

Air-ground data link infrastructure and ATS applications

SEMINAR ON DATA LINK COMMUNICATIONS

Recife – Brazil, 16-18 March 2016



Agenda

- Introduction to SITAONAIR
- Global SITAONAIR ATS datalink context and footprint
- SITAONAIR experience with datalink implementation
- Lessons learns from European ATN/VDL deployment : issues and improvement



Introduction to SITAONAIR

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SITAONAIR a new organisation to serve the connected aircraft market



SITAONAIR a worldwide organisation to serve the connected aircraft market



SITA and OnAir combine market leading capabilities in a new business organization to help airlines realize the full potential of the connected aircraft



What does SITAONAIR bring to the connected aircraft?



- Nose-to-Tail portfolio covering all aircraft domains
- Why SITAONAIR?
 - One-stop shop across all aircraft domains
 - Modular portfolio of solutions
 - IT execution coherence, minimize costs & effort across all aircraft domains, protecting investments
 - Secured aircraft data exchanges
 - Neutral, agnostic, dedicated to ATI technology transformation

Enabling airlines to adopt OEMS'Air Framers' services



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AIRCOM Network Infrastructure – VHF and VDL

- VHF AIRCOM was launched more than 25 years ago as SITA's first step beyond ground network services into radio communications.
- AIRCOM also provides data and voice service via the Inmarsat satellites with coverage around the world between 80 deg N/S (since 2009, using I4 constellation) and benefits from the Japanese MTSAT satellite as well.
- Since 2008 AIRCOM service has extended to provide data and voices services via the Iridium constellation.



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AIRCOM Network – VHF



AIRCOM Network – VDL mode 2



AIRCOM Network Infrastructure – satellite

- Inmarsat :
 - Classic Aero services (high-quality voice, low-speed data and safety communications)
 - SwiftBroadband (Simultaneous voice and broadband data, Contended IP data at up to 432kbps)
- Iridium :
 - Voice
 - Data (datalink)
- MTSAT : Standard Classic Aero Services via JCAB MTSAT constellation



AIRCOM Network – Inmarsat Classic Aero

AIRCOM Satellite Classic Aero Inmarsat coverage



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AIRCOM Network – Inmarsat SwiftBroadband

AIRCOM Satellite Swift Broadband coverage





AIRCOM Network – MTSAT



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AIRCOM Network Infrastructure - Iridium



Polar-type constellation of low earth-orbiting (LEO) satellites 6 orbital planes with 11 satellites (+1 spare) per plane







AIRCOM Network Infrastructure

The Context – datalink in AOC

• Datakink has been initially developed for AOC (Airline Operational Communication) and now Airline Operations depend on datalink



Aircraft Maintenance Engine reports via ACARS enable preventive maintenance avoiding costly in-flight breakdowns



Operations Control Aircraft movement reports via ACARS key to synchronize operations through airports Flight Planning Flight plans & weather transmission to cockpit enable efficient operation of modern aircraf

The Context – datalink in ATC

- Since the early 90s, data-link services are used for Air Traffic Control applications.
- ATC datalink services are implemented at Airport Towers :
 - DCL : Datalink Departure Clearance,
 - **D-ATIS** : Digital ATIS,
 - D-VOLMET : Digital VOLMET
- and also in En Route centres :
 - CM / AFN : Context Management / Aicraft Facility Notification,
 - CPDLC : Controler Pilot Datalink Communication,
 - ADS-C : Automatic Dependant Surveillance Contract
- Now Air Traffic Control increasingly relies on datalink for surveillance and communication, enabling to enhance safety and improve performance



ATC datalink functions















ATS Services footprint – FANS Customers*







end. However, most shown are operational. $^{\rm 24}$

ATS Services footprint – US – Data Comm (NexGen)

- Provides data communications between the cockpit and controllers to replace some current voice communications
 - Already implemented: Airport Departure Clearances already at 10 airports being rolled out to top 70 airports by end 2016
 - 2019: Enroute (in-flight) Controller Pilot Data Link clearances, instructions, traffic flow management, flight crew requests and reports
- FAA in 2012 awarded Harris Corp \$330m Data Comm (VHF) Network Service contract
 - SITA subcontracted with Harris to provide VHF stations, ACARS processor to build FAA compliant network replacing SITA network
 - SITA resells Harris network use, higher quality should enable winning RC ARINC customers



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Federal Aviation Administration

ATS Services footprint – Brazil

- 1. VHF data link Concession
 - Total of implemented sites: 51
 - Total of active ground stations: **102**
 - VDL stations delivered: 51
 - ACARS stations delivered: 51
- 2. Airport Tower Systems (23 Towers Pre FANS project)
 - 17 of 23 sites delivered;
- 3. FANS
 - ADS& CPDLC oceanic in ACC Atlantico. Operational since 2009
- 4. D-VOLMET
 - FIRs Brasilia, Recife, Atlantico, Curitiba and Amazonia. Operational since 2012





ATS Services footprint – Europe



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PANSA (Poland):

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VHF Partnership principles

- Deploying, operating and maintaining a VHF datalink network is a complex project, requiring specific equipment (VHF stations), ground network and supporting systems (routing and monitoring).
- VHF ground stations (VGS) would include both VDL and POA (ACARS) radios
- SITA OnAir can provide the required equipment (VHF stations and supporting systems) for the ANSP to connect on its ground network along with supporting services.
- Supporting systems can include monitoring (AMOS), VDL monitoring (COSMOS), ACARS traffic processing (ADLT) and ATN routing systems (ProATN router).
- The ANSP VHF network is also used by SITA OnAir customer airlines for datalink AOC purposes, and in return SITA OnAir contributes to VHF network operating costs



VHF Partnership principles



Win / Win Approach

 SITA OnAir outsources the provision of its A/G communication service (AOC, ATC) to the ANSP SITA OnAir contributes to the ANSP costs for operating the A/G infrastructure 	- T co co - T an	 The ANSP deploys a state-of-the art A/G datalink communication infrastructure at a fraction of the costs it would sustain if developed from scratch The ANSP owns and operates the infrastructure and
	1	develops its know-how - The ANSP receives a cost contribution that is directly linked to the volume of AOC trafficient or or

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VHF Partnership traffic flows



Studies and R&Ds



Studies and R&D:

- Involved in SESAR and SESAR
 2020
- Contributed to SESAR i4D trials, the first step of 4DTRAD concept validation
- SESAR AFD (ATC Full Data Link) project (led by ENAV)
- SESAR VDL Capacity study
- SESAR ELSA Project VDL
 Measurement and multi-frequency
- ESA IRIS Precursor project (ATN over SBB), led by INM



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ATS QBR / 1Q2015

VDL/ATN deployment lessons learned

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EUR Context : the European Implementing Rule on DLS



- Performance is bad
 - Too many CPDLC air/ground connections abort
 - Problem known as Provider Aborts (PA)
 - Up to 30% of the connections abort
 - New dates:
 - Ground: ANSPs must provide the service by February 2018
 - Airborne:
 - Forward fit already in force
 - Retrofit deadline
 extended until 2020



Provider Aborts

The ATN/VDLm2 service evidences performance issues

- Provider Aborts
 - Unintended disconnection of the Air/Ground CPDLC connection



Provider Aborts

Two main categories of causes

- 1. Interworking Issues
 - Mainly between airborne and ground equipment

2. Frequency Congestion

 Use of unique VDLm2 CSC Channel







The ELSA Project

Funded by SESAR JU NATS UK Lead Consortium

Project : "VDL Mode 2 Measurement - Collection and analysis of data from avionics and ground systems to determine the levels RF interference and VDL/2 channel occupancy as well as identifying issues affecting the end-toend performance of the VDL/2 datalink"

Lood by:

	<u>Leau by.</u>
WA0: Project Management and Reporting	NATS
WA1: VDL performance analysis	AIRBUS
WA2: Multi-frequency options modeling & testing	ENAV
WA3: RF level modeling and testing	ALTYS



ELSA Consortium and Partnership Structure



Multifrequency Deployment by SITA

EUROPE - VDL FREQUENCY COVERAGE MAXIMUM COVERAGE AT 30 000 FEET ON-LINE VDL ARE IN RED, PLANNED ARE IN BLUE



EUROPE - VDL SECOND FREQUENCY COVERAGE ON LINE VDLARE IN RED, PLANNED ARE IN BLUE



Principle: on the airport sites with the highest VDLm2 usage, SITA deploys an additional VDLm2 station to capture ground data traffic.



Multifrequency Deployment by SITA - results

PA level

- Eurocontrol MUAC experiences PA rate dropped to 7.5 9.0%
- Skyguide (Geneva and Zürich ACCs) reported no PA in January 2016
- Karlsruhe also reported significant improvement
- Consequences
 - MUAC removed « White Lists »
 - KLM and Lufthansa reactivated CPLDC

• Way Forward

SITA is part of the Consortium for the ELSA study where VDLm2 deployment is being investigated.



Conclusion

The ATC use of datalink is increasingly shaping ANSPs' environment



SITAONAIR remains committed to supporting ATC datalink implementation worldwide, with the objective of providing better service to both our airlines and ANSPs customers.







SITA OnAir

112 Av Charles de Gaulle 92200 Neuilly-sur-seine France

Simply connect to www.sitaonair.aero

