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

Nashville, TN
8/13/2016

ADS-B and Mandates Overview
Mark Francetic, Duncan Aviation

CPDLC/FANS and DCL Overview
Christian Renneissen, ARINC Direct

Rockwell Collins Mandates Update
William Elliott, Rockwell Collins

L-3 is a FAN of ADS-B, are you?
William Ladigo, L-3 Aviation Products

Garmin NextGen Solutions
James Laster, Garmin

FlightDeck Freedom Datalink and FANS
Andrea Duggan, Satcom Direct

Universal Avionics Solutions for NextGen
Robert Randall, Universal Avionics

Mandates Made Easy
Johnny Glakas, Honeywell

DUNCAN AVIATION

ADS-B

Automatic Dependent Surveillance-Broadcast

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Get the latest NextGen developments at
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Affected Aircraft

- The FAA estimates that 150,000 aircraft still need to be equipped for the mandate
- There are approximately 18,584 corporate aircraft (jets & turboprops--AMSTAT May 2015) that will require this equipment to fly in their best performance range.

FAA Asserts 2020 Deadline

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ADS-B Solutions, continued

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Benefits

- Aircraft with ADS-B get priority over non-ADS-B equipped aircraft
- No need for position reports
- More efficient use of routes, routes at FL/FL levels
- Reduced runway incursions
- Improved safety in areas that previously had no surveillance coverage

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

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

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

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 Inclusion
- **NAC** Navigation Accuracy Category
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- **SA** Selective Awareness
- **SPI** Special Position Indication (Ident)
- **LOA** Letter of Approval

Do I have ADS-B?

Approved Systems

Part Number Specific
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- ACSS XS-950*
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United States ADS-B

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- The FAA mandates in AC 20-165A that all ADS-B systems require an STC
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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-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

- 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-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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NEXTGEN
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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 §91.225 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** MSL (Mean Sea Level) 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 TSOs (Technical Service Orders) 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
    1. ADS-B failure
    2. 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 w
  aircraft
- No need
- More flex
- Reduced
- Improve
  surveilla

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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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ARINC Direct℠

ARINCDirect FANS CPDLC and DCL Overview

Duncan Aviation NextGen Seminar

October 13, 2016

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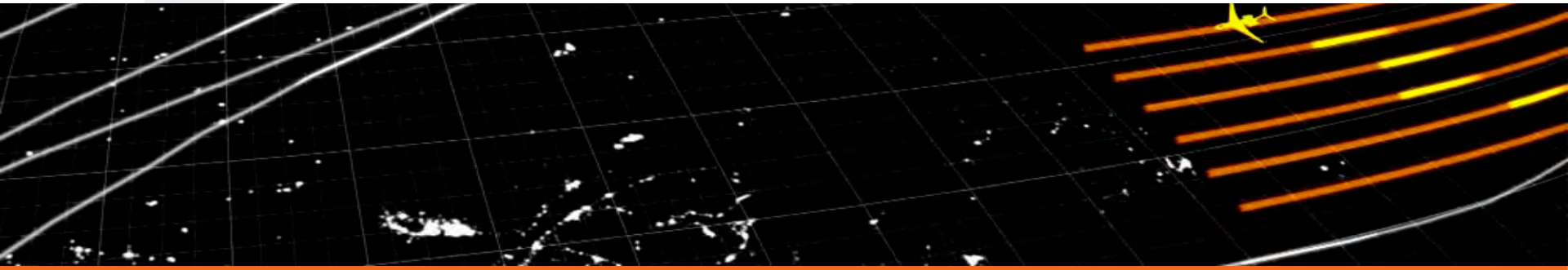
Agenda

- Future Air Navigation System FANS 1/A+
- ICAO GOLD Document
- Components of FANS 1/A+
- Logon and Handoff Process
- Coverage Maps
- Mandates and Requirements
- FANS CPDLC DCL
- DCL Requirements
- Current DCL Airports
- 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

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GOLD Document

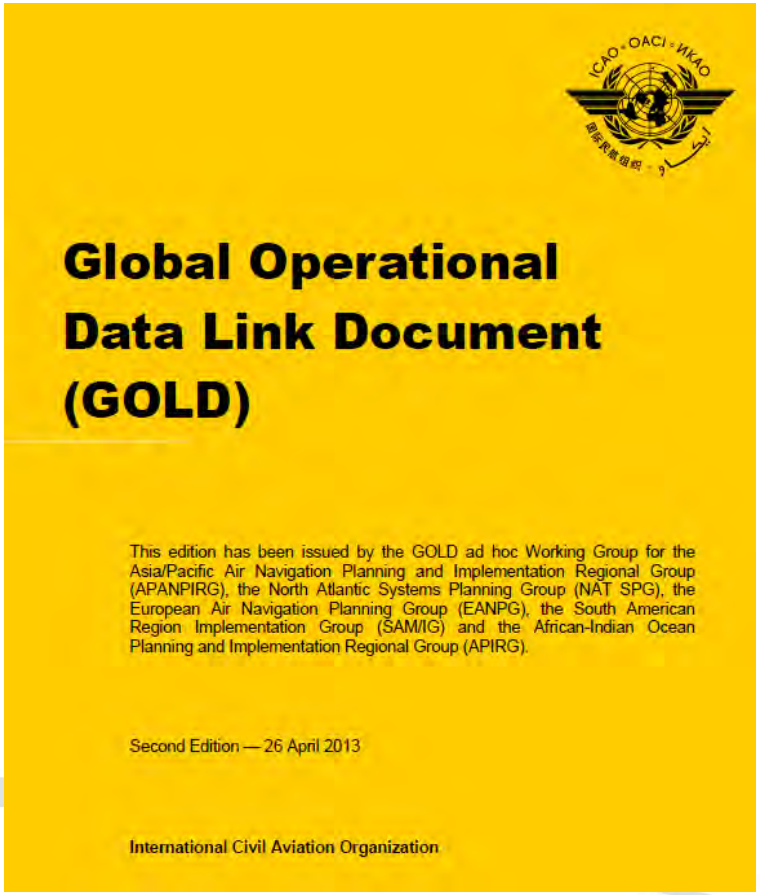
Global Operational Data Link Document

•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



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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

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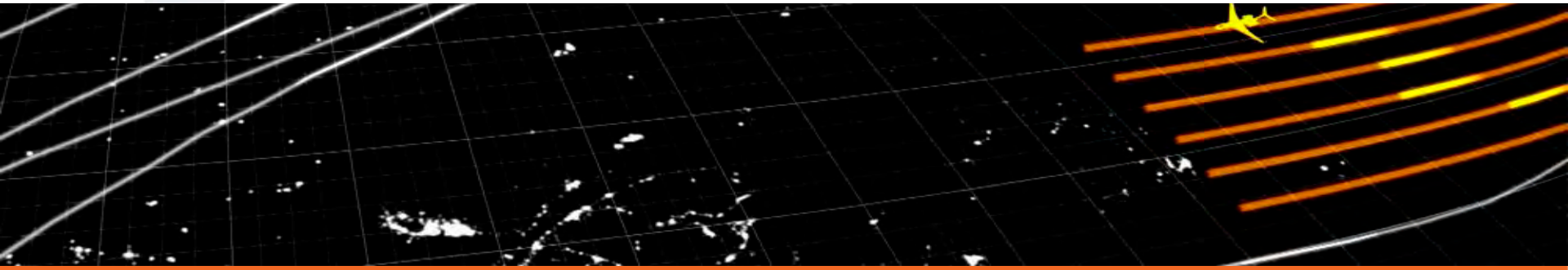
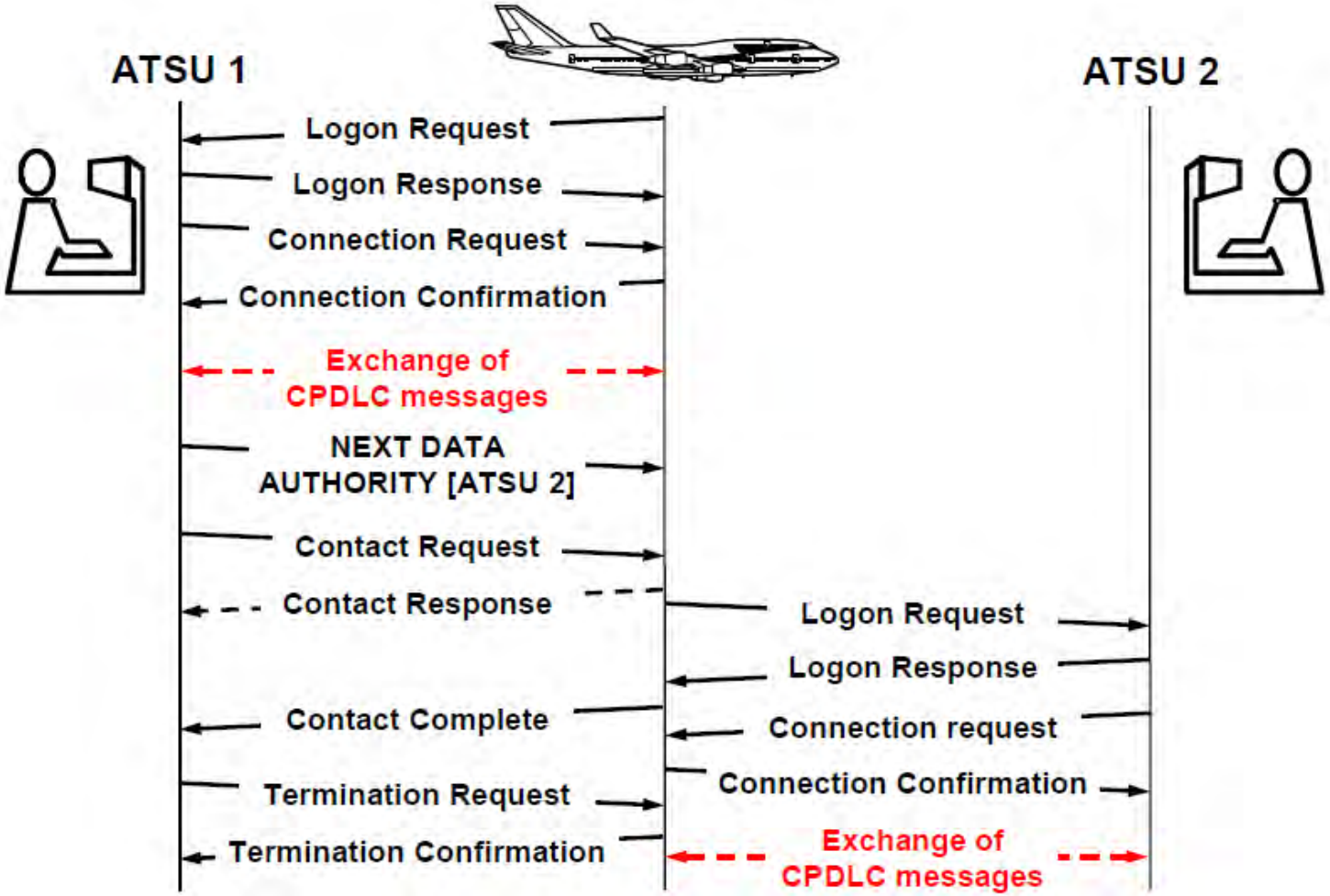
ADS-C

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



FANS Logon and Handoff Process



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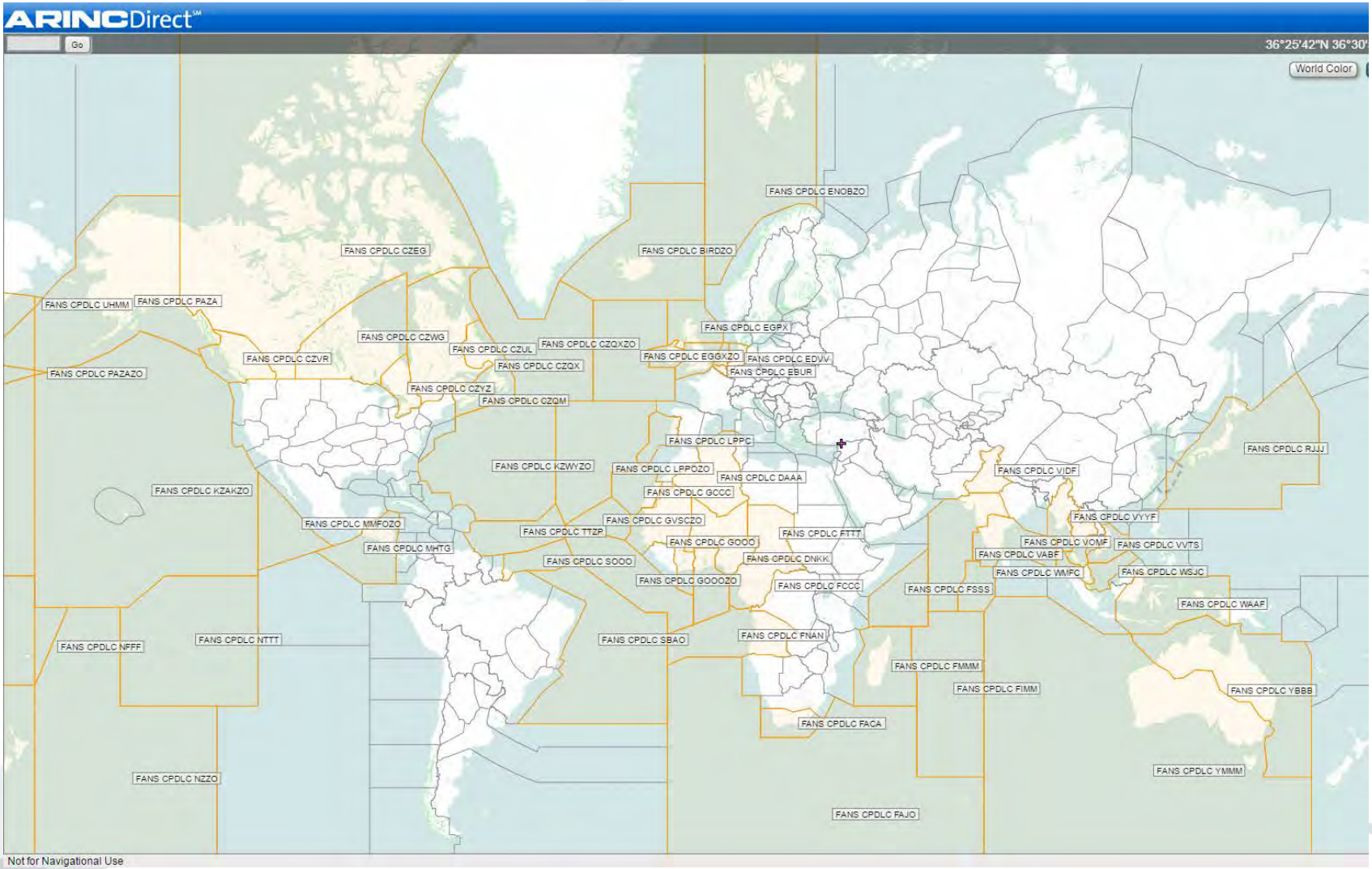
Current Enroute FANS Coverage



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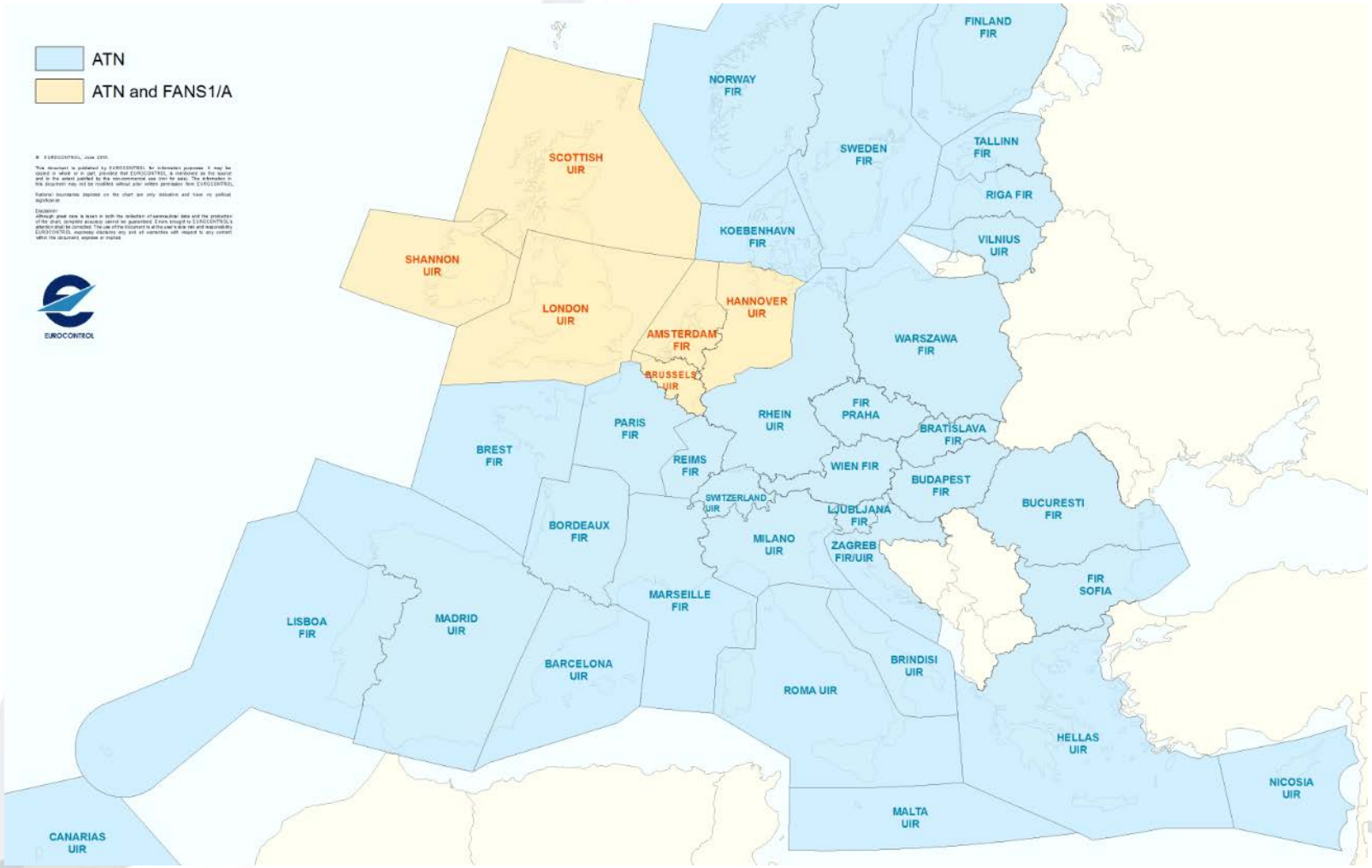
FANS Coverage in Europe



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FANS CPDLC Mandates

Phase 2A - Current

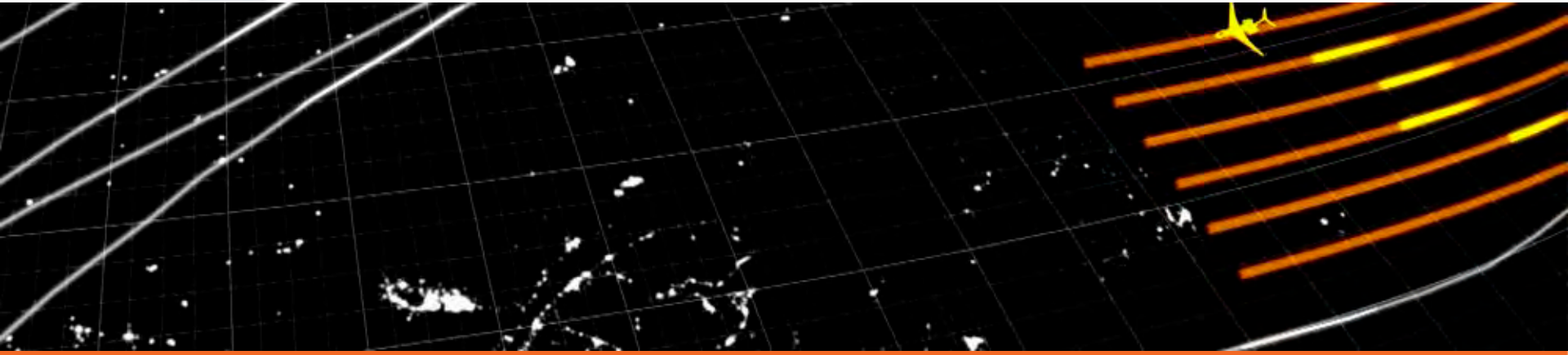
As of Feb 2015 FL 350-390 on all North Atlantic (NAT) Tracks

Phase 2B

Dec 2017 FL 350-390 within NAT Region

Phase 2C

January 2020 - Above FL 290 within NAT Region



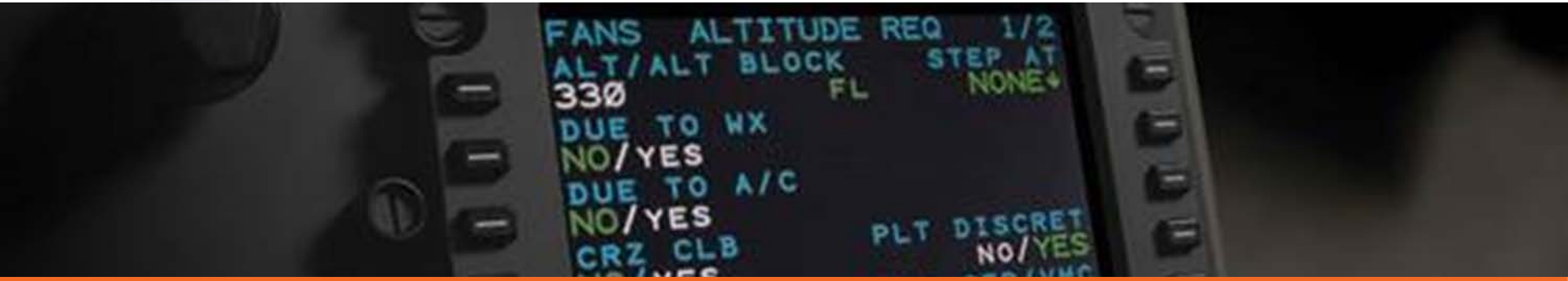
FANS Requirements

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

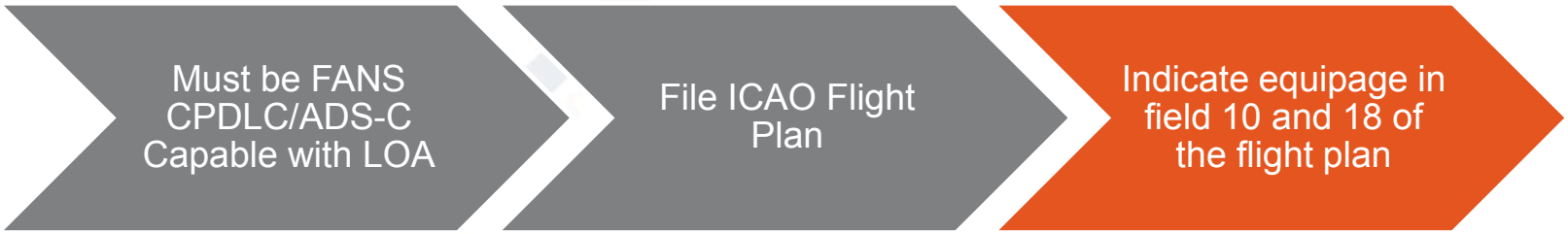
- FAA approved FANS CPDLC training

- 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



Equipment/Flight Plan Requirements for FANS 1/A+



- 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 tail number in Field 18 (Other Information) REG/

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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 Field 10a and Field 18 entries required
- DCL does not replace PDC

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FAA's proposed Rollout of DCL

Key Sites			
Site Name	Site ID	ARTCC ID	IOC
Boise (Non-CPDLC)	BOI	ZLC	06/10/15
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
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	ARTC C ID	IOC
Louisville	SDF	ZID	02/10/16
Cincinnati (Non-CPDLC)	CVG	ZID	02/29/16
Indianapolis	IND	ZID	03/07/16
Columbus (Non-CPDLC)	CMH	ZID	03/17/16
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	ARTC C 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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Current DCL Capable Airports

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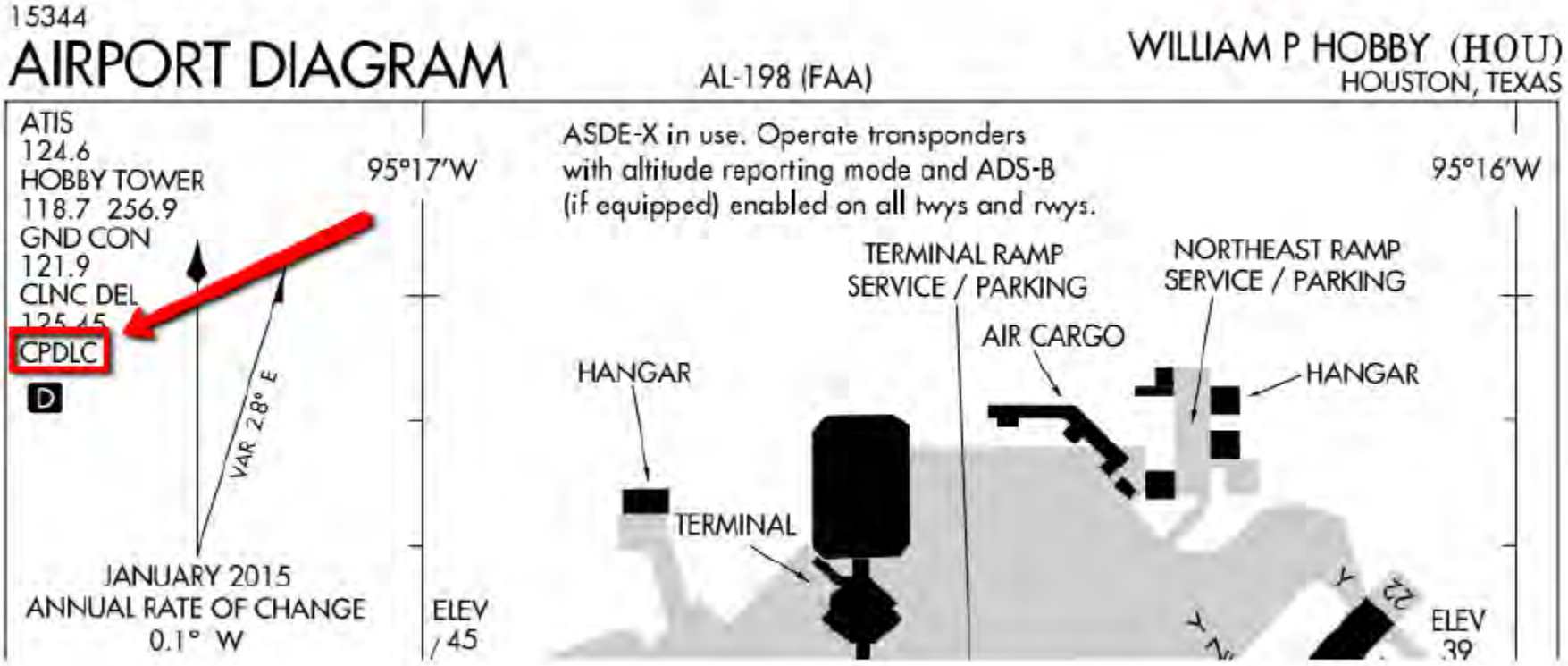
How is a CPDLC capable airport depicted?



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

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Equipment and FPL Requirements for DCL

- 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*

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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

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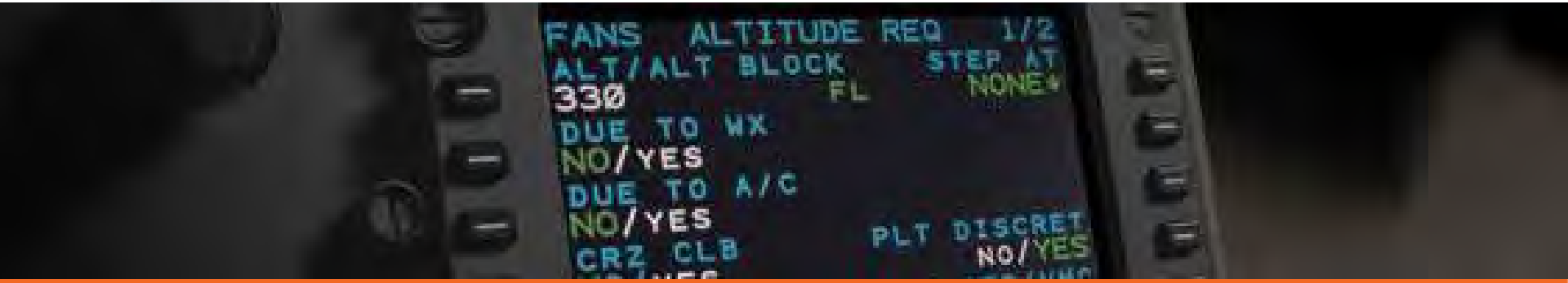
ARINCDirect FANS CPDLC Testing

- 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 Contact Information

Main Contact: Erin Santiago

Tech Support Group Phone: 410.266.2990

Email: ADFANS@arinc.com

ARINCDirect℠

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Questions?

Christian Renneissen
crenneis@arinc.com
720.239.2737

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Solutions? We got 'em!

William H Elliott

Pr Regional Manager

Southeast US

william.elliott@rockwellcollins.com

727.871.3876

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.

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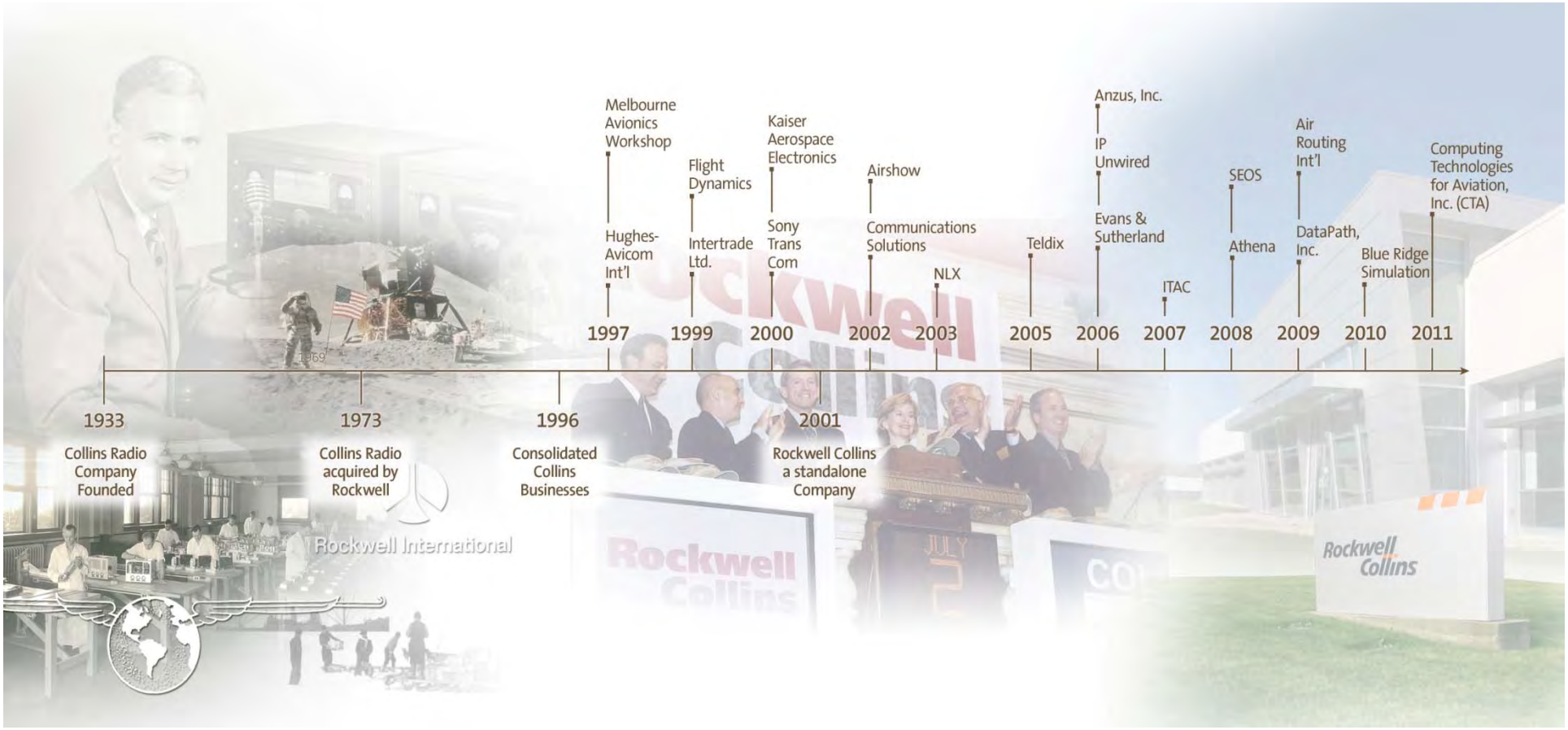
Our Heritage…



80 years of history and innovation…

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Who We Are…

- *A global company operating from more than 60 locations in 27 countries*
- *Nearly 20,000 team members worldwide*
- *A uniquely balanced business across markets we serve; Commercial, Business, & Government Avionics*

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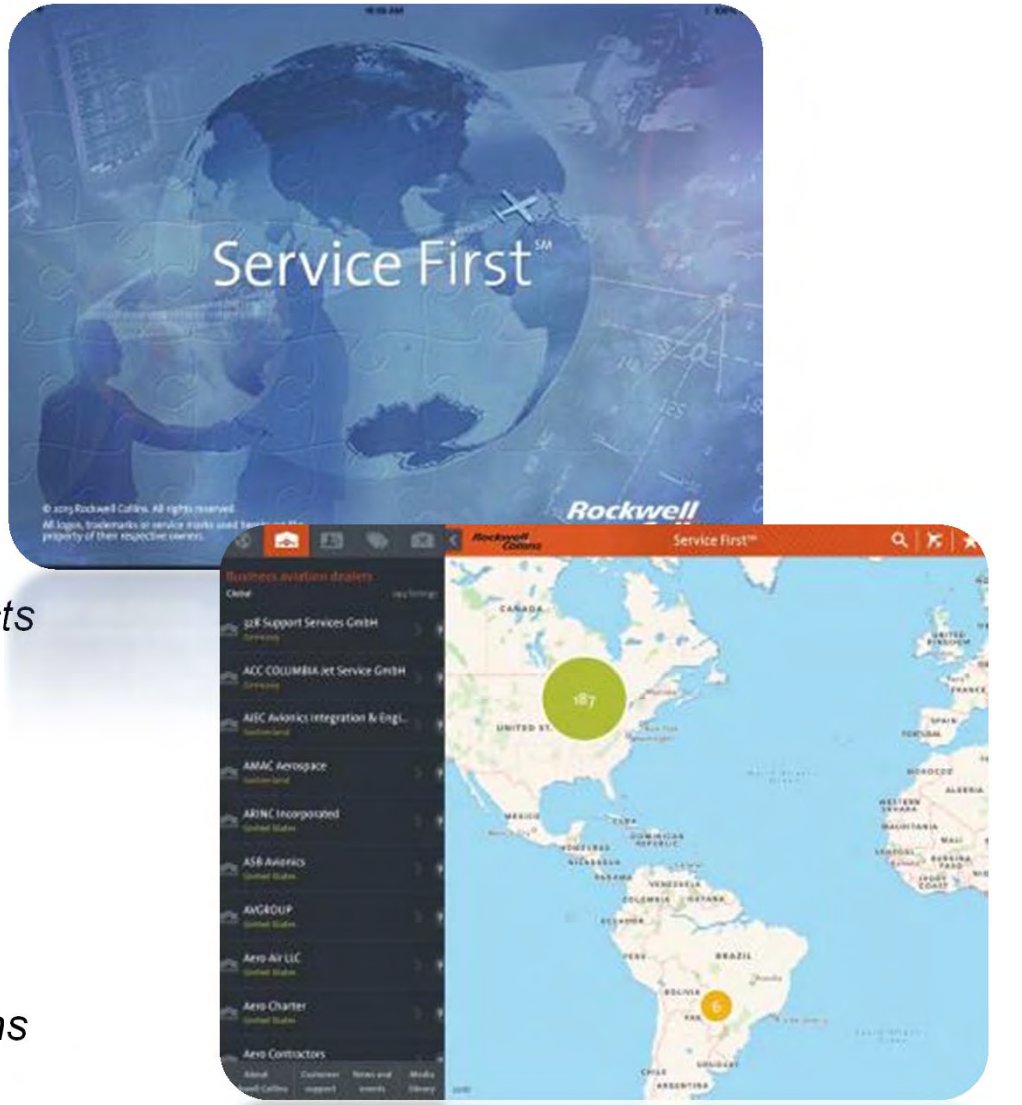
Service First app

Features:

- *Find Field Support*
- *Find Field Sales*
- *Find Authorized Avionics Shops*
- *Service Center locations and contacts*
- *Review Marketing materials*
  - *Bulletins*
  - *Brochures*
  - *White Papers*
  - *Sales videos*
- *News and Events @ Rockwell Collins*
- *Available for iOS & Android*



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Airspace Modernization NextGen

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

5 Areas of Focus

- GPS (Global Positioning System)
  - WAAS (SBAS) for ADS-B Out
- FMS (Flight Management System)
  - LPV, (Loc Perf), RNP(Required Navigation Performance), PBN (Perf Based)
- CMU (Data Link)
  - FANS (FANS Domestic, Clearance & CPDLC), Link 2000+
- TDR/TTR (Transponder/TCAS for ADS-B)
  - ~20,000 TDRs to update = > 300 units per week since Jan 2015
- PFD/MFD (Displays)
  - Map Data display, Approach, SVS, EVS, graphical WX, ADS-B IN

NextGEN is restructuring how airspace is managed

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GPS (WAAS) & FMS (LPV)

They go hand in hand

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Rockwell Collins WAAS LPV Solution

GPS-4000S

Equips Aircraft for SBAS

GPS Primary Means Navigation

Value in advance of FMS v 4.0

Simpler RNAV Procedures

(no preflight RAIM check)

Better Availability

Enhanced Mission Flexibility and Efficiency

Required for ADS-B Out

(DO-260B)

+

Enables LPV Approaches

Improved Airport Access

Additional Value

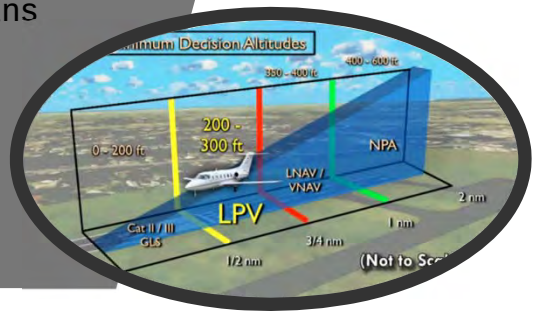
Faster Data Loading

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

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OEM SB RCI STC OEM SB

Falcon 50EX
Avail Now

Falcon 2000
Avail Now

Falcon 2000EX
Avail Now

Falcon 50
Retrofit
Avail Now

Falcon 20

Challenger 604
Available Now

CJ 1+
Avail Now

22+ WAAS / LPV Solutions

Google: "WAAS ROI Calculator"

G150 Avail
Now

CJ 2+
Avail Now

CL300
Avail Now

King Air 350/B200
Avail Now

* C90 Avail Now

CL605
Avail Now

G200
Avail Now

CJ 3
Avail Now

Encore+
Avail Now

BJ 400A
Avail Now

Hawker 750
Avail now

Hawker 800XP
Avail Now

Hawker 850XP
Avail Now

Hawker 900
Avail Now

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CMU (Datalink)

FANS 1/A & Link 2000+

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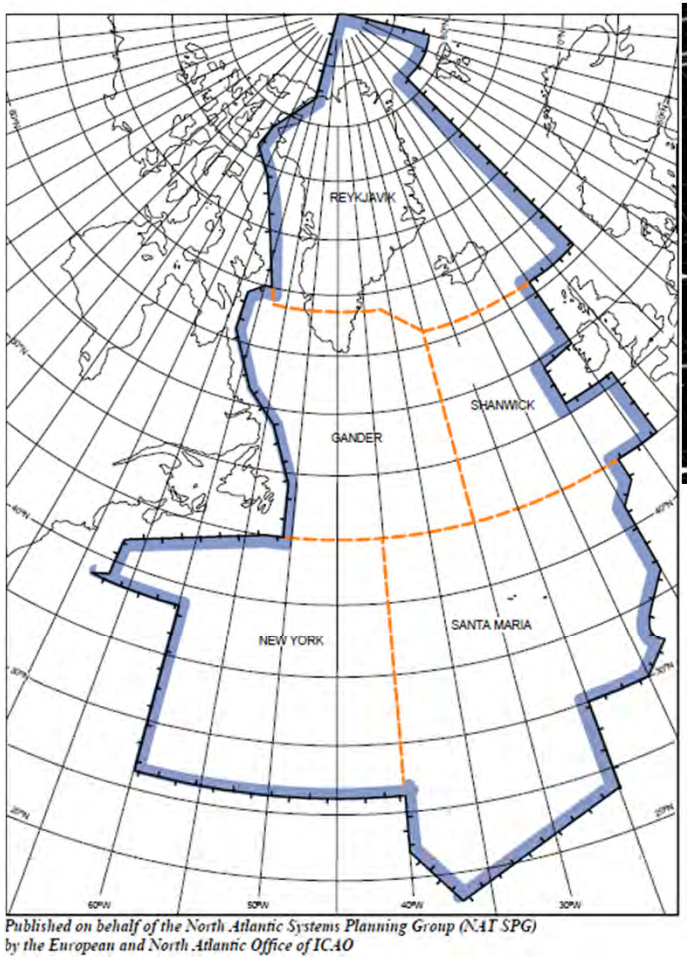
Airspace Crossing the Atlantic



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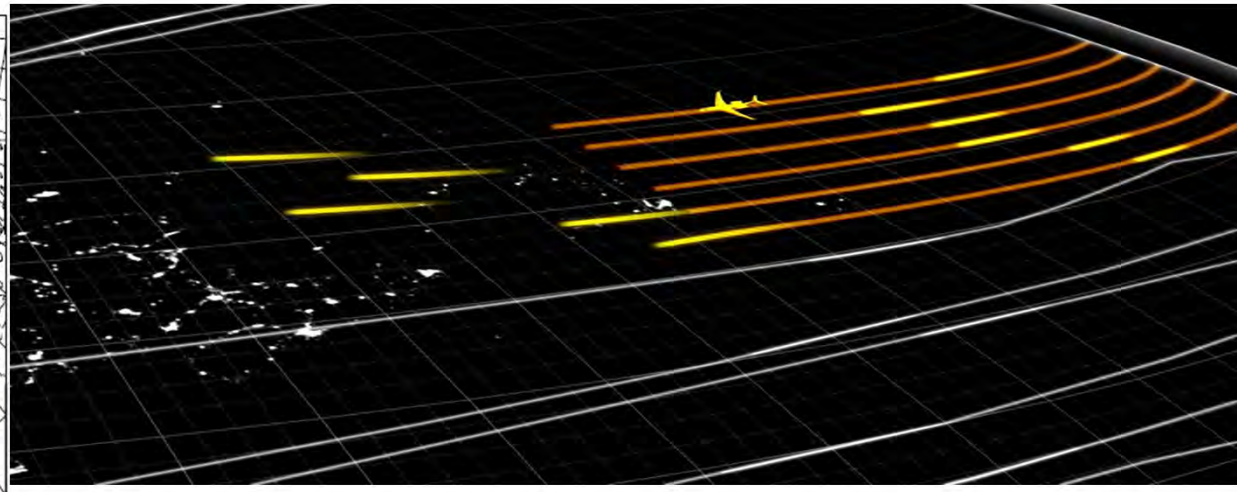

North Atlantic Tracks (NAT) FANS 1/A Data Link

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 to restrict North Atlantic airspace to non-FANS 1/A aircraft

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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)
- Remote Oceanic Airspace
- ***U.S. implemented departure clearance using FANS 1/A – DCL @ 56+ airports by the end of 2016 (CPDLC-DCL)***

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
- **Fusion Platforms**

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

- **Pro Line 4 and 21 platforms**

--Put on hold due to mandate slip, many exempt

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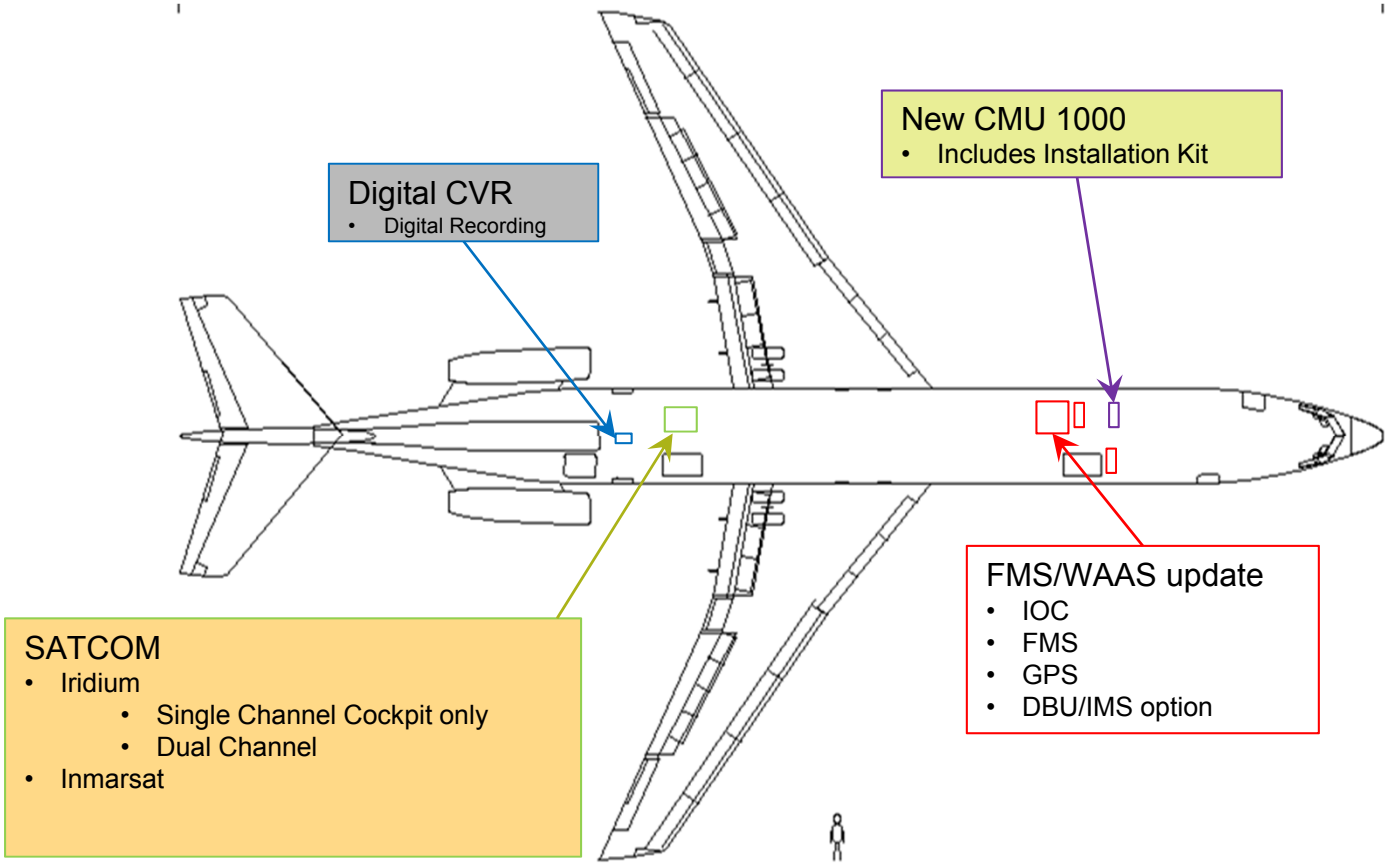
FANS 1A update on Pro Line 4 or 21 include:

CMU 1000 Datalink unit
Minimum of FMS 4.0
DCVR to record CPDLC message
SATCOM qualified for ICAO safety service and FANS 1/A



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FANS 1/A Certification list

Aircraft Type	Certification Path	Availability
Challenger 300	Bombardier SB	Late'16 early '17 (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.
Gulfstream G200	Offer Submitted	TBD
Gulfstream G150	Offer submitted	TBD
Hawker 900/800	Evaluating	TBD

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TDR / TTR

Transponder / TCAS

New website:
http://www.rockwellcollins.com/ads-b

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ADS-B is a vital enabler of the NextGen plan

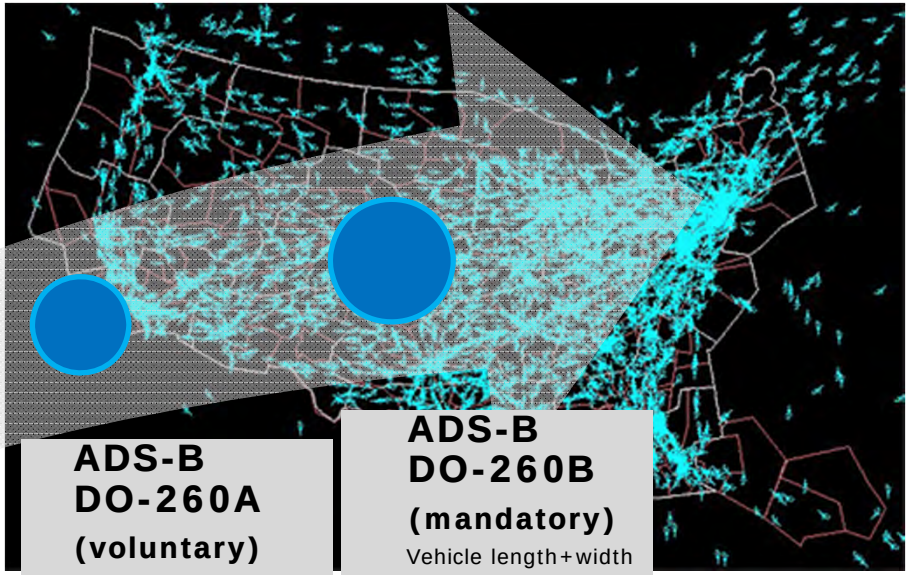
Why Automatic Dependent Surveillance- Broadcast (ADS-B)?

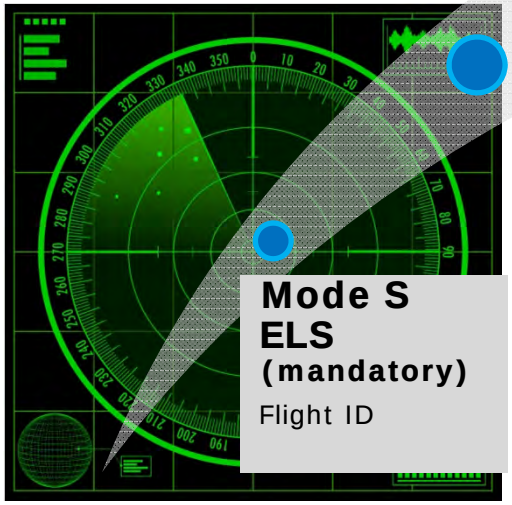
** Increase airspace capacity and efficiency * Surveillance where previously not possible. i.e.: Gulf of Mexico *Lower cost, more accurate infrastructure * Provides vehicle for safety services to the cockpit * Provides widespread unprecedented pilot situational awareness*

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

Mandate is JAN 2020!! But THINK, DEC 2019!!

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ADS - B Out (DO-260B) Certification List

Business Aircraft

Beechcraft Premier I, 1A
Beechjet 400A
Nextant 400XT
Bombardier Global 5000, 6000
Challenger 300, 350
Challenger 605
Challenger CL601-3A, CL601-3R
Challenger CL604
Citation CJ1+,
Citation CJ2+
Citation CJ3
Citation CJ4
Citation Encore+
Citation XLS+
Embraer Legacy 450, 500

Falcon 2000, 2000EX
Falcon 20F,
Falcon 50, 50EX
Falcon 900, 900B, 900C, 900DX, 900EX, 900LX
Gulfstream G280
Gulfstream IV
Hawker 400XP
Hawker 750, 800XP, 850XP, 900XP
King Airs - 300, 300LW, 350, 350C, 350ER, 350i, 350iER, B250, B200, B200C, B200GT, B200T, C90GT, C90GTi, C90GTx, 100, 200, 200C, 200T
Learjet 60, 60XR

…many *more unannounced certifications* are in process

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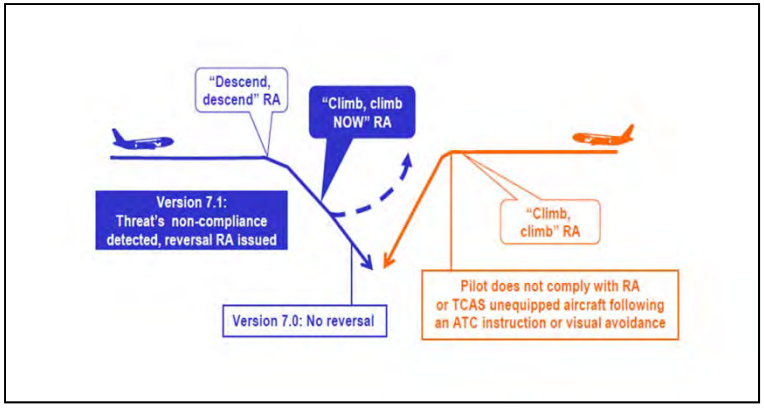
TCAS 7.1- Address Safety Issues

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

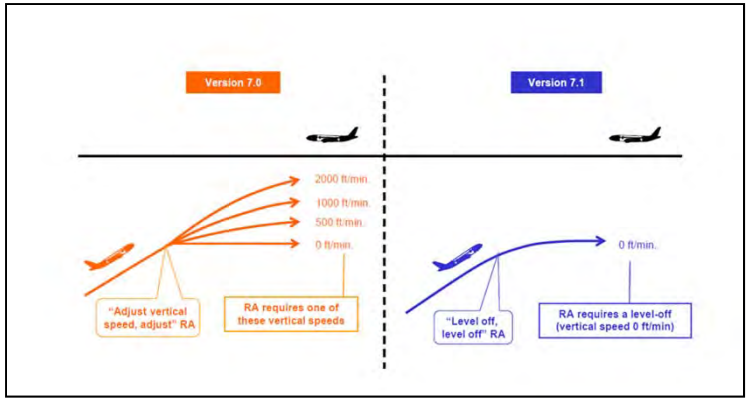


Courtesy of Eurocontrol Website

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

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TCAS 7.1 Certifications

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

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PFD / MFD

Displays

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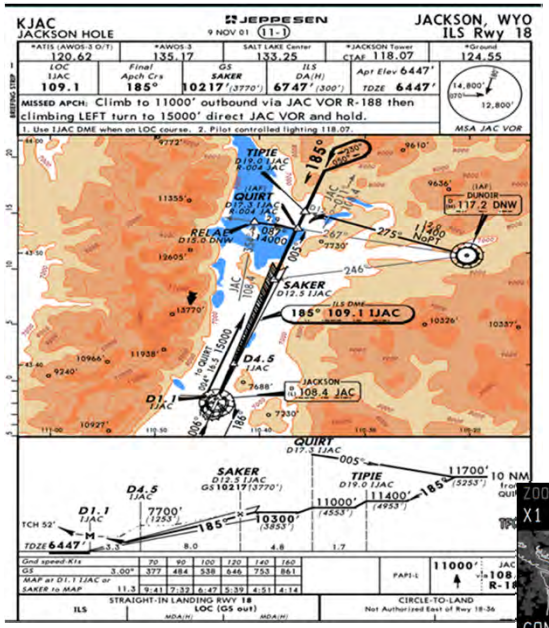
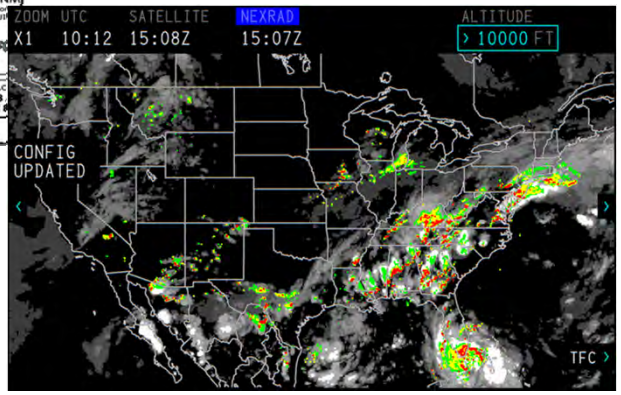
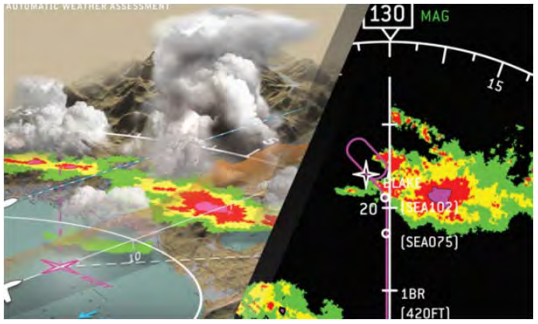
Operational Efficiencies & Safety Enhancements

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







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King Air & Hawker Pro Line 21 Airspace Modernization Packages

Packages have been created to address the majority of the market, exceptions may be applicable

- ✓ #1 has been tailored to address aircraft needing to meet the mandates and were built before IFIS was added at production.
- ✓ #2 has been tailored to address aircraft needing to meet the mandates that were built with IFIS but not WAAS/LPV.
- ✓ #3 has been tailored to address aircraft needing ADS-B and seeking to update to SVS.

SVS Included in Each Package

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Consider this?

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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

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Thank you.

DUNCAN AVIATION

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NextGen Transponders:

ADS-B Transponder Solutions from

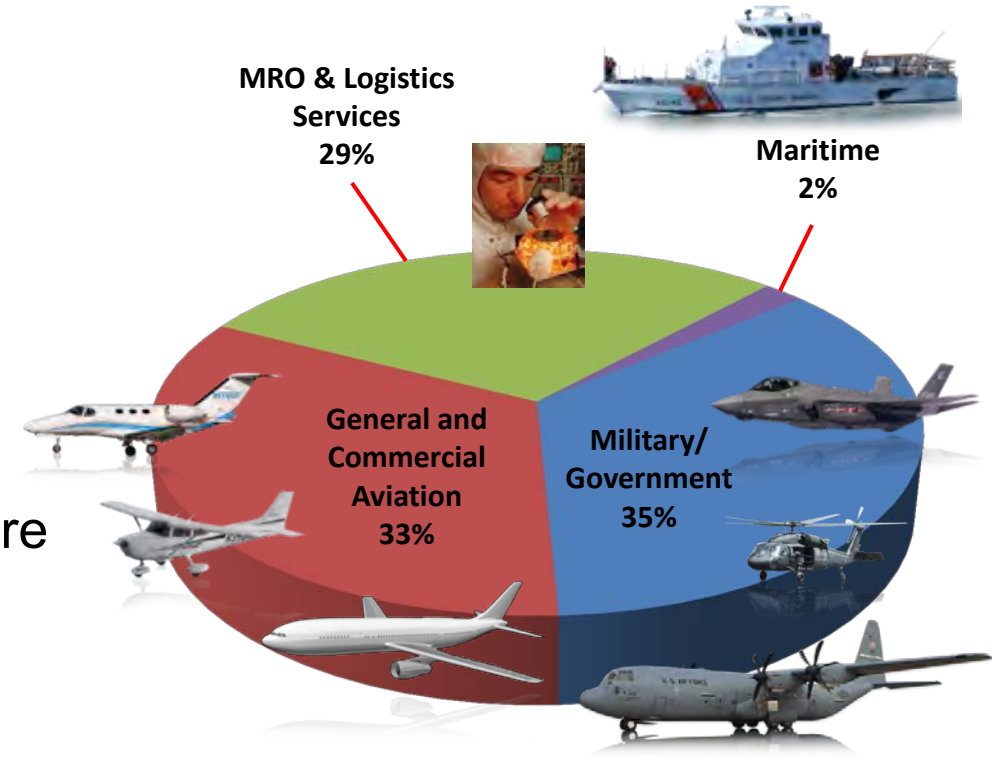
L-3 Aviation Products

Overview

Bill Ladigo
L-3 Aviation Products
Sr. Aftermarket Sales Rep – SE Region
316-641-7766 Mobile
800-220-6443 Office
Bill.Ladigo@L-3Com.com

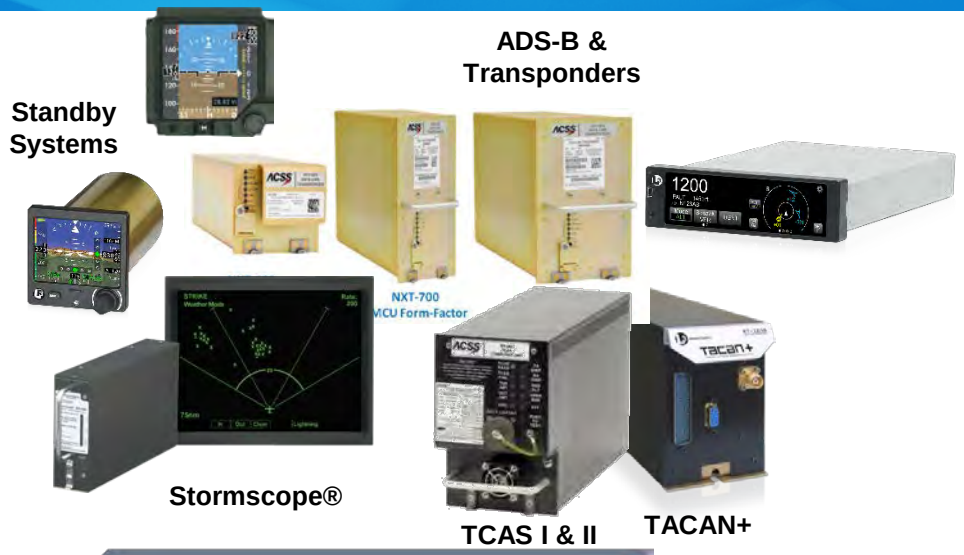
Aviation Products At A Glance

- 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



Aviation Products At A Glance

Aviation Products



Integrated Avionics

Flight Displays / Processors

Flight Data & Cockpit Voice Recorders

Avionics/Electronics Repair & Overhaul

LRUs & Controllers

NextGen Transponder Solutions for ADS-B

Lynx NGT-9000

Lynx NGT-9000R

NextGen Transponder Solutions for ADS-B

NXT-600

“RCZ” Form-factor

NXT-700

2MCU Form-factor

NXT-800

4MCU Form-factor

Lynx Transponders

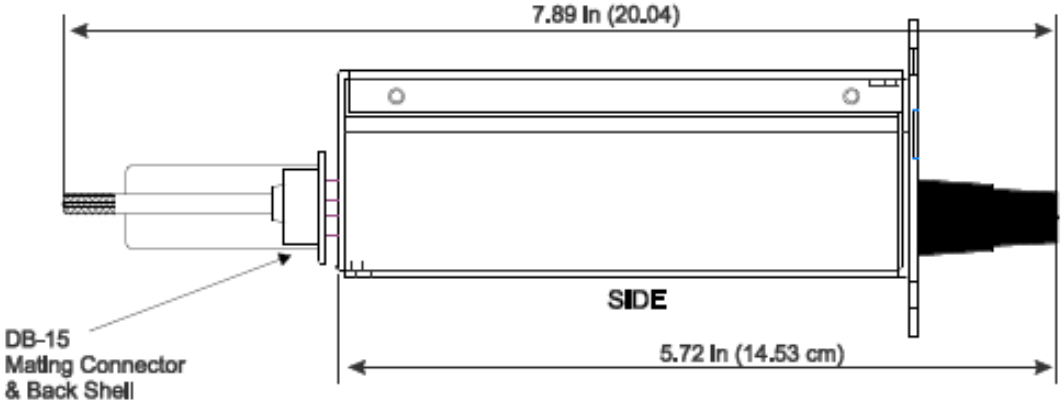
Lynx NGT-9000

- **NGT-9000 / NGT-9000+ / NGT-9000D / NGT-9000D+**
  - **TSO-C112d, TSO-C166b, TSO-C195b, DO-260B, DO-181E Compliant**
  - **Broadcasts 1090MHz Mode S Extended Squitter**
  - **Receives BOTH 1090MHz and 978MHz ADS-B and FIS-B**
  - **Internal rule-compliant (TSO C145c) WAAS GPS receiver**
  - **Multifunction touch screen displays**
  - **NGT-9000**
    - **Provides transponder & ADS-B functions, displays weather & traffic on own displays, on tablet apps through Wi-Fi Module, and outputs to MFDs (ARINC 429, RS-232/422)**
  - **NGT-9000+**
    - **NGT-9000 with active traffic (Skywatch/TAS) enabled**
  - **NGT-9000D**
    - **NGT-9000 with diversity antenna option enabled**
  - **NGT-9000D+**
    - **NGT-9000 with active traffic and diversity antenna option enabled**

Lynx NGT-9000R

- Same features as NGT-9000 but without the touch-screen display
- Uses CP-2500 Controller or interfaces to integrated avionics suite
- NGT-9000R
  - Base unit with standard features
- NGT-9000R+
  - NGT-9000R with active traffic (Skywatch/TAS) enabled
- NGT-9000RD
  - NGT-9000R with diversity antenna option enabled
- NGT-9000RD+
  - NGT-9000R with active traffic and diversity antenna option enabled

CP-2500 for the NGT-9000R



NGT-9000 Models and Features

All dual band panel mount models contain:

- Multifunction touch screen display
- Mode S 1090ES transponder (ADS-B OUT)
- 1090MHz IN
- 978MHz UAT IN (traffic and FIS-B weather)
- Fits standard 6.25” radio racks
- Internal rule-compliant (TSO C145c) WAAS GPS receiver
- USB maintenance port
- Data Configuration Module in harness
- Field loadable software
- +14VDC or +28VDC power input
- Wi-Fi serial output

NGT-9000 ATAS and eTAWS

- **Two new features for the NGT-9000**
  - **ATAS (also referred to as TSAA)**
  - **Class B Terrain Awareness and Warning System (TAWS)**
- **Both features activated via software enablement codes**
- **ATAS provides traffic alerts using ADS-B IN traffic information**
  - **First certified (TSO-C195b) application for ADS-B IN**
- **Embedded Class B TAWS provides terrain and obstacle alerting**

NGT-9000 Block Diagram

LYNX MULTILINK SURVEILLANCE SYSTEM

L3 Aviation Products

WAAS GPS Antenna

Pressure Altitude
(Grey code, serial, digital)

Transponder
Antenna

Audio Alerting (ATAS, TAS, TAWS)

Serial interface to
PIM-9000 Wi-Fi for
iPad/tablet integration

Digital Magnetic Heading

Power (+14V or +28V)
and GND

External Cockpit Displays

= Required Inputs/Outputs

= Optional Inputs/Outputs

Tested Display Interfaces

- **Active Traffic Displays (TAS/TCAS ARINC 735 format)**
  - **Garmin G500/G600**
  - **Garmin GNS430(W)/530(W)**
  - **Garmin MX-20/GMX-200**
  - **Garmin GTN650/750**
  - **Avidyne EX500/5000**
- **FIS-B WX and Traffic Display (RS-422)**
  - **Aspen EFD1000 PFD and MFD, EFD500 MFD**
  - **Garmin MX-20/GMX-200**
  - **Avidyne IFD 440/540 – will be tested soon**

Installation Considerations
Panel Mount Models

Spacing Requirements in Panel:

Bezel Dimensions

Width 6.25”

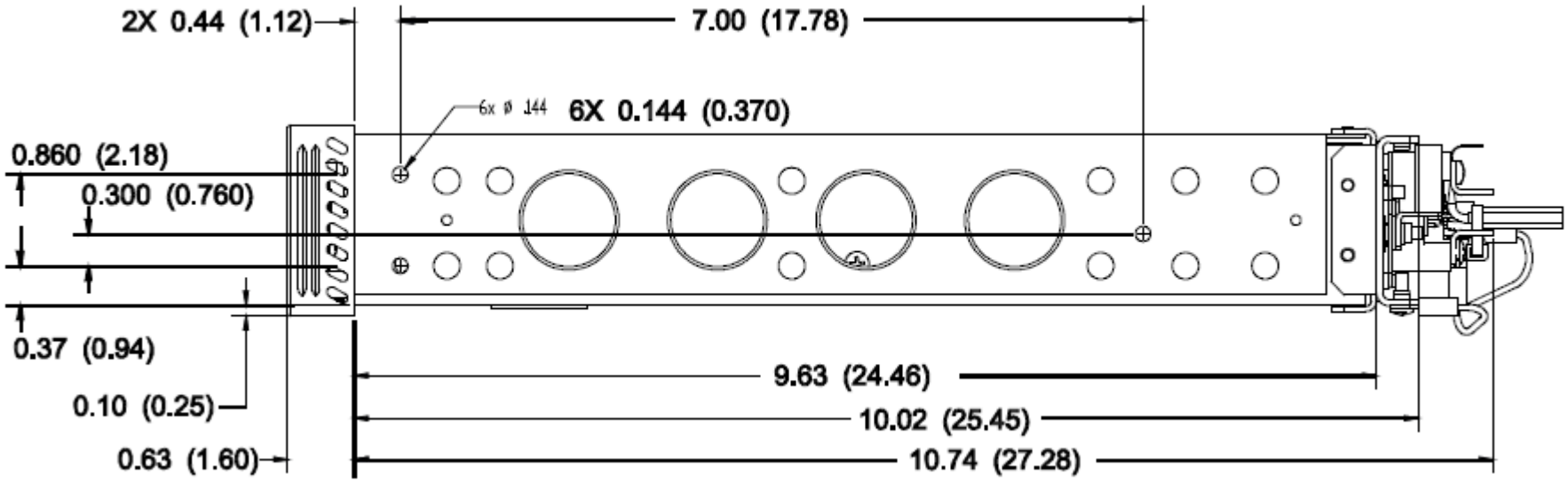
Height 1.8”

Extra spacing may be required between panel mounted avionics due to NGT bezel height of 1.8”

Depth of unit is 11” including connectors

Installation Considerations

- **Extra spacing is required between racks due to NGT bezel being slightly taller than the rack itself**
- **Depth of rack including connectors is 11”**



Installation Approvals

- **AML STC for the NGT-9000/9000R on….**
  - **Part 23/25 fixed-wing aircraft**
  - **Part 27/29 rotorcraft**

United States Of America
Department of Transportation - Federal Aviation Administration

Supplemental Type Certificate

Number SA02444AK

This Certificate issued to: ADS-B Technologies, LLC
900 Merrill Field Drive
Anchorage, Alaska 99501

certifies that the change in the type design for the following product with the limitations and conditions therefore as specified herein meets the airworthiness requirements of Part 23 of the Federal Aviation Regulations.

Original Product — Type Certificate Number / Make / Model: *Refer to FAA Approved Model List (AML), Number SA02444AK, Revision 1, dated June 19, 2015, or later FAA approved revision, for airplane makes and models, corresponding Type Certificate numbers, and applicable airworthiness regulations.

Description of Type Design Change:
Approval of the L-3 Communications NGT 9000/9000R ADS-B system installed in accordance with the Master Data List, L3-76AK-MDL1, Revision 1, dated June 2, 2015, or later FAA approved revision.

Limitations and Conditions:
1) The installer must determine whether this design change is compatible with previously approved modifications.
2) If the holder agrees to permit another person to use this Certificate to alter the product, the holder shall give the other person written evidence of that permission.
3) Installation requires prior FAA approved antenna installation for Global Positioning antenna, Universal Access Transceiver antenna and 1090 megahertz Antenna.
4) Instructions for Continued Airworthiness, L3-76-ICA1, Revision 1, dated May 22, 2015, or later FAA accepted revision is required as part of this installation.

Limitations and Conditions continued on Page 3

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application: July 18, 2013
Date of issuance: March 31, 2015
Date reissued:
Date amended: June 19, 2015

By direction of the Administrator
for August A. Asay (Signature)
August A. Asay
Manager, Anchorage Aircraft Certification Office
(Title)

Any alteration of this certificate is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both.

FAA Form 8110-2(10-68) Page 1 of 3 This certificate may be transferred in accordance with FAR 21.47.

United States Of America
Department of Transportation - Federal Aviation Administration

Supplemental Type Certificate

Number SR02471AK

This Certificate issued to: ADS-B Technologies, LLC
900 Merrill Field Drive
Anchorage, Alaska 99501

certifies that the change in the type design for the following product with the limitations and conditions therefore as specified herein meets the airworthiness requirements of Part 27 of the Federal Aviation Regulations.

Original Product — Type Certificate Number / Make / Model: *Refer to FAA Approved Model List (AML), Number SR02471AK, dated February 16, 2016, or later FAA approved revision, for airplane makes and models, corresponding Type Certificate numbers, and applicable airworthiness regulations.

Description of Type Design Change:
Installation of the L-3 Communications NGT -9000/9000R ADS-B System in accordance with Lynx NGT -9000 and CP2500 Rotorcraft Installation Manual, L3-89-IM, Revision 0, dated December 2, 2015, or later FAA approved revision.

Limitations and Conditions:
1) The installer must determine whether this design change is compatible with previously approved modifications.
2) If the holder agrees to permit another person to use this Certificate to alter the product, the holder shall give the other person written evidence of that permission.
3) Installation requires prior FAA approved antenna installation for Global Positioning antenna, Universal Access Transceiver antenna and 1090 megahertz antenna.
4) Rotorcraft Flight Manual Supplement or Supplemental Flight Manuals, L3-89-RFMS1, Revision 0, dated February 16, 2016, is required to be carried on the rotorcraft as part of the installation of the NGT-9000 or, L3-89-RFMS2, Revision 0, dated February 16, 2016, is required to be carried on the rotorcraft as part of the installation of the NGT-9000R, or later FAA approved revisions.

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application: August 8, 2015
Date of issuance: February 16, 2016
Date reissued:
Date amended:

By direction of the Administrator
August A. Asay (Signature)
August A. Asay
Manager, Anchorage Aircraft Certification Office
(Title)

Any alteration of this certificate is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both.

FAA Form 8110-2(10-68) Page 1 of 2 This certificate may be transferred in accordance with FAR 21.47.

NXT Transponders
NextGen Transponder

NextGen Transponder Solutions for ADS-B

NXT-600

“RCZ” Form-factor

NXT-700

2MCU Form-factor

NXT-800

4MCU Form-factor

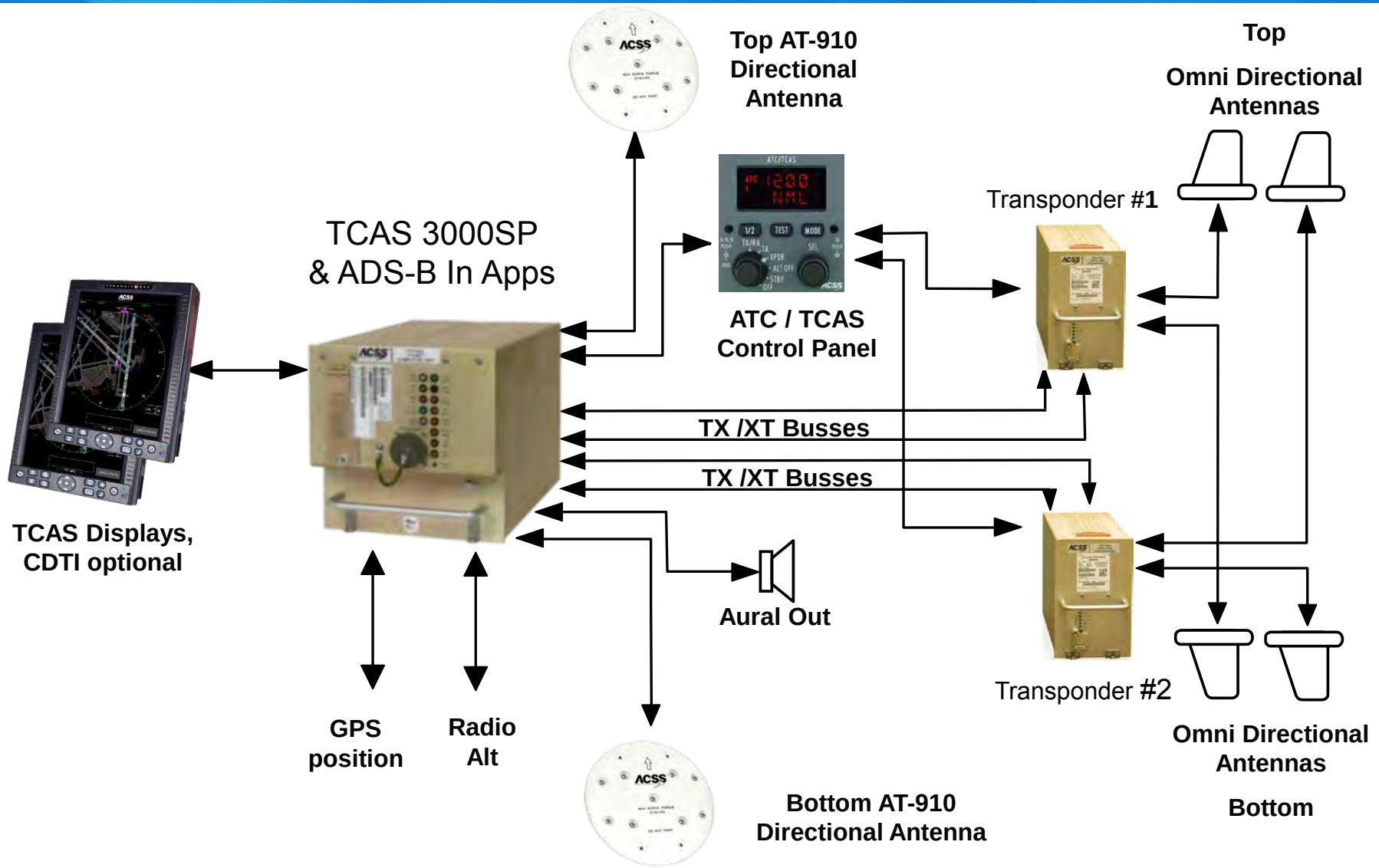
NXT Transponders

- **NXT-600/700/800 NextGen Transponders**
  - **DO-260B and DO-181E (EASA) Compliant – meets global ADS-B mandate**
  - **TSO-C112d (Mode S ES transponder)**
  - **TSO-C166b (ADS-B Out)**
  - **Elementary Surveillance (ELS) and Enhanced Surveillance (EHS) compliant**
  - **Datalink functionality for Downlink of Aircraft Parameters (DAPs)**
  - **DC or AC (NXT-800 only)**
  - **Compatible with all ARINC 735B/735A/735 TCAS II systems**
    - **including ACSS TCAS 3000SP, TCAS 2000, T^2CAS, T^3CAS**

Next Gen: ADS-B
DF17 Extended Squitters

- **DF17 Extended Squitter Reports:**
  1. **Airborne Position (BDS 0,5)**
  2. **Surface Position (BDS 0,6)**
  3. **Extended Squitter Status (BDS 0,7)**
  4. **Identity and Category (BDS 0,8)**
  5. **Airborne Velocity (BDS 0,9)**
  6. **Emergency/Priority Status (BDS 6,1)**
  7. **Target State and Status (BDS 6,2)**
  8. **Aircraft Operational Status, Airborne (BDS 6,5)**
  9. **Aircraft Operational Status, Surface (BDS 6,5).**

Top level Architecture Dual Mode S



NXT-600 Transponder

- Form factor replacement for legacy RCZ-852
- Compliant to EASA/FAA 2020 DO-260B Mandate
  - Next generation based on RCZ-852 predecessor form fit,
    - Over 1500 RCZ Units sold
  - Highest level of DO-260B Out (A3)
  - DO-181E, DO-260B, A718A-4 compliant
- Elementary & Enhanced Surveillance
- Interfaces with all ARINC standard TCAS II
- Commercial Mode S Transponder
- Onboard maintenance system interface
- Software upgradeable via front panel RJ-45
- Available as stand-alone product
- *FWD* Fit on ATR and Q-400 Aircraft

RCZ-852

NXT 600

NXT-700

- *Designed to be a form-fit replacement for the MST-67A*
  - *¼ ATR short form*
  - *Operator can utilize existing tray*
  - *Compatible with current retrofit TCAS II, 7.1 systems*
  - *Can use existing mounting rack and connectors*
  - *No additional control head required*

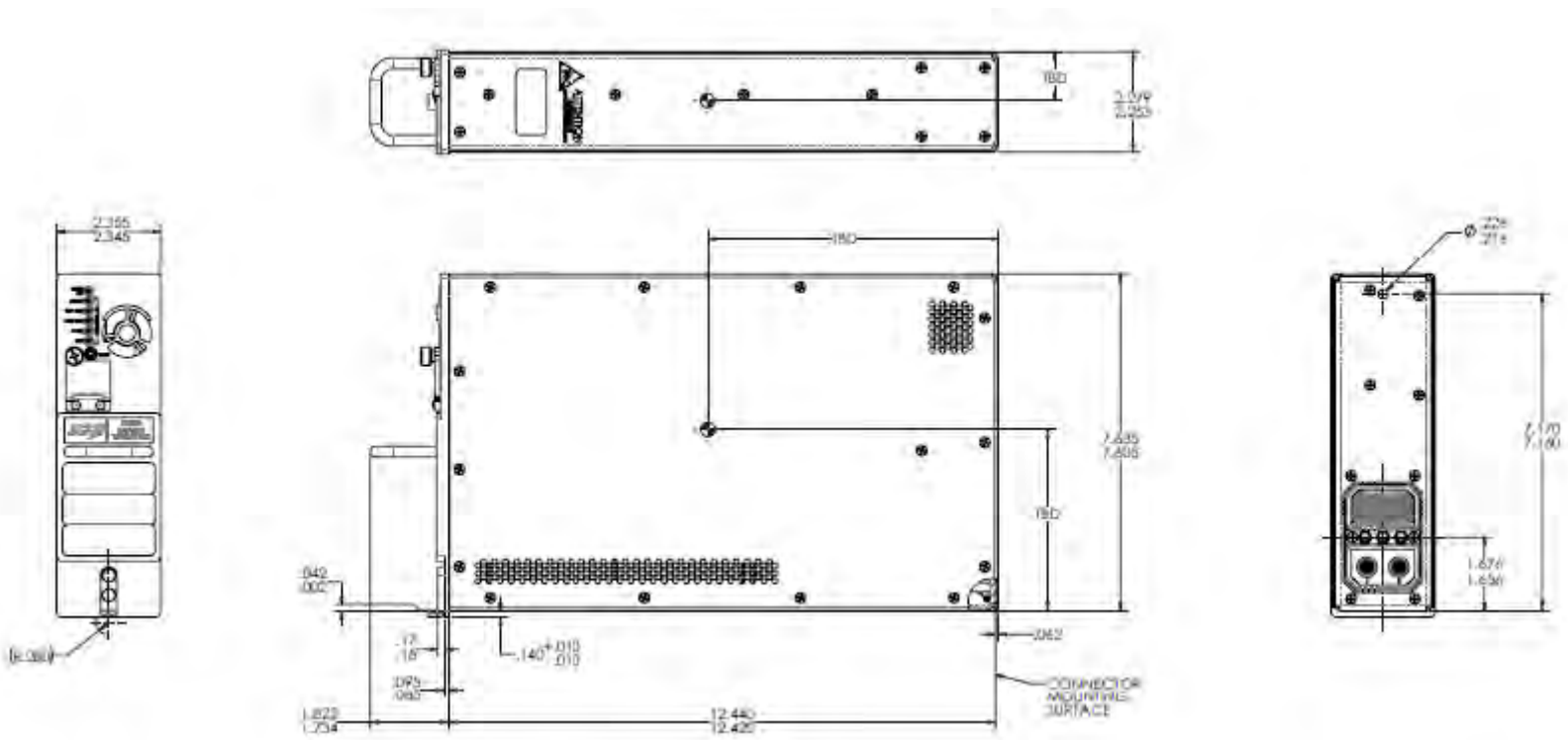
NXT-700

- *Features*
  - *Interfaces with TPU-67A 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*
  - *Interfaces with Rockwell Collins TTR-921, TTR-2100 TCAS II Processors*

NXT-700

- *An approved Model List Supplemental Type Certificate (AML STC) with the FAA, TCCA and EASA will be offered as a certification path.*
- *NXT-700 Compatible Platforms*
  - *Beechcraft Hawker 125-400/600/700, Early Series*
  - *Beechcraft Hawker 400 SP/ (Beechjet), Early 400 Series only*
  - *Bombardier CL601-3A/R*
  - *Dassault Aviation Falcon 50, 20, 900, 900B and Falcon 10*
  - *Gulfstream III and IIB*
  - *Hawker Beechcraft 750/950*
  - *IAI Westwind 1124*
  - *Learjet 35, 36, 35A and 36A*
  - *Textron Aviation Inc. Citation Jet, Ultra, VII and 550*
  - *Others….*

NXT-700: Mechanical Drawing



NXT-700: Mechanical – Mounting Rack

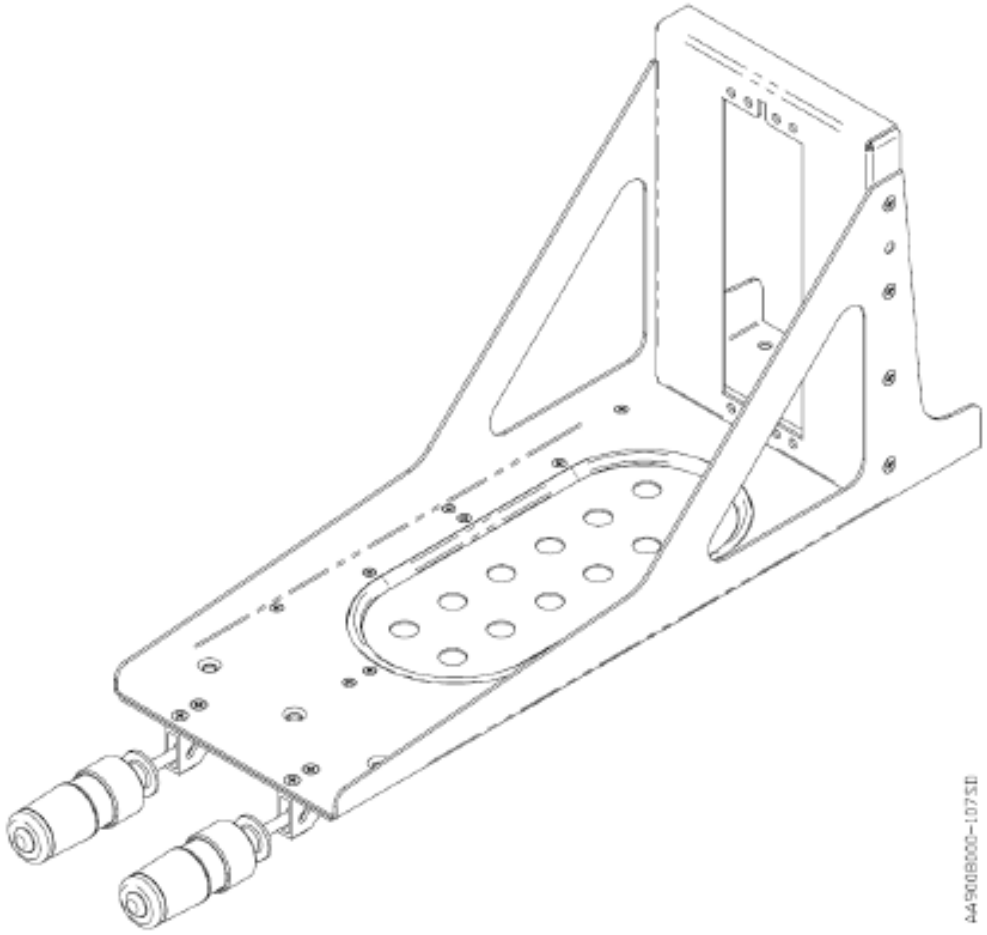
NXT-800 Transponder

- Form factor replacement for legacy XS-950 ATDL
- Compliant to EASA/FAA 2020 DO-260B Mandate
  - Next generation based on XS-950 predecessor,
    - Over 11,000 Units sold
    - First Certified in June 2010 (on XS-950)
  - Highest level of DO-260B Out (A3)
  - DO-181E, DO-260B, A718A-4 compliant
  - NXT-800 TC'd on B737, B767, & B777
- Elementary & Enhanced Surveillance
- Interfaces with all ARINC standard TCAS II
- Commercial Mode S Transponder Onboard maintenance system interface
- Software upgradeable via front panel RJ-45 port
- Available as stand-alone product

ATDL Mode S Level 4/5

NXT 800

NXT-800: Mechanical - Mounting Rack



NXT-600/700/800 Specifics

	NXT-600	NXT-700	NXT-800
PHYSICAL DESCRIPTION			
Size (inches)	3.4 (H) x 4.1 (W) x 14.01 (L)	4.76 (H) x 2.25 (W) x 12.4 (L)	4 MCU
Weight	5.0 lbs.	5.5 lbs.	8.6 lbs. (AC), 7.8 lbs. (DC)
Mounting	MT-600 Mount	ARINC 404A, 1/4 ATR Short	ARINC 600 4 MCU Mount
Cooling	Internal	Internal	ARINC 600 External
CERTIFICATION			
Environmental	DO-160G		
TSO/JTSO	C112d, C166b / C112d		
Software	DO-178B Level B		
Transp. Data Link Capability	ICAO Level 3 (COMM-A/B/C)		
ADS-B Capability	1090ES Extended Squitter per RTCA DO-260B MOPS for 1090 ADS-B Equipment		
Operating Altitude	Sea level to 55,000 feet		
Operating Temperature	-55 to +70 degrees C		
Storage Temperature	-55 to +85 degrees C		
Power	28V DC	28V DC	115VAC, 400Hz or 28V DC
Power Consumption	28 Watts (standby), 55 Watts (maximum)	28 Watts (standby), 55 Watts (maximum)	40 Watts (standby), 85 Watts (maximum)
No. of Antenna Ports	2 (diversity)		
INTERFACES			
Controller	Low speed ARINC 429		
TCAS II	High speed ARINC 429		
GPS	High or low speed ARINC 429		
Altimeter	ARINC 429/575 (digital air data)		
Flight Identifier	Various		
Maintenance Computer	Low speed ARINC 429		
WebEDDIT	RS-232		

Control Panel Considerations

Gables
G7130-XX

Item	Specification
Dimensions (maximum):	
• Height	2.25 in. (57.2 mm)
• Weight	5.75 in. (146.1 mm)
• Length	5.80 in. (147.3 mm)
Weight (maximum)	2.0 lb (0.907 kg) (Gables units)
Power Requirements:	
• Primary	+28 ± 4 V dc, 0.25 A maximum current
• Lighting	5 V, 400 Hz, 2.3 A maximum
Mating Connectors:	
• J1	M83723/75R16247 or equivalent
• J2 (Dual Mode S transponder Version)	M83723/75R16248 or equivalent
Mounting	Unit Dzus Fasteners

Control Panel: G7624

SPECIFICATIONS		
PHYSICAL		
Unit Dimensions	Refer to Outline Dimensions, Figure 201	
Weight	1.1 lbs (0.50 Kg) maximum	
Mounting	Two modified round allen keyed mounting screws, washers, and hex nuts	
Color	*Front Panel	Black, Fed. Std. 595b color 37038 Gray, Fed. Std. 595b color 36118
	*Pushbutton Keys	Black, Fed. Std. 595b color 37038 Gray, Fed. Std. 595b color 36118
	*Mode Select Rotary Knob	Black, Fed. Std. 595b color 37038 Gray, Fed. Std. 595b color 36118
	*Knobstack	Black, Fed. Std. 595b color 37038 Gray, Fed. Std. 595b color 36118
Front Panel Display (LCD)	*2 row Twisted Nematic	Backlighting - White Amber NVIS
Panel Lighting	GEI Lighting Spec. Document A40810	
Temperature	Operating	-20° C to + 70° C
	Storage	-55° C to +85° C
Cooling	No special requirements	
ELECTRICAL		
Power Requirements	Control Panel, Annunciators, LCD Backlighting, Light Plate	28 Vdc @ 7 Watts (maximum)
SYSTEM		
ARINC 429	Mark 33 Digital Information Transfer System (DITS)	
ARINC 532D	Air Traffic Control Transponder	
ARINC 572-1	Mark 2 Air Traffic Control Transponder	
ARINC 718	Mark 4 Air Traffic Controller Transponder (Mode-S/ATCRBS)	
ARINC 720	Digital Frequency/Function Selection	
ARINC 735	TCAS	

ADS-B Position Source

What about a rule-compliant GPS position source for my NXT ADS-B transponder??

…we've got that covered also!!

LYNX MULTILINK SURVEILLANCE SYSTEM

NXG-900

L3 Aviation Products

WAAS/SBAS Compliant GPS Source w/978 MHz UAT ADS-B IN

Why use the NXG-900?

- **Inexpensive rule-compliant GPS position source solution for the NXT NextGen Mode S transponders**
- **No need to upgrade FMS for ADS-B compliance**

NXG-900 Specifications

- TSO-C145c, C154c, C157a
- Meets requirements of AC20-138D and AC20-165B
- Designed to be paired with the NXT line of transponders
- Sends GPS position, velocity, time and integrity information to NXT transponder via ARINC 429
- Contains 978Mhz UAT ADS-B IN receiver for FIS-B subscription free weather
- Wi-Fi interface to tablet computer for displaying FIS-B weather products

Other DO-260B GPS Solutions

- CMC
  - CMA-5024 GPS/SBAS Receivers
- Rockwell Collins
  - GPS-4000
- FreeFlight
  - 1201
  - 1203C
  - 1204

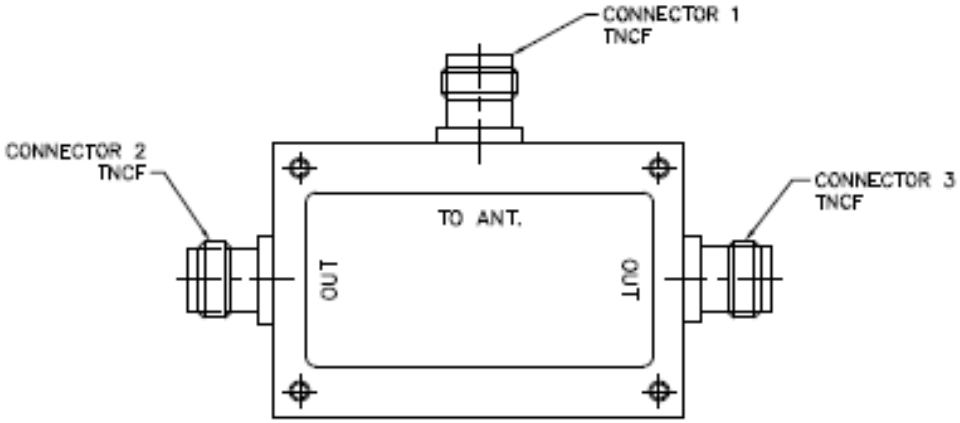
Installation Approvals

- **AML STCs are in work for both the NXT-600 and 700 with the NXG-900 as the position source, as well as the previously mentioned GPS sources**

GPS Splitter/Coupler

- **Eliminates adding multiple GPS antennas for dual transponder systems**
- **STC Approved**

GPS Networking GPS Splitter p/n LDCBS1X2-N



AeroAntenna Technology Inc.
PD20RG GPS Coupler


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.
  - Changes the current TCAS II aural warning from "Adjust Vertical Speed, Adjust" to "Level Off, Level Off."
  - 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

CPDLC Data Recording Requirements

- When is data link recording required?
  - EASA
    - Airplanes first issued with an individual certificate of airworthiness (C of A) on or after April 8th, 2014 that have the capability to operate data link communications and are required to be equipped with a CVR, shall record data link communications on a recorder, as defined by EASA CAT.IDE.A.195
    - Helicopters first issued with an individual certificate of airworthiness (C of A) on or after April 8th, 2014 that have the capability to operate data link communications and are required to be equipped with a CVR, shall record data link communications on a recorder, as defined by EASA CAT.IDE.H.195
    - Rules apply to forward-fit only, no current requirement for retrofit

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

L-3 Recorders on Commercial and BGA Platforms

CUSTOMER	AIRFRAME
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**
SUKHOI	SUPERJET 100

90 Day Under Water Locator Beacons

- L-3 has already implemented the 90 day beacon for Forward Fit Recorder Solutions – conversion kit
  - SB L3AR-001 R1
  - SB FA2100FDR SB024 RB03
  - SB FA2100CVR SB022 R03


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

Garmin Next Gen Solutions

GARMIN®

Special Thanks

Duncan Aviation

Today's Agenda

- Garmin Overview
- Current Garmin Overview
- Garmin Part 25 Solutions
  - New Policy Memo changes
- Questions
- Closing Thoughts

Aviation

Research & Development

Garmin International
Olathe, KS

Garmin AT
Salem, OR

Garmin Corporation
Taipei, Taiwan

Garmin
Chandler, AZ

Garmin DCI
Chanhassen, MN

Garmin
Wichita, KS

GARMIN

Compliance for Garmin Flight Decks

- **G5000**
  - Cessna Citation X+ (FANS 1/A, CPDLC, ADS-B)
  - Cessna Citation Sovereign+ (FANS 1/A, CPDLC, ADS-B)
  - Cessna Citation Latitude (FANS 1/A, CPDLC, ADS-B)
  - Bombardier Learjet 75 (CPDLC, ADS-B)
  - Bombardier Learjet 70 (CPDLC, ADS-B)
  - Beechjet 400A/Hawker 400XP (ADS-B)
- **G3000**
  - Citation CJ3+ (CPDLC, ADS-B)
  - Citation CJ2+ Alpine Edition (CPDLC, ADS-B)
  - Honda HA420 “HondaJet” (CPDLC, ADS-B)
  - Embraer Phenom 300 (CPDLC, ADS-B)
- **G1000**
  - Cessna Citation CJ (ADS-B)
  - Cessna Citation Mustang (ADS-B)
  - Embraer Phenom 100 (ADS-B)
  - Beechcraft King Air C90, B200, B300/350 (ADS-B)

GARMIN

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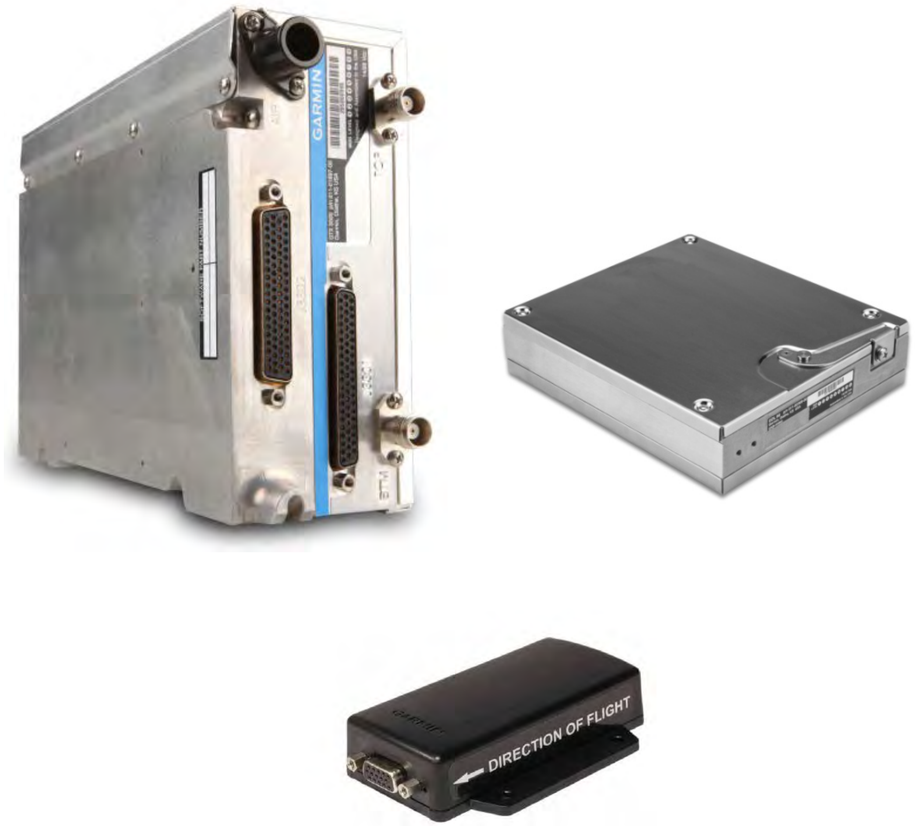
Garmin Part 25 ADS-B Solutions

Program Goals

- Address market need for minimally invasive, lower-cost ADS-B solution for Part 25 aircraft.
- Leverage existing TSO'd/STC'd equipment from Garmin's ADS-B product portfolio.
- Minimize cost and installation time through integration with existing non-Garmin avionics where able.



GARMIN

Garmin Part 25 ADS-B Solutions

Flight Stream 210

- TargetTrend™
- AHRS information
- Safe Taxi
- Nexrad

Garmin Part 25 ADS-B Solutions

- **Gulfstream G150 and G200**
  - Available now from Gulfstream Factory Service Centers
  - Available soon from Duncan Aviation

Garmin Part 25 ADS-B Solutions

- **Hawker 750, 800A/XP, 850/900XP, 1000 (Elliott Aviation)**
  - Certification Complete
  - Collins equipped aircraft are initial certification aircraft, including Pro Line 21
    - Honeywell-equipped aircraft to follow immediately

Garmin Part 25 ADS-B Solutions

- Cessna Citation 550/560 (SPZ-500 only) (Columbia Avionics)
  - STC currently available for non-TCAS II aircraft.
  - STC covers non-Primus aircraft (no Ultra, no Encore)

Garmin Part 25 ADS-B Solutions

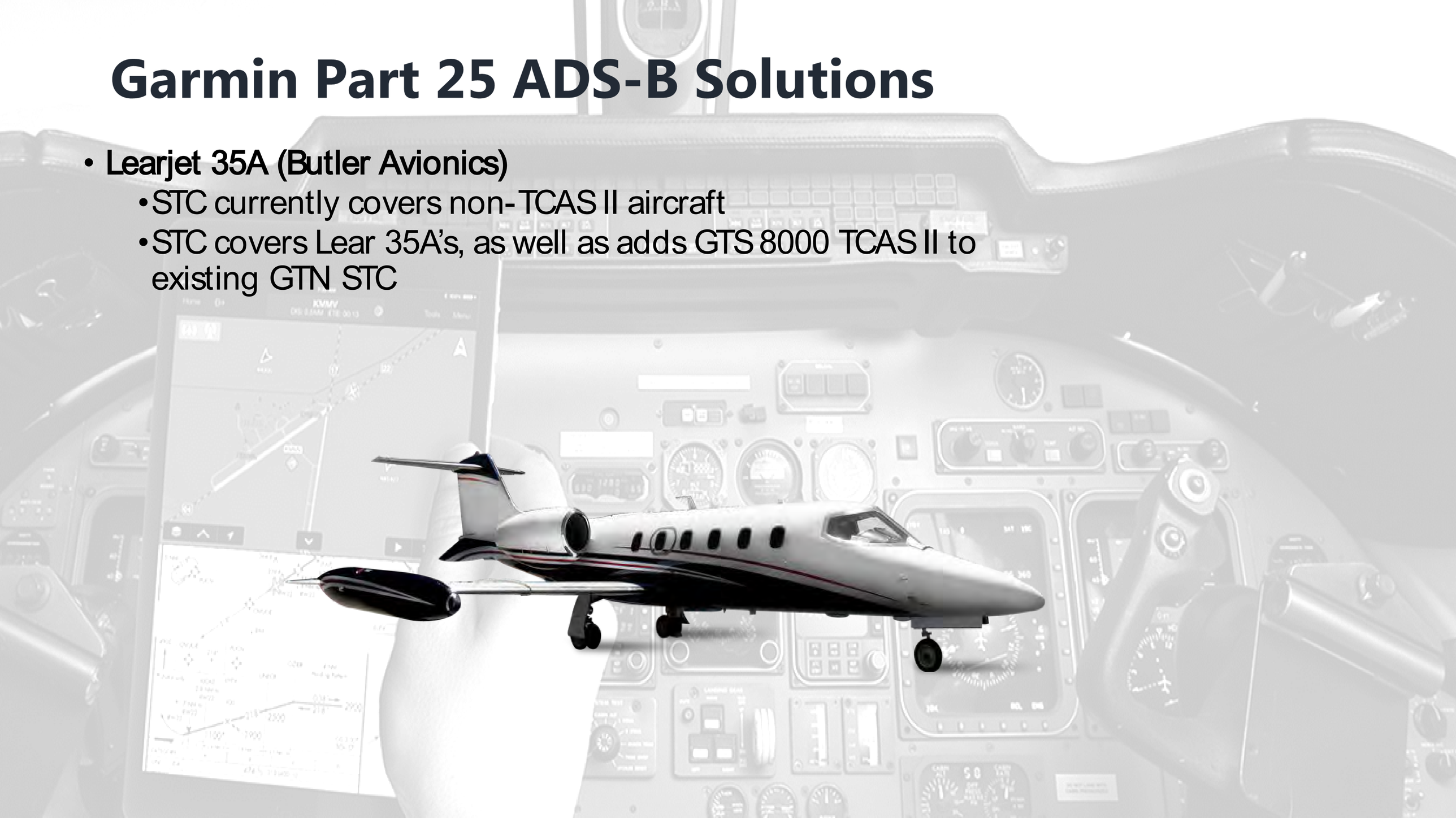
- **Cessna Citation 560XL (Columbia Avionics)**
  - STC currently available for non-TCAS II aircraft.
  - STC covers Primus aircraft
  - GTN 750 GPS NAV COM, GMA-35 audio panel, GDL-69A data link, GTX-3000 transponders and the GTS-855 TCAS I

Garmin Part 25 ADS-B Solutions

- **Learjet 60 (Butler Avionics)**
  - Certification Complete
  - STC covers the Pro Line 4 Lear 60's, no coverage for Lear 60XR's
    - Provisions for Lear 60's with WAAS/LPV upgrade.

Garmin Part 25 ADS-B Solutions

- **Learjet 35A (Butler Avionics)**
  - STC currently covers non-TCAS II aircraft
  - STC covers Lear 35A's, as well as adds GTS 8000 TCAS II to existing GTN STC



Garmin Part 25 ADS-B Solutions

- **Premier I/IA (Elliott Aviation)**
  - Certification expected Q4
  - STC covers both Premier I and I/A aircraft

Garmin Part 25 ADS-B Solutions

Beechjet 400A/Hawker 400XP

- NOW SHIPPING!

Garmin Part 25 ADS-B Solutions NON TCAS II

Southeast Aerospace AML STC

- New GTX 345 STC Pending for **NON-TCAS II**
- Low COST SOULUTION
- **Over 58 aircraft on the AML**

STC AML Models	
Aircraft Make	**Aircraft Model(s)**
Beechcraft Corporation	HS. 125 Series 700A/700B BAe 125 Series 800A/800B Hawker 800/800XP MU-300-10/400/400A/400T
Cessna	650 (Citation III, VI and VII) 500, 550, S550, 552, 560
Dassault Aviation	Fan Jet Falcon (Original and Series C/D/E/F/G) Mystere-Falcon 20 (-C5/-D5/-E5/-F5) Mystere-Falcon 50 Mystere-Falcon 200 Mystere-Falcon 900
Learjet	24, 24A, 24B, 24B-A, 24C, 24D, 24D-A, 24E, 24F, 24F-A, 25, 25A, 25B, 25C, 25D, 25F, 28, 29, 31, 31A, 35, 36, 35A (C-21A), 36A, 55, 55B, 55C

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Garmin Part 25 ADS-B Solutions

Approved Pairings

NOTICE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

N 8900.362

National Policy

Effective Date:
5/9/16

Cancellation Date:
5/9/17

SUBJ: Policy for Installation of ADS-B OUT Systems

Federal Aviation Administration

Memorandum

Date: MAR – 2 2016

To: See Distribution List

From: Margaret Gilligan, Associate Administrator for Aviation Safety, AVS-1
THRU: John S. Duncan, Director, Flight Standards Service, AFS-1
FOR THRU: Dorenda Baker, Director, Aircraft Certification, AIR-1

Prepared by: James Marks, ADS-B Focus Team Lead, AFS-360, (202) 267-1707

Subject: Installation Approval for ADS-B OUT Systems

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Questions?

FlightDeck freedom® and FANS

Andrea Duggan

Satcom Direct

Mid-Atlantic Regional Manager

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Agenda

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

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SD Overview

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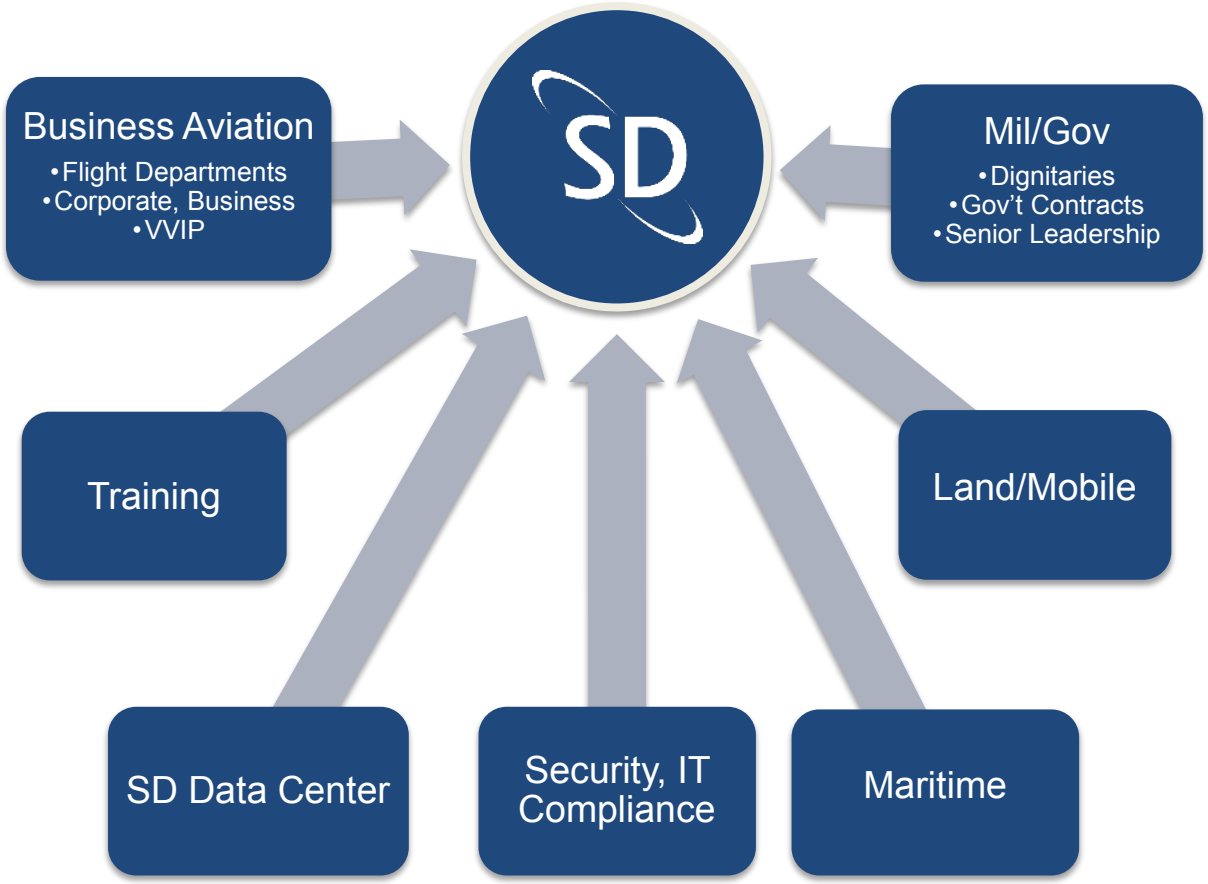
Company Overview

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



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Where We Lead

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

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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	AeroIT Certification and Industry Training

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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

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New Global Headquarters

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

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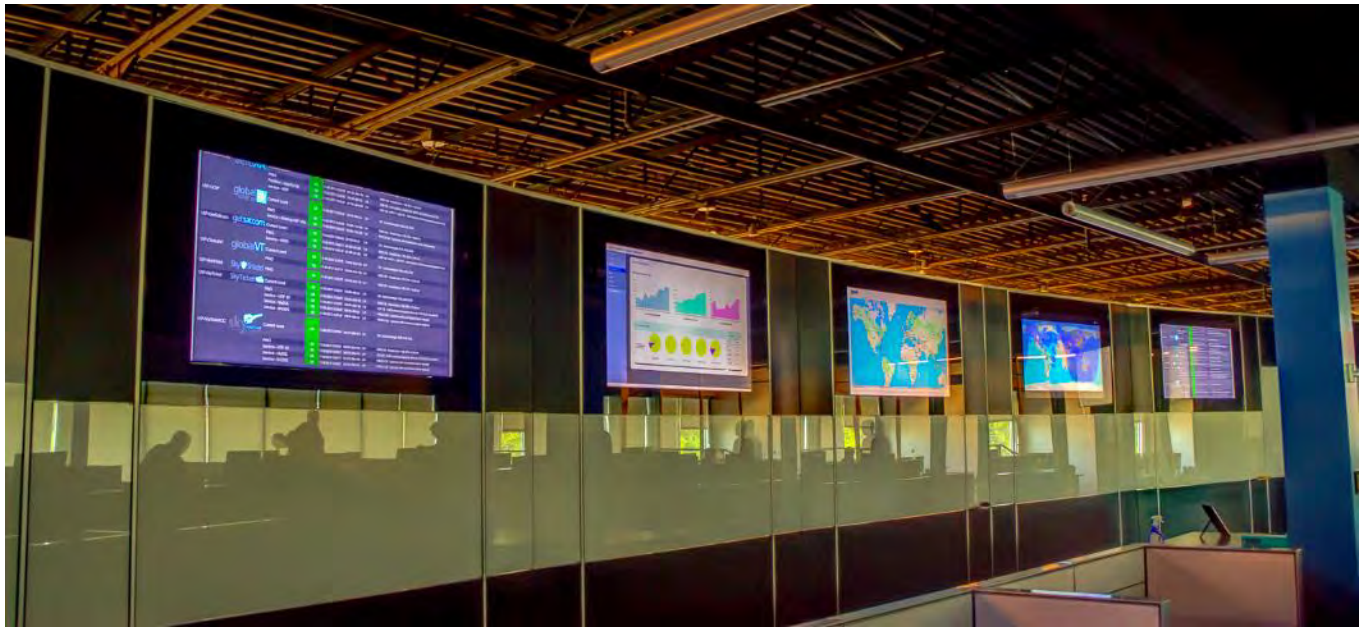
SD Network Operations Center

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



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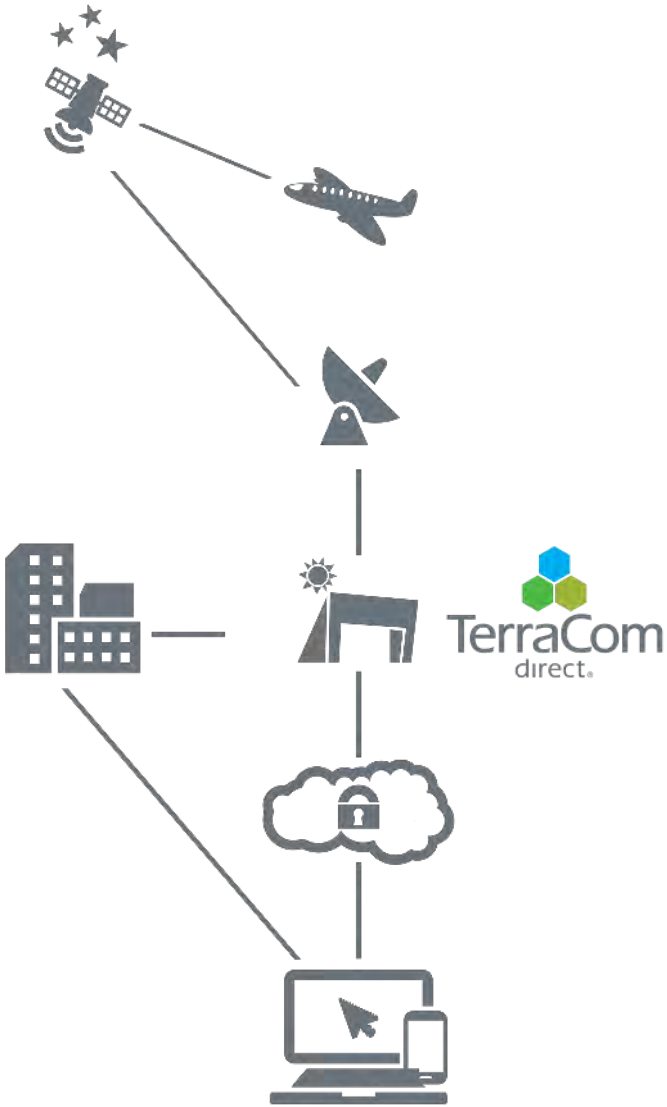
SD Data Center

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



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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

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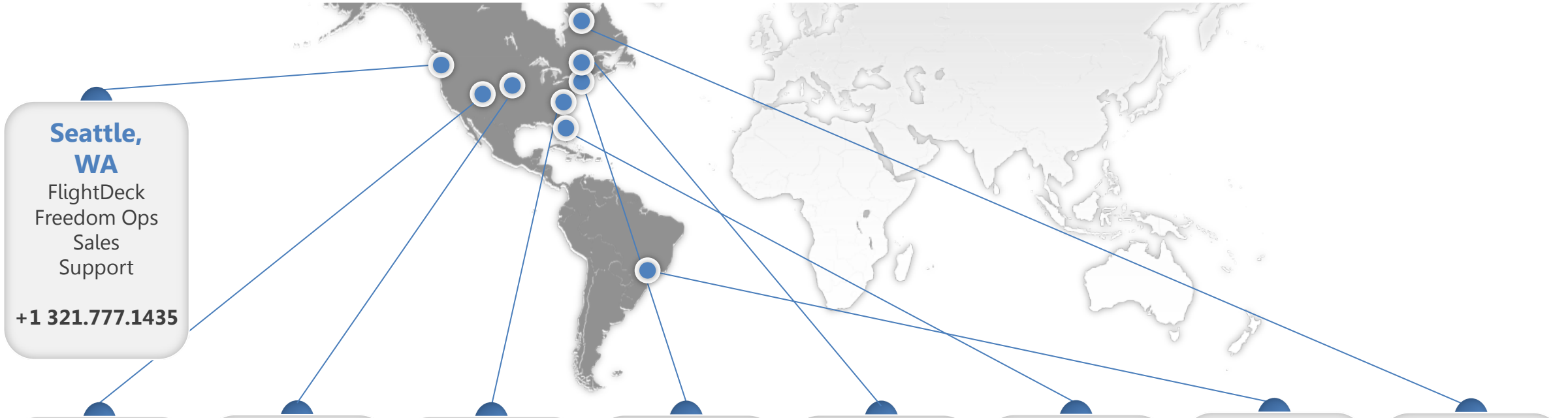
Global Sales, Support and Training – 24/7



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Freedom Ops
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+1 321.777.1435

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Sales
Support
Product Development Center
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Sales
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Savannah, GA
FlightSafety/ Gulfstream Lab
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US Government Contracting
Acct Mgt
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Support
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Training Lab, NOC
SD Store
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Secured Data Ctr.
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FlightDeck freedom®

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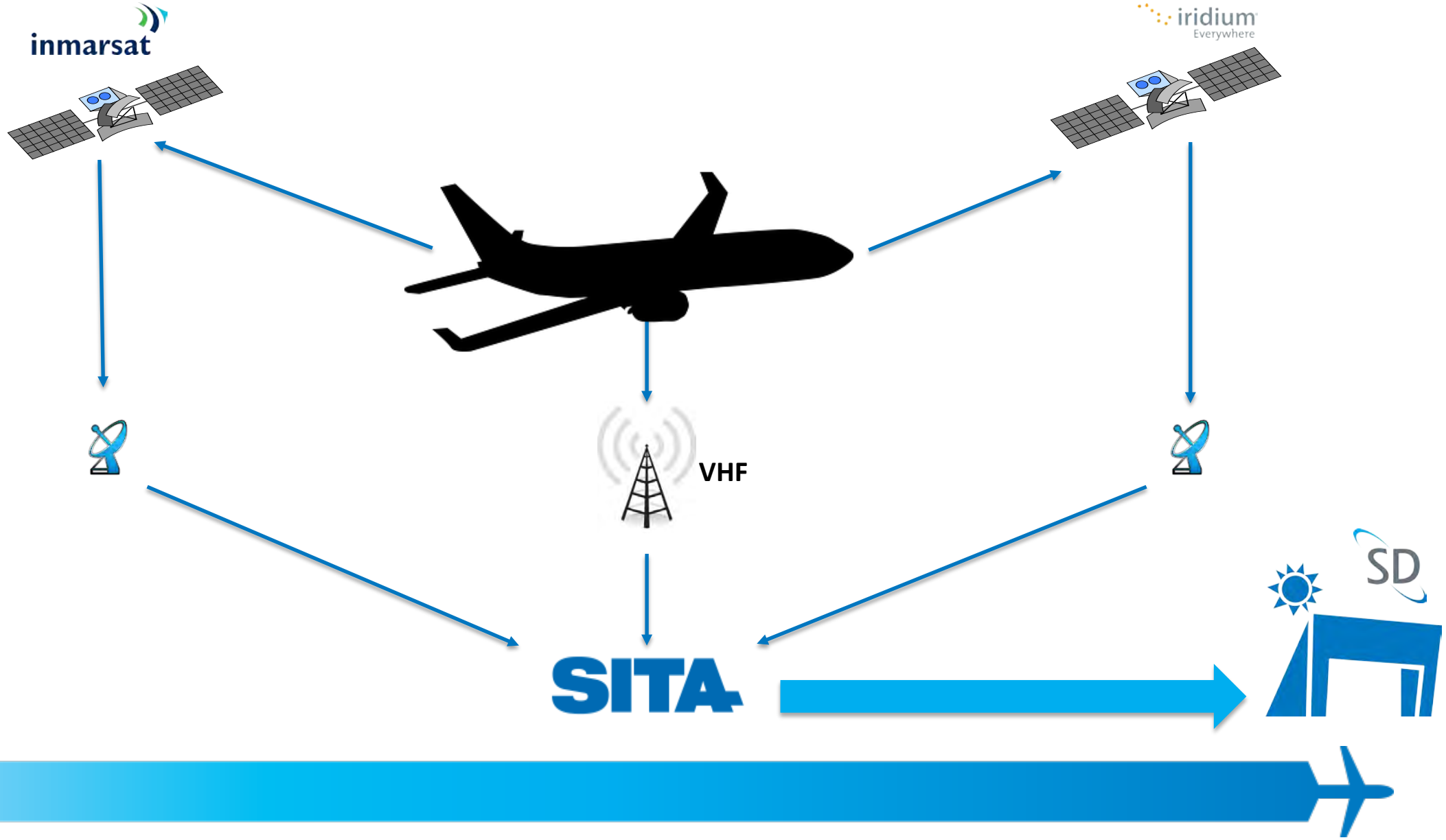
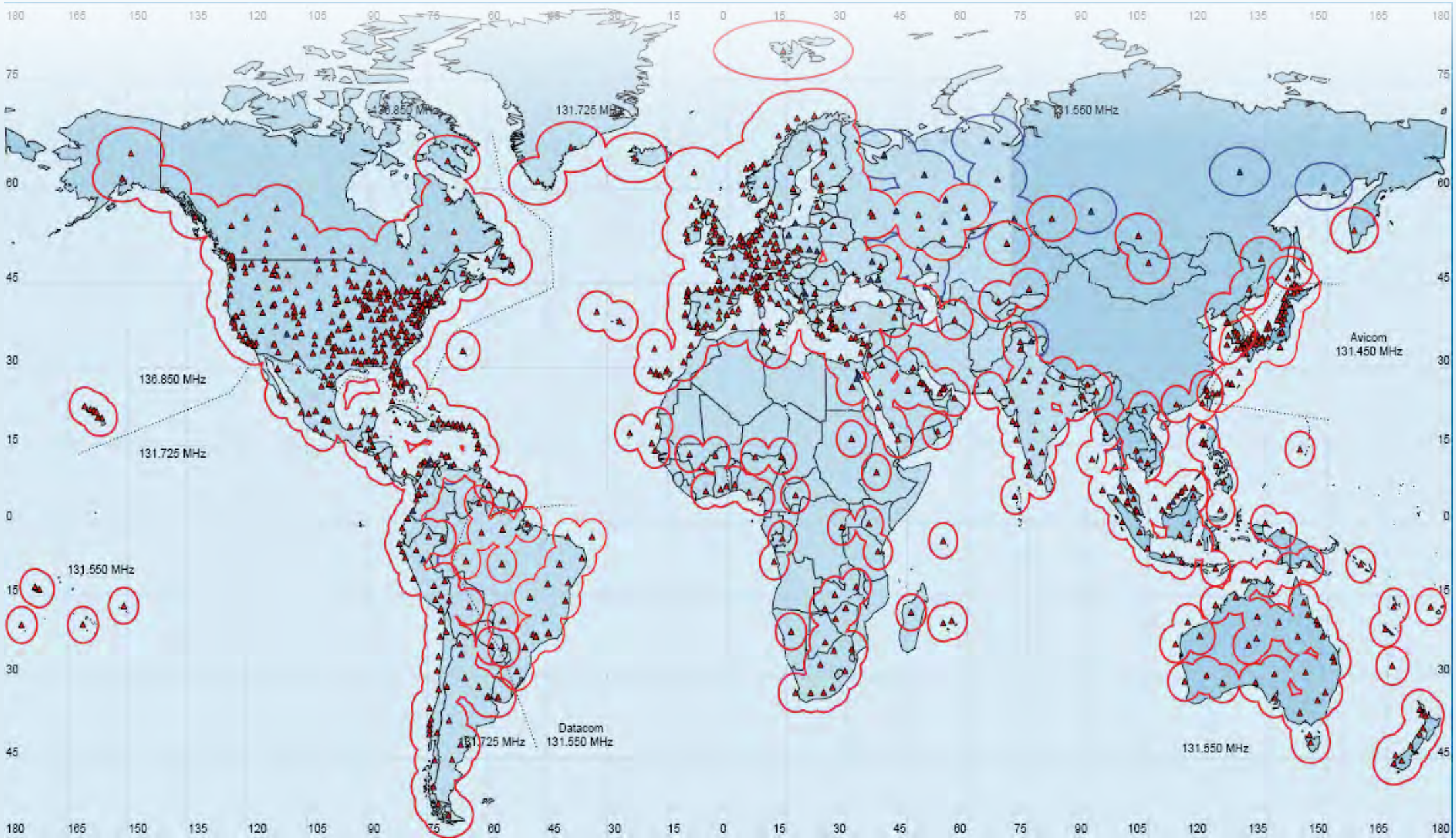
The Datalink Network

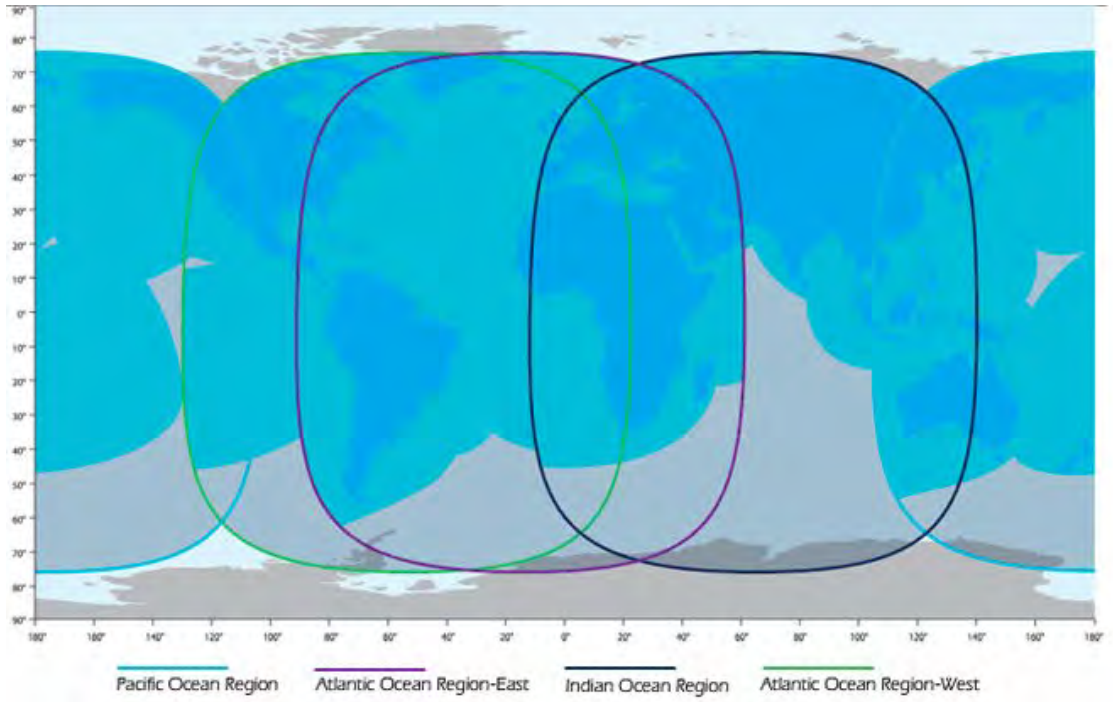


SITA VHF Coverage

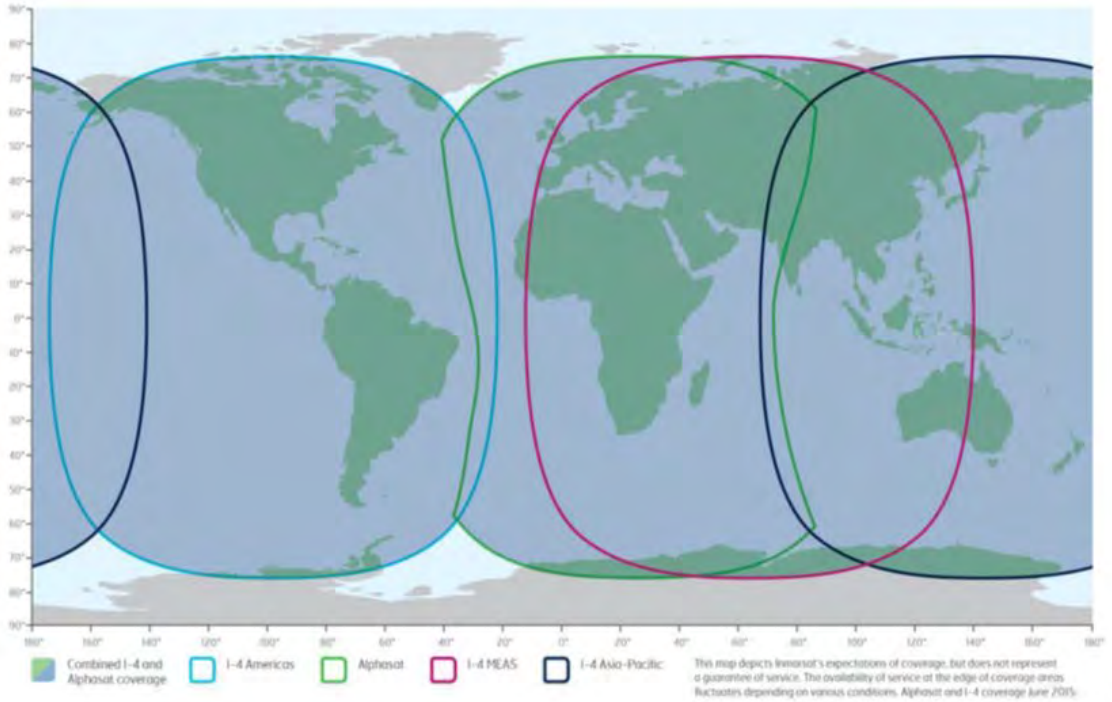


Inmarsat Coverage

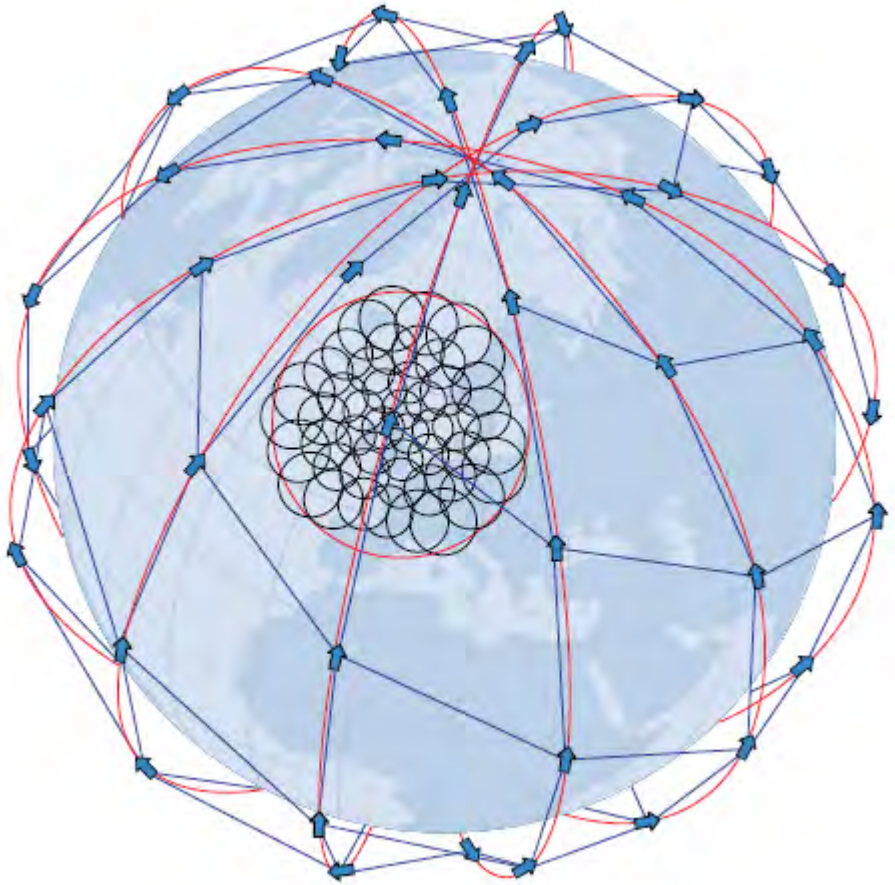
I-3 Coverage



I-4 coverage



Iridium Coverage



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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**

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FDF and FANS

FlightDeck freedom®

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

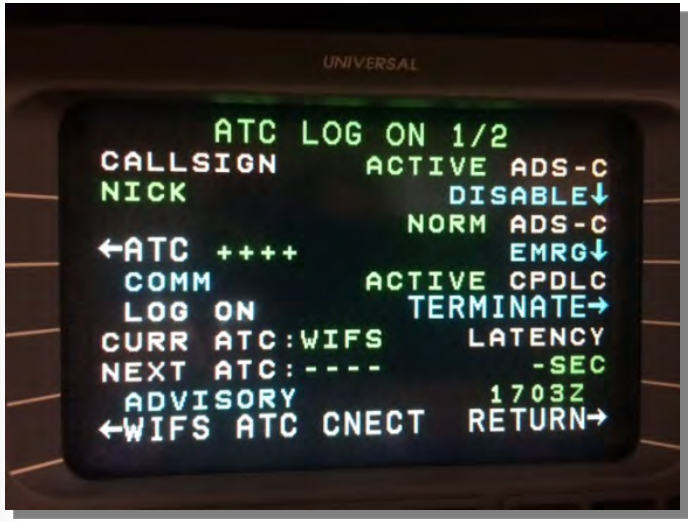
This Technical Information Letter outlines the procedures required to utilize Satcom Direct's FANS test station for the purpose of validating FANS equipment.

Created By

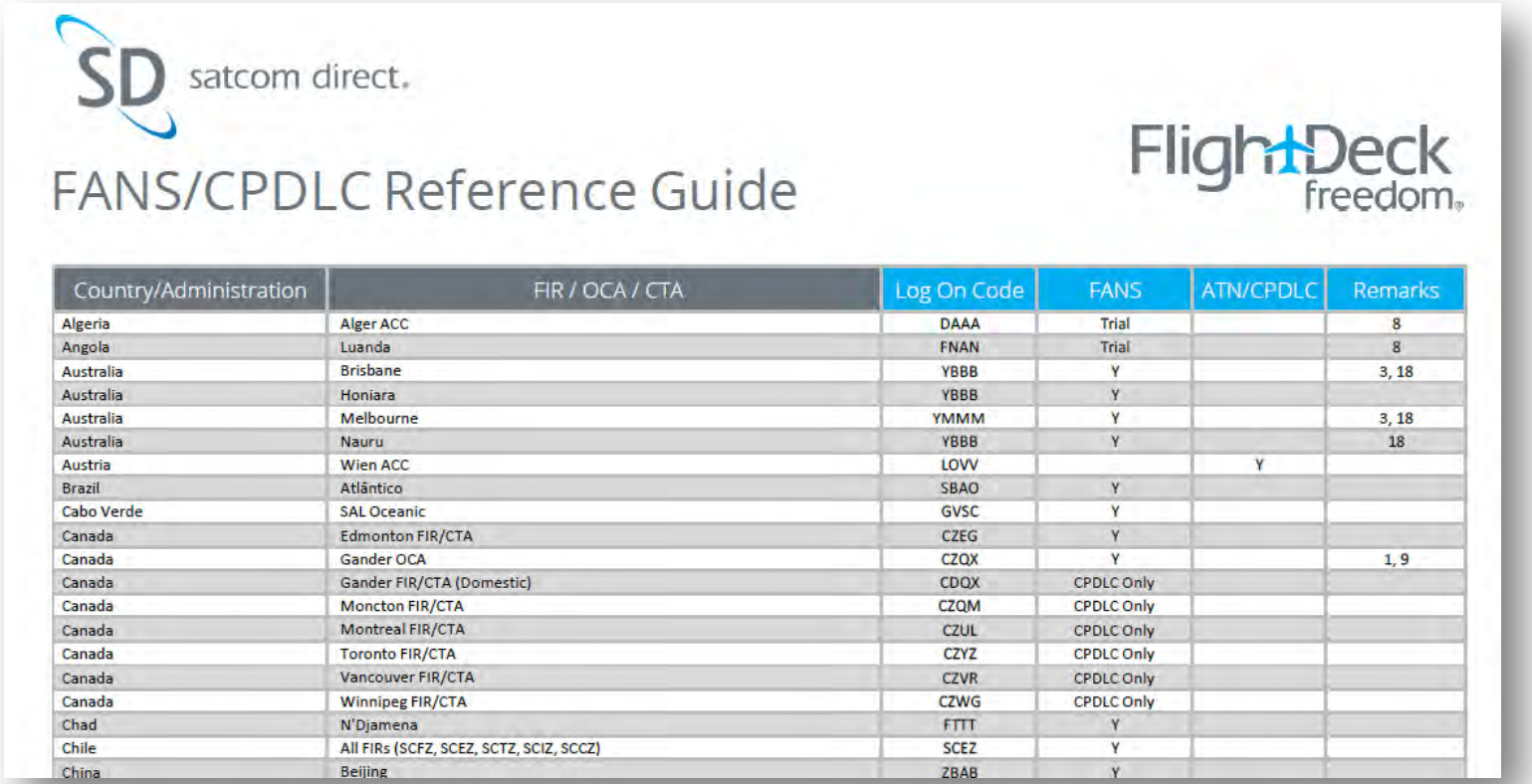
Name	Date
David Buchart	03/10/2015

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.

FANS/CPDLC Reference Guide

FlightDeck freedom

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

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

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	

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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	
Site Operational	

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

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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

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Unique to

FlightDeck freedom®

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Trip Planning and Flight Support Providers

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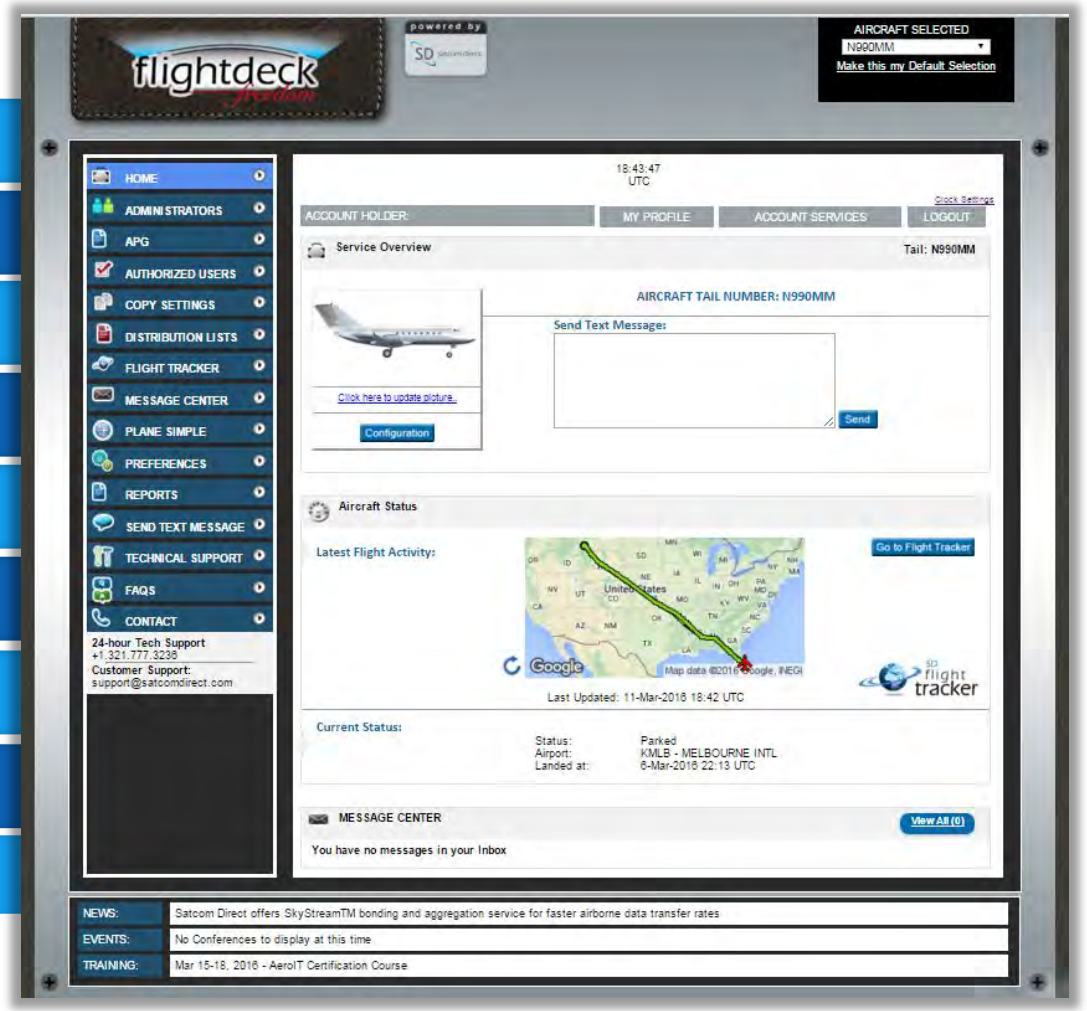
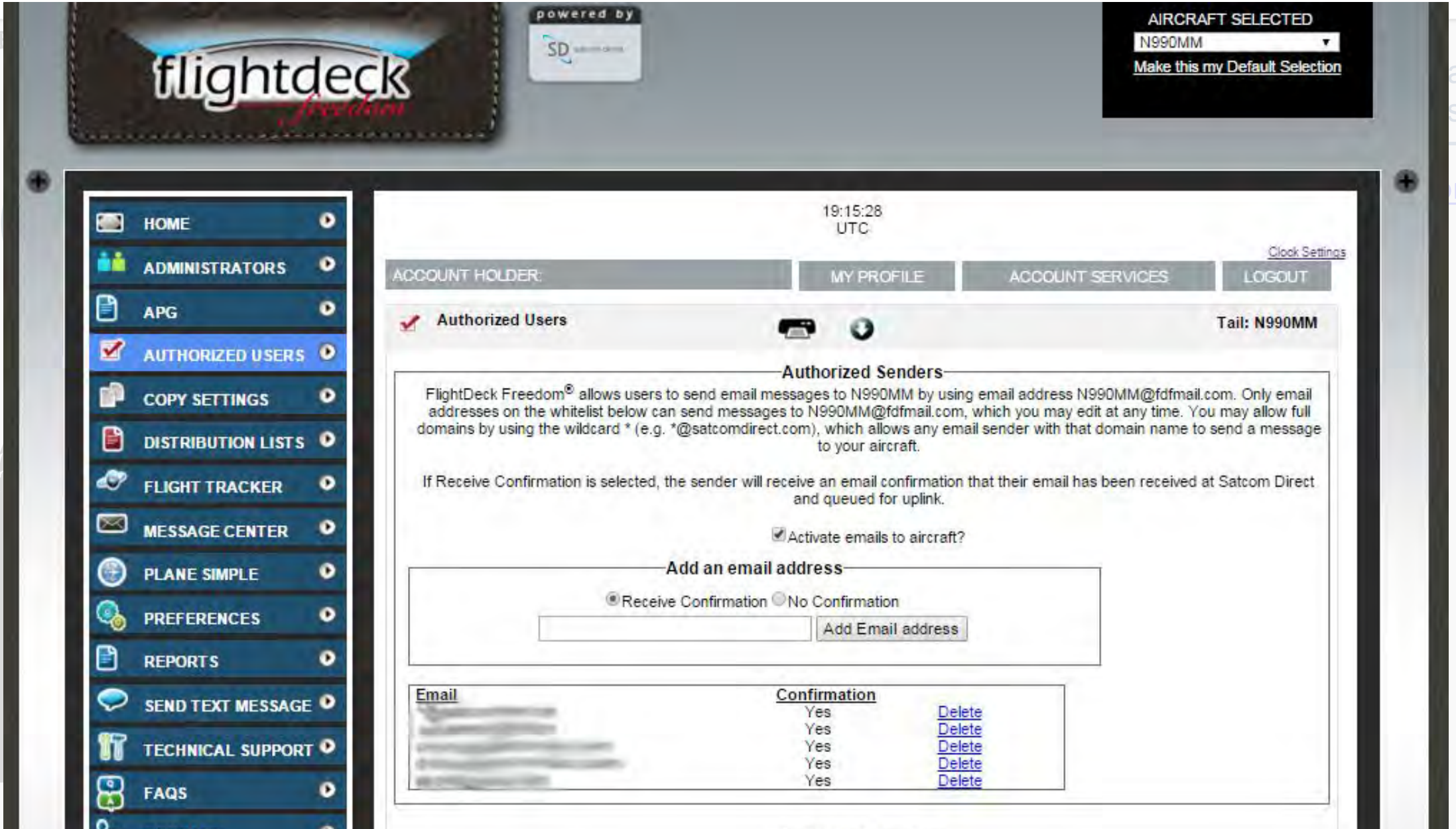
FlightDeck Freedom Portal

- 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

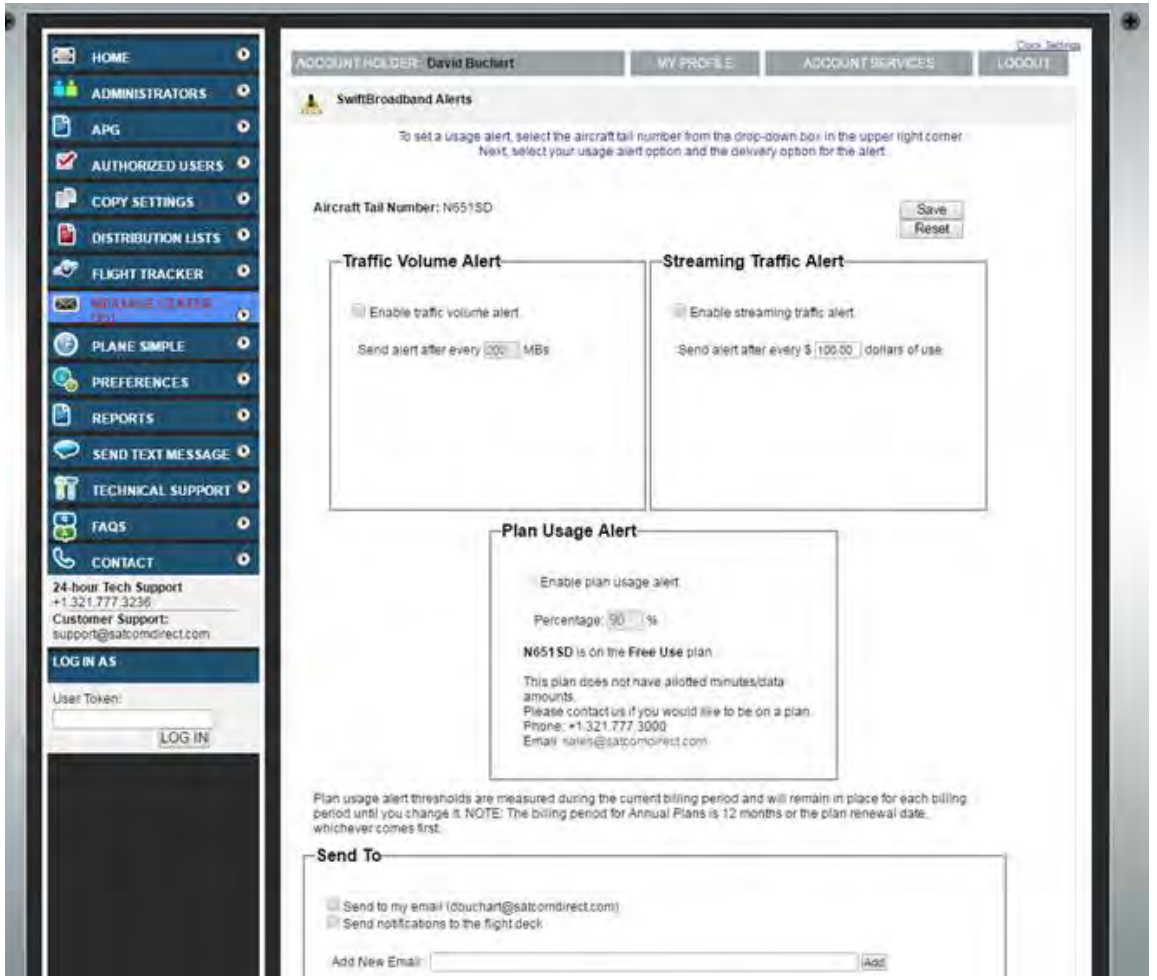
Service Notifications (Planned/Unplanned Outages, Service Impacts)

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

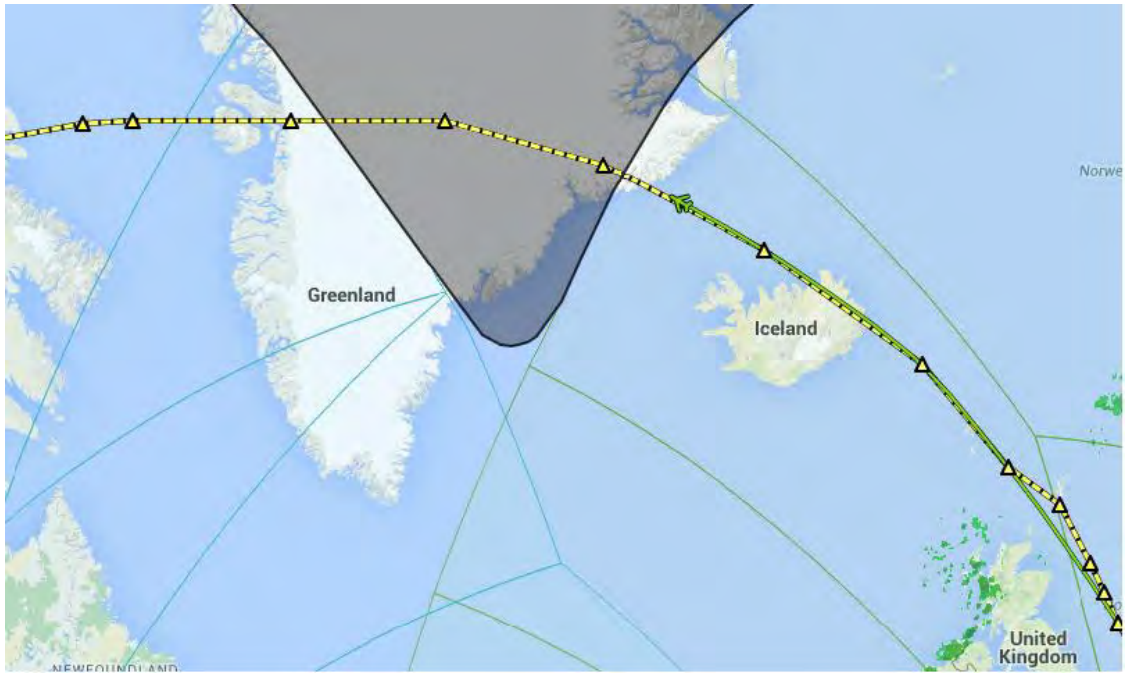


SD GeoServices - GeoFence

- 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.



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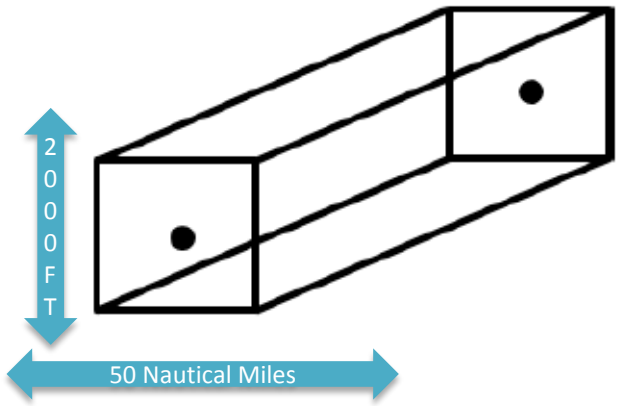
Active GeoFence Alerts

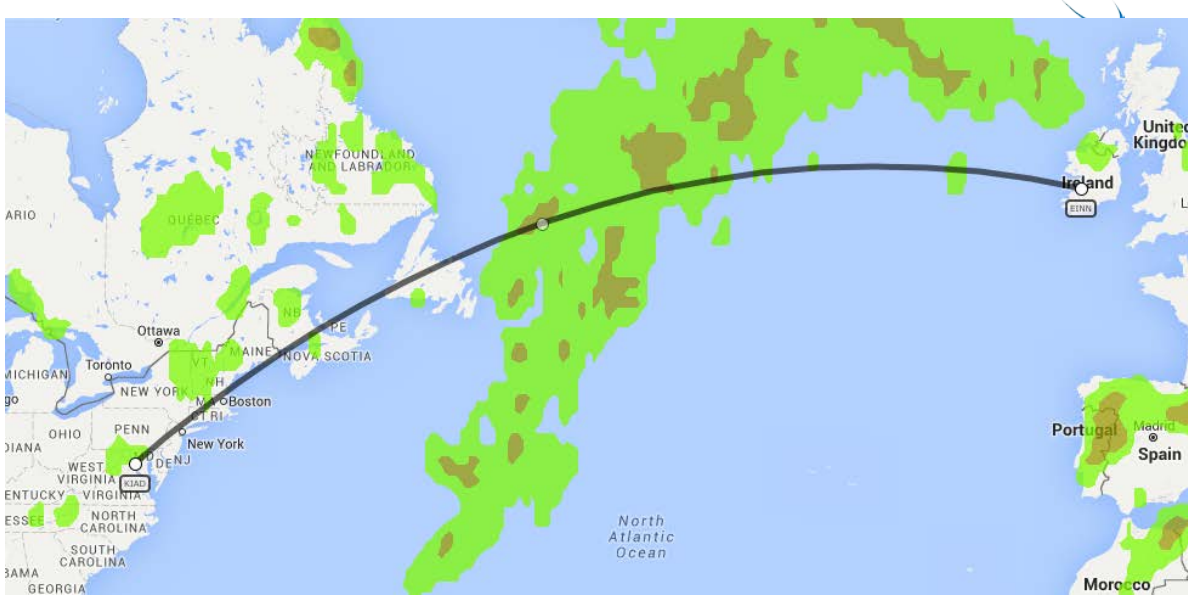
GeoFence	Service Type	Region	Summary
China SAS	SwiftBroadband	China	Alerts SwiftBroadband customers when entering/exiting region where traffic is routed to China access station (SAS)
China VHF	FlightDeck Freedom	China	Alerts select EPIC equipped aircraft of limitations within coverage region
DirecTV 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

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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

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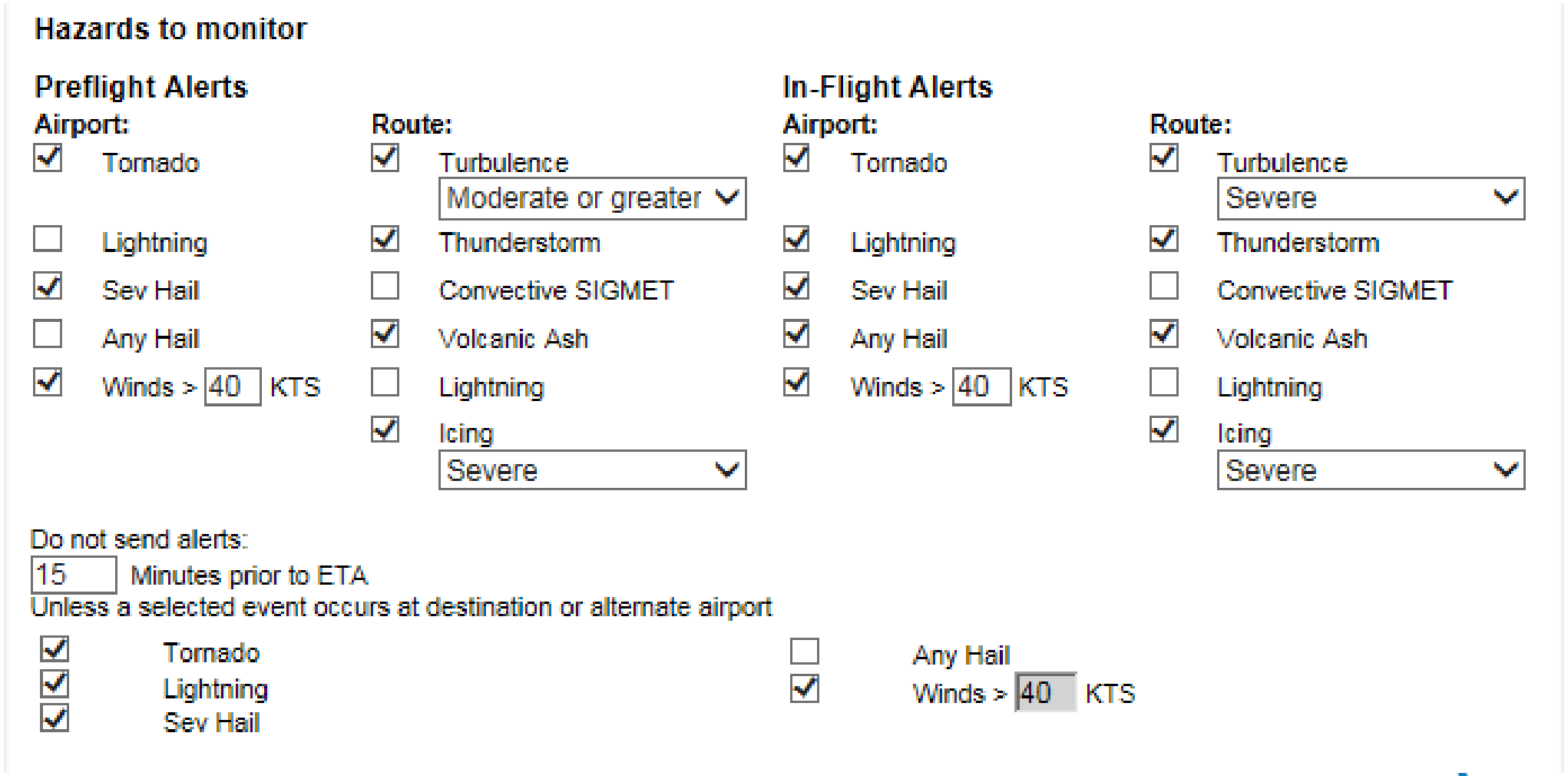
Route Alerts – FDF Portal



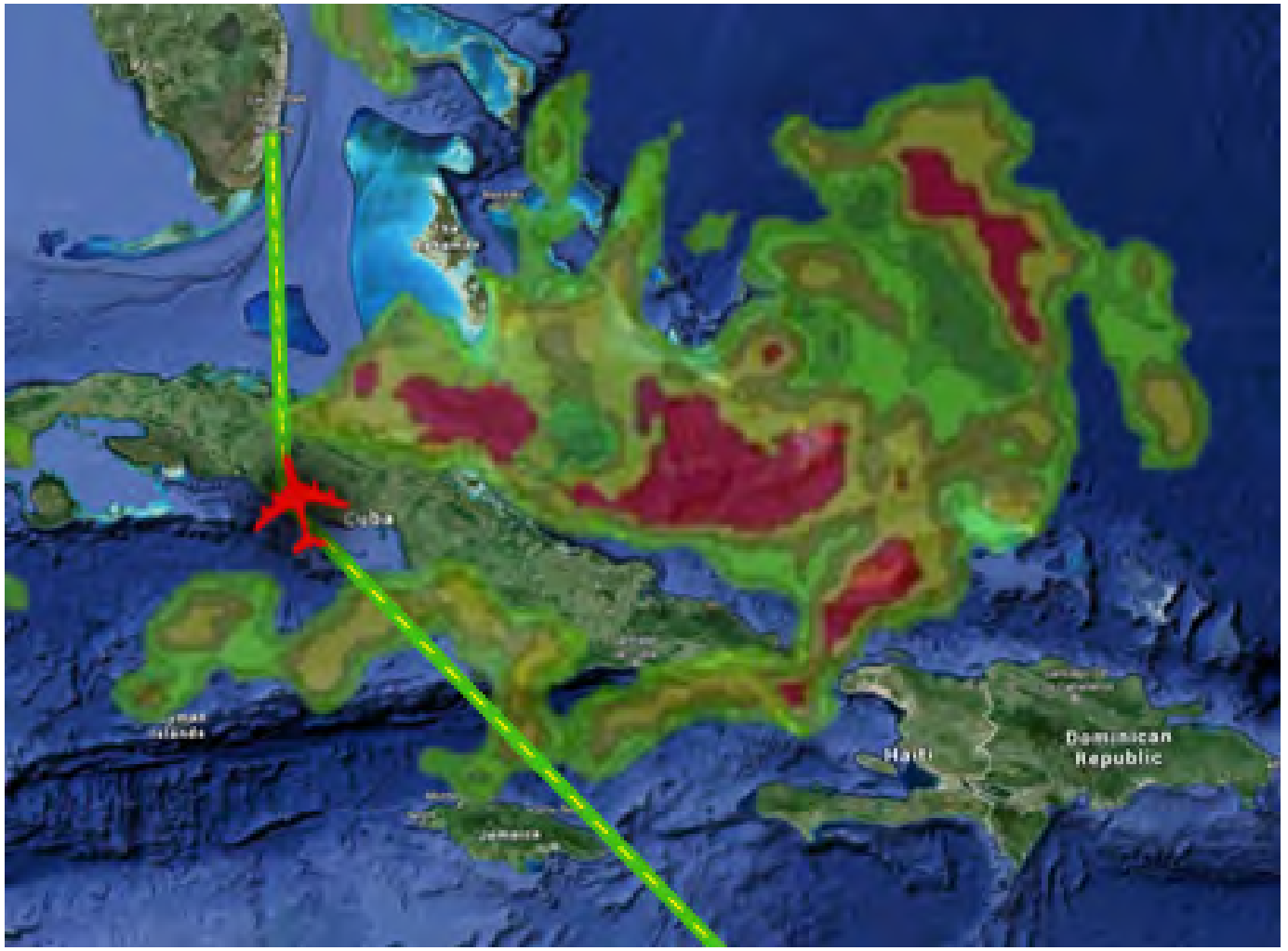
Why SD Route Alerts?

Efficiency

- Passenger Comfort
- Diversion Planning
- Reduce WX deviation.

Safety

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

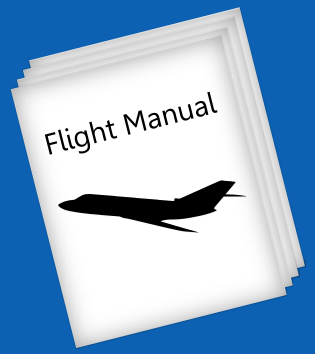


APG & FDF

FlightDeck freedom®

APG

Flight manual performance data



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

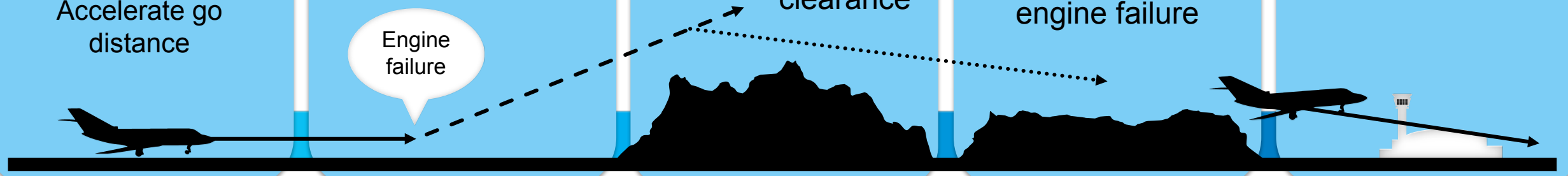
Critical speeds

Engine failure

Obstacle clearance

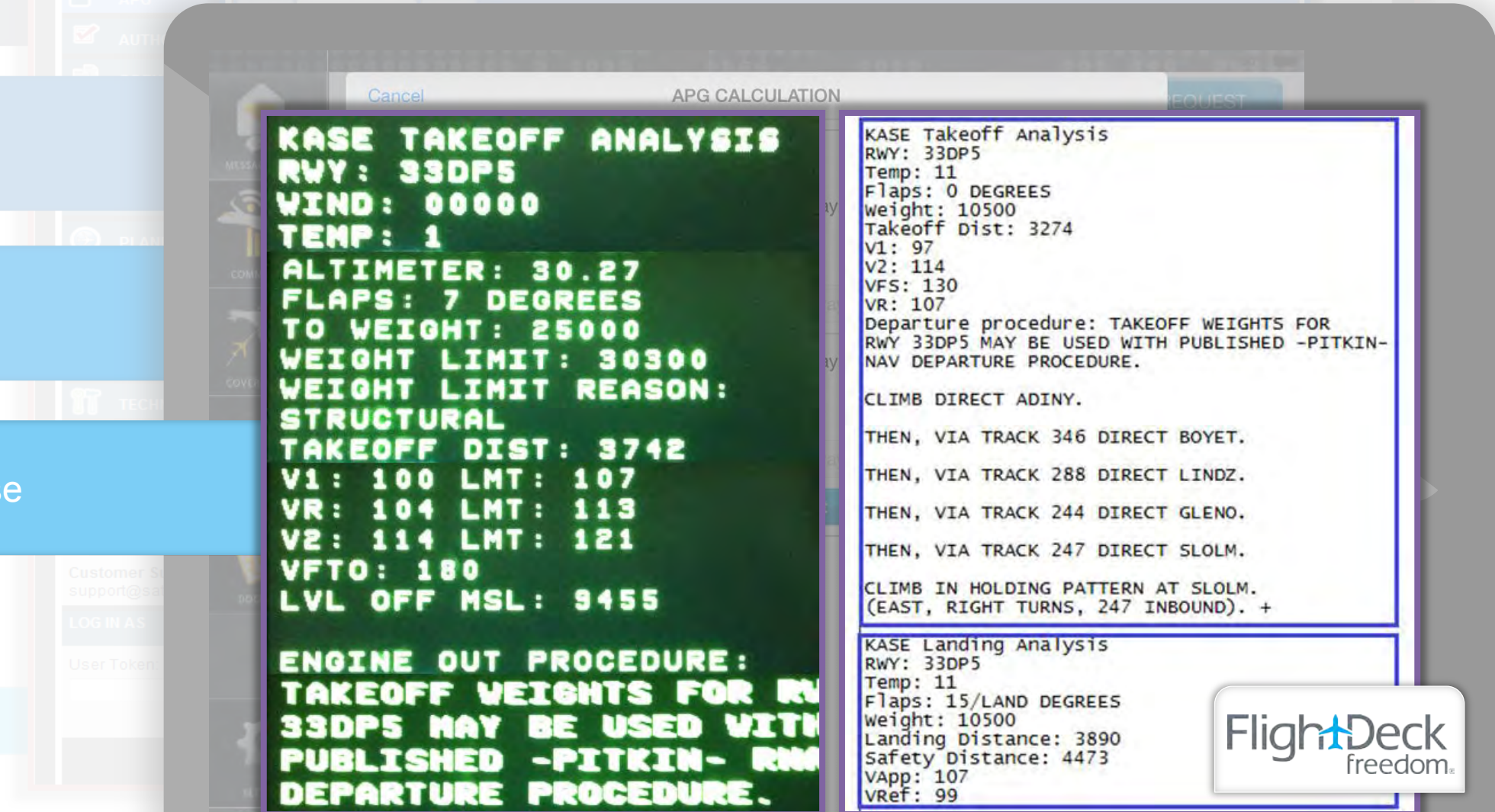
Obstacle clearance with engine failure

Landing distance



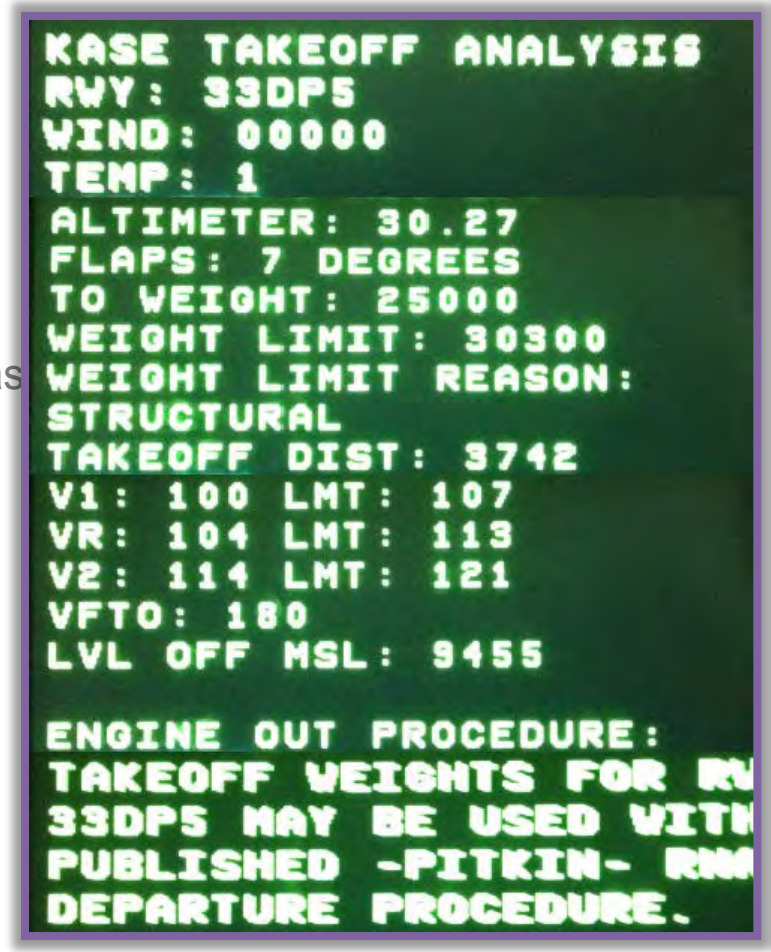
APG

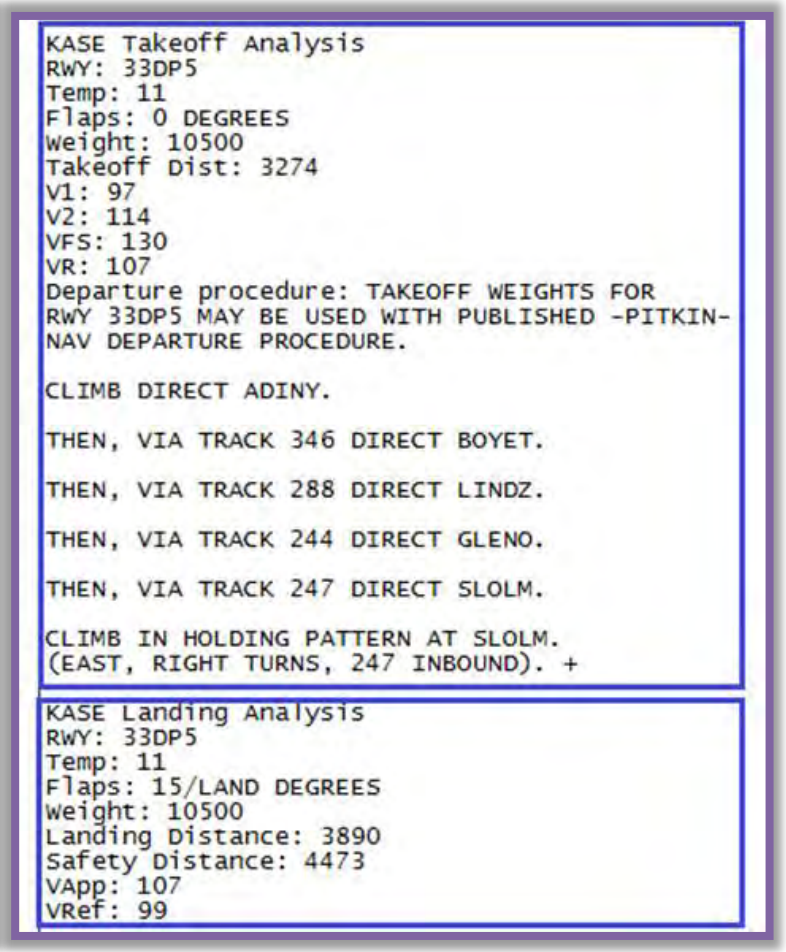
- FDF portal
- APG interface
- iPad interface
- APG request & response



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





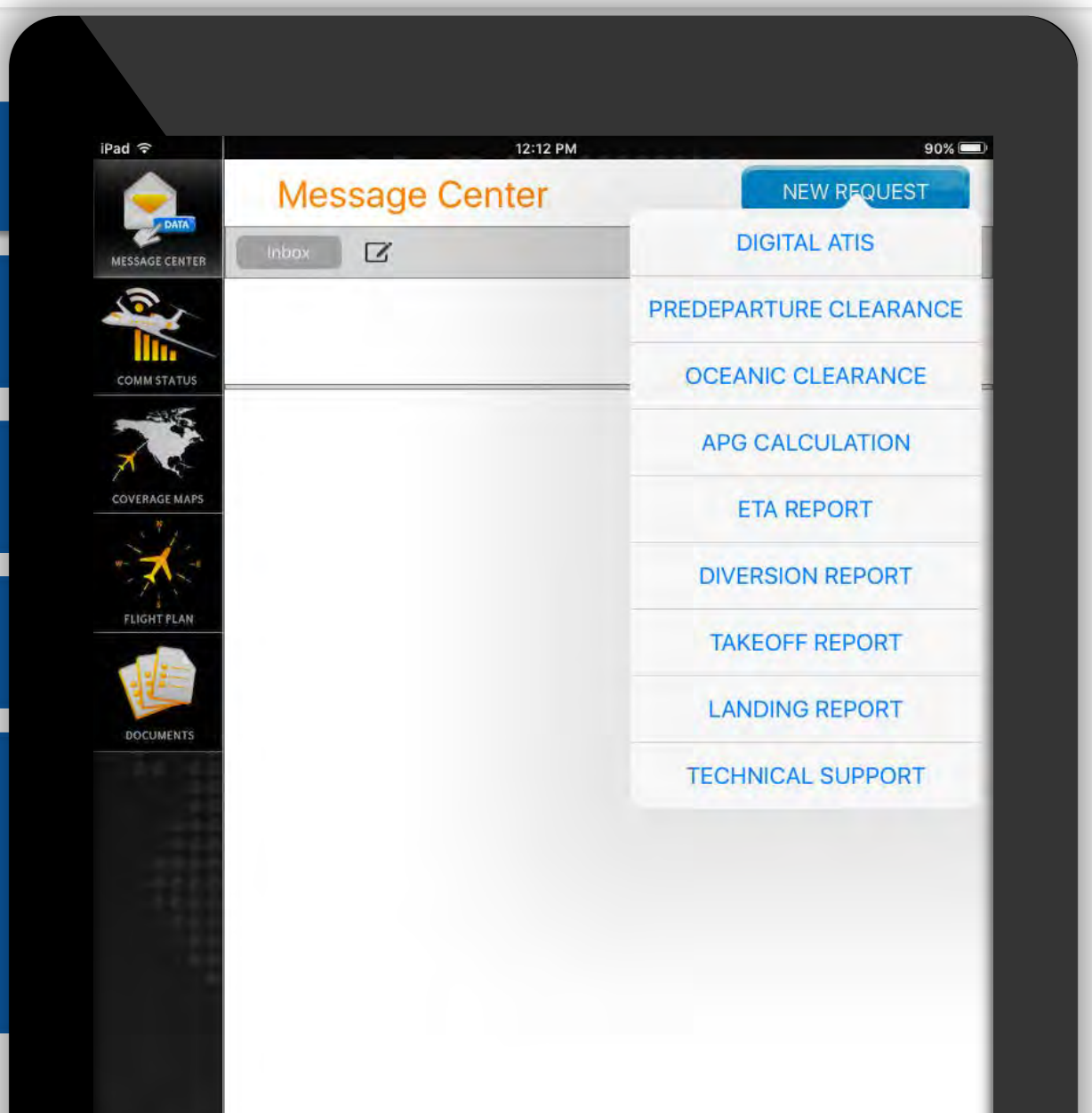
FD360 iPad Application

FlightDeck freedom®

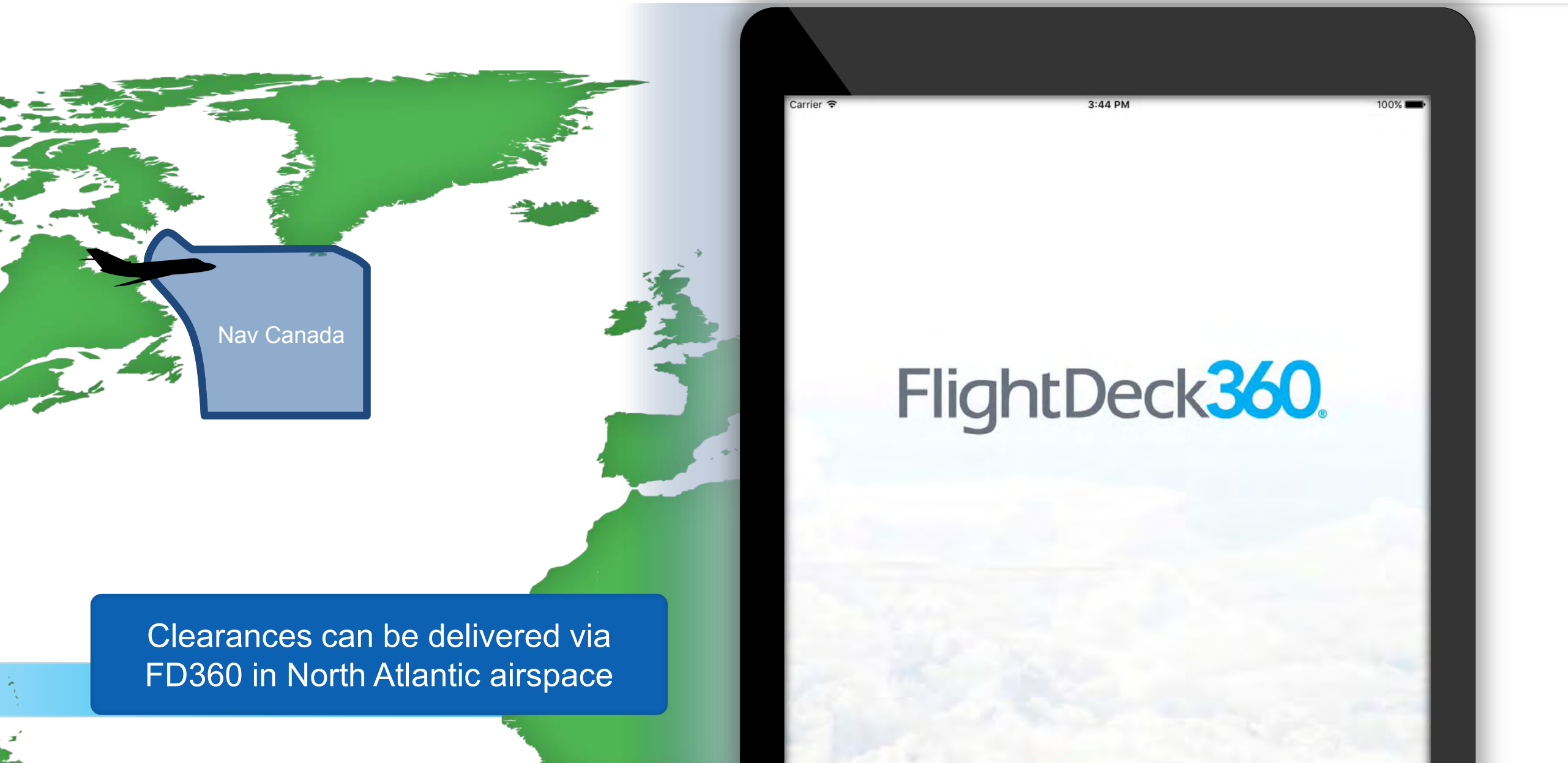
FlightDeck 360

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®

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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

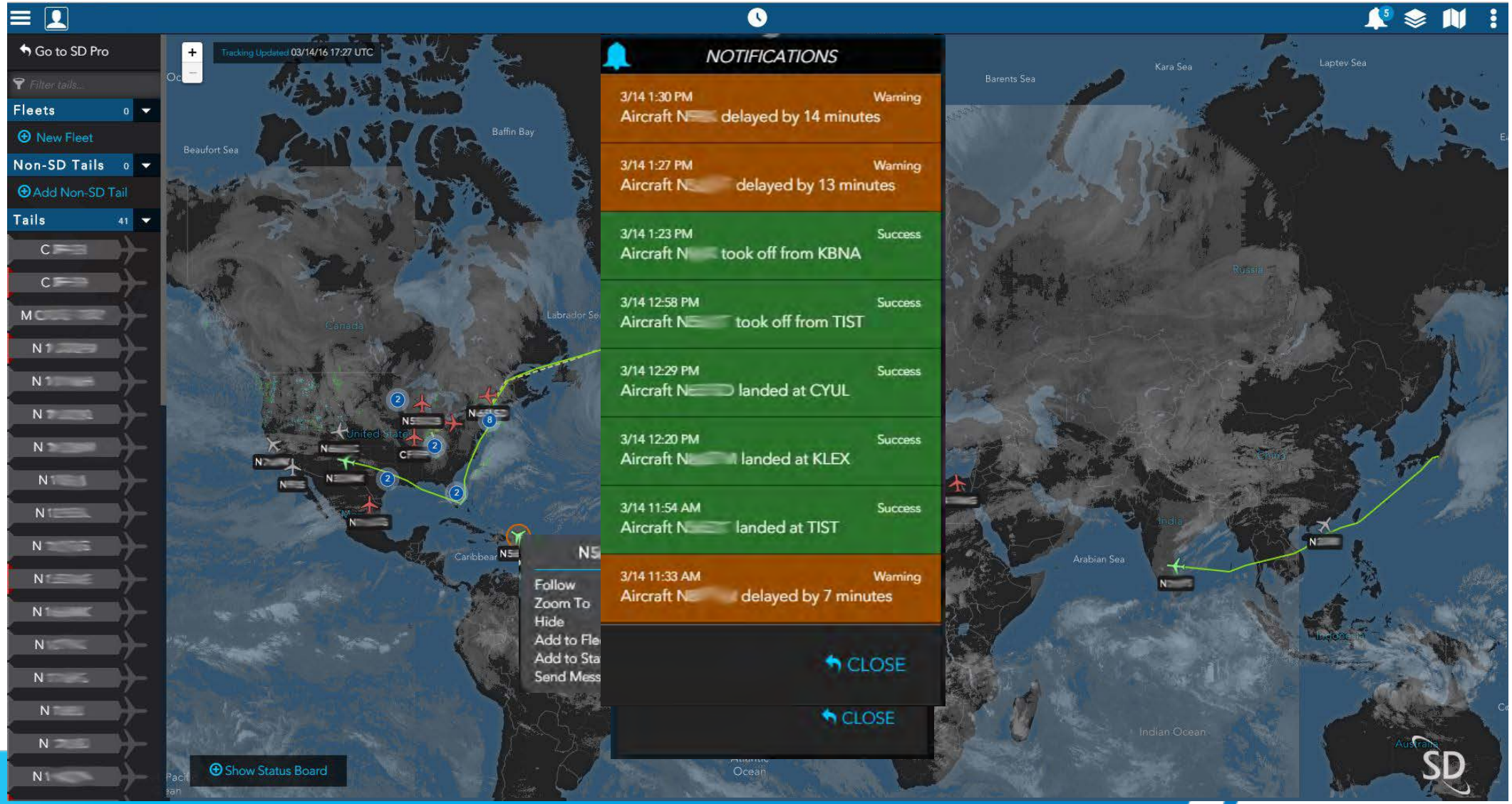
Tracking

Weather

Messages

Layers

Reports



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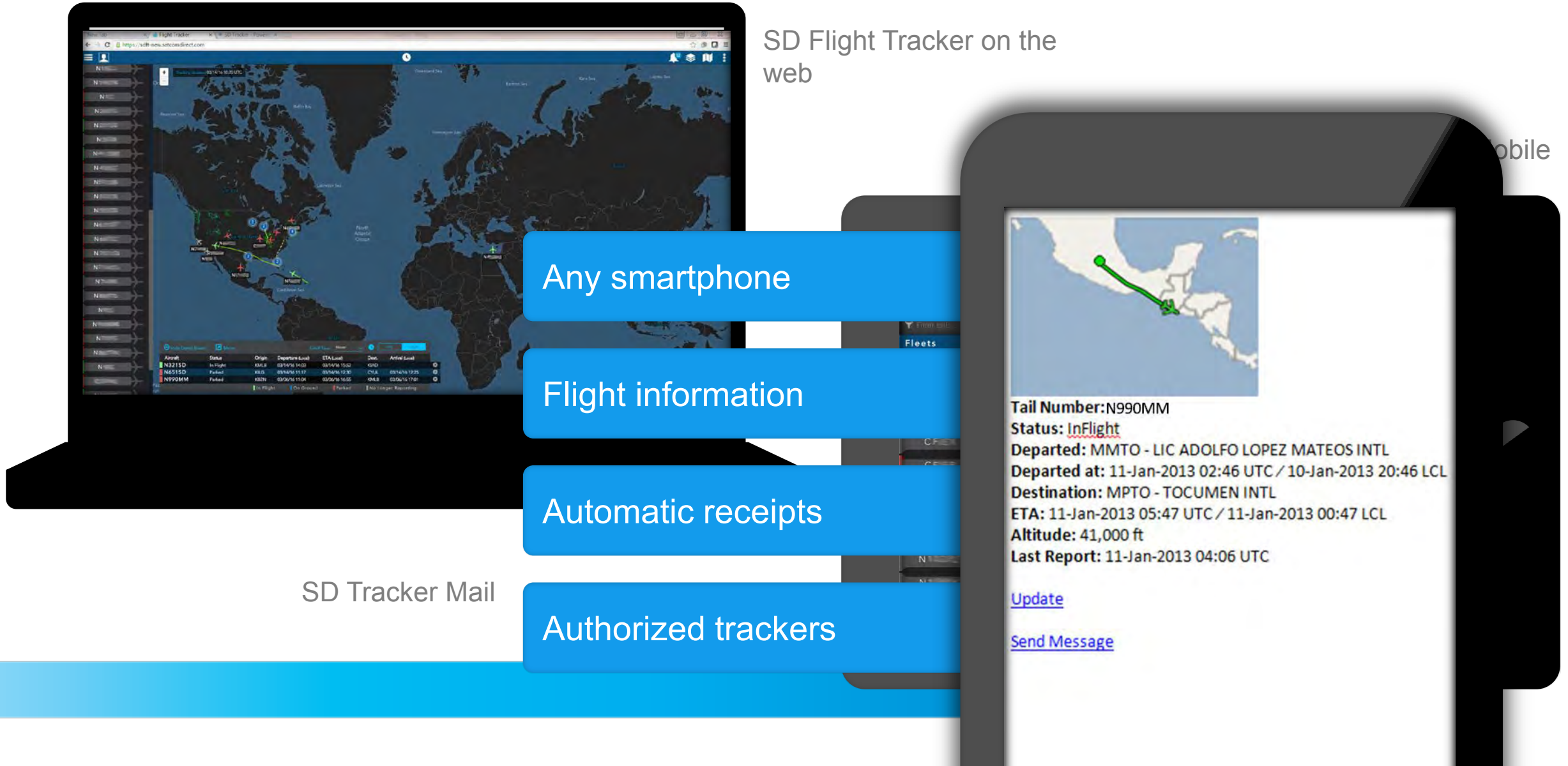
Flight Tracker Options



SD Pro is an integrated flight operations management platform

SD Pro

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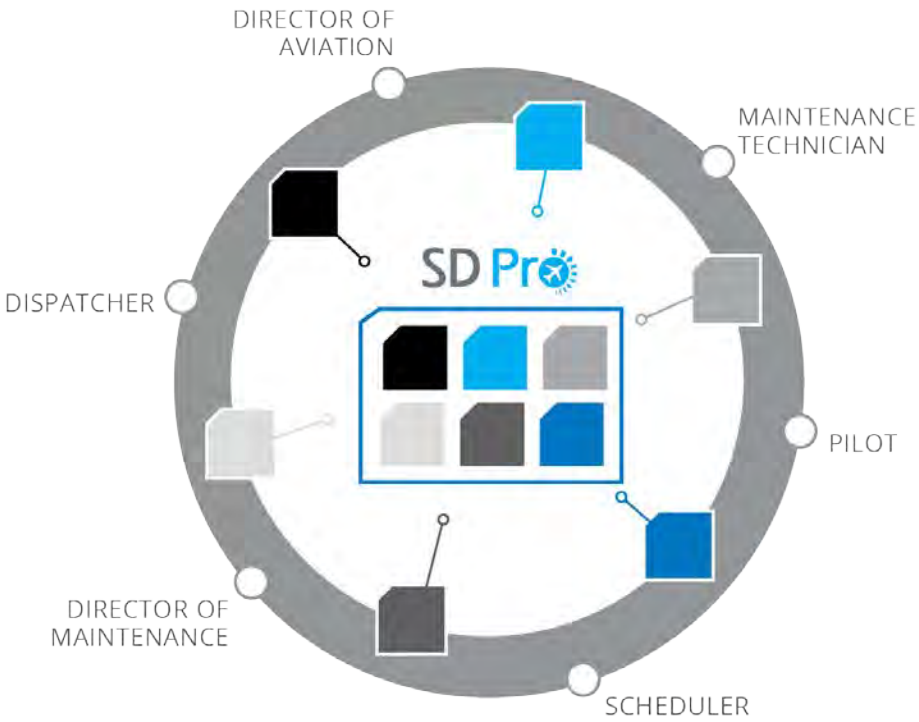
SD Pro

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



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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

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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; PFM
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

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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

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MORE THAN JUST SATCOM

Thank you

SD World Headquarters

TerraCom Datacenter

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Universal Avionics Solutions for NextGen

UNIVERSAL® AVIONICS SYSTEMS CORPORATION

Agenda

- NextGen Implementation Plan
- UASC SBAS FMS
- UASC Unilink 80X for FANS 1/A, Datacomm.
- UASC CVFDR
- UASC Incentives for upgrades
- Bonus Depreciation Tax Incentive.

NextGEN FAA Implementation Plan

- NextGen Plan includes these important items

➢ Automatic Dependent Surveillance–Broadcast out (ADS-B out)

➢ CPDLC – DCL (Departure Clearance)

➢ CPDLC FANS 1/A, LINK 2000+ and DataComm

➢ Performance Based Navigation (PBN)

NextGEN FAA Implementation Plan

- ADS-B out AND Performance Based Navigation

➢ These two topics must be considered simultaneously when selecting your aircraft solution for ADS-B out

➢ The FAA NextGen road map as you know has mandated ADS-B out.

➢ You also need to be aware the FAA is currently certifying and implementing Performance Based Navigation (PBN) procedures.

➢ The **ONLY** way to satisfy both of these operational capabilities will be with an integrated SBAS Flight Management System.

NextGEN FAA Implementation Plan

- Performance Based Navigation (PBN)

➢ The FAA has been funded to develop PBN

➢ Increase Capacity and Efficiency Using RNAV and RNP with much tighter accuracy requirements such as RNP 1

➢ Implements RNAV SIDS and STARS

➢ Implements Time Based Metering Using RNAV and RNP

➢ Again the **ONLY WAY** to meet the requirements is with an Integrated SBAS Flight Management System

SBAS Flight Management System

- All Universal Avionics SBAS Flight Management Systems meet and exceed the requirements for the position input sensor required to interface with the aircraft Transponder for ADS-B Out
- Our SBAS FMS has been certified for the Collins and the Honeywell Transponders for ADS-B out.
- Universal Avionics is offering a competitive package available through our approved dealer network that offers our SBAS FMS with the Rockwell Collins TDR-94 Transponders.
- Installation or upgrading to the SBAS FMS will also equip your aircraft for operations in the upcoming performance based navigation program included in the NextGEN road map.
- **An Integrated SBAS FMS IS THE CORRECT CHOICE** for meeting the position source sensor required for the ADS-B out mandate.

UNIVERSAL® AVIONICS SYSTEMS CORPORATION

SBAS Flight Management System

- The most important piece of the building block for NextGen Operations is an SBAS FMS

UNIVERSAL® AVIONICS SYSTEMS CORPORATION

NextGEN FAA Implementation Plan

- FANS 1/A, LINK 2000+ AND DataComm

➢ As you have heard today FANS 1/A is operational and mandated.

➢ LINK 2000+ will be mandated in European Airspace

➢ FAA has been funded and is testing and developing DataComm for the Continental United States utilizing proven Controller Pilot Data Link Communications (CPDLC).

➢ CPDLC-DCL is up and running today!

NextGEN FAA Implementation Plan

- **DataComm Continued**

➢ DataComm will provide a direct link between ground automation and flight deck avionics for safety-of-flight clearances, instructions, traffic flow management, flight crew requests and reports

➢ DataComm will enhance safety by reducing communication errors, increase controller productivity by reducing communication time between controllers and pilots, and increase airspace capacity and efficiency while reducing delays, fuel burn, and carbon emissions

➢ The FAA commits 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 CY2016

UNILINK 80X.X Communications Management Unit

- The second piece of the NextGEN solution architecture is the UL-80X.X CMU for CPDLC FANS 1/A, LINK 2000+ and DataComm

UNIVERSAL® AVIONICS SYSTEMS CORPORATION

UNILINK 80X.X Communications Management Unit

- The UL-800 or UL-801 when integrated with the UASC SBAS FMS provides **THE solution** for FAN 1/A, LINK 2000+ and DataComm CPDLC, CPDLC-DCL.

UNIVERSAL® AVIONICS SYSTEMS CORPORATION

Cockpit Voice/Data Recording

- Complying with CPDLC FANS 1/A and DataComm will also require the recording of data transmitted to and from the aircraft. A CVR capable of meeting these requirements must be installed.

THE Universal Avionics NextGen Solution

- **Solution Summary**

➢The installation of the Universal Avionics SBAS FMS, UniLink 80X.X a CVR and associated annunciators WILL make your aircraft capable of operating in NextGEN airspace for 2020 and beyond.

➢SBAS FMS SCN 1001.1 and 1101.1 eliminates the need for additional Transponder fail annunciators in the instrument panel for ADS-B out.

UNIVERSAL® AVIONICS SYSTEMS CORPORATION

THE Universal Avionics NextGen Solution

- Current Sales Incentives for upgrades

➢ Universal is offering significant trade in credits for upgrading your existing Non SBAS FMS or Non Universal FMS to our new SBAS FMS for meeting the required mandates.

➢ Please contact your authorized UASC Dealer for details.

➢ You can find more information about NextGen and our solutions at www.uasc.com

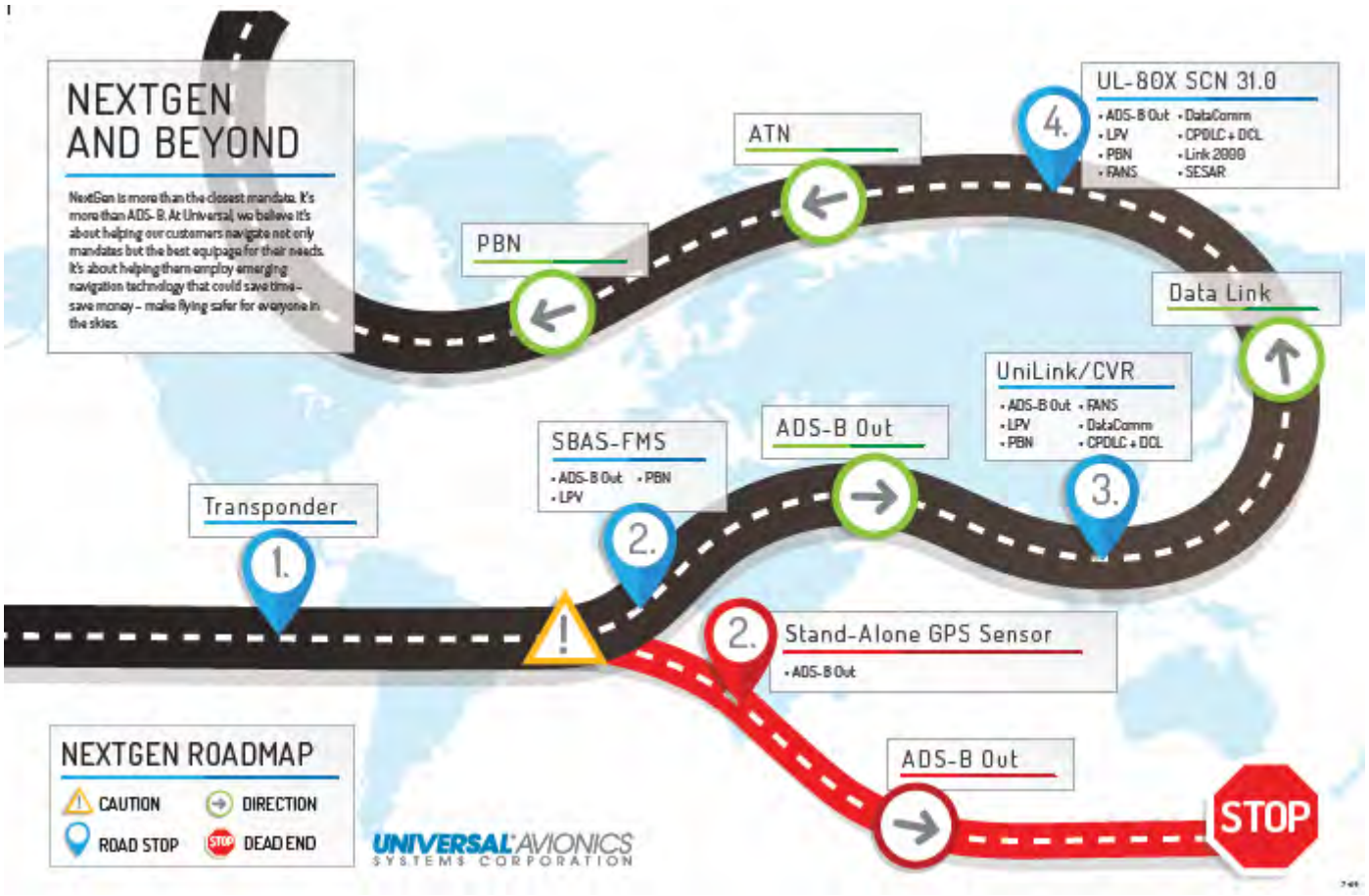
UNIVERSAL® AVIONICS SYSTEMS CORPORATION

THE Universal Avionics NextGen Solution

- Congress has extended the Bonus Depreciation rules
- According to information published by Advocate Consulting Legal Group, PLLC
- You may be able to claim up to 50% on your tax credits for the same year as your installation is completed with specific stipulations.
- Yes this includes NEW equipment installations and labor cost for the install.
- Contact your Professional Tax Representative for details

NextGen Road Map

NextGen Road Map



The Building Blocks for NextGen

Questions?

Thank You

www.uasc.com

UNIVERSAL® AVIONICS
SYSTEMS CORPORATION

Possibilities of Mandates….
Made Easy

October 13, 2016
Nashville, TN

Honeywell

Overview

- 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**

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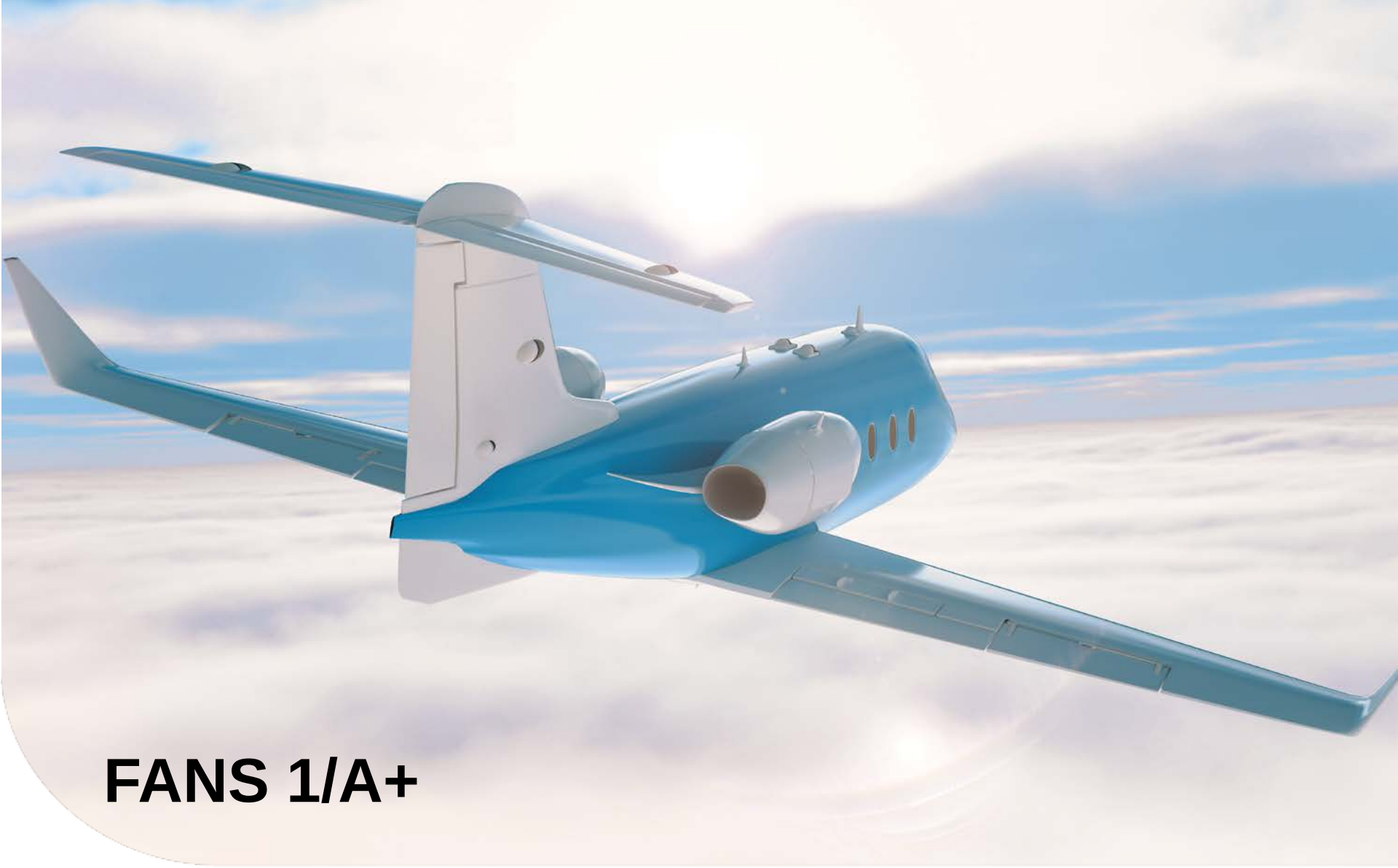
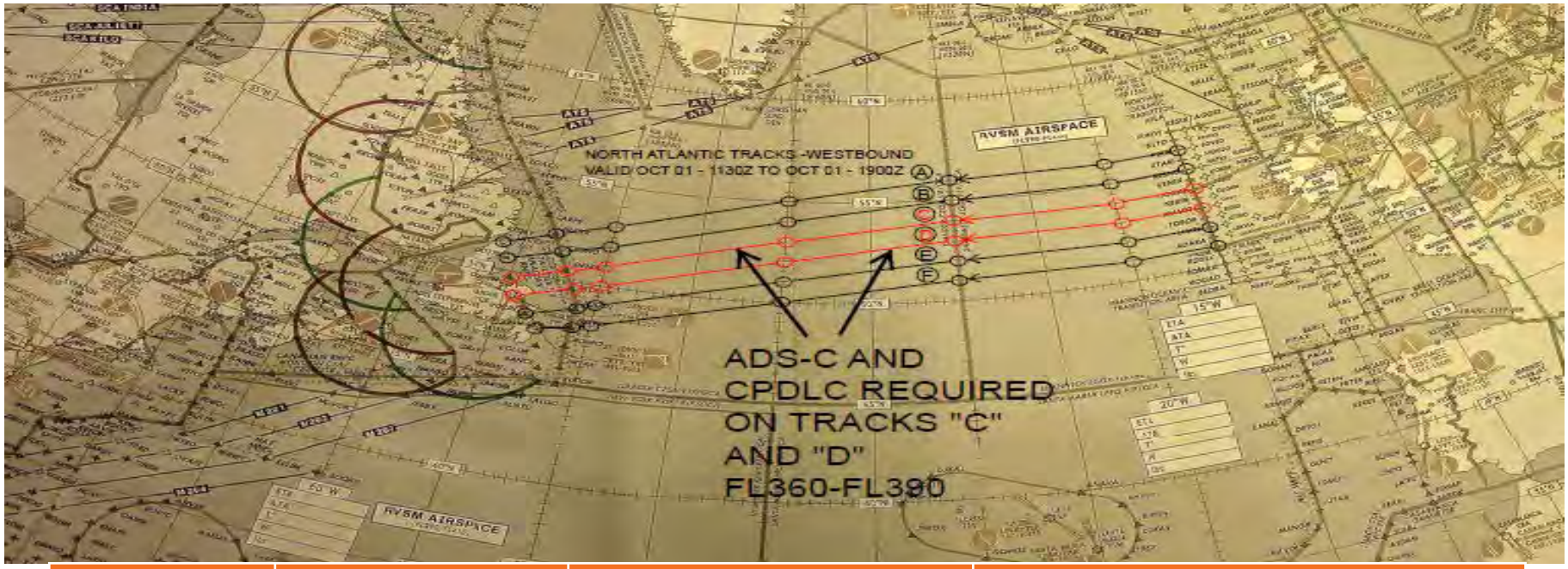
Honeywell



FANS 1/A+

Honeywell

FANS 1/A+ North Atlantic Tracks



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

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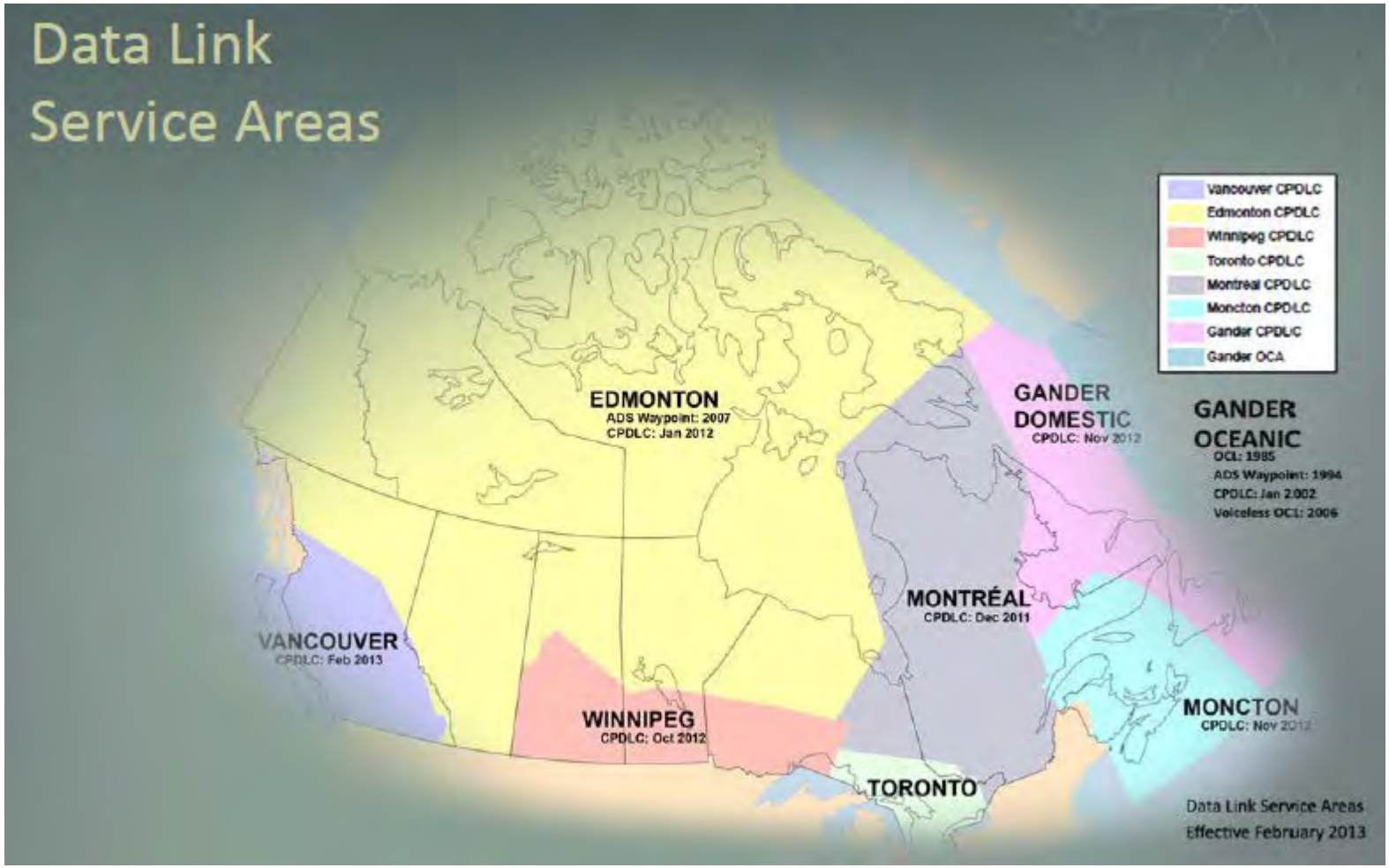
Nav Canada – FANS 1/A+ Operational



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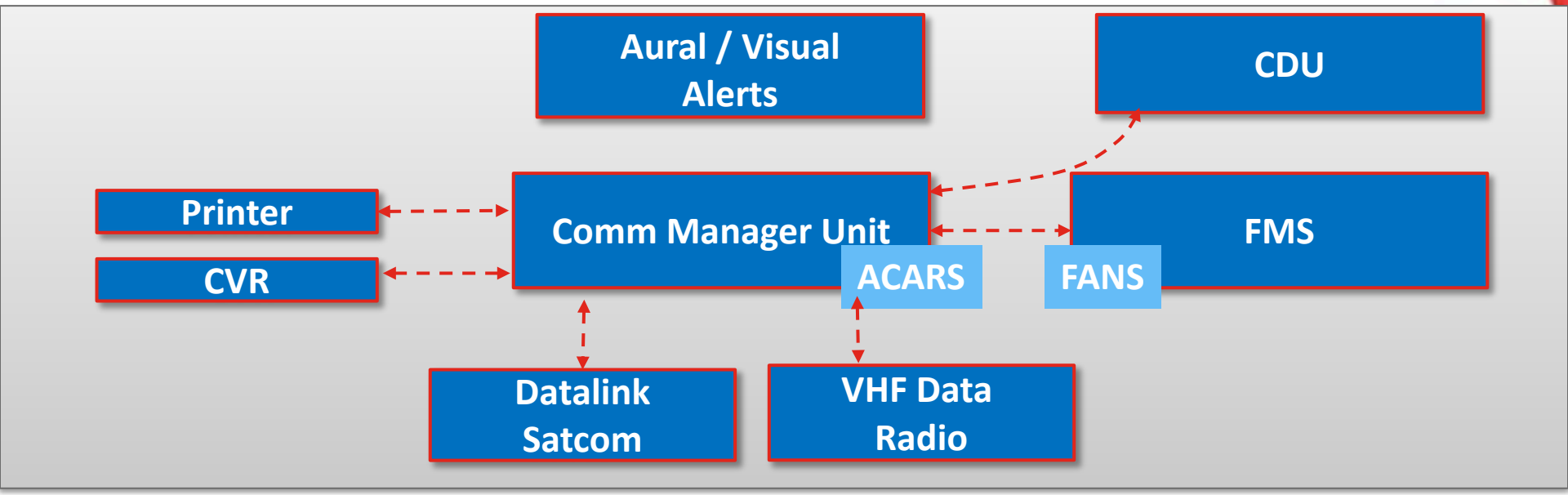
FANS Fully Operational in Canada

FANS Solution



- 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

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FANS is an Integrated System Solution

Honeywell Integrated System Solution

CVR-DLR

Printer

CD-810/ 820/830

VDRm2

SATCOM

Mark III CMU

FMS

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

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Honeywell FANS solutions

- 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
Legacy 650	Available
Global Express/XRS/5000	Available

- Check with your OEM for specific certification dates

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PM-CPDLC / Link 2000+

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There Has Been an Extension to 2020 – Why?

- **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**

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Crash Protected Recorders

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Crash Protected Recorders

- **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

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Crash Protected Recorders

- 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

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ADS-B Overview

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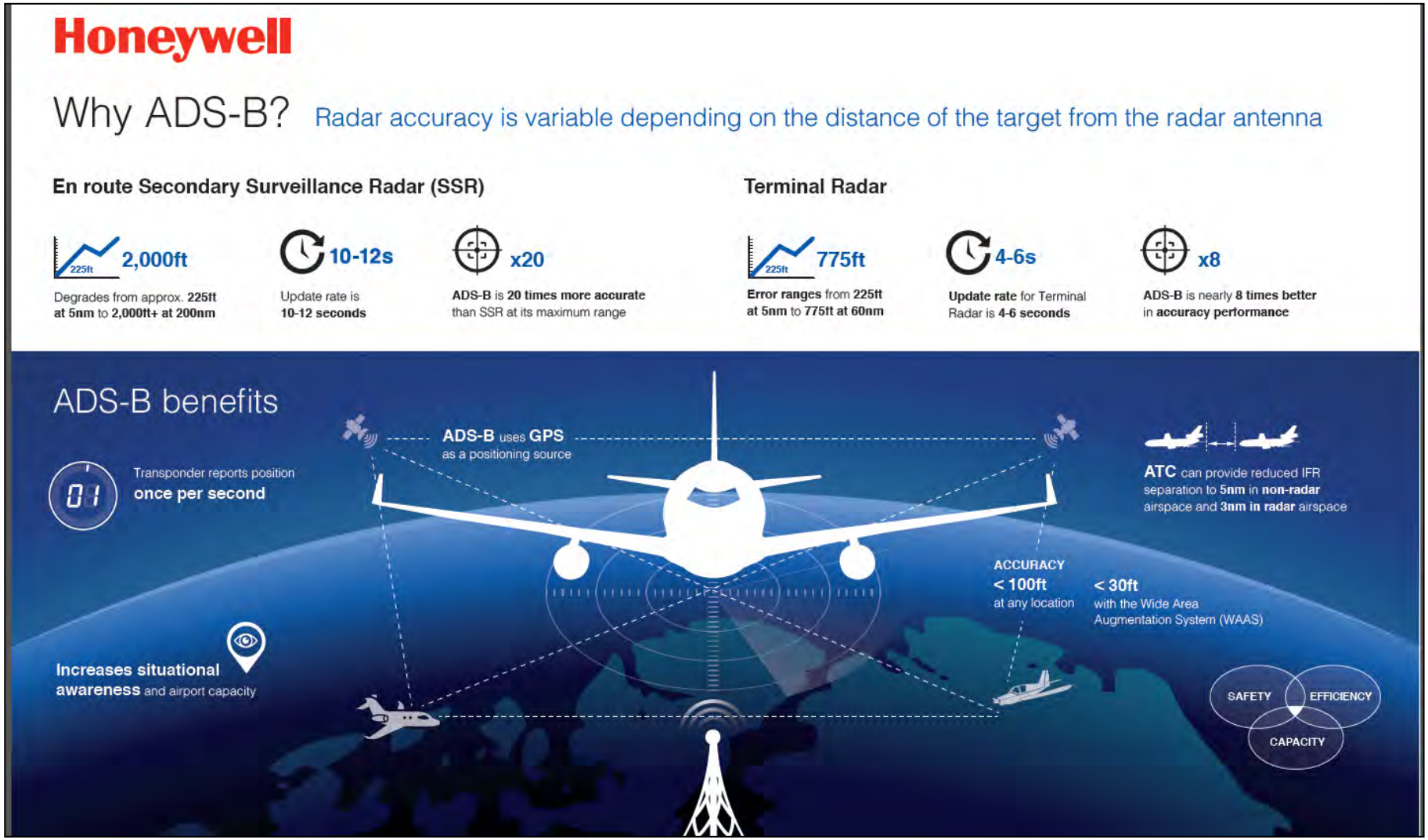
Why ADS-B



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Honeywell – Epic and Primus II

- **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

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Honeywell Mode S Transponders ADS-B Out Status

Epic Module

MST-100B

Apex Module
KXP-2290

Primus II

KT-73 Panel Mount

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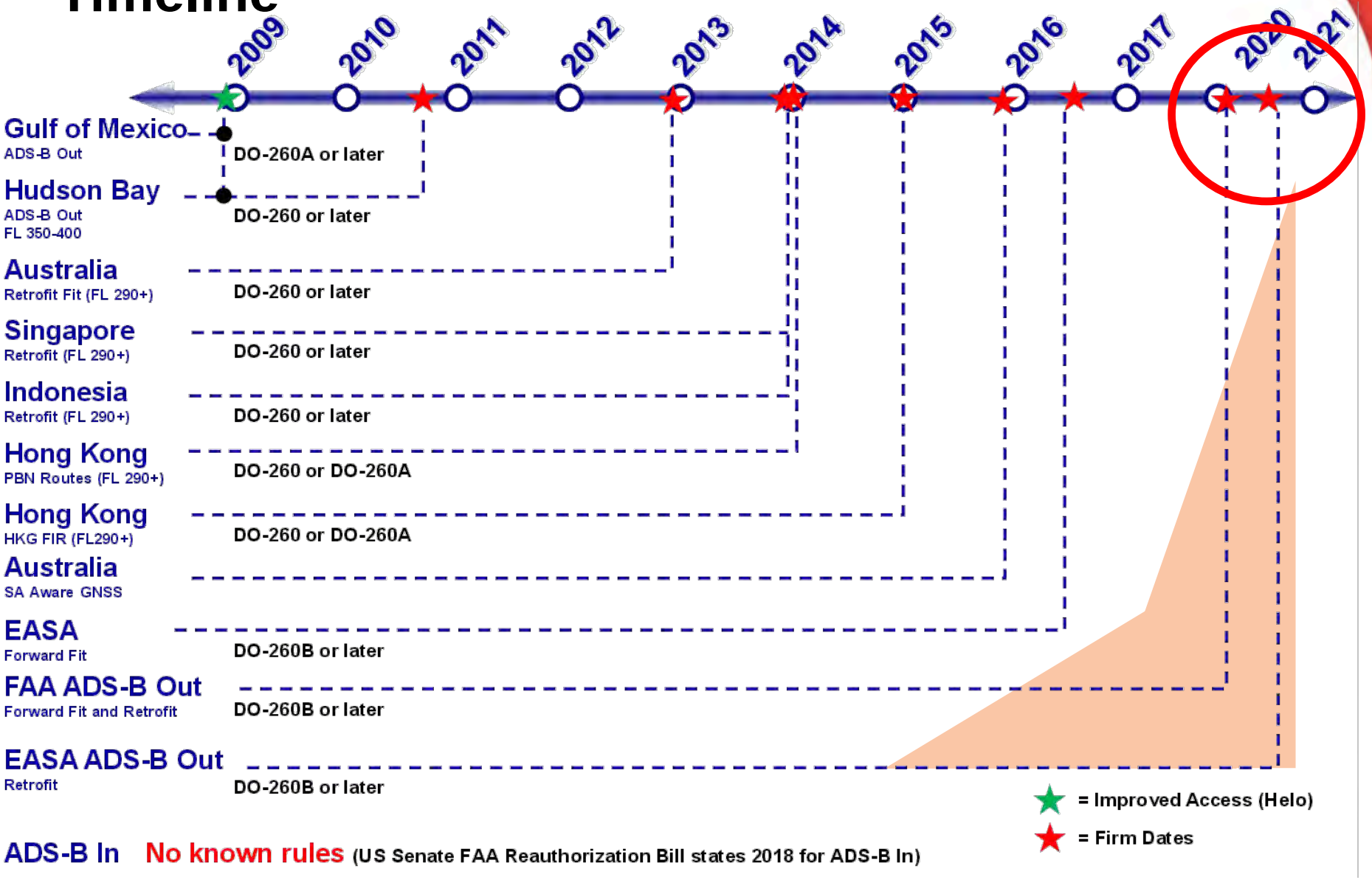
Timeline



ADS-B In **No known rules** (US Senate FAA Reauthorization Bill states 2018 for ADS-B In)

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

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TCAS Overview

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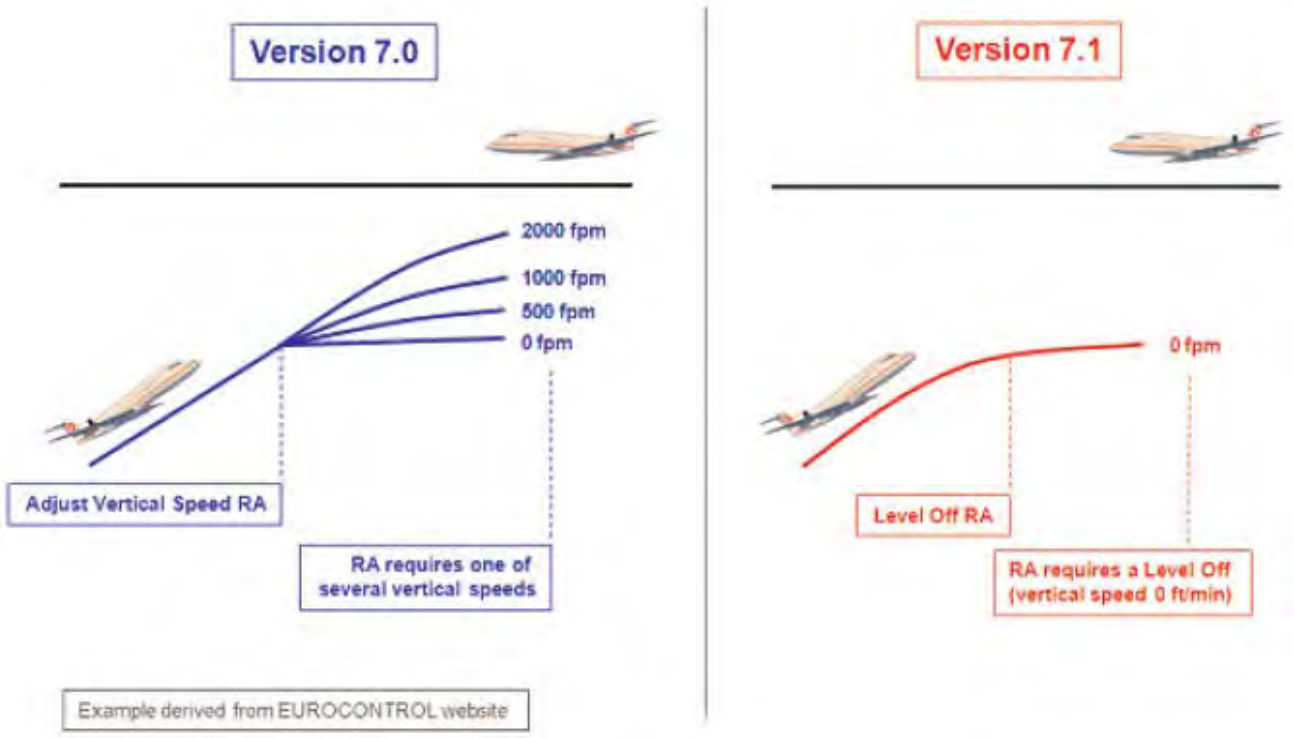
TCAS Change 7.1 – Adjust Vertical Speed

- **“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.**



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TCAS Change 7.1 – TCAS Reversals

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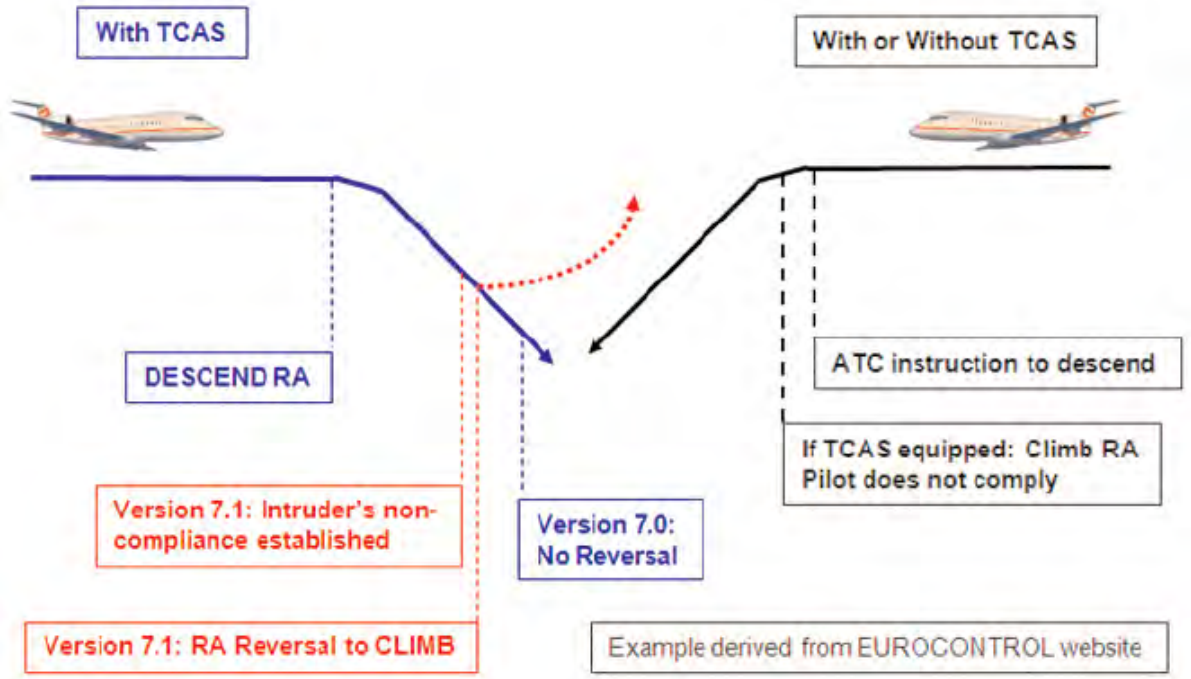
- **TCAS reversals were introduced in 7.0 to adapt to changing situations where the original guidance became the wrong thing to do if one of the pilots did not follow the RA or was instructed by ATC to perform a particular maneuver**
- **Change 7.1 improves this reversal logic to address late issuance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



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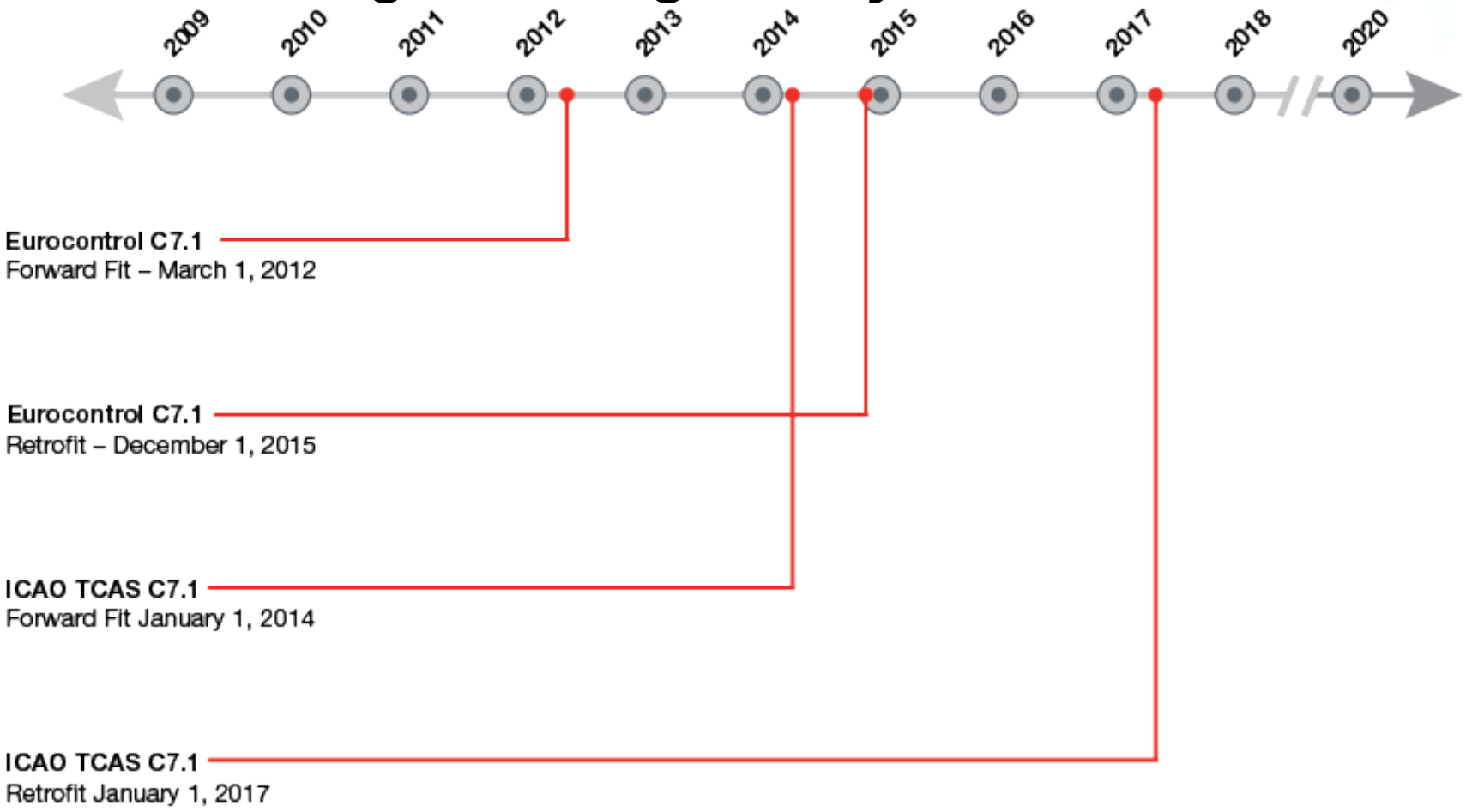
TCAS Change 7.1 Regulatory Timeline



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TCAS 7.1 Honeywell Solutions

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 for 2016

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TPU 67 is <u>not</u> ADS-B 'IN' capable

GoDirect® Cabin Services

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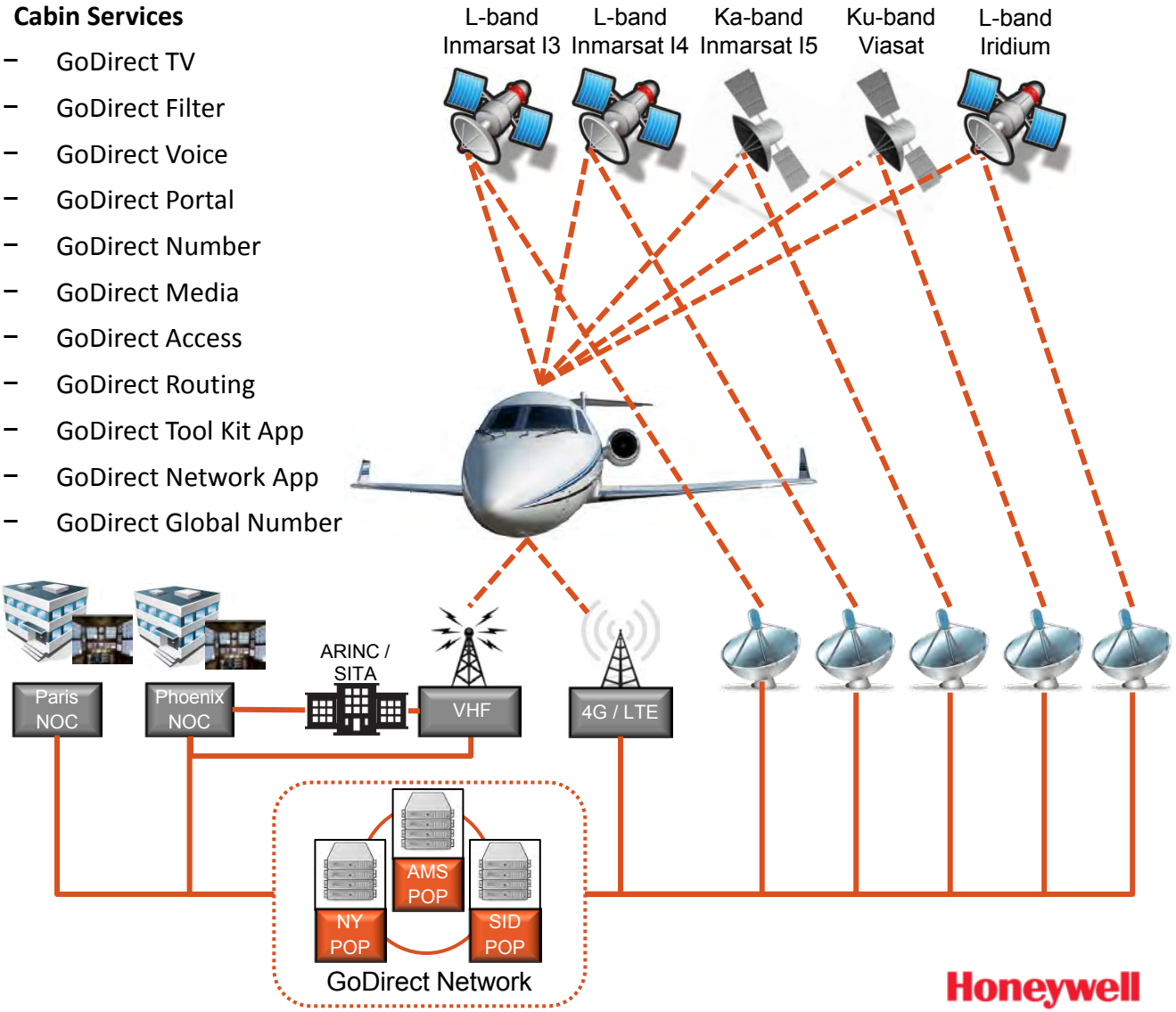
3Q2016

Honeywell GoDirect Services

- **Cockpit Services**
  - Flight Logs
  - Geo-Fencing
  - ATC Services
  - Flight Sentinel
  - Flight Tracking
  - Flight Dispatch
  - Flight Planning
  - Flight Following
  - Weight & Balance
  - Health Monitoring
  - Text & Graphical Weather
  - Datalink Communications
- **GoDirect provides the most comprehensive services offering**
  - The most compelling links with a secure world wide network
  - Increases passenger experience and reduced latencies

- **Cabin Services**
  - GoDirect TV
  - GoDirect Filter
  - GoDirect Voice
  - GoDirect Portal
  - GoDirect Number
  - GoDirect Media
  - GoDirect Access
  - GoDirect Routing
  - GoDirect Tool Kit App
  - GoDirect Network App
  - GoDirect Global Number



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Full Compliment of Services Agreements

- AT&T
- Iridium
  - Iridium CERTUS in negotiation
- Inmarsat
  - Swift64
  - Jet ConneX
  - SwiftBroadband
  - Classic Aero-I, H, H+ (voice & ACARS)
- ACARS VHF networks
  - SITA
  - ARINC
- ViaSat
  - Ku-band “Yonder
  - Ka-band “Excede”

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HONEYWELL GODIRECT SERVICES

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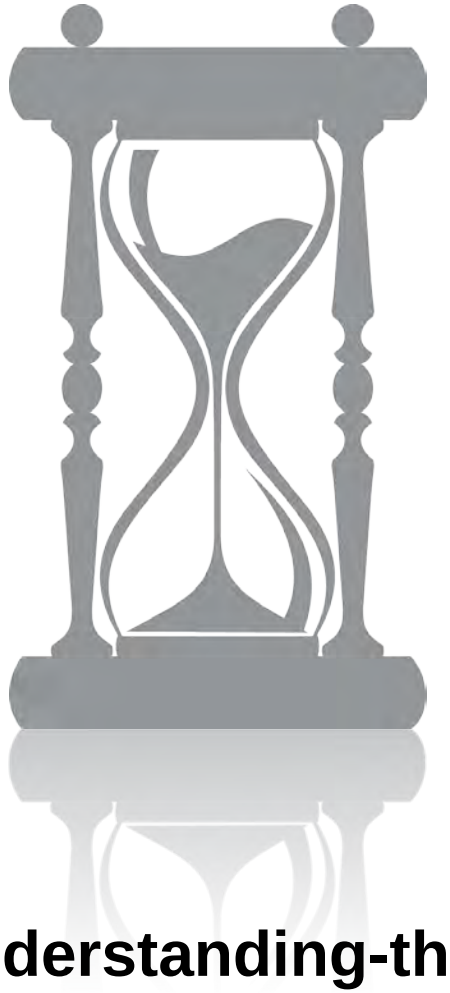
Time is running out…Don't be late to Mandates.

Questions?



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

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