Mandates & Timelines

Jeff Holt
October 21, 2014
HONEYWELL CONFIDENTIAL: This copyrighted work and all information are the property of Honeywell International, Inc., contain trade secrets and may not, in whole or in part, be used, duplicated, or disclosed for any purpose without prior written permission of Honeywell International, Inc. All Rights Reserved.

EXPORT CLASSIFICATION: The enclosed technical data is export classified as 9E991. Its export is being transmitted under U.S. Export Administration Regulations designation “NLR” (No License Required) and is to be used solely by the individual / organization to whom it is addressed. Diversion contrary to U.S. export laws and regulations is prohibited.
Table of Contents

• Description
  – ADS-B
  – Data Link (FANS 1/A & PM-CPDLC)
  – TCAS

In-Depth information on these subjects is on pilots.honeywell.com
ADS-B (Automatic Dependent Surveillance – Broadcast)
**Automatic**
Periodically transmits information with no pilot or operator input required

**Dependent**
Position and velocity vector are derived from the Global Positioning System

**Surveillance**
A method of determining position of aircraft, vehicles, or other assets

**Broadcast**
Transmitted information available to anyone with the appropriate receiving equipment
Why - ADS-B In

- Signals can be received by aircraft and ground stations
  - Traffic Situation can be depicted on Aircraft Display but with much more information than what TCAS provides
  - Allows new features based on ADS-B data
    - Airport Surface Management
    - Spacing & Merging
    - In-Trail Procedures

ATC Providers and Regulators are Interested because
- Potentially allows them to decommission expensive SSR Radars
- Provides much better “quality” surveillance
  - Position Accuracy
  - Aircraft State and Intent information
- Ultimately will allow more aircraft to use existing airspace with equivalent or better safety and efficiency

Currently there are no Mandates for ADS-B In
ADS-B Out Timeline

- GOMEX / Hudson Bay
  - Australia
    - Forward Fit (FL 290+)
  - DO-260A or later

- Singapore
  - DO-260 or later, SA Aware GPS

- Australia
  - DO-260 or later

- Hong Kong
  - PBN Routes FL290+
  - DO-260 or DO-260A

- Indonesia
  - DO-260 or DO-260A

- Seychelles
  - DO-260B or later

- China
  - DO-260B or later

- FAA ADS-B Out
  - Forward Fit and Retrofit
  - DO-260B or later

- EASA ADS-B Out
  - DO-260B or later
UAT or 1090ES

1090ES Required
Class A
18,000’
1090ES Required

UAT or 1090ES
Class E
10,000’
UAT or 1090ES

1090ES Can be used anywhere! UAT can only be used below 18,000’ in the US & China
Using - DO-260/A/B

- **Mode A/C Mode-S**
- **Elementary & Enhanced Surveillance (ELS & EHS)**

**Altitude Code A/C Address**
- Flight ID
- Selected ALT
- Mach Number
- Mag HDH
- Roll Angle
- Track Angle
- Track Angle Rate
- TAS
- IAS
- GS
- VS

**ADSB DO-260 Broadcast**
- Position
- Velocity
- Flight ID
- NUC
- Navigation Uncertainty Category

**ADSB DO-260A Broadcast**
- Position
- Velocity
- Flight ID
- NIC & NAC
- Navigation Integrity Category & Navigation Accuracy Category

**ADSB DO-260B Broadcast**
- Position
- Velocity
- Flight ID
- Changed how NIC, NAC are set
- SBAS Required

**Mode A/C Mode-S**
- Elementary & Enhanced Surveillance (ELS & EHS)**
Do I Need an Op Spec/LOA?

- **In the USA**
  - The FAA is **not** requiring a formal operational approval for ADS-B operations in US airspace

- **But...**
  - There are countries requiring ops approval to use ADS-B in their airspace, so
  - FAA authorization (Ops Spec/LOA A153) is required for US operators conducting ADS-B operations outside of US designated airspace
  - This approval satisfies the requirement in foreign countries
How Do I Get an Op Spec/LOA?

- Applying For Operational Approval
  - Required documentation for an Ops Spec/LOA A153 application is documented in FAA Advisory Circular 90-114 (Change 1) Appendix 1.
  - The operator must submit items including:
    - Letter of Request
    - Make, model, and part number of the ADS-B transmitter and positioning source installed on each airplane.
    - A copy of OpSpec B050 annotating where A153 will be used (not required for Part 91 operators)
    - Part 91 operators will need to provided a statement indicating that their pilots have knowledge of current air traffic ADS-B directives for the intended areas of en route operations and will comply with § 91.703

Source: FAA A153 Application Checklist
ADS-B Resources

- FAA Information for Operators (InFO) 13009
  - Guidance on which countries require operational approval
  - This is revised regularly; operators should check periodically for updates
  - [http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/info/all_infos/](http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/info/all_infos/)

- FAA A153 Application Checklist

- FAA Advisory Circular 90-114, *Change 1* – ADS-B Operations
  - [http://www.faa.gov/regulations_policies/advisory_circulars/](http://www.faa.gov/regulations_policies/advisory_circulars/)

- FAA ADS-B Website

- Nav Canada ADS-B Website
  - [http://www.navcanada.ca/EN/products-and-services/Pages/on-board-operational-initiatives-ads-b.aspx](http://www.navcanada.ca/EN/products-and-services/Pages/on-board-operational-initiatives-ads-b.aspx)
ADS-B Resources

- Australia - Exemption to operate aircraft without ADS-B in defined areas of airspace
  - One-time exemption
  - For aircraft scheduled to have ADS-B Installed
  - Duration of exemption is from 12/12/13 to 12/11/15
  - J-Curve area shown on right
ADS-B Out Availability

Primus Epic (DO 260B)
- Gulfstream G650
  - Available with Block Point Upgrade
- Gulfstream G450/550
  - Available Now
- Dassault F900/F2000/F7X EASy
  - EASy II Option - Available Now
- Hawker 4000
  - No current plan for ADS-B Out
- Cessna Sovereign
  - Phase VI – Q4 2014

Primus1000/2000, SPZ-8X00 (DO 260B)
- HSB 2014-17
  - Primus II Transponder (XS-852)
  - RM-855 update required for annunciation
    - RM-850 not supported, must upgrade
Data Link Overview
Controller Pilot Data Link Communication

- CPDLC is “text messaging” between the pilot and ATC for aircraft control instead of using voice communication.
- Pilot can request and/or acknowledge changes to aircraft speed, altitude and route using standard ATC phraseology.
- Functionality contained in Flight Management Computer and/or Communications Management Unit.
- Utilize SATCOM (FANS) and VHF Data Links.
# Data Link

<table>
<thead>
<tr>
<th></th>
<th>FANS-1/A</th>
<th>ATN-B1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Also Called</strong></td>
<td>FANS-1/A+</td>
<td>PM-CPDLC, Datacomm, Link 2000+</td>
</tr>
<tr>
<td><strong>Where is it used?</strong></td>
<td>Oceanic/Remote</td>
<td>Domestic</td>
</tr>
<tr>
<td><strong>Position Reporting</strong></td>
<td>YES: ADS-C</td>
<td>NO</td>
</tr>
<tr>
<td><strong>Text Messaging</strong></td>
<td>Yes: CPDLC</td>
<td>Yes: CPDLC</td>
</tr>
<tr>
<td><strong>Using</strong></td>
<td>SATCOM/VHF</td>
<td>VDL Mode 2</td>
</tr>
<tr>
<td><strong>Protocol</strong></td>
<td>AFN over ACARS</td>
<td>ATN-B1</td>
</tr>
<tr>
<td><strong>Backup</strong></td>
<td>HF Voice</td>
<td>VHF Voice</td>
</tr>
</tbody>
</table>

**FANS-2/B is FANS-1/A and ATN-B1 integrated within the FMS**
FANS 1/A

- Complies with NAT Region Mandates
- Fully automated oceanic position reporting (ADS-C)
- Increased situational awareness - improved controller awareness of aircraft position
- Better oceanic communications quality vs. noisy HF
- Reduction in errors between pilots and controllers
- Quicker Identification of Gross Navigational Errors
- Allows the flight crew re-view and print clearances
- Reduced separation
- HF used as a backup
## Data Link Definitions

### FANS-1/A (Future Air Navigation System)
- AFN (ATS Facilities Notification) Protocol  
  ATS = Air Traffic Services
- ACARS – Aircraft Communication Addressing and Reporting System Network
- ADS-C (Automatic Dependant Surveillance – Contract)
- CPDLC (Controller Pilot Data Link Communication)

### ATN B1 (Aeronautical Telecommunications Network, Level B1)
- PM-CPDLC (Protected Mode CPDLC)
- VDL Mode 2 (VHF Data Link Mode 2)

### Variants
- FANS 1/A+ (Use of FANS-1/A in congested, continental and ATN airspace)
- FANS 2/B (FANS-1/A and PM CPDLC integrated within FMS)
PM-CPDLC (ATN-B1)

• Link 2000+ Mandate
  – The LINK 2000+ program is air-ground data link services implementing ATN to solve sector frequency congestion
  – Protected Mode defines an alternative CPDLC protocol for air/ground applications
  – Stronger processes against miss-delivery
  – Protected Mode (PM) CPDLC is a higher speed data link service in use and being expanded in Europe

• Benefits
  – Auto-load specific uplink messages into FMS
  – Downlink complex route clearance request
  – Uplink messages arm FMS automatically
  – Downlink / Uplink messages auto-update Flight Data ground systems
  – Workload reduction for flight crew and controllers
### ADS-C vs. ADS-B

<table>
<thead>
<tr>
<th>Item</th>
<th>ADS-C</th>
<th>ADS-B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Areas of Operations</strong></td>
<td>Oceanic / Remote North Atlantic North Pacific South Pacific</td>
<td>Continental Airspace Semi-Remote Hudson Bay Gulf of Mexico</td>
</tr>
<tr>
<td><strong>Network</strong></td>
<td>Satellite and VHF ACARS</td>
<td>Ground-Based receiver stations only</td>
</tr>
<tr>
<td><strong>Equipment Requirements</strong></td>
<td>FMS SATCOM VHF VDL (ACARS)</td>
<td>Transponder 1090ES/UAT GPS</td>
</tr>
<tr>
<td><strong>Crew Requirements</strong></td>
<td>Must log onto system</td>
<td>Automatic - No crew interaction required</td>
</tr>
<tr>
<td><strong>LOA Requirements</strong></td>
<td>Yes (LOA A056)</td>
<td>Only outside of US</td>
</tr>
</tbody>
</table>

**ADS-C and ADS-B share the same purpose – aircraft surveillance**

**However their functionality, equipment requirements, and areas of operations are vastly different**
Data Link Recording & CPDLC Timeline

- **FAA CVR CPDLC Recording**
  - Part 135 (CPDLC installed)
  - Dec 2010

- **FAA CVR CPDLC Recording**
  - Part 91 (CPDLC installed)
  - Apr 2012

- **Eurocontrol PM-CPDLC**
  - End of Exemption with FANS-1/A
  - Jan 2014 Above FL285

- **Eurocontrol PM-CPDLC**
  - Non-Exempt Aircraft
  - Feb 2015 Above FL285

- **North Atlantic Tracks - FANS 1/A**
  - Feb 2013 – 2 Core Tracks FL360-390

- **North Atlantic Tracks - FANS 1/A**
  - Feb 2015 – All tracks FL350-390

- **North Atlantic Tracks - FANS 1/A**
  - Dec 2017 – Entire NAT region FL350-390

- **North Atlantic Tracks - FANS 1/A**
  - Jan 2020 – Entire NAT Region FL290 and above
Eurocontrol Link 2000+ Aircraft Exemptions

• Exemptions for aircraft types
  – Reaching the end of their production life
  – Aircraft produced in limited numbers
  – Temporary exemptions only apply to Forward Fit applications
  – Permanent exemptions should not compromise 75% DLS capability

• Exemption Requests (ERQs)
  – An Applicant may be an airspace user or manufacturer
  – Any exemption request shall be based on the criteria defined in Article 14
  – ERQ Requirements and Template made available by the European Commission
  – Applicant submits an ERQ to the European Commission either directly or via an appropriate Member State
Eurocontrol Link 2000+

• Where to find exemption lists:

http://www.eurocontrol.int/articles/data-link-services-implementing-rule-exemptions

Exemption requests should be submitted in electronic form to the responsible Policy Officer at the European Commission Gzim Ocakoglu at the following address:

Gzim.OCAKOGLU@ec.europa.eu

All correspondence regarding the on-going process should also be directed to Gzim Ocakoglu at the European Commission.

The EUROCONTROL DLS-Exemption cell made its 1st report to the European Commission in Nov 2010 which resulted in a decision published 20/05/11.

• 1st Decision on DLS Exemptions (Commission Decision 20/5/2011)

The 2nd report of the exemption cell was delivered in Sept 2011 which was passed by the Single Sky Committee on 28/09/11 which resulted in a decision published 9/12/2011.

• 2nd Decision on DLS Exemptions (Commission Decision 09/12/2011)

The final date for the submission of exemption requests was 31st December 2012. A 3rd and final report is being drafted by the EUROCONTROL exemption cell with a final decision expected end Q1 2013, followed by publication in Q2 2013.
Exceptions to the North Atlantic FANS Mandate

• No Exemptions available
• Airspace not included in the North Atlantic FANS mandate:
  – Airspace where surveillance is provided by radar and/or ADS-B for aircraft that are suitably equipped (transponder/ADS-B Extended Squitter). (pink shaded area)
  – Airspace north of 80° North (this airspace lies outside the reliable service area of geostationary satellites)
  – The New York Oceanic FIR
Do I Need an Op Spec/LOA?

- **Operators of US-registered aircraft**
  - Yes - LOA/Ops Spec (A056) is required for FANS or ATN data link
- **Operators of non-US-registered aircraft**
  - Varies with state of registry

**Applying For Operational Approval**
- Application for operational approval must address the following:
  - Airworthiness Substantiation (AFM documentation)
  - Areas of operation
  - Operating procedures
  - MEL requirement
  - Flight crew training
  - Maintenance procedures
CPDLC Availability

• Primus Epic
  – Gulfstream G450/550/650 PlaneView
    • FANS-1/A in Cert Foxtrot (available today)
    • PM CPDLC is planned for 2014 in production
  – Dassault F900/F2000/F7X EASy II
    • FANS-1/A and ATN-B1 in EASy II
  – Hawker 4000
    • No current plan for PM CPDLC.
CPDLC Availability (cont)

- FANS 1/A Available on GEX-Batch 3 and EMB L650-FMS6.1
- GIV, GV, F900EX/C, F900B
  - FMS 6.1 will require a “mini-load” mod to support FANS-1/A and PM-CPDLC and…
    - Required change of the AFIS DMU to a new Honeywell CMU for both FANS (Mark III) Early 2015 and PM CPDLC (Next Gen) - Mid 2016
    - CD-810 (w/ NAV/INDEX mod) or CD-820 will work with for FANS
    - Estimated availability 2Q 2015

Primus 1000/2000, SPZ-8000, 8400, 8500

- CD-810 (w/ NAV/INDEX mod) or CD-820 will work with for FANS
- Estimated availability 2Q 2015
Data Link Resources

• FAA NAT Resource Guide
  – http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afs/afs400/afs470/media/NAT.pdf

• Link 2000 Program Details
  – http://www.eurocontrol.int/articles/link-2000-library

• ICAO NAT Ops Bulletin
TCAS Change 7.1

- Change 7.1 includes many updates but primarily addresses two issues:
  - “Adjust Vertical Speed, Adjust” changed to “Level Off, Level Off”
  - Correct missed and/or late TCAS reversals
TCAS Change 7.1 – Adjust Vertical Speed

• “Adjust Vertical Speed, Adjust” (AVSA) Resolution Advisory (RA), there is a history of some pilots not responding as intended

• The solution in Change 7.1 is to replace the four AVSA RAs with a single “Level Off, Level Off” RA
TCAS Change 7.1 – TCAS Reversals

- 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.

Diagram:

- **Version 7.1: Intruder’s non-compliance established**
- **Version 7.1: RA Reversal to CLIMB**
- **Version 7.0: No Reversal**
- **ATC instruction to descend**
- **If TCAS equipped: Climb RA. Pilot does not comply**

Example derived from EUROCONTROL website.
No current mandate but the FAA has stated “The latest version of software for TCAS II is version 7.1. To ensure compatibility with international standards, the FAA encourages the installation of this software as soon as practical.”

A US Mandate may be coming
## TCAS 7.1

<table>
<thead>
<tr>
<th>Product</th>
<th>Old PN</th>
<th>New PN</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPA-100 (6MCU)</td>
<td>940-0300-001</td>
<td>940-0351-001</td>
<td>Available Now</td>
</tr>
<tr>
<td>TPA-100 (4MCU)</td>
<td>940-0400-001</td>
<td>940-0451-001</td>
<td>Available Now</td>
</tr>
<tr>
<td>TPA-81</td>
<td>066-50000-XXXXX</td>
<td>Replace with TPA-100 (940-0351-001)</td>
<td>Available Now</td>
</tr>
<tr>
<td>TPU-67</td>
<td>066-01146-1111</td>
<td>066-01146-2121</td>
<td>Available Now</td>
</tr>
<tr>
<td>TPU-67</td>
<td>066-01146-1211</td>
<td>066-01146-2221</td>
<td>Available Now</td>
</tr>
</tbody>
</table>
TCAS 7.1 Resources

- **FAA Information for Operators (InFO) 12010**
  - Informs air carriers and operators of the recent European Union (EU) Implementing rule, mandating TCAS II Version 7.1 equipage to operate in European airspace. Authorizes, but does not mandate TCAS 7.1 in the US
    - [http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/info/all_infos/media/2012/InFO12010.pdf](http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/info/all_infos/media/2012/InFO12010.pdf)

- **FAA’s Introduction to TCAS II V7.1 pamphlet**

- **EU Implementing Rule**
Questions?