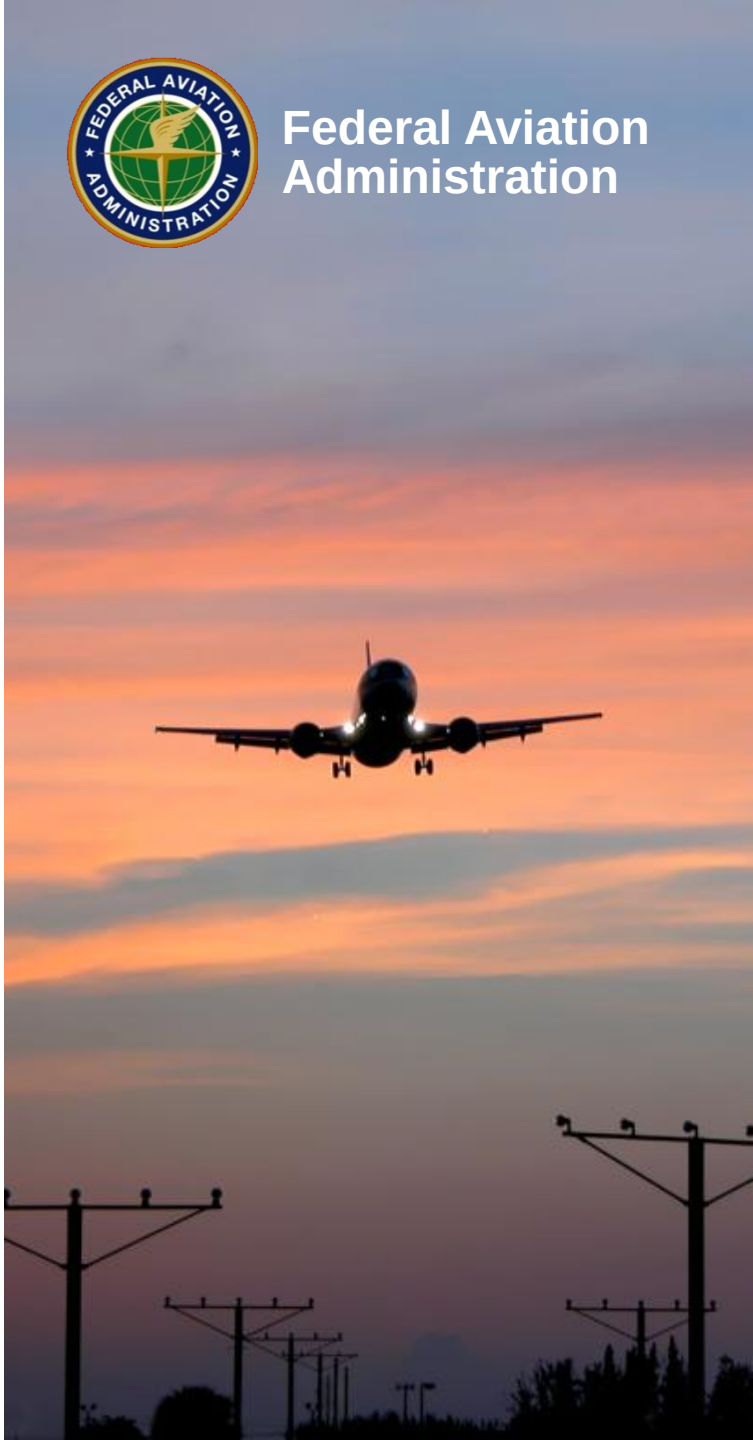
Program Management Organization

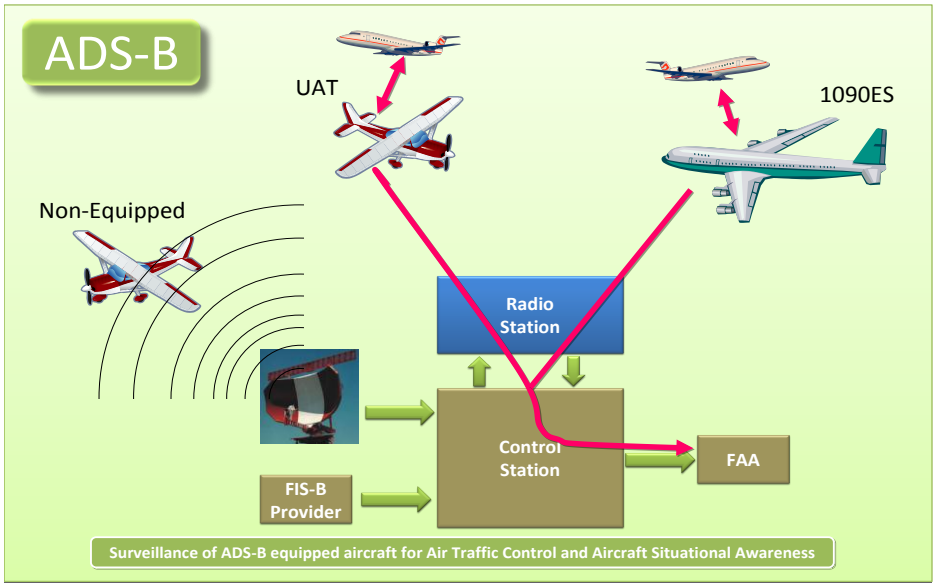
U.S. ADS-B Program Activities

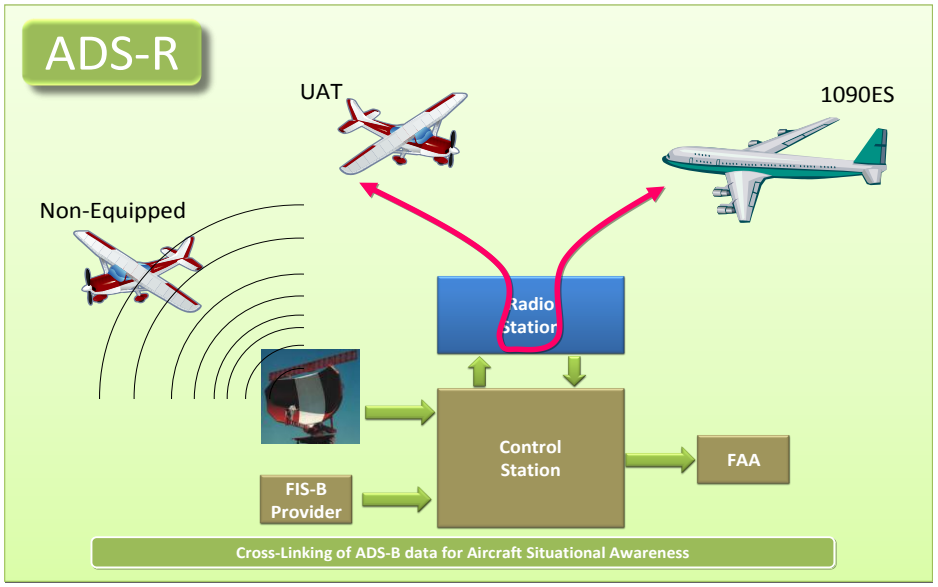
Presented to: ICAO SITF/11

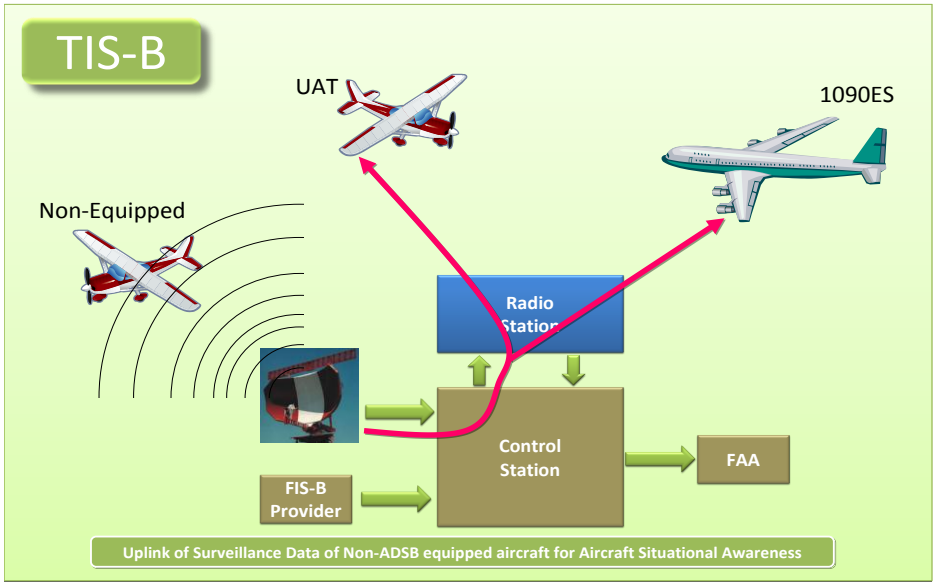
April, 2012

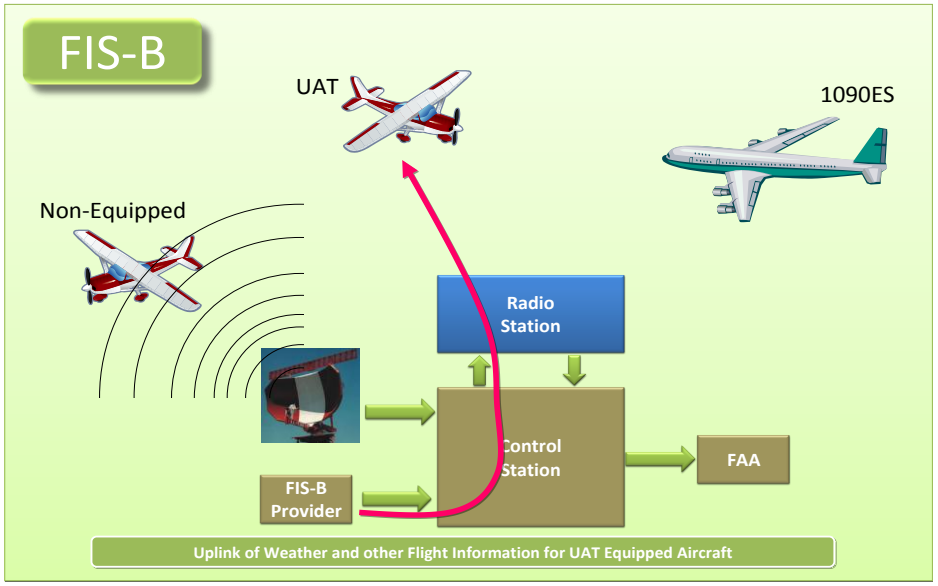


U.S. ADS-B Service Architecture









Service Delivery Points for ATC Separation Services									
	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Operational
En Route	2	0	4	15	3	0	0	0	2 of 24
Terminal	2	1	16	45	52	43	0	0	3 of 159
Surface (Advisory)	2	0	14	15	5	1	5	2	2 of 44

Rule-Driven ADS-B Out Avionics Equipage 119

ATC Spacing Services

Ground-Based Interval Mgmt - Spacing (GIM-S) (En Route only)

2011 - 2012 GIM-S Develop → 2013 GIM-S Deploy → 2013 - 2014 GIM-S Test → 2014 GIM-S IOC → 2020 Avionics Equipage

2011 - 2015

Flight Deck Based Interval Mgmt– Spacing (FIM-S)

In Trail Procedures (ITP)

Traffic Situation Awareness with Alerts (TSAA)

Pilot Applications

Pilot Advisory Services								
	FY08	FY09	FY10	FY11	FY12	FY13	FY14	Actual / Planned
Radio Station Installations	11	43	211	101	52 of 134	184	46	418 of 730
Operational Radio Stations	371							

TIS-B
FIS-B
ADS-R

ADS-B In Avionics Equipage 529

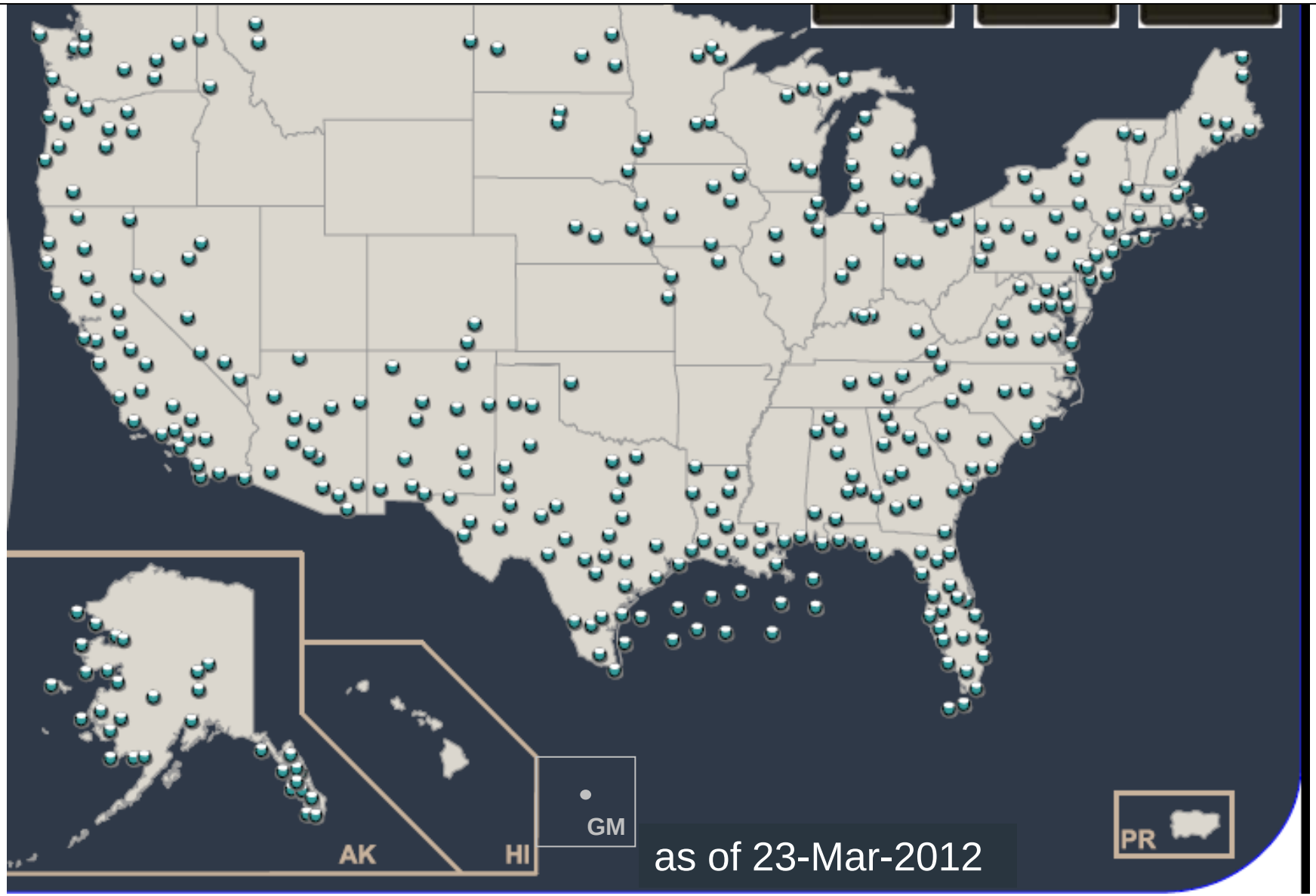
In Process | Complete

As of 3-23-2012

Implementation Status

http://www.faa.gov/nextgen/flashmap/

- 424 ADS-B Stations Constructed; 75 Stations Under Construction or in Final Design
- 90 Operational Service Volumes comprised of 371 ADS-B Stations



FY12 En Route Sites (4 ERAM)

Site	SBS Infrastructure Complete	Pilot Advisory Services IOC	Automation Ready	Training	ATC Services Operational
Albuquerque (ZAB)	Complete	Complete	4th Q FY12	3rd Q FY12	September 2012
Denver (ZDV)	3rd Q FY 12	3rd Q FY 12	3rd Q FY12	3rd Q FY12	September 2012
Minneapolis (ZMP)	Complete	Complete	3rd Q FY12	3rd Q FY12	September 2012
Seattle (ZSE)	Complete	Complete	3rd Q FY12	3rd Q FY12	September 2012

Note: The SBS program goal is September. ERAM is working to an earlier date to facilitate discovery and response to issues

FY12 Terminal Sites (5 CARTS, 11 STARS)

Site	ADS-B Infrastructure Complete	Pilot Advisory Services IOC	Automation Ready	Training	ATC Services Operational	
Potomac (PCT)	Complete	Complete	May 2012	June 2012	June 2012	CARTS
Atlanta (A80)	Complete	Complete	May 2012	June 2012	June 2012	
Southern Cal (SCT)	Complete	Complete	May 2012	June 2012	June 2012	
Minneapolis (M98)	Complete	Complete	May 2012	July 2012	July 2012	
Northern Cal (NCT)	Complete	Complete	May 2012	July 2012	July 2012	
Houston (I90)	Complete	Complete	Complete	Complete	Complete	STARS
El Paso (ELP)	Complete	Complete	June 2012	July 2012	July 2012	
Kansas City (MCI)	Complete	Complete	June 2012	July 2012	July 2012	
New Orleans (MSY)	Complete	Complete	May 2012	July 2012	July 2012	
Charlotte (CLT)	Complete	June 2012	June 2012	July 2012	July 2012	
Daytona Beach (DAB)	Complete	June 2012	June 2012	July 2012	July 2012	
San Antonio (SAT)	Complete	Complete	June 2012	August 2012	August 2012	
Corpus Christi (CRP)	Complete	Complete	June 2012	August 2012	August 2012	
Miami (MIA)	Complete	Complete	June 2012	August 2012	August 2012	
Anchorage (A11)	Complete	June 2012	July 2012	August 2012	August 2012	
Seattle (SEA)	Complete	Complete	July 2012	August 2012	September 2012	

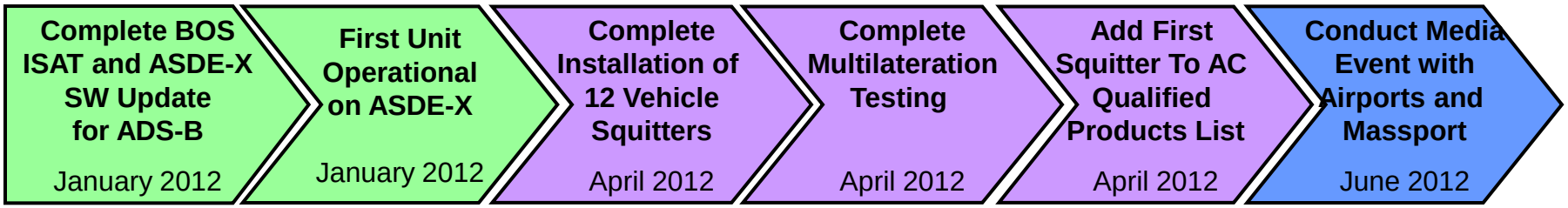
FY12 Surface Advisory Sites (14 Sites)

Site	ADS-B Infrastructure Complete	ADS-B Advisory Services IOC	ASDE-X Upgrade Complete	ATC Services Operational
Orlando (MCO)	Complete	Complete	Complete	Complete
Seattle – Tacoma (SEA)	Complete	Complete	Complete	Complete
Boston (BOS)	Complete	Complete	Complete	April 2012
San Diego (SAN)	Complete	Complete	Complete	April 2012
Ft. Lauderdale (FLL)	Complete	Complete	Complete	April 2012
Newark (EWR)	Complete	Complete	Complete	July 2012
LaGuardia (LGA)	April 2012	June 2012	Complete	July 2012
Phoenix (PHX)	Complete	Complete	Complete	July 2012
Miami (MIA)	April 2012	June 2012	Complete	August 2012
Dallas Ft. Worth (DFW)	May 2012	August 2012	April 2012	August 2012
John Wayne Airport (SNA)	May 2012	August 2012	Complete	September 2012
Washington Reagan (DCA)	April 2012	September 2012	June 2012	September 2012
Houston Hobby (HOU)	June 2012	September 2012	June 2012	September 2012
Houston Intercontinental (IAH)	July 2012	September 2012	May 2012	September 2012

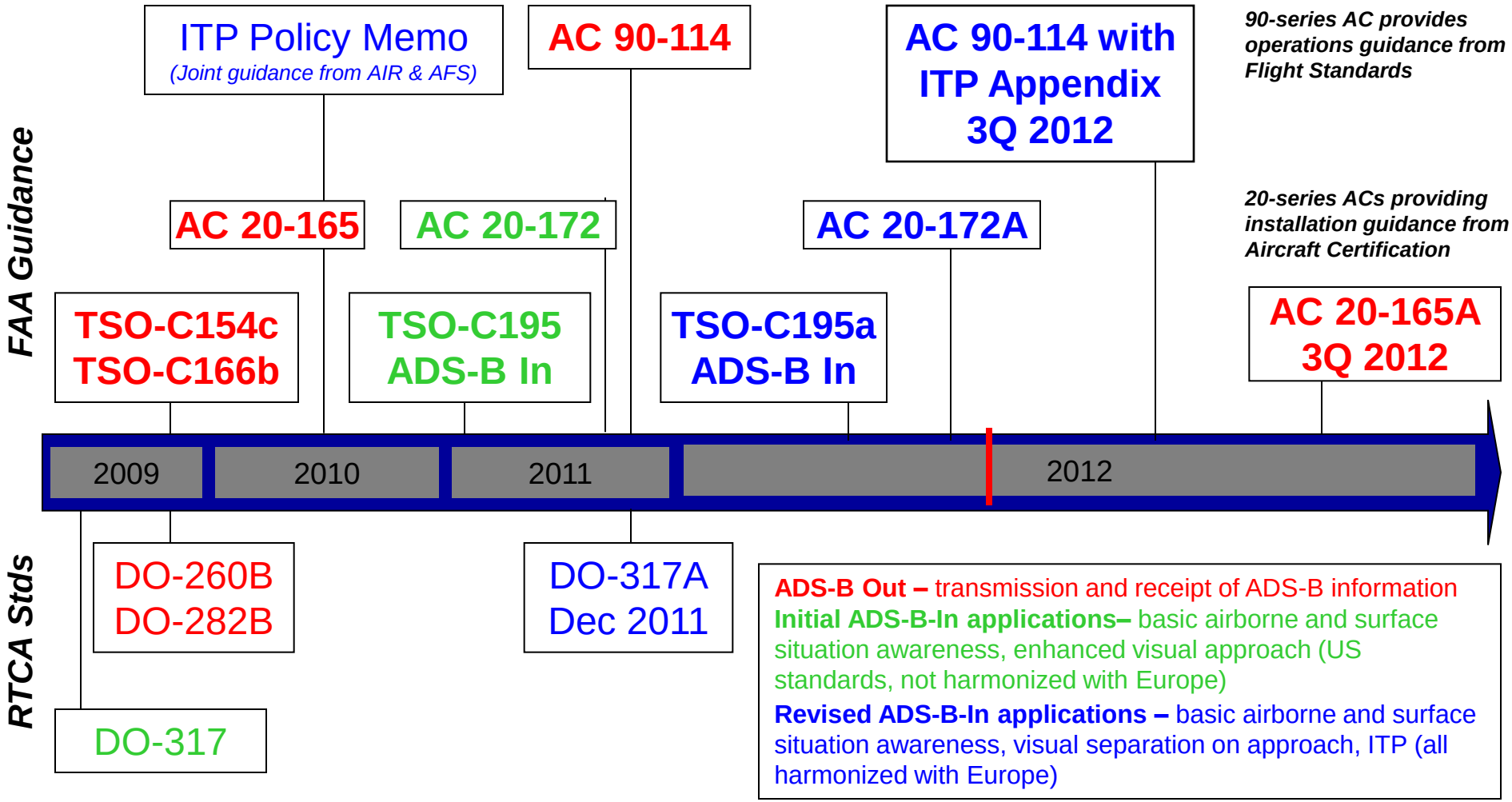
Vehicle ADS-B

Purpose:	Facilitate and regulate deployment of certified vehicle tracking capability at U.S. airports to enhance safety through reduction of runway incursions
Goal:	Mature process for introduction and sustainment of certified vehicle ADS-B transmitters in support of NTSB recommendation A-00-66
Objectives:	Complete requirements definition and approval for vehicle ADS-B units
	Validate/conduct test procedures for a vendor-delivered unit
	Develop and implement lifecycle compliance monitoring of vehicle ADS-B units
Key Activities:	Develop vehicle ADS-B specification and advisory circular
	Perform outreach with airports and vendors
	Develop compliance monitoring process
	Perform laboratory testing at WJHTC
	Perform Site Acceptance Testing for vehicle ADS-B squitters
	Achieve interoperability with ASDE-X

Complete
In Progress
Not Yet Started

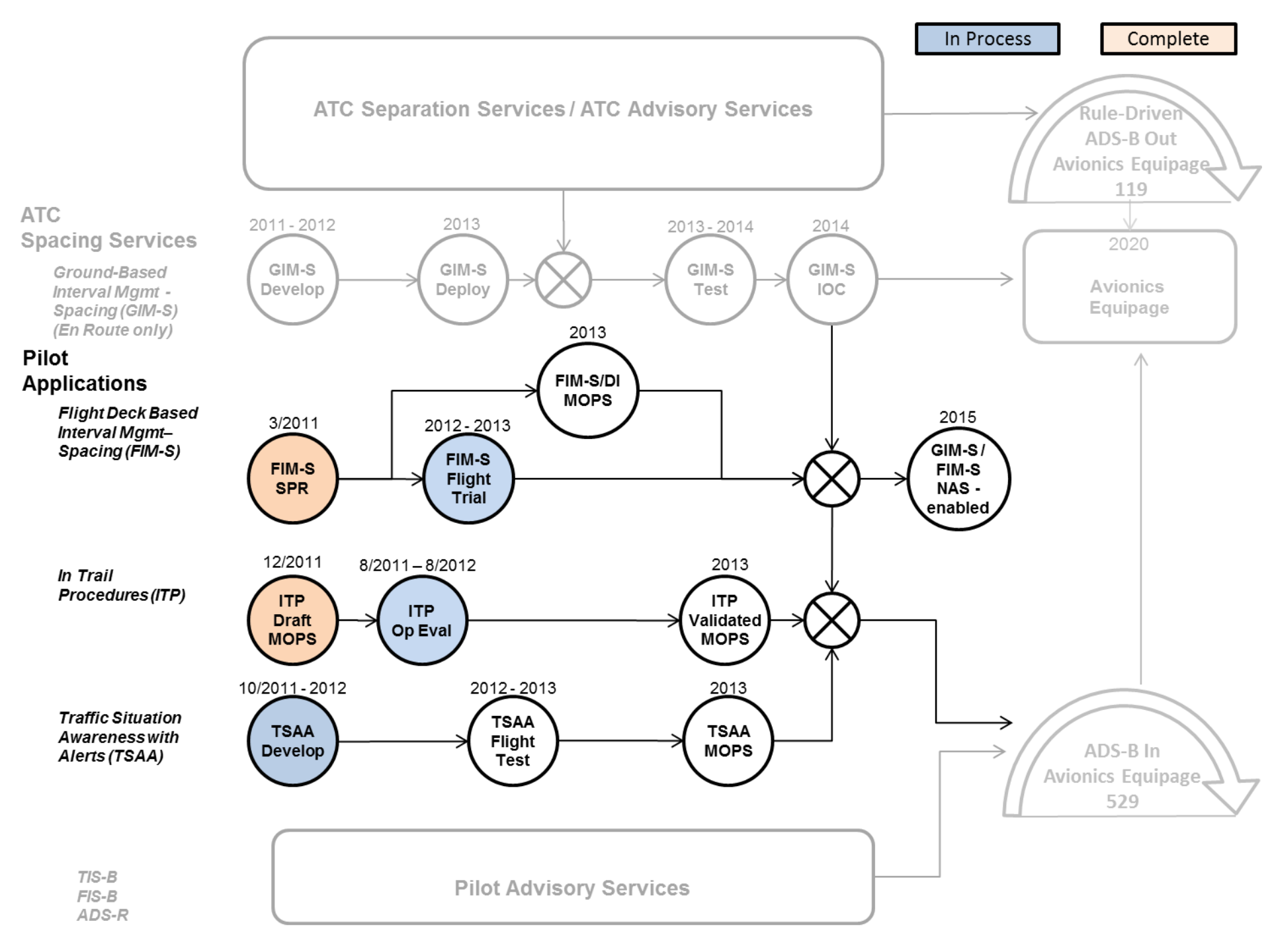


U.S. ADS-B Standards & Guidance



Status: Avionics Upgrades

Carrier	Aircraft Type	Quantity	Status
JetBlue	A320	35	Flight test for STC will be conducted in spring 2012; STC will be submitted in summer 2012, with estimated approval in summer 2012.
United	747	12 (ADS-B In)	12 installations complete. ADS-B Out is DO-260; upgrades to DO-260B ADS-B Out will begin in 2013.
USAir	A330-300/200	20 (ADS-B In and Out)	Flight test for ADS-B Out (DO-260B) STC will be conducted in summer 2012; STC will be submitted after the flight test. The ADS-B In STC is planned for Fall 2012.
UPS	747 – 13 aircraft 767 – 39 aircraft A300 – 53 aircraft MD11 – 38 aircraft	143	STC for the 767 aircraft was approved in December 2011, the first 767s will be equipped by June 2012. The STC for the 747 aircraft was approved in March 2012. 747 installations are expected to begin in April 2012. As the STCs for the remaining aircraft types are approved, additional aircraft will be equipped, with a target to have all 143 aircraft rule-compliant in spring 2014.
Gulf of Mexico Operators	Helicopters	54	9 Chevron – STC flight test targeted in April 2012, with estimated approval in summer 2012; Technical Standard Order (TSO) for rule-compliant FreeFlight ADS-B 978MHz transmitter authorized on October 12, 2011. 45 PHI Aircraft – STC targeted in December 2012
Alaska operators	Varies	Approx. 400	Market survey complete, Request for Offer (RFO) will be released in May 2012.

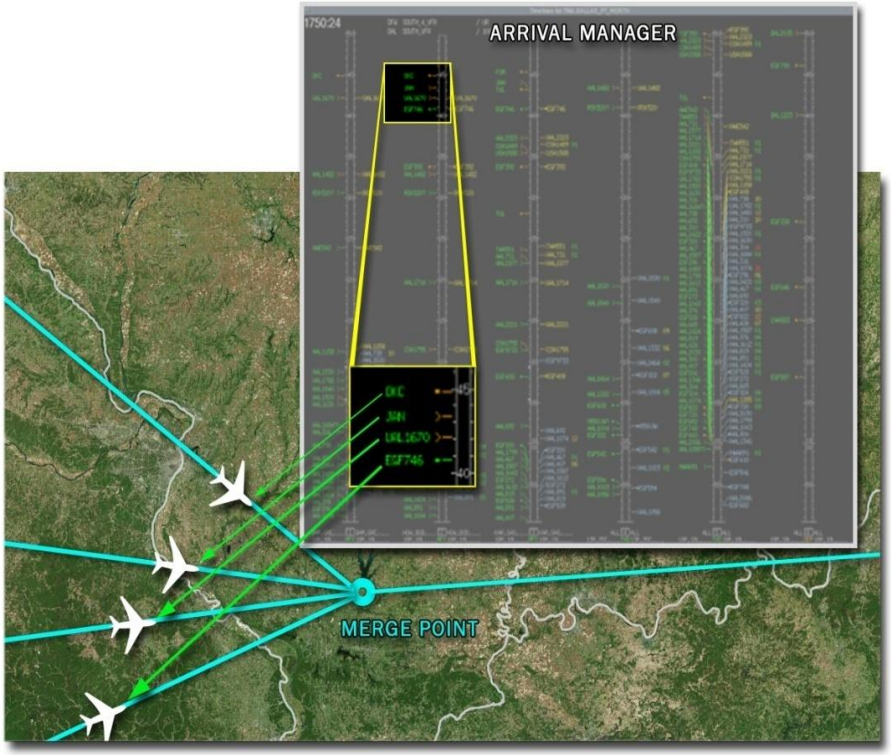

In Process
Complete
ATC Separation Services / ATC Advisory Services
Rule-Driven ADS-B Out Avionics Equipage 119
ATC Spacing Services
Ground-Based Interval Mgmt - Spacing (GIM-S) (En Route only)
2011 - 2012
GIM-S Develop
2013
GIM-S Deploy
2013 - 2014
GIM-S Test
2014
GIM-S IOC
2020
Avionics Equipage
Pilot Applications
Flight Deck Based Interval Mgmt– Spacing (FIM-S)
2013
FIM-S/DI MOPS
3/2011
FIM-S SPR
2012 - 2013
FIM-S Flight Trial
2015
GIM-S / FIM-S NAS - enabled
In Trail Procedures (ITP)
12/2011
ITP Draft MOPS
8/2011 – 8/2012
ITP Op Eval
2013
ITP Validated MOPS
Traffic Situation Awareness with Alerts (TSAA)
10/2011 - 2012
TSAA Develop
2012 - 2013
TSAA Flight Test
2013
TSAA MOPS
ADS-B In Avionics Equipage 529
TIS-B
FIS-B
ADS-R
Pilot Advisory Services

Ground-based Interval Management (GIM)

Purpose: Minimize vectoring during arrival sequence and maximize the opportunities for OPDs and FIM-S operations

Goal: Achieve optimal spacing intervals between arriving aircraft using an ATC based spacing/metering tool

Objective: Ensure NAS implementation of GIM-S functionality to begin benefits accrual



Partners: TBFM, ERAM, ATO-T Safety and Operations and ATO-E Safety and Operations

Complete
In Progress
Not Yet Started
Unfunded

GIM-S RD & Conops v2.0	TBFM Functional Description	ERAM human interface	GIM-S System Test Plan	ERAM S/W Delivery – R4	GIM-S IOC
Dec 2011	Jan 2012	July 2012	Dec 2013	Jan 2014	Sep 2014

Flight-deck-based Interval Management (FIM)

Purpose: Reduce fuel burn, noise and emissions, while maintaining high throughput and efficient flight operations throughout the NAS

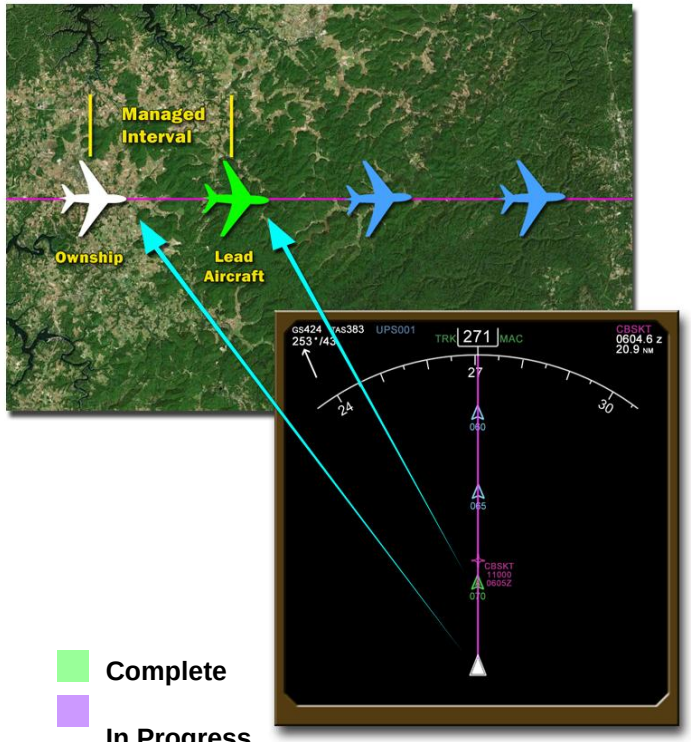
Goals: Develop and validate flight deck technology to enable FIM-S Operations

Objective: Produce a FIM MOPS

Assist in certification of avionics

Assist one airline in obtaining Operational approval with benefits accrual

Partners - US Airways, ACSS, UPS



Complete

In Progress

Not Yet Started

FIM-S SPR	ARC Final Report	Frozen Δ OSED	IM CONOPS v3.0	TFID Final Report	FIM MOPS
Mar 2011	Nov 2011	August 2012	Nov 2012	Sept 2013	Sept 2013

In-Trail Procedure (ITP)

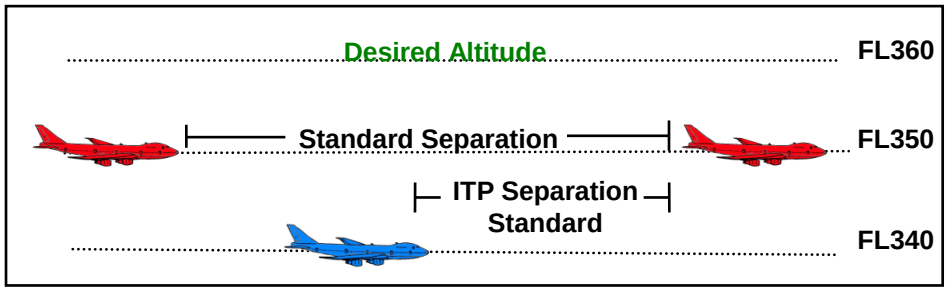
Purpose: Provide operational benefits in non-surveillance airspace by enabling “in-trail” climbs/descents at reduced separation distances

Goal: Employ ITP in oceanic air carrier operations (revenue service)

Objectives: Validate operational performance and economic benefits of ITP

Develop and validate ADS-B ITP MOPS material

Partners: United Airlines, Honeywell, Goodrich, Airservices Australia, Airways Corp NZ



Begin SOPAC OpEval	Expand into PACOTS	ITP MOPS Approval	ITP OpEval Results (6 Month Interval)	ITP OpEval Results (1 Year Interval)	ATOP ITP Modifications Completed
August 2011	Dec 2011	Dec 2011	March 2012	August 2012	TBD 2014

Op Eval Results - Aug

- **9 ITPs were performed in an operational environment**
  - Conducted by two different United airplanes using each other and one other airline as ITP traffic aircraft
  - Controllers and pilots thought procedure was straight forward
  - Pilots were particularly impressed with increased situation awareness
  - Data collected during the flights and initial data analysis has been performed

Event	Geometry	Climb or Descend	ITP Distance
1	following	climb 3000 ft (FL270-FL300)	82nm
2	leading	climb 2000 ft (FL300-FL320)	22nm
3	leading	descend 2000 ft (FL320-FL300)	24nm
4	following	descend 2000 ft (FL310-FL290)	22 nm
5	following	climb 3000 ft (FL290-FL320)	23nm
6	combined leading/following	climb 2000 ft (FL310-FL330)	26nm/77nm behind
7	following	climb 2000 ft (FL320-FL340)	26nm
8	leading	climb 2000 ft (FL330-FL350)	34nm
9	following	climb 2000 ft (FL340-FL360)	34nm

Op Eval Results -- Dec-Mar ITP Requests

- **Five ITP requests in December/January; no requests in February/March**
  - None resulted in ITP flight level changes
- **Summary of Observations**

Event	Request	Result	Observation
1	climb 2000 ft (FL320-FL340)	No altitude change	Near ZOA/ZAN boundary; desired altitude not available in ZAN
2	climb 2000 ft (FL300-FL320)	Cleared for climb of 2000 feet using 30/30	Controller waited a few minutes until they were able to apply 30/30 separation
3	climb 2000 ft (FL320-FL340)	No altitude change	Valid reference aircraft not included in ITP request (ADS-B inop on reference aircraft?)
4	descend 3000 ft (FL390-FL360)	No altitude change	Pilot referenced an aircraft on a nearly parallel track, 100 nm south of their position; believe that flight crew did not use lateral filter
5	climb 2000 ft (FL330-FL350)	Cleared standard climb to FL340 (1000 foot climb)	Head on/crossing traffic most likely out of range of ITP aircraft

Traffic Situation Awareness with Alerts (TSAA)

Purpose: Enhance safety in the National Airspace System by providing alerts to General Aviation pilots of conflicting airborne traffic

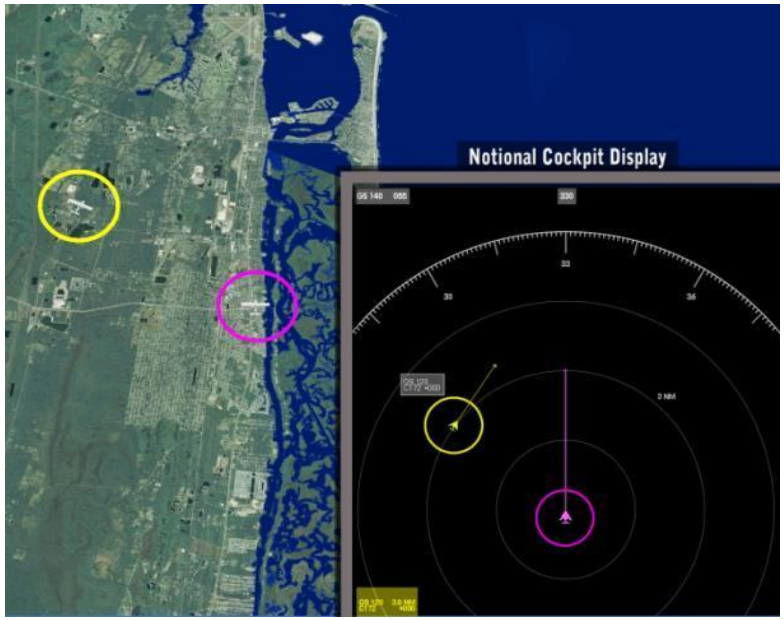
Goals: Reduce the risk of airborne aircraft-to-aircraft encounters

Expand ADS-B benefits for General Aviation

Objective: MOPS, TSO

Partners: MIT/Avidyne

Stakeholders: AOPA, GAMA, HAI, ALPA



ADS-B In Aviation Rulemaking Committee

Member Affiliation

First meeting held July 1, 2010

FAA-requested Deliverables:

- **Task 1: Endorsement (or not) of continued work on 3 ADS-B-In application standards development projects**
  -> by October 2010 √
- **Task 2: Final ARC ADS-B-In Strategy Recommendations**
  -> by September 2011 √
- **Task 3: Delivery of products from any activities that follow up ADS-B-In Strategy Recommendations**
  -> by June 2012

Categorization of FAA Responses

17-Mar-2012

Based on 113 Recommendations

41%	Concur
7%	Under Analysis - expect to Concur
2%	Under Analysis - Concur with General Strategy
6%	Under Analysis - ask ARC
19%	Under Analysis
18%	Under Analysis - pending JRC outcome
4%	Under Analysis - pending JRC plus other FAA pgm response
4%	Under Analysis - likely to Non-Concur
0%	Non-Concur

ARC Priority Applications

ARC recommended FAA focus funding on accelerating development of equipment standards, certification guidance, operational approval guidance, ground automation, and any policy adjustments to enable operational implementation of applications listed below, in priority order [with targeted completion date]:

1. **CDTI-Assisted Visual Separation (CAVS) [FY12]**
2. **Flight-deck-based Interval Management–Spacing (FIM–S) [FY15]**
3. **Traffic Situation Awareness with Alerts (TSAA) [FY13]**
4. **Oceanic In-Trail Procedures (ITP) [FY13]**
5. **CDTI-Enabled Delegated Separation (CEDS) (ending in a visual approach) [FY16]**
6. **Ground-based Interval Management–Spacing (GIM–S) with Wake Mitigation [FY18]**
7. **Flight-deck-based Interval Management—Defined Interval (FIM–DI) [FY19]**
8. **FIM–DI for Closely Spaced Parallel Runway Operations (CSPO) [FY17]**
9. **Oceanic Interval Management (IM) [FY15]**
10. **Airport Traffic Situation Awareness with Indications and Alerts (SURF–IA) at top 44 airports [FY17]**

Except for SURF-IA (#10) and possibly GIM-S with Wake Mitigation (#6), all of above referenced applications are compatible with U.S. ADS-B Out Rule compliant avionics & performance requirements

SBS FY12 JRC - Overview

- **SBS FY12 JRC will secure funding for the next segment of the program from FY14 to FY20**

- **Scope of activities fall into three general categories**
  - Continue provision of baseline services and applications
  - Provide coverage in additional service volumes via two solutions
    - Ground Based
    - Space Based (* Requesting approval to conduct acquisition planning with action to return to the JRC)
  - Develop additional applications to varying levels depending on maturity (see next chart)

SBS FY12 JRC – Application Maturity Definition

	Requirements Definition	Requirements Validation	NAS Enabled	NAS Implementation
Standards/Regulatory Documents				
Safety, Performance and interoperability Requirements (SPR) document	X	X	X	X
Minimum Operational Performance Standards		X	X	X
Technical Standards Orders		AVS policy memo	X	X
Advisory Circulars		AVS policy memo	X	X
Aircraft Certification		X	X	X
Operational Specifications		X	X	X
Operational Approval for 1 operator		X	X	X
Operations				
Flight Test (equipment not certified)	X			
Operational Evaluation (supported by operational ATC system, prototype, or procedural workaround)		X	X	X
ATC Key Site Test (includes approved safety case and procedures)			X	X
Implemented in all appropriate FAA Systems				X

SBS FY12 JRC – Scope Definition

Current Baseline

Requested Baseline

Potential for Future Baseline

	Requirements Definition	Requirements Validation	NAS Enabled	NAS Implementation
3nm En Route Separation		FY19	FY22	FY25
Flight-deck-based Interval Management-Spacing (FIM-S)		FY16	FY16 •Requires sending FIM-S pairs to terminal and modifying CHI	FY18
Oceanic In-Trail Procedures (ITP)			FY15 •Requires ATOP modifications	FY16
CDTI Enabled Delegated Separation (CEDS) ending in a visual approach – limited to following along-path traffic		FY16	FY17 •Requires automation to notify ATC which a/c can receive clearance and track which have received clearance	FY20
Ground-based Interval Management-Spacing (GIM-S) with Wake Mitigation	FY20			
Flight-deck-based Interval Management-Defined Interval (FIM-DI)	FY16 •Includes SME support for Terminal Metering and Scheduling development and automation CHI changes	FY20		
FIM-DI for Closely Spaced Parallel Runway Operations (CSPO) – limited to dependent parallel target aircraft	FY16 •Includes SME support for Terminal Metering and Scheduling development and automation CHI changes	FY20		
Interval Management Defined Interval – Oceanic (IMDIO)	FY16	FY19	FY19 •Requires ATOP modifications	FY20
Airport Traffic Situation Awareness with Indications and Alerts (SURF-IA)				
- Accuracy Enhancements via Ground Solution		FY19		
- Accuracy Enhancement via Avionics Solution	FY20			

U.S. Public Law 112-95 sec 211(b) – 1 of 2

- **Requirement: Directs Administrator to initiate rulemaking proceeding within 1 year after enactment to issue guidelines & regulations relating to ADS-B In**
- **Rulemaking must require all aircraft operating in capacity constrained airspace, at capacity constrained airports, or in any other airspace deemed appropriate by the Administrator, to be equipped with ADS–B–In technology by 2020**
- **Requires Chief NextGen Officer to verify that necessary ground infrastructure is installed and functioning properly, certification standards have been approved, and appropriate operational platforms interface safely and efficiently before issuing a final rule**

Next Steps

- **Continue U.S. deployment of ADS-B Services**
- **Continue Requirements Development / Validation for ADS-B-In Pilot Applications**
  - In-Trail Procedure (ITP)
  - Traffic Situation Awareness with Alerts (TSAA)
  - Flight-deck-based Interval Management (FIM)
- **Incentivize Aircraft Retrofits and Forward Fit with agreements**
- **Continue to Build Alliances and Private–Public Partnerships**
- **Obtain Decision for Program Funding from 2014 to 2020**

Backup

PMO Air Traffic Systems Directorate