

Air-ground data link infrastructure and ATS applications

SEMINAR ON DATA LINK COMMUNICATIONS

Recife – Brazil, 16-18 March 2016



AGENDA

- Brasil VHF concession: current status and RGS / VDLm2 coverage
- Brasil ATS data link services
- Brasil ATN initial deployment
- The next steps





WHY A CONCESSION MODEL

DECEA is responsible for aeronautical telecommunications in Brazil and was looking forward to select a CSP partner with well recognized experience on implementation and operation of data link infrastructure for long term investment and partnership.

CHALLENGES	SAFETY	EFFICIENCY
 To provide SIRIUS program with stat-of-art air ground data link communication technology To responde continued traffic growth in Brazil Major step on SISCEAB modernization strategy to support big events (World soccer games in 2014 and Olimpycs in 2016) 	 To enhance communication between ATC and aircraft users, by adding data to voice To ensure communication integrity, specially with foreign airline crews 	 For both ATC and aircraft users: To reduce ATCO and Crew workload by replacing voice by data on routine communication, To reduce the use of voice radio frequencies



VHF CONCESSION OVERVIEW

- In 2010, after a public RFP process, SITA has been selected by DECEA to deploy a new VHF data link network in Brazil;
- The agreement model is a 20 years public concession where SITA operates and maintain the VHF network on behalf of DECEA;
- SITAONAIR became exclusive service provider in Brazil for AOC and keeps Internetworking with other DSP for ATS purpose;
- SITAONAIR replaced obsolete DECEA's data link network and Processor.

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Rede Terrestre do Sistema Data Link Brasil





Operational requirement: to provide ACARS and VDL M2 full coverage on Brazilian airspace above FL245 and selected Terminal Areas (TMAs).







PROJECT COMPLEXITY

During the project, it was required to handle great complexity of factors to deliver the project on time

VHF sites	 Most located on INFRAERO airports Public Calls, location of the antennas and cabinet, technical projects, installation authorization.
	 Private airports and small cities airports Commercial agreements and technical project evaluation
Radio licenses	 Application submission to the Brazilian Telecom agency (ANATEL) that has issued and granted the use of VHF frequencies by SITAONAIR on behalf of DECEA
Logistis	 Transport, storage and installation of equipment Compliance with Brazilian Law and tax regulation
	SITA

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Create success. Together

Example of Installations

SDU site 1



GIG site 1





Example of Installations









VHF INFRASTRUCTURE SUMMARY



- 51 implemented sites.
- 102 active ground stations.
 - 51 VDL stations.
 - 51 ACARS stations.
- 1 ACARS processor:
- 1 ATN router.
- 2 new sites (JCR and SJL) requested by DECEA under implementation.



Datalink users

 There are currently 592 aircraft are data link equipped that are configured in SITA processor to use the service in Brazil.





Datalink Traffic in Brazil



Traffic per Year (in Kilobits)

SITA's Brazilian Network Availability

SITA is delivering a much more stable and available network in Brazil, compared to the legacy Network.





ATS DATA LINK SERVICES

- 1. Existing Pre FANS services in 2 major airports: Galeao (Rio) and Guarulhos (Sao Paulo).
- 2. Pre FANS expansion program includes 23 Control Towers equipped with D-ATIS and DCL:



- Partnership with Saipher (TATIC) and ACAMS/ATCsys (Automated Tower System).
- 1. FANS
 - ADS& CPDLC oceanic in ACC Atlantico. Operational since 2009.
- 2. D-VOLMET
 - FIRs Brasilia, Recife, Atlantico, Curitiba and Amazonia. Operational since 2012.





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CENTRALIZED ATS SERVER (CATS)



São Paulo

PRE FANS USAGE

Total pre FANS traffic (Jan2016)

	Ground Traffic (Uplink + Downlink)	Percentage Total	Air-Ground Traffic (Uplink + Downlink)	Percentage Total
Total Pre-FANS	241.699	100,00%	66.844	100,00%
d-ATIS Traffic	204.430	84,58%	63.530	95,04%
Departure Clearance Traffic	37.266	15,42%	3.314	04,96%
Oceanic Clearance Traffic	3	00,00%		

 Brazilian airlines (TAM, GOL, AZUL) represent nearly 90% of total generated traffic



DATIS USE BY AIRPORT – Feb2016



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FANS 1/A OPERATIONS BY ACC AO



Service Availability	# of outages	Shortest Duration	Average Duration	Longest Duration	Total Duration	Availability	3-month average	12-month average
VHF FANS AIRCOM Processor Availability	0	0	0	0	0	100,00%	100,00%	99,99%
Satellite FANS AIRCOM Processor Availability	0	0	0	0	0	100,00%	100,00%	99,99%
VHF Access Network Availability								
Satellite Access Network Availability					1	99,99%	100,00%	100,00%
VHF FANS Service Availability								
Satellite FANS Service Availability						99,99%	100,00%	99,98%





CONCESSION RACK





BRAZIL ATN INTERNAL NETWORK OVERVIEW

2.3.1 OVERALL NETWORK ARCHITECTURE

The following picture presents the network architecture applicable to Rio operational environment.





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BRAZIL ATN SAT RESULTS @GIG IN DEC-2015

- Finished the installation and configuration together with Thales (ProATN supplier);
- Performed 17 tests all passed without open issue, being checked the following items:
 - HW and documentation;
 - All software components, agents and licenses;
 - Cabling between both ATN Servers and network components;
 - ATN Topology
 - System Startup
 - System Failure and automatic witch in case of failure (Cluster)
 - Software Failure
 - Supervision (SNMP functionality)
 - Web Monitoring Tool
 - Log Files Management



BRAZIL ATN @GIG: CLUSTER STATUS

localhost/cgi-bin/Pro	ATN/setup.sh?next_file=	/ProATN/ClusterStatus.htm	ે ન્ હે	Google	9
HALES	5			ProA	FN Web Manager v3
		ProATN High Av	ailability Bounda	y Intermediate System	gigp-atn-l1
Status		Status		Setup	
	Cluster ProATN	System			
Global informatio	n	Des ATM DOMC Winessen			
	Current time:	2016-03-14 14:11:18			
Note	gigp-atn-11	online			
Cuprellanas tink/s	gigp-atn-12	online			
Surveinance mints	192.168.1.1 192.168.2.1	ACTIVE - with no faults ACTIVE - with no faults			
Service	cl0-snmp	Started gigp-atn-11 - Started gigp-atn-12 Started gigp-atn-11			
	gr1-xot gr1-ll stack	Started gigp-atn-11 Started gigp-atn-11			
	gr1-ll_agent	Started gigp-atn-11			



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BRAZIL ATN: SOME RECENTE LOGS SHOW CONNECTIVITY

AES ld (oct)	AES Id (hex)	Airline	Message number
00400220	020090	RAM	21
01000112	04004A	ETF	27
22050655	4851AD	KLM	42
22050656	4851AE	KLM	22
5000000	A00000	General Aviation	20
50236742	A13DE2	UAL	7
51004537	A4095F	UAL	26
71106656	E48DAE	AZU	16
71107111	E48E49	AZU	6
71107210	E48E88	AZU	14



BRAZIL ATN: TRACE SHOWING AN AZUL FLIGHT CONNECTION

														m mi
age Type														
Content Type														
cancene 1394	falart = 7	1406056												10
100	411 -												1080110301201	
	<u> </u>													
ge Stats	Ristograme Syst	ens Stats Aircraft	/ Stations Sround Systems Logs											
Timesta	ne Micro se	ec Pitg type	Hog content	Gircuit	Connectio	n 1d Connection Options	LREF DUT A	Holding Tire	r Sequence	No Acknowledgement His Erro	er Code Sub Code Buffer Len	gth Source Destination Aircraft addres	s Source NSAP	
6-03-11	18:50:34 08713	3 X25-CALL-Ind	MOBILE CONNECT PDU/NPDU ISH	-	45	LREF		180			38	111693040219 30028368854901 _	-	-
6 03 11	18:50:34 08768	15 X25-CALL-rsp	MOBILE ACCEPT PDU/NPDU ISH		45	LREF	1	65534			38	111693040219 30028368854901 _	-	
.6-03-11	L8:50:34 08964	3 OUTGOING NPD	J NPDU DT/IPDU OPEN	mob_vd	1	-	1	900	2	0.	140	111693040219 71106656 _	47002701425241000000010001080020ffba7000	4700274
.6-03-11	18:50:34 08980	5 X25-DATA-req	NPDU DT/IPDU OPEN	-	45	-	64 1	900	2	0	143	111693040219 30028368854901 _	47002701425241000000010001080020ffba7000	4700274
6-03-11	18:50:37 89479	1 X25-DATA-ind	MOBILE Initial DT/IPDU OPEN	-	45	25	64 1	900	1	2	68	111693040219 30028368854901 _	-	-
6-03-11	L8:50:37 89493	I INCOMING NPDU	NPDU DT/IPDU OPEN	mob_vd	1	20	1	900	1	2	140	71105656 111693040219 _	47002741415a5500e48dae000000000000000000000000000000000000	4700270
6-03-11	18:50:37 89557	7 OUTGOING NPD	J NPDU DT/IPDU KEEPALIVE	mob_vd		27	2		3	1	108	111693040219 71106656	47002701425241000000010001080020ffba7000	470027
6-03-11	18:50:37 89571	1 X25-DATA-req	MOBILE Initial DT/IPDU KEEPAL/VE	-	45	-	64 2		3	1	36	111693040219 30028368854901 _	-	-
6-03-11	18:50:37 89646	IS DUTGOING NPD	J NPDU DT/IPDU UPDATE	mob_vd	1	# C	3		3	1	186	111693040219 71106656	47002701425241000000010001080020ffba7000	470027
6-03-11	18:50:37 89662	9 X25-DATA-req	MOBILE Initial DT/IPDU UPDATE	-	45		64 3		3	1	114	111693040219 30028368854901 _	-	-
6-03-11	18:50:41 03281	1 X25-DATA-Ind	NPDU ISH		45	-		65535			30	111693040219 30028368854901 _	-	
6-03-11	18:50:42 38874	17 X25-DATA-ind	MOBILE Initial DT/IPDU UPDATE	-	45	-	64 2		2	3	111	111693040219 30028368854901 _	-	-
6-03-11	18:50:42 38887	1 INCOMING NPDU	NPDU DT/IPDU UPDATE	mob_vd	1	-	2		2	3	183	71106656 111693040219 _	47002741415a5500e48dae000000000000000000000000000000000000	470027
6-03-11	18:50:43 31701	7 OUTGOING NPD	J NPDU DT/IPDU KEEPAUVE	mob_vd	1	-	4		4	2	108	111693040219 71106656 _	47002701425241000000010001080020ffba7000	470027-
6-03-11	18:50:43 31716	i5 X25-DATA-req	MOBILE Initial DT/IPDU KEEPALIVE	-	45	-	64 4		4	2	36	111693040219 30028368854901 _	-	-
6-03-11	18:55:11 21265	D OUTGOING NPD	J NPDU DT/IPDU KEEPALIVE	mob_vd		2	5		4	2	108	111693040219 71106656 _	47002701425241000000010001080020ffba7000	470027
6-03-11	18:55:11 21280	13 X25-DATA-req	MOBILE Initial DT/IPDU KEEPALIVE	-	45	20	64 5		4	2	36	111693040219 30028368854901 _	21 C	-
6-03-11	18:55:40 90032	3 X25-DATA-ind	MOBILE Initial DT/IPDU KEEPALME	-	45		64 3		3	3	35	111693040219 30028368854901 _	-	-
6-03-11	18:55:40 90049	INCOMING NPDL	NPDU DT/IPDU KEEPALIVE	mob_vd		27	3		3	3	108	71105655 111693040219 _	47002741415a5500e48dae000000000000000000000000000000000000	4700270
6-03-11	18:59:28 85454	3 DUTGOING NPD	J NPDU DT/IPDU KEEPALIVE	mob_vd		-	6		4	2	108	111693040219 71106656	47002701425241000000010001080020ffba7000	4700274
6-03-11	18:59:28 85473	15 X25-DATA-req	MOBILE Initial DT/IPDU KEEPALIVE	-	45	-	64 6		4	2	36	111693040219 30028368854901 _	-	-
5-03-11	19:00:45 63013	7 X25-DATA-Ind	MOBILE Initial DT/IPDU KEEPALIVE	-	45	-	64 4		3	3	36	111693040219 30028368854901 _	-	-
6-03-11	19:00:45 63026	IS INCOMING NPDL	NPDU DT/IPDU KEEPAUVE	mob_vd		-	4		3	3	108	71106656 111693040219 _	47002741415a5500e48dae00000000000000000000	4700270
6-03-11	19:03:50 20254	14 OUTGOING NPD	J NPOU DT/IPDU KEEPALIVE	mob_vd		-	7		4	2	108	111693040219 71106656 _	47002701425241000000010001080020#ba7000	4700274
6-03-11	19:03:50 20273	IB X25-DATA-req	MOBILE Initial OT/IPDU KEEPALIVE	-	45		64 7		4	2	36	111693040219 30028368854901 _	-	-
0.03-11	19:05:41 09759	is x25-DATA-ind	MUBILE Initial DT/IPDU KEEPAL/VE	-	45	-	64 5		3	8	36	111693040219 30028368854901	-	-
0-03-11	19:05:41 09775	S INCOMING NPOL	NPDU DT/IPDU KEEPALIVE	mob_vd		-	5		3	3	108	/1106036 111693040219 _	4/002/4141585500848dae0000000000000000000	470027
6-03-11	19:08:27 65058	4 UUTGUING NPD	U NPOU DI/IPOU KEEPALIVE	mob_vd		-	8		4	×	108	111033040513 \1106226 -	4/002/01425241000000010001080020#ba7000	4/00274
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PROATN SYSTEM ARCHITECTURE OVERVIEW





PROPOSED ROADMAP

- Phase #1 : Proof of concept.
- Objective: build ATN (and mixed environment) expertise
 - Implementation of end-to-end chain in lab
 - Airborne : lab avionic and/or simulators
 - ATN router
 - DL-FEP + CPDLC HMI
- Phase #2 : Flight trials.
- Objective: build expertise with real aircraft operations
 - Trials with lab aircraft (GEIV)
 - Trials with ATN aircraft (short hauls)
 - Trials with FANS aircraft (long hauls)
 - Trials mixing environments

Phase #3: Integrating with ATM systems

- Interoperability tests
- Full validation.
- Initial tests with CINDACTA continental



SITAONAIR SUPPORT TO CPDCL TRIAL

- Implementation Roadmap
 - Working with DECEA in defining "proof of concept" project
 - Producing evaluation / project report
- Providing ATN/CPDLC components
 - ATN/CPDLC Test & Evaluation Platform
 - ATN A/G and G/G routers
 - VDL Test Station (if needed)
 - Data-Link Front End Processor (DL-FEP) to connect to ATECH ATM system
 - Avionic bench (if needed in addition to YUL lab and GEIV a/c)
- Providing support services
 - ATN Test Services
 - Support to end-to-end tests and validation
 - Coordinating trials with airlines if required



ATM ENVIRONMENT FOR CPDLC TRIAL



Conclusion

- Brazil is leading a major ATM transformation program in the Latin America, the SIRIUS program which includes the introduction of data link technology in the ATS routine operation in airports and en route airspace.
- The VHF data link infrastructure in Brazil was designed by SITAONAIR to become the air-ground datalink platform for the SIRIUS program.
- The proof of concept and ATN validation is proposed in a step-by-step and evolving manner and will require the effective participation of the airlines in order to evaluate the potential benefits for the implementation of ATC datalink based services.





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