Air/Ground ATN Implementation Status

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Presentation Overview

- An Approach to Defining CPDLC/ATN Benefits
- Air/Ground CPDLC/ATN Implementation Status
  - EUROCONTROL PETAL IIE Project
  - FAA CPDLC Programs
  - Airline/Avionics Programs
- Next Steps/Future Initiatives
  - RTCA CPDLC Benefits Activity
  - FANS 1/A Accommodation
  - Security Initiatives
- Conclusions
# ATN Infrastructure Upgrade

<table>
<thead>
<tr>
<th></th>
<th><strong>ACARS Infrastructure</strong></th>
<th><strong>ATN Infrastructure</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applications</strong></td>
<td>Operational, and Administrative Services and initial Air Traffic Services</td>
<td>Expanded Air Traffic, Operational, Administrative, and Passenger Services</td>
</tr>
<tr>
<td><strong>Network</strong></td>
<td>ACARS</td>
<td>ATN</td>
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<tr>
<td><strong>Sub-Networks</strong></td>
<td>Character Oriented</td>
<td>Bit Oriented</td>
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Air/Ground ATN Infrastructure

- Air/Ground Subnetworks
  - VHF
  - Satellite
  - HF

- Public/Private Ground Networks

- FAA/CAAs

- ATN Components

- Aircraft

- Airlines/Other Users
ATN - Why Invest

- Only Alternative for Strategic, Common, World-Wide Data Communication Infrastructure Upgrade for the Aeronautical Industry
- Enables Common Systems to accommodate Air Traffic Services, Operational and Administrative Services, and Passenger Services (possibly)
- Facilitates Reduction in Development/Operational Costs
  - Creates Larger Market facilitating reduced “per unit” Pricing
  - Facilitates System Development Vendor Competition by basing Requirements on Open Standards
  - Facilitates “Real Time” Data Communication Service Provider Competition for Ground/Ground and Air/Ground Operational Services
- Supports Contract Requirements based on Required Communication Performance (RCP)
- Future Proof - Enables integration of emerging “bit-oriented” Data Communication Subnetworks
ATN - Impact of No Investment

- Industry (CAAs and Airspace Users, Including Airlines)
  - Loss of Opportunity to Baseline System Automation Upgrades against Data Communication Infrastructure
    - Delay in Realization of Improved Air Traffic Services
  - Exposure to Non-Compliant Requirements
    - Increase in Development Costs and Operational Service Costs
    - Negative Impact on Utility of Common Systems for World-Wide Operations
  - Delay in Realization of Benefits based on User Equipage

- Airlines
  - Missed “Window of Opportunity” for Updated Avionics on New Aircraft Orders
ATN - Investment Perspective

- The Data Communication Infrastructure is a Long-Term Investment
- Industry MUST agree on a Common Data Communication Infrastructure Upgrade Path
- The ATN is on the Upgrade Path
- Decisions as to “When” to Equip with ATN will be based on Internal Economic Analyses
Air/Ground ATN Application Services

- **Air Traffic Control (ATC) Services**
  - Controller Pilot Data Link Communications (CPDLC)
  - Automatic Dependant Surveillance (ADS)
  - Flight Information Services (FIS)
  - Context Management (CMA)

- **Other Potential Services**
  - Aeronautical Operational Control (AOC)
  - Aeronautical Administrative Communication (AAC)
  - Aeronautical Passenger Communications (APC)
ATC Service Benefits

Operational Improvements
- Increased Capacity
- Operational Efficiencies (e.g. Delay Reduction, Reduced Restrictions)

Service Improvements
- Improved Service Availability
- Operational Predictability
- Bank Integrity

Safety Benefits
- Reduced Comm Errors
- Additional Comm Mechanisms
- Improved Information Flow

Direct Cost Avoidance

Indirect Cost Avoidance

Opportunity Cost Avoidance

Loss of access to Service Benefits because of delay in Service Implementation

ATNSI, ATN Seminar
First Step: Controller Communications Workload

"SYSCO" Approximate Controller Workload Distribution
Problem: Voice Congestion

- Single channel communications
- High comm workload for radar controller
- Restricted team coordination
- Limited contribution of added positions and new technologies
- Limited sector productivity

Low effective capacity
Solution: Data Communications
Example: FAA Study

- FL230
- FL290
- FL350

Arrival Sector: 11,000 ft

Departure Sector: FL290

EN ROUTE ARTCC

TRACON
FAA Study: Reduction in Holding

Problem

Solution
FAA Study: Radio Occupation Time
Air/Ground ATN Implementation Status
Air/Ground ATN Implementation Programs

- FAA CPDLC Build 1/1A Programs
- EUROCONTROL PETAL IIE Project
- FAA CPDLC Build 2 Program and Link 2000+ Initiatives
PETAL IIE Project Overview

- PETAL = Preliminary Eurocontrol Test of Air/Ground Data Link
  - PETAL IIE = Extension of PETAL Project to include ATN Operations
- Single Site: Maastricht Upper Area Control Centre
- Operational Services
  - Transfer of Voice Communication, Initial Contact, Altimeter Setting
  - Clearances and Requests: Flight Level, Route and Heading, Speed
  - “Passive” Requests (e.g. Preferred Level, Top of Descent)
- Uses VDL Mode 2 as Air/Ground Subnetwork
- American Airlines is the Launch Airline

www.eurocontrol.be/projects/eatchip/petal2/
PETAL IIE Overview

Status:
- MISSION COMPLETE
- PETAL II Link Bridge Project (P2L) to start in January 2002
F AA CPDLC Build 1 Overview

- Single Site: Miami Air Route Traffic Control Center
- Provides 4 Operational Services
  - Transfer of Voice Communication
  - Initial Contact
  - Altimeter Setting
  - Informational Free Text (menu capability built by supervisor inputs)
- Uses VDL Mode 2 as Air/Ground Subnetwork
- American Airlines is the Launch Airline

www.adl.tc.faa.gov
FAA CPDLC Build 1A Overview

- National Deployment: All Air Route Traffic Control Centers
- Provides Additional Operational Services
  - Larger Message Set accommodating assignment of Speeds, Headings, and Altitudes
  - Includes Route Clearance Function
  - Capability to accommodate Pilot-Initiated Altitude Requests
- Uses VDL Mode 2 as Air/Ground Subnetwork
- American Airlines is the Launch Airline
- Widespread Industry Participation is Anticipated

www.adl.tc.faa.gov
FAA CPDLC Build 1/1A Architecture

FAA En Route CPDLC Ground System

Display

HOST

National Airspace System Local Network

Router

Data Link CPDLC Processor (ATN compliant)

Context Management Application (ATN compliant)

NADIN II

VDL Mode 2 Ground Stations

VDL Mode 2

A/G ATN Router

G/G ATN Router

CMU/ATSU (ATN compliant)

VDR Multi-Mode Transceivers

Display

FAA En Route CPDLC Ground System

A/G ATN Router

G/G ATN Router
CPDLC/ATN Avionics: Functional Overview

Flight Management System Integration

Pilot Interface
- Control/Display Unit
- Alerting
- Dedicated Display

CPDLC
ATN
(End System/Router Configuration)

Air/Ground Subnetworks
- VHF Digital Radio - Mode 2
- SATCOM Data 3
- Other ICAO-Compliant Subnetworks

Initial Architecture
Architecture Upgrade
## ATNSI Airlines: Target Fleet Types

### Fleet Types Table

<table>
<thead>
<tr>
<th>Fleet Types</th>
<th>American</th>
<th>Continental</th>
<th>Delta</th>
<th>Northwest</th>
<th>United</th>
<th>US Airways</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airbus Fleet Types</td>
<td>All</td>
<td>N/A</td>
<td>N/A</td>
<td>Some</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Boeing Fleet Types</td>
<td>All</td>
<td>Most</td>
<td>Most</td>
<td>Some</td>
<td>Most</td>
<td>None</td>
</tr>
<tr>
<td>Regional Jet Fleet Types</td>
<td>All</td>
<td>Under Consideration</td>
<td>Under Consideration</td>
<td>None</td>
<td>Under Consideration</td>
<td>None</td>
</tr>
</tbody>
</table>

N/A = Not Applicable

Preliminary Airline Data. Subject to Revision.
Pre-Sep 11th Data.
Does not represent any actual or planned commitment by any airline to CPDLC equipage.
Avionics ATN Program Status

- **Rockwell Collins**
  - CPDLC/ATN-Capable CMU: Certified/Flew in PETAL IIE, Upgrade for CPDLC Build 1 Under Development

- **Honeywell**
  - CPDLC/ATN-Capable CMU: Under Development

- **Thales Avionics (Sextant):**
  - Software for CPDLC/ATN-Capable Airbus ATSU: Under Development

ATSU = Air Traffic Services Unit
CMU = Communication Management Unit
ATNSI Projects

- **Router Reference Implementation (RRI)**
  - **Avionics: ATN End System and/or Router**
  - **Ground Systems: ATN End System and/or Router**

- **Conformance Test Suite (CTS)**
  - **Verification Tool for Installed RRI (Avionics or Ground Systems) or other “equivalent” ATN Systems**
  - **Integrated into Common American European Reference ATN Facility (CAERAF) Project**
    - CAERAF Project is co-sponsored by EUROCONTROL and the FAA Certification Office
    - Use of CAERAF is not limited to America/Europe, usage is intended for world-wide ATN verification
Next Steps
RTCA Free Flight Select Committee CPDLC Benefits Subgroup

- Charter
  - Update CPDLC Build 1A Business Case
  - Recommend Incentives for Early Equipage
  - Identify Impediments and Recommend Solutions

- Milestones
  - Apr 2002: Final Report to RTCA Free Flight Steering Committee
Future Initiatives
FANS 1/A Accommodation

ATN VDL-2 Avionics

a/g ATN VDL-2

FANS-1/A VDL-2 Avionics

a/g FANS-1/A VDL-2

Multi-Stack Gateway
ICAO CNS/ATM
Operational data and behavior
Future Initiatives

Security Initiatives

- Potential Initiatives
  - Analysis of Security Features present in existing CPDLC/ATN/VDL2 Architecture
  - Implementation of Security Features in upgraded CPDLC/ATN/VDL2 Architecture
  - Implementation of Security Features in new Applications and Services

- Issues
  - Standardization
  - Globalization
Conclusions

- **CPDLC/ATN Benefits**
  - Benefits can accrue Locally (dependent upon equipage)
  - Regional Jet equipage is a significant Benefits component
  - Delay in CPDLC implementation is an Opportunity Cost

- **Post-Sep 11 Impacts**
  - Near-Term Lower Traffic Densities
  - Older Aircraft are already being removed from the Fleet
  - Regional/Business operations are growing

- **CPDLC/ATN Implementation Plans must stay in Place**

  Traffic and Voice Communication Congestion will Return - CPDLC IS NEEDED!!
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