Global Data Link
Agenda

• CNS/ATM
• FANS 1/A
• DLS-IR (Link 2000+)
• ADS-B
CNS-ATM
General Trends

• Average Global Air Traffic Growing at 5% per Year (IATA)
• Aircraft Equipage and Ground Infrastructure Must Improve to Increase Airspace Capacity
• Communication
  – Moving from VHF voice to data link for domestic operations
  – Moving from HF to satcom for oceanic operations, voice & data
• Navigation
  – Moving from sensor-based (ex. Loc & GS) to performance-based navigation (PBN) which includes – GNSS, RNP, RNAV
• Surveillance
  – Moving from traditional radar to ADS-B – higher update rate
• Air Traffic Management
  – Moving from time-based operations to trajectory and performance-based
Future Air Navigation System 1/A (FANS)

The FANS 1A Advantage
Saving time and fuel is now a breeze
FANS 1/A

Development

- Developed in 1980’s
- International Civil Aviation Organization (ICAO)
- First Implementation in the Early ‘90’s
FANS 1/A

Typical HF Communication
FANS 1/A

What is it?

• Provides an improvement to HF Radio Communications in remote and/or oceanic areas (Solar flare peak May, 2013)
• Provides a data link communication to ATC through Satcom (Inmarsat or Iridium) or VHF
• ADS-C: Automatic Dependent Surveillance-Contract
  • Provides digital **automatic position reports** to ATC
• CPDLC: Controller Pilot Data Link
  • Provides digital communication for **requests and intervention**
• Iridium Satcom recently approved for FANS 1/A operations by the FAA, check with state AIPs (aeronautical information publications) for other areas
• Provides a higher level of performance, which will lead towards reduced separation initiatives
• **Proven Solution for Communication**
• Also planned for use in US NextGen System using VDL Mode 2 as early as 2015
FANS 1/A
North Atlantic

- Approximately 1400 North Atlantic Track Crossings per Day and increasing (6% Corporate)
- Approximately 60% of all North Atlantic Track Crossings are FANS 1/A Equipped and increasing
- Current Separation 10 minutes in trail, 60 nm (1 degree) lateral and 1000ft vertical
- Approaching Airspace Saturation
FANS 1/A
North Atlantic

- **Primary Goal: Improved Safety**
- **Secondary Goal: Reduced Separation**
- Reduced Longitudinal Separation Minimum (RLongSM)
  - Proposed separation *5 minutes in trail*
  - Trials underway
  - Provides aircraft the ability step climb for greater fuel efficiency (In-trail)
  - Implementation timing has not been proposed
- Reduced Lateral Separation Minimum (RLatSM)
  - Proposed separation *1/2 degree (25-30nm) lateral*
  - Trials to start in 2015
- **Both require additional approvals for FANS 1/A (ADS-C & CPDLC), RNP 4 (using GNSS)**
# FANS 1/A

## Datalink Mandates

<table>
<thead>
<tr>
<th>Date</th>
<th>Mandate</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 2013</td>
<td>Phase 1 FANS 1/A in the North Atlantic Track System (NATS)</td>
<td>Two center (most desirable) tracks, FL360-FL390 inclusive (no exemptions)</td>
</tr>
<tr>
<td>February 2013</td>
<td>RLongSM Trials</td>
<td>Two center (most desirable) tracks, FL360-FL390 inclusive for step climbs</td>
</tr>
<tr>
<td>January 2014</td>
<td>European DataLink (Link2000+) Services Implementing Rule (DLS IR) Exemption</td>
<td>Aircraft that are FANS equipped and have operational approval before, are exempt from the DLS IR mandate for the lifetime of the aircraft</td>
</tr>
<tr>
<td>February 2015</td>
<td>DLS IR equipage (Link 2000+ FL 280 and above)</td>
<td>2013 for forward fit and 2015 for retrofit</td>
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</table>
# FANS 1/A

## Datalink Mandates

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<tbody>
<tr>
<td>2015</td>
<td>RLatSM trials in NATS</td>
<td>Two center (most desirable) tracks will have a ½ track in between them</td>
</tr>
</tbody>
</table>
| 2015   | “Phase 2a” Expanded FANS 1/A Airspace (determined June 2013) | One of four scenarios:  
1. All OTS FL360-FL390 inclusive  
2. All OTS FL340-FL390 inclusive  
3. All MNPS FL360-FL390 inclusive  
4. All MNPS FL340-FL390 inclusive  
(no exemptions)                  |
| 2016/? | “Phase 2b”                                                  | FANS 1/A required in all flight levels of MNPS airspace                 |
| TBD    | RLatSM & RLongSM                                            | Specified portions of FANS 1/A airspace                                 |

*By 2016/?, aircraft not FANS 1/A equipped will have to fly the “Blue Spruce Routes” or above/below MNPS airspace FL290-FL410 inclusive*
FANS 1/A

Cost of Non-Compliance

- **Many Long-Range Aircraft Optimum Altitudes are FL370-FL390**
  - FL400 is not achievable if temps are too hot (ISA +10) at full gross weight
  - FL420 is not available due to non-RVSM airspace above (2k separation)
  - At FL340 or FL350, aircraft will burn at least 10% more fuel
    - Higher cruise speed to keep up with airliners could increase fuel flow by an additional 10% as well
  - *Result: aircraft flying outside the North Atlantic “Core” tracks initially, and eventually, only the “Blue Spruce” routes*
# FANS 1/A

## Cost of Non-Compliance

*Assumptions: $3,500 direct operating cost (per hour), 400kt Cruise, 4 North Atlantic trips per year (3000nm average)*

<table>
<thead>
<tr>
<th>Flying outside the core tracks today</th>
<th>Cost per Year</th>
</tr>
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<tbody>
<tr>
<td>4 Flights Eastbound Outside Tracks (120 add’l miles + unfavorable winds of 15kts) = 30 min each flight</td>
<td>$7,000</td>
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<tr>
<td>4 Flights Westbound Outside Tracks (120 add’l miles + 30 kts add’l headwind) = 60 min each flight</td>
<td>$14,000</td>
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<table>
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<tr>
<th>If Forced to Fly at a Lower Altitude by 2015</th>
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<tr>
<td>Additional Tech Stop Eastbound 50% of the Time (add’l 60 min each flight + fees ($1,000 US each stop)</td>
<td>$9,000</td>
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<tr>
<td>Additional Tech Stop Westbound 100% of the Time (add’l 60 min each flight + fees ($5,000 EU each stop)</td>
<td>$34,000</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$64,000</strong></td>
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</tbody>
</table>
ADS-C and/or CPDLC
Available in Many Oceanic/Remote Regions Today
FANS 1/A
Additional Benefits

- Significantly improved communications
  - Large quantity of HF traffic is no longer an issue
  - Poor quality of HF is no longer an issue
  - Language barrier is no longer an issue due to message set
  - Increased solar flares in 2013 will not be an issue
  - Lower stress on crew

- Resulting in significantly improved safety!
FANS 1/A

How Do I Get It?

• Install FANS 1/A equipment under STC or OEM Service Bulletin (AC 20-140b)
  – FMS Update (UNS sw 1000.6 or later)
  – Communications Management Unit (CMU)
  – Annunciator “cube” or integrated into displays
  – Aural Alert
  – Data Capable CVR Required (AC 20-160)
  – Level “D” Satcom system
• For “N” registered aircraft, Letter of Authorization required from the FAA
FANS 1/A

Guidance Material

- FAA Data Link Website
  - http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/oceanic/data_link/
  - AC 120-70B - Operational Authorization Process
  - Data Link Approval Checklist
  - Operator Guide to Data Link Approval
  - GOLD – Global Operational Data Link Document
    - ICAO Document developed for operators and air traffic service providers as a global standard
    - Operators should review Chapter 1, 2, 5, & 6
    - Update planned for 1st quarter 2013
  - AC 91-70A – Oceanic and International Operations
  - New York CPDLC NOTAM (31 May, 2006)
  - Data Link News – non-FAA site with good data link Information

- Be aware the link name might be different than the actual document title and file name
FANS 1/A
Universal Avionics’ Solution

UniLink® UL-800/801
• Airborne data link system
• Two-way digital data communication
• Multiple communications transmission media
  • VHF & SatCom (Iridium & Inmarsat)
• Built-in VDL Mode 2 VDR (UL-801)
• CPDLC & ADS-C functionality for FANS
• ARINC and SITA network compatible
• Classic VHF “ACARS” text data link
• 1 MCU LRU, less than 5 lbs.
• Provisioned for Link 2000+ and ATN
FANS 1/A
Universal Avionics’ Solution

UniLink® UL-800/801
• Works with WAAS/SBAS-FMS
  • WAAS accuracy needed for ADS-B
• Trade-in credits available for non-WAAS FMS and UL-700/701
• CVR required for FANS operations
FANS 1/A

Basic Functionality

- AFN (ATS Facilities Notification) LOG-ON
- Log-on to North Pacific
- Log-on to KZAK (Oakland)

- After an AFN log-on, ATC **may** establish an ADS Contract

- Ready to accept ADS Contract
FANS 1/A

Basic Functionality

- ADS-C
- Successful ADS Contract
- ATC Address - up to 5 ADS connections can be maintained
- The rate column displays the interval between successive periodic report downlinks
- The event column indicates the type of event reporting requested by ATC ("W" is a waypoint change contract)
- Mode column indicates normal or emergency
Basic Functionality

- CPDLC
- Before CPDLC messages can be sent, ATC must establish a CPDLC connection with the aircraft
- CPDLC connection active
- Altitude request with using CPDLC
FANS 1/A

Additional Capabilities with UniLink®
(after subscribing to AOC services)

• Hi-res weather graphics
• Textual based data – e.g. weather, change in flight status, etc. (based on service offering)
• Aircraft tracking and ground-to-air messaging from any Internet connection
• Flight plan uploading (AOC)
FANS 1/A

Additional Capabilities with UniLink®

(after subscribing to AOC services)

- Flight information services (airport dependent)
  - D-ATIS
  - Pre-Departure Clearance
  - Expected Taxi Clearance
  - Push Back and Oceanic Clearances
  - TWIP (Terminal Weather Information for Pilots)
- Capable of Iridium or Inmarsat ACARS Data Link
FANS 1/A
Proven Support

Universal Avionics Customer Support Organization
• UASC Website with Additional FANS 1/A information www.uasc.com/fans

• Agreement with Air Training International, Ltd. http://www.trainati.com/ to provide approved training using UASC FANS 1/A Simulator
Data Link Services Implementing Rule (DLS-IR)

Summary of Requirements

- Applies to all IFR aircraft flying in European airspace above FL285
- Applicable to new aircraft delivered as of Jan 2011
- Existing aircraft retrofit complete by 2015
- FANS operational aircraft delivered before January 2014 will be exempted, but will have to use voice operations
- Required aircraft capabilities:
  - Unilink 801 with VDL Mode 2 Radio
  - SCN 31.0 (Link 2000+)
  - UASC WAAS FMS
    - Meets ADS-B accuracy requirement by 2017
    - WAAS/LPV will be the next big push in EU
  - Data capable CVR by Jan. 2016
- ANSPs must implement ground systems before end of 2013 in the Link Region
Figure 1: Worldwide Status of ADS-B Implementation in Feb 2012 (multiple references)
## Worldwide ADS-B Timeline

<table>
<thead>
<tr>
<th>Year</th>
<th>FAA</th>
<th>Europe</th>
<th>Australia</th>
<th>Canada</th>
<th>Others</th>
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<td>2020</td>
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**FAA**
- ADS-B Out NPRM*
  - Final Rule Published
- NAS-Wide Infrastructure Deployed
- ADS-B Out Avionics Equipage 100%

**Europe**
- 1090 Only
  - ADS-B Out Rule Consultation
  - Final Rule Published
- ADS-B Out New Aircraft
- ADS-B Out Retrofit

**Australia**
- WAAS GPS
  - Either TSO of 1090 Only
  - ADS-B Out NPRM
  - Final Rule Published
  - ADS-B Out FL 290+ Avionics 100%

**Canada**
- Hudson Bay ADS-B Ground Network
  - ADS-B Out Equipage
  - Required for entry FL350-FL400 Inclusive, eventually to FL290

**Others**
- Hong Kong & Singapore
  - ADS-B Out FL 290+

*NPRM - Notice of proposed rulemaking.
ADS-B Compliance

Hudson Bay example:
- Capability known to controllers from your aircraft contact
- Not cleared for altitudes above FL350 if not equipped
- Violations are handled just like other airspace violations
- “White List” of certified performing avionics
- Typical cost of +4% fuel at low altitude and missing optimal winds

Aircraft capability example
- For the US & EU, transponders must be TSO-c166b compliant
  - This will require a **UASC WAAS FMS**
  - Alerts the pilot of any loss of ADS-B output parameter (**update RCU**)
## Data Link Summary

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<td>North Atlantic Track System Core Tracks</td>
<td>Unilink 800/801 SCN 30.X, UNS WAAS FMS, Data Capable CVR, Annunciators, Aural tone generator, Level “D” Satcom</td>
</tr>
<tr>
<td>2013</td>
<td>ADS-B Out - Australia, Canada (Hudson Bay), Hong Kong, Singapore</td>
<td>UNS WAAS FMS, Radio Control Unit upgrade (if applicable)</td>
</tr>
<tr>
<td>2015</td>
<td>ADS-B Out – New Aircraft in Europe</td>
<td>UNS WAAS FMS, Radio Control Unit upgrade (if applicable)</td>
</tr>
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<td>2015</td>
<td>“Phase 2a” Expanded FANS 1/A Airspace (determined June 2013)</td>
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<td>ADS-B Out – Retrofit Aircraft in Europe</td>
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<td>2020</td>
<td>ADS-B Out – USA and Canada</td>
<td>UNS WAAS FMS, Radio Control Unit upgrade (if applicable)</td>
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Thank You

www.uasc.com