. This increment will expand the application of FAA Order 7110.308 beyond the locations and runway ends already approved, and implement this capability using available ground and airborne equipment, existing displaced runway thresholds, historical wind data and procedural modifications to instrument approach procedures to maximize the reduced separation benefit
Task Force: Increase Use of Staggered Approaches (12)

Wake Turbulence Mitigation for Arrivals-Procedures (WTMA-P) for Heavy/B757 Aircraft
This increment allows heavy and Boeing 757 aircraft to lead a dependent, staggered instrument approach procedure to closely spaced parallel runways at spacings less than the single-runway separation used today. This will increase the efficiency of runwa throughput at approved airports. Operational availability is planned for 2014-2015.

Implement Satellite Navigation (SATNAV) or Instrument Landing System (ILS) for Parallel Runway Operations
This increment will enable policy, standards and procedures to allow use of SATNAV or ILS when conducting simultaneous independent and dependent instrument approaches, and implement this new capability at approved locations. The current standard for parallel approaches relies on ILS for simultaneous independent and dependent approaches. This increment expands this capability by implementing both unaugmented GPS-based approaches, such as Area Navigation (RNAV) (GPS), and RNAV Required Navigation Performance (RNP), as well as Wide Area Augmentation System-augmented GPS-based approaches, such as Localizer Performance with Vertical Guidance and Ground Based Augmentation System Landing System (GLS), for these parallel approach applications. This provides more options for air traffic control and users du ing Instrument Meteorological Conditions (IMC). Further research and evaluation of GLS approaches is required, but their inclusion in a future update to FAA Order 7110.65 is expected. These additional options increase the chance of maintaining higher throughput when needed to support demand.

This improvement will increase access to parallel runways during IMC, particularly where various constraints prevent ILS installation, and will allow continued operation using SATNAV as a backup approach option if the ILS is out of service.
Task Force: Implement CSPO: SATNAV or ILS (37a)

Amend Independent Runway Separation Standards in Order 7110.65 (Including Blunder Model Analysis)
This increment amends runway spacing standards to achieve increased access to parallel runways with centerline spacing less than 4,300 feet without high-update surveillance, and implements this change at approved locations. Current runway spacing standards for independent closely spaced parallel approaches are based, in part, on outdated assumptions about aircraft blunder rates that include severity and frequency. Due to the fact that the blunder assumptions were based on information available 20 years ago and some subjective views at the time, current spacing standards may be unnecessarily conservative, limiting capacity and airport growth. This increment includes the collection and analysis of data leading to a revision of these assumptions, followed by a safety analysis to determine possible new, reduced, safe minimum spacing for simultaneous independent approaches in IMC, as outlined in FAA Order 7110.65.

Changes to standards will result in increased access in a number of possible ways, including reducing spacing for new runway construction and allowing independent approach operations where currently only dependent, or single-runway, operations are authorized.
Task Force: Revise the Blunder Assumptions (13)

In Concept Exploration | **In Development** | **Available** at least one site

Descriptions of OIs and Capabilities

Enable Additional Approach Options for New Independent Runway Separation Standards
The analysis that provided the basis for the recommended simultaneous independent parallel instrument approach (SIPIA) runway separation standard addressed the use of ILS, Localizer Performance with Vertical Guidance, and Ground Based Augmentation System Landing System approach operations, for determining the limits of safe operation utilizing current National Airspace System (NAS) infrastructure with no high-update surveillance. This increment will enable use of additional GPS-based approach options with vertical guidance that may include Lateral Navigation/Vertical Navigation, RNP and RNP Authorization Required for use in performing SIPIAs to runways at reduced lateral runway separation (less than 4,300 feet). It is anticipated that these approach options will meet the same independent runway separation standard as determined in Order 7110.65. However, further analysis is required to determine the supported lateral runway spacing. These additional approach options will allow for continued use of higher throughput procedures, for example, if the ILS is out of service or where no ILS currently exists.

Amend Dependent Runway Separation Standards in Order 7110.65
This increment will support the safety analysis and additional work required to identify a revised separation standard for simultaneous dependent parallel instrument approaches (runways spaced between 2,500 feet and 4,299 feet), as well as revise FAA Order 7110.65 to permit this operation. This would lead to a significant increase in the arrival rate f r dependent operations.

3 OI 108209: Increase Capacity and Efficiency Using RN V and RNP

The spacing and sequencing of air traffic safely maximizes the fficiency and capacity of the NAS throughout the arrival and de arture phases of flight. Air traffic controllers optimize the arrival and departure port on of flight by sequencing and spacing aircraft on fin approach and coordinating arrival and departure air traffic wit adjacent air traffic control facilities. The primary factor in establishing spacing and sequencing is the principle of “first come, first s ved.” Other factors may include emergencies, presidential movement, lifeguard, etc. Controllers apply separation standards to achieve efficient use of airports and the navigable airspace between them.

Traffic Management Coordinators (TMC) establish initial traffic nagement planning and anticipated flow rates using arrival/depa ture rates and current/anticipated airport conditions. TMC functionality is distributed throughout the NAS to traffic anagement units at Air Route Traffic Control Centers, high-activity Terminal Radar Approach Control facilities, and at the highest-activity airport traffic contro towers. Each plays a role in arrival and departure sequencing, depending upon the current conditions. The TRACON plays a major role in the spacing and sequencing in the terminal area. Arrival traffic is sequenced by using speed control and vectori g until cleared for the appropriate approach. Departures are handled in a similar manner with speed control and vectoring until transitioned to the en route environment. Additionally the Departure Spacing Program evaluates aircraft flight plans at participating airports, models projected aircraft demand at shared departure fixes, and provides windows of depar ure times to controllers based on projected fix crossing times

In performing traffic synchronization functions, controlle s receive input from various sources such as, voice and data communications, and weather and automation systems. Voice inputs include Pilot Reports (PIREPS) via radio from aircraft, coordination air traffic contro towers, other TRACON positions, adjacent ATC facilities, Traffic Management Unit, and the TRACON area supervisor.

Data inputs include track and weather data from Airport Surveillance Radar and Air Traffic Control Beacon Interrogator–Model 5/Mod S, and intent/flight plan data from the Host Computer System. The controller may also enter information directly.

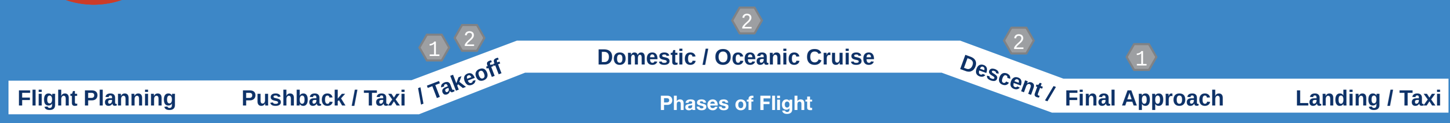
Task Force: Runway Access

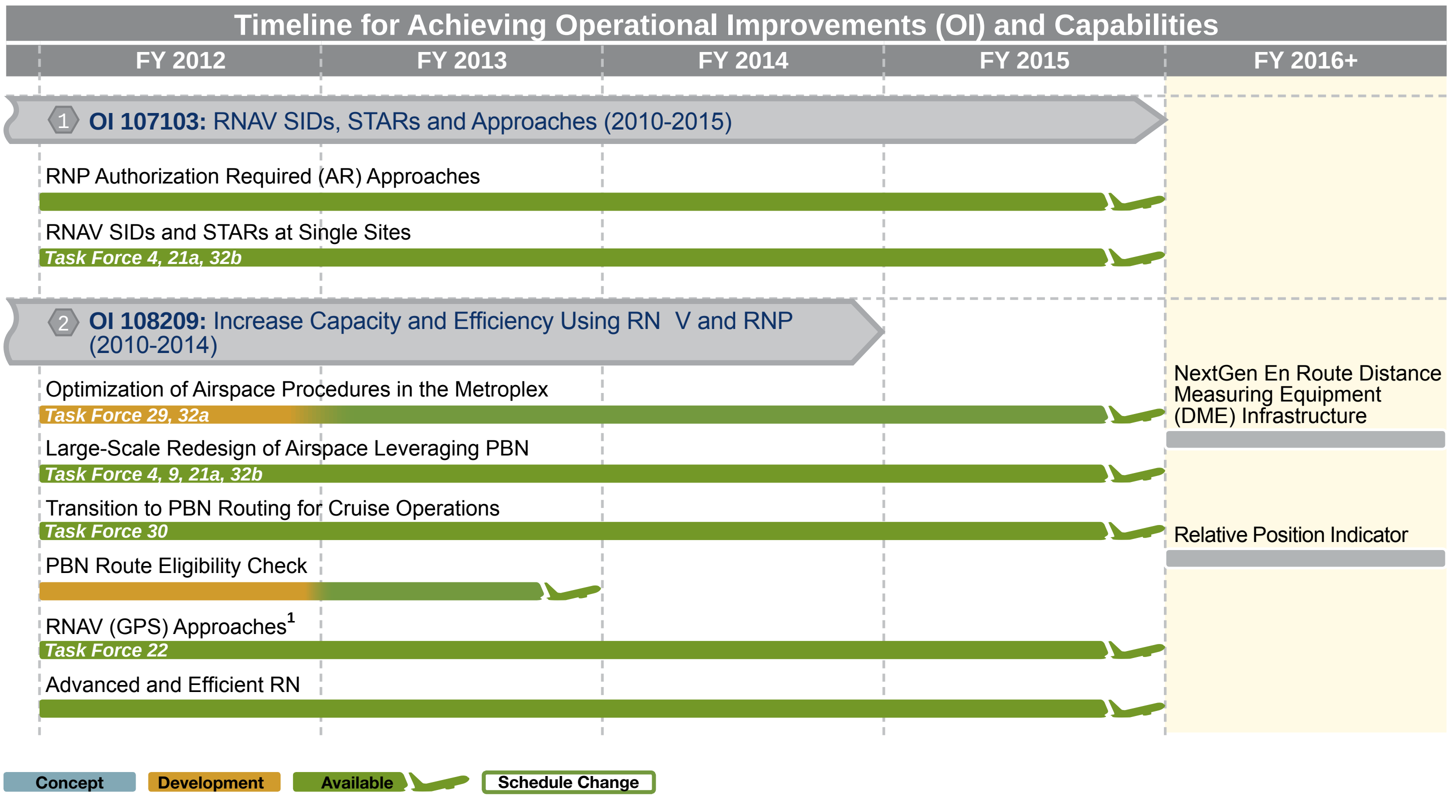
Use Converging Runway Display Aid (CRDA)
CRDA is an automation aid used by air traffic controllers to judge patial relationships between aircraft that are destined for converging or intersecting runways. CRDA projects position information for an aircraft approaching one runway onto the straight-in final approach course of another aircraft approaching a converg ng or intersecting runway (known as “ghost” targets), thus allowing a controller to easily visualize and direct a safe and efficien separation distance between the two arriving aircraft. This activity is assessing the current use of CRDA functionality and facilitating the development of procedures to extend its use. This activity supports the implementation of an arrival/departure window tool at selected sites.
Task Force: Increase Capacity and Throughput for Converging and Intersecting Runways (9)

In Concept Exploration | **In Development** | **Available** at least one site

Performance Based Navigation

Addresses ways to leverage emerging technologies, such as satellite-based Area Navigation and Required Navigation Performance, to improve access and flexibility for point-to-point operations.





[1] Formerly LPV Approaches, moved from Improved Approaches and Low-Visibility Operations portfolio.

Selected Work Activities

Budget	FY 2012	FY 2013	FY 2014+
1 **OI 107103:** RNAV SIDs, STARs and Approaches (2010-2015)			
Supported by Operations Appropriations	✓ Completed 4 STARs at ○ BOS ✓ Completed 2 SIDs at ○ MSP ✓ Completed 2 STARs at ○ LAX ✓ Completed 18 SIDs and 4 STARs at ○ MEM ✓ Completed 4 SIDs at ○ MIA	• Complete RNPs at ○ DEN • Publish SIDs at ○ DEN • Publish STARs and RNPs at ○ MSP • Publish procedures at ○ SEA • Publish SIDs at ○ MSP • Publish STARs at ○ PDX	• Continue implementation of RNAV SIDs, STARs and Approaches

Performance Based Navigation

Selected Work Activities			
Budget	**FY 2012**	**FY 2013**	**FY 2014+**
OI 108209: Increase Capacity and Efficiency Using RN V and RNP (2010-2014)			
Supported by NextGen PBN-Metroplex RNAV/RNP	✓ Completed Las Vegas Optimization environmental assessment ✓ Initiated design teams for implementation of PBN-optimized airspace and procedures at ○ Charlotte Metroplex ○ Southern California Metroplex ○ Atlanta Metroplex ○ Houston Metroplex ✓ Selected sites for next set of study teams for implementation of PBN-optimized airspace and procedures ✓ Completed ZAB (1 route) Q 37 route implementation ✓ Completed implementation of ZNY 4 Q-routes ✓ Declared PBN route eligibility check operationally available at key sites ✓ Completed ZSE 9 Q-routes implementation ✓ Completed ZBW 3 T-routes implementation ✓ Published 500 WAAS LPV and LP procedures	• Continue Las Vegas Optimization: ○ Complete Phase 1 implementation ○ Complete Phase 1 training and development ○ Complete Phase 1 cutover • Complete 1st Article for NextGen En Route DME Infrastructure • Initiate implementation for PBN-optimized airspace and procedures at ○ Houston Metroplex • Initiate PBN Optimization of Airspace and procedures projects for: ○ Chicago Metroplex ○ Phoenix Metroplex • Continue production of 500 WAAS LPV and LP procedures per year	• Implement remaining stages of New York/New Jersey/Philadelphia Metropolitan Area Airspace Redesign ○ Stage 2B: PHL route expansion and 3rd dispersal heading • Complete Las Vegas Optimization procedure implementation • Initiate Stage 3: West Side of Chicago Airspace Program Controller training Chart 1 & 2 • Complete implementation of PBN-optimized airspace and procedures for: ○ Washington Metroplex ○ Houston Metroplex • Implement remaining stages of New York/New Jersey/Philadelphia Metropolitan Area Airspace Redesign ○ Stage 3: North Gate realignment ○ Stage 4: full airspace integration • Continue production of 500 WAAS LPV and LP procedures per year

Descriptions of OIs and Capabilities

1 OI 107103: RNAV SIDs, STARs and Approaches

Area Navigation (RNAV) is available throughout the National Airspace System (NAS) using satellite-based avionics equipment and systems.

Task Force: Metroplex

RNP Authorization Required (AR) Approaches
Required Navigation Performance (RNP) AR approaches are performance-based navigation operations that are implemented to meet the needs of the airspace users and airports in terms of efficienc , safety, and access. A key feature of RNP AR approaches is the ability to use curved, guided path segments known as radius-to-fix (RF). RN AR is an optional capability that involves avionics and flight crew training. Safety analysis will be conducted to elp determine the feasible route spacing for these approaches based on equipage.

RNAV SIDs and STARs at Single Sites
This increment covers Performance Based Navigation (PBN) procedure improvements initiated and developed outside of the Optimization of Airspace and Procedures in the Metroplex (OAPM) and Large-Scale Redesign of Airspace Leveraging PBN increments. These RNAV procedures address location-specific requirements and seek to add efficiency and optimize existing initia capability PBN procedures.
Task Force: Integrate Procedure Design to Deconflict Airports, Implement RNP with Radius-to-Fix (RF) Capability, and Expand Use of Terminal Separation Rules (4, 21a and 32b)

2 OI 108209: Increase Capacity and Efficiency Using RNAV and RNP

RNAV and RNP can enable more efficient aircraft trajectories. Combined with airspace changes, RNAV and RNP increase airspace efficiency and capacit .

Task Force: Metroplex, Cruise Overarching, and NAS Access

<u>**Navigation System Infrastructure**</u>

NextGen En Route Distance Measuring Equipment (DME) Infrastructure
Additional DME coverage over the continental United States is needed to optimize and expand RNAV routes by closing coverage gaps at and above Flight Level 240. Work is being done to improve the determination of Expanded Service Volumes (ESV) that may help eliminate DME gaps. Where ESVs cannot be established, DME will be installed at selected locations to support RNAV and Required Navigation Performance using DME/DME/Inertial Reference Unit as the primary navigation means, and provide backup if GPS is not available.

In Concept Exploration | **In Development** | **Available** at least one site

Descriptions of OIs and Capabilities

Integrated Airspace and Procedures

Optimization of Airspace Procedures in the Metroplex
OAPM is a systematic approach to implementing Performance Based Navigation procedures and associated airspace changes in major metropolitan areas with multiple airports, including all types of operations and connectivity with other metroplexes making use of existing aircraft equipage. Expected improvements from OAPM include efficient descents, diverging departure paths an decoupling of operations among airports within the metroplex airspace.

The OAPM expedited timeline and focused scope binds the airspace and procedures solutions to those that can be achieved without requiring an Environmental Impact Statement (requiring only an environmental assessment or categorical exclusion) and within current infrastructure and operating criteria. The major metroplexes addressed under OAPM have been defined in the RTCA Task Force 5 Final Report and FAA Destination 2025 and have been prioritized using criteria and considerations developed with aviation industry consensus.
Task Force: Optimize and Increase RNAV Procedures (32a and 29)

Large-Scale Redesign of Airspace Leveraging PBN
Airspace and procedures solutions that do not fit within the en ironmental and criteria boundaries of an Optimization of Airspace and Procedures in the Metroplex project become candidates for other integrated airspace and procedures efforts. Also included in this increment are the legacy airspace management program projects. These include projects started prior to the formation of the National Operational Airspace Council in August 2009 and include the New York/New Jersey/Philadelphia Metropolitan Area Airspace Redesign, Chicago Airspace Project, Houston Area Air Traffic System and the Las egas Optimization Project. Although these are considered legacy projects, many of the efficiencies and benefi gains will come from optimized PBN procedures.
Task Force: Integrate Procedure Design to Deconflict Airports, Implement RNP with RF Capability, and Expand Use of Terminal Separation Rules (4, 21a and 32b), Increase Capacity and Throughput for Converging and Intersecting Runways (9)

Transition to PBN Routing for Cruise Operations
This approach replaces the conventional Navigation Aid (NAVAID)-based Jet and Victor airways with RNAV routes, including high-altitude Q-routes. High-altitude RNAV routes offer an efficient way to navigate en route airspace instead of N VAID-to-NAVAID routing. Key focus areas include Q-route development connecting the terminal improvements in the OAPM and legacy large-scale airspace redesign projects, New York Wind Route Options Playbook transitions and resolution of en route choke points.
Task Force: Develop RNAV-Based En Route System (30)

RNAV (GPS) Approaches
RNAV approach procedures allow aircraft to fly precise paths, with and without vertical guidance, providing airports with signific nt increases in access, especially for runway ends not equipped with an Instrument Landing System (ILS), and in flexibilit , by providing an alternative instrument approach at airports with ILS. All RNAV approach procedures require the aircraft to be equipped with suitable RNAV avionics with GPS or the Wide Area Augmentation System (WAAS) and are published as RNAV(GPS) procedures. RNAV(GPS) approaches include minimums for lateral navigation (LNAV), LNAV with vertical navigation (LNAV/VNAV), localizer performance (LP), and localizer performance with vertical guidance (LPV). Implementation of RNAV (GPS) procedures with LPV or LP will continue until all qualified runway ends are served. This improvement will provide increased benefits to more than 5 ,000 general aviation aircraft (Part 23), 3,800 corporate business jets/turbo props (Part 25 and some Part 23) and 200 regional jets already equipped with WAAS.

In addition to LPV approach implementation, the FAA will deliver LP approaches to runways that do not qualify for LPVs due to obstacles. LP procedures will provide the lower possible minima for runways that cannot support LPV approaches.
Task Force: Implement LPV Approaches to Airports without Precision Approach Capabilities (22)

Advanced and Efficient RNP
This increment includes RNP-established for simultaneous and dependent parallel approaches and concurrent RNP operations at airports in close proximity (for example, SEA/BFI). RNP-established will allow suitably equipped RNP-capable aircraft to turn onto final to a parallel runway using an RN curved path without the necessity of 1,000 feet of vertical separation. This would allow shorter downwind legs for the suitably equipped aircraft, and also would allow Optimized Profile Descents. This increment will lead to development of safety case and air traffic control rule changes that enable the implementation of RNP-established for advanced RNP procedures, including parallel approaches to maximize the benefits to RNP-equipped aircraft. Operational benefits are anticipat d in the areas of safety, efficienc , predictability and the environment. This increment will be implemented only at SEA/BFI.

Air Traffic Tools/Automation

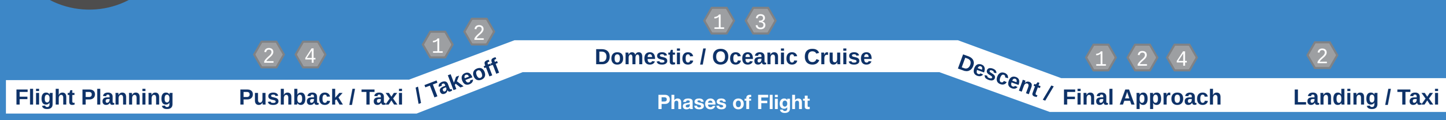
Relative Position Indicator
RPI is a tool that can assist both the controller and traffic m nagement in managing the flow of traffic through a terminal are merge point. RPI provides a symbol on the radar situation display that conveys relative position information for converging traffic. It does this by calculating the flight path distance to the merge of the sou ce aircraft and places the indicator at that distance as measured along the merging route, including curved paths. RPI's effectiveness is enhanced by the predictability and repeatability of flight tracks, lik those produced by RNAV, RNP, and advanced leg types, such as radius-to-fix legs and proced res.

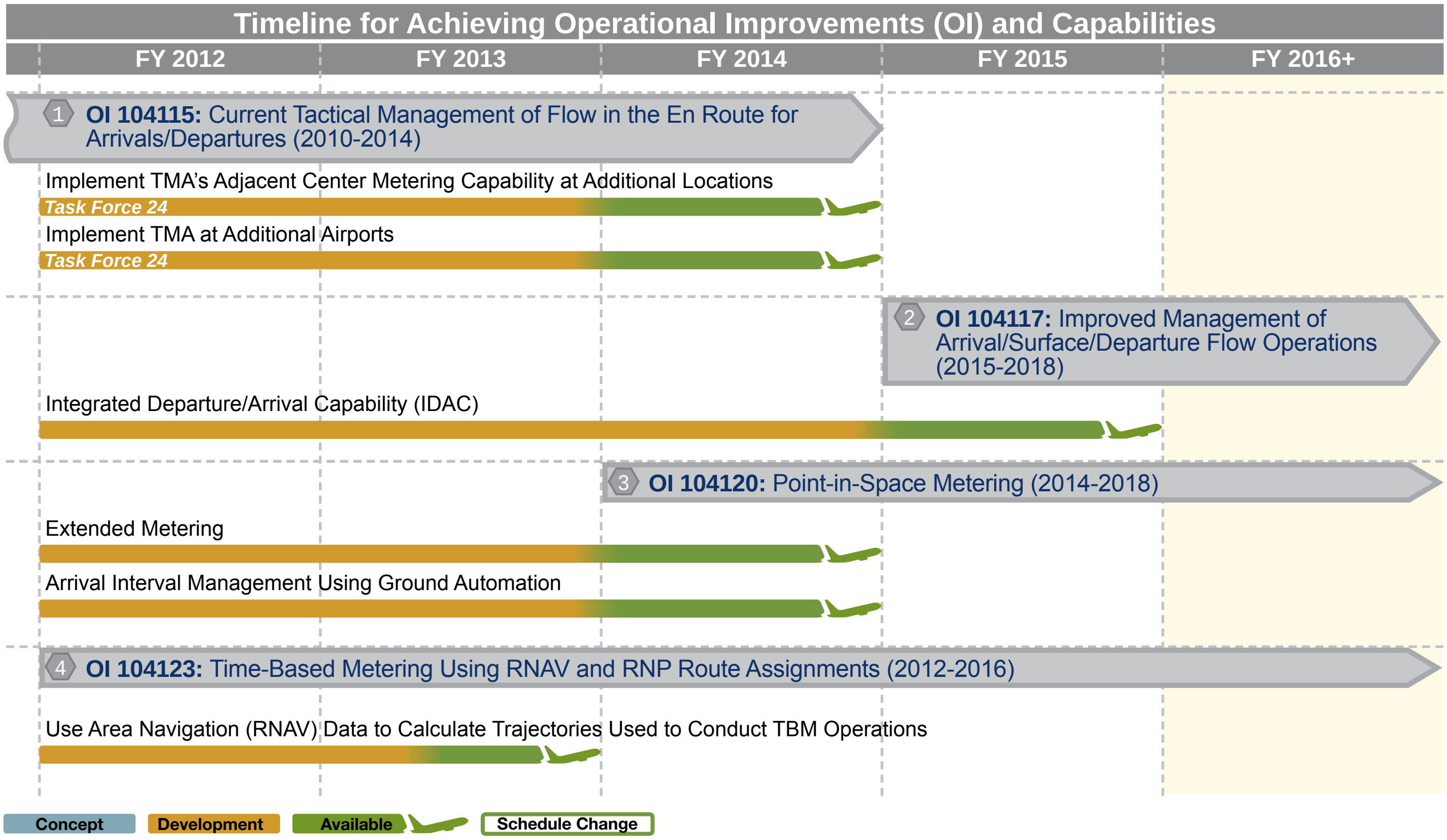
PBN Route Eligibility Check
En route automation will check the eligibility of aircraft to operate on performance-restricted routes. Performance-restricted routes are identified in system adaptation using associated attributes tha characterize the required performance. A filed flight plan amendme with ineligible routes will be rejected, the ineligible portion replaced with an alternative route, or indication provided to the controller that the flight is ineligible for a portion of its flight This capability is part of En Route Automation Modernization Release 3.

In Concept Exploration | **In Development** | **Available** at least one site

Time Based Flow Management[1]

Enhances system efficiency and improves traffic flow by leveraging the capabilities of the Traffic Management Advisor decision-support tool, a system that is already deployed to all contiguous U.S. Air Route Traffic Control Centers.





[1] The Arrival Interval Management using Ground Automation increment, which was included in the FY 2012 Appendix B, is not included in this timeline because it is in the concept maturity phase and the implementation timeline is being revisited.

Selected Work Activities

Budget	FY 2012	FY 2013	FY 2014 +
1 OI 104115: Current Tactical Management of Flow in the En Route for Arrivals/Departures (2010-2014)			
Supported by NextGen TBFM	✓ Developed site integration and deployment plan ✓ Implemented TMA's ACM Capability at Additional Locations: ○ SFO	• Develop site evaluation plan for Implementation of TMA at Additional Airports: ○ CLE ○ DCA ○ BWI • Develop site evaluation plan for Implementation of TMA's ACM Capability at Additional Locations: ○ IAD	• Implement TMA at Additional Airports: ○ BWI ○ DCA ○ TEB ○ CLE ○ HPN • Implement TMA's ACM Capability at Additional Locations: ○ ATL ○ SAN ○ LAX ○ IAD
2 OI 104117: Improved Management of Arrival/Surface/Departure Flow Operations (2015-2018)			
Supported by NextGen TBFM	✓ Initiated software development	• Develop integrated test strategies	• Declare IDAC operationally available at an ARTCC and an airport

Time Based Flow Management

Selected Work Activities			
Budget	**FY 2012**	**FY 2013**	**FY 2014 +**
③ **OI 104120:** Point-in-Space Metering (2014-2018)			
Supported by NextGen TBFM and ADS-B	✓ Developed course design material for an improved training program for traffic management ✓ Updated concept and requirements document ✓ Began development of flight deck interval management minimum operational performance standards	• Identify key site for Extended Metering • Complete integrated test strategy for Arrival Interval Management Using Ground Automation • Conduct system design technical interchange meeting (TIM) for Arrival Interval Management Using Ground Automation	• Deliver improved Traffic Management Coordinator training to traffic management • Declare arrival interval management using ground automation available in the NAS
④ **OI 104123:** Time-Based Metering Using RNAV and RNP Route Assignments (2012-2016)			
Supported by NextGen TBFM	✓ Initiated software development	• Conduct integrated testing • Declare TBM using RNAV & RNP route data operationally available at an ARTCC	

Descriptions of OIs and Capabilities

① OI 104115: Current Tactical Management of Flow in the En Route for Arrivals/Departures

Proper spacing and sequencing of air traffic maximizes National Airspace System efficiency and capacity in the arrival and depa ture phases of flight

Task Force: Cruise

Implement TMA's Adjacent Center Metering Capability at Additional Locations
To expand the benefits of time-based metering and Time Based Flow Management's (TBFM) other advanced flow managemen capabilities, Adjacent Center Metering (ACM) will be implemented at the following additional locations:
LAX — ACM from ZAB;
SFO — ACM from ZSE, ZOA, ZLA and ZLC;
SAN — ACM from ZLA and ZOA;
ATL — ACM from ZDC and ZHU; and
IAD — ACM from ZNY.
Task Force: Expand Use of Time-Based Metering (24)

Implement TMA at Additional Airports
To expand the benefits of time-based metering and TBFM's other advanced flow management capabilities, TBFM will be implemented at the following additional locations: BWI, CLE, DCA, HPN, SAN and TEB.
Task Force: Expand Use of Time-Based Metering (24)

② OI 104117: Improved Management of Arrival/Surface/Departure Flow Operations

This integrates advanced arrival/departure flow management with advanced surface operation functions to improve overall airport capacity and efficienc .

Integrated Departure/Arrival Capability (IDAC)
IDAC, the first increment of this OI, increases National Airspace System efficiency and reduces delays by providing deci ion-making support capabilities for departure flows. IDAC automates the pr cess of monitoring departure demand and identifying departure slots. It also deconflicts the departure times between airports with traffic departing to common points in space and provide situational awareness to air traffic control tower personnel so they can select from available departure times and plan their operations to meet these times. The results of these enhancements are more efficient departure ows and less delay.

③ OI 104120: Point-in-Space Metering

The air navigation service provider uses scheduling tools and trajectory-based operations to assure smooth flow of traffic and ncrease the efficient use of airspace. The following capabilities comprise elements of the interval management concept, which is designed to improve aircraft spacing by precisely managing the intervals between aircraft whose trajectories are common or merging. This concept increases airspace throughput while enabling aircraft to reduce fuel burn and environmental impacts.

In Concept Exploration | **In Development** | **Available** at least one site

Descriptions of OIs and Capabilities

Extended Metering
This capability will extend the metering horizon beyond the nominal distance used today. Currently, metering is conducted approximately 150-200 nautical miles from the adapted arrival airport, though this distance is extended during ACM operations, which are conducted at several locations. ACM will be implemented at additional locations — see sub-section 5.1.2.4.1. Building upon the ACM capability, Extended Metering will increase the distance from the airport where metering will be conducted without significant degradation in the accuracy of aircraft-specific sl   times to the meter reference points. This capability will provide flow deconfliction for metered aircraft at the meter reference point   (in addition to meter fixes). The specific distances and locations wher extended metering operations will be implemented will be based on operational need and benefits. This capability will be leveraged in the future to support end-to-end metering, meaning metering through each phase of flight
Additionally, the technical infrastructure that will be developed for this increment will be scalable to support additional metering initiatives planned for subsequent implementation.

Arrival Interval Management Using Ground Automation
The ground-based component of Interval Management (Ground-Interval Management–Spacing) provides automation changes that will enable en route controllers to use speed control to maneuver aircraft to meet metering times while providing the opportunity for aircraft to fly optimized descents to the meter fix (th   Terminal Radar Approach Control boundary).

4 **OI 104123:** Time-Based Metering Using RNAV and RNP Route Assignments

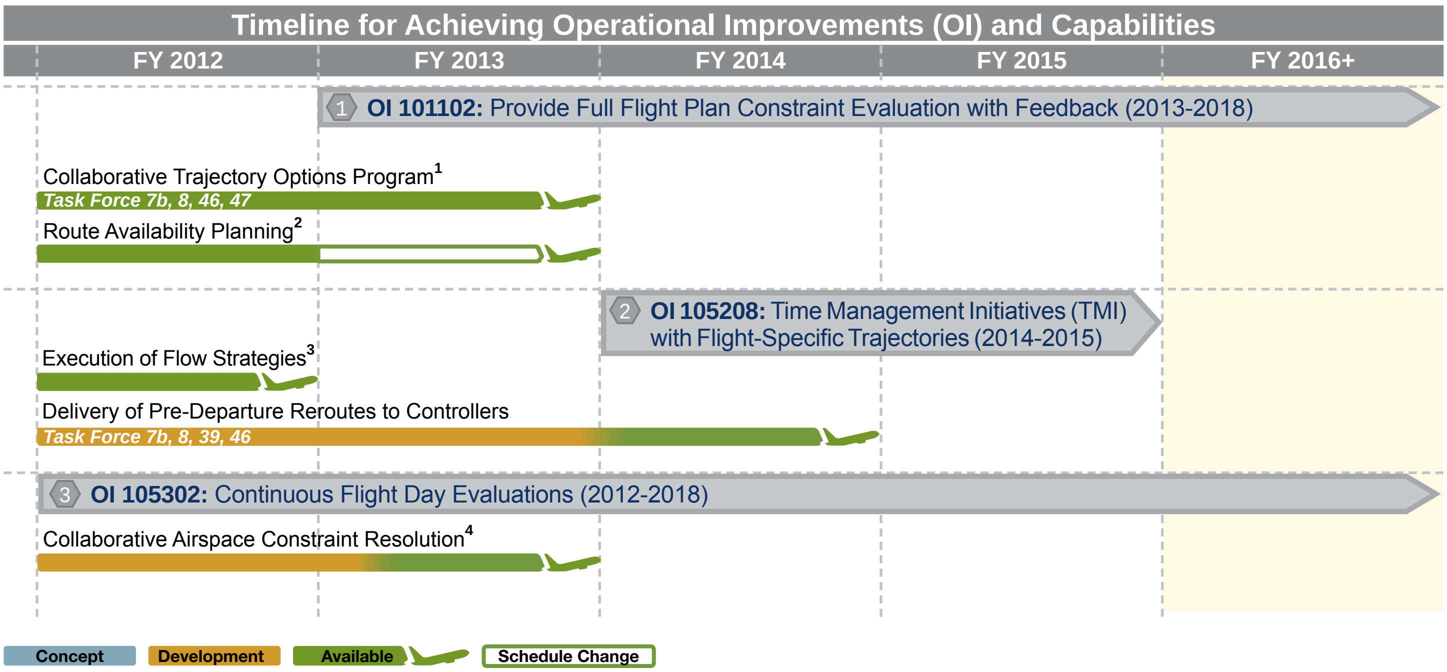
RNAV, RNP and time-based metering provide efficient use of runways and a rspace in high-density airport environments. Metering automation will manage the flow of aircraft to meter fixes, thu   permitting efficient use of runways and airspace

Use Area Navigation (RNAV) Data to Calculate Trajectories Used to Conduct TBM Operations
In addition to the en route RNAV routes, which are already used to calculate trajectories, the Terminal Radar Control Center RNAV routes for both Standard Instrument Departures and Standard Terminal Arrival Routes will be used to calculate the terminal component of aircraft trajectories.

In Concept Exploration | **In Development** | **Available** at least one site

Collaborative Air Traffic Management

Involves NAS operators and FAA traffic managers, along with advanced automation, in managing daily airspace and airport capacity issues such as congestion, special activity airspace and weather. Updated automation will deliver routine information digitally.



1 Formerly Electronic Negotiations
2 Formerly Departure Routing Increment 1 2012, moved from Improved Surface Operations portfolio, timeline updated to reflect program baselin
3 Formerly Basic Rerouting Capability
4 Formerly Automated Congestion Resolution

Selected Work Activities

Budget	FY 2012	FY 2013	FY 2014+
1 OI 101102: Provide Full Flight Plan Constraint Evaluation with Feedback (2013-2018)			
Supported by NextGen CATMT	✓ Completed factory acceptance testing for Collaborative Trajectory Options Program ✓ Completed operational testing with user flight planning interfaces for Collaborative Trajectory Options Program	• Deploy Route Availability Planning for operational use at ○ C90	
2 OI 105208: Time Management Initiatives (TMI) with Flight-Specific Trajectories (2014-2015)			
Supported by NextGen CATMT	✓ Execution of Flow Strategies operationally available NAS-wide	• Conduct system and operational testing of accepting pre-departure reroutes into ERAM at ○ ZMP ○ ZDV	• Delivery of Predeparture Reroutes to Controllers operationally available NAS-wide
3 OI 105302: Continuous Flight Day Evaluations (2012-2018)			
Supported by NextGen CATMT	✓ Completed requirements analysis for Collaborative Airspace Constraint Resolution	• Deploy Collaborative Airspace Constraint Resolution for operational use for strategic and tactical constraints NAS-wide	

Descriptions of OIs and Capabilities

1 OI 101102: Provide Full Flight Plan Constraint Evaluation with Feedback

Constraint information that impacts the proposed route of fligh is incorporated into air navigation service provider (ANSP) automation, and is available to users.
Task Force: Integrated Air Traffic Management

Collaborative Trajectory Options Program
This increment provides flight planners with information about ongestion along their intended routes and allows the system to accept user preferences as part of constraint resolution. This is a two-way exchange that gives the flight planner the ch ice of delaying a flight or choosing alternate routes. The initial phase of Collaborative Trajectory Options Program is limited to the period before a flight plan is file
Task Force: Improve CATM Automation to Negotiate User-Preferred and Alternative Trajectories (7b, 8 and 46) and Integrated System-Wide Approach (CDM/TFM/ATC) (47)

Route Availability Planning
Assessment of weather impact on departure routes and associated flights will be provided to tower traffic management coordinat s and supervisors to improve departure operations.
This increment will be implemented via the Route Availability Planning Tool capability. This capability, coupled with Automatic Dependent Surveillance–Broadcast In, will be available to supervisory personnel and/or traffic management coordinators in Traffi Flow Management System-equipped towers.

2 OI 105208: Traffic Management Initiatives (TMI) with Flight-Specifi Trajectories

This capability will increase the agility of the National Airspace System (NAS) to adjust and respond to dynamically changing conditions such as impacting weather, congestion and system outages.
Task Force: Integrated Air Traffic Management and Data Communications

Execution of Flow Strategies
This capability is the means by which Traffic Flow Management System-generated reroutes are defined an transmitted via System Wide Information Management, making the reroute information available to air traffic control facility automation tools. This capability makes reroute information available for processing, but depends upon changes in the En Route Automation Modernization (ERAM) program to deliver the change to the appropriate sectors.

Delivery of Pre-Departure Reroutes to Controllers
This increment will give ERAM additional capabilities to receive amended routes pre-departure and provide updated flight data o the tower. ERAM will also display the protected route segment data to the en route controllers to make them aware of any constraints it affects.
Task Force: Improve CATM Automation to Negotiate User-Preferred Routes and Alternate Trajectories (7b, 8 and 46) and Digital Air Traffic Control Communications for Revised Departure Clearances, Reroutes and Routine Communications (39)

3 OI 105302: Continuous Flight Day Evaluations

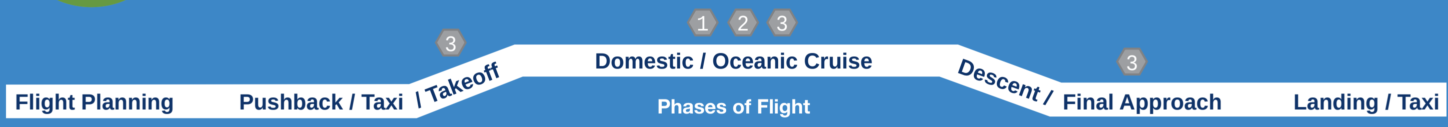
Continuous (real-time) constraints are provided to ANSP traffic management decision-support tools and the NAS users

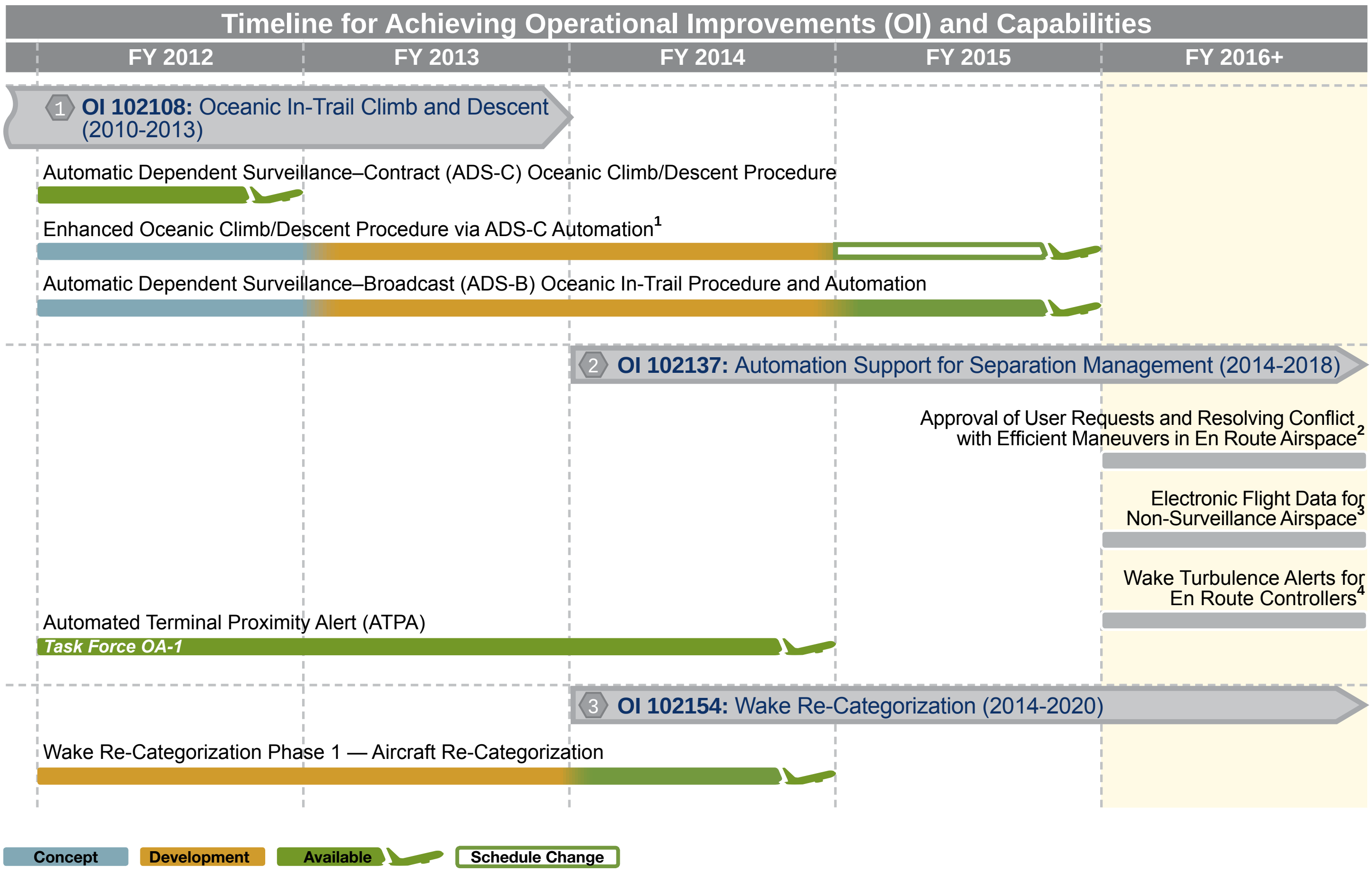
Collaborative Airspace Constraint Resolution
This increment recommends reroutes for flight-specifi Traffic Management Initiatives. An automated decision support tool models and proposes reroute solutions for pre-departure and airborne flights. It uses enhanced congestion prediction capabilities enabled by the integration of weather forecast data with existing and enhanced Traffic Flow Management system rerouting capabilities Collaborative Airspace Constraint Resolution will allow NAS customers whose flights are predicted to encounter en route congestion due to weather (or other constraints) to submit inputs for constraint resolution.

In Concept Exploration | In Development | Available at least one site

Separation Management

Provides controllers with tools to manage aircraft in a mixed environment of varying navigation equipment and wake performance capabilities.





[1] Formerly ADS-C Automation for Oceanic Climb/Descent Procedure, schedule extended to 2015
[2] Formerly Automation Support for Non-Surveillance Airspace – Electronic Flight Strips
[3] Formerly Problem Detection and Wake Turbulence Alert in 3 nm Separation Areas
[4] Formerly Introduce Probed Menus onto the Radar and Data Consoles

Separation Management

Selected Work Activities			
Budget	**FY 2012**	**FY 2013**	**FY 2014+**
① **OI 102108:** Oceanic In-Trail Climb and Descent (2010-2013)			
Supported by NextGen Trajectory Based Operations and ADS-B	✓ Completed ADS-C CDP operational trial ✓ Conducted ADS-C CDP automation transition ✓ Completed ITP operational evaluation interim analysis ✓ Completed ITP operational evaluation flights in the Pacific	• Complete second phase of operational trials for ADS-B ITP	• ADS-B ITP operationally available
② **OI 102137:** Automation Support for Separation Management (2014-2018)			
Supported by Flexible Terminal Environment	✓ ATPA service available at CARTS facilities with color displays at ○ DEN ○ NCT ○ A80 ○ SCT ○ SDF ○ PCT ✓ Conducted ATPA integration and developmental test	• Implement ATPA in a Standard Terminal Automation Replacement System facility	• Implement ATPA Service Available in all STARS Facilities
③ **OI 102154:** Wake Re-Categorization (2014-2020)			
Supported by NextGen System Development	✓ Completed draft changes to FAA Orders for implementing the 6 Category wake separation standards ✓ Completed draft supporting SRMD and implementation strategy for changes to NAS automation	• First Site Operational at ○ MEM	• Publish new wake separation standards in Order 7110.65

Descriptions of OIs and Capabilities

① OI 102108: Oceanic In-Trail Climb and Descent

Air navigation service provider (ANSP) automation enhancements will take advantage of improved communication, navigation and surveillance coverage in the oceanic domain. When authorized by the controller, pilots of equipped aircraft use established procedures for climbs and descents.

Automatic Dependent Surveillance–Contract (ADS-C) Oceanic Climb/Descent Procedure
The ADS-C Climb/Descent Procedure (CDP) (previously known as ADS-C In-Trail Procedure (ITP)) is a new concept that allows a properly equipped aircraft (aircraft equipped with Future Air Navigation System 1/A) to climb or descend through the altitude of another properly equipped aircraft with a reduced longitudinal separation distance (compared with the required longitudinal separation minima for same-track, same-altitude aircraft). This procedure allows more aircraft to reach their preferred altitudes. ADS-C CDP will increase the benefits from the use of advanced communicat on, navigation and surveillance capabilities through Controller-Pilot Data Link Communications, Required Navigation Performance and ADS-C.

Enhanced Oceanic Climb/Descent Procedure via ADS-C Automation
Automation enhancements to the Oceanic Automation System (Ocean21) would maximize the benefits of ADS-C CDP as traffic an the number of equipped aircraft increase. The automation enhancements to Ocean21 include capabilities to allow a controller to select two aircraft and ensure they are eligible for ADS-C CDP, send concurrent on-demand position reports to two aircraft, determine if the minimum separation distance between the two aircraft is greater than the ADS-C CDP separation distance (greater than 15 nautical mile (nm)), display the ADS-C CDP conflict probe results to a controller and build an uplink cle rance message to the ADS-C CDP requesting aircraft and an uplink traffic advisory message to he blocking aircraft.

Automatic Dependent Surveillance–Broadcast (ADS-B) Oceanic In-Trail Procedure and Automation
Similar to the ADS-C CDP concept, ADS-B ITP will enable aircraft equipped with ADS-B and appropriate on-board automation to climb and descend through altitudes where current non-ADS-B separation standards would prevent desired altitude changes. With this procedure, the aircraft desiring to climb or descend (the maneuvering aircraft) obtains flight identification, altitude,   sition and ground speed transmitted by proximate ADS-B-equipped non-maneuvering (reference) aircraft. The maneuvering aircraft must therefore be equipped with ADS-B In capability and an appropriate onboard decision-support system, both of which would have to be certified for this application. The reference aircraft is required to have ADS-B Out capability (the maneuvering aircraft should also have ADS-B Out to serve as a reference aircraft for other aircraft). The ADS-B signal can be received by aircraft equipped with ADS-B In and by ground stations providing information to ground stations and other aircraft. The pilot of the aircraft desiring a maneuver uses the ADS-B information received to determine if the ITP criteria have been met before requesting the maneuver.

The FAA is conducting an operational trial of ADS-B ITP along South Pacific routes with migration to other oceanic reg ons. During this operational trial, the ADS-B ITP criteria will be manually checked by the controllers using current Oceanic Automation System tools. The FAA has formed a contractual partnership that is focused on the next steps necessary to conduct this operational trial. These steps include but are not limited to development and certification of onboard systems that provide the ADS-B ITP criteria and display that information to the pilot.

If the operational trial of manual ADS-B ITP is successful, the ground system may be updated to better support ADS-B ITP. The operational trials will help determine what should be automated, e.g., aircraft eligibility checks, and what information should be displayed to controllers.

In Concept Exploration | **In Development** | **Available** at least one site

Descriptions of OIs and Capabilities

2 OI 102137: Automation Support for Separation Management

ANSP automation provides the controller with tools to manage aircraft separation in a mixed navigation and wake performance environment.

Task Force: Overarching

Approval of User Requests and Resolving Conflicts with Efficient Maneuvers in En Route Airspace
Probed menus will be integrated on the en route radar and the data consoles. Integrating this capability into the consoles assists radar controllers in determining possible problem-free flight p an changes without having to use the data consoles to create trial plans. A controller will also be able to use this capability to simultaneously examine the problem status of a set of possible clearances. The problem status for each of these trial plans is presented in the following menus:

- Route (for each downstream route fix
- Altitude (for a range of altitudes around the filed altitude
- Speed (a range of speeds around the trajectory speed)

This capability allows the controller to gauge quickly whether user requests can be granted and to provide the least disruptive maneuvers to resolve detected problems.

Electronic Flight Data for Non-Surveillance Airspace
This capability will provide automation support to controllers for flights in airspace without radar or ADS-B coverage, and for aircraft in this non-radar airspace that are not ADS-B equipped. This capability will utilize electronic flight data, eliminatin the need for paper flight strips. The automation will distinguish non-surveillance flights on the display.

Paper flight strips will be eliminated because all the capabili ies available from the paper-based system will be provided by electronic flight data or other display views. The automation will be enhanced to take advantage of new information sharing capabilities such as display of critical information to the controller, who can display additional information when needed, and collapse data when not needed.

The automation will also be enhanced to accept Aircraft List flight data notations, including non-radar symbol gy, entered by the controller for use in all sector displays.

Wake Turbulence Alerts for En Route Controllers
The use of 3-nm separation in en route airspace is being expanded based on the current procedures for using 3-nm separation because En Route Automation Modernization (ERAM) can accommodate additional radar inputs and the redesign of airspace being accomplished in the optimization of airspace and procedures in the metroplex. En route conflict alert will be enhanced to supp rt wake turbulence separation requirements in 3-nm separation areas and transition airspace. The introduction of variable separation standards may result in circumstances where wake separation becomes the driver for safe separation. Providing a wake turbulence separation indicator will benefit the controller by enhancing s tuational awareness, helping the controller to maintain awareness of wake turbulence separation requirements for any given aircraft pair in an effort to reduce operational errors, and avoiding the occurrence of wake encounter incidents.

Wake separation standards are integrated with problem detection to better ensure that wake separation is accounted for in specific operational conditions. The introduction of various separation standards applicable to the special classes of aircraft expected in the National Airspace System, e.g., the Airbus 380, will increase the complexity of the traffic. Planni g for reduced separation in the 3-nm airspaces will enhance throughput into terminal areas.

En route conflict alert will be enhanced to support wake vortex separation requirements in 3-nm separation areas and transition airspace. Problem detection and trial planning capabilities also will be enhanced to support aircraft-to-aircraft alerts in 3-nm separation areas and transition airspace, to include alerts based on wake vortex separation requirements. Sectors that contain tactical airspace (sectors where 3-nm separation is likely to be used and transition airspace) have traditionally been the areas where problem detection was inhibited. Problem detection will be enhanced to support areas where procedures and surveillance accuracy allow reduced separation in en route airspace. These enhancements will support separation management in more tactical areas of air traffic control, areas where wake vortex separation will ne d to be applied.

Automated Terminal Proximity Alert (ATPA)
ATPA is an air traffic control automation tool that provides situational awareness and alerts to controllers on Common Automated Radar Terminal System (CARTS) color displays and on Standard Terminal Automation Replacement System (STARS) displays. ATPA provides decision support information to controllers to make spacing adjustments needed to safely achieve optimal final approach spacing and efficienc , and alerts controllers when compression between subsequent aircraft is likely to result in unsafe separation.
Task Force: Achieving Existing 3- and 5-mile Separation Standards (OA-1)

3 OI 102154: Wake Re-Categorization

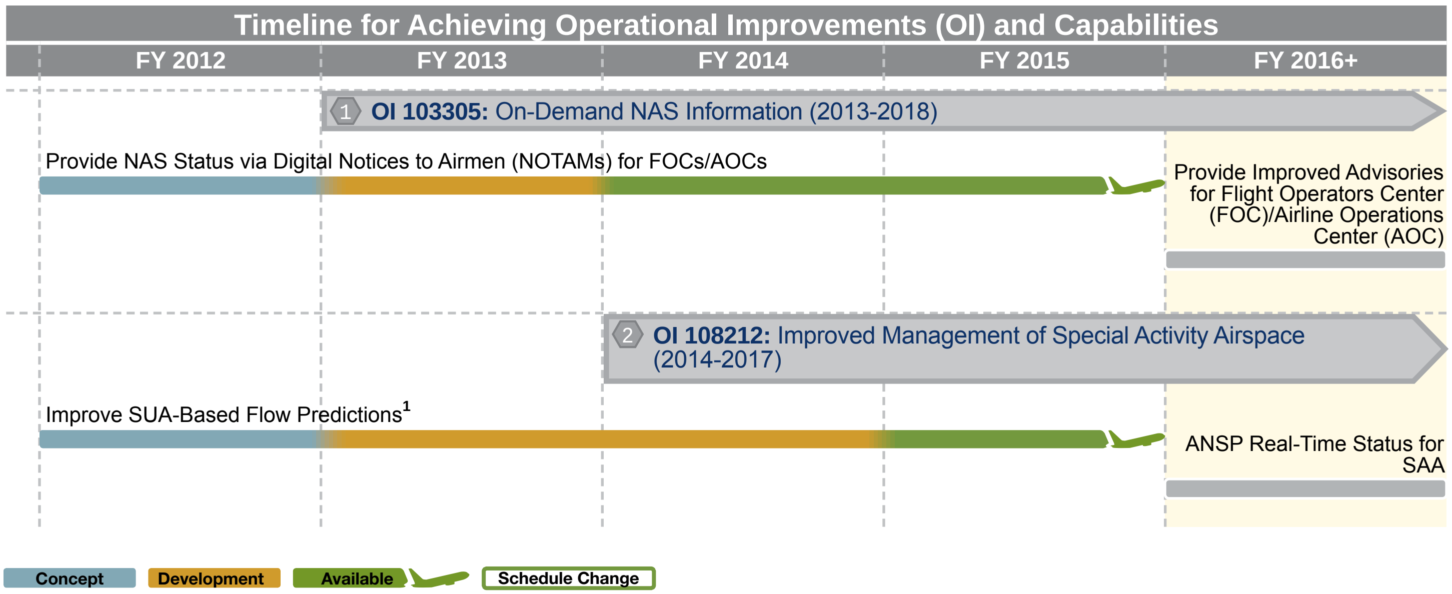
Legacy wake separation categories are updated based on analysis of wake generation, wake decay and encounter effects for representative aircraft.

Wake Re-Categorization Phase 1 — Aircraft Re-Categorization
Wake re-categorization is a joint effort between the FAA and the European Organization for the Safety of Air Navigation that identifie changes to the International Civil Aviation Organization aircraft weight categories for improved throughput at capacity-constrained, high-density airports while maintaining or improving wake safety. New wake turbulence categories have been proposed that more accurately group like aircraft based on their wake turbulence characteristics, resulting in closer longitudinal separation for certain aircraft types without sacrificing safet . The re-categorization will require document changes to reflect he new separation standards.

In Concept Exploration | **In Development** | **Available** at least one site

On-Demand NAS Information

Ensures that airspace and aeronautical information is consistent across applications and locations, and available to authorized subscribers and equipped aircraft.



[1] Formerly SUA Forecast of Capacity Constraints

Selected Work Activities

Budget	FY 2012	FY 2013	FY 2014+
1 OI 103305: On-Demand NAS Information (2013-2018)			
Supported by NextGen ADS-B, CATMT and SWIM	✓ Prototyped Aeronautical Common Service infrastructure through integration of commercial off-the-shelf tools	• Achieve In-Service Decision	• Operational Use of Digital NOTAMS in the NAS
2 OI 108212: Improved Management of Special Activity Airspace (2014-2017)			
Supported by NextGen Collaborative Air Traffic Management (CATM), CATMT and SWIM	✓ Deployed SWIM enterprise messaging nodes based on internal user demand at ○ ATL ○ ZLC ✓ Completed prototype development and demonstrations of Airport Survey Collection, SUA editing capability, and Aeronautical Common Service information ✓ Conducted airborne access to SWIM Operational and Technical Requirements Industry Day ✓ Developed the requirements for Aeronautical Information Management, SWIM interface for SUA	• Develop the interface requirements for Traffic Flow Management System (TFMS) for SUA	• Operational Use of SUA Data for Internal & External Consumers

Descriptions of OIs and Capabilities

1 OI 103305: On-Demand National Airspace System (NAS) Information

NAS and aeronautical information will be available to users on demand. NAS and aeronautical information is consistent across applications and locations are available to authorized subscribers and equipped aircraft. Proprietary and security-sensitive information is not shared with unauthorized agencies or individuals.

Provide NAS Status via Digital Notice to Airmen (NOTAMs) for FOCs/AOCs
This increment enables the issuance of digital NOTAMs for those airspace constraints affecting a flight based on its trajector . The initial implementation includes distribution outside of the air navigation service provider (ANSP), including FOCs and AOCs.

Provide Improved Advisories for Flight Operations Center (FOC)/Airline Operations Center (AOC)
This increment ensures that National Airspace System and aeronautical information is consistent, allowing users to subscribe to and receive the most current information from a single source. The information that will be made available and be distributed via System Wide Information Management is airport reference and configuration (current and planned) and will follow the Aeronautical Information Exchange Model standard.

2 OI 108212: Improved Management of Special Activity Airspace

Changes to status of airspace for special use are readily available for operators and the ANSP. The status changes are transmitted to the flight deck via voice or Data Communications. Flight trajectory planning is managed dynamically based on real-time use of airspace.

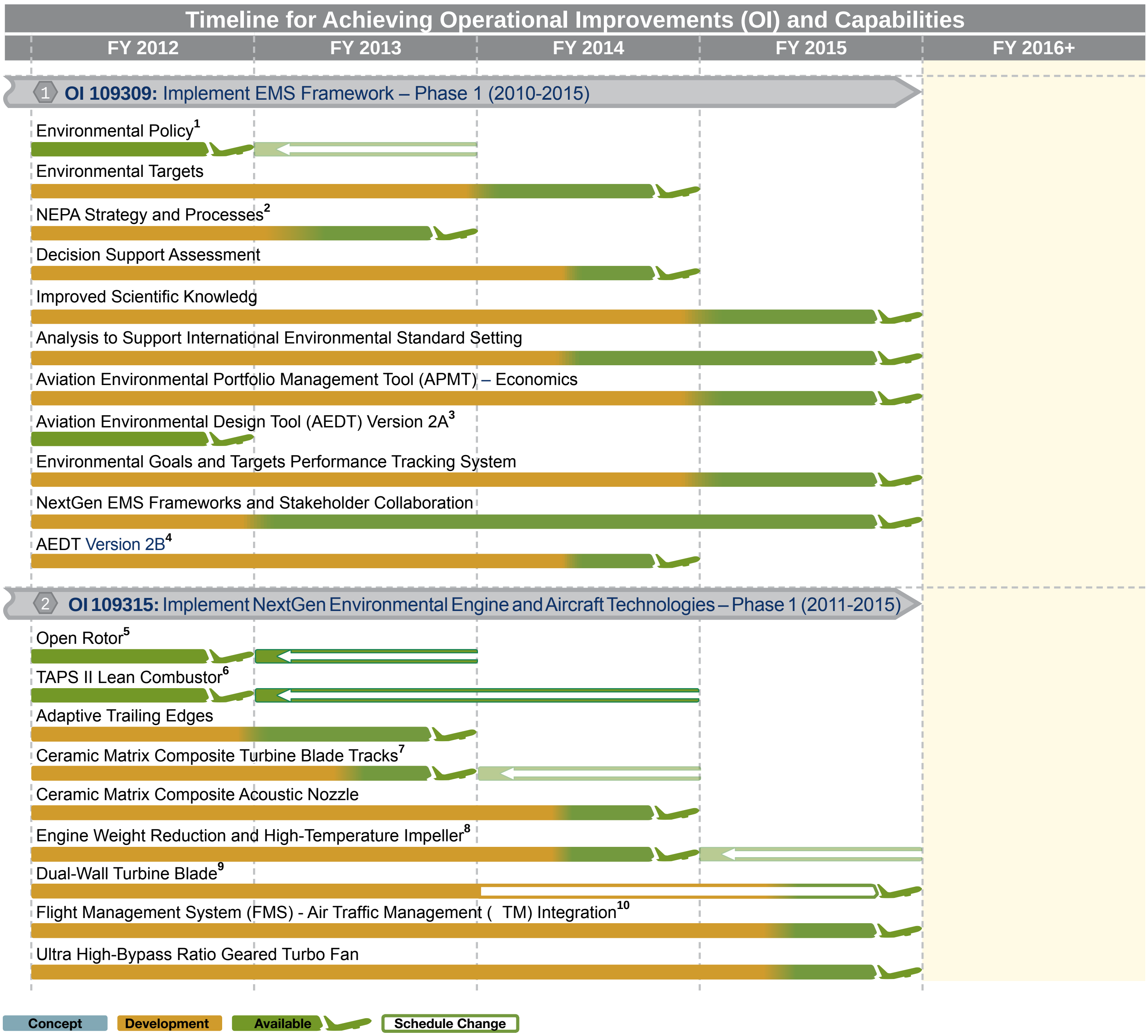
Improve SUA-Based Flow Predictions
This increment translates the Special Use Airspace (SUA) activation schedule and knowledge of the airspace configurations int predicted traffic flow constraints. Route impact assessments wo d therefore account for forecast airspace capacity loss and route blockage, including SUAs.

ANSP Real-Time Status for SAA
Airspace use is optimized and managed in real time, based on actual flight profiles and real-time operational use parameter Airspace reservations for military operations, unmanned aircraft system flights, space flight and re-ent , restricted or warning areas, and flight training areas are managed on an as-needed ba is. Enhanced automation-to-automation communications and collaboration enables decision makers to dynamically manage airspace for special use, increasing real-time access and use of available airspace. The enhanced interface provides a consistent source of Special Activity Airspace status digitally to external users such as the Department of Defense.

In Concept Exploration | **In Development** | **Available** at least one site

Environment and Energy

Describes enabling activities leading to the establishment and implementation of the NextGen Environmental Management System, the strategy for ensuring compliance with the National Environmental Policy Act and technologies that support NextGen environmental goals.



[1] Implementation of this capability occurred in 2012.
[2] Implementation of this capability occurred in 2012.
[3] Formerly AEDT-Regional (AEDT2a)
[4] Formerly AEDT-Airport (AEDT2b)
[5] Demonstration of this capability occurred in 2012.
[6] Implementation of this capability occurred in 2012.
[7] Demonstration of this capability is planned for 2013.
[8] TRL 7 demonstration no longer required. Capability will be available upon successful completion of TRL 6 demonstration.
[9] Demonstration of this capability is planned to occur in 2015; further analysis and development required to mature technology.
[10] TRL 7 demonstration no longer required. Capability will be available upon successful completion of TRL 6 demonstration.

Timeline for Achieving Operational Improvements (OI) and Capabilities (cont'd)

FY 2012 | FY 2013 | FY 2014 | FY 2015 | FY 2016+

3 OI 109316: Increased Use of Alternative Aviation Fuels – Phase 1 (2011-2015)

Drop-In >50% HRJ/HEFA Fuels (Greater than 50% Blend)[11]

Other Advanced Aviation Alternative Fuels

4 OI 109319: Environmentally and Energy Favorable Air Traffic Management Concepts an Gate-to-Gate Operational Procedures – Phase 1 (2011-2015)

Note: Increments associated with OI 109319 are addressed through other portfolios that affect operational efficienc , capacity and/or flexibilit .

Concept | Development | Available | Schedule Change

[11] Formerly Drop-In >50% HRJ Fuels (Greater than 50% Blend). HRJ has been relabled as HEFA by ASTM.

Selected Work Activities

Budget	FY 2012	FY 2013	FY 2014+
1 OI 109309: Implement Environmental Management System (EMS) Framework – Phase 1 (2010-2015)			
Supported by NextGen System Development	✓ Publicly issued FAA aviation environment and energy policy ✓ Developed preliminary quantitative NextGen targets for noise, climate and energy ✓ Secured international approval of metrics for aircraft carbon dioxide emissions standards ✓ Publicly released AEDT–Regional tool ✓ Completed FAA NextGen NEPA Plan	• Develop EMS performance tracking system • Report on NAS-wide impacts of potential aircraft CO_2 emissions standard options • Enhance AEDT capability and complete Beta version of AEDT2b analysis tool with supporting documentation • Deliver report on aviation emissions impact on climate change through Aviation Climate Change Research Initiative program • Develop targets for NextGen air quality goal	• Refine quantitative targets supporting NextGen goals for noise, air quality, climate and energy • Report on the analysis to support ICAO's Commission on Aviation Environmental Protection noise certification and aircraft emission standard • Document standardized approach for aviation stakeholders to apply and address NextGen environmental goals and targets • Publicly release AEDT-airport tool (AEDT2b)
2 OI 109315: Implement NextGen Environmental Engine and Aircraft Technologies – Phase 1 (2011-2015)			
Supported by NextGen R , E & D	✓ Matured and demonstrated at the following TRLs: ○ Twin Annular Premixing Swirler II Lean Combustor (TRL 6) ○ Adaptive Trailing Edges (TRL 7) ○ Ceramic Matrix Composite Turbine Blade Tracks (TRL 5) ○ Ceramic Matrix Composite Acoustic Nozzle – Completed instrumentation of CMC Nozzle in preparation for ground test demo (TRL 5) ○ Dual-Wall Turbine Blade (TRL 5) ○ Open Rotor (TRL 5)	• Mature and demonstrate at the following TRLs: ○ Ceramic Matrix Composite Acoustic Nozzle (TRL 7) ○ Ceramic Matrix Composite Turbine Blade Tracks (TRL 6) ○ FMS-engine integration (TRL 5) ○ Engine Weight Reduction and High-Temperature Impeller (TRL 5)	• Mature and demonstrate at the following TRLs: ○ Dual-Wall Turbine Blade (TRL 6) ○ Ceramic Matrix Composite Acoustic Nozzle (TRL 7) ○ Engine Weight Reduction and High-Temperature Impeller (TRL 6) ○ Flight Management System (FMS) – Air Traffic Management (TM) Integration (TRL 6) ○ FMS-engine integration (TRL 6) ○ Ultra High-Bypass Ratio Geared Turbofan (TRL 6)
3 OI 109316: Increased Use of Alternative Aviation Fuels – Phase 1 (2011-2015)			
Supported by NextGen System Development	✓ Developed >50% renewable alternative aviation fuel (bio-fuel) characterization Fuel Readiness Level (FRL) 3-4	• Conduct engine component tests of >50% renewable alternative fuel (FRL 5)	• Conduct ground test demonstration of >50% renewable HRJ alternative fuel (FRL 6)

Descriptions of OIs and Capabilities

1 OI 109309: Implement EMS Framework – Phase 1

Enable the use of the Environmental Management System (EMS) framework, including environmental goals and decision-support tools, to address, plan and mitigate environmental issues through development of an initial EMS framework, pilot analysis and outreach programs.

Environmental Policy
This enabling activity will refine and formalize NextGen enviro mental and energy policy, including NextGen environmental goals. It also will establish EMS roles and responsibilities for FAA organizations to efficiently address critical NextGen environm ntal requirements, goals and other policies to improve environmental performance.

Environmental Targets
This enabling activity will explore, test and refine quantitati e NextGen environmental targets for noise, air quality, climate, energy and water quality.

NEPA Strategy and Processes
This enabling activity establishes effective strategic approaches for addressing the National Environmental Policy Act (NEPA) requirements of NextGen improvements. This includes applying best practices to minimize redundancy of analyses and maximizing time and cost efficiencies. When necessar , it will outline an approach for integrating NEPA considerations into existing FAA guidance at key decision points, such as the Acquisition Management System and Systems Engineering Manual to ensure appropriate consideration is given early in the planning phase.

Decision Support Assessment
This enabling activity addresses mission-level NextGen decision-support capabilities (capabilities that support FAA planning decisions such as those related to capacity management) and operational-level capabilities, e.g., those related to flow contin ency management and trajectory flo . NextGen decision-support capabilities will be screened to identify environmental and energy aspects and possible changes to the decision-support capabilities to support environmental and energy goals.

Improved Scientific Knowledge
This enabling activity will improve knowledge of aircraft source-level noise and emissions of air pollutants and greenhouse gases, their atmospheric evolution, and impacts on human health and welfare and climate change. Improved scientific knowledge is used to inform each of the environment- and energy-enabling activities and support other NextGen OIs.

Analysis to Support International Environmental Standard-setting
This enabling activity addresses analysis and benefit assessmen to support the development and implementation of the U.S. Aviation Greenhouse Gas Emissions Reduction Plan and International Civil Aviation Organization environmental standards, such as for aircraft carbon dioxide emissions and more stringent noise levels.

Aviation Environmental Portfolio Management Tool (APMT) — Economics
APMT capabilities will be continuously enhanced through 2015 to enable analysis of airline-and aviation-market responses to environmental mitigation and policy options, and for analyzing U.S. environmental issues critical to NextGen under various fle t growth and evolution scenarios.

Aviation Environmental Design Tool (AEDT) Version 2A
The AEDT will provide capabilities for integrated environmental analysis at regional levels for fuel burn, emissions and noise.

Environmental Goals and Targets Performance Tracking System
A system will be established that will support the systematic identification of environmental benefits across the Nationa Airspace System (NAS), enabling the FAA to measure progress toward achieving NextGen environmental goals. This system may include business practices, automation capabilities and interfaces with other automation systems.

NextGen EMS Frameworks and Stakeholder Collaboration
Standardized approaches will be identified for aviation stakeho ders, e.g., manufacturers, airports, airlines and the FAA, to identify and address key environmental issues critical to stakeholder environmental programs or EMSs. These approaches are intended to allow aviation stakeholders to collaborate and address cross-cutting environmental challenges.

AEDT Version 2B
The AEDT will provide capabilities for integrated environmental analysis at airport, regional and global levels for fuel burn, emissions and noise.

2 OI 109315: Implement NextGen Environmental Engine and Aircraft Technologies – Phase 1

Mature technologies to reduce noise, emissions and fuel burn of commercial subsonic jet aircraft. Technologies are demonstrated at sufficient readiness levels to achieve goals of the AA's Continuous Lower Energy, Emissions, and Noise program.

Open Rotor
General Electric will mature open rotor technology to Technology Readiness Level (TRL) 5. This technology will reduce fuel burn, emissions and noise.

TAPS II Lean Combustor
General Electric will mature Twin Annular Premixing Swirler (TAPS) II lean combustor technology to TRL 6. This technology will reduce engine combustion emissions.

Adaptive Trailing Edges
Boeing will mature adaptive trailing edges technology to TRL 7. This technology will reduce fuel burn, emissions and noise.

Descriptions of OIs and Capabilities

Ceramic Matrix Composite Turbine Blade Tracks
Rolls-Royce will mature ceramic matrix composite turbine blade tracks technology to TRL 6. This technology will reduce fuel burn and emissions.

Ceramic Matrix Composite Acoustic Nozzle
Boeing will mature ceramic matrix composite acoustic nozzle technology to TRL 7. This technology will reduce fuel burn, emissions and noise.

Engine Weight Reduction and High-Temperature Impeller
Honeywell will mature engine weight reduction and high-temperature impeller technology to TRL 6. This technology will reduce fuel burn, emissions and noise.

Dual-Wall Turbine Blade
Rolls-Royce will mature dual-wall turbine blade technology to TRL 6. This technology will reduce fuel burn and emissions.

Flight Management System (FMS) – Air Traffic Management (ATM) Integration
General Electric will mature FMS-ATM technology to TRL 6. This technology will reduce fuel burn, emissions and, potentially noise.

Ultra High-Bypass Ratio Geared Turbofan
Pratt & Whitney will mature ultra high-bypass ratio geared turbo fan technology to TRL 7. This technology will reduce fuel burn, emissions and noise.

3 OI 109316: Increased Use of Alternative Aviation Fuels – Phase 1

Determine the feasibility and market viability of alternative aviation fuels for commercial aviation use. Obtain ASTM International approval of Hydrotreated Renewable Jet (HRJ) blends and other advanced sustainable fuel blends from renewable resources that are compatible with existing infrastructure and fleet, thus meeting requiremen to be a drop-in fuel.

Drop-In Greater Than 50 Percent HRJ/HEFA Blend Fuels
This enabling activity will advance the use, acceptance, and deployment of other HRJ/HEFA blend fuels (>50 percent) through air quality impact assessments, lifecycle emissions analyses, engine ground tests and flight demonstrations by 2015

Other Advanced Aviation Alternative Fuels
This enabling activity will explore and qualify additional classes of sustainable aviation alternative fuels blends that use novel feedstocks and conversion processes, e.g., advanced fermentation, alcohol oligomerization and pyrolysis. Efforts include environmental and performance feasibility through air quality and lifecycle emissions analyses, fuel properties analysis, engine performance evaluation, ground tests and flight demonstrations   y 2015. These efforts will advance deployment of these sustainable alternative fuels, including environmental acceptability and ASTM International approval.

4 OI 109319: Environmentally and Energy Favorable Air Traffic Management Concepts and Gate-to-Gat Operational Procedures – Phase 1

Explore, develop, demonstrate, evaluate and support the implementation and deployment of air traffic management and gate-to-ga e operational changes to the NAS that have the potential to reduce the environmental impacts of aviation support mobility growth by increasing the capacity and throughput of the NAS.

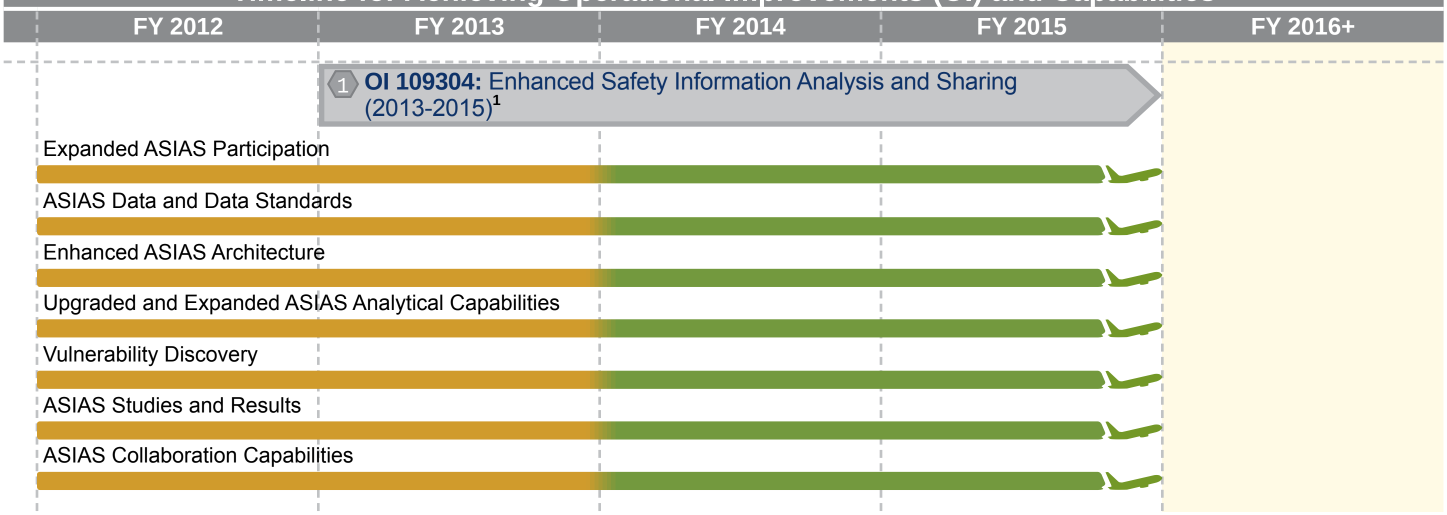
In Concept Exploration | In Development | Available at least one site

System Safety Management

Contains activities that enable development and implementation of policies, processes and analytical tools that the FAA and industry will use to ensure that changes introduced with NextGen enhance or do not degrade safety while delivering benefits.

Phases of Flight: Flight Planning | Pushback / Taxi | Takeoff | Domestic / Oceanic Cruise | Descent / Final Approach | Landing / Taxi

Timeline for Achieving Operational Improvements (OI) and Capabilities



[1] ASIAS is realigning enabling activities based on a new 5-year plan, which refines the original five capabilities listed in the 201 Appendix B into seven new capabilities that better defines the development work. The new enabling activities are Expanded ASIAS Participation, ASIAS Data and Data Standards, Enhanced ASIAS Architecture, Upgraded and Expanded ASIAS Analytical Capabilities, Vulnerability Discovery, ASIAS Studies and Results, and ASIAS Collaboration Capabilities. They replace Enhanced Query Capabilities, Airspance Facility Data, General Aviation Flight Data, Enhanced Stakeholder Access, and Enhanced Data Standards.

Selected Work Activities

Budget	FY 2012	FY 2013	FY 2014+
1 OI 109304: Enhanced Safety Information Analysis and Sharing (2013-2015)			
Supported by NextGen System Development and ASIAS	✓ Deployed capabilities that fuse text and digital data from proprietary and government sources ✓ Developed a prototype of an information retrieval and indexing system that demonstrates the ability to detect NAS risks that have a one in 3 million chance of occurrence with a probability of 95% using multiple ASIAS data sources and a single search directive ✓ Incorporated NAS facility performance and additional data into ASIAS database, i.e., outage data, traffic management data, sector complexity data ✓ Established agreements with two of the FAA Center of Excellence for General Aviation Research members Embry-Riddle Aeronautical University and University of North Dakota to include digital data from general aviation aircraft	• Demonstrate use of aggregate high-end general aviation data to identify, measure and track general aviation-related safety risks • Deploy track visualization tools on ASIAS portal to provide search interface and additional data for ASIAS participants, such as weather, runway configurations and threaded track • Develop a FOQA sampling plan to ensure statistically significant representation of aircraft types and equipage in the ASIAS FOQA archive • Incorporate general aviation data into the ASIAS data set • Report on data currently being captured by aircraft sensors useful to safety analysis that should be incorporated into the revised FOQA standard, including data from new technologies • Demonstrate the ability to link available voice recorder data to other data sources for retrieval, e.g., given a threaded track, find the associated voice tape	• Deploy capability to detect anomalies from aggregated views of track data and other FAA data sources for identification of safety risks • Deploy the capability to query multiple databases with a graphical interface, both FAA and proprietary, with one search directive to retrieve information of interest to safety analysts in an efficient manner • Prioritize known risk monitoring metrics specifically for NextGen system changes based upon risk prioritization assessment framework and timeline for changes • Establish required data standards for all voluntary safety reports used by ASIAS, including ASAP for all domains and ATSAP reports • Develop a plan to ensure statistically significant representation of maintenance, dispatch, and cabin safety voluntary reporting programs in the ASIAS archive • Deploy portal based capabilities organized by airport of "airport scorecard" for selected airports based upon the risk assessment framework

Descriptions of OIs and Capabilities

1 OI 109304: Enhanced Safety Information Analysis and Sharing

Aviation Safety Information Analysis and Sharing (ASIAS) will improve system-wide risk identification, integrated risk analysis an modeling and implementation of emergent risk management.

Expanded ASIAS Participation
To date, ASIAS has been focused on key domestic Federal Aviation Regulation Part 121 operators. In upcoming years, ASIAS will work toward expanding participation to enhance safety throughout the National Airspace System.

ASIAS Data and Data Standards
Each ASIAS data source must support established data quality standards. Data quality standards are unique for each source and are based on the identified purposes and use of the data source as outlined in the ASIAS Data Source Assessment. This enabling activity continues to enhance the data available for ASIAS in addition to implementing data standards within the ASIAS community.

Enhanced ASIAS Architecture
This enabling activity will continue to evolve the ASIAS architecture toward a more centralized model to achieve operational cost efficiencies and data fusion capabilities when data is stored i a central archive.

Upgraded and Expanded ASIAS Analytical Capabilities
The enabling activity will upgrade and expand ASIAS capabilities in the areas of dashboards and visualization, metrics and monitoring tools, information management and retrieval, text/digital data fusion, voice recorder to data linkage (including fusion of voice data with threaded track data), development of customized data mining and extraction techniques and enhanced query tools and techniques (including the capability to query and extract voice data).

Vulnerability Discovery
This enabling activity will develop enhanced risk assessment techniques and will enhance the timeliness of NextGen safety analysis results through improved data access, reduction and management techniques.

ASIAS Studies and Results
Under the direction of the ASIAS Executive Board, ASIAS conducts various studies including directed studies, safety enhancement assessments, known-risk monitoring and benchmarking. This enabling activity will support sharing of the results of these studies throughout the FAA and the ASIAS community.

ASIAS Collaboration Capabilities
This enabling activity supports the sharing of ASIAS results and capabilities with and among ASIAS participants, the FAA, and the global aviation safety community.

In Concept Exploration | **In Development** | **Available** at least one site

Selected Work Activities						
Budget Line	**Task Force**	**Activity**	**Description**	**FY 2012**	**FY 2013**	**FY 2014+**
Automatic Dependent Surveillance–Broadcast (ADS-B)	28	ADS-B NAS-wide implemen-tation	Provides highly accurate and more comprehensive surveillance information, than currently available from radar, via a broadcast communication link. ADS-B receives flight data from aircraft, via a data link, derived from on-board position-fixing and navigational systems. Aircraft position (longitude, latitude, altitude and time) is determined using GPS, an internal inertial navigational reference system or other navigation aids.	✓Completed final assessment of 3-nautical mile (nm) separation in en route operations (beyond those achievable in the near-term prior to ADS-B equipage)	• Achieve Initial Operational Capability (IOC) for ATC Surface Advisory Services at 12 sites • Achieve IOC for En Route ATC Separation Services at 15 sites • Achieve IOC for Terminal ATC Separation Services at 45 sites	• Achieve IOC of Automation Upgrades for ATOP automation platform • Achieve IOC for at 1 ASSC Site • Achieve IOC for Ground-Based Interval Management–Spacing • Achieve IOC for Terminal ATC Separation Services at 15 sites
Data Com-munications (Data Comm)	16 17 39 44 42	Data Comm	Implements Data Comm capabilities that provide new methods for delivery of departure clearances, revisions and taxi instructions in the terminal environment, specifically in the towe . In the en route environment, Data Comm Segment 1 will provide the basic capabilities for controllers and flight crews to transfer air traffic control (ATC) clearances, requests, instructions, notifications, voice frequency communications transfers and flight crew reports as a supplement to voice communications.	✓Achieved final investment decision for procurement of en route Data Comm automation infrastructure and controller-pilot data link communications applications	• Complete Revised Departure Clearance trials procedures and training development	• ERAM 4.2 Initial Test Release (ITR) • TDLS V12 ITR • Complete Data Comm Integration Testing
NAS Voice System (NVS)		NVS	Provides the connectivity for efficient communications among air traffic controllers, pilots and ground personnel. It connects incoming and outgoing communication lines via a switching matrix to the controller's workstation.	✓Released Screening Information Request ✓Achieved final investment decision for NVS Segment 1 ✓Awarded contract for NVS Segment 1	• Acceptance of first demonstration system from NVS vendor	• Achieve final investment decision for NVS Segment 2, the production system • Achieve First site IOC
System Wide Information Management (SWIM)	40 35	SWIM	Provides policies and standards to support NAS data management, secure its integrity and control its access and use.	✓Achieved final investment decision for SWIM Segment 2	• Provide terminal data distribution capability • Complete Flight Data Publication - Initial Flight Data Services operational • Complete documentation in support of Initial Investment Decision (IID) for Common Support Services–Weather (CSS-WX) Segment	• Publish data for: ○ pilot weather report ○ Traffic Flow Management ○ flight data ○ Runway Visual Range • Provide flight data publication host air traffic management data distribution system/flight data input/output and AIM Special Use Airspace client

NextGen Infrastructure

Selected Work Activities						
Budget Line	**Task Force**	**Activity**	**Description**	**FY 2012**	**FY 2013**	**FY 2014+**
Collaborative Air Traffic Management Technologies (CATMT)	47	CATMT	Identifies cognitive support and displays change requirements necessary for a transition to a high-altitude specialty that addresses the FAA's goals for capacity and organization excellence.	✓Upgraded the Traffic Flow Management System to include an initial electronic negotiation capability for more efficient flight planning	• Design and develop Route Availability Planning Tool (RAPT) • Design and develop the next increment of the Collaborative Airspace Constraint Resolution capability	CATMT WP3: • Complete test and deployment of Collaborative Information Exchange (CIX) • Deploy the 1st increment of TFM Remote Site Re-engineering (TRS-R) Phase 2 • Begin design, develop and test the 2nd increment of TRS-R Phase 2
Demonstra-tions	28	Colorado Wide Area Multilatera-tion (WAM) Phase 2	Supports the Denver Air Route Traffic Control Cente 's ability to provide en route air traffic separation services to DRO, GUC, MTJ and TEX.	✓Completed key site installation	• Deploy phase 2 system that includes WAM and ADS-B at ○ DRO ○ GUC	• Provide WAM surveillance services supporting air traffic for: ○ DRO ○ GUC ○ MTJ ○ TEX
Future Facilities		Future Facilities Investment Planning	Supports optimization of FAA's air traffic service provider resources. Considers infrastructure alternatives and associated benefits, which include improved work environment, reduced time and cost to train controllers, seamless information exchange and reduced overall air traffic service provider costs while increasing the level of service.	✓Achieved initial investment decision for segment 1, project 1 (also known as Liberty Integrated Control Facility)	• Begin final location selection for segment 1, project 1	• Complete Final Site Selection • Approve and execute land acquisition
Airport Improvement Program		Airfiel development	Continues the development of new runways and extensions to increase capacity and efficienc .	✓Completed ANC Runway 7R/25L extension ✓Completed rehabilitation of PDX Runway 10R/28L ✓Completed ATL Runway 9L/27R extension ✓Continued Future Airport Capacity Task (FACT) 3 to identify capacity-constrained airports in 2020 and 2030 ✓Completed Airport System Strategic Evaluation Task study, to propose updates to the federal airport classifications for general aviation airports that reflect the airports' roles in their community, the region and the NAS ✓Considered obstruction removal and lighting needs so that airports with LPV approach procedures can achieve lower minimums ✓Continued ADS-B vehicle squitter demonstration program at BOS ✓Continued research into low-cost surface surveillance framework	• Complete ATL Runway 9L/27R extension and Runway 9R/27L widening • Complete SAT Runway 3/21 extension • Complete FACT3 to identify capacity-constrained airports in 2020 and 2030 • Consider obstruction removal and lighting needs so that general aviation airports with LPV approach procedures can achieve lower minimums • Continue ADS-B vehicle squitter demonstration program at ○ BOS and expand to ○ DEN ○ ORD ○ SFO • Continue research into low-cost surface surveillance framework	• Complete ORD Runway 10C/28C • Complete FLL Runway 9R/27L • Complete CMH Runway 10R/28L relocation • Continue additional JFK taxiway improvements • Complete JFK Runway 4L/22R reconstruction, extension, and widening • Continue ORD O'Hare Modernization Program • Continue PHL Capacity Enhancement Program • Continue planning and environmental projects

Concept Maturity and System Development

Arrivals/Departures at High Density Airports (HD)

The focus of this solution set is to increase the arrivals and departures in areas where demand for runway capacity is high, where there are multiple runways with airspace and taxiing interaction, and where airports are in close proximity with potential for airspace/approach interference.

Collaborative Air Traffic Management (CATM)

This solution set focuses on delivering services to accommodate flight operator preferences to the maximum extent possible

Flexibility in the Terminal Environment (FLEX)

This solution set covers the terminal and airport operations for all airports. The focus of FLEX is to advance separation procedures and improve trajectory management.

Reduce Weather Impact (RWI)

This solution set includes improvements to weather information and its use to enhance safety, capacity and efficienc .

System Networked Facilities (FAC)

This solution set focuses on delivering a facility infrastructure that supports the transformation of air navigation service delivery unencumbered by legacy constraints. NextGen facilities will provide for expanded services; service continuity; and optimal deployment and training of the workforce, all supported by cost-effective and flexible systems for information sharing and back-u .

Trajectory Based Operations (TBO)

This solution set represents a shift from clearance-based to trajectory-based control. Aircraft will fly negotiated trajectories and ai traffic control moves to trajectory management. The roles of pilots/controllers will evolve due to the increase in automation support. The focus of TBO is primarily en route cruise. Additional information about TBO operational capabilities can be found in the NAS Enterprise Architecture.

Arrivals/Departures at High Density Airports (HD) Selected Work Activities						
OI	**Task Force**	**Activity**	**Description**	**FY 2012**	**FY 2013**	**FY 2014 +**
		Trajectory Management – Surface Traffic Data Sharing	Focuses on the development and implementation of the technical infrastructure, operational procedures and data governance policies to facilitate the exchange of surface related data needed to enhance system efficienc , reduce delays, and foster increased collaborative decision making between the air navigation service provider, the flying community and other airport stakeholders.	✓ ASDE-X data provided to industry via ASDE-X System Oriented Architecture (SOA) Distributor (ASDE-X SD)	• The SWIM Terminal Data Distribution System (STDDS) is scheduled to be deployed at 39 sites, including all 35 instances of ASDE-X installations in the NAS. ASDE-X SD functionality will transition to STDDS providing ASDE-X data to industry and internal NAS consumers through the NAS Enterprise Messaging System (NEMS)	
104209	40 43 38 41	Trajectory Management – Surface Tactical Flow	Focuses on the development of surface-based trajectory operations and provides a roadmap for the development of a collaborative Surface Traffic Management System.	✓ Completed the evaluation report on the field assessment conducted at MEM in 2011 on the feasibility of queue management in the surface tactical flow arena for fligh operators and the air traffic control towe ✓ Completed a technical transfer of queue management concepts to the Program Management Office and support artifacts	• Develop an initial shortfall analysis to identify possible gaps of airport configuration management	• Conduct field evaluations at MEM to validate the airport configuration concep • Continue technical transfer of mature surface capabilities to the Program Management Offic
		Trajectory Management – Time-Based Flow Management (TBFM) Work Package III	Leverages time-based metering capabilities to implement NextGen concepts, such as terminal metering, expanding tower scheduling of departures to additional locations, integrating surface data into TBFM calculations to improve departure scheduling, enabling the opportunity for optimized descents during metering operations, and making TBFM more flexible to accommodate dynamic reroute operations in response to changing weather conditions.	✓ Developed an initial shortfall analysis to identify possible limitations of TBFM capabilities	• Develop Acquisition Management System documentation for investment analysis readiness document (IARD)	• Develop Acquisition Management System documentation for final investment decision (FID)

Collaborative Air Traffic Management (CATM) Selected Work Activities						
OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
103305		Flight and State Data Management, Flight Object	Facilitates the sharing of common flight information between systems and enables collaboration using common reference framework. The Flight Object (FO) is an extensible and dynamic collection of data elements that describes an individual flight throughout its life cycle. It is the single common reference for all system information about that flight. It associates and merges disparate data into a cohesive picture of the flight. Authorized system stakeholders and the ANSP may electronically access consistent flight data that are tailored to their specific need and use. A FO is created for each proposed flight. The FO description does not include environment or weather information since these are system-wide elements that affect multiple flights	✓ Developed requirements of key airborne reroute capabilities for ERAM Post Release 3 to support improved system flexibility and efficienc ✓ Completed FO industry and international collaboration	• Develop the Flight Information Exchange Model (FIXM) and Schema version 2.0 • Develop the FO requirements and FO adapter requirements • Update FIXM website	• Continue development of the FIXM, and produce subsequent versions of FIXM 3.0, 4.0, etc. • Upgrade FIXM 3.0 and others to reflect data elements required by Flight Data Publication Services (FDPS) as well as collaboration with ICAO, IATA, ATMRPP, ATIEC, etc. • Continue development of architecture artifacts for Flight Object Exchange Services (FOXS) and FOXS evaluation model
103305 105208 108212	35	Flight and State Data Management, Common Status and Structure Data (CSSD)	Addresses information and capability gaps within aeronautical information to achieve NextGen shared situational awareness.	✓ Demonstrated the initial CSSD services with the digital airport data	• Conduct a prototype demonstration of Aeronautical Common Services (ACS) capabilities to support AIM Modernization Segment 2	• Develop a concept of operations for the collection and dissemination of Standard Operating Procedure (SOP)/ Letters of Agreement (LOA) to decision support tools for performing flight planning and providing situation awareness • Demonstrate limited SOP/LOA capture and dissemination capabilities in line with the concept of operations • Perform safety assessments • Develop artifacts to support investment analysis for AIM Modernization future Segment 3
105208	7b 8 46	Flow Control Management, Strategic Flow Management Integration (Integration Execution of Flow Strategies into Controller Tools)	Refines active aircraft reroute concepts; develops active aircraft reroute requirements; analyzes, simulates and develops white papers on active aircraft reroutes functions.	✓ Developed requirements of key airborne reroute capabilities for ERAM Post Release 3 to support improved system flexibility and efficienc	• Develop an ERAM system airborne reroute use case document • Finalize the ERAM system airborne reroute A-level, B-level, and display system requirements	• Validating concepts with Human-in-the-Loop (HITL) and high-level requirements development for complex routes with Data Communications • Continue requirements analysis of integration and delivery needs of re-route information from TFMS through ERAM to Data Comm

Collaborative Air Traffic Management (CATM) Selected Work Activities						
OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
105208 101102	47	Flow Control Management, Strategic Flow Management Enhancement (Enhancing the Strategic Flow Program)	Refines concept of operations for strategic flow management, analysis and white paper of strategic flow management, and modeling and simulation.	✓ Completed the concept requirements and definition plan for the Traffic Flow Management System/ CATMT Work Package 4	• Prepare a functional analysis for improving demand prediction • Prepare a functional analysis of the Integrated TMI Modeling	• Validating concepts for Work Package 4 capabilities, including examination and refinement of concepts and requirements • Complete gap analysis document to determine operational, functional, and performance gaps associated with Traffic Flow Management (TFM) after WP4
105302 105208 101102		Flight and State Data Management, Advanced Methods	Integrates weather into air traffic management (TM); probabilistic TFM Area Flow Program will develop advanced algorithms to support the area flow support tool. Creates a unified flight planning fili by continuing assessment of fuzzy performance and common reference to the ATM domain.	✓ Conducted initial assessment of requirement for a Unified Flight Planning and Filing (UFPF) evaluation model platform and finalize the evaluation plan ✓ Conducted a demonstration of the NAS Common Reference (NCR) providing multiple NAS constraints information to prefligh	• Develop a functional analysis report for UFPF and NCR concepts • Develop an initial operational requirements document for UFPF and NCR	• Complete UFPF Specific Functional Allocation • Develop UFPF Cost Analysis for Functional Allocation • Complete NCR Initial Functional Analysis • Develop NCR Operational Integration Strategy
108209 102141		Flight and State Data Management, Concept Development for Integrated NAS Design and Procedure Planning	Develops a framework for integrated national airspace design and procedures planning, enhancements to existing infrastructure to support impact assessments, and develops initial concept for best-equipped, best-served.	✓ Developed the Greener Skies research plan to identify scenarios, performance capabilities and associated ATC rules for modeling and simulation ✓ Conducted analysis to determine integration and dependency challenges for policy implementation of best-equipped, best-served	• Determine whether procedures allow the concepts to be implemented • Enhance fast time models to incorporate procedures and complete analysis	• Develop preliminary business case analysis for Required Navigational Performance to Instrument Landing System (RNP to ILS) capture • Design initial Standard Instrument Departure/ Standard Terminal Arrival Route (SID/ STAR) RNP separation procedure
		Collaborative Information Management	Develop information exchange protocol and architecture with interagency aviation stakeholders, and conduct flight operational trials as needed.		• Determine requirements and applications for mobile access to System Wide Information Management (SWIM) prototype • Develop a wireless security white paper	• Develop Agency to Agency operational data model • Simulation and Validation of interagency data and information exchange strategy

Flexible Terminal Environment (FLEX) Selected Work Activities						
OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
107107		Separation Management, Approaches, Ground Based Augmentation System (GBAS)	Begins implementation of GBAS at the nation's busiest airports (OEP 35) to achieve capacity and efficiency benefit by integrating RNAV and RNP capabilities with the Category 1 GBAS Landing System capability.	✓ Completed modification and evaluation report on development of the GBAS system at EWR to combat radio frequency interference (RFI)	• Create and update the GBAS Category III System (GAST-D) initial requirements database • Complete testing of commercially developed RFI-robust GBAS Category III Ground Prototype System	• Complete validation of compliance with the International Civil Aviation Organization (ICAO) Standards and Recommended Practices (SARPS) for the GBAS Category III system
107119		Separation Management, Approaches, NextGen Navigation Initiatives	Develops and baselines specifications and initiates solution development including acquisition and testing of navigation aid equipment.	✓ Completed a surface navigation shortfall analysis to support the development of related requirements to support implementation of the NextGen Concept of Operations ✓ Conducted an assessment of NAS operational requirement to support the development of a detailed RVR deployment schedule	• Complete coverage testing for updates to the National Standards and Orders for Terminal RNAV DME-DME • Achieve a Final Investment Decision for Enhanced Low Visibility Operations (ELVO)	• Conduct systems engineering support for NextGen Navigation concepts
107118 107119		Separation Management, Approaches, Optimize Navigation Technology	Develops and baselines specifications and initiates solution development, including acquisition and testing of navigation aid equipment.	✓ Conducted design qualification test for LED PAPI development		
	25	Trajectory Management, Arrivals (RNAV/ RNP) with 3D and Required Time of Arrival (RTA)	Evaluates the ability of aircraft to accurately meet vertical constraints and time of arrival. Evaluates the advantages and disadvantages with imposing vertical constraints and RTA in different congestion scenarios. Also evaluates Data Communications (Data Comm) capabilities for aircraft messaging for RTA, and reroutes.	✓ Conducted an expanded Required Time of Arrival Demonstration to determine the feasibility of the RTA capabilities using current technologies in the NAS		
103207 104209 102406	43 38 9 41	Flight and State Data Management, Surface/Tower/ Terminal Systems Engineering	Redefines and extends the TFDM and Arrival/Departure Management Tool concept of operations, funding will be used to update current analysis proposals and assess acquisition risks.	✓ Completed AMS technical and business analysis products required for Initial Investment Decision for the Terminal Flight Data Manager (TFDM) investment decision	• Complete the TFDM initial Program Requirements document (iPR) and final Investment Analysis Plan	
		Trajectory Management, Reduced RVR Minima	Brings improved capabilities through the prudent lowering of the RVR requirement by acknowledging benefits provided by cockpit equipment and crew training.		• Initiate installation and operational implementation of Reduced RVR equipment at initial candidate sites	

Flexible Terminal Environment (FLEX) Selected Work Activities						
OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
102141	37a 13	Separation Management, Closely Spaced Parallel Runway Operations (CSPO)	Examines alternate proposals for further reductions of separation standards in runway spacing, and conducts simulator trials to collect data and conduct analysis.	✓ Conducted site specific examinations to determine airport operational considerations (combination of ground infrastructure, aircraft characteristics and operational conditions) that may lead to reduction in lateral runway separation standards	• Deliver the site specific evaluation final report for ORD • Develop Simplified Aircraft-Based Paired Approaches (SAPA) alerting algorithms and accompanying software reference documentation	• Acquire High Update Rate (HUR) Surveillance Data for future analysis with closely spaced parallel operations • Conduct fast-time simulations and analysis for triple approaches or operations using three closely spaced parallel runways
		Flight and State Data Management, Future Communications Infrastructure	Evaluates selected mobile and fixed applications of the aeronautical mobile airport communications system (AeroMACS) for future provisioning of both safety critical and advisory services.	✓ Conducted analysis of segregation and transport alternatives for air traffic control and airline operations center data, which will provide opportunities to reduce the infrastructure needs for digital communications on the ground		

Reduced Weather Impact (RWI) Selected Work Activities						
OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
		Reduce Weather Impact (NextGen Weather Processor)	Provides improved weather observations and forecasts and tailors weather data for integration into decision support tools for collaborative and dynamic NAS decision making	✓ Completed draft cost estimate for Business Case Analysis Report ✓ Performed risk reduction activities of government furnished information (GFI) package	• Initial investment decision (IID) for NextGen Weather Processor Work Package 1 • Develop Final Implementation Strategy and Planning Document (ISPD) • Complete GFI Package	• Final investment decision (FID) for NextGen Weather Processor Work Package 1 • NWP Contract Award
		Reduce Weather Impact (Weather Observation Improvements)	Optimize observing platforms to include legacy and future systems; provide observational data of requisite space and time resolution for NextGen	✓ Delivered Flexible Terminal Sensor Network (FTSN) Initial Design Document	• Initiate proof of concept demonstration of FTSN functionality • Develop Updated Legacy Transition Plan	• Concept Requirements Definition Readiness (CRDR) activities
		Reduce Weather Impact (Weather Forecast Improvements)	Develop concepts and conduct analyzes for weather integration into decision support tools and processes	✓ Completed documentation on avoidable delay analysis and model/tool enhancements from the WITI framework	• Maintain and deliver QMS reports and documentation • Weather Impact Evaluation of CORE Airports	• Analysis on utility of the Convective Weather Avoidance Model (CWAM) for Time Based Flow Management Work Package 3 (TBFM WP3) and Collaborative Air Traffic Management Tools Work Package 4 (CATMT WP4)

System Networked Facilities (FAC) Selected Work Activities						
OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
	32a 29	Integration, Development and Operations Analysis Capability	Continues to enhance, operate and maintain the operations analysis capability to support the development of iterative designs to evaluate concepts and alternatives. This will provide for an integrated environment ranging from low- to high-fidelity capabilities to support NextGen concept validation and requirements, which are required to facilitate the transition of NextGen technologies in the NAS.	✓ Designed and implement airline operations center capability for NextGen Integration and Evaluation Capability (NIEC)	• Complete the technical refresh analysis report for the reconfigurable cockpit simulator and initiate the procurement of equipment to support the NIEC technical refresh	• Install a mini-Traffic Flow Management Production Center (TPC) and integrate Traffic Flow Management (TFM) Auxiliary Platform into the NIEC
		NextGen Test Bed/ Demonstration Sites	Continues to expand the NextGen Test Bed capabilities in Daytona Beach, Fla. This program will continue integration activities between the NextGen Test Beds, increase system capabilities and improve operational fidelity of the environment. The NextGen Test Bed is a multi-domain demonstration and testing facility that integrates individual airspace domains and allows for end-to-end demonstrations, evaluations and testing in line with the NextGen gate-to-gate concept.	✓ Provided additional Florida Test Bed infrastructure to enhance demonstration capabilities	• Provide hardware (HW), and network equipment to enable connectivity to remote FAA, NASA and Industry sites	• Integrate systems between the Florida Test Bed and remote sites to leverage shared capabilities and enable inter-facility demonstration activities

Trajectory Based Operations (TBO) Selected Work Activities						
OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
108209		Separation Management, High Altitude	Identifies cognitive support and displays change requirements necessary for a transition to a high-altitude specialty that addresses the goals for capacity and organization excellence.	✓ Conducted integrated Human-in-the-Loop simulation of high altitude concept		
102108		Oceanic Tactical Trajectory Management	Develop an initial mid-term concept for Oceanic Trajectory Management in Four Dimensions (OTM-4D). A key objective of this concept is to use trajectory-based operations to improve fuel efficienc , system predictability, and performance by enabling airlines and other operators to flight plan and fl closer to their optimal (or preferred) 4D trajectories while in oceanic airspace.	✓ Conducted Automatic Dependent Surveillance–Contract (ADS-C) Climb/Descent Procedure (CDP) automation transition	• Conduct Oceanic Conflict Advisory Tool (OCAT) operational trial	• ADS-C CDP Automation Requirements • ADS-C CDP Automation Software Release • Controller Readiness • International Civil Aviation Organization (ICAO) Procedure Change
108209		Capacity Management - NextGen Distance Measuring Equipment (DME)	Provides the necessary equipment enhancements, relocation, and replacements to ensure that DME facilities are available.	✓ First article (design approval, test plan, procedures and safety assessment of contract data requirements list)		
108209 102137		Separation Management, Modern Procedures (Separation Automation Enhancements, Data-Side and Radar-Side)	Performs pre-implementation activities necessary to transition separation management automation enhancements for implementation and continued functionality for Performance Based Navigation route eligibility checking for inclusion in En Route Automation Modernization (ERAM) Release 3.	✓ Evaluated trajectory model enhancements	• D-position CHI Mini-Operational evaluation • Conflict Probe and Trajectory Model Algorithm Improvements Evaluations	• Complete Requirements Documents for Enhancements to Trajectory Modeling Accuracy and Conflict Alert and Detection Algorithm

System Development Selected Work Activities						
OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
103305 108212		New ATM Requirements	Conducts research across all solution sets, focused on maturing concepts and technologies targeting application toward the end of the NextGen mid-term.	✓ Completed the baseline requirements for future Traffic Collision and Avoidance Systems (TCAS) that define the operational and technical requirements underlying the present TCAS II equipment and standards	• Alaska current icing product/forecast icing product (CIP/FIP AK) • Develop the TCAS/ ADS-B Compatibility/ Future Requirements Document • Deliver initial report on full-antenna aperture performance model for multifunction radar capability • Complete development of NAS trajectory performance requirements • Provide acquisition planning to support requirements levied on NAS systems by uses of Airborne Access to SWIM (AAtS)	• Continuation of data elements support for trajectory modeling • Complete update to the Multi-function Phased-Array Radar (MPAR) Concept of Operations • Develop high level requirements document for MPAR
		Operational Assessments	Conducts integrated assessments to ensure that safety, environmental and system performance considerations are properly addressed throughout the integration and implementation of NextGen.	✓ Updated NextGen cost and benefits estimate	• Develop and maintain the website for NextGen Performance Snapshots (NPS) to aid in the tracking and reporting of progress within NextGen	• Continue to develop and maintain the website for NPS to aid in the tracking and reporting of progress within NextGen

System Development Selected Work Activities						
OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
		Systems Safety Management Transformation	Develops tools and supporting processes leading to a comprehensive and proactive approach to aviation safety in conjunction with implementation of NextGen capacity and efficiency capabilities. The implementation of these capabilities will require changes in the process of safety management, the definition and implementation of risk management systems and management of the overall transformation process to ensure that safety is not only maintained but improved. Creates system-wide risk baselines — and annual impact assessment of changes — including NextGen, on safety risk. Ensures highly capable and consistent risk assessment processes through Safety Risk Management (SRM) processes and taxonomy, analytical methods and integrated evaluation applications. Develops new methods to ensure continual surveillance of design approval holder compliance with Safety Management System (SMS) requirements.	✓ Demonstrated terminal area operational risk model to assess impact of NextGen operational improvements for three airports	• Compete a predictive system safety assessment of potential risks for selected NextGen Operational Improvements as defined in the NextGen Segment Implementation Plan (NSIP) version 4.0. Potential safety impacts will be assessed on accident categories similar to those in the Commercial Aviation Safety Team (CAST) plan. A final analysis report will be provided, as well as a copy of the analysis software and end-user documentation	• Deliver a fully integrated web-based pilot and controller Integrated Safety Assessment Model (ISAM) for to assess terminal and airport surface anomaly rates related to safety for NextGen Operational Improvements • Develop airport surface and high-density terminal area risk baseline and forecast safety risk models for additional airports covering top 100 terminal and airport environments
101102		ATC/Technical Operations Human Factors	Conducts system engineering and other technical support to fully integrate human factors considerations into the NextGen portfolio, and conducts focused human factors studies in areas such as controller workload and work station interfaces.	✓ Conducted a demonstration of the human error/ safety database for off-nominal NextGen conditions ✓ Established collaborative air traffic management-human factors requirements ✓ Planned NextGen human factors air-ground integration Human-in-the-Loop testing	• NextGen Human Systems Integration Research and Engineering Strategic Plan Update • NextGen Tech Ops Integrated Work Environment (IWE) Segment 2 Requirements	• Human Performance/ Safety baseline assessment • Develop Information Requirements for TMC, Dispatchers, Controllers, and Pilots for Increased Throughput During Routes and Special Handling Situations
		Staffed NextGen Towers (SNT)		✓ Issued report from second SNT field demonstration ✓ Updated SNT program requirements document		

System Development Selected Work Activities						
OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
		Wake Turbulence Recategorization		✓ Completed an initial concept of operations document for more efficient leader/follower wake turbulence separation standards	• Complete a benefit assessment based on Initial Concept of Operations document for more efficient leader/follower wake turbulence separation standards	• Complete the implementation plan for the leader/follower pair-wise static tailored aircraft wake separation standards procedures and processes

Demonstration and Infrastructure (DEMO) Selected Work Activities						
OI	Task Force	Activity	Description	FY 2012	FY 2013	FY 2014 +
102137 108212		NextGen – Demonstrations and Infrastructure Development	Demonstration, development and validation planning activities including International Air Traffic Interoperability, RNAV-RNP Terminal Area Demonstration, Airborne Access to SWIM (AAtS), Airborne Execution of Flow Strategies, GBAS Demonstration, Mini Global Demonstration, UAS Integration into NAS, and Future Planning.	✓ Identified a commercial service provider for an AAtS demonstration that will aid in the evaluation of the feasibility of transmitting information from the SWIM platform to the aircraft ✓ Developed a plan for Airborne Execution of Strategic Flows that will aid in the planning, development and evaluation of its feasibility within the NAS ✓ Coordinated planning documentation for GBAS in Guam with stakeholders, in order to assure harmonization within the user community	• Conduct demonstration and complete final report of results to show the capability of the FAA system and airborne aircraft to communicate non-safety-critical information via an airborne network • Work with the Single European Sky Air Traffic Management Research (SESAR) program and ICAO to define Aviation System Block Upgrades (ASBU), a set of modular targets for each country to work toward within specific time frames, in relation to the Atlantic Interoperability Initiative to Reduce Emissions (AIRE) and SWIM activities	• Conduct demonstration activities of collaborative end-to-end domain and develop standards and alternatives of near-term emerging technologies and airspace customer initiatives related to International Air Traffic Interoperability • Provide reporting and tracking for the NextGen projects in support of the NextGen Segment Implementation Portfolios as well as the pre-engineering work that aids in the mitigation of risk to developing projects • Conduct demonstration activities to show capabilities for re-routing airborne flights and continue to develop metrics and methodology for strategic flow initiative • Conduct a Mini Global demonstration of Flight Object concepts validation, such as the Flight Information Exchange Model (FIXM) standard while developing evaluation strategies to harmonize Flight Object concepts • Complete a demonstration and prepare report to assess feasibility and requirements for integration of UAS operations in the NAS including exchange of loss-link procedures using FIXM protocols

AIRPORT AND FACILITY CODES

CORE 30 AIRPORTS

ATL	Atlanta
BOS	Boston
BWI	Baltimore-Washington
CLT	Charlotte
DCA	Washington Reagan
DEN	Denver
DFW	Dallas/Fort Worth
DTW	Detroit
EWR	Newark
FLL	Fort Lauderdale-Hollywood
HNL	Honolulu
IAD	Washington Dulles
IAH	Houston
JFK	New York John F. Kennedy
LAS	Las Vegas McCarran
LAX	Los Angeles
LGA	New York LaGuardia
MCO	Orlando
MDW	Chicago Midway
MEM	Memphis
MIA	Miami
MSP	Minneapolis-Saint Paul
ORD	Chicago O'Hare
PHL	Philadelphia
PHX	Phoenix
SAN	San Diego
SEA	Seattle
SFO	San Francisco
SLC	Salt Lake City
TPA	Tampa

OTHER AIRPORTS

ADW	Andrews Air Force Base (Maryland)
ANC	Anchorage
BFI	King County (Boeing Field)
CLE	Cleveland
CMH	Columbus
CVG	Cincinnati
DRO	Durango (Colorado)
GUC	Gunnison (Colorado)
HPN	Westchester County
MCI	Kansas City
MKE	Milwaukee
MSY	New Orleans
MTJ	Montrose (Colorado)
PDX	Portland (Oregon)
PIT	Pittsburgh
SDF	Louisville (Kentucky)
TEB	Teterboro (New Jersey)
TEX	Telluride (Colorado)

FAA FACILITIES

A80	Atlanta TRACON
C90	Chicago TRACON
N90	New York TRACON
NCT	Northern California TRACON
PCT	Potomac TRACON
SCT	Southern California TRACON
ZAB	Albuquerque ARTCC
ZBW	Boston ARTCC
ZDC	Washington ARTCC
ZDV	Denver ARTCC
ZHU	Houston ARTCC
ZLA	Los Angeles ARTCC
ZLC	Salt Lake City ARTCC
ZMP	Minneapolis ARTCC
ZNY	New York ARTCC
ZOA	Oakland ARTCC
ZSE	Seattle ARTCC

ACRONYMS

3D	Three Dimensional
1090 ES	1090 Extended Squitter
AAtS	Airborne Access to SWIM
ABRR	Airborne Reroute Execution
AC	Advisory Circular
ACAS-X	Airborne Collision Avoidance System
ACM	Adjacent Center Metering
ACS	Aeronautical Common Services
ADS-B	Automatic Dependent Surveillance–Broadcast
ADS-C	Automatic Dependent Surveillance–Contract
ADS-R	Automatic Dependent Surveillance–Rebroadcast
AEDT	Aviation Environmental Design Tool
AeroMACS	Aeronautical Mobile Airport Communications System
AIM	Aeronautical Information Management System
AIP	Air Improvement Program
AIRE	Atlantic Interoperability Initiative to Reduce Emissions
AirPASS	Aircraft Priority Access Selection Sequence
AMS	Acquisition Management System
ANSP	Air Navigation Service Provider
AOC	Airline Operations Center
APMT	Aviation Environmental Portfolio Management Tool
AR	Authorization Required
ARC	Aviation Rulemaking Committee
ARTCC	Air Route Traffic Control Center
ASAP	Aviation Safety Action Program
ASDE-3	Airport Surface Detection Equipment–Model 3
ASDE-X	Airport Surface Detection Equipment–Model X
ASIAS	Aviation Safety Information Analysis and Sharing
ASPIRE	Asia and Pacific Initiative to Reduce Emissions
ASR	Airport Surveillance Radar
ASSC	Airport Surface Surveillance Capability
ASTM	Standard-setting organization
ATC	Air Traffic Control
ATCBI	Air Traffic Control Beacon Interrogator
ATCT	Air Traffic Control Tower
ATIEC	Air Transportation Information Exchange Conference
ATM	Air Traffic Management
ATMRPP	ATM Requirements and Performance Panel
ATN	Aeronautical Telecommunication Network
ATOP	Advanced Technologies and Oceanic Procedures
ATPA	Automated Terminal Proximity Alert
ATSAP	Air Traffic Safety Action Program
baro-VNAV	Barometric Vertical Navigation
CARTS	Common Automated Radar Terminal System
CAST	Commercial Aviation Safety Team
Cat	Category
CATM	Collaborative Air Traffic Management
CATMT	Collaborative Air Traffic Management Technologies
CDM	Collaborative Decision Making
CDP	Climb/Descend Procedure
CDTI	Cockpit Display of Traffic Information
CFR	Code of Federal Regulations
CHI	Computer-Human Interface
CIP/FIP	Current Icing Product/Forecast Icing Product
CIX	Collaborative Information Exchange
CLEEN	Continuous Lower Energy, Emissions and Noise
ConOps	Concept of Operations
CRDA	Converging Runway Display Aid
CRDR	Concept Requirements Definition Readiness

CSPO	Closely Spaced Parallel Operations
CSSD	Common Status and Structure Data
CSS-Wx	Common Support Services–Weather
CWAM	Convective Weather Avoidance Model
DA/DH	Decision Altitude/Decision Height
Data Comm	Data Communications
DCL	Departure Clearance
DDU	Data Distribution Unit
DoD	Department of Defense
DME	Distance Measuring Equipment
DOT	Department of Transportation
DRM	Departure Reservoir Manager
DSP	Departure Spacing Program
EFB	Electronic Flight Bag
EFVS	Enhanced Flight Vision System
ELVO	Enhanced Low Visibility Operations
EMS	Environmental Management System
ERAM	En Route Automation Modernization
ESV	Expanded Service Volume
EUROCONTROL	European Organization for the Safety of Air Navigation
EVS	Enhanced Vision System
FAA	Federal Aviation Administration
FAC	System Networked Facilities
FACT	Future Airport Capacity Task
FANS	Future Air Navigation System
FAS	Final Approach Segment
FDPS	Flight Data Publication Services
FID	Final Investment Decision
FIS-B	Flight Information Service–Broadcast
FIXM	Flight Information Exchange Model
FL	Flight Level
FLEX	Flexibility in the Terminal Environment
FMS	Flight Management System
FO	Flight Object
FOC	Flight Operations Center
FOQA	Flight Operational Quality Assurance
FOXS	Flight Object Exchange Services
FRL	Fuel Readiness Level
FTSN	Flexible Terminal Sensor Network
FY	Fiscal Year
GAST-D	GBAS Category III System
GBAS	Ground Based Augmentation System
GDP	Gross Domestic Product
GFI	Government Furnished Information
GIS	Geographic Information System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HAATS	Houston Area Air Traffic System
HCS	Host Computer System
HD	High Density Airports
HEFA	Hydroprocessed Esters and Fatty Acids (fuel)
HITL	Human-in-the-Loop
HRJ	Hydrotreated Renewable Jet (fuel)
HUD	Head-Up Display
HUR	High Update Rate
IARD	Investment Analysis Readiness Document
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IDAC	Integrated Departure/Arrival Capability
IID	Initial Investment Decision
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IOC	Initial Operating Capability
IPR	Initial Program Requirements document
ISAM	Integrated Safety Assessment Model
ISPD	Implementation Strategy and Planning Document
ITP	In-Trail Procedure
IWE	Integrated Work Environment

LED	Light-Emitting Diode
LNAV	Lateral Navigation
LOA	Letter of Agreement
LP	Localizer Performance
LPV	Localizer Performance with Vertical Guidance
Massport	Massachusetts Port Authority
MDA	Minimum Descent Altitude
MPAR	Multi-function Phased-Array Radar
MSL	Mean Sea Level
NAC	NextGen Advisory Committee
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NAVAID	Navigational Aid
NCR	NAS Common Reference
NDB	Nondirectional Beacon
NEMS	NAS Enterprise Messaging System
NEPA	National Environmental Policy Act
NextGen	Next Generation Air Transportation System
NIEC	NextGen Integration and Evaluation Capability
nm	nautical mile
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notice to Airmen
NPRM	Notice of Proposed Rulemaking
NPS	NextGen Performance Snapshots
NSIP	NextGen Segment Implementation Plan
NWP	NextGen Weather Processor
OAPM	Optimization of Airspace and Procedures in the Metroplex
OARS	Operational Analysis and Reporting System
OCAT	Oceanic Conflict Advisory Trial
Ocean21	Oceanic Automation System
OEP	Operational Evolution Partnership
OI	Operational Improvement
OPD	Optimized Profile Descent
PAPI	Precision Approach Path Indictor
PBN	Performance Based Navigation
PIREPS	Pilot Reports
PNT	Positioning, Navigation and Timing
PPP	Public-Private Partnership
QMS	Quality Management System
RAP	Rulemaking Action Plan
RAPT	Route Availability Planning Tool
RF	Radius-to-Fix
RFI	Radio Frequency Interference
RNAV	Area Navigation
RNP	Required Navigation Performance
RPI	Relative Position Indicator
RTA	Required Time of Arrival
RTCA	Aviation industry group
RVR	Runway Visual Range
RVSM	Reduced Vertical Separation Minimum
RWI	Reduce Weather Impact
SA	Special Authorization
SAA	Special Activity Airspace
SAPA	Simplified Aircraft-Based Paired Approaches
SARPS	Standards and Recommended Practices
SATNAV	Satellite Navigation
SBAS	Satellite Based Augmentation System
SC	Special Committee
SCDM	Surface Collaborative Decision Making
SCT	FAA-Industry Surface CDM Team
SD	System Oriented Architecture Distributor
SESAR	Single European Sky Air Traffic Management Research
SFMI	Strategic Flow Management Integration
SID	Standard Instrument Departure
SIPIA	Simultaneous Independent Parallel Instrument Approach

SITS	Security Integrated Tool Set
SMS	Safety Managements System
SNT	Staffed NextGen Towers
SOA	System Oriented Architecture
SOIA	Simultaneous Offset Instrument Approach
SOP	Standard Operating Procedure
SRM	Safety Risk Management
SRMD	Safety Risk Management Document
SSE	Safety, Security and Environment
STAR	Standard Terminal Arrival
STARS	Standard Terminal Automation Replacement System
STC	Supplemental Type Certificate
STDDS	System Wide Information Management Terminal Data Distribution System
SUA	Special Use Airspace
SVS	Synthetic Vision System
SWIM	System Wide Information Management
TAPS	Twin Annular Premixing Swirler
TAWS	Terrain Awareness and Warning System
TBFM	Time Based Flow Management
TBM	Time-Based Metering
TBO	Trajectory Based Operations
TCAS	Traffic Alert and Collision Avoidance System
TFDM	Terminal Flight Data Manager
TFM	Traffic Flow Management
TFMS	Traffic Flow Management System
TIM	Technical Interchange Meeting
TIS-B	Traffic Information Service–Broadcast
TMA	Traffic Management Advisor
TMC	Traffic Management Coordinator
TMU	Traffic Management Unit
TPC	TFM Production Center
TRACON	Terminal Radar Approach Control
TRS-R	TFM Remote Site Re-Engineering
TSAA	Traffic Situational Awareness with Alerts
T-SAP	Technical Operations Safety Action Program
TSO	Technical Standard Order
UAS	Unmanned Aircraft System
UAT	Universal Access Transceiver
UFPF	Unified Flight Planning and Filing
VDL	VHF Digital Link
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VNAV	Vertical Navigation
VOR	VHF Omnidirectional Range
WAAS	Wide Area Augmentation System
WAM	Wide Area Multilateration
WITI	Weather Impacted Traffic Index
WP	Work Package
WTMA	Wake Turbulence Mitigation for Arrivals
WTMA-P	Wake Turbulence Mitigation for Arrivals–Procedures
WTMD	Wake Turbulence Mitigation for Departures

PHOTO CREDITS

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Why NextGEN Matters

The movement to the next generation of aviation is being enabled by a shift to smarter, satellite-based and digital technologies and new procedures that combine to make air travel more convenient, predictable and environmentally friendly.

As demand for our nation's increasingly congested airspace continues to grow, NextGen improvements are enabling the FAA to guide and track aircraft more precisely on more direct routes. NextGen efficiency enhances safety, reduces delays, saves fuel and reduces aircraft exhaust emissions. NextGen is also vital to preserving aviation's significant contributions to our national economy.

- NextGen provides a better travel experience, with less time spent sitting on the ground and holding in the air.
- NextGen gets the right information to the right person at the right time.
- NextGen reduces aviation's adverse environmental impact.
- NextGen lays a foundation for continually improving and accommodating future air transportation needs while strengthening the economy locally and nationally.
- NextGen increases airport access, predictability and reliability.
- NextGen enables us to meet our increasing national security and safety needs.
- NextGen safety management helps us to proactively identify and resolve potential hazards.
- NextGen brings about one seamless, global sky.

U.S. Department of Transportation
Federal Aviation Administration

Office of NextGen
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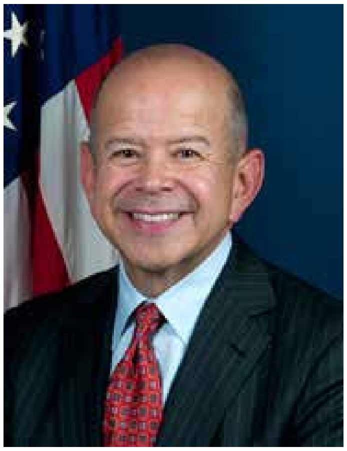
NextGEN

NextGen Implementation Plan 2015



From the
Administrator

May 2015

In 2015, the FAA will complete implementation of the majority of NextGen's foundational infrastructure. While most of that technology supports FAA in-house advancements, the upgrades were necessary to deploy future enhancements that will provide direct benefits to external aviation stakeholders.

Within the pages of this Implementation Plan, you will find status updates and milestone information on six programs that are changing the way the National Airspace System (NAS) operates:

- Automatic Dependent Surveillance–Broadcast (ADS-B)
- Data Communications (Data Comm)
- En Route Automation Modernization (ERAM)
- Terminal Automation Modernization and Replacement (TAMR)
- NAS Voice System (NVS)
- System Wide Information Management (SWIM)

These six programs are primarily FAA internal system upgrades that are necessary to deploy additional capabilities. The second half of this report provides a look at the timelines for new capabilities that are being developed and matured through a set of implementation portfolios.

We completed the baseline deployment of all ADS-B ground stations and made ADS-B available nationwide. As of this month, all 20 air route traffic control centers are using ERAM, and we're making tremendous progress in modernizing and standardizing the automation platforms used by our terminal air traffic controllers. More information is available on the NextGen website, www.faa.gov/nextgen.

The future of NextGen looks just as bright. We're working in partnership with industry to provide the capabilities in which the aviation community is most interested, in the areas where they are most needed.

The NextGen Interagency Planning Office is working with our partner agencies to develop integrated plans, adapt existing technologies and continue the research and development needed to ensure our air transportation system keeps pace with evolving needs and technology.

I am pleased to provide you with the 2015 NextGen Implementation Plan. I trust you will find it of value. Should you have any questions about the information reported in this document, please contact me or Molly Harris, Acting Assistant Administrator for Government and Industry Affairs, at (202) 267-8206.

Sincerely,

Michael P. Huerta
Administrator

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NEXTGEN PROGRAMS






AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST

Automatic Dependent Surveillance–Broadcast (ADS-B) is the more precise, satellite-based successor to radar. ADS-B Out uses GPS to determine an aircraft's location, airspeed and other data. It broadcasts that information to a network of ground stations (which relays the data to air traffic controllers) and to nearby aircraft equipped to receive the data via ADS-B In. ADS-B In provides operators of properly equipped aircraft with weather and traffic information delivered directly to the cockpit.

ADS-B Out equipage has been mandated in most controlled airspace — generally where transponders are required today — by January 1, 2020. ADS-B In equipage is not currently mandated.

TARGET USERS

Aircraft owners and pilots flying in most controlled airspace, air traffic controllers, airport surface vehicle operators

EQUIPAGE REQUIREMENTS

Avionics equipment requirements for operators and installers are detailed in FAA Advisory Circular 90-114 and Technical Standard Orders TSO-C166b and TSO-C154c. To meet the ADS-B Out mandate, aircraft require a position source (GPS) and a compatible transmitter. A display device is needed for ADS-B In.

- Aircraft operating above 18,000 feet (FL180) or internationally require a Mode S transponder operating on 1090 MHz with Extended Squitter (1090ES). A 1090 MHz receiver is needed to process Traffic Information Service-Broadcast (TIS-B) information. Flight Information Services-Broadcast (FIS-B) is not available with 1090ES.
- Aircraft operating within U.S. airspace below FL180 can use either a 1090ES or a Universal Access Transceiver (UAT) operating on 978 MHz. UAT is capable of receiving TIS-B and FIS-B.

OPERATIONAL CAPABILITIES

ADS-B Out avionics transmit position, airspeed and other data to ground receivers that in turn relay the information to controllers and aircraft equipped for ADS-B In. ADS-B In requires additional aircraft equipage to receive and display data from ground stations and ADS-B Out-equipped aircraft.

SERVICE CAPABILITIES

ADS-B In-equipped aircraft have access to the following additional broadcast services:

- FIS-B: Broadcasts graphical weather to the cockpit as well as text-based advisories, including Notices to Airmen and significant weather activit . Available only with a UAT.
- TIS-B: Provides altitude, ground track, speed and distance of aircraft flying in radar contact with controllers, and within a 15-nautical mile radius, up to 3,500 feet above or below the receiving aircraft's position.
- Automatic Dependent Surveillance–Rebroadcast (ADS-R): ADS-B Out information can be broadcast on two frequencies, 1090 MHz and 978 MHz. ADS-R rebroadcasts data from one frequency to the other, providing aircraft operating on both ADS-B links the ability to see each other on their traffic displays

IMPLEMENTATION

The FAA completed the baseline deployment of 634 ground stations in 2014. ADS-B has now been integrated into the automation platforms at 22 of 24 en route air traffic control facilities (19 of 20 En Route Automation Modernization systems and three of four Microprocessor En Route Automated Radar Tracking systems), which control high-altitude traffic. ADS-B traffic and weather broadcasts are now available nationwide. Similar system upgrades in our terminal radar approach control facilities are also on track and will be completed by 2016.

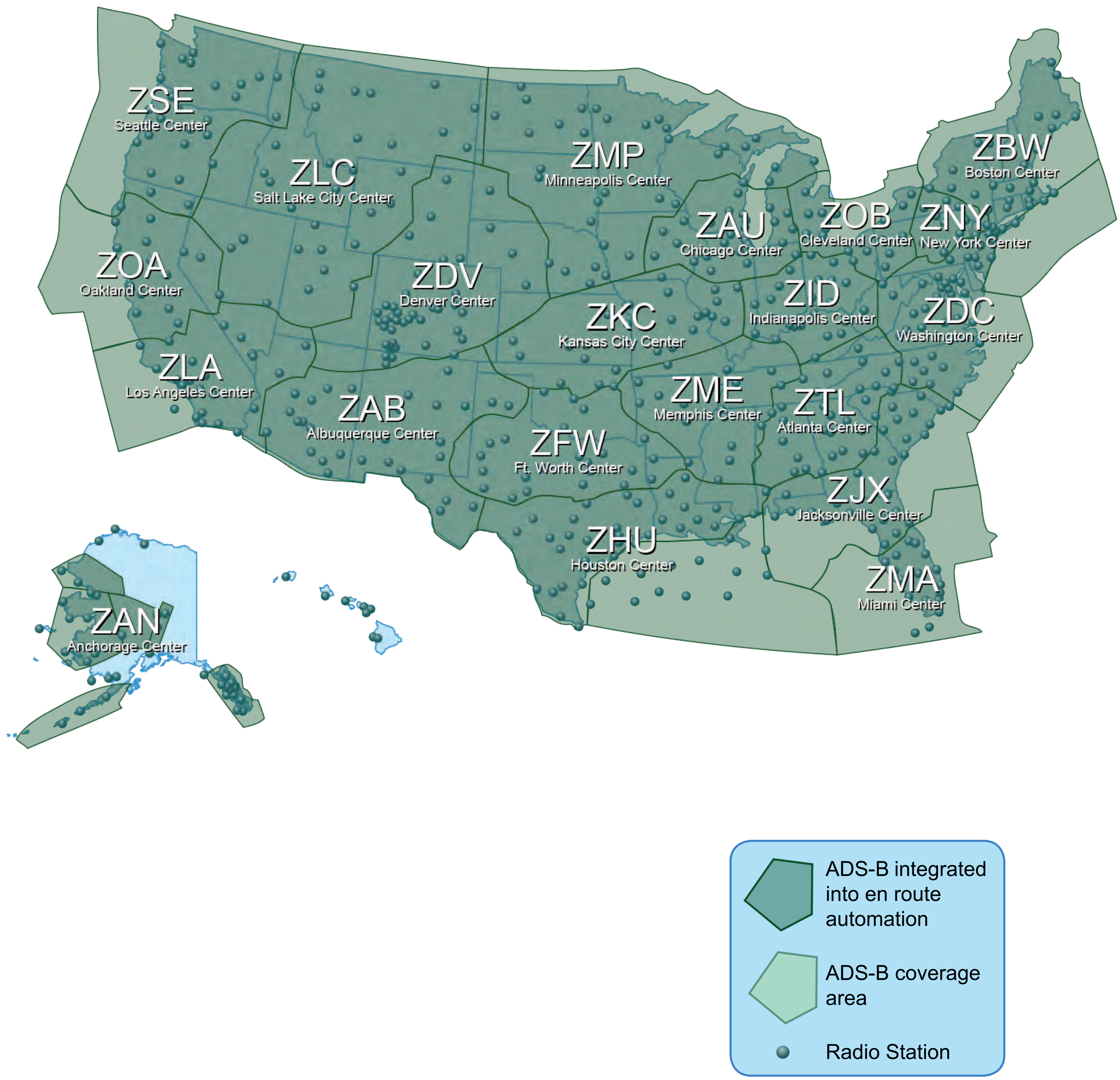
BENEFITS ACHIEVED TO DATE

The FAA declared ADS-B Initial Operating Capability (IOC) in the Gulf of Mexico on December 17, 2009, providing improved communications, weather and surveillance services to operators in the Gulf region. Of the 458 helicopters servicing oil platforms in the Gulf, more than 100 are now equipped with ADS-B avionics.

- ADS-B surveillance permits reduced separation between helicopters in the Gulf from a single aircraft inside a 20-by-20-mile block of airspace to 5 nautical miles (nm). This allows direct routing clearances for ADS-B-equipped helicopters, which has shortened trips by about 14 nm and saved about 14 gallons of fuel per flight. The FAA estimates over 300,000 nm in flight savings from December 2009 to February 2014.
- Helicopter operator PHI reports an increase in annual flight hours during periods of low visibility from 1,500 to 20,000.
- JetBlue Airways has become a pioneer for airline use of ADS-B over the Gulf of Mexico where there is no radar coverage. When severe weather blocks the usual flight plan between Florida and California, the airline is able to fly a more efficien ADS-B route over the Gulf as opposed to the typical over-land reroute. Flights that use the ADS-B route during severe weather save between 7 and 11 minutes of flight time on average, burning less fuel and creating fewer emissions than flights on the typical reroute
- General aviation pilots in properly equipped aircraft have subscription-free access to traffic and weathe . As of October 2014, more than 6,000 general aviation aircraft and 225 commercial aircraft have been equipped with ADS-B avionics.

ADS-B COVERAGE AND EN ROUTE INTEGRATION

As of April 2015



PROGRAM MILESTONES	DATE
ADS-B Segment 1 and Segment 2 Investment Decision	August 2007
Segment 1 Surveillance and Broadcast Services Interim Situation Display for ADS-B	September 2010
Initial Operating Capability (IOC) ADS-B Capability on Common -Automated Radar Terminal System IIIE at New York TRACON	July 2011
IOC ADS-B Capability on Standard Terminal Automation Replacement System at Houston TRACON	March 2012
Manufacture "Boards"	March 2012
IOC ERAM Release 3 with ADS-B Capability at Houston Center	April 2012
Flight Testing	June 2013
Traffic Situational Awareness with Alerts - RTCA Releases DO-3178	March 2014
Achieve En Route Separation Services IOC at the 12th site	March 2014
Achieve 12 of 16 Remote Units sending Airport Service Surveillance Capability data to Air Traffic Control Tower equipment at SFO	March 2014
Achievement of critical Services Implementation Service Acceptance Test at all 306 Service Volumes (Services encompass ADS-B Out, ADS-B In, TIS-B, FIS-B)	March 2014
Complete baseline ADS-B radio station infrastructure deployment	March 2014
Achieve Terminal Separation Services IOC at the 55th site	June 2014
Investment Analysis Readiness Decision for ADS-B In Applications Planning Milestone	September 2014
Complete IOC Surface Advisory Services at all 35 Airport Surface Detection Equipment, Model X sites	September 2014
Investment Analysis Readiness Decision for ADS-B In Applications Planning Milestones	June 2015
Complete IOC at last (24th) En Route site	September 2015
Final Investment Decision for ADS-B In Applications Planning Milestone	June 2016
Oceanic In-Trail Procedures operation at Oakland, New York and Anchorage	September 2017
Complete all Terminal and Surface IOCs	2019
ADS-B Out Rule Compliance (aircraft equipage deadline)	January 1, 2020

DATA COMMUNICATIONS

Data Communications (Data Comm) enables controllers and pilots to communicate with digitally-delivered messages, rather than rely solely on radio voice communications. With the push of a button, controllers will be able to electronically send routine instructions, such as departure clearances (DCL) and weather-avoiding reroutes, directly to the flight deck. Messages will appear only on the cockpit display of the aircraft to which they apply, reducing the potential for miscommunication that can occur from radio voice exchanges.

TARGET USERS

Air traffic controllers, airl ne pilots, airline dispatchers

EQUIPAGE REQUIREMENTS

Future Air Navigation System 1/A (direct data link between pilot and controller).

VHF Digital Link Mode 2 avionics for en route services.

VHF Digital Link Mode 0 avionics will be accommodated for tower services.

OPERATIONAL CAPABILITIES

- Data Comm will initially deliver digital tower pre-departure clearance services, including route revisions.
- Data Comm services will be provided in en route airspace, enabling controllers to provide pilots with frequency handoffs, altitude changes and inflight reroutes. Pilots can also send digital messages to controllers.
- Collectively, these services will save time and increase controller and pilot productivity, leading to greater efficienc , improved routing around weather and congestion, increased flexibility and accommodation of user requests, and reduce the potential for miscommunication as controllers send digital messages to each aircraft.

IMPLEMENTATION

In October 2014, the FAA made the Final Investment Decision for initial en route services, with initial Data Comm capabilities expected in high-altitude airspace beginning in 2019. These services will expand to full operational capability at all 20 air route traffic control centers in the continental United States in 2021.

The FAA is encouraging Data Comm equipage on the flight decks of 1,900 aircraft by 2019. Under the Data Comm equipage incentive program, eight airlines have agreed to equip their aircraft with Data Comm avionics with the first aircraft being so equipped in 2014.

At the beginning of Fiscal Year 2014, the FAA agreed with the NextGen Advisory Committee (NAC) to continue operating the Data Comm prototype for 15 additional months at Memphis and Newark. These trials began in 2013 and are resulting in 60-80 operations per day that use Data Comm at both airports. The FAA plans to deploy Data Comm to towers at 56 airports starting in 2016 and finishing in 2019. In alignment with NAC recommendations, the AA is working to accelerate deployment of Data Comm tower services to begin in summer 2015 at Salt Lake City, Houston Intercontinental and Houston Hobby airports with the remaining tower deployment planned for 2016.

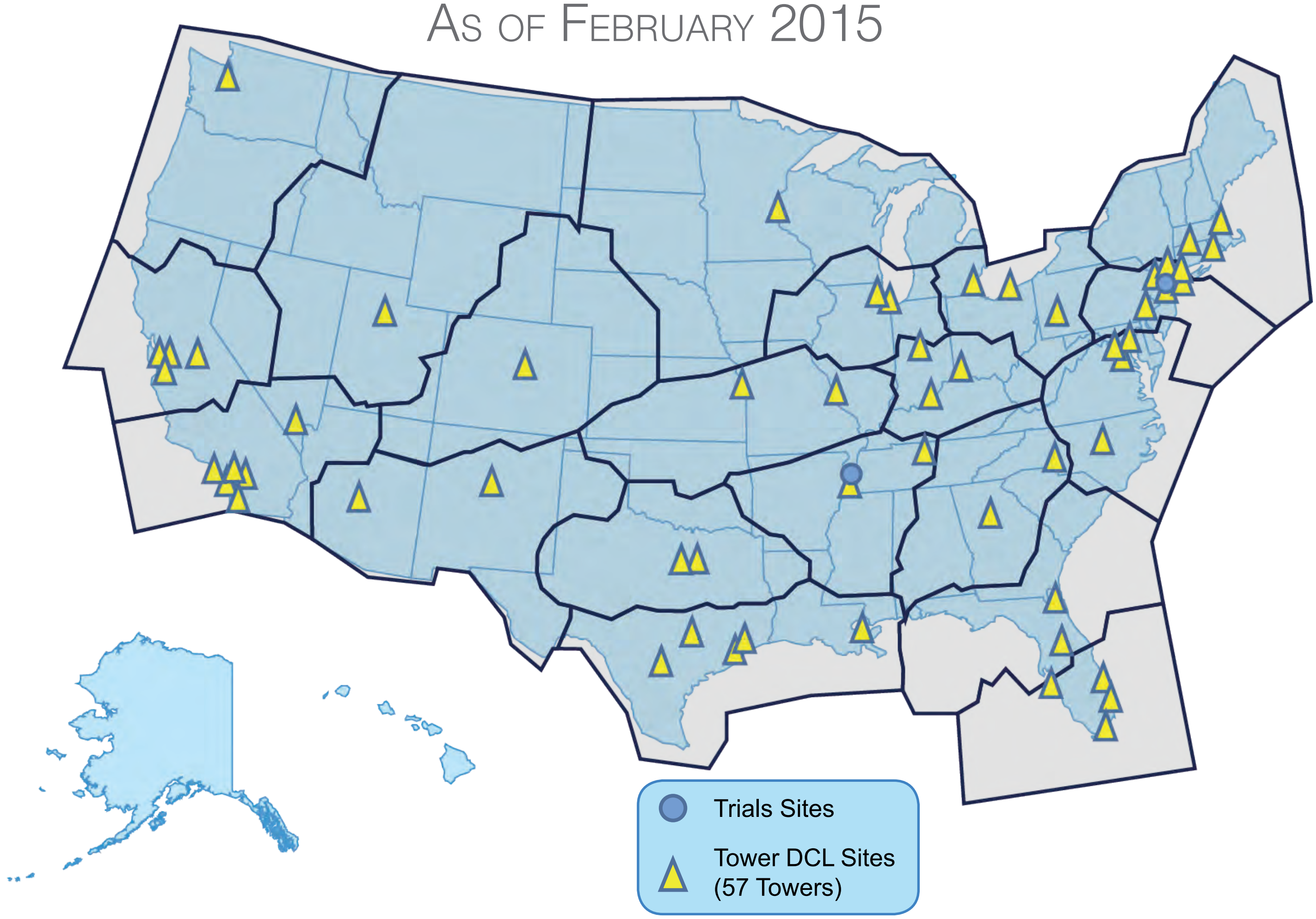
There are no current plans for deployment to terminal radar approach control facilities, which control traffic arriving at and departing from our nation s airports.

BENEFITS ACHIEVED TO DATE

Preliminary qualitative benefits seen uring trials in Memphis and Newark include reduced communications time resulting in faster taxi outs, reduced delays and reduced pilot and controller workload.

DATA COMMUNICATIONS DEPARTURE CLEARANCE TOWER SERVICE

As of February 2015



PROGRAM MILESTONES	DATE
SEGMENT 1	
Data Comm Segment 1 Phase 1 Final Investment Decision (FID) for En Route Automation Modernization (ERAM) and Tower Data Link System (TDLS)	May 2012
Data Comm Segment 1 Phase 1 Data Comm Integrated Services Contract Award	September 2012
Data Comm Segment 1 Phase 1 TDLS Preliminary Design Review complete	July 2013
Data Comm Segment 1 Phase 1 ERAM Initial Test Release (ITR)	April 2014
ERAM R4 ITR	June 2014
TDLS V12 ITR	July 2014
Deliver Data Comm Network Service Build 1 to William J. Hughes Technical Center	September 2014
Complete Program Level Integrated Baseline Review	September 2014
Complete Data Comm Informal Integration and Interface Service Test	September 2014
Data Comm Segment 1 Phase 2 Initial En Route Services FID	October 2014
Data Comm Segment 1 Phase 1 Operational Test and Evaluation	November 2015
Data Comm Segment 1 Phase 2 Full En Route Services FID planning date	December 2015
Data Comm Segment 1 Phase 1 IOC at first site	March 2016
Data Comm Segment 1 Phase 1 In-Service Decision	December 2016
Data Comm Segment 1 Phase 1 Site Operational Readiness Decision	April 2017
Data Comm Segment 1 Phase 1 IOC at last site	May 2019
Data Comm Segment 1 Phase 2 IOC at first site	October 2019
Data Comm Segment 1 Phase 2 IOC at last site	October 2021
TOWER TRIALS	
Initiate Departure Clearance (DCL) tower trials at MEM	January 2013
Initiate DCL tower trials at EWR	April 2013
Complete DCL tower trials	September 2014

DEPARTURE CLEARANCE TOWER SERVICES CHALLENGE MILESTONES

The NextGen Priorities Joint Implementation Plan commits the FAA to begin delivering departure clearances at 56 airports under the Data Comm program's Segment 1 Phase 1. The baseline calls for this work to be completed by the end of 2019 but the agency is working toward challenge dates that would have services at all 56 locations in place by the end of CY 2016 (see chart below for specifics). The order of the towers may move within the groups based on operational requirements; however, the FAA and industry will work together to manage these changes.

KEYSITE (3 TOWERS)			
SITE NAME	SITE ID	ARTCC ID	IOC (CY)
KS 1: Salt Lake City	SLC	ZLC	Q2 2015
KS 2: Houston Intel	IAH	ZHU	Q3 2015
KS 3: Houston Hbby	HOU	ZHU	Q3 2015

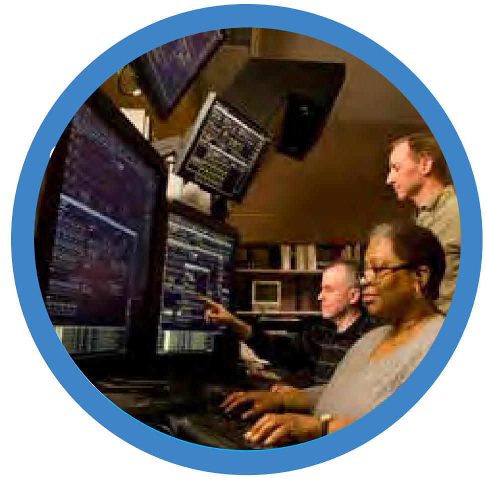
GROUP A (19 TOWERS)			
SITE NAME	SITE ID	ARTCC ID	IOC (CY)
New Orleans	MSY	ZHU	Q1 2016
Austin	AUS	ZHU	Q1 2016
San Antonio	SAT	ZHU	Q1 2016
Los Angeles	LAX	ZLA	Q1 2016
Las Vegas	LAS	ZLA	Q1 2016
San Diego	SAN	ZLA	Q2 2016
John Wayne	SNA	ZLA	Q2 2016
Bob Hope	BUR	ZLA	Q2 2016
Ontario	ONT	ZLA	Q2 2016
San Francisco	SFO	ZOA	Q2 2016
Oakland	OAK	ZOA	Q2 2016
San Jose	SJC	ZOA	Q3 2016
Sacramento	SMF	ZOA	Q3 2016
Phoenix	PHX	ZAB	Q3 2016
Albuquerque	ABQ	ZAB	Q3 2016
Seattle	SEA	ZSE	Q3 2016
Dallas Love	DAL	ZFW	Q4 2016
Dallas/Fort Worth (x2)	DFW	ZFW	Q4 2016

GROUP B (17 TOWERS)			
SITE NAME	SITE ID	ARTCC ID	IOC (CY)
Louisville	SDF	ZID	Q1 2016
Indianapolis	IND	ZID	Q1 2016
Cincinnati	CVG	ZID	Q1 2016
Memphis	MEM	ZME	Q2 2016
Nashville	BNA	ZME	Q1 2016
Denver	DEN	ZDV	Q2 2016
Atlanta	ATL	ZTL	Q2 2016
Charlotte	CLT	ZTL	Q2 2016
Jacksonville	JAX	ZJX	Q2 2016
Orlando	MCO	ZJX	Q3 2016
Miami	MIA	ZMA	Q2 2016
Fort Landerdale	FLL	ZMA	Q3 2016
Tampa	TPA	ZMA	Q3 2016
Palm Beach	PBI	ZMA	Q3 2016
St. Louis	STL	ZKC	Q4 2016
Kansas City	MCI	ZKC	Q3 2016
Minneapolis-St. Paul	MSP	ZMP	Q4 2016

GROUP C (18 TOWERS)			
SITE NAME	SITE ID	ARTCC ID	IOC (CY)
Newark	EWR	ZNY	Q1 2016
New York John F. Kennedy	JFK	ZNY	Q1 2016
New York La Guardia	LGA	ZNY	Q1 2016
Philadelphia	PHL	ZNY	Q2 2016
Teterboro	TEB	ZNY	Q1 2016
Westchester	HPN	ZNY	Q2 2016
Boston	BOS	ZBW	Q2 2016
Providence	PVD	ZBW	Q2 2016
Bradley	BDL	ZBW	Q2 2016
Detroit	DTW	ZOB	Q3 2016
Cleveland	CLE	ZDC	Q2 2016
Pittsburgh	PIT	ZDC	Q3 2016
Baltimore-Washington	BWI	ZDC	Q3 2016
Washington Dulles	IAD	ZDC	Q3 2016
Washington Reagan	DCA	ZDC	Q3 2016
Raleigh/Durham	RDU	ZDC	Q4 2016
Chicago Midway	MDW	ZAU	Q4 2016
Chicago O'Hare	ORD	ZAU	Q4 2016

EN ROUTE AUTOMATION MODERNIZATION

En Route Automation Modernization (ERAM) replaces the legacy HOST automation system at 20 of the FAA's network of en route centers, which control high-altitude traffic. This scalable system combines flight plan information with information from surveillance sources to automate many air traffic control functions and support controller decisions. The ERAM base program is not a NextGen program, but it is foundational to the success of many NextGen capabilities. For instance, ERAM serves as the platform upon which NextGen capabilities such as data sharing, digital communications and trajectory-based operations will reside.



TARGET USERS

Air traffic control ers at air route traffic control centers

EQUIPAGE REQUIREMENTS

Additional equipage not required for National Airspace System (NAS) users.

OPERATIONAL CAPABILITIES

- ERAM combines flight plan information with surveillance data from Automatic Dependent Surveillance–Broadcast, Wide Area Multilateration and radar to automate a number of air traffic control functions such as tracking aircraft, providing conflict alerts and minimum saf altitude warnings, and recording air traffic events
- ERAM enables controllers to see beyond the boundaries of the airspace managed by their own center, enabling them to handle traffic more efficient . This extended coverage is possible because ERAM processes data from 64 radars, compared with 24 for HOST.
- ERAM can track 1,900 aircraft at a time, compared with 1,100 for HOST.

IMPLEMENTATION

The FAA considers an ERAM site fully implemented once it has accomplished three phases — initial operating capability (IOC), continuous operations and operational readiness demonstration (ORD). The agency has completed installation and conducted IOC at all 20 facilities.

As of January 2015, 16 of the 20 facilities have achieved the ORD milestone, and three of the remaining four are using ERAM on a continuous basis. All 20 centers are expected to achieve final implementation and declare the ORD milestone by March 2015. Other air traffic facilitie and agencies will be connected to the centers via ERAM.

The FAA has baselined the next segment of ERAM – System Enhancements and Tech Refresh. These will include initial technical refresh and deployment of enhanced capabilities that go above and beyond the core ERAM deployment. These capabilities were identified by users and will enhance the operational effectiveness of ERAM in the NAS. ERAM tech refresh and system enhancement will continue through 2017.

BENEFITS ACHIEVED TO DATE

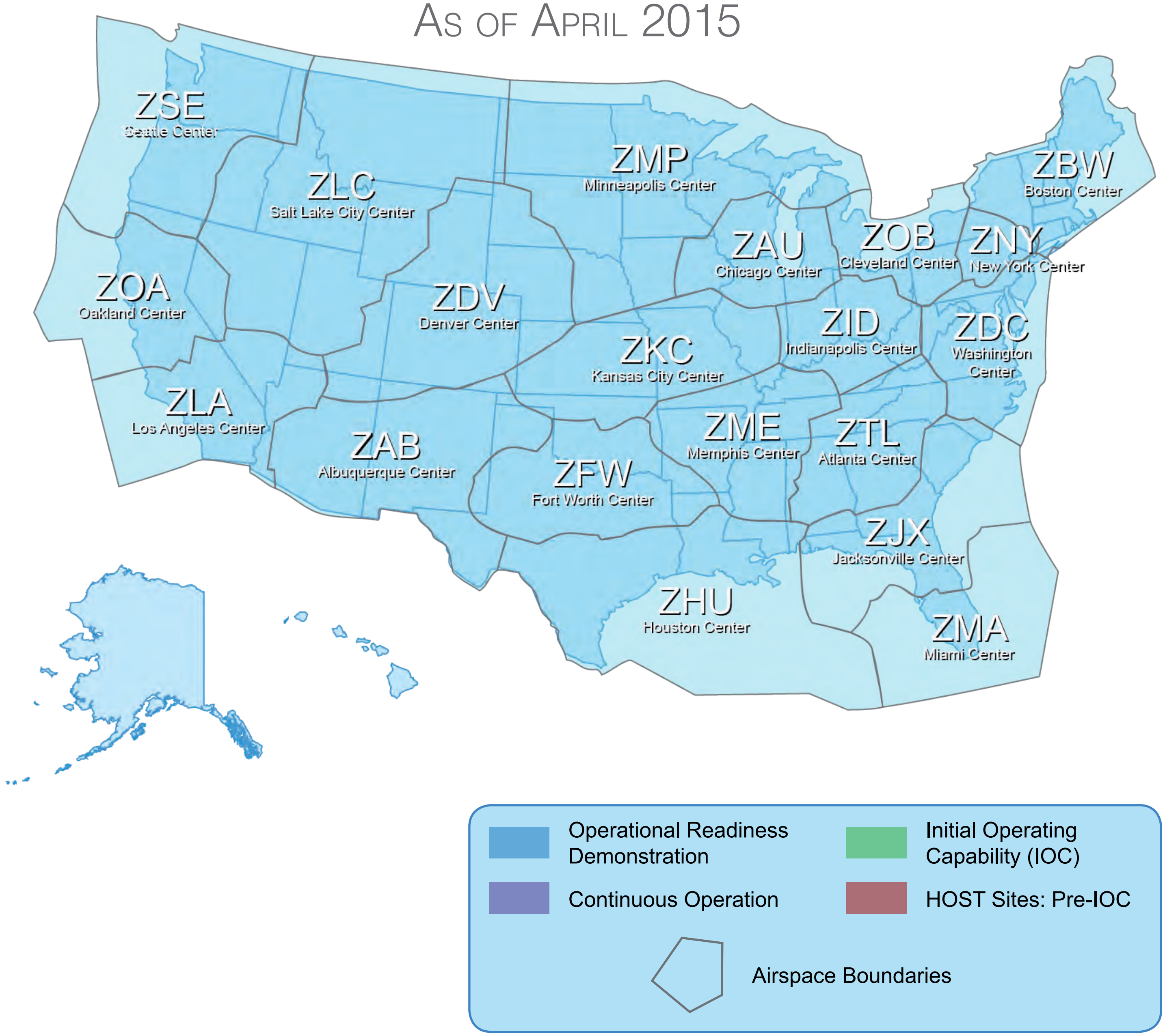
ERAM detects conflicts between two aircraft, reducing the number of missed alerts and fa se conflicts

The system provides for routine maintenance without interrupting air traffic control services, eliminating planned outages.

New color screens used with ERAM no longer reflect glare, which allows brighter light levels in radar rooms. ERAM also gives controllers the ability to customize what they see. For example, a controller could turn all of the airplanes in a sector to a single color, such as blue, to distinguish them from others in nearby airspace.

EN ROUTE AUTOMATION

As of April 2015



PROGRAM MILESTONES	DATE
Final Investment Decision (FID) for ERAM	June 2003
ERAM Release 1: Systems Integration Milestone	November 2006
ERAM Release 1: William J. Hughes Technical Center general aviation	October 2007
ERAM Release 1: Key site - general aviation	April 2008
ERAM In Service Decision	March 2011
ERAM Release 2: Key site Operation Readiness Demonstration (ORD)	March 2012
ERAM Release 3: First site ORD	August 2012
System Enhancement and Tech Refresh FID	February 2014
Collaborative Air Traffic Management (CATM) - Airborne Reroute (ABRR) - S/W Build EAC 1500 Release	May 2014
Investment Analysis Readiness Decision for ERAM Sector Enhancement Planning Milestone	June 2014
Investment Analysis Readiness Decision for ERAM Sector Enhancements	July 2014
Achieve Initial Operating Capability at last two sites (Jacksonville and Atlanta)	September 2014
Complete installation of En Route Information Display System (ERIDS) equipment components of first site	March 2015
Last site ORD	March 2015
FID for ERAM Sector Enhancement Planning Milestone	September 2015
Deploy first ERAM release containing system enhancements	September 2015
Complete installation of En Route Communication Gateway (ECG) router firewall equipment at last site	September 2015
Complete installation of ERIDS equipment components at last site	September 2015
Complete installation of ECG router firewall equipment at last site	March 2016
CATM - ABRR - ABRR capability operationally available	December 2016
Deploy last ERAM release containing system enhancements	September 2017

TERMINAL AUTOMATION MODERNIZATION AND REPLACEMENT

Air traffic controllers use di ferent automation platforms depending on whether the airspace involved is near airports or at high altitude. The Terminal Automation Modernization and Replacement (TAMR) program converts terminal air traffic control facilities to a single, common automation platform: the Standard Terminal Automation Replacement System (STARS). TAMR is funding a technology refresh at the 55 sites where STARS is already in operational use while replacing older automation platforms at 108 other facilities. TAMR is not a NextGen program but, like ERAM, the successful transition to this common automation platform is foundational to successfully deploying other NextGen capabilities.

TARGET USERS

Air traffic controllers at towers an Terminal Radar Approach Control (TRACON) facilities

EQUIPAGE REQUIREMENTS

Additional equipage not required for National Airspace System (NAS) users.

OPERATIONAL CAPABILITIES

STARS provides individual preference settings for controllers. STARS meets operational requirements for core NextGen capabilities, such as Automatic Dependent Surveillance–Broadcast (ADS-B). It further provides data-recording capability and quadruple redundancy. The system significantly improves flight plan processing with a 4-D trajectory — lateral, vertica and horizontal plus time — of every flight from takeo f to landing. This improves a controller's situational awareness, allowing for better decision making and more efficient routing of aircraft

IMPLEMENTATION

TAMR is being implemented in three phases.

- Phase 1 is a technology refresh of the existing STARS platform at 47 sites by 2020.
- Phase 2, completed in 2008, replaced automation systems with STARS at four TRACONs: Anchorage, Alaska; Corpus Christi, Texas; Pensacola, Florida; and Wichita, Kansas. It also modernized aging air traffic controller displays and system processors at four additional TRACONs: Chicago, Denver, St. Louis and Minneapolis/St. Paul.
- Phase 3 is replacing the remaining 100+ automation systems with STARS to support the increasing demand for air traffic services. Phase 3 is occurring in two segments defined by th type of automation systems being replaced by STARS.
    - Phase 3 (Segment 1) will replace Common Automated Radar Terminal System IIIE

(CARTS IIIE) at 11 facilities by 2017. CARTS IIIE consists of a common software baseline capable of operating on three terminal automation platforms, ARTS IIIEs, ARTS IIEs and ARTS IEs.

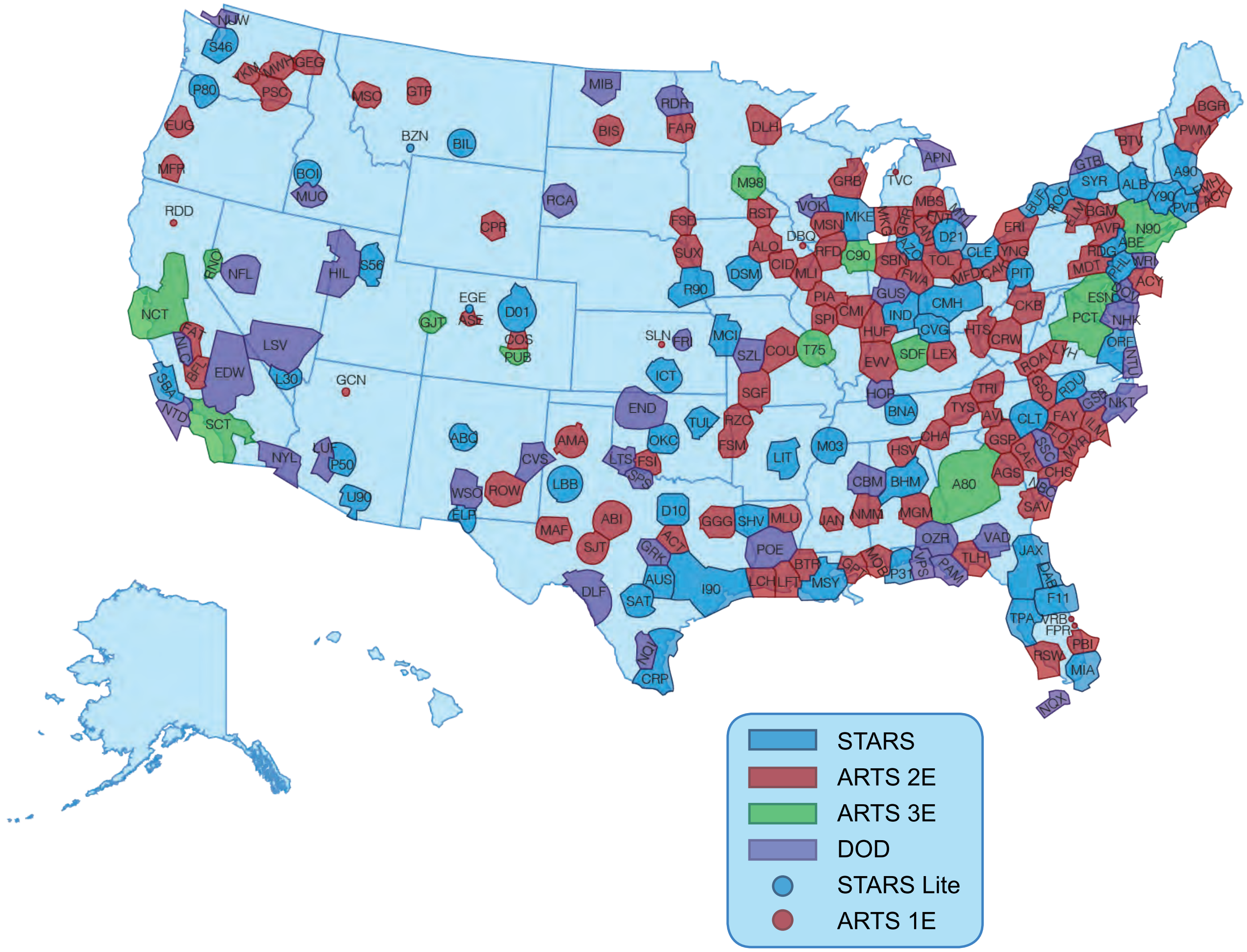
- Phase 3 (Segment 2) replaces CARTS IIE and IE at 97 facilities by 2019. In April 2014, IOC was achieved at the first Phase 3 (Segment 2) site, Allentown, Pennsylvania, TRACON.
- Full deployment of TAMR is planned for 2020.

BENEFITS ACHIEVED TO DATE

LCD screens cut electricity use by 67 percent, take less time to maintain and are more reliable than the previous CRT screens.

TERMINAL AUTOMATION

As of February 2015



PROGRAM MILESTONES	DATE
TAMR PHASE 1	
TAMR Phase 1 Final Investment Decision (FID)	September 2012
TAMR Phase 1 complete Initial Operating Capability (IOC) at key site	December 2012
TAMR Phase 1 Software Build R26 (STARS) complete	August 2013
TAMR Phase 1 National STARS Release Build 26	August 2013
TAMR Phase 1 Software Build 37C (CARTS) complete	September 2013
TAMR Phase 1 National CARTS Release 37C	September 2013
TAMR Phase 1 complete IOC at 2nd site	January 2014
TAMR Phase 1 complete IOC at 26th site	December 2017
TAMR Phase 1 complete IOC at 39th site	March 2019
TAMR Phase 1 complete IOC at last (48th) site	February 2020
TAMR PHASE 3 SEGMENT 1	
TAMR Phase 3 Segment 1 Authorization to Proceed	December 2010
TAMR Phase 3 Segment 1 Contract Award - 11 STARS Systems (NTE)	December 2010
TAMR Phase 3 Segment 1 Final Investment Decision (FID)	December 2011
TAMR Phase 3 Segment 1 first site hardware delivery	April 2012
TAMR Phase 3 Segment 1 complete installation and checkout of upgraded hardware for CARTS IIIE system at N90	May 2012
TAMR Phase 3 Segment 1 Contract Definitization	July 2012
TAMR Phase 3 Segment 1 complete IOC at key site on E1 - D10	May 2013
TAMR Phase 3 Segment 1 complete IOC at key site on E2 - D10	September 2014
TAMR Phase 3 Segment 1 complete Operational Readiness Demonstration (ORD) at key site on E2 - D10	May 2015
TAMR Phase 3 Segment 1 complete IOC at 5th site	October 2015
TAMR Phase 3 Segment 1 Software Build S6R4 (CARTS/STARS) Complete Planning Milestone	February 2016
TAMR Phase 3 Segment 1 complete IOC at last (11th) site	October 2016
TAMR Phase 3 Segment 1 complete ORD at last (11th) site	October 2017
TAMR PHASE 3 SEGMENT 2	
TAMR Phase 3 Segment 2 first site hardware delivery (ARTS IIE)	August 2013
TAMR Phase 3 Segment 2 complete STARS ELITE OT&E	February 2014
TAMR Phase 3 Segment 2 complete IOC at first site (ARTS IIE)	August 2014
TAMR Phase 3 Segment 2 complete IOC at 12th site (ARTS IIE)	December 2015
TAMR Phase 3 Segment 2 complete IOC at 34th site (ARTS IIE)	December 2016
TAMR Phase 3 Segment 2 complete IOC at 65th site (ARTS IIE)	December 2017
TAMR Phase 3 Segment 2 complete IOC at last (91st) site (ARTS IIE)	March 2019
TAMR Phase 3 Segment 2 complete ORD at last site	June 2019

NAS VOICE SYSTEM

The National Airspace System (NAS) Voice System (NVS) replaces the current voice switches operated independently at individual facilities. NVS will use router-based communications linked through the FAA Telecommunications Infrastructure (FTI) network. NVS and FTI will provide the FAA with a nationwide capability for routing, monitoring and sharing communication assets among facilities, enabling greater flexibility for the development and usage of airspace/traffi assignments in all airspace.

TARGET USERS

Air traffic controllers, pilots, including pilots of Unmanned Aircraft Systems (UAS)

EQUIPAGE REQUIREMENTS

Additional equipage not required for NAS users.

OPERATIONAL CAPABILITIES

- NVS provides the FAA increased flexibility to shift controller workload from one air route traffi control center to another as needed. For example, NVS will allow adjacent facilities to share communication resources to mitigate the effect of bad weather on air traffic. If an air traffi facility is out of commission for any reason, the control of aircraft can be shifted to another facility.
- NVS will enable direct communication between air traffic controllers and pilots, including UAS pilots.

IMPLEMENTATION

The NVS contract was awarded on August 24, 2012. A demonstration of NextGen capabilities was completed on November 20, 2013, using three networked demonstration systems. These systems are located at the William J. Hughes Technical Center, the Mike Monroney Aeronautical Center and a vendor facility in Melbourne, Florida, operated by Harris Corporation. The FAA made a Final Investment Decision (FID) in September 2014 to develop NVS, with Seattle Center as the initial site. Two systems will be deployed for testing and three key site systems are planned to
be procured in order to achieve an In-Service Decision in FY 2019. A second FID is planned in fiscal year 2017 for approval of the deployment of production systems. Once certified NV production systems are available in 2020, the FAA will begin installing them in both terminal and en route facilities.

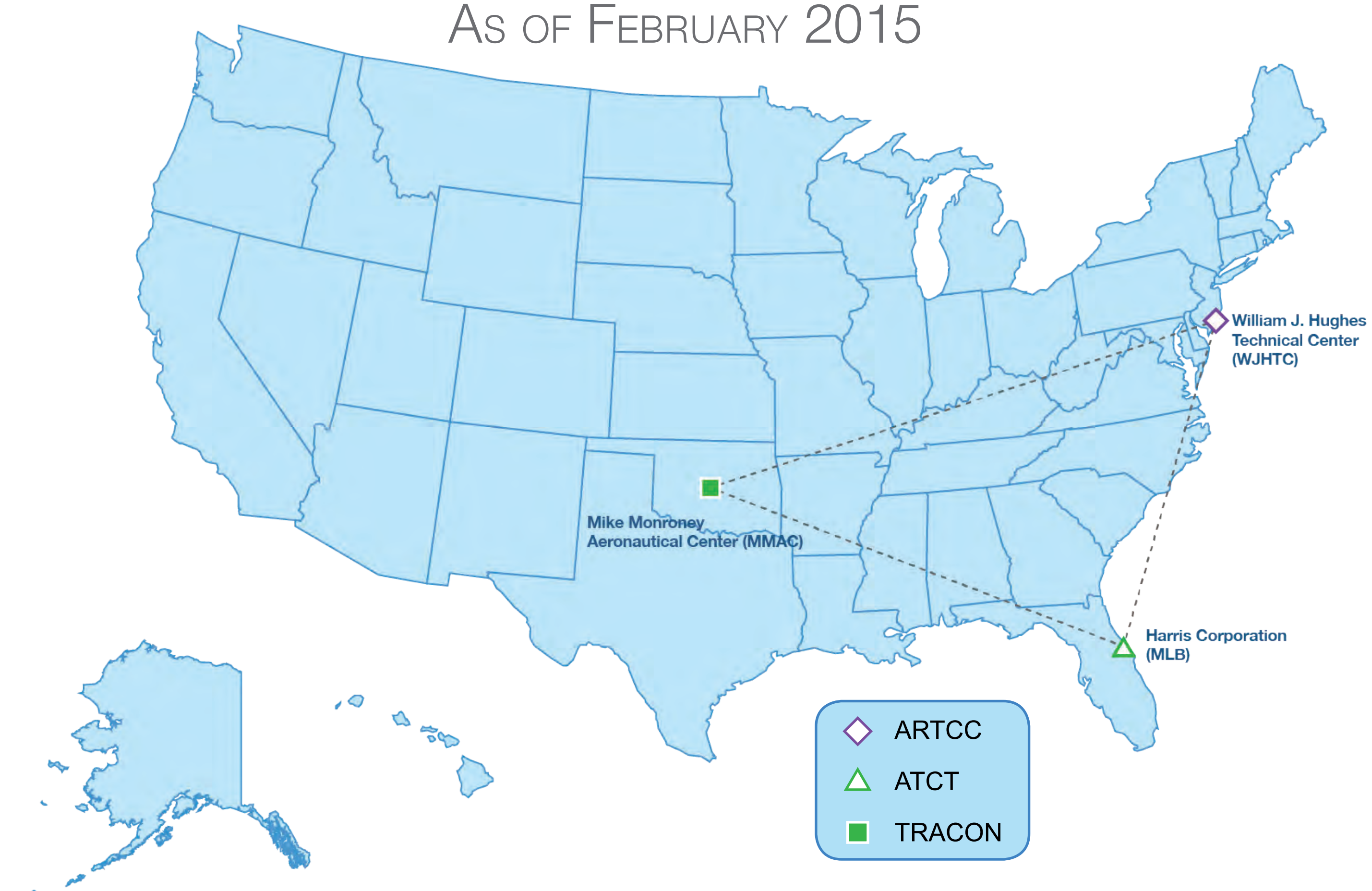
BENEFITS ACHIEVED TO DATE

Not applicable, capability still in development.

PROGRAM MILESTONES	DATE
NVS Contract Award	March 2012
Demonstrate the Business Continuity Plan, which is part of the NVS NextGen Capabilities Validation and Demonstration	March 2014
Preliminary Design Review completed	July 2014
Achieve NVS Segment 2 Final Investment Decision (FID) for Qualification Phase	September 2014
Critical Design Review completed	June 2015
Achieve NVS FID for Deployment Approval of Operational Systems	September 2017
Functional Configuration Audit and Physical Configuration completed	October 2017
Contractor Acceptance Inspection of Equipment at key sites	March 2019
Operational Test and Evaluation completed	May 2019
Key sites Initial Operating Capability	September 2019
In-Service Decision	March 2020
Production and Deployment of NVS Operational Systems	2019-2026

NAS VOICE SYSTEM

As of February 2015



SYSTEM WIDE INFORMATION MANAGEMENT

System Wide Information Management (SWIM) is the digital data-sharing backbone of NextGen. SWIM infrastructure enables air traffic management (TM)-related information sharing among diverse, qualified systems. SWIM also provides information governance.

SWIM has been distributing weather and flight planning information to National Airspace System (NAS) users, mainly airline operations centers, since 2010 and will continue to develop and add services.

TARGET USERS

Air traffic controllers, operators in the NAS including airlines, cargo carriers, business jet operators and airports

EQUIPAGE REQUIREMENTS

Minimal equipage is required for NAS users.

OPERATIONAL CAPABILITIES

- SWIM Terminal Data Distribution System (STDDS) converts raw surface data from airport towers into accessible information to share the picture being seen by controllers in the air traffic control tower with controllers in the corresponding Terminal Radar Approach Control (TRACON) facility. STDDS is currently installed at 38 TRACONS. The TRACON makes information available to airlines and airports through SWIM messaging services. STDDS will provide surface data to the Traffic Flow Management System, which controllers use to balance traffic demands with capacity across the NAS. Controllers can better calculate end-to-end trajectories. In August 2013, Miami TRACON became the first facility to start distributing data from towers in its coverage area to an airline via STDDS.
- SWIM Flight Data Publication Service (SFDPS), currently available in the SWIM research and development domain, will improve flight data sharing. It will also ensure consistency of this data across the NAS via standards and consolidation of flight data currently maintained by multiple systems into a common repository. SFDPS is the first system to provide data using the standard Flight Information Exchange Model (FIXM) with a Globally Unique Flight Identifie . SFDPS also makes information available to airlines and airports through SWIM messaging services.

IMPLEMENTATION

SWIM Segment 2 consists of two parts.
Segment 2a (2015) includes:

- capabilities added to the NAS Enterprise Messaging Services (NEMS), an information-sharing infrastructure that enables the publication and sharing of NAS data

- NEMS nodes at all air route traffic control centers (e.g., currently at Atlanta, Boston, Chicago, Fort Worth, Los Angeles, Minneapolis, Miami, Salt Lake City, Seattle and Washington)
- increased security capabilities
- the ability for consumers to self-manage data subscriptions
- an enriched set of traffic flow data for external consumers to maintain common situationa awareness of the NAS

Segment 2b builds upon the infrastructure foundation laid by Segment 2a, and

- increases and improves products from SFDPS
- increases the security of NAS data flows with identify verification and acces management that provides a certificate management service to enable more secure data exchanges with outside partners
- builds upon the monitoring capability of the existing infrastructure by adding status information about producers and consumers (this aims to build end-to-end situational awareness of all elements of, or participants in, an information exchange)
- adds additional terminal data to the list of STDDS published information and enriches the functionality of existing services
- adds new data query functionality to the NAS: NAS Common Reference (NCR) supports complex data queries for NAS flight weather and aeronautical informatio
- enables the efficient transition to global harmonization of information standards, including the Aeronautical Information Exchange, Weather Information Exchange and FIXM

BENEFITS ACHIEVED TO DATE

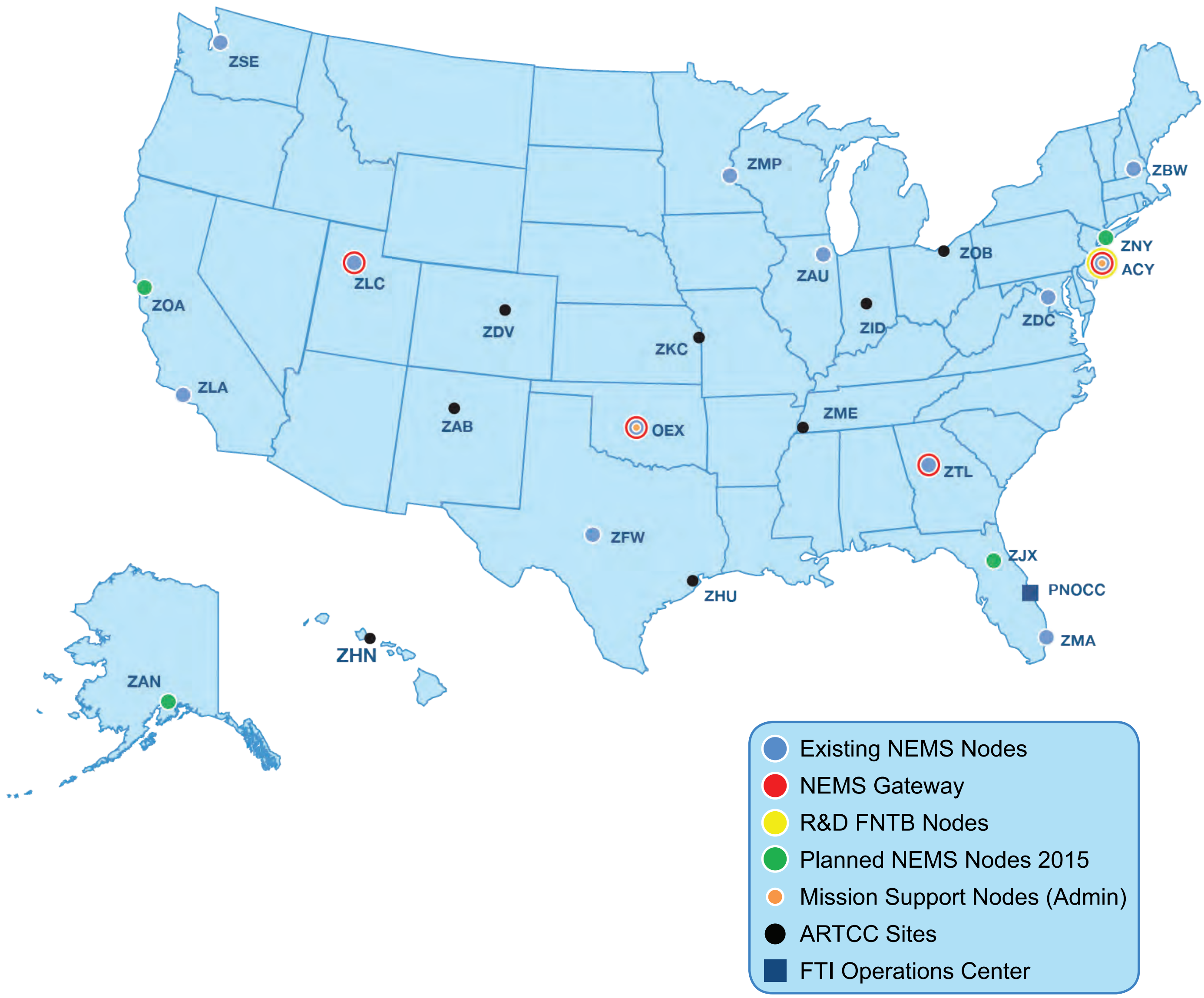
SWIM provides increased ground situational awareness with data shared from STDDS via NEMS to TRACONS and airport authorities (e.g., Southern California TRACON and Los Angeles runway construction, operational April 2014; San Francisco runway construction, operational May 2014). The FAA has already installed the SWIM Visualization Tool (SVT) at the New York, Chicago, Houston, Boston and Louisville TRACONs in 2015, enabling controllers to see aircraft moving on the surface at airports they serve. SVT is installed at nine TRACON Traffic Management Unit (TMU) stations providing situational awareness during peak traffic and during airport construction and runway closures. The initial SVT deployment to these nine sites has supported the Terminal Flight Data Manager (TFDM) early implementation strategy.

The FAA Notices to Airmen (NOTAM) Distribution Service (NDS) has made digital NOTAM data available on request using SWIM. NDS will be expanded to a publication-subscription capability in 2015. This modernization of the NOTAM system provides more timely information that can be electronically sorted to suit the needs of pilots flying a particular route. The Department of Defense has recently adopted this service and is progressively expanding their capabilities within the SWIM environment.

SWIM INFRASTRUCTURE DEPLOYMENT

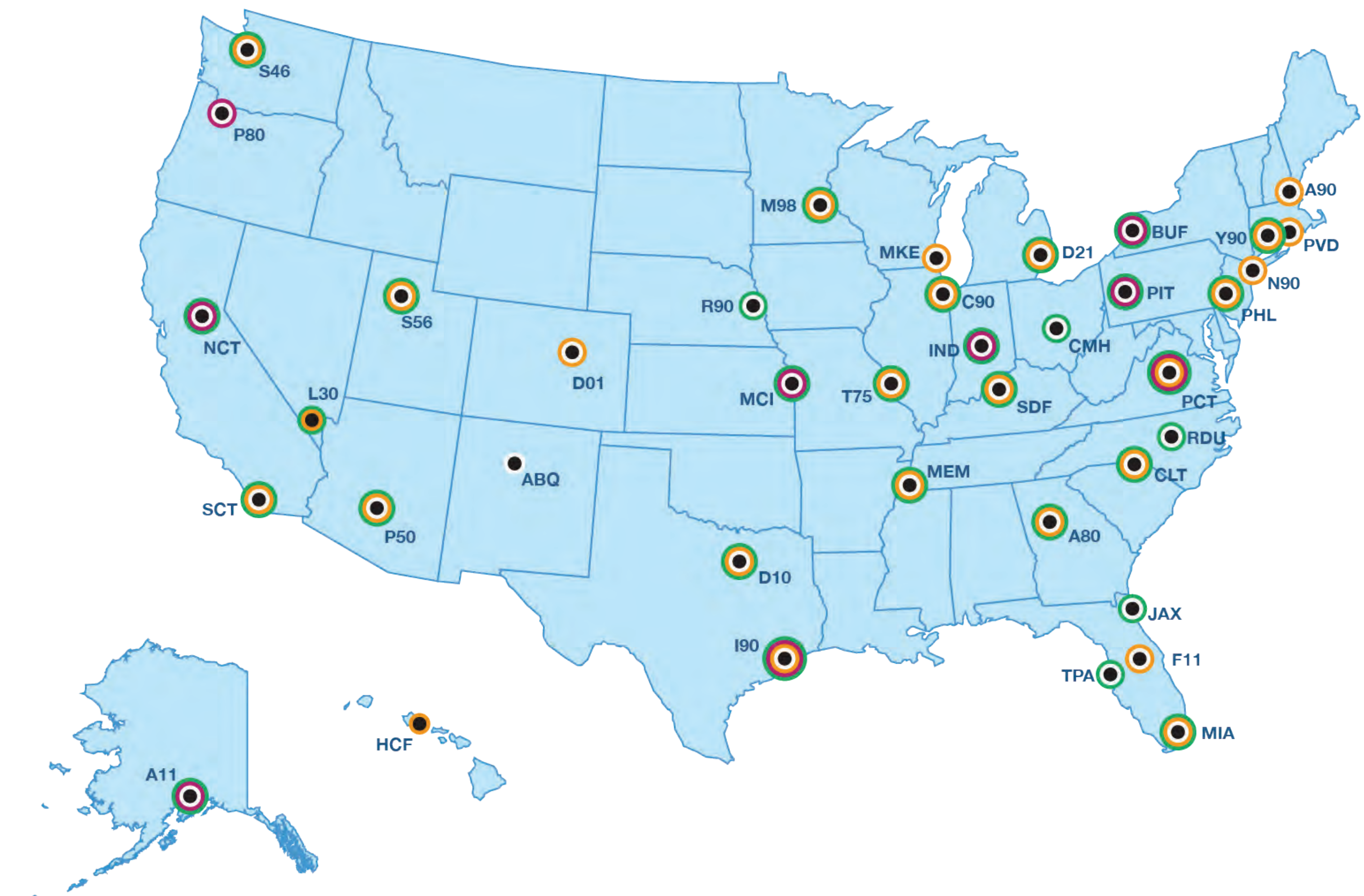
NAS ENTERPRISE MESSAGING SERVICE (NEMS)

As of February 2015



SWIM TERMINAL DATA DISTRIBUTION SYSTEM (STDDS) BY TRACON

As of February 2015



- Tower Data Link Services (TDLS)
- Runway Visual Range
- Airport Surface Detection Equipment, Model X
- Airport Surface Surveillance Capability
- Electronic Flight Strip Transfer System
- STDDS Completed Installation
- STDDS Completed System Acceptance Test

PROGRAM MILESTONES	DATE
SEGMENT 1	
SWIM Segment 1 Final Investment Decision (FID)	July 2009
SWIM Segment 1 Corridor Integrated Weather System (CIWS) Publication operational - SWIM Implementation Programs (SIP) = CIWS	September 2010
SWIM Segment 1 Special Use Airspace (SUA) Automated Data Exchange operational - SIP=Aeronautical Information Management (AIM)	December 2010
SWIM Segment 1 Integrated Terminal Weather Service (ITWS) Publication operational - SIP=ITWS	January 2011
SWIM Segment 1 Reroute Data Exchange operational - SIP=Traffic Flow Management (TFM)	June 2011
SWIM Segment 1 Terminal Data Distribution operational - SIP=SWIM Terminal Data Distribution System (STDDS)	May 2012
SWIM Segment 1 Pilot Report Data Publication operational - SIP=Weather Switching Center Replacement (WMSCR)	June 2012
SWIM Segment 1 Flight Data Publication - Initial Flight Data Services operational - SIP=En Route Automation Modernization	December 2012
Miami TRACON distributes data to airline via STDDS	August 2013
Complete NextGen Capabilities Packages	September 2013
SWIM Segment 1 Operational Test and Evaluation complete - Flight Data Publication Service (FDPS) - SIP=FDPS	March 2014
SWIM Segment 1 Runway Visual Range (RVR) Publication Service operational - SIP=STDDS	June 2014
SWIM Segment 1 Flow Information Publication operational - SIP=TFM	December 2014
SWIM Segment 1 Flight Data Publication operational - SIP=FDPS	July 2015
SWIM Segment 1 SWIM Tool Kits (Core Services) - complete implementation	September 2015
SEGMENT 2	
SWIM Segment 2a Authorization to Proceed	November 2010
SWIM Segment 2a FID for SWIM Segment 2a Planning Milestone	July 2012
SWIM Segment 2a complete NEMS Demand Assessment and Associated Deployment of new NEMS Nodes - Phase I	April 2013
SWIM Segment 2a complete NEMS Dynamic Subscription Capability Development	June 2013
SWIM Segment 2a complete on-ramping of ITWS using SWIM NEMS	June 2013
SWIM Segment 2a complete NEMS Web Services Capability development	June 2013
SWIM Segment 2a complete on-ramping of CIWS and WMSCR using SWIM NAS Enterprise Messaging Service (NEMS)	September 2013
Complete on-ramping of EWINS using SWIM NEMS	November 2013
SWIM Segment 2a complete Enhanced Weather Information Network Server (EWINS) using SWIM NEMS	November 2013
SWIM Segment 2a complete NEMS Demand Assessment and Associated Deployment of new NEMS Nodes - Phase II	April 2014
SWIM Segment 2a complete on-ramping of Time Based Flow Management using SWIM NEMS	April 2014
Complete on-ramping of AIM SUA using SWIM NEMS	September 2014
SWIM Segment 2a complete NEMS Security Services Capability development	February 2015
SWIM Segment 2a complete NEMS Demand Assessment and Associated Deployment of new NEMS Nodes - Phase III	April 2015
SWIM Segment 2b FID for SWIM Segment 2b Planning Milestone	June 2015
SWIM Segment 2a complete NEMS Demand Assessment and Associated Deployment of new NEMS Nodes - Phase IV	April 2016
SWIM Segment 2a completion	December 2017

NEXTGEN PORTFOLIOS

IMPROVED SURFACE OPERATIONS

Improved Surface Operations will improve safety, efficiency and flexibility on the airport surface by implementing new traffic management capabilities for pilots and controllers using shared surface movement data. The capabilities in the portfolio address surface movement and the exchange of information between controllers, pilots and air traffic managers that occur for departing aircraft from the gate to departure of the aircraft from the airport; and for landing traffic from exiting the runway to arriving at the terminal gate.

The increments in this portfolio will achieve success by tracking the movement of surface vehicles and aircraft, incorporating the movement data into the airport surveillance infrastructure and sharing the information with controllers, pilots and airline operations managers.

TARGET USERS

Air traffic controllers, operators, airport

TARGET AREAS

Surface, terminal, en route

ANTICIPATED BENEFITS

FLEXIBILITY

Capabilities in this portfolio will improve the timely exchange of data to enable aircraft operators to more accurately adjust their departure and arrival times for the most efficient use of available runways, taxiways and gates:

- Permitting taxi operations to occur that support low visibility operations for takeoff, improving access during those times
- Reducing effects of weather-related delays

EFFICIENCY

Capabilities in this portfolio improve efficiency:

- Enabling more effective scheduling that includes runway, departure fix and Traffic Flow Management ground-management constraints with automatic reassessment and update of the departure schedule based on the ability of departing flights to meet the designated departure schedule
- Enhancing the ability to react to changing airport conditions, such as severe

weather, by issuing digital pre-departure clearances, including routing revisions, using Data Communications (Data Comm)

- Improving awareness of surface congestion at major hub airports, greatly streamlining the coordination of corrective action and improving the resilience of the system
- Reducing fuel burn and operating costs related to long departure queues
- Reducing delays by improving event data quality and adherence to controlled departure times
- Reducing FAA operating costs through the use of advanced electronic flight strips

SAFETY

Capabilities in this portfolio enhance safety on the airport surface by improving pilot and controller awareness of surface traffic through ground-based automation, data distribution and flight deck capabilities

Enhancements to Aviation Safety Information Analysis and Sharing system will support NextGen with in-depth analysis of safety data from industry and government sources:

- Identifying existing or prospective operational risks that exist in the National Airspace System
- Revealing potential improvements for efficiency and capacity

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FUNDING

SUPPORTED BY AIRPORT SURFACE SURVEILLANCE CAPABILITY

OI 102406 – Provide Full Surface Situation Information

SUPPORTED BY AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST

OI 102406 – Provide Full Surface Situation Information

SUPPORTED BY NEXTGEN DATA COMM

OI 104208 – Enhanced Departure Flow Operations

SUPPORTED BY NEXTGEN IMPROVED SURFACE OPERATIONS PORTFOLIO

OI 104209 – Initial Surface Traffic Managemen

IMPROVED SURFACE OPERATIONS

	FY 2014	FY 2015	FY 2016	FY 2017+
Pre-Implementation Phase:				
Surface Tactical Flow	Concept Development and Validation for Future Terminal Flight Data Manager (TFDM) Work Packages (Concept)			
TFDM	Business Case Development and Acquisition Management System work for TFDM (Concept)			
Implementation Phase:				
Airport Surface Detection System – Model X (ASDE-X) & Automatic Dependent Surveillance – Broadcast (ADS-B)ASDE-X and ADS-B: Situational Awareness and Alerting of Ground Vehicles	ADS-B Out equipment available for installation in airport vehicles that regularly operate in the movement area. (Operation)			
Increment implemented: • 102406-11 Situational Awareness and Alerting of Ground Vehicles				
TFDM Early Implementation	Early Implementation Scope includes Electronic Flight Strip Transfer System Technology Refresh, Advanced Electronic Flight Strips Deployment, Traffic Flow Management System Modifications to Extend Flight Operator Data Exchange (Operation)			
Increment implemented: • 104209-17 Surface Situational Awareness for Traffic Management • 104209-31 Electronic Flight Data Exchange				
Airport Surface Surveillance Capability	Installation of Airport Surface Surveillance Capability at nine ASDE-3/Airport Movement Area Safety System airports. (Operation)			

[1] Moved from 103207-13

Concept | Development | Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

IMPROVED SURFACE OPERATIONS

	FY 2014	FY 2015	FY 2016	FY 2017+
Implementation Phase:				
Data Communications (Data Comm)	Revised Departure Clearance (DCL) Development		Revised DCL Deployment	
Increment implemented: • 104208-12 Revised DCL via Data Comm[2]				
TFDM (Segment 1 and 2)			Development to begin following Final Investment Decision in FY 2016 timeframe	
Increment implemented: • 104209-13 TFDM Scheduler/Sequencer • 104209-31 Electronic Flight Data Exchange • 104209-27 Departure Reservoir Management (DRM)				
TFDM Future Work Package				Development to occur following implementation of TFDM Segment 2 (FY 2021)
Increment implemented: • 104209-27 DRM				

[2] Moved from 104207-11

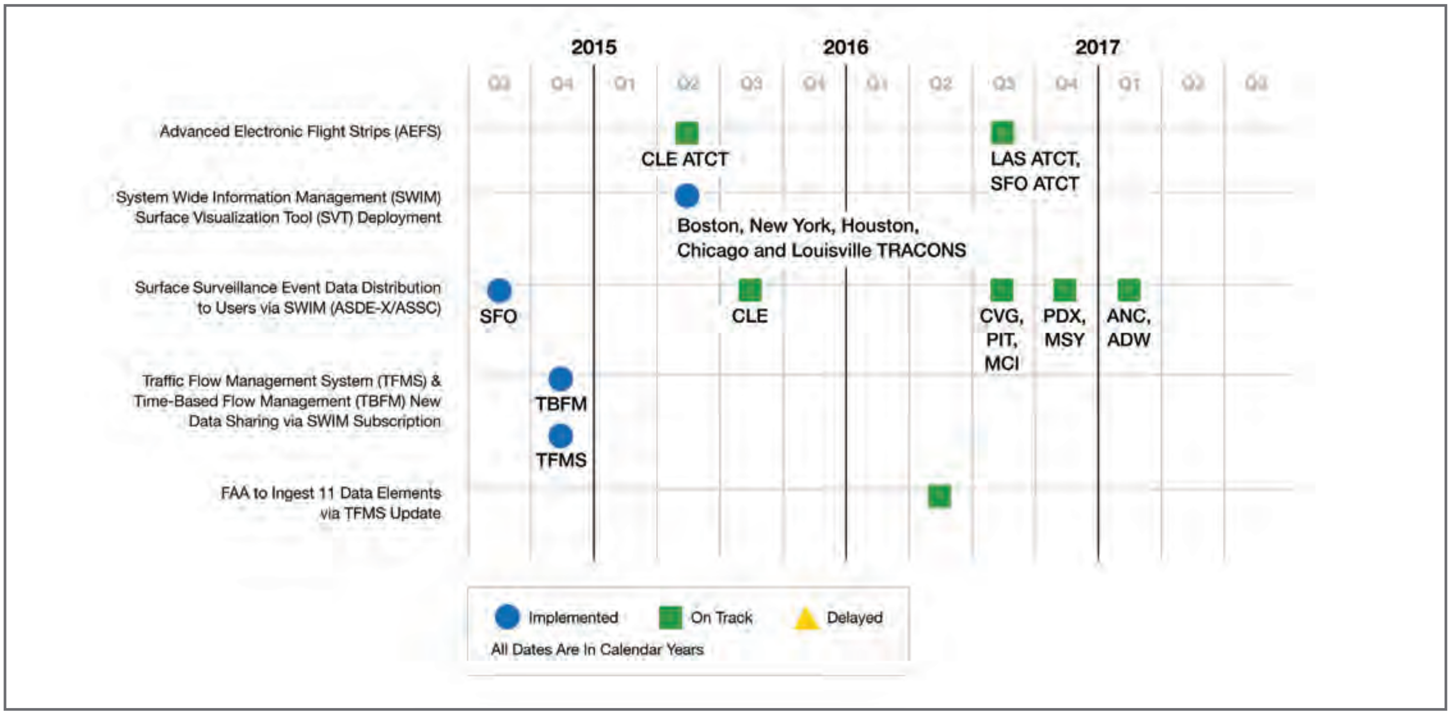
Concept | Development | Operation

* Work Supports Post FY 2016 Capabilities

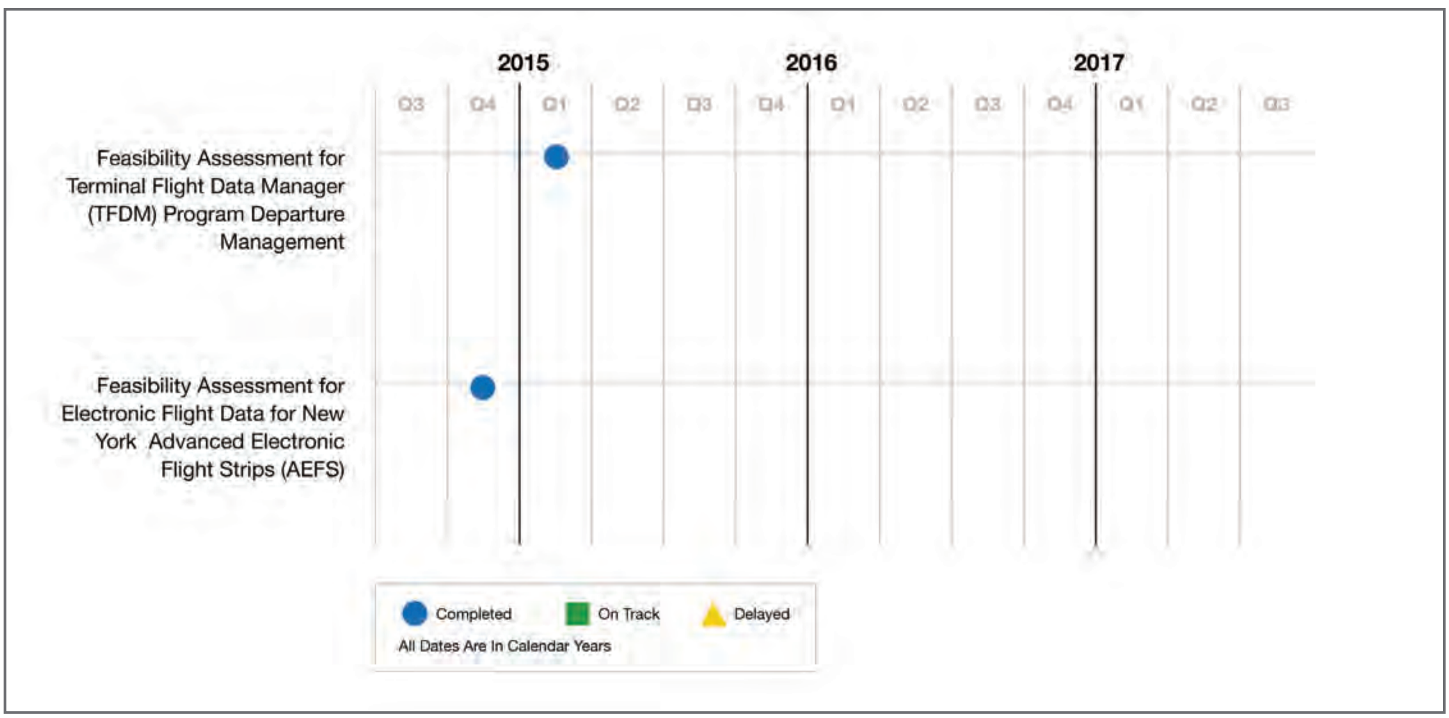
† NextGen Advisory Committee/NextGen Integration Working Group Commitment

Some of the greatest efficiencies can be gained while an aircraft is still on the ground. The FAA commits to implementing near-term surface improvements, sharing more data with stakeholders, and completing feasibility assessments of other capabilities of interest. The goal of these enhancements is to measurably increase predictability and provide actionable and measurable surface efficiency improvements. These commitments are a subset of the overall series of programs and activities the FAA is planning to improve operations in these domains.

NEXTGEN PRIORITIES JOINT IMPLEMENTATION COMMITMENTS



NEXTGEN PRIORITIES JOINT PRE-IMPLEMENTATION COMMITMENTS



IMPROVED APPROACHES AND LOW-VISIBILITY OPERATIONS

Improved Approaches and Low-Visibility Operations include capabilities designed to increase airport approach and arrival access and flexibilit . This will be accomplished through a combination of procedural changes, improved aircraft capabilities and improved precision approach guidance. The procedural changes allow for more efficient flight tracks which lead to reduced fuel use and emissions while keeping aircraft safely separated through the use of Optimized Profile Descents (OPD). The Enhanced Flight Vision System (EFVS) and other similar flight deck capabilities provide access to more runways when visibility is low, leading to increased throughput and reduced delay. Ground Based Augmentation Systems will provide Category II/III precision-approach guidance with one system per airport instead of one instrument landing system per runway end.

The increments in this portfolio will achieve success through a combination of effective procedure design and implementation, air traffic controller training, and aircraft equipage and approval. Some increments also require installation and certification of ground infrastructure

TARGET USERS

Air traffic controllers, pilot

TARGET AREAS

Terminal

ANTICIPATED BENEFITS

ACCESS AND EQUITY

Capabilities in this portfolio provide greater access to airports (approach and landing) during periods of low visibility or low cloud ceiling, through the use of:

- Global Navigation Satellite System
- Required Navigation Performance procedures
- EFVS
- Other flight deck technologie

EFFICIENCY

The use of OPDs will lead to fuel efficiency benefits

- Meeting the airspace design objective of separating different flows of traffi
- Allowing for more efficient descent profiles, e.g. profiles that reduce level fs and engine power-ups

ENVIRONMENT

Capabilities in this portfolio will, where feasible:

- Enable equipped aircraft to fly precise and more fuel-efficient vertical and horizonta paths from high-altitude airspace down to the runway
- Save time, fuel and emissions while allowing for the potential to limit overflight of environmentally sensitive areas

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FUNDING

SUPPORTED BY OPERATIONS APPROPRIATIONS

OI 107115 – Low-Visibility/Ceiling Takeoff and Departure Operations

OI 107117 – Low-Visibility/Ceiling Approach and Landing Operations

OI 107202 – Low-Visibility Surface Operations

SUPPORTED BY NEXTGEN FLEXIBLE TERMINAL ENVIRONMENT/IMPROVED MULTIPLE RUNWAY OPERATIONS PORTFOLIO

OI 107107 – Ground Based Augmentation System Precision Approaches

IMPROVED APPROACHES AND LOW-VISIBILITY OPERATIONS

	FY 2014	FY 2015	FY 2016	FY 2017+
Pre-Implementation Phase:				
Ground Based Augmentation Systems (GBAS)	Category (CAT) II/III Standards Validation Development Work (Development)		CAT II/III Non-Federal Approval Development Work (Development)	
Synthetic Vision Guidance System (SVGS) for Approach	Work Supports Post FY 2016 Capabilities (Development)			
Enhanced Flight Vision System (EFVS) for Landing	Work Supports Post FY 2015 Capabilities of Aircraft and Operations Approval (Development)			
EFVS[1]	EFVS Improved Low-Vis Taxi Development (Development)			
Implementation Phase:				
GBAS				GBAS CAT II/III Standards: Ground System Design Approval and Validation (Operation)
Increment implemented: • 107107-11 GBAS CAT I Non-Federal System Approval • 107107-21 GBAS CAT II/III Standards *Note: The GBAS CAT I/II/III validation provides approval for non-federal acquisition and use of the GBAS CAT I/II/III systems. For this reason, the implementation strategy beyond the FAA approval is dependent on external acquisition and deployment of GBAS capability.*				
EFVS for Approach	EFVS for approach is approved and ready for continued expansion. (Operation)			
Increment implemented: • 107117-11 EFVS for Approach[2]				
SVGS for Approach				SVGS used by suitably equipped operators (Operation)
Increment implemented: • 107117-12 SVGS for Approach[3]				

[1] Moved from Improved Surface portfolio
[2] Renamed
[3] Renamed

Concept | Development | Operation

* Work Supports Post FY 2016 Capabilities
† NextGen Advisory Committee/NextGen Integration Working Group Commitment

IMPROVED APPROACHES AND LOW-VISIBILITY OPERATIONS

	FY 2014	FY 2015	FY 2016	FY 2017+
Implementation Phase:				
EFVS for Takeoff	Operationally available to suitably equipped operators			
Increment implemented: • 107115-11 EFVS for Takeoff				
EFVS for Landing		Operationally available for suitably equipped operators		
Increment implemented: • 107117-13 EFVS for Landing[4]				
EFVS			Improved Low Visibility Taxi Implementation	
Increment implemented: • 107202-22 EFVS/Accurate Position Information for Taxi[5]				

[4] Renamed and renumbered
[5] Moved from Improved Surface portfolio and renamed

Concept   Development   Operation

*** Work Supports Post FY 2016 Capabilities**

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

IMPROVED MULTIPLE RUNWAY OPERATIONS

Improved Multiple Runway Operations (IMRO) improves access to closely spaced parallel runways (CSPR). This will enable more arrivals and departures, which will increase efficiency and capacity at those airports while reducing fligh delays. The capabilities in this portfolio will enable the use of simultaneous approaches (two aircraft on the approach path at the same time) during periods of reduced visibility, decrease the required separations between aircraft on dependent approaches (staggered aircraft arrivals on parallel runways) and departure procedures, and alleviate the effects of wake turbulence that normally require increased separation between aircraft in terminal airspace (airspace surrounding airports).

The increments in this portfolio will achieve success through the approval of procedures via authorization of FAA orders. After analysis is complete to determine the required procedure and separation standards, the FAA follows safety risk management processes for approval of the separation changes, and controller training is performed as needed prior to operational use.

TARGET USERS

Air traffic controllers, pilots, airport

TARGET AREAS

Terminal

ANTICIPATED BENEFITS

ACCESS AND EQUITY

Capabilities in this portfolio will improve access to parallel, intersecting and converging runways through new procedures, standards, guidance and decision support tools.

CAPACITY

This portfolio increases airport capacity through the introduction of capabilities that:

- Safely reduce separation standards for closely spaced parallel operations and makes this capability available at additional airports
- Improve air traffic controller awareness of all relevant airborne traffic approachin runways that converge or intersect, or whose flight paths converge or intersec
- Reduce wait time between departures

FUNDING

SUPPORTED BY NEXTGEN FLEXIBLE TERMINAL ENVIRONMENT/IMRO PORTFOLIO

OI 102140 – Improved Wake Turbulence Mitigation for Departures

OI 102141 – Improved Parallel Runway Operations

OI 102144 – Wake Turbulence Mitigation for Arrivals: CSPRs

IMPROVED MULTIPLE RUNWAY OPERATIONS

	FY 2014	FY 2015	FY 2016	FY 2017+
Pre-Implementation Phase:				
Closely Spaced Parallel Operations (CSPO): Simultaneous Dual Approaches for CSPRs spaced >3600’	Orders effective at ATL†			
CSPO: 1.0 nautical mile (nm) Dependent Stagger for Closely Spaced Parallel Runways (CSPR) spaced >2500’ & <3600’	Procedure design and authorization to be completed in FY 2015		Orders effective beginning FY 2015 through FY2016 at MSP, JFK, SEA, PDX, RDU, DAL and MEM†	Orders effective at SFO and BOS†
CSPO: Simultaneous Dual Approaches with Offset	Concept validation initiated in FY 2013 and planned for completion in FY 2014	Procedure design and authorization to be completed in FY 2016	Order effective in FY 2016 at JFK†	Orders effective in FY 2017 at PDX, MSP and DTW†
CSPO: Simultaneous Triple Approaches	Concept validation initiated in FY 2013 and planned for completion in FY 2015	Procedure design and authorization to be completed in FY 2016		Orders effective in FY 2017 at ATL and IAD†
CSPO: Enable Additional Approach Options for New Independent Runway Separation Standards	Procedure design and authorization FY 2013-FY 2015			
CSPO: Simultaneous Approaches with High Update Radar Surveillance Required	Concept validation and analysis initiated in FY 2013 and planned for completion in FY 2015		Procedure design and authorization to be completed in FY 2017 Orders effective in FY 2018+	
CSPO: Paired Approach for Category (CAT) I	Concept validation and analysis initiated in FY 2009 and planned for completion in FY 2018			
				Orders to be effective in FY 2020+

Concept — Development — Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

IMPROVED MULTIPLE RUNWAY OPERATIONS				
	FY 2014	FY 2015	FY 2016	FY2 017+
Implementation Phase:				
CSPO: Simultaneous Dual Approaches for CSPRs spaced >3600'	Procedures implemented at ATL†			
Increments implemented: • 102141-13: Amend Independent Runway Separation Standards in Order 7110.65 (including Blunder Model Analysis)				
CSPO: 1.0 nm Dependent Stagger for CSPRs spaced >2500' & <3600'			Procedures implemented beginning FY 2015 through FY2016 at MSP, JFK, SEA, PDX, RDU, DAL and MEM†	Procedures implemented at SFO and BOS†
Increments implemented: • 102141-14: Amend Dependent Runway Separation Standards in Order 7110.65				
CSPO: Simultaneous Dual Approaches with Offset			Procedures implemented in FY 2016 at JFK†	Procedures implemented in FY 2017 at PDX, MSP and DTW†
Increments implemented: • 102141-22: Amend Standards for Simultaneous Independent Approaches – Dual with Offset				
CSPO: Simultaneous Triple Approaches				Procedures implemented in FY 2017 at ATL and IAD†
Increments implemented: • 102141-24: Amend Standards for Simultaneous Independent Approaches – Triple				

Concept Development Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

IMPROVED MULTIPLE RUNWAY OPERATIONS				
	FY 2014	FY 2015	FY 2016	FY 2017+
Implementation Phase:				
CSPO: Simultaneous Approaches with High Update Radar Surveillance Required				Procedures implemented in FY 2018+ (Operation)
Increments implemented: • 102141-23: Simultaneous Independent Closely Spaced Approaches – High Update Rate Surveillance Required				
CSPO: Enable Additional Approach Options for New Independent Runway Separation Standards	Revise standards in Order 7110.65 to set lower runway separation standards for LNAV/VNAV, RNP, and RNP AR approaches in SIPIA operations without high-update surveillance (Operation)			
Increments implemented: • 102141-15: Enable Additional Approach Options for New Independent Runway Separation Standards				
CSPO: Paired Approach for CAT I				Procedures implemented in FY 2020+ (Operation)
Increments implemented: • 102157-21: Paired Approaches for Runways Spaced <2500' (CAT I)				

Concept | Development | Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

IMPROVED MULTIPLE RUNWAY OPERATIONS				
	FY 2014	FY 2015	FY 2016	FY 2017+
Pre-Implementation Phase:				
Wake Turbulence Mitigation for Departures (WTMD)		Benefits Decision for WTMD to support implementation at BOS, EWR, MIA, SEA, DTW, STL and PHL†		
Wake Turbulence Mitigation for Arrivals - Procedure (WTMA-P)	Procedure design and safety analysis for PHL and DTW† was completed in FY 2014. Safety analysis for ATL will be completed in FY 2015†			
Wake Turbulence Mitigation for Arrivals - System (WTMA-S) for CSPRs Spaced <2500' Apart			Work Supports Post FY 2016 Capabilities	
Implementation Phase:				
WTMD	Deployments at SFO, IAH, and MEM initiated in FY 2013 to validate benefits prior to further deployment at up to seven more sites through FY 2016			
Increment implemented: • 102140-01: WTMD				
WTMA-P	Orders effective starting in FY 2015 at PHL, ATL and DTW, with consideration to more sites pending safety and benefits analysis			
Increment implemented: • 102144-11: WTMA-P for Heavy/B757 Aircraft				

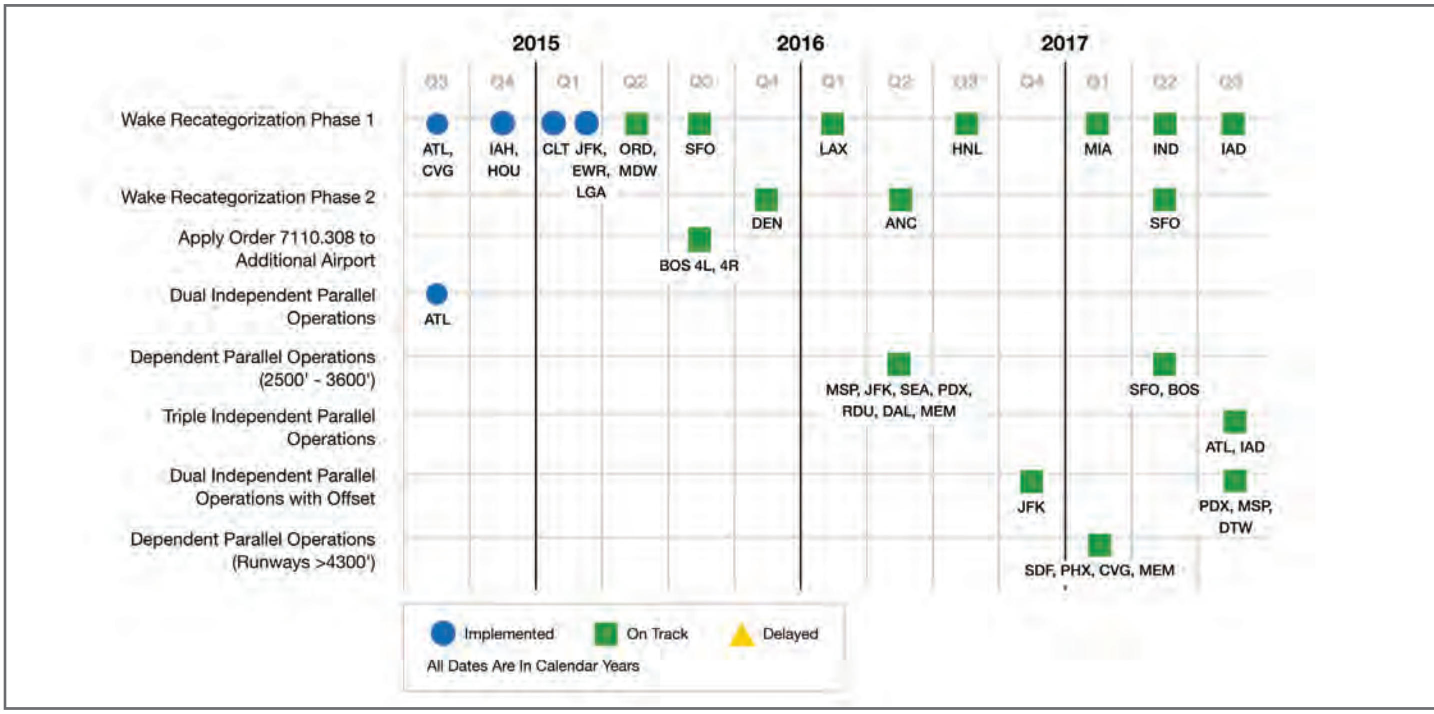
Concept Development Operation

* Work Supports Post FY 2016 Capabilities

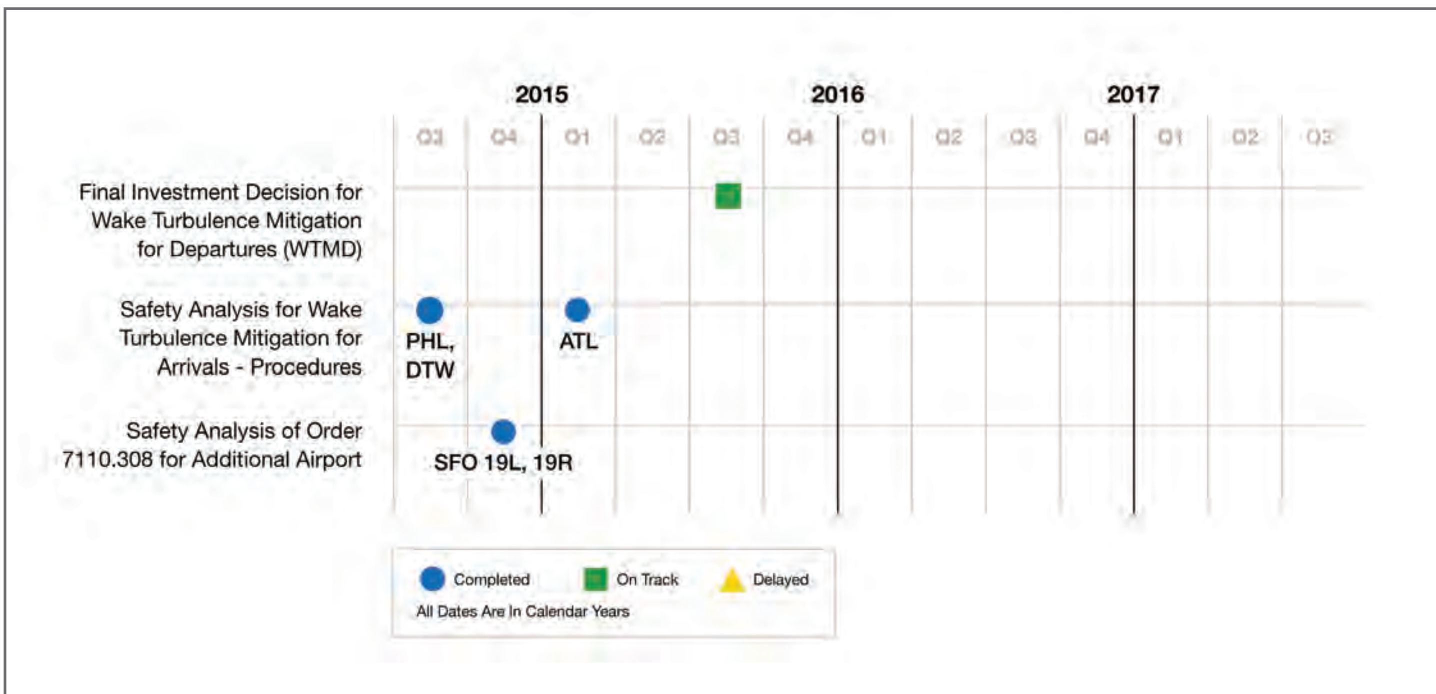
† NextGen Advisory Committee/NextGen Integration Working Group Commitment

The efficiency of parallel runways, particularly those that are closely spaced, has been limited by the interplay of wake vortices with nearby aircraft. Multiple Runway Operations capabilities improve access to these runways and can increase basic runway capacity and throughput by reducing separation between aircraft based on improved wake categorization standards. Improved access will enable more arrivals and/or departures during less than visual meteorological conditions, which will increase efficiency and reduce flight delays. These commitments are a subset of the overall series of programs and activities the FAA has planned to address these issues.

NEXTGEN PRIORITIES JOINT IMPLEMENTATION COMMITMENTS



NEXTGEN PRIORITIES JOINT PRE-IMPLEMENTATION COMMITMENTS



PERFORMANCE BASED NAVIGATION

Performance Based Navigation (PBN) uses Area Navigation (RNAV) and Required Navigation Performance (RNP) to improve access and flexibility in the National Airspace System (NAS) with the goal of providing the most efficient aircraft routes from departure runway to arrival runway. PBN defines the performance requirements for routes and procedures that enable aircraft to navigate with greater precision and accuracy. It provides a basis for designing and implementing new flight paths, redesigning airspace and providing safe obstacle clearance. Progressive stages of PBN capabilities include the safe implementation of more closely spaced flight paths for departure, arrival and approach. The portfolio also looks to right-size the navigation assets in the NAS through reviews of procedures and infrastructure to determine whether they are still useful, require revision or can be removed.

The increments in this portfolio will achieve success through the development of high- and low-altitude routes and terminal procedures that allow for integrated operations connecting airports from runway to runway. New PBN operations will provide more direct flight operations while continuing to provide routing flexibility for operations and air traffic controllers. Procedures wil be prioritized and implemented based on new FAA PBN Orders. National standards for reduced separation and divergence, vertical design guidance and criteria will be developed to further advance PBN capabilities. Teams are continuing work at several Metroplex[1] sites to study current operations, identify design improvements and implement new procedures. The combination of new procedures, separation standards and methods reduce the dependency on ground-based navigation structure.

TARGET USERS

Air traffic controllers, pilot

TARGET AREAS

Selected areas of the NAS

ANTICIPATED BENEFITS

ACCESS AND EQUITY

Capabilities in this portfolio provide improved benefits by defining navigation performanc specifications for an aircraft along a route, during a procedure, or in airspace. In addition, certain capabilities provide an access benefit to all qualified runway ends, especially for those runwa

[1] Metroplex is an effort to expedite PBN in large metropolitan areas that include several commercial and general aviation airports.

ends not equipped with Instrument Landing System (ILS). It also provides a flexibility benefit a ILS airports by providing an alternative instrument approach to continue operations if the ILS fails.

- Optimization of arrival and departure vertical profile
- Reductions in lateral track distances
- Repeatable, predictable flight path

CAPACITY

Capabilities in this portfolio improve capacity by removing level-offs on arrivals, segregating arrival routes to deconflict flows, adding departure points, expediting departures, adding ne high-altitude PBN routes and realigning airspace to enhance the NAS.

- Increased capacity in transition airspace for arrivals and departures
- Improved collaboration within and between air traffic control (TC) facilities
- Improved opportunity for traffic flow managers to more fully exploit the use of availabl NAS resources

EFFICIENCY

Capabilities promote flight efficiency by ensuring that flights obtain the most efficient reques or assigned routing for which the flight is performance qualified, given th ATC situation. RNAV- and RNP-equipped aircraft have access to performance-restricted routes, without creating additional workload for controllers.

- Reduced ATC task complexity and pilot/controller communications due to reduced radar vectoring
- Reduced need for traffic management initiatives due to provision of additional exit points/earlier route divergence
- Reduced emissions and fuel burn through operational improvements

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FUNDING

SUPPORTED BY NEXTGEN PBN-METROPLEX RNAV/RNP/PBN & METROPLEX PORTFOLIO/OPERATIONS APPROPRIATIONS

OI 108209 – Increase Capacity and Efficiency Using RN V and RNP

SUPPORTED BY OPERATIONS APPROPRIATIONS

OI 107103 – RNAV Standard Instrument Departures, Standard Terminal Arrival Routes and Approaches

SUPPORTED BY SYSTEM DEVELOPMENT

OI 104123 – Time Based Metering Using RNAV and RNP Route Assignments

PERFORMANCE BASED NAVIGATION				
	FY 2014	FY 2015	FY 2016	FY 2017+
Pre-Implementation Phase:				
Metroplex – Study Phase	Study Phase work began in FY 2011 at DC and North Texas Metroplexes and will continue across approximately 12 sites (Concept)			
Metroplex – Design Phase	Design Phase work began in FY 2011 at DC and North Texas Metroplexes and will continue across approximately 12 sites (Development)			
Metroplex – Evaluation Phase	Evaluation Phase work began in FY 2012 at Houston and DC Metroplexes and will continue across approximately 12 sites (Development)			
Integration of National Airspace System (NAS) Design and Procedure Planning – PBN Initiatives	Modeling, simulation and safety analysis for new Area Navigation (RNAV)/Required Navigation Performance (RNP) procedure development (Development)			
Equivalent Lateral Spacing Operation Standard (ELSO)	ELSO safety analysis research† (Development)			

Implementation Phase:				
Metroplex - Implementation Phase	Implementation Phase work began in FY 2013 at Houston Metroplex and will continue across approximately 12 sites (Operation)			
Increment implemented: • 2015: Complete Northern California Metroplex implementation activities† • 2015: Complete Washington DC Metroplex implementation activities • 2015: Complete North Texas Metroplex implementation activities • 2016: Complete Southern California Metroplex implementation activities • 2017: Complete Atlanta Metroplex implementation activities† • 2017: Complete Charlotte Metroplex implementation activities†				
Metroplex - Post Implementation Phase	Post Implementation Phase work is expected to begin in Q3 of FY 2014 at Houston Metroplex and will continue across approximately 12 sites (Operation)			
Increment implemented: • 108209-12 Metroplex PBN Procedures				
Integration of NAS Design and Procedure Planning – PBN Initiatives				PBN Initiatives implementation complete at 2nd location. (Operation)
Increment implemented: • 108209-20 Advanced and Efficient RNP				

Concept | Development | Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

<table>
<tr><th colspan="5">PERFORMANCE BASED NAVIGATION</th></tr>
<tr><th></th><th>FY 2014</th><th>FY 2015</th><th>FY 2016</th><th>FY 2017+</th></tr>
<tr><td colspan="5">Implementation Phase:</td></tr>
<tr><td>Large Scale Redesign of Airspace Leveraging PBN</td><td>Timeline reflects most recent Congressional guidance on New York/New Jersey/ Philadelphia Metropolitan Area Airspace Redesign</td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Increment implemented:
• 108209-13 Large Scale Redesign of Airspace Leveraging PBN</td></tr>
<tr><td>Transition to PBN Routing for Cruise Operations</td><td colspan="2">Complete PBN Route Structure Concept of Operation</td><td></td><td></td></tr>
<tr><td colspan="5">Increment implemented:
• 108209-14 Transition to PBN Routing for Cruise Operations</td></tr>
<tr><td>RNAV (GPS) Approaches</td><td colspan="3">WAAS program</td><td></td></tr>
<tr><td colspan="5">Increment implemented:
• 108209-19 RNAV (GPS) Approaches</td></tr>
<tr><td>ELSO</td><td>Implement ELSO capability at one location in the NAS</td><td colspan="3">Update of FAA Order 7110.65</td></tr>
<tr><td colspan="5">Increment implemented:
• 108209-21 ELSO</td></tr>
<tr><td>RNP Authorization Required (AR) Approaches</td><td colspan="3">Certify, publish, and implement procedures outlined in H.R. 58 Section 213 a & b[1†]</td><td></td></tr>
<tr><td colspan="5">Increment implemented:
• 107103-12 RNP AR Approaches</td></tr>
<tr><td>RNAV SIDs and STARs at Single Sites</td><td colspan="2">Certify, publish, and implement procedures outlined in H.R. 58 Section 213 a & b[2†]</td><td></td><td></td></tr>
<tr><td colspan="5">Increment implemented:
• 107103-13 RNAV SIDs and STARs at Single Sites</td></tr>
</table>

[1,2] Procedure development will continue through FAAO 7100.41 process

Concept Development Operation

*** Work Supports Post FY 2016 Capabilities**

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

METROPLEX SCHEDULE

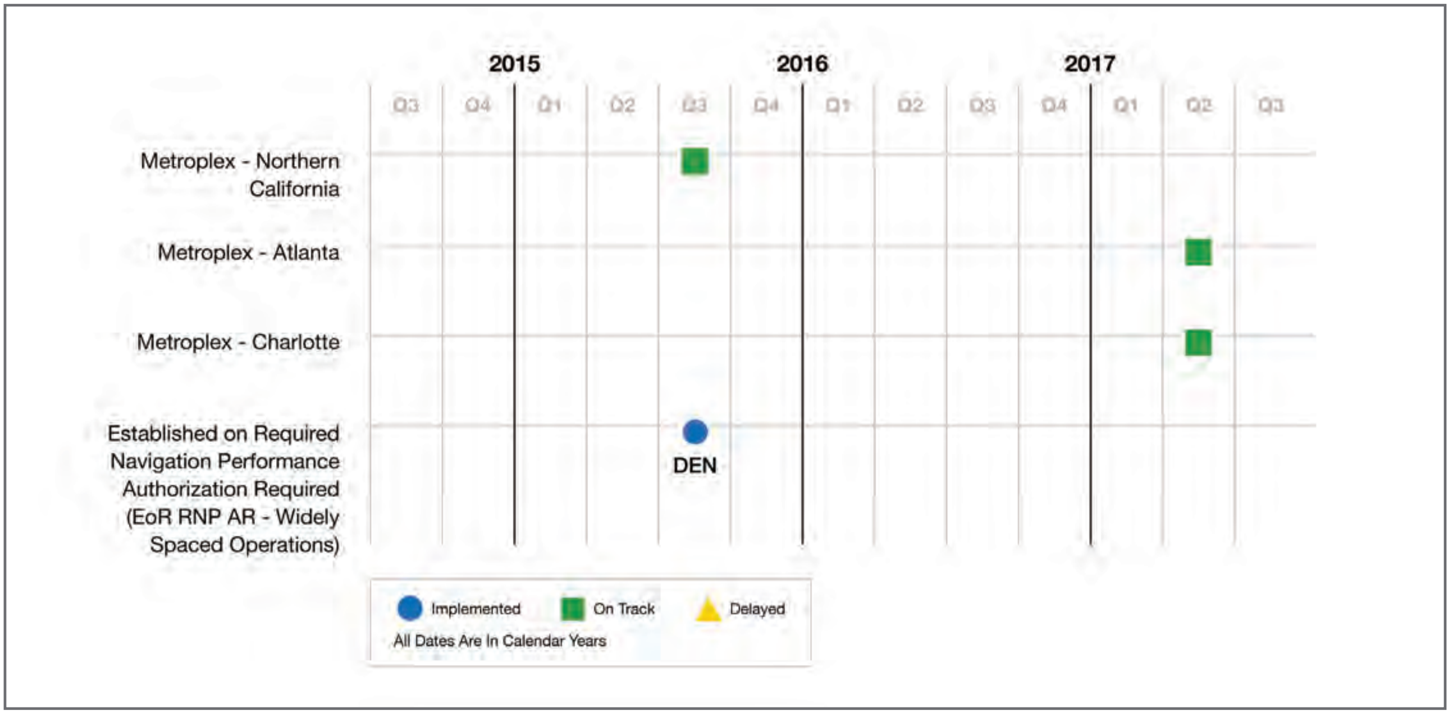
Site	FY 2014 1Q	FY 2014 2Q	FY 2014 3Q	FY 2014 4Q	FY 2015 1Q	FY 2015 2Q	FY 2015 3Q	FY 2015 4Q	FY 2016 1Q	FY 2016 2Q	FY 2016 3Q	FY 2016 4Q	FY 2017 1Q	FY 2017 2Q	FY 2017 3Q	FY 2017 4Q	FY 2018 1Q	FY 2018 2Q	FY 2018 3Q	FY 2018 4Q
Houston	I	I	I P	P	P															
North Tex	E	E I	I	I	P	P														
North Cal	E	E	E	E I	I	I	I P	P	P											
Washington	E #	#	#	# I	I	I	I	P	P											
Atlanta	E	E #	#	#	#	#	I	I	I	I	I	I	I P P	P	P					
Charlotte	E	E	E	E	E	E	I	I	I	I	I	I	I	P	P	P				
South Cal	D	D	E	E	E	E	E	E	E	I	I	I	I	P	P					
Phoenix	$	$	++	++	++ D	D	D	D E	E	E	E	E	I	I	I	P	P			
CLE/DTW		S	S	S ++ D	D	D	D	E	E	E	E	E I	I	I	I	P	P			
Denver				S	S	++	D	D	D	E	E	E	E I	I	I	I	I P	P	P	
Florida	$	$ #	#	# S	D	D	D	D	D	E	E	E	E	E	I	I	I	I	P	P

Milestone Leads Organizational Symbol	Functional Description
AJV-1	Airspace Services
AJV-121	Airspace Optimization Group
AJV-E	Mission Support, Eastern Service Center
AJV-C	Mission Support, Central Service Center
AJV-W	Mission Support, Western Service Center
AJV-114	Environmental Analysis
AJW-3	Aviation Systems Standards – Flight Checks

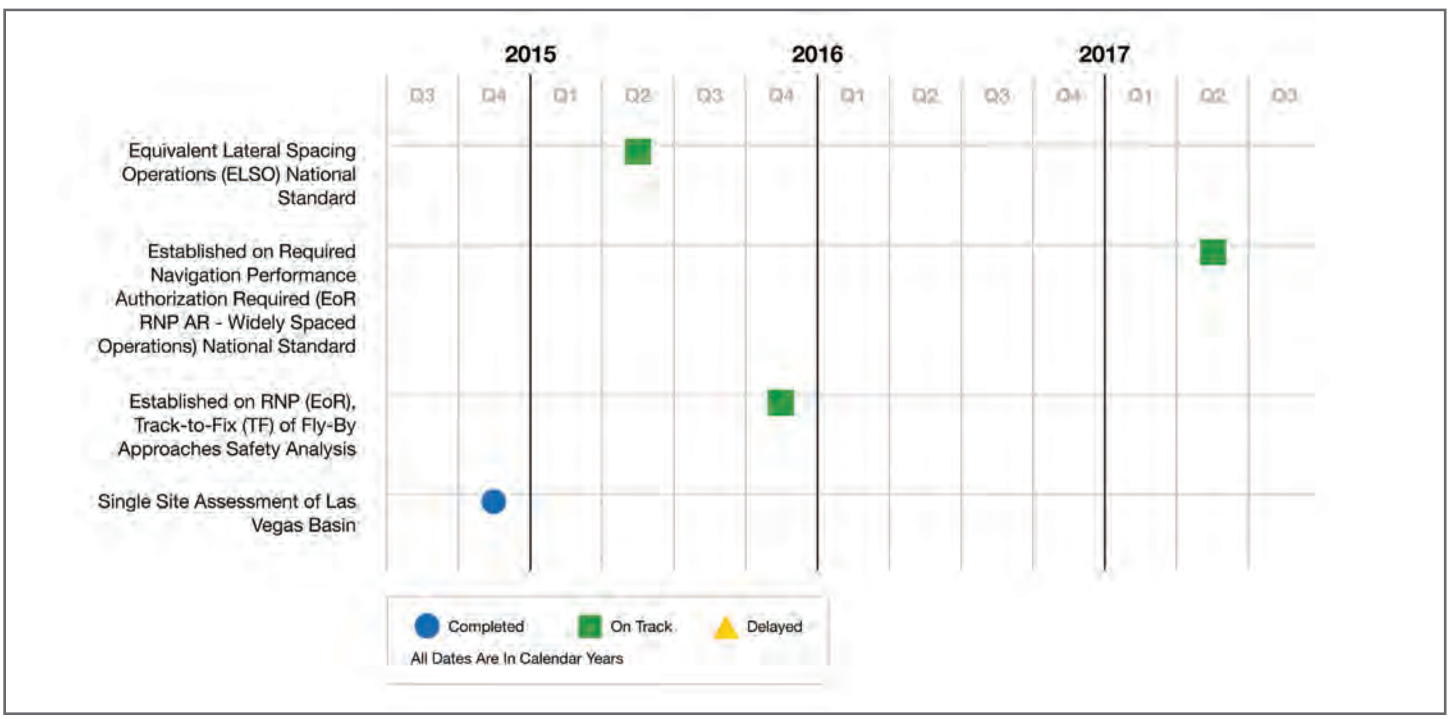
S	Study
D	Design
E	Eval
I	Implementation
P	Post Implementation
$	Budget Impact
F	Furlough Impact
#	ERAM Resource Impact
++	Facility Resource Issue

With PBN, the FAA delivers new routes and procedures that primarily use satellite-based navigation and on-board aircraft equipment to navigate with greater precision and accuracy. PBN provides a basis for designing and implementing automated flight paths, airspace redesign and obstacle clearance. Benefits include shorter and more direct flight paths, improved airport arrival rates, enhanced controller productivity, increased safety due to repeatable and predictable flight paths, fuel savings and a reduction in aviation's adverse environmental impact. These commitments are a subset of the overall series of PBN activities the FAA is planning to implement.

NEXTGEN PRIORITIES JOINT IMPLEMENTATION COMMITMENTS



NEXTGEN PRIORITIES JOINT PRE-IMPLEMENTATION COMMITMENTS



TIME BASED FLOW MANAGEMENT

Time Based Flow Management (TBFM) will enhance National Airspace System (NAS) efficiency by using the capabilities of the Traffic Management Advisor (TMA) decision-support tool, a system that is already deployed at all air route traffic control centers in the contiguous United States. In particular, improvements in TMA's core Time Based Metering (TBM) capability and its trajectory modeler, an expansion of TMA and its departure capabilities to additional locations, and enhancements to TMA's departure capabilities will enhance efficiency and optimize demand and capacit . Improvements will also be made to enable controllers to more accurately deliver aircraft to the Terminal Radar Approach Control facility while providing the opportunity for aircraft to fly optimized descents.

TARGET USERS

Air traffic controllers, operator

TARGET AREAS

NAS-wide

ANTICIPATED BENEFITS

EFFICIENCY

Efficiency is improved through the introduction of capabilities in this portfolio that will

- Expand TBM and other advanced TBFM-based capabilities to additional geographical areas, as they provide more efficient traffic flow compared with traditional miles-in-tra traffic flow manageme
- Enable TBFM's use of more accurate trajectories, which will translate into more accurate estimated times of arrival resulting in more efficient slot and delay allocatio
- Increase departure-time compliance by enabling control tower personnel to manage ground operations to meet self-scheduled, deconflicted departure time

ENVIRONMENT

More efficient flight paths have the potential to reduce fuel burn and emissions through reduce holding and improved delivery to optimized descents.

FUNDING

SUPPORTED BY AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST

OI 102118 – Interval Management – Spacing

SUPPORTED BY NEXTGEN TBFM/TBFM PORTFOLIO

OI 104115 – Current Tactical Management of Flow in En Route for Arrivals and Departures

OI 104117 – Improved Management of Arrival/Surface/Departure Flow Operations

OI 104120 – Point-in-Space Metering

OI 104123 – TBM Using Area Navigation and Required Navigation Performance Route Assignments

OI 104128 – TBM in the Terminal Environment

TIME BASED FLOW MANAGEMENT				
	FY 2014	FY 2015	FY 2016	FY 2017+
Pre-Implementation Phase:				
Time Based Flow Management (TBFM) Work Package (WP) 3	Investment Analysis WP 3 – Final Investment Decision expected in Q3 FY 2015 (Concept)			
TBFM Tech Refresh		Mission Analysis activities (Concept)	Investment Analysis Activities (Concept)	
Flight Operations Center (FOC) Preferences Incorporated into Metering			Work supports post-FY 2016 capabilities (Development)	
Interval Management – Spacing (IM-S) Cruise			Work supports post-FY 2016 capabilities (Development)	
IM-S Arrivals and Approach			Work supports post-FY 2016 capabilities (Development)	
Complex Clearances				
Implementation Phase:				
TBFM WP 2	Operationally Available for FY 2014 to FY 2017 (Operation)			
Increments implemented: • 104120-11 Extended Metering • 1104123-12 Ground-based Interval Management - Spacing[1] • 104115-11 Implement Traffic Management Advisor's (TMA) Adjacent Center Metering Capability at Additional Locations • 104115-12 Implement TMA at Additional Airports • 104123-11 Use Area Navigation (RNAV) Route Data to Calculate Trajectories Used to Conduct Time Based Metering (TBM) Operations[2] • 104117-11 Integrated Departure/Arrival Capability (IDAC)[3]				
TBFM Work Package 3				Operationally Available for FY 2018 to FY 2020 (Development)
Increments implemented: • 104128-24 TBM in the Terminal Environment • 104117-11 IDAC[3]				
TBFM Tech Refresh				Operationally Available in FY 2019 (Development)
Increment implemented: • N/A				

[1] Formerly Arrival Interval Management Using Ground Automation. Moved from OI 104120 to OI 104123.
[2] This increment now ends in FY 2014.
[3] Timeline extended to capture the remaining waterfall schedule of 15 sites.

Concept | Development | Operation

* **Work Supports Post FY 2016 Capabilities**

† **NextGen Advisory Committee/NextGen Integration Working Group Commitment**

TIME BASED FLOW MANAGEMENT

	FY 2014	FY 2015	FY 2016	FY 2017+
Implementation Phase:				
FOC Preferences Incorporated into Metering				Operationally Available in FY 2022
Increments implemented: • 104120-28 FOC Preferences Incorporated into Metering				
IM-S Cruise				Operationally Available in FY 2022
Increments implemented: • 102118-21 IM-S Cruise				
IM-S Arrivals and Approach				Operationally Available in FY 2020
Increments implemented: • 102118-23 IM-S Arrivals and Approach				
Complex Clearances				Operationally Available in FY 2021+
Increments implemented: • 104123-23 Complex Clearances				

Concept Development Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

COLLABORATIVE AIR TRAFFIC MANAGEMENT

Collaborative Air Traffic Management (CATM) coordinates flight and flow decision-making by flight planners and AA traffic managers to improve overall efficiency of the National Airspace System (NAS), provide greater flexibility to the flight planner and make the best use of available airspace and airport capacity. The overall philosophy driving the delivery of CATM services is to accommodate user preferences to the maximum extent possible. Traffic managers impose Traffic Management Initiatives (TMI) to account for congestion, weather, special activity airspace or other constraints. TMIs are the means by which traffic managers manage constraints. These initiatives can alter users' flight plans. The effect of TMIs can be reduced by tailoring flow management actions to specific fligh

CATM services are targeted to deliver a combination of increased information on the users' preferred alternative routes, enhanced tools for assessing the impact of rerouting decisions, and improved communications and display of instructions to controllers in order to accommodate user preferences to the maximum extent possible.

TARGET USERS

Air traffic controllers, traffi managers, operators

TARGET AREAS

NAS-wide

ANTICIPATED BENEFITS

CAPACITY

This portfolio increases capacity through the introduction of capabilities that result in:

- Imposing fewer en route capacity constraints as congestion is resolved through tailored incremental congestion responses
- Automated congestion resolution tools matching user preferences to airspace with available capacity

FLEXIBILITY

Capabilities in this portfolio improve flexibility by

- Increasing user route flexibility through negotiated trajectories for congestion resolution
- Simplifying relieving departure queue and reducing surface delays through Integrated Departure Route Planning decision support
- Facilitating the ability of local traffic managers to balance workload even on days when there are no major impacts from severe weather
- Enabling improved/optimal runway assignments considering airspace configuration change

EFFICIENCY

This portfolio provides efficiency benefits throug

- Increasing aggregate flight efficiency by factoring individual flight trajectories into t congestion solution
- Reducing arrival delay by identifying opportunities for reopening arrival airspace
- Advance forecast of impact and clearing enabling decision to hold arrivals at higher altitudes or on the ground, reducing fuel burn, emissions and terminal congestion
- Optimizing flight trajectory before take-o f (pre-departure) or entry into oceanic airspace (pre-oceanic) to reduce fuel consumption and environmental impact of oceanic flight

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FUNDING

SUPPORTED BY NEXTGEN CATM TECHNOLOGY/CATM PORTFOLIO

OI 101102 – Provide Full Flight Plan Constraint Evaluation with Feedback

OI 104208 – Enhanced Departure Flow Operations

OI 105208 – Traffic Management Initiatives with Flight-Specifi Trajectories

OI 105302 – Continuous Flight Day Evaluations

SUPPORTED BY SEPARATION MANAGEMENT PORTFOLIO

OI 104102 – Interactive Planning using 4-D Trajectory Information in the Oceanic Environment

SUPPORTED BY IMPROVED SURFACE/TERMINAL FLIGHT DATA MANAGEMENT PORTFOLIO

OI 104117 – Improved Management of Arrival/Surface/Departure Flow Operations

SUPPORTED BY SYSTEM DEVELOPMENT

OI 105207 – Full Collaborative Decision-Making

COLLABORATIVE AIR TRAFFIC MANAGEMENT				
	FY 2014	FY 2015	FY 2016	FY 2017+
Pre-Implementation Phase:				
CATM-T Work Package (WP) 4	Concept Validation, and FAA Acquisition Management System (AMS) Investment Analysis [Investment Analysis Readiness Decision (IARD), Initial Investment Decision (IID)			
CATM-T WP 5	IID and Final Investment Decision (FID) CATM-T WP 5 Concept exploration			Concept Validation, and FAA AMS Investment Analysis (IARD, IID, FID) through FY 2019
Airborne Rerouting with Data Communications	Concept exploration of automation systems and procedures for future enhancements to the airborne rerouting capability			
Implementation Phase:				
CATM-T WP 1	Fully Deployed by the end of FY 2016[1]			
Increments Implemented • 105208-11 Execution of Flow Strategies • 104208-11 Delivery of Pre-Departure Reroutes (PDRR) to Controllers				
CATM-T WP 2	Fully Deployed by the end of FY 2016[2]			
Increments Implemented • 101102-11 Collaborative Trajectory Options Program • 105302-11 Collaborative Airspace Constraint Resolution[2] • 101102-12 Route Availability Planning • 105208-21 Airborne Rerouting				
CATM-T WP 3	Fully deployed by the end of Calendar Year 2015			
Operational Improvements Supported • Collaborative Information Exchange - Completed • Traffic Flow Management (TFM) Remote Site Engineering				

[1]Timeline extended from FY 2015 to FY 2016

[2]Timeline extended from FY 2015 to FY 2016

Concept   Development   Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

COLLABORATIVE AIR TRAFFIC MANAGEMENT					
	FY 2014	FY 2015	FY 2016	FY 2017+	
Implementation Phase:					
CATM-T WP 4			CATM-T WP 4 capability development up to FY 2019+		Operationally available FY 2019+
Increments Supported • 105207-26 Integrated Departure Route Planning • 105208-23 Arrival Route Availability Planning[1] • 105302-23 Integrate Traffic Management Initiative (TMI) Modeling • 105302-25 Airport Acceptance Rate Decision Support • 105302-21 Improve Demand Predictions					
CATM-T WP 5 and Future WPs				CATM-T WP 5 capability development up to FY 2020+	Operationally available in FY 2020+
Potential Increments Supported • 101103-25 Constraint Evaluation Feedback • 101102-22 Negotiate Mitigations • 104102-21 User Tactical Trajectory Feedback • 104117-31 Collaborative Airport and Airspace Configuration Management • 105207-28 Airborne Trajectory Negotiations with Flight Operations Centers • 105208-24 Aircraft Equipage Eligibility During TMIs • 105302-22 Probabilistic Constraint Prediction • 105302-24 Enhanced Post Operations • 105302-26 Improved Statistical Methods for Departure Predictions[2] • 105207-22 Daily Objectives Exchange[3]					
Airborne Rerouting Automation	Software development, procedure design, and key site testing		Solution Implementation		

[1] Previous number was 104208-23
[2] Previous number was 101102-21
[3] New Increment

Concept | Development | Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

SEPARATION MANAGEMENT

Separation Management focuses on the enhancement of aircraft separation assurance. Separation Management improvements will provide air traffic controllers with tools and procedures to separate aircraft with different kinds of navigation equipment and wake performance capabilities, in what is known as a mixed environment.

The increments in this portfolio will achieve success by enhancing current National Airspace System (NAS) infrastructure through the integration into air traffic control automation systems of enabling technologies, new standards and new procedures. Common Automated Radar Terminal System, Standard Terminal Automation Replacement System, Advanced Technologies and Oceanic Procedures and En Route Automation and Modernization are the key automation systems impacted by this portfolio.

TARGET USERS

Air traffic controllers, operator

TARGET AREAS

NAS-wide

ANTICIPATED BENEFITS

Capabilities in this portfolio will enhance aircraft separation assurance by safely reducing separation between aircraft, and as a result improve capacity, efficiency and safety in the NAS

CAPACITY

Capabilities in this portfolio will support an increase in capacity by:

- Increasing airport throughput as a result of closer spacing of flights accepted from Terminal Radar Approach Control airspace and managed on final approac
- Enabling air traffic controllers and pilots through reduced separation between aircraft to manage increasing traffic levels in oceanic airspac

EFFICIENCY

This portfolio will provide improved efficiency through the introduction of capabilities that will:

- Enable more oceanic flights to ascend and descend to their preferred altitude
- Allow controllers to approve additional pilot requests for direct routes and more efficient altitude

SAFETY

This portfolio will provide controllers automated information about wake vortex separation requirements for any given aircraft pair, along with accurate wind data, which will help predict more accurate and safer separation standards.

FUNDING

SUPPORTED BY EN ROUTE AUTOMATION MODERNIZATION

OI 102146 – Flexible Routing

SUPPORTED BY FLEXIBLE TERMINAL ENVIRONMENT/IMPROVED MULTIPLE RUNWAY OPERATIONS PORTFOLIO

OI 102137 – Automation Support for Separation Management

OI 102144 – Wake Turbulence Mitigation for Arrivals: Closely Spaced Parallel Runways

SUPPORTED BY NEXTGEN SYSTEM DEVELOPMENT/SEPARATION MANAGEMENT PORTFOLIO

OI 102154 – Wake Re-Categorization

SUPPORTED BY NEXTGEN TRAJECTORY BASED OPERATIONS (TBO)

OI 104104 – Initial Conflict Resolution Advisories

SUPPORTED BY NEXTGEN TBO/SEPARATION MANAGEMENT PORTFOLIO

OI 102117 – Reduced Horizontal Separation Standards En Route – 3 Miles

OI 104102 – Interactive Planning using 4-D Trajectory Information in the Oceanic Environment

OI 108212 – Improved Management of Special Activity Airspace

OI 104122 – Integrated Arrival and Departure Airspace Management

OI 104127 – Automated Support for Conflict Resolutio

SUPPORTED BY NEXTGEN TBO/SEPARATION MANAGEMENT PORTFOLIO AND AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST

OI 102108 – Oceanic In-Trail Climb and Descent

SEPARATION MANAGEMENT				
	FY 2014	FY 2015	FY 2016	FY 2017+
Pre-Implementation Phase:				
Oceanic Tactical Trajectory Management (OTTM) - Advanced Technologies and Oceanic Procedures (ATOP) Enhancement Work Package (WP) 1			ATOP WP 2 Work (Concept) • Investment Analysis Readiness Decision (IARD) (ATOP WP1) – Targeted for 2nd Quarter Calendar Year 2016 • Final Investment Decision (FID) (ATOP WP 1) – Targeted for 2nd Quarter Calendar Year 2017 (Concept)	
OTTM - ATOP Concept Engineering	Concept Engineering in support of ATOP WP 1 (Concept)		Concept Engineering in support of ATOP Future WP (Concept)	
Implementation Phase:				
Oceanic In-Trail Climb and Descent	Software build development and release to key site (Development)			Operational Readiness by 2016 (Operation)
Increments implemented: • 102108-12 Enhanced Oceanic Climb/Descent Procedure via Automatic Dependent Surveillance-Contract Automation • 102108-13 Automatic Dependent Surveillance-Broadcast (ADS-B) Oceanic In-Trail Procedure and Automation †				
ATOP Enhancement WP[1]				Operational Readiness by 2022 (Development)
Increments implemented: • 104102-22 Approval of User Requests in Oceanic Airspace - Auto Re-Probe • 104102-25 Preferred Routing in Constrained Oceanic Airspace (Data Exchange via System Wide Information Management) • 104102-26 Approval of User Requests in Oceanic Airspace - Conflict Resolution Advisory • 104102-30 Enhanced Conflict Probe for ATOP Surveillance Airspace				
En Route Automation Modernization (ERAM) Sector Enhancement Work Package			Operational Readiness by 2020 (Development)	
Increments Implemented: • 101202-22 Unique Attributes for Unmanned Aircraft System (UAS) Flight Planning • 102112-22 UAS Air Traffic Control Direct Communications • 102117-21 Wake Turbulence Mitigations for En Route Controllers[1]				

[1]Formerly Wake Turbulence Alerts for En Route Controllers. Moved from OI 102137 to OI 102117.

Concept | Development | Operation

*** Work Supports Post FY 2016 Capabilities**

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

SEPARATION MANAGEMENT				
	FY2014	FY2015	FY2016	FY2017+
Pre-Implementation Phase:				
Separation Management – ERAM Sector Enhancements – ERAM Enhancements Investment Analysis	IARD – Achieved successfully, July 2014 FID – Targeted 3rd Quarter, Calendar Year 2015		ERAM Future Segment Work	
Separation Management – Modern Procedures - ERAM Enhancement Concept Engineering	Concept Engineering in support of ERAM Sector Enhancement		Concept Engineering in support of ERAM System Enhancements Future Segment	
Trajectory Based Operations and UAS Integration Demonstration	Demonstration project			
Wake Turbulence Re-categorization (RECAT)	FAA Wake RECAT Phase II (Leader/Follower) Benefit Study FAA Wake RECAT Phase II (Leader/Follower) Safety Argument			
Alternative Positioning, Navigation, and Timing	Pre-implementation and Investment Analysis activities			

Concept Development Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

SEPARATION MANAGEMENT

	FY 2014	FY 2015	FY 2016	FY 2017+
Implementation Phase:				
Wake RECAT, Phase 1	Approval for Wake RECAT Standards Change in 7110.608 Implementation of Wake RECAT phase 1 at 9 sites (A80, C90, N90, CLT, CVG, IAH, HOU, SDF, SFO) to be complete FY 2015 Q4 Implementation of Automated Terminal Proximity Alert (ATPA) at SDF, CLT, CVG, JFK/LGA/EWR, IAH/HOU completed in FY 2014 Q2 (Operation)			
Increments implemented: • 102154-11 Wake Re-Categorization Phase 1 - Aircraft Re-Categorization • 102137-15 ATPA for In-Trail Separation[2]				
Wake RECAT, Phase 2			• Complete changes to FAA Orders Order 7110.608 • Complete NCPand associated Safety Risk Management Document for WakeRECAT Phase II • Develop prototype software and adaptation changes for Phase II (Development)	Operational Readiness by 2017 (Operation)
Increments implemented: • 102154-21 Wake RECAT Phase 2 - Static Pair-wise Wake Separation Standards †				

[2] Formerly Closely Spaced Parallel Runway

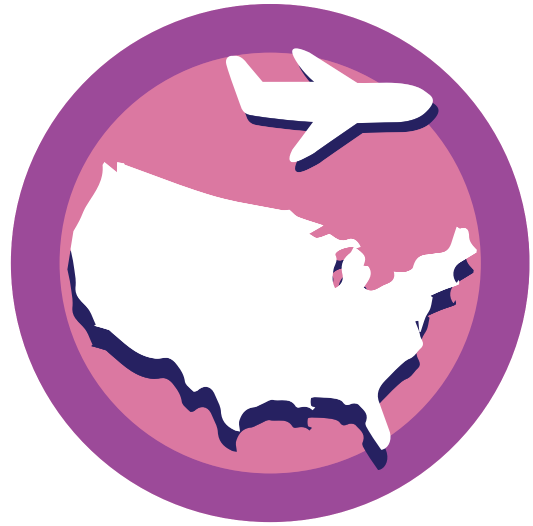
Concept | Development | Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

ON-DEMAND NAS INFORMATION

On-Demand National Airspace System (NAS) Information will provide flight planners, air traffic controllers and traffic managers, and flight crews with consistent and complete information related to changes in various areas of the NAS, such as temporary flight restrictions, temporary availability of special activity airspace (this includes military, TFRs, other), equipment outages and runway closures. The capabilities in this portfolio will be realized through net-enabled information access to and exchange of aeronautical and flight information using common data formatting and information exchange standards.



TARGET USERS

Air traffic controllers, traffi   managers, flight planners, flight cre

TARGET AREAS

NAS-wide

ANTICIPATED BENEFITS

Improving the consistency, completeness and accuracy of the NAS advisory service information has the following anticipated benefits:

- Reduced fuel burn and operating costs related to planning around constraints that are not accurate representations of NAS status and airspace usage
- Increased flexibility of the NAS to enable users to adapt according to their own need
- Maintenance and improved safety of the NAS

CAPACITY

Capabilities in this portfolio permit coordination of available schedules for special acitvity airspace, providing access to airspace that otherwise would not be available and thereby improving airspace capacity.

EFFICIENCY

Capabilities in this portfolio improve flight efficiency by reducing flight time and distance, whi reduces fuel burn and emissions, for operators who opt for more efficient routes thrrough awareness of the availability of special activity airspace.

PREDICTABILITY

Capabilities in this portfolio provide real-time status of airspace, enabling operators to more predictably plan their schedules.

SAFETY

Capabilities in this portfolio provide an additional margin of safety by delivering real-time traffic, flight and NAS status information directly to the flight deck, providing flight crews informati quickly and in a usable form.

FUNDING

SUPPORTED BY AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST (ADS-B)

OI 103209 – Enhance Traffic Advisory Services

SUPPORTED BY NEXTGEN ADS-B, COLLABORATIVE AIR TRAFFIC MANAGEMENT TECHNOLOGY (CATMT)/COLLABORATIVE AIR TRAFFIC MANAGEMENT (CATM) PORTFOLIO & SYSTEM WIDE INFORMATION MANAGEMENT (SWIM)

OI 103305 – On-Demand NAS Information

SUPPORTED BY NEXTGEN CATM/ON-DEMAND NAS PORTFOLIO, CATMT/ CATM PORTFOLIO & SWIM

OI 108212 – Improved Management of Special Activity Airspace

ON DEMAND NAS INFORMATION				
	FY 2014	FY 2015	FY 2016	FY 2017+
Pre-Implementation Phase:				
Aeronautical Information Management Modernization (AIMM) Segment 2	AIMM Segment 2 Investment Analysis [Final Investment Decision (FID) in Q4 FY 2014]			
AIMM Segment 3	Concept work (12 months) in FY 2014 and FY 2015 for Standard Operation Procedures and Letters of Agreement Airspace Constraints Digitization. This is AIMM Segment 3 increment, 108207-21 Planned Airspace Constraints		AIMM Segment 3 Investment Analysis [Concept and Requirements Definition Readiness Decision (CRDRD) FY 2016, Investment Analysis Readiness Decision (IARD) FY 2017, Initial Investment Decision (IID) FY 2018 and FID FY 2019]	

Concept Development Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

ON DEMAND NAS INFORMATION

	FY 2014	FY 2015	FY 2016	FY 2017+
Implementation Phase:				
AIMM Segment 1	AIMM S1 Operational Development Activities; Operationally available FY 2014 through FY 2015	Operationally available FY 2014 through FY 2015		
AIMM Segment 2		AIMM Segment 2 Operational Development Activities	AIMM Segment 2 Operational Development Activities	Operationally Available in FY 2018 - FY 2020
AIMM Segment 3				AIMM Segment 3 Operational Development Activities in FY 2019+; Operationally Available in FY 2020+

AIMM Segment 1 – Increments implemented:
- 103209-01 Traffic Situational Awareness with Alerts (TSAA)
- 103305-13 Provide National Airspace System (NAS) Status via Digital Notices to Airmen (NOTAMs) or Flight Operations Centers (FOC)/Airline Operations Centers (AOC)
- 103305-23 Airborne Access to Information Portal
- 108212-12 Improve Special Use Airspace-Based Flow Predictions

AIMM Segment 2 – Increments implemented:
- 103305-12 Improved Access to NAS Aeronautical, Status, and Constraint Information for Authorized NAS Users and Subscribers
- 103306-02 Tailored NAS Status via Digital NOTAMs for Air Navigation Service Providers (ANSP)[1]
- 105104-21 Improve Special Activity Airspace (SAA)-Based Flow Predictions[2]

AIMM Segment 3 – Increments implemented:
- 103306-01 Static Airspace Constraints[3]
- 108207-21 Planned Airspace Constraints[4]
- 108212-11 ANSP Real-Time Status for SAAs

[1] Renumbered from 103305-24
[2] Renumbered from 108212-21
[3] Renumbered from 103305-21
[4] Renumbered from 103305-22

Concept | Development | Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

ON DEMAND NAS INFORMATION

	FY 2014	FY 2015	FY 2016	FY 2017+
Pre-Implementation Phase:				
Flight Object	(Operation)			
	v3.0 (Development)	(Operation)		
		V4.0 (Development)		(Operation)
				v5.0, v6.0, v7.0 (Development)
Flight Object Exchange Service (FOXS)			Engineering and Investment Analysis for FOXS Implementation and Flight Iinformation Exchange Model v5.0/v6.0/v7.0 incorporation into FOXS (Concept)	
Advanced Methods: Unified Flight Planning & Filing; NAS Common Reference; Service Level Expectations and Learning Automation	Development of constraint prediction, monitoring and alerting; operational response development; post-operational analysis and training (Concept)			
Collaborative Information Management	Flight Information Authentication and Credentialing Recommendations (Concept)	Air-to-ground data link modeling and simulation exercise; analysis report and sharing strategy (Concept)		

Concept Development Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

ENVIRONMENT AND ENERGY

Environment and Energy uses a comprehensive five-pillar approach to overcome the environmental constraints that are facing aviation from noise, air quality, climate, energy and water quality concerns. The five-pillar approach is comprised of improved scientific knowledge and integrated modeling, aircraft technology maturation, sustainable alternative jet fuels, air traffic management modernization and operational improvements, and policies, environmental standards and market-based measures. The environmental performance of the National Airspace System (NAS) will be tracked using the NextGen Environmental Management System (EMS) Framework to identify additional system improvements with the goal of achieving sustainable aviation growth.

TARGET USERS

Air traffic controllers, AA, airports, airline operators and manufacturers

TARGET AREAS

Airport Local to NAS-wide

ANTICIPATED BENEFITS

Capabilities in this portfolio will, where feasible, improve environment, efficienc , mobility, save fuel, and reduce emissions, while reducing noise footprint and enabling the avoidance of environmentally sensitive areas when practicable.

FUNDING

SUPPORTED BY ENVIRONMENT PORTIFOLIO

OI 701102 – NextGen Environmental Modeling – Phase I

OI 701103 – Integrated Environment Modeling – Phase II

OI 702102 – NextGen Environmental Engine and Aircraft Technologies – Phase I

OI 704102 – Environmental Policies, Standards and Measures – Phase I

OI 704103 – Environmental Policies, Standards and Measures – Phase II

SUPPORTED BY NEXTGEN RESEARCH, ENGINEERING AND DEVELOPMENT

OI 701102 Integrated Environmental Modeling – Phase I

OI 701103 integrated Environmental Modeling – Phase II

OI 702102 NextGen environmental Engine and Aircraft Technologies – Phase I

OI 702103 NextGen Environmental Engine and Aircraft Technologies – Phase II

OI 703102 Sustainable Alternative Jet Fuels – Phase I

OI 703103 Sustainable Alternative Jet Fuels – Phase II

OI 704102 Environmental Polices, Standards and Measures – Phase I

OI 704103 Environmental Policies, Standards and Measures – Phase II

ENVIRONMENT AND ENERGY				
	FY 2014	FY 2015	FY 2016	FY 2017+
Pre-Implementation Phase:				
Integrated Environmental Modeling - Phase I±	Development work from FY 2010 through FY 2015			
Integrated Environmental Modeling - Phase II±			Development work FY 2016+	
NextGen Environmental Engine and Aircraft Technologies - Phase I±	Development work occurred from FY 2012 through FY 2014 with additional testing and maturation demonstration of technologies occurring through FY 2017			
NextGen Environmental Engine and Aircraft Technologies - Phase II±			Development work FY 2016+	
Sustainable Alternative Jet Fuels - Phase I±	Development work from FY 2011 through FY 2015			
Sustainable Alternative Jet Fuels - Phase II±			Development work FY 2016+	
Environmental Policies, Standards and Measures - Phase I±	Development work from FY 2009 through FY 2015			
Environmental Policies, Standards and Measures - Phase II±			Development work FY 2016+	

± The work from NGIP 2014 has been redistributed to better align the OIs to the FAA's Aviation Environmental and Energy Policy Statement

Concept Development Operation

*** Work Supports Post FY 2016 Capabilities**

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

ENVIRONMENT AND ENERGY				
	FY 2014	FY 2015	FY 2016	FY 2017+
Implementation Phase:				
Integrated Environmental Modeling - Phase I		Available in FY 2015		
Increments implemented : • 701102-02[1] Aviation Environmental Design Tool Version 2B • 701102-03[2] Improved Scientific Knowledge • 701102-04[3] Aviation Environmental Portfolio Management Tool				
Integrated Environmental Modeling - Phase II				Availability in FY 2022
Increments implemented : • 701103-01[4] Aviation Environmental Tools Suite				

[1]Renumbered from 109309-21
[2]Renumbered from 109309-15
[3]Renumbered from 109309-17
[4]Renumbered from 109309-17

Concept Development Operation

*** Work Supports Post FY 2016 Capabilities**

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

ENVIRONMENT AND ENERGY				
	FY 2014	FY 2015	FY 2016	FY 2017+
Implementation Phase:				
NextGen Environmental Engine and Aircraft Technologies - Phase I		Available to industry FY 2015+		
Increments implemented: • 702102-05[5] Engine Weight Reduction and High-Temperature Impeller • 702102-06[6] Flight Management System - Air Traffic Management (FMS-ATM) Integration • 702102-07[7] Ultra High-Bypass Ratio Geared Turbo Fan • 702102-08[8] Ceramic Matrix Composite Turbine Blade Tracks[9] • 702102-09[10] Dual-Wall Turbine Vane[11]				
NextGen Environmental Engine and Aircraft Technologies - Phase II				Available to industry in FY 2017+
Increments implemented: • 702103-01[12] Flight-Management System-Air Traffic Management (FMS-ATM) Integration - Phase II • 702103-03[13] Explore and Demonstrate New Technologies Under Continuous Lower Energy, Emissions, and Noise - Phase II				

[5]Renumbered from 109315-16
[6]Renumbered from 109315-18
[7]Renumbered from 109315-19
[8]Renumbered from 109315-14
[9]Timeline extended to reflect testing and demonstration to mature the technologies at the designated Technology Readiness Level (TRL).
[10]Renumbered from 109315-17
[11]Timeline extended to reflect testing and demonstration to mature the technologies at the designated TRL.
[12]Renumbered from 109318-26
[13]Renumbered from 109318-28

Concept Development Operation

*** Work Supports Post FY 2016 Capabilities**

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

ENVIRONMENT AND ENERGY				
	FY 2014	FY 2015	FY 2016	FY 2017+
Implementation Phase:				
Sustainable Alternative Jet Fuels - Phase I		Available to industry in FY 2015		
Increments implemented: • 703102-02[14] Drop-In >50% HRJ/HEFA Fuels (Greater than 50% Blend)[15] • 703102-03[16] Other Advanced Aviation Alternative Fuels - Phase I				
Sustainable Alternative Jet Fuels - Phase II				Available to industry in FY 2017+
Increments implemented: • 703103-01[17] Other Advanced Drop-In Aviation Alternative Fuels - Phase II • 703103-02[18] Generic Methodology for Alternative Fuels Approval				

[14]Renumbered from 109316-12
[15]Formerly Drop-In > 50% HEFA Fuels (Greater than 50% Blend)
[16]Renumbered from 109316-13
[17]Renumbered from 109321-21
[18]Renumbered from 109321-22

Concept | Development | Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

ENVIRONMENT AND ENERGY				
	FY 2014	FY 2015	FY 2016	FY 2017+
Implementation Phase:				
Environmental Policies, Standards and Measures - Phase I		Available in FY 2015		
Increments implemented: • 704102-03[19] Environmental Targets • 704102-04[20] Environmental Assessment of NextGen Capabilities • 704102-05[21] Analysis to Support International Environmental Standard-Setting - Phase I • 704102-06[22] Environmental Goals and Targets Performance Tracking System • 704102-07[23] NextGen Environmental Management System (EMS) Frameworks and Stakeholder Collaboration				
Environmental Policies, Standards and Measures - Phase II				Available in FY 2022
Increments implemented: • 704103-01[24] Environmental Performance and Targets • 704103-02[25] NEPA Strategy and Processes - Phase II • 704103-03[26] EMS Data Management and Stakeholder Collaboration • 704103-04[27] Analysis to Support International Environmental Standard-Setting - Phase II				

[19]Renumbered from 109309-12
[20]Renumbered from 109309-14
[21]Renumbered from 109309-16
[22]Renumbered from 109309-19
[23]Renumbered from 109309-20
[24]Renumbered from 109310-22
[25]Renumbered from 109310-23
[26]Renumbered from 109310-24
[27]Renumbered from 109310-26

Concept | Development | Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

SYSTEM SAFETY MANAGEMENT

System Safety Management is developing data acquisition, storage, analysis and modeling capabilities to meet the safety analysis needs of NextGen designers, implementers and practitioners. These resources will be used throughout theFAA to ensure that new capabilities either improve or maintain current safety levels while simultaneously improving capacity and efficiency in the National Airspace System (NAS). The portfolio currently contains two projects.

The Aviation Safety Information Analysis and Sharing (ASIAS) project collects aviation data from more than 100 commercial and general aviation operations sources, and fuses the data to improve the analysis of complex issues related to NextGen operational improvements. ASIAS also maintains many aviation-related metrics and benchmarks that enable analysts to monitor important aviation system characteristics.

The System Safety Management Transformation (SSMT) project, which uses ASIAS data and data from other sources, is developing data analysis and modeling capabilities that will enable safety analysis to determine how NAS-wide operational improvements will affect safety and evaluate potential safety-risk mitigations. SSMT results are returned to stakeholders for use in planning and evaluation, and to ASIAS for metrics development and tracking. Long-term tracking of ASIAS metrics are embedded in the SSMT risk analysis baseline capability (the Integrated Safety Assessment Model) to provide ongoing support to the NextGen safety assessment process.

TARGET USERS

FAA, operators

TARGET AREAS

NAS-wide

ANTICIPATED BENEFITS

SAFETY

The capabilities in this portfolio enable the sharing of de-identified safety and risk data among the FAA and NAS users, which will identify NAS-wide trends and emerging airspace management risks before they result in accidents or incidents.

FUNDING

SUPPORTED BY SYSTEM SAFETY MANAGEMENT PORTFOLIO

OI 601102 – Enhanced Safety Information Analysis and Sharing

OI 601103 – Safety Information Sharing and Emergent Trend Detection

OI 601202 – Integrated Safety Analysis and Sharing

SYSTEM SAFETY MANAGEMENT

	FY 2014	FY 2015	FY 2016	FY 2017+
Pre-Implementation Phase:				
Enhanced Safety Information Analysis and Sharing	Aviation Safety Information Analysis and Sharing (ASIAS) 1.0 Development work from FY 2013 through FY 2015			
Safety Information Sharing and Emergent Trend Detection			ASIAS 2.0 Development work from FY 2016 through FY 2020	
Integrated Safety Analysis and Modeling (ISAM)	ISAM/ASIAC 1.0 Development work from FY 2014 - FY 2017			

Concept Development Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

SYSTEM SAFETY MANAGEMENT

	FY 2014	FY 2015	FY 2016	FY 2017+
Implementation Phase:				
Enhanced Safety Information Analysis and Sharing			ASIAS 1.0 available in FY 2016	
Increments implemented : • 601102-01[1] Expanded ASIAS Participation • 601102-02[2] ASIAS Data and Data Standards • 601102-03[3] Enhanced ASIAS Architecture • 601102-04[4] Upgraded and Expanded ASIAS Analytical Capabilities • 601102-05[5] Vulnerability Discovery • 601102-06[6] ASIAS Studies and Results • 601102-07[7] ASIAS Collaboration Capabilities				
Safety Information Sharing and Emergent Trend Detection				ASIAS 2.0 available in FY 2021
Increments implemented : • 601103-01[8] Additional ASIAS Participants • 601103-02[9] NextGen Enabled Data • 601103-03[10] Architecture Evolution and NextGen Support • 601103-04[11] Analytical Capabilities in Support of NextGen • 601103-05[12] Automated Vulnerability Discovery • 601103-06[13] Continued Studies and Results • 601103-07[14] Expanded Collaboration Environments				

[1]Renumbered from 109304-17
[2]Renumbered from 109304-18
[3]Renumbered from 109304-19
[4]Renumbered from 109304-20
[5]Renumbered from 109304-21
[6]Renumbered from 109304-22
[7]Renumbered from 109304-23
[8]Renumbered from 109303-21
[9]Renumbered from 109303-22
[10]Renumbered from 109303-13
[11]Renumbered from 109303-24
[12]Renumbered from 109303-25
[13]Renumbered from 109303-26
[14]Renumbered from 109303-27

Concept   Development   Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

SYSTEM SAFETY MANAGEMENT				
	FY 2014	FY 2015	FY 2016	FY 2017+
Implementation Phase:				
ISAM				ISAM/ASIAC 1.0 available in FY 2017-FY 2020

Increments implemented:

- 601202-01[15] Automated Operational Anomaly Detection, Analysis and Forecasting Models
- 601202-02[16] System-Wide Integrated Risk Baseline Annual Reports
- 601202-03[17] Tailored, Domain-Specific Baseline and Predictive Risk Models (NextGen Portfolio Support)
- 601202-04[18] Integrated NAS-wide Hazard Identification, Evaluation and Forecasting
- 601202-05[19] Integrated NAS-wide Automation System Modeling and Anomaly Detection
- 601202-06[20] Near Real Time Integrated Safety Prediction Models

[15]Renumbered from 109326-01
[16]Renumbered from 109326-02
[17]Renumbered from 109326-03
[18]Renumbered from 109326-04
[19]Renumbered from 109326-05
[20]New Increment

Concept | Development | Operation

*** Work Supports Post FY 2016 Capabilities**

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

NAS INFRASTRUCTURE

National Airspace System (NAS) Infrastructure provides research, development and analysis of capabilities that depend on and affect activities in more than one NextGen portfolio. Work in this portfolio includes capabilities that address aviation weather issues, which supports the need to improve air traffic management (ATM) decision making during adverse weather conditions, improves the use of weather forecast information in the transformed NAS and evolves the existing aviation weather infrastructure, i.e., dissemination, processor, and sensor systems, to standardize weather information and interfaces, and reduce operational costs. This portfolio also includes capabilities that address engineering issues, which provide for cross-cutting research, development and analysis in Terminal/ Terminal Radar Approach Control system engineering, NextGen navigation engineering, information management and new ATM requirements to determine if these new systems can achieve the targets for 2025 and beyond. This includes new air traffic control management procedures, separation standards and flexible airspace categories to increase throughput

TARGET USERS

FAA, other government agencies (e.g., NOAA), operators

TARGET AREAS

NAS-wide

FUNDING

SUPPORTED BY DATA COMMUNICATIONS

OI 102158 – Automated Support for Initial Trajectory Negotiation

SUPPORTED BY NAS INFRASTRUCTURE PORTFOLIO

OI 103119 – Initial Integration of Weather Information into NAS Automation and Decision Making

OI 103305 – On-Demand NAS Information

SUPPORTED BY TERMINAL FLIGHT DATA MANAGEMENT

OI 104209 – Initial Surface Traffic Managemen

NATIONAL AIRSPACE SYSTEM INFRASTRUCTURE				
	FY 2014	FY 2015	FY 2016	FY 2017+
Pre-Implementation Phase:				
Common Support Services – Weather	Work Package (WP) 1 Acuisition Mangement System (AMS) work – Final Investment Decision (FID) scheduled for Q2 FY 2015 (Concept)			
NextGen Weather Processor	WP1 AMS work – FID scheduled for Q2 FY 2015 (Concept)			
Terminal Flight Data Manager (TFDM)	Development and AMS work for TFDM (Development)			
Data Communications (Data Comm) Services	Initial En Route Services Data Comm (Concept)			
Weather Observation	Improved automated winter weather observing capability technology maturation (Concept)			Terminal Winds concept work (Concept)

Concept | Development | Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

NATIONAL AIRSPACE SYSTEM INFRASTRUCTURE

	FY 2014	FY 2015	FY 2016	FY 2017+
Implementation Phase:				
Common Support Services - Weather		Implementation to begin post-FID in FY 2015 (Operation)		
Increments Implemented • 103305-25 Common Support Services - Weather • 103119-13 Enhanced In-Flight Icing Diagnosis and Forecast • 103119-17 4-D Tailored Volumetric Retrievals for Aviation Weather Information • 103119-18 Enhanced Turbulence Forecast and Graphical Guidance • 103119-19 Enhanced Ceiling and Visibility Analysis • 103119-23 Space Weather Information				
NextGen Weather Processor – WP1		Implementation to begin post-FID in FY 2015 (Operation)		
Increments Implemented • 103119-11 Enhanced NAS-wide Access of 0-2 Hours Convective Weather on Traffic Forecast for NextGen Decision-Making • 103119-14 Enhanced Weather Radar Information for Air Traffic Control Decision-Making • 103119-15 Extended Convective Weather on Traffic Forecast for NextGen Decision-Making • 103119-16 Convective Weather Avoidance Model for Arrival/Departure Operations				
Weather Observation				Develop Tech Transfer Package (Development)
Increments Implemented • 103119-22 Enhanced Automated Winter Weather Information				
Data Comm Services		Initial En Route Services Data Comm Development (Development)		
Increments Implemented • 102158-01 Initial En Route Data Comm Services				
TFDM (Segment 1 and 2)			Development to begin following FID in FY 2015/FY 2016 timeframe (Development)	
Increments Implemented • 104209-32 Integrate Surveillance Data with Flight Data (Surface)				

Concept | Development | Operation

* Work Supports Post FY 2016 Capabilities

† NextGen Advisory Committee/NextGen Integration Working Group Commitment

APPENDIX A: NEXTGEN FUNDING

BLI NUMBER	CAPITAL BUDGET LINE ITEM (BLI) PROGRAM	FY 2016 BUDGET	FY 2017 ESTIMATE	FY 2018 ESTIMATE	FY 2019 ESTIMATE	FY 2020 ESTIMATE
1A05	NextGen – Separation Management Portfolio	$26.5	$26.8	$27.0	$40.0	$42.5
1A06	NextGen – Improved Surface/ Terminal Flight Data Manager (TFDM) Portfolio	$17.0	$53.0	$90.6	$116.3	$100.8
1A07	NextGen – On Demand NAS Portfolio	$11.0	$14.5	$17.0	$18.0	$32.0
1A08	NextGen – Environment Portfolio	$1.0	$1.0	$0.0	$0.0	$0.0
1A09	NextGen – Improved Multiple Runway Operations Portfolio	$8.0	$9.5	$5.0	$4.0	$5.0
1A10	NextGen – NAS Infrastructure Portfolio	$11.0	$14.0	$15.2	$13.0	$15.0
1A11	NextGen – Support Portfolio at WJHTC	$10.0	$12.0	$13.0	$13.0	$13.0
1A12	NextGen – Performance Based Navigation & Metroplex Portfolio	$13.0	$18.0	$18.0	$21.5	$21.0
2A01	NextGen – En Route Automation Modernization (ERAM) – System Enhancements and Technology Refresh	$79.4	$59.0	$87.6	$106.1	$126.4
2A11	NextGen – System-Wide Information Management (SWIM)	$37.4	$40.9	$50.7	$47.1	$40.4
2A12	NextGen – Automatic Dependent Surveillance - Broadcast (ADS-B) NAS Wide Implementation	$45.2	$37.7	$27.9	$39.7	$43.5
2A14	NextGen – Collaborative Air Traffic Management Portfoli	$9.8	$14.7	$15.3	$25.3	$25.0
2A15	NextGen – Time Based Flow Management (TBFM) Portfolio	$42.6	$45.3	$39.2	$50.2	$30.0
2A17	NextGen – Next Generation Weather Processor (NWP)	$7.0	$20.3	$18.3	$20.0	$16.8
2A19	NextGen – Data Communication in support of NextGen	$234.9	$241.7	$242.9	$238.9	$212.6
2B13	NextGen – National Airspace System Voice System (NVS)	$53.6	$47.7	$68.4	$32.2	$116.6
3A10	NextGen – System Safety Management Portfolio	$17.0	$18.0	$18.0	$18.0	$18.0
4A09	NextGen – Aeronautical Information Management Program	$5.0	$10.4	$6.9	$11.0	$15.0
4A10	NextGen – Cross Agency NextGen Management	$3.0	$2.0	$3.0	$3.0	$3.0

Note: FY 2017-2020 outyear funding amounts are estimates.

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