SITA AIRCOM
ATN Services

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ICAO ATN Seminar

- SITA Services
  - Datalink today with pre-FANS and FANS
  - ATN CPDLC, ADS-C and AMHS
- SITA ATN Subnetworks
  - VDL
  - ATN router (air-ground-air and ground-ground)
  - AMHS
- SITA and ATN
  - Security
  - Authentication
- Summary and Conclusions
SITA Services

Why ATN?

- To meet the predicted increase in aircraft movements ATS Providers seek affordable and sustainable growth in airspace capacity to meet (i.e. reduce) delay targets
- Increased air traffic will be supported by migrating from voice to data comms, leading to an increase in ATC data link
- Harmonisation of airline data applications and those of ATC data link applications, including avionics and ground system elements
SITA Services

- Airlines Seek:
  - Increased operational efficiency
  - Increased operational flexibility
  - To take advantage of increased aircraft automation

- Airlines need a single, global standard to ensure that the same avionics can be used world-wide

- New aircraft performance metrics see increased amounts of data transactions and reports of avionics to ground hosts

- Focus on data link applications, airspace efficiencies, technology harmonisation, costs and benefits to airlines and ATS providers
SITA Services – Datalink Today

SITA Air Traffic Services
SITA Overview

- Today, Datalink is implemented as ACARS with SITA providing SATELLITE AIRCOM and VHF AIRCOM Services
  - SATELLITE AIRCOM using INMARSAT Aero-H, Aero-H+ and Aero-I Services
  - VHF AIRCOM consists of a Network of VHF Ground Stations operated and owned by SITA

- Telephony/fax services are provided using SATELLITE AIRCOM and are used by passengers and crew
SITA AIRCOM Service

- **SITA Satellite AIRCOM**
  - 60+ contracted airlines
  - 750+ equipped aircraft
  - Two, dual-Ocean Region Satellite Ground Earth Stations (GES)
    - Perth, Australia and Aussaguel, France
  - ICAO AMSS and ATN SARP compliant Data-3 Service is available today
Inmarsat worldwide coverage
SITA AIRCOM Service

- **SITA VHF AIRCOM**
  - 780+ VHF Remote Ground Stations (RGS) for ACARS
  - These RGS are located in some 164 countries
  - Some 4,500+ ACARS-equipped aircraft & 100 Airlines enjoy services SITA's ACARS datalink today
  - SARPs compliant VDL2 services deployment has begun in 2001
SITA VHF AIRCOM (ACARS) Service
ATS AIRCOM Service

- For ATS Providers the ATS AIRCOM services enable benefits for their ATS datalink applications to the datalink equipped aircraft.
- SITA currently has two generations of ATS applications that are supported today:
  - Pre-FANS services (text message exchange)
  - FANS services (binary data exchange on ACARS link)
ATS AIRCOM Pre-FANS Services

- These applications send text messages to a cockpit printer or gate printer or airline host.
- They remove the need for pilots and controllers to manually transcribe voice messages during periods of high workload, nominally:
  - d-ATIS: Automatic Terminal Information Service
  - PDC/DCL: (Pre-)Departure Clearance
  - (North Atlantic) Oceanic Clearance delivery
ATS AIRCOM FANS Services

- SITA FANS Services facilitate optimum flight trajectories, FANS routes
  - flight economies enabled through greater load uplift & reduced fuel burn
- The FANS applications of ADS, CPDLC and AFN are supported, allowing:
  - replacement of ATC voice radiotelephony for position reporting and routine communications
  - Reduced pilot and controller workloads
SITA and CNS/ATM Transition

SITA Air Traffic Services
Why SITA involved in the ATN?

- SITA is involved in the ATN due to the significant role we play in service delivery of airline and ATS applications today.
- This includes:
  - Extensive infrastructure air-ground-air and telecommunications
  - Extensive application delivery that are essential for airline operations
  - Extensive application delivery of ATC data link applications
  - SITA is a World-wide civil aviation service provider
Why SITA involved in the ATN?

SITA is developing ATN systems to:

- ensure we keep up technologically
- have the opportunity to influence world-wide ATN implementation choices
- minimise future transition costs for airlines and ATC service providers
- be ready when airlines require ATN services
- Maintain airline (AOC) services as customers move from ACARS to ATN
- advance operational benefits and optimise the overall Air Traffic Service efficiency
SITA ATN Services

Current non-ATN services:
- Pre-FANS – ACARS, PDC, Digital ATIS
- FANS – CPDLC, ADS-C
- Airline applications

ATN services:
- Pre-FANS
- FANS
- VHF Datalink (VDL Mode 2)
- AMHS (includes AIDC)
ATS AIRCOM Ground Services

- ATS Message Handling Service (AMHS)
  - Replaces AFTN intercentre communications
  - As AMHS has its own addressing scheme, AMHS systems can communicate via generic networks and do not require ATN Internet routers
  - SITA’s homogeneous X.400 ground connectivity ensures a robust & reliable service
  - AMHS may be run over X.25 networks
  - SITA X.400 and X.25 networks can be used for AMHS today!
ATS AIRCOM Ground Services

- ATS Interfacility Data Communications (AIDC) can be supported by Customers on the SITA international network
  - replaces verbal ATS co-ordination and transfer of control
  - automation saves time for ATC staff
  - SITA’s homogeneous X.25 ground connectivity ensures a robust & reliable service
SITA and CNS/ATM Message Handling Services

SITA Air Traffic Services
AMHS Background

- ATN-P Subgroup 1 has defined the use of AMHS for ground-ground messaging and transition from AFTN to AMHS
- AMHS fully complies with ITU X.400 standards with a global ADMD name “ICAO” under the country code “XX”
- Several ATSs already have an operational AMHS service in place, or plan to do so within short term, as we have seen also in the Asia Pacific Regional Plans
- However because of limited commercial success several public X.400 services have closed
- SITA continues to provide X.400 and AFTN services, and plans for AMHS services to assist and support the transition from AFTN TO AMHS
SITA Messaging Services

- **Airline Messaging domain**
  - Type B Services (MQ-Type-B, MATIP-Type-B ..)
  - Web-Type B and SITATEX

- **X.400 Messaging domain**
  - X.400 Relay Service (PRMD to PRMD/ADMD)
  - X.400 Mailbox; GMS Mail

- **AFTN Messaging domain**
  - Direct Connections to AFTN networks for message delivery to airlines

- **SMTP Messaging domain**
  - SMTP Relay Service (private & open Internet)
  - SMTP Mailbox; PoP3, IMAP4, Web

- **Delivery to other domains (Gateways)**
  - Gateways to FAX and TELEX services
  - Inter-domain Messaging gateways, Internet Gateway
SITA Plans for AMHS

- SITA plans to complement the existing services for a complete Messaging service to ATS Providers including:
  - Fully tested AMHS relay and mailbox services
  - AMHS gateways to AFTN and airline messaging
  - PRMD hosting services
  - Consultancy and partnership for deployment and migration

- Provision of different services will depend on community plans for a regional, global or back up use
SITA Plans for AMHS

The AMHS architecture includes the following components:

- MTA/MS (ATS Message Server)
- DS (X.500/88 Directory Server)
- Communication stacks (ATN, LAN, WAN)
- AFTN/AMHS gateway
- UA (AMHS terminal)
- Integration with the existing SITA Messaging services for communications to AFTN, Type B, SMTP, Internet email, fax and telex
SITA Plans for AMHS

For AMHS implementation we have the options of:

(1) Agreement between ATS Providers as done now for AFTN
   – May prove expensive and inefficient given AMHS traffic levels
   – Requires individual agreements between ATC Service Providers
   – Not truly homogeneous AMHS network
   – May lead to inefficiencies as different ATC Service Providers implement individual solutions of AFTN/AMHS gateways, circuits and ground-ground routers
SITA Plans for AMHS

(2) SITA AMHS with ATS Providers using SITA X.25 or X.400 for AMHS delivery
- utilises existing SITA X.400 and/or X.25 network
- utilises existing X.25 FANS network connections that many ATS Providers enjoy with SITA today
- efficiencies in costs without explicit AFTN and AMHS point-to-point circuits, especially in the early transition from AFTN to AMHS
- uniform and homogeneous AMHS network
- uniform and consistent SITA AMHS network access and message transaction charging regime
SITA Plans for AMHS

(3) ATS Providers use alternative X.25 or X.400 networks for AMHS delivery
- may use existing X.25 FANS network connections of alternative Data Service Providers
- AMHS network harmony heavily reliant of internetworking agreements between Data Service Providers
- may prove inefficient with regard to AMHS implementation and network topology
SITA Plans for AMHS

ATS Providers have set the schedule for AMHS implementation:

- Regional ICAO ATN Plan
  - AFTN loadings and circuit topology
  - AFTN to AMHS transition
  - AMHS deployment from 2002
  - AMHS network topology akin to that for AFTN
  - AMHS implemented with routers

- While this is a Plan, it does not address:
  - Economics of implementation of choice
  - Network security or regulatory requirements
  - Application authentication across network elements
  - Certification of network elements
  - Internetworking regulation across the network elements
SITA and CNS/ATM
ATN Routers

SITA Air Traffic Services
SITA ATN 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
SITA and CNS/ATM Transition

SITA ATN development and achievements:

- SITA developed an ATN Router as a partner in ProATN from 1995-2000 and in the previous EurATN project from 1990-1995
- More recently SITA issued a RFP for production ATN routers to provide operational service
- SITA has developed strategies that see existing network support ATN applications and be ATN compliant
- SITA ATN service was to be available in early 2002 – in line with the first operational implementation of ATN CPDLC in the FAA CPDLC Build 1, but will now slip as has the FAA project to mid 2003
SITA and CNS/ATM Sub-networks

SITA Air Traffic Services
SITA ATN Sub-networks

SITA sub-networks for ATN will include:

- The SITA Satellite AIRCOM service supports ATN communications and has been demonstrated in the ADS Europe project.
- SITA has acquired a new VHF AIRCOM ground stations that will support ATN/VDL sub-network service.
- The SITA VDL ground station will also support the use of the AVLC protocol specified in the ICAO VDL standard for the exchange of ACARS messages. The AEEC has specified this ACARS over AVLC (VDL AOA) service.
- SITA will maintain existing VHF analogue service (ACARS).
SITA VDL Ground Station Architecture

VHF Data Radios: Each VDR can be programmed to handle VHF analogue ACARS or VHF Digital Link Mode 2

VHF Ground Computer (VGC)

Antenna Relay switches

Uninterruptible Power Supply

Power Supply

Dual Power Supply

SITA Ground Network

ATN Router

VDL Subnetwork Connections

ACARS and VDL AOA Traffic

ACARS Processor

VGS Management Interface

VDL Management Entity Processor

Laptop computer for maintenance

GPS source

Wide band Antenna

Narrow band Antenna

interface (8) - X1

interface (8) - X2

interface (1) - X10
Avionics Transition from ACARS to ATN/VDL

No Datalink

A

ACARS

B

AOA

C

FANS-1/A

D

ATN & Mobile Subnets

E

New aircraft deliveries

New aircraft deliveries

New aircraft deliveries

New aircraft deliveries

Graphic c/o Eurocontrol Link 2000+
SITA ATN/VDL Sub-network

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 FMC solution by 2006

Supported by AC, ANZ, DHL, QF and UAL.
SITA ATN/VDL Sub-network

SITA is implementing VDL to increase data link capacity in the VHF band:

- Aircraft that implement VDL Mode 2 will obtain VHF link performance 10 times better than VHF analogue ACARS
- A 250 character ACARS block will take about 0.06 seconds to cross the VDL Mode 2 link instead of 0.83 on the VHF analogue link
- Improvement in the RF robustness of VDL over ACARS
- For aircraft using VDL AOA, the VHF link transit time be a negligible factor in the end to end performance
SITA ATN/VDL Sub-network

- The implementation of ACARS over AVLC (VDL AOA) service has the following components:
  - The VGS is made up of a VHF Data Radio that processes the VDL D8PSK physical layer and a computer that processes the Aviation VHF Link Control (AVLC) protocol specified in the ICAO VDL standard
  - The service requires no major modifications to SITA ACARS processor because aircraft use the same ACARS message formats over VDL AOA links as over VHF analogue links
  - SITA will implement the VHF Management Entity (VME) processor to manage the VDL links
SITA ATN/VDL Sub-network

SITA ATN development and achievements:

- Dec 2000 => Implement preliminary VDL Avionics Qualification capability
- Nov 2000 => VDL ground system validation
- Dec 2000 => VGS Service Cut-over (analogue)
  - PAR and GVA have been operational since Nov./Dec. 2000
  - ORY and AMS followed in Feb. and Mar. 2001
- Oct 2000 => Interoperability testing between VDL avionics and VGS successfully performed at the SITA Montreal test bed
- Jan 2001 => VGS installed at Rockwell Collins, Cedar Rapids for testing in the lab and with test aircraft
SITA ATN/VDL Sub-network

- The earliest plan to implement operational ATN CPDLC service is the FAA CPDLC Build 1 in July 2006 (was July 2002)
- The FAA will start certifying the ATN CPDLC avionics in 2002, but it will take several years for the avionics to be installed in a significant proportion of the airline fleet.
- In Europe, the Eurocontrol Maastricht ATC centre plans to implement ATN CPDLC in 2002 but no other centre has a firm plan so they could not have CPDLC in service before 2004.
SITA ATN/VDL Sub-network

Pre-Opr VGS Deployment
VGS POA Operational
ATN Router Evaluation
VGS/ATN Router Inter-Operability Testing
Preliminary VDL VAQ Ready

Pre-Operational VDL AOA Service
Official AOA Service Launch
ATN Router Selection
ATN testing with Avionics
Preliminary ATN VAQ Ready

July 2006
FAA CPDLC Build 1
SITA ATN/VDL Sub-network

AIRCOM
Internetworking and
FANS Partners

SITA ATN Router

ADLT - (X)ASP
(Singapore)

Primary

Backup

ADLT - (X)ASP
(Montreal)

GACS

SITA X.25 MTN

GES

RGS

VGS

MSS

MSW

DHP

Airlines and CAA
Customers

ATN Sub-Networf

(A)

(B)

(C)

(A) ACARS

(B) AOA

(C) VDL/ATN

SITA

THE SKY IS NOT THE LIMIT
SITA and CNS/ATM Internetworking

SITA Air Traffic Services
Internetworking by Service Providers

Internetworking between data service providers is the means for message assurance, application performance and system monitoring:

- ATS Providers need to communicate with all aircraft in their airspace.
- With FANS this data communication to all aircraft in all airspace is heavily reliant on internetworking between Datalink Service Providers such as SITA.
- ATC communication is independent of which Datalink Service Provider the airline has chosen to contract with.
Internetworking by Service Providers

- To date there is agreement between Data Service Providers for no double billing of airlines and ATS Providers for ATC data applications
  - FANS CPDLC and ADS-C
- A feature of SITA network connections for ATC ensure that ATC ground systems can communicate with all ACARS aircraft
- SITA views the responsibility of internetworking and the associated obligations are that of Data Service Providers
- for ATN as this responsibility is the same, ensuring network integrity, authentication and security is managed across networks
Summary and Conclusions

- SITA is moving towards ATN
  - Router developments (ground-ground and a-g-a)
  - VDL implementation for mid-2002
  - VDL spectrum planning
  - SITA AMHS deployment and support
  - FANS services continuing
  - pre-FANS services continuing
  - SITA network upgrades for ATN linked to CPDLC Build 1 Project
  - Regulatory framework for network security, authentication and internetworking is required
Discussion and Questions?

SITA Air Traffic Services