Agenda Item 4: Air-ground Communications

SITA AIRCOM AIR-GROUND ATN DATA LINK

(Presented by SITA)
SITA AIRCOM
Air-ground ATN Data Link

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ATN Structure

Airborne End System

Airborne Boundary Intermediate System (mobile)

Ground/Ground Boundary Intermediate System

Ground Network

Mobile Network

End System

SITA

THE SKY IS NOT THE LIMIT
ATN Structure - Routers

- ICAO CNS/ATM implementation will see different levels of ATN routers functionality:
  1. Ground - ground router
  2. Air - ground - air router
  3. Avionics router

- Each router will see differing levels of ATN SARPs compliance and features
  - Each router has varying levels of complexity and associated costs
  - Each router has explicit network compliance issues for existing Data Service Providers such as SITA

- Router deployment will be linked to application

- Implementation is only based on benefits to airlines and airspace managers
Aircraft Capabilities

- No Datalink
- FANS-1/A
- ACARS
- AOA
- ATN & Mobile Subnets

New aircraft deliveries:
- A
- B
- D
- E

Graphic c/o Eurocontrol Link 2000+
Aircraft Capabilities

Given the multifunctional avionics requirement we will see a graceful migration from FANS to ATN:

- FANS 1/A initial ATN dual stack on ground systems
- FANS 1/A over VDL Mode 2, ATN “Convergence Pack”, ATN aircraft – 2002
- Full ATN integrated FMS solution by 2006

Supported by AC, ANZ, DHL, QF and UAL.

Support for FANS1/A capability in FAA CPDLC Build 1A Project – UAL, Continental, AC, QF and DHL.
Aircraft Capabilities

FANS Current Architectures

Current and Possible ATN Architectures
Aircraft Capabilities

Transition from ACARS to AOA:

- **BFE Market**
  - Collins: 1Q01 (red label)
  - Honeywell: 2Q01 (CMU Mk II red label)
    3Q01 (CMU Mk III red label)

- **SFE Market**
  - Airbus/Aerospatiale ATSU:
    - Single aisle aircraft: 1Q02 (black label)
    - Dual aisle aircraft: 3Q02 (black label)
  - B777: in 2003
VHF ACARS to VDL transition

- VHF Data Link (VDL) standards were developed by the ICAO Aeronautical Mobile Communications Panel

- VDL Mode 1
  - Interim step for migration from existing ACARS and ICAO compliant VHF datalink
  - MSK modulation, 2400 bps, 25 KHz VHF channel

- VDL Mode 2
  - ATN compliant VHF datalink
  - D8PSK modulation, 31.5 Kbps, 25 KHz VHF channel

- VDL Mode 3
  - D8PSK modulation, 31.5 Kbps, 25 KHz VHF channel
  - Integrated voice and data capability, 4 slot TDMA

- VDL Mode 4
  - D8PSK modulation, 31.5 Kbps, 25 KHz VHF channel
  - 9600 slot TDMA with inherent ADS-B message structure
VHF ACARS to VDL transition

- SITA has contracted with HARRIS Corp to develop a VHF Ground Station (VGS), provisioning ICAO standard VHF Digital Link (VDL) Mode 2 service.

- SITA will increase VHF AIRCOM data link capacity by introducing VDL mode 2 service providing 10-20 times more capacity by channel.

- SITA is already offering ACARS over AVLC (AOA) service at 10 locations in Europe.

- SITA VGS supports successful VDL flight tests in Europe with KLM and Eurocontrol.

- Currently there are some 680 ACARS RGS that will be replaced with VDL Mode 2 capable hardware by 2007.
## VHF ACARS to VDL transition

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VHF Data link Network Evolution

(A) POA
(B) AOA
(C) VDL/GACS
(D) VDL M2 (ATN)
VHF Data link Network Migration

- **POA**: VGS to replace RGS for provision of old “Plain ACARS” (POA) service. ACARS messages still supported as before by (X) ASP platforms in Montreal and Singapore.

- **VDL mode 2/AOA**: Provision of VDL mode 2 AOA (ACARS over AVLC). Higher level message formats are identical to POA without any changes to the airborne and ground application.

- **VDL mode 2/GACS**: Support ACARS over ATN VDL Mode 2. This service requires the implementation of ATN Avionics, ATN ground routers and the Generic ATN Communication services (GACS) gateway implemented as a DSP ATN end system.

- **VDL mode 2/ATN**: End to end support of VDL mode 2 in an ATN environment
VHF Data link Network Evolution

VGC

A2 CPU2
A12 FPC
SCC1
SCC2
SCC3
SCC4
SMC1

A1 CPU1
A11 UPC
SMC1
SCC3
V24/V35

A20 TIMING

To SITA MTN

Radios mode 1/ mode 2

VDR 1
filter

VDR 2
filter

VDR 3
filter

VDR 4
filter

Surge protectors

Maintenance PC

THE SKY IS NOT THE LIMIT
Satellite AIRCOM

- Aeronautical Mobile Satellite Services (AMSS) standards were developed by the ICAO Aeronautical Mobile Communications Panel (AMCP).
- ICAO AMSS SARPs based on the Inmarsat service:
  - Circuit mode
  - Packet mode
    - Data 2
    - Data 3
- ICAO AMSS and ATN SARPs compliant Data-3 Service is available today as demonstrated in the ADS Europe and Australian ‘INCA’ projects (Data-3 Service validation was provided by SITA and Inmarsat).
Inmarsat worldwide coverage