



ADS-B - A Boeing Perspective

**NAM/CAR/SAM Automatic Dependent Surveillance – Broadcast (ADS-B)
Implementation Meeting/Workshop (ADS-B/IMP)**

Lima, Peru

13-16 November 2017

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Boeing Commercial Airplanes

Avionics/ Air Traffic Management

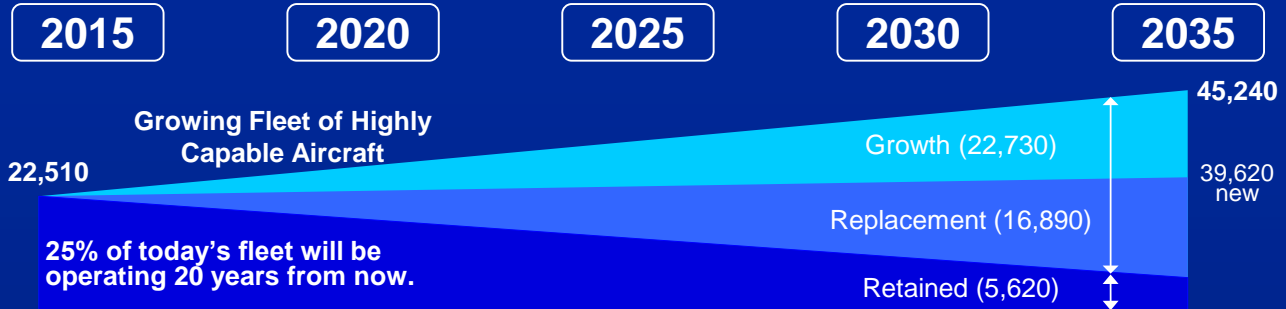
Agenda

Boeing Commercial Airplanes – Avionics / Air Traffic Management

- **Air Transportation System Landscape**
- **Standards/Certification**
- **Boeing Plan – ADS-B Out**
- **ADS-B Out Position Sources**
- **ADS-B In for 787**
- **Summary**



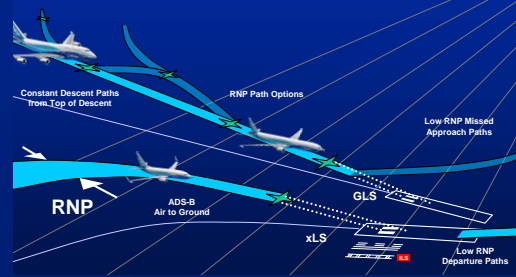
Air Transportation System Roadmap



Manual ATC Intervention, Control by Radar



Pre-Defined Performance Based Airspace



Dynamic Performance Based Airspace



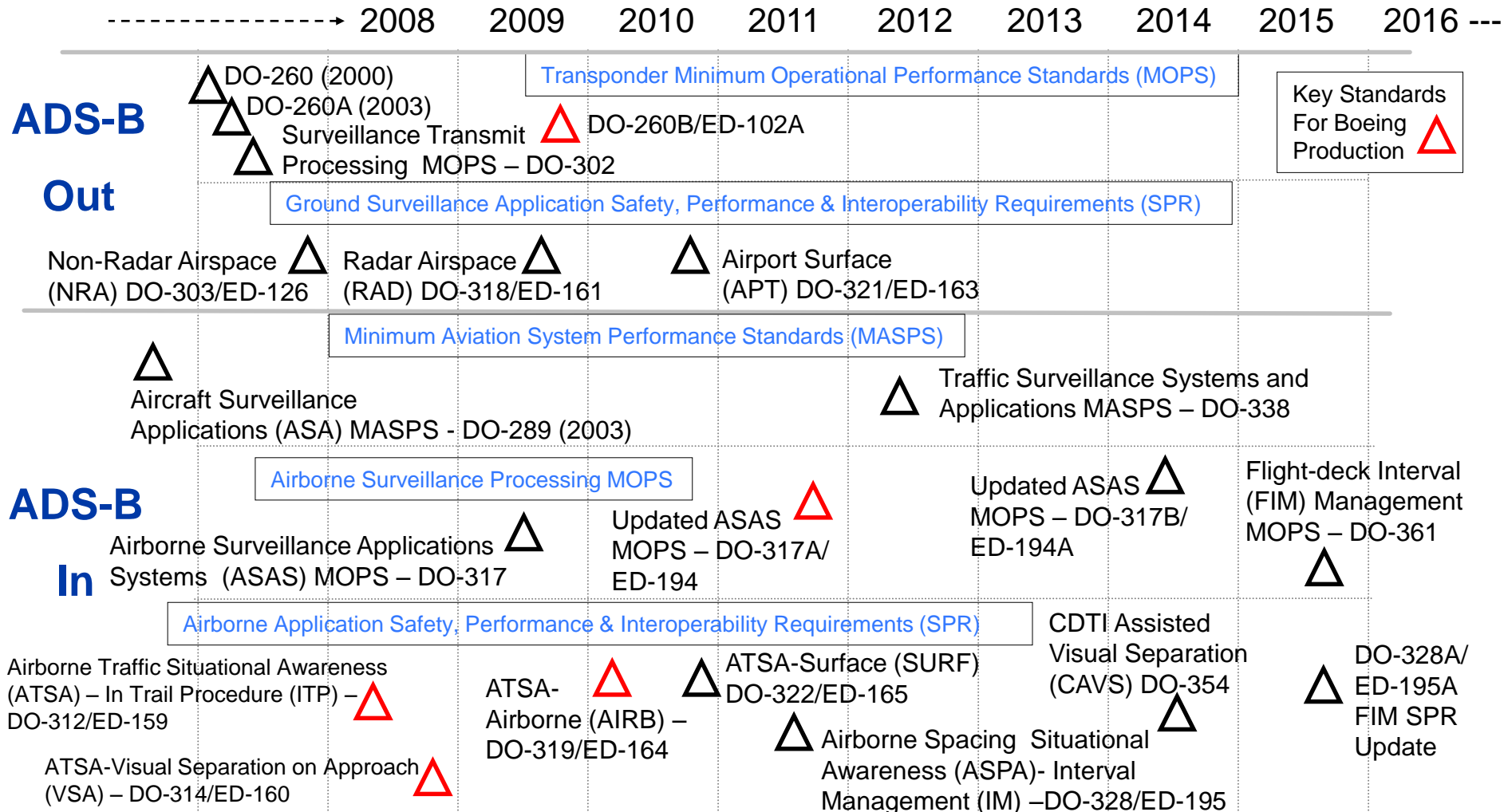
Key Capabilities

ATM Automation	Airspace Flow Program	CTOP	Surf Schedule	TFM Reroutes	TFDM Datalink Taxi
Conflict Detection		PDRR	IDAC	VCV	4D Conflict Resolution
Time-based Arrivals			TBM in Terminal	TBM w/Path	4D Negotiation
		GIM-S			IM-S
Communication	Oceanic RCP	Continental RCP			
Analog Voice	FANS-1 ACARS	FANS-2 Link 2000+ (B1)	Broadband IP		FANS-3 (B2)
	ATN Polar SATCOM		Future Subnetworks		IPS
Navigation	GLS CAT I	GLS CAT III	SBAS LPV	Multi Const GNSS	Global CAT I
RNP	Full Profile RTA	Expanded Wind Field	Temp Comp		Adv RTA
RNP AR	Airport Moving Map				Graphical Taxi
	ADS-B DO260	ADS-B Out DO260B	SURF SA	SURF IA	GNSS Backup
	Ext. Squitter	ADS-B In/CDTI	Distress Tracking	Adv Interval Management	DRNP
Radar Wx Radar	ACAS 7.1		ACAS-X		ADS-B In w/CD&R
Surveillance					
ADS-C					
System Wide Information Management					
OLDI	RADNET	AIDC	ETMS	FIXM Aero/Met Info	Adv Inter-Facility Coord
					Shared Trajectory & Surveillance Info

R10.1

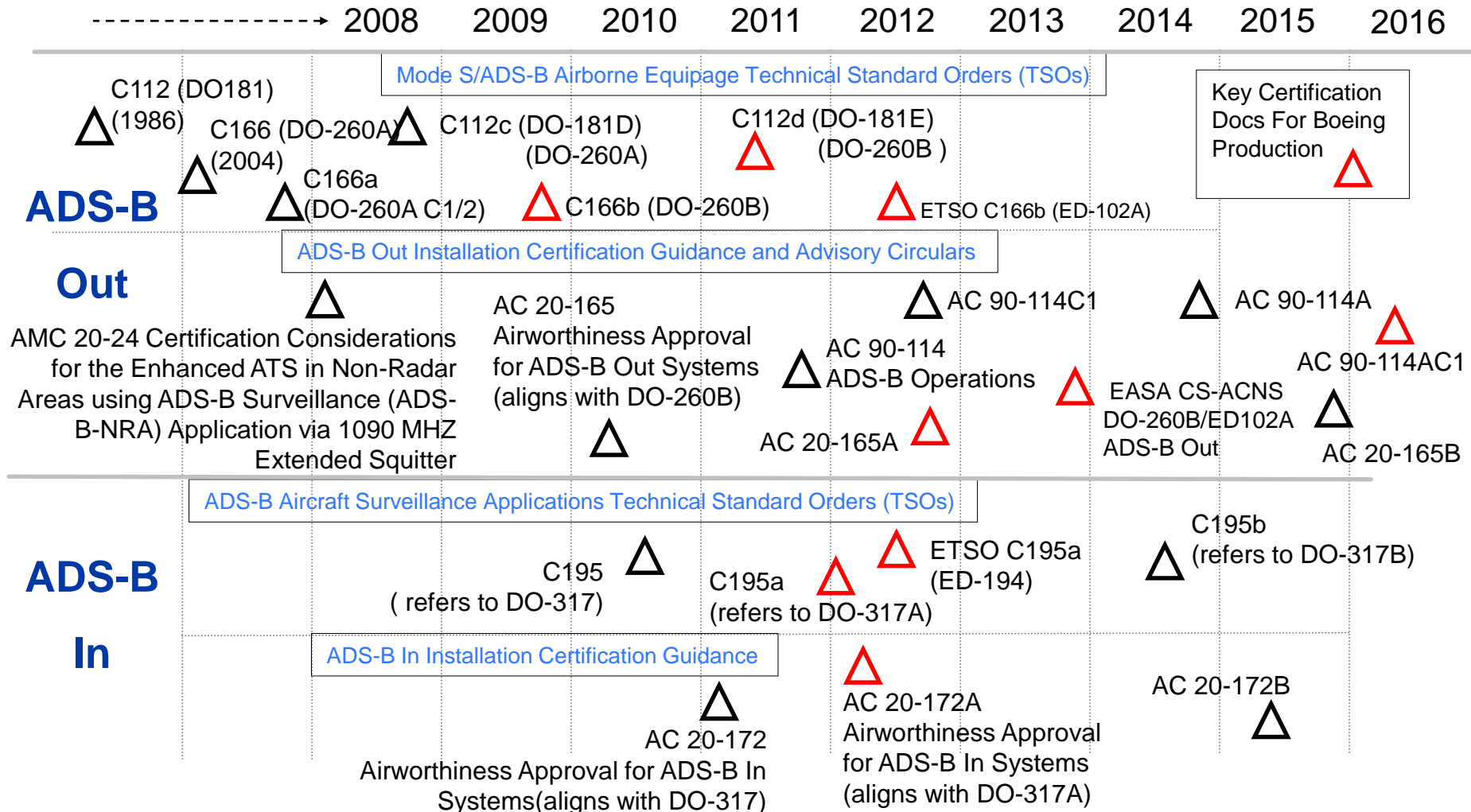
Standards Development

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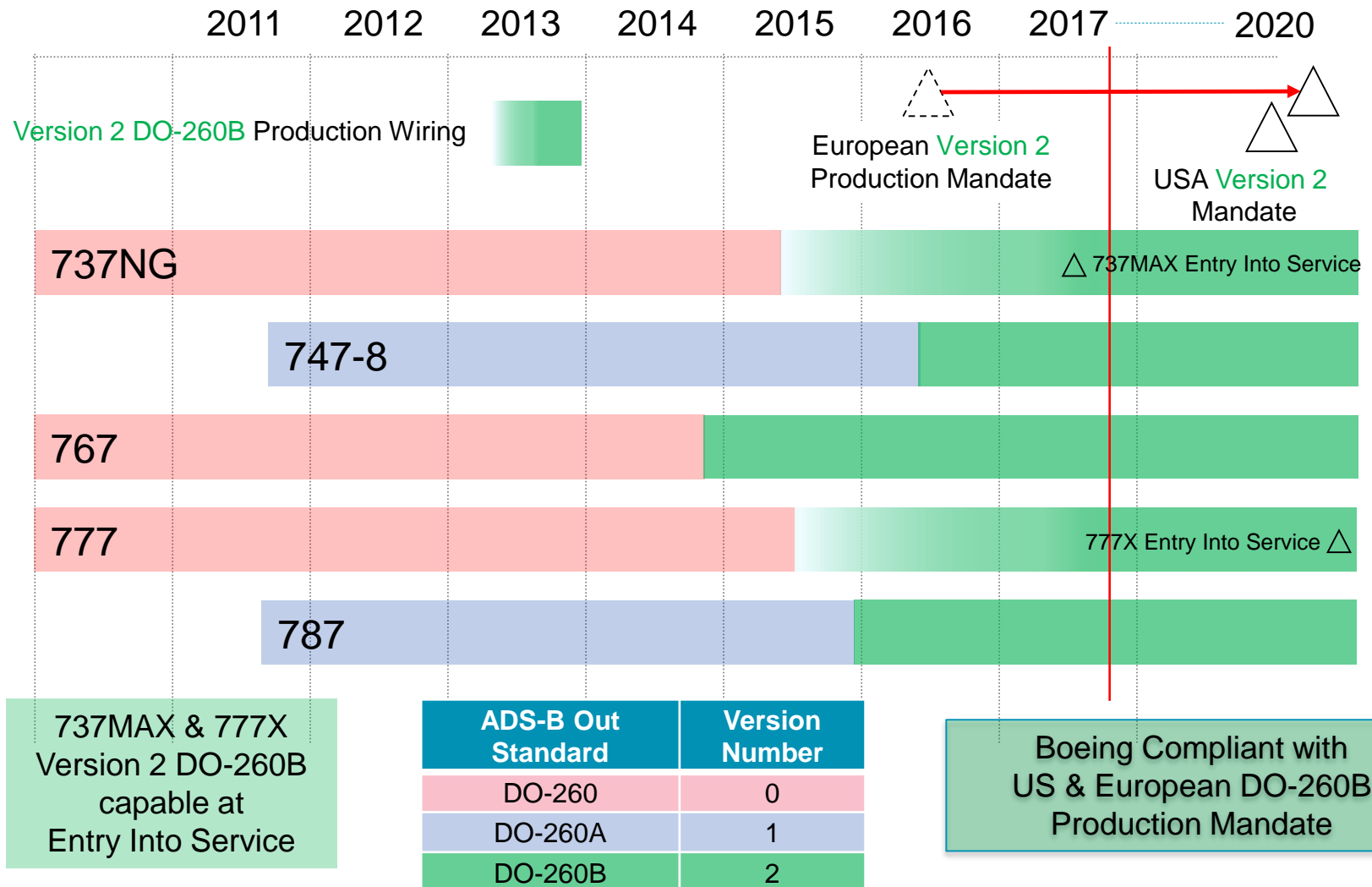
Certification Documents

Boeing Commercial Airplanes – Avionics / Air Traffic Management



ADS-B Out – Production Airplanes

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ADS-B Out – Version 2 ATC Transponders

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Boeing In-production Version 2 (DO-260B) ATC Transponder Capability

	737NG/MAX	747-8	767	777	787
Buyer Furnished Equipment (BFE)	ACSS (NXT-800) Honeywell (TRA-100B) RCI (TPR 901-205)		ACSS (NXT-800) Honeywell (TRA-100B) RCI (TPR 901-205)	ACSS (NXT-800) Honeywell (TRA-100B) RCI (TPR 901-205)	
Supplier Furnished Equipment (SFE)		RCI ⁽¹⁾ (TPR 901-205)			RCI ISS- 2100 ⁽²⁾

(1) Same unit as Buyer Furnished Equipment

(2) Integrated Surveillance System (ISS) includes ATC Transponder, ADS-B Out, TCAS/ACAS, Terrain Awareness, and Weather Radar

- All units planned to be certified to TSO-C112d/C166b
- Interfaces per ARINC 718A Supplement 4 (787 ARINC 768-2)
- Installation compliant with published regulatory requirements
 - FAA AC 20-165A
 - EASA Certification Specification/AMC (CS-ACNS)

BFE – Equipment selected/provided by buyer
SFE - Equipment basic to airplane
RCI – Rockwell Collins Inc.

DO-260B should be maintained as world-wide minimum ADS-B Out standard

ADS-B Out Version 2 ATC Transponders Production Certification Schedule (by Model)

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	737NG/MAX		747-8	767		777		787
BFE	ACSS	April 2015 L/N 5389	N/A	ACSS	December 2014 L/N 1072	ACSS	May 2015 L/N 1309	N/A
	Honeywell	2017 MAX		Honeywell	No Customer	Honeywell	1 st Half 2018	
		1 st Half 2018 NG						
	Rockwell	Nov 2015 L/N 5673		Rockwell	No Customer	Rockwell	Jan 2016 L/N 1365	
SFE	N/A		Rockwell May 2016 L/N 1531	N/A		N/A		RCI ISS 2100 ⁽²⁾ Dec 2015 L/N 369, 371 and on

(1) Same unit as Buyer Furnished Equipment

(2) Integrated Surveillance System (ISS) includes ATC Transponder, ADS-B Out, TCAS/ACAS, Terrain Awareness, and Weather Radar

BFE – Equipment selected/provided by buyer
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RCI – Rockwell Collins Inc.

Supplier	Model	Part No.
ACSS	NXT 800	9008000-10000
Honeywell	TRA 100B	066-01212-0301
Rockwell Collins	TPR 901-205	822-1338-205
Rockwell Collins	ISS 2100	822-2120-101 or -102*



Available Today

* Supports ADS-B In

Boeing Service Bulletins available for all production configurations

787 ADS-B Software Update / Service Bulletin

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■ In Service Issue

- ADS-B Out position reports begin “coasting” at constant track angle
- Two unique root causes

■ Root Causes

- Root Cause #1 - Lat/Long from Nav Radio contained within different network packets
- Root Cause #2 – Internal timing issue between 2 software elements (Sys I/O and Traffic)

■ Resolution

- Software resolving both issues first installed on 787 L/N 544 and on (for new aircraft) on 23 Mar 2017
- Software service bulletin is scheduled to be released in June of 2017
- Implement Boeing Service Bulletin B787-81205-SB340036-00
- Boeing recommends serviceBoeing Service Bulletin B787-81205-SB340036-00e bulletin install within 12 months from release
- Upgrade has 2 software parts loaded into Integrated Surveillance System (ISS) unit
- Available at no cost on MyBoeingFleet / ~1-hour for both ISS units (SB conservatively estimates 3 hrs)
- Software compliant with US/European DO-260B mandates
- Do not confuse with Boeing Service Bulletin B787-81205-SB340025-00
 - Updates ISS Hardware for ADS-B In capability (ISS Hardware Part No. 822-2120-102)

Recommend Implementation of No Cost Software Upgrade As Soon As Possible

ADS-B Out – Multi-Mode Receivers (MMRs)

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■ Boeing in-production Multi-mode receiver (MMR) capability

	737NG	747-8	767	777	787
Buyer Furnished Equipment (BFE)	Honeywell (RMA-55B SA On) <i>ACSS Transponder Certified with Honeywell SA On MMR</i>		Honeywell (RMA-55B SA On)	Honeywell (RMA-55B SA On) <i>ACSS Transponder Certified with Honeywell SA On MMR</i>	Stopped production in 2015
	Thales (TLS-755 SA Aware)		Thales (TLS-755 SA Aware)	Thales (TLS-755 SA Aware)	
	Rockwell (RCI) (GLU-920-001/002 SA On) (GLU-920-004 SA Aware) (GLU-925 SA Aware)		Rockwell (RCI) (GLU-920-001/002 SA On) (GLU-920-004 SA Aware) (GLU-925 SA Aware)	Rockwell (RCI) (GLU-920-001/002 SA On) (GLU-920-004 SA Aware) (GLU-925 SA Aware)	
Supplier Furnished Equipment (SFE)		Rockwell ⁽¹⁾ (RCI) (GLU-925 SA Aware)			Honeywell INR ⁽²⁾ (SA-Aware)

■ All units certified to TSO C129a

■ Interfaces per ARINC 755-3

- (1) Same unit as Buyer Furnished Equipment
- (2) Integrated Navigation Radio

BFE – Equipment selected/provided by buyer
SFE - Equipment basic to airplane

To Maximize Dispatch Availability Boeing Recommends SA-Aware/SBAS MMRs

ADS-B Out – SBAS Receivers (MMRs)

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- **Boeing in-production SBAS capability**

- 737MAX

	3GMMR	
	Honeywell	Rockwell
Model Name	IMMR	GLU-2100
Initial Capability	SBAS (WAAS)	SBAS (WAAS)
Projected Production Availability	3Q2017	2Q2018
Cutover	737-8MAX (After Entry Into Service)	737-9MAX (Entry Into Service)
Wiring Provisions	At Entry Into Service	At Entry Into Service

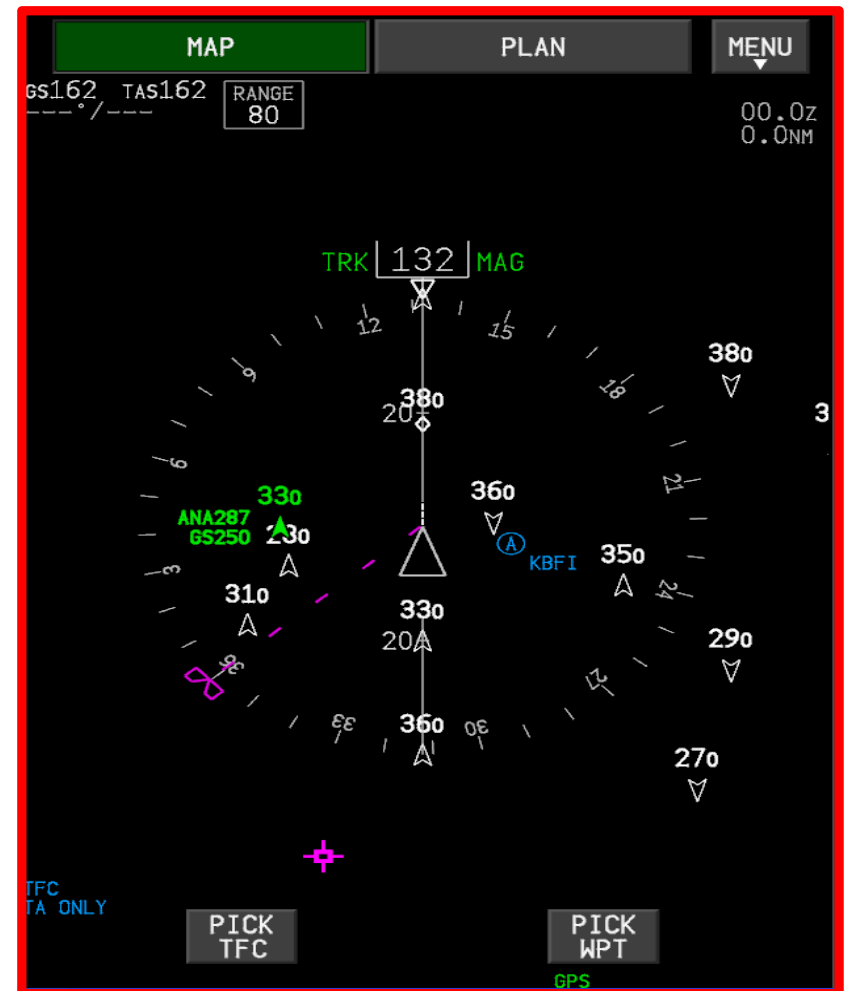
- 737NG – Available after introduction on 737MAX (with CAT I GLS option)
- 777 - Available after introduction on 737MAX (without GLS)
- 777X – Available at entry into service

SBAS Plans for 747-8/767/787 Under Review

787 ADS-B In

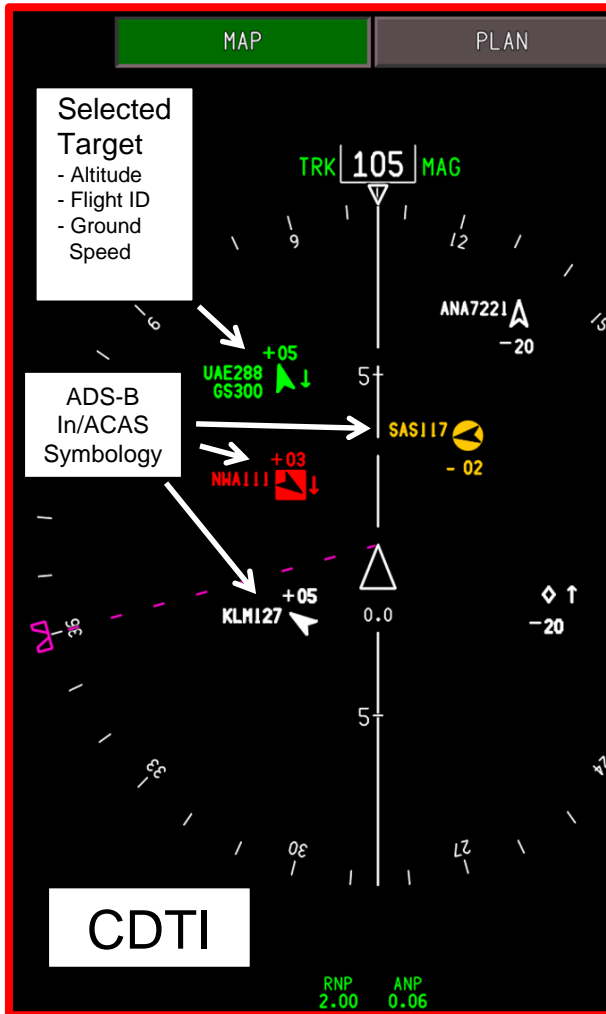
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- **Provides suite of situational awareness applications**
 - Airborne Traffic Display (AIRB)
 - Visual Separation on Approach (VSA)
 - In Trail Procedure (ITP)
- **Offerable starting June 2013**
 - 787 Catalog Rev W
- **1st install was end of 2015**



787 CDTI & VSA

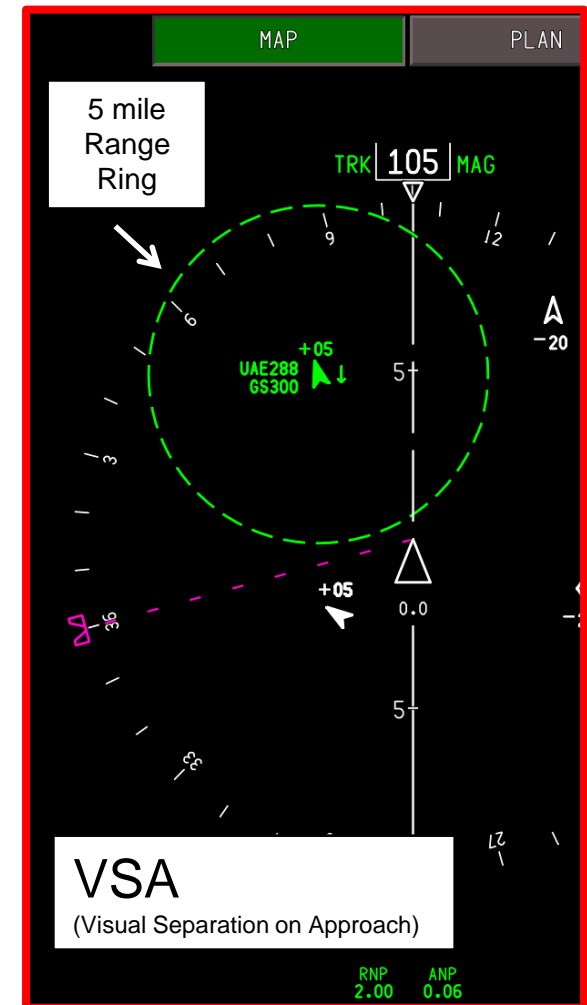
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Traffic List

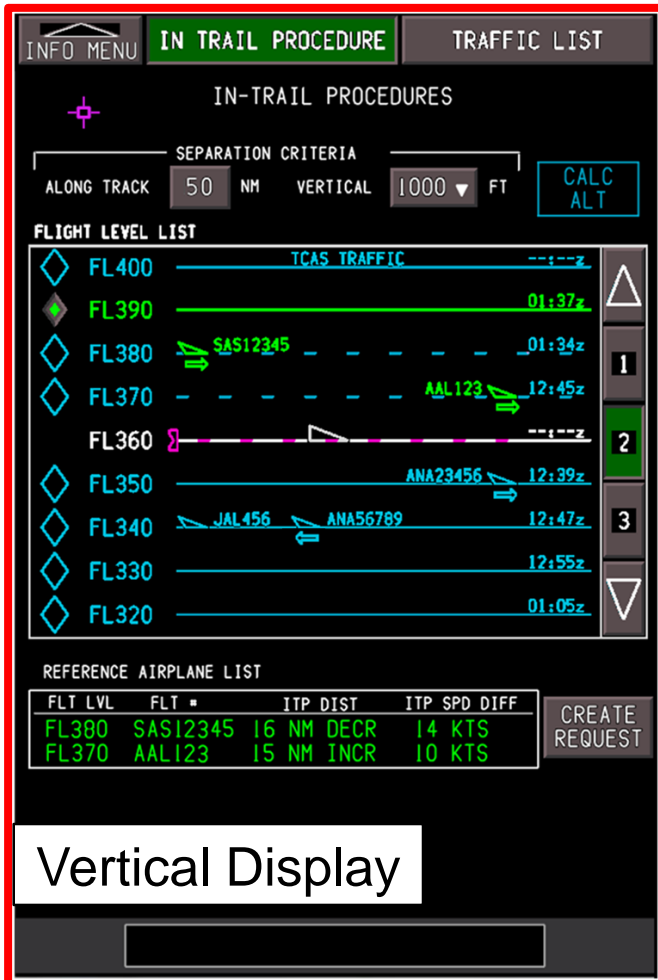
INFO MENU		IN TRAIL PROCEDURE		TRAFFIC LIST	
SORT		ADS-B TRAFFIC LIST			
FLT #	DIST	CAT	GND SPEED	RANGE RING	
UAE288	5.6 NM	HVY	300 KTS	5	
ANA111	2.9 NM	HVY	240 KTS	--	
KLM127	3.3 NM	HVY	440 KTS	--	
SAS117	3.9 NM	HVY	240 KTS	--	
ANA7221	8.0 NM	MED	440 KTS	--	
AAL123	57 NM	HVY	325 KTS	--	
ANA722	107 NM	MED	209 KTS	--	
HVN344	113 NM	HVY	241 KTS	--	
JAL256	121 NM	MED	231 KTS	--	
KAL851	122 NM	HVY	162 KTS	--	
SIA677	127 NM	HVY	259 KTS	--	
QTR257	142 NM	HVY	190 KTS	--	
CPA118	149 NM	MED	202 KTS	--	
UAE2687	154 NM	HVY	194 KTS	--	
ANA2687	174 NM	MED	294 KTS	--	

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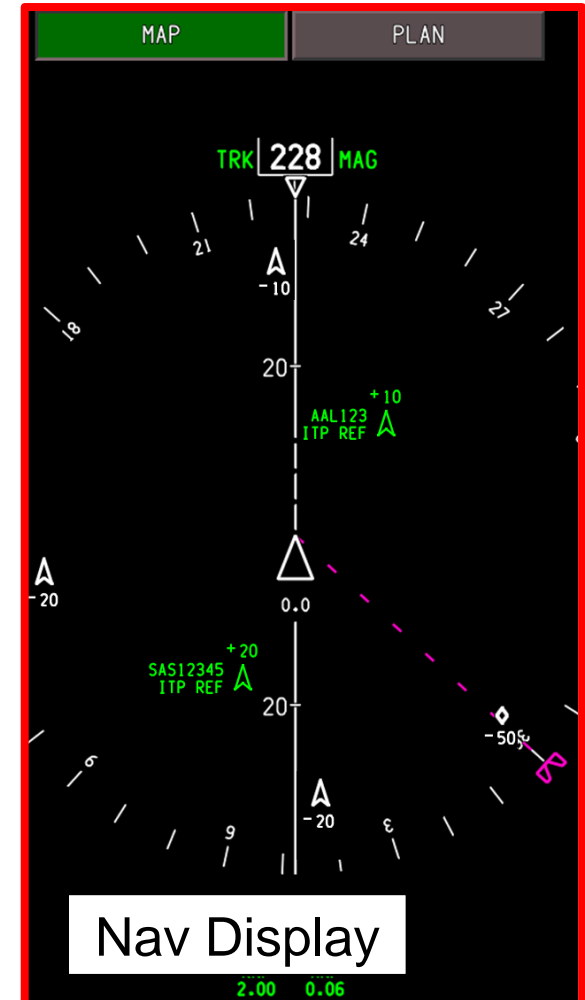


787 In Trail Procedure (ITP)

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Summary

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- Meeting production/retrofit mandates for ADS-B Out
- Working with Air Navigation Service Providers to ensure common airborne requirements and global harmonization
- Developing ADS-B In solutions which maximize value of equipage
 - Conducting forward fit studies targeting primary field of view to ensure cost-effective architectures with growth capability
 - Evaluating retrofit solutions including auxiliary displays
- Participating in ADS-B In trials and demonstrations
- Engaging with airlines and industry partners on rulemaking around the world
- Continuing industry standards support

**Boeing is actively engaged in ADS-B development,
a key capability for improved airline operations**

Questions

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