SITA

Specialists in air transport communications and IT solutions

AIRCRAFT OPERATIONAL COMMUNICATIONS KNOW-HOW

# ADS-C Technical aspects and Implementation Status

**ICAO Seminar on the Implementation of Aeronautical Surveillance and Automation Systems in the SAM Region**

San Carlos de Bariloche, Argentina, 6 to 8 December 2010

Adriana Mattos

ATM Senior Manager

Latin America and Caribbean

# Majority of air traffic controllers have communication problems: poll

Central News Agency
2008-12-11 02:29 PM

Nearly two thirds of air traffic controllers in Taiwan have difficulty communicating with foreign pilots, mainly due to the pilots' English accents, a survey released by the Ministry of Transportation and Communications (MOTC) showed Thursday.

The MOTC conducted the survey between April and July on 2,003 pilots of six Taiwan air carriers -- China Airlines, EVA Airways,

Mandarin Airlines, Trans Asia Airways, UNI Airways Corp. and Daily Air Corp. -- and 261 air traffic controllers of the Civil Aeronautics Administration. Responses were obtained from 38.2 percent of the pilots and 93.5 percent of the air traffic controllers.

According to the survey, 74.6 percent of the air traffic controllers said they have difficulty communicating with foreign pilots.

The main reasons for the problems were found to be the level of English proficiency of the air traffic controllers and the English accents of foreign pilots from non-English speaking countries.

“Hola Adriana:

Ayer 03 de agosto, hemos hecho el primer ensayo CPDLC con una aeronave en vuelo, un A340 de LAN de Santiago a Buenos Aires al que monitoreamos su ruta hasta el aterrizaje con el ADS. En mi opinión, lo de ayer es un hito para nuestro servicio, solo comparable con la instalación de nuestro primer RADAR en 1973.

Hemos trabajado muy bien con la gente de SITA, Iñaqui y Damian,

Un abrazo,

Alberto Fernández D/ Servicios Transito Aéreo-DGAC Chile”

In June 6th, 2007, DGAC Chile was recognized by IATA with Eagle Awards for outstanding performance in customer satisfaction, cost efficiency and continuous improvement

# Agenda

- Introduction to Data link
- The infrastructure
- Future Air Navigation Services (FANS)
- FANS Implmentation Status
- ADS C in the CAR SAM Region
- SITA Aircraft Communications Services
- Conclusion

# Introduction to Datalink

“Data link” is a generic term that encompasses different types of data link systems and subnetworks.(GOLD)

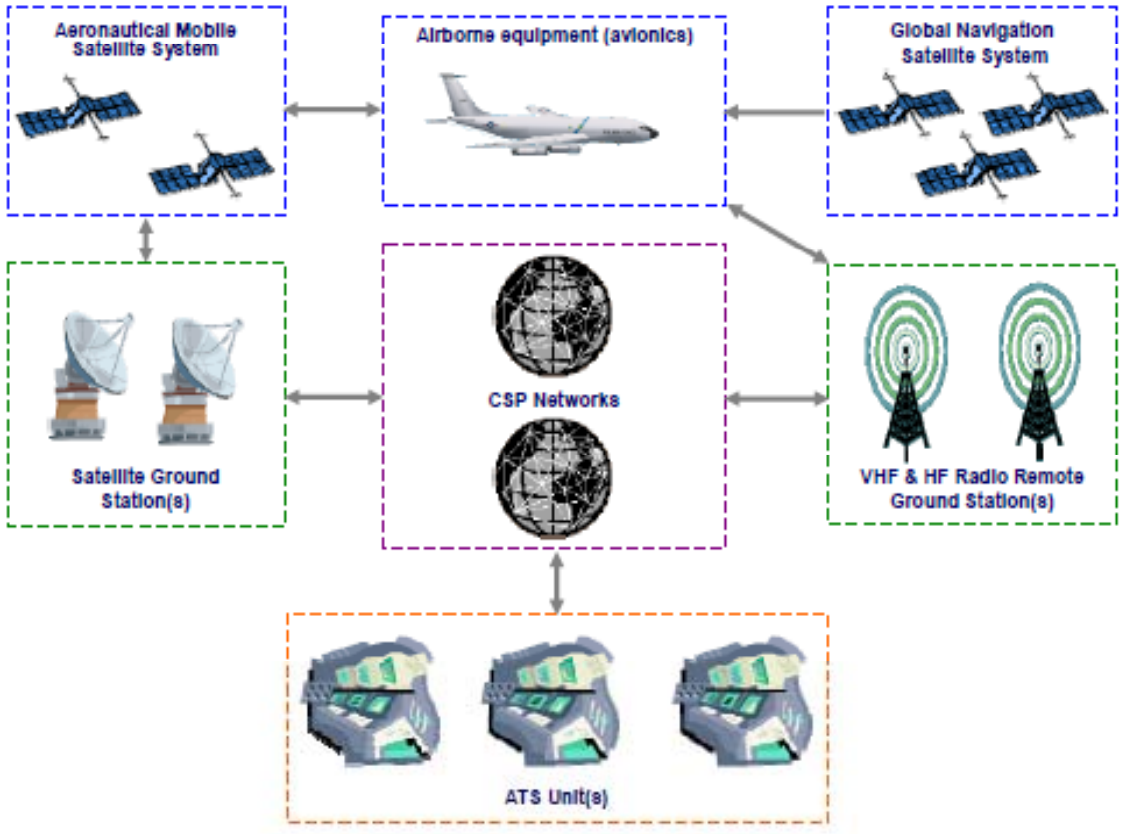



Figure 2-1. Overview of a data link system

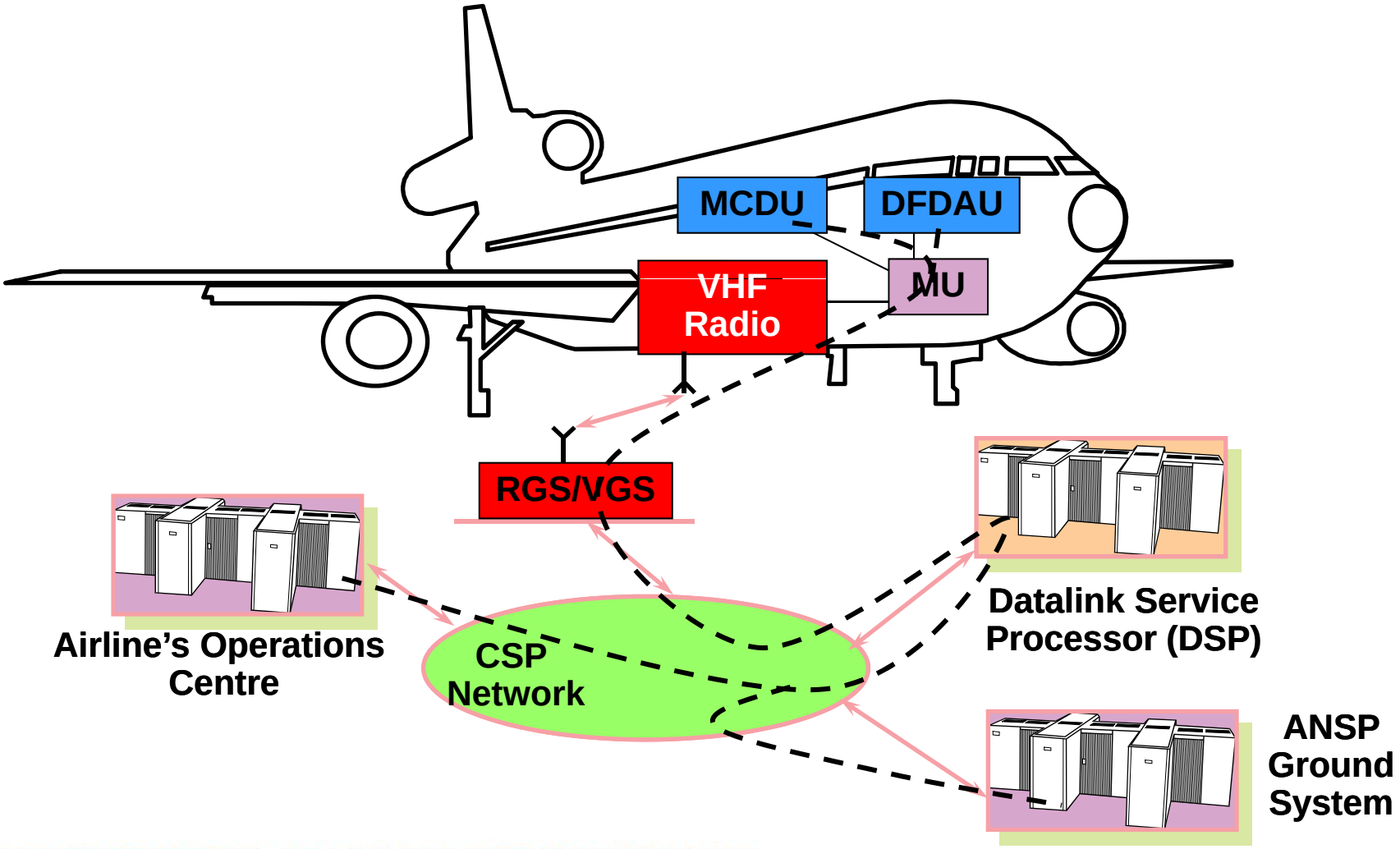
# Data Link relevant information

- The numbers of data link equipped aircraft has grown exponentially since the introduction of the VHF ACARS service, an industry communication technology
- Data link services are provided through private and public communication network infrastructure
- Many Civil Aviation Authorities (CAAs) that provides Air Navigation Services around the world have implemented or are planning simple ATS applications using the ACARS basic text capability until a complete ATN compliant infrastructure become available
- All applications replace voice communication routine by data link:
  - Clearances, position reports (ADS-C and FMC WPR), weather reports and controller pilot data link communication (CPDLC)
- The first operational use of ATS over ATN is the CPDLC messages in the European environment

# About ACARS

- ACARS is an industry technology that:
  - provides crew with the capability to send text and view messages that are received in a printer or computer screen on board
  - communicates with ground networks via various radio systems, always including a VHF radio, satellite avionics and/or an HF data radio
  - data link protocols for ACARS communications are designed by Industry bodies such as AEEC (Airlines Electronic Engineering Committee)
- ACARS cockpit data link avionics are installed on approximately 10,000 air transport aircraft
- It is vital for the efficiency of airlines' flight operations

# ACARS Architecture

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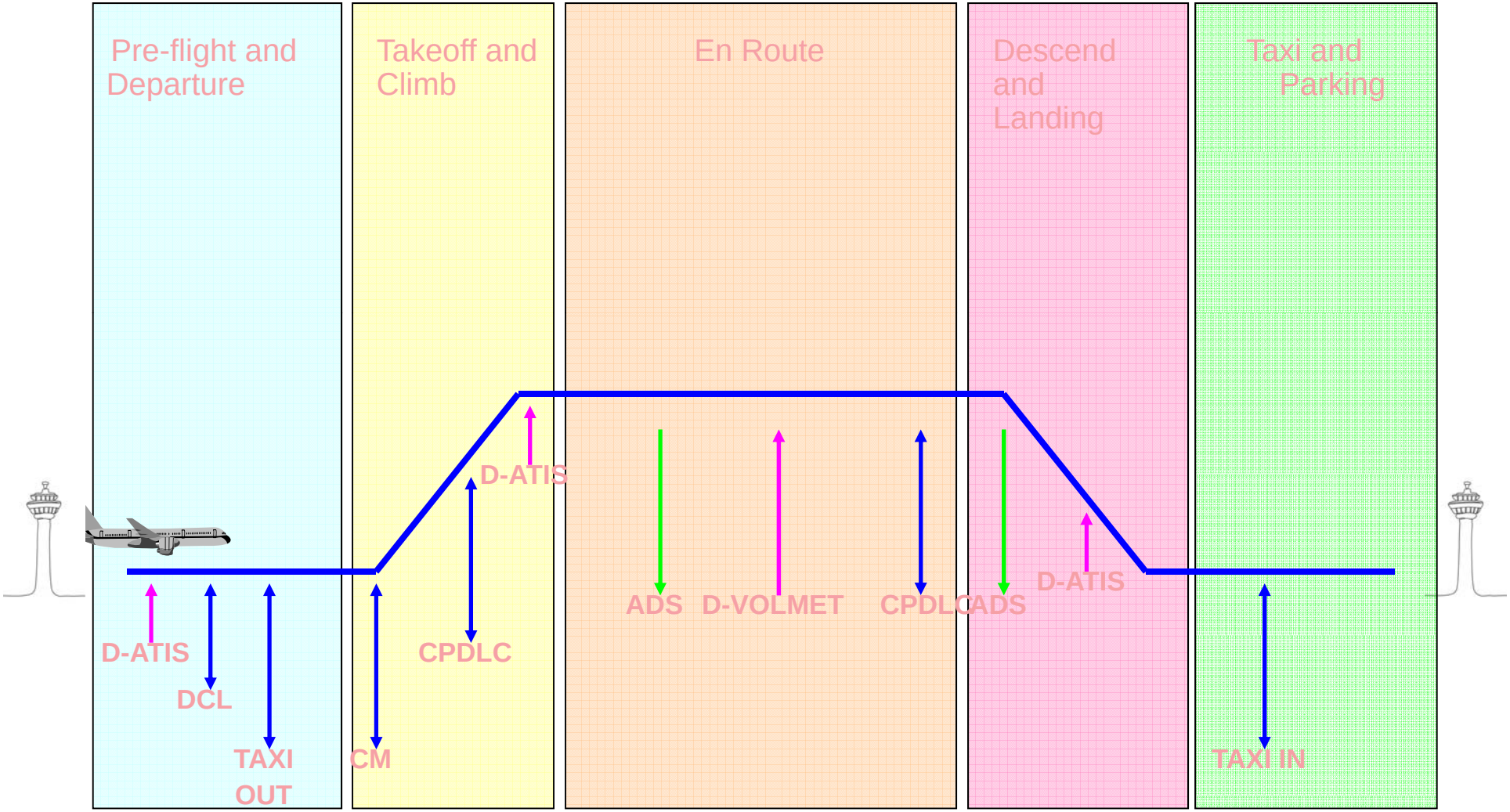
# ATS use of data-link

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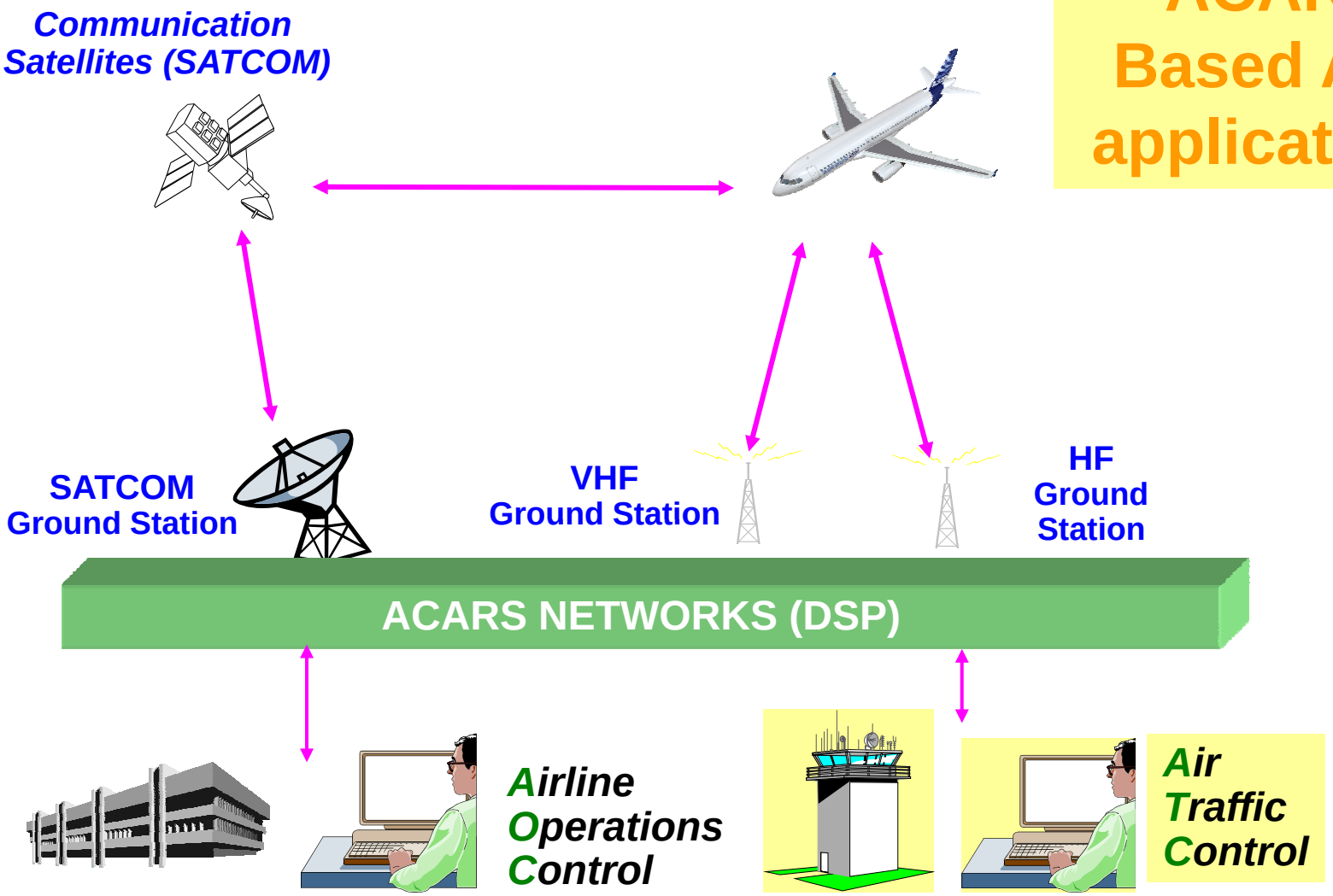
# The Infrastructure

# ACARS Based ATS applications

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# Datalink Service Provider (DSP)

- Extensive VHF and Satellite Network worldwide
- Internetworking (I/W)
- Air-Ground Communications and Ground-to-Ground Services for airlines users and air navigation service providers implementing ATS services using datalink communications
- Traffic Monitoring/ Statistics
- Customer Support Service: Helpdesk 24H, dedicated staff, technical support and performance reports.

# SITA AIRCOM Data link

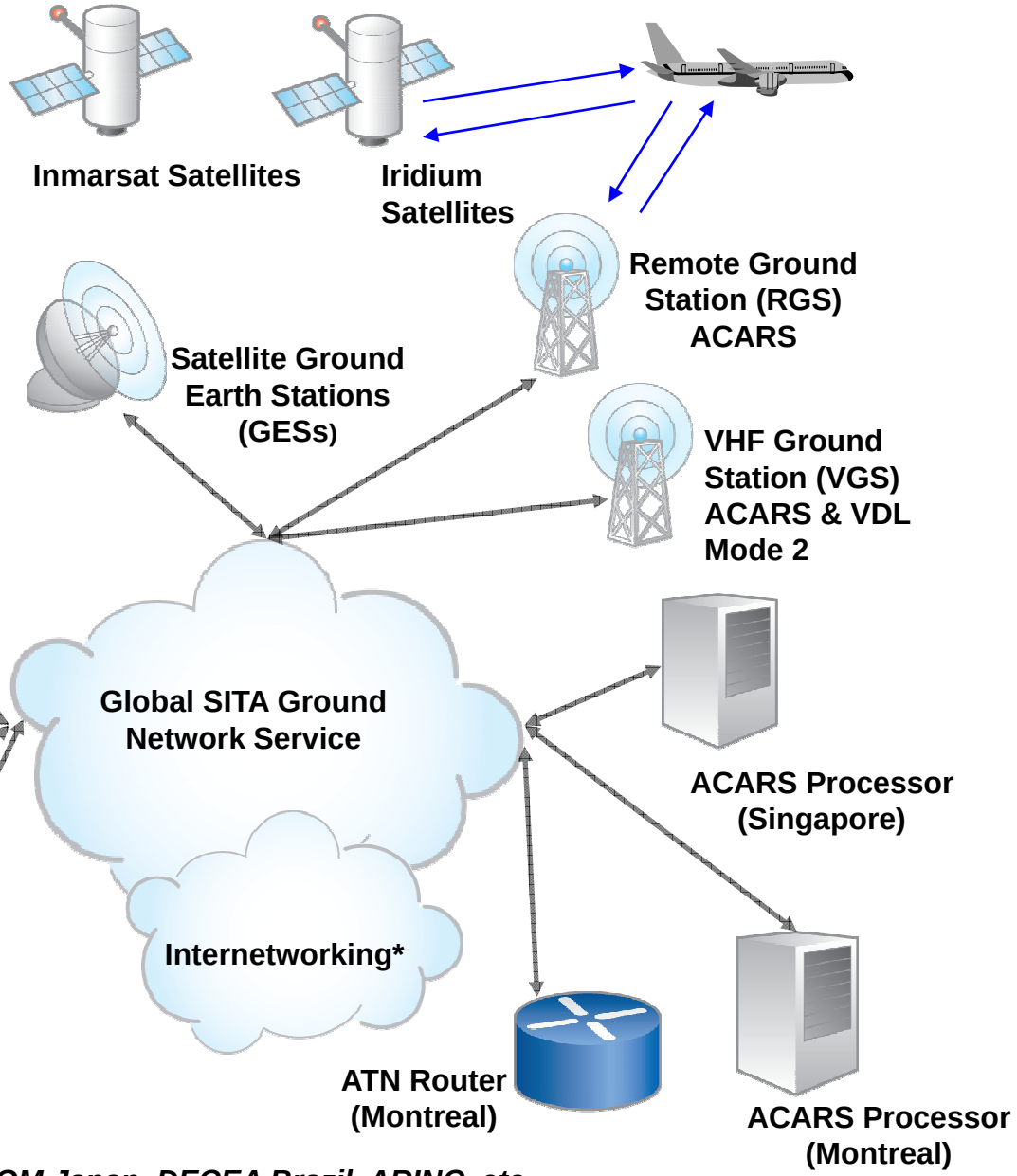
**1984: VHF AIRCOM ACARS Service**

**1990s: Satellite AIRCOM**

**2001: VDL AIRCOM**

**2005: ATN AIRCOM**

**2008: Iridium**




***Internetworking with third parties networks: AVICOM Japan, DECEA Brazil, ARINC, etc***

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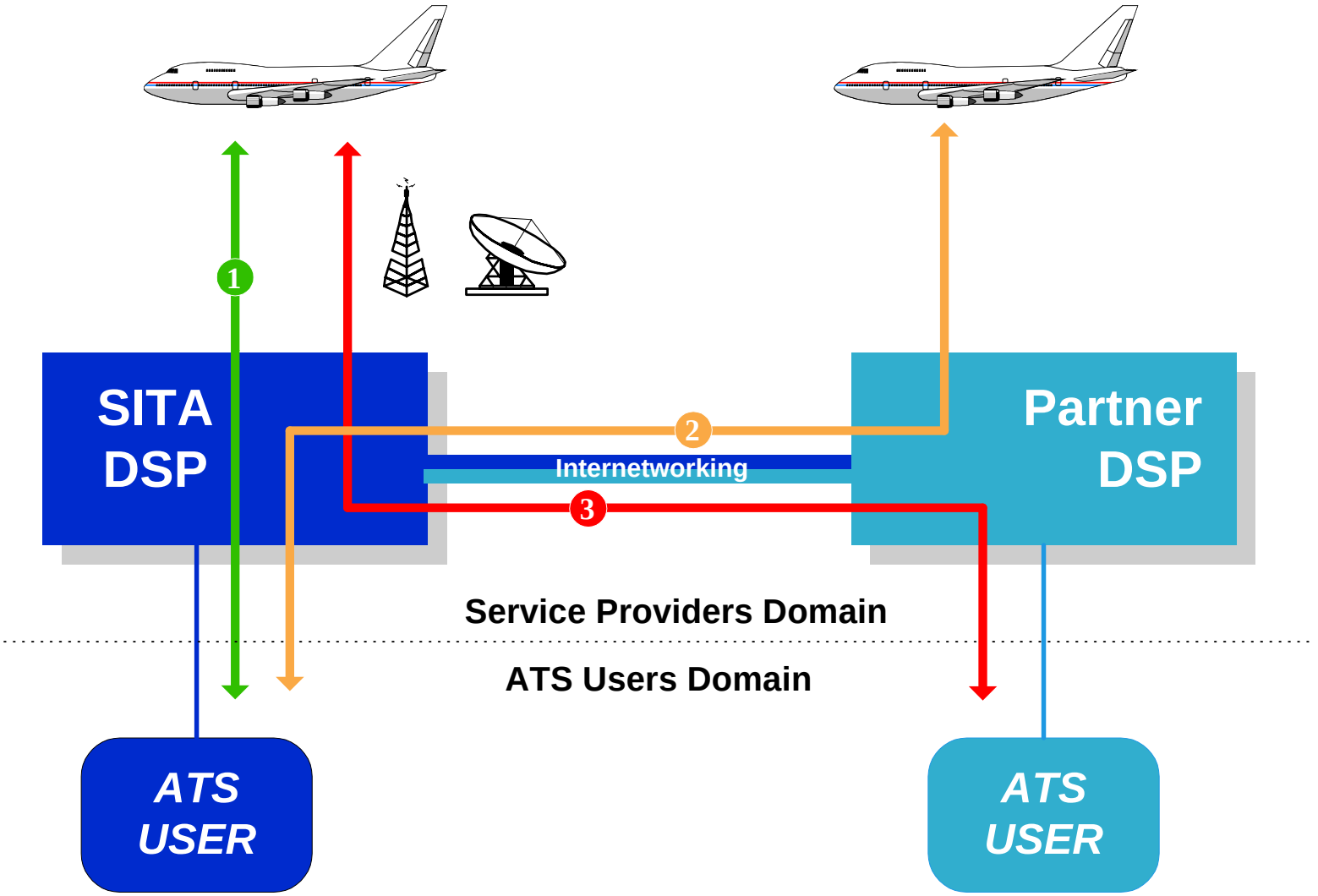
# ATS Internetworking

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# Future Air Navigation Services (FANS)

# FANS story

- 1993 : Boeing FANS applications in the Honeywell FMS installed on the B747-400 (FANS/1)
- 1995 : First B747-400 certified (Quantas)
- 2000 : Airbus develops the ATSU supporting FANS application for A340/A330 (FANS/A)
- 2005 : Boeing and Airbus develop the FANS 1/A+ enhancement package

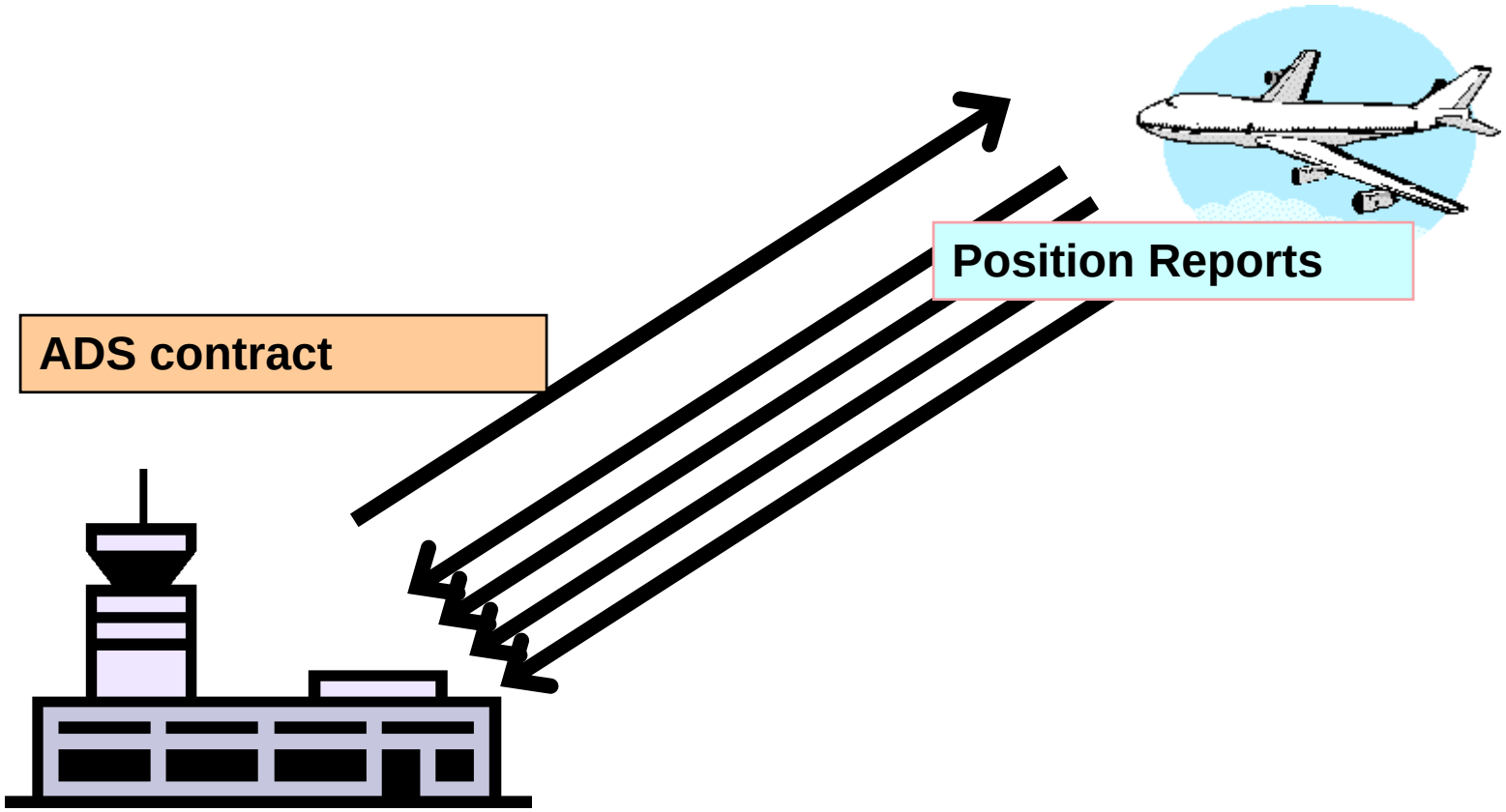
# FANS 1/A Benefits

- Use of CPDLC enables standard phraseology through use of preformatted messages and reduces risk of misunderstanding thus enhancing safety.
- Use of ADS enables position information can be automatically downlinked.
- HF voice becomes backup
- Use of CPDLC and ADS enables more flexibility in routing and can enable dynamic routing such that can get more favorable track to fly.
- Use of CPDLC and ADS enables potential reduction in separation minima.
- The benefits of CPDLS and ADS can lead to reduced flight times, reduced delays, resulting in reduced costs to the airline.

# FANS 1/A applications

- AFN (ATS Facilities Notification)
  - Allows aircraft to logon to ATC facility & the transfer of control
- CPDLC (Controller Pilot Data Link Communications)
  - Replaces for verbal ATC instructions and pilots read-backs
  - Automates ATC processes
- ADS (Automatic Dependent Surveillance)
  - Gives accurate position reporting
  - Allows additional data reporting (wind, temperature etc)
  - Providers reporting in regions out of radar coverage
  - Significantly increases traffic that can be handled in remote areas

# FANS applications - ADS



# The ADS application

- ADS stands for Automatic Dependant Surveillance.
- ADS application consists for the aircraft to transmit its GPS position (and other data) via datalink
- ADS enables aircraft situation awareness were radar is not available (e.g oceanic regions).
- ADS enables “periodic” contracts, “demand” contract, “event” contract
- ADS contracts are initiated by ATM ground system
- In the NAT, ATSPs also make use of FMS WPRs. (transcoded into pseudo HF position reports)
- ADS situation display usually reproduce radar display

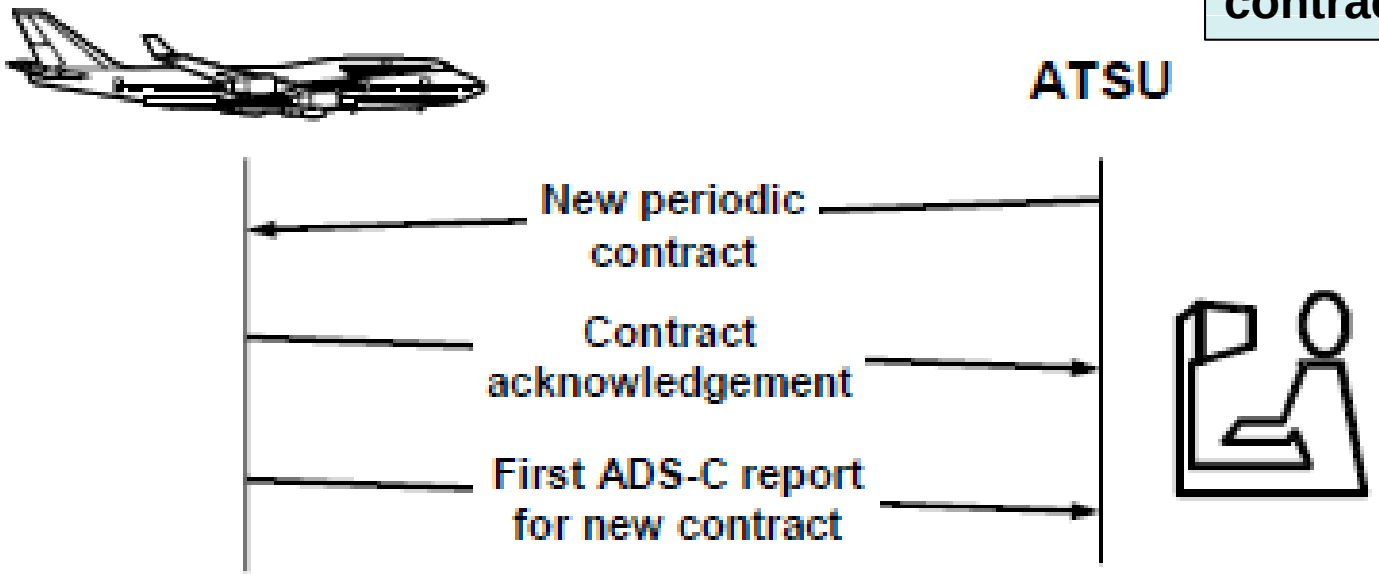
# Periodic Contract

- A periodic contract allows to define the time interval at which an aircraft will send an ADS -C report;
- Only one periodic contract can be established between an aircraft and an ATM ground system at each one time
- A periodic contract remains in place until it is either cancelled or modified
- Short periodic reporting interval adds undue economic costs and unnecessarily loads the data link system

# Demand Contract

- A demand contract allows to request a single ADS -C periodic report;
- A demand contract does not cancel or modify any other ADS contracts that may be in effect with the aircraft

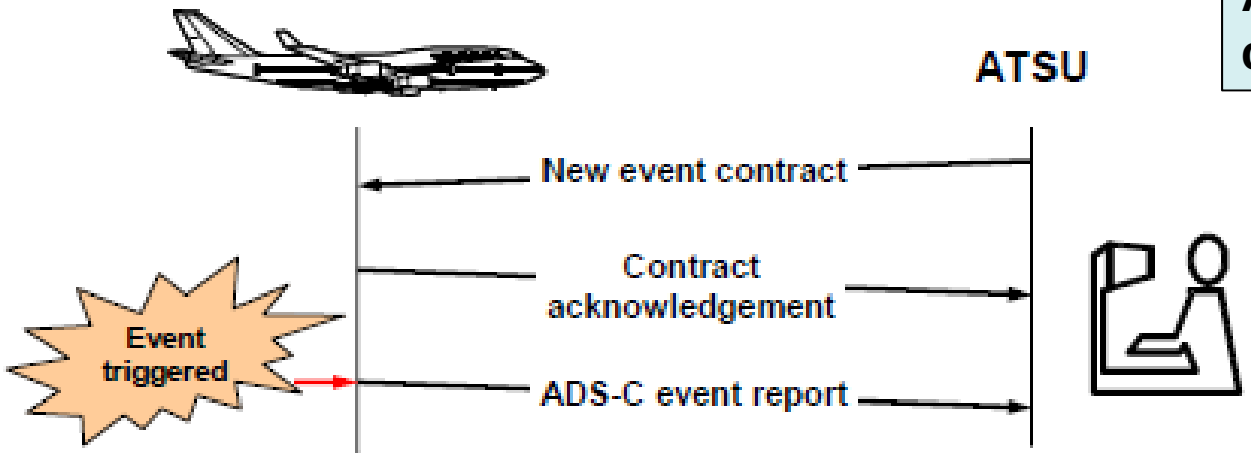
**ADS periodic contract sequence**



# Event Contract

- A periodic contract allows to request an ADS-C report whenever a specific event occurs;
- The event contract can contain multiple event types:
    1. Waypoint change event (WCE)
    2. Level range deviation event (LRDE)
    3. Lateral deviation event (LDE)
    4. Vertical rate change event (VRE)

**ADS C event contract sequence**

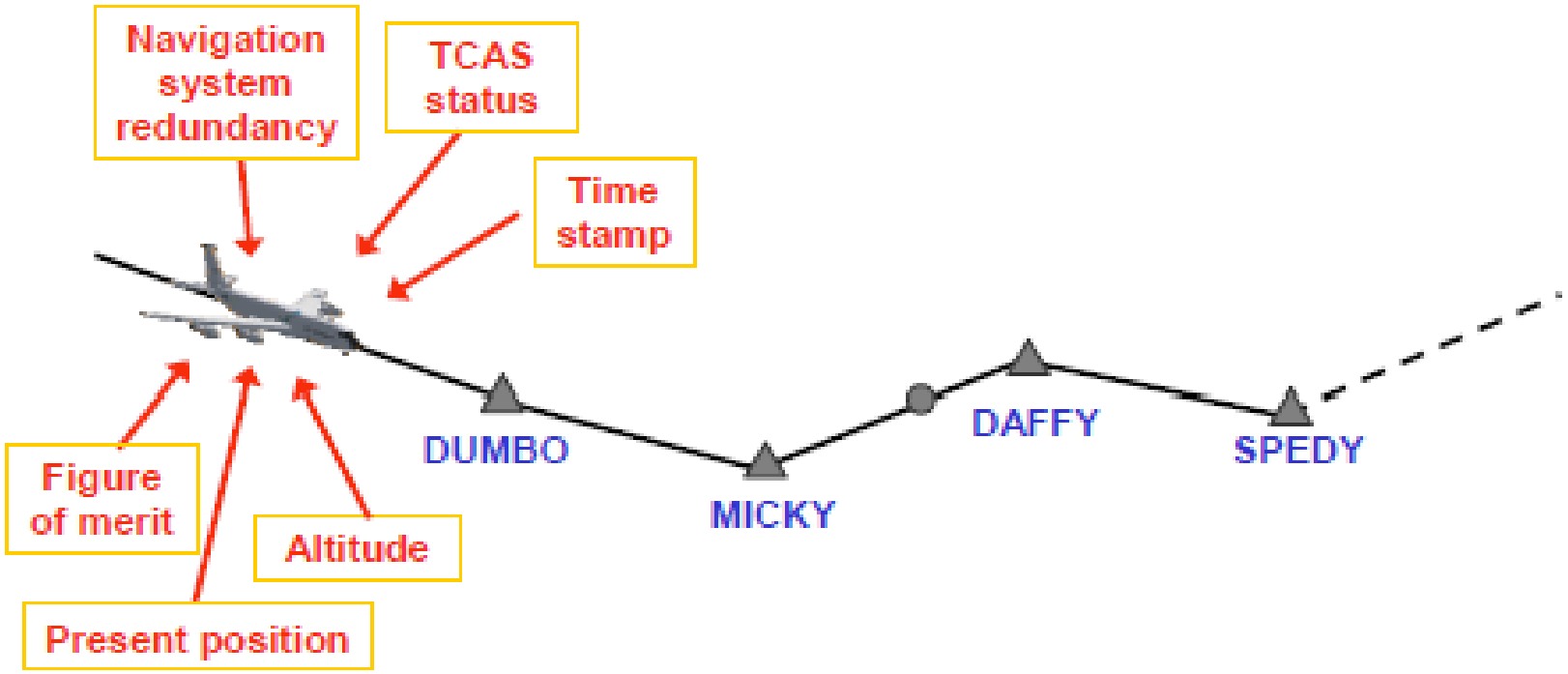


# ADS C report content

- Each type of ADS C report (periodic, event,demand ) can contain different groups of information /data to be transmitted to the ground systems. ADS-C groups include:
  - a) Basic group ;
  - b) Flight identification group
  - c) Earth reference group
  - d) Air reference group
  - e) Airframe identification group
  - f) Meteorological group
  - g) Predicted route group
  - h) Fixed projected intent group; and
  - i) Intermediate projected intent group

- At a minimum, all ADS-C reports contain the basic group.

# ADS C Basic Data Group



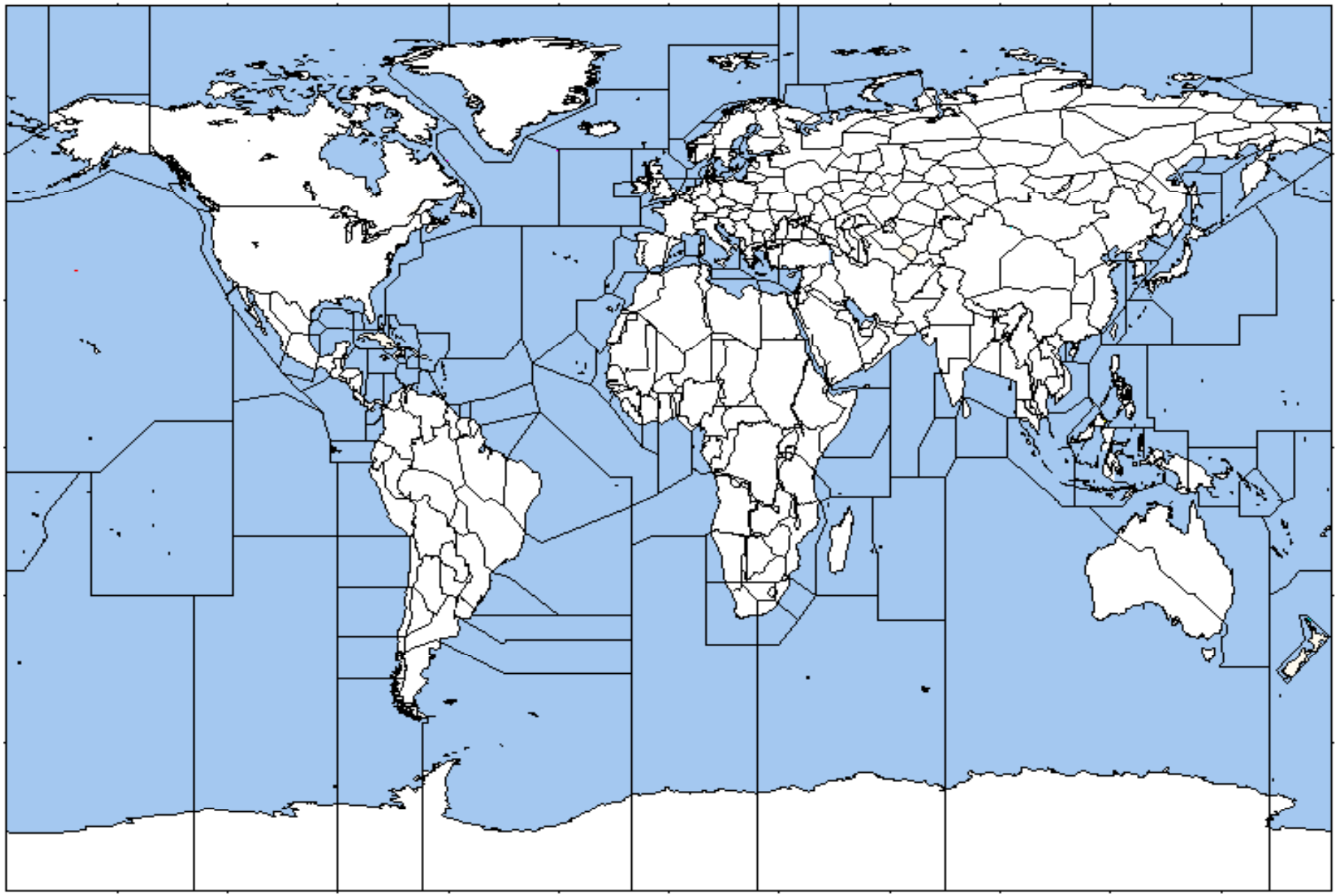
# Figure of Merit – FOM

The ADS-C basic report contains a figure of merit (FOM) that provides the navigational accuracy of position data in the basic report in accordance with table bellow

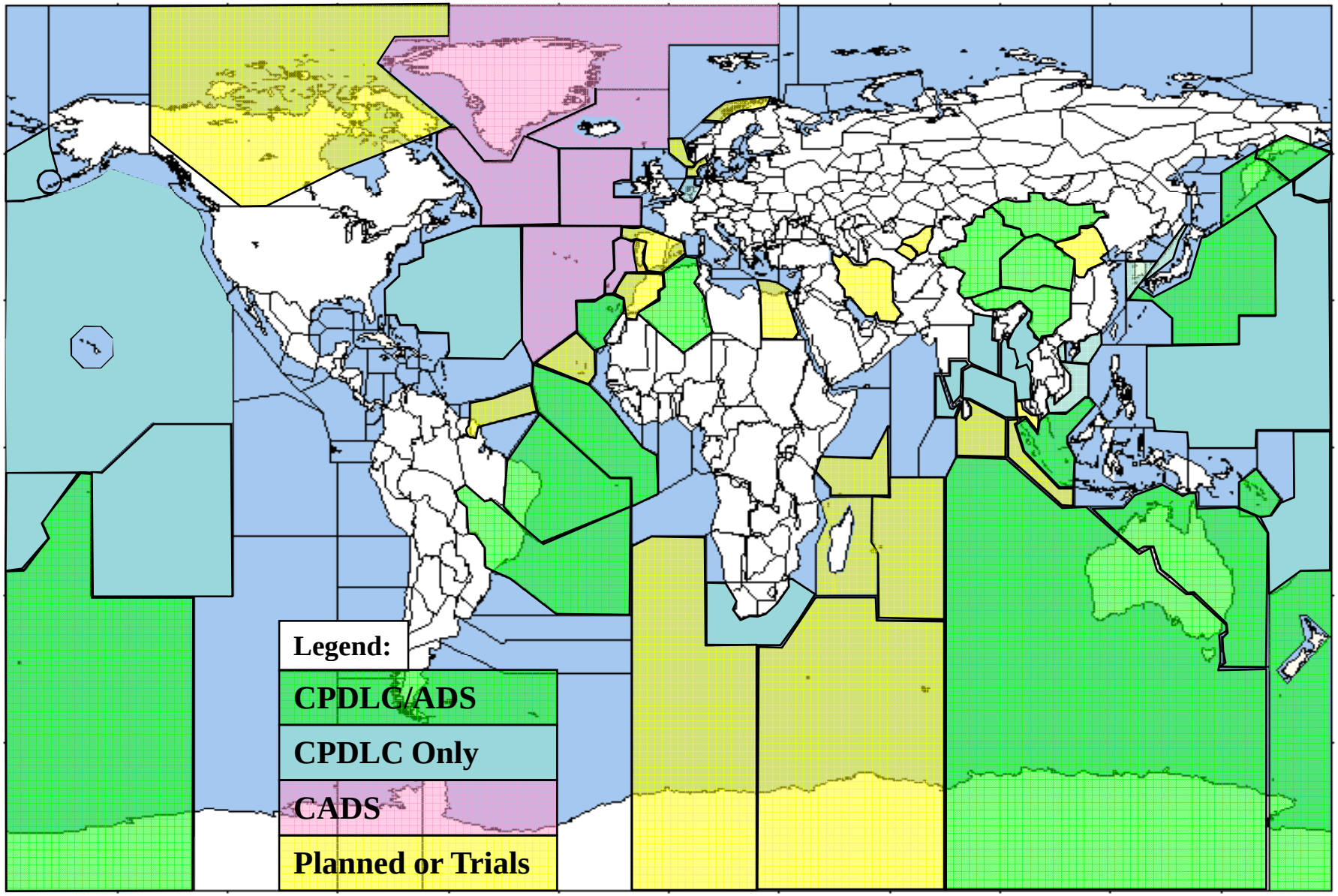
| FOM value | Position accuracity | Comments |
|---|---|---|
| **0** | Complete loss of navigational capabilities | Inability to determine position within 30 nautical miles is considered total loss of navigation. Includes the inability to associate a valid time with the position |
| **1** | <30 NM | Consistent with inertial navigation on long flight without updates |
| **2** | <15 NM | Consistent with inertial navigation on intermediate length flight without updates. |
| **3** | < 8NM | Consistent with inertial navigation on short length flight and beyond 50 nautical miles from VOR. |
| **4** | < 4Nm | Consistent with VOR accuracies at 50 nautical miles or less and with GPS worldwide |
| **5** | < 1NM | Consistent with RHO-RHO applications of ground-based DME, RNAV using multiple DME or GPS position updates |
| **6** | < 0.25 NM | Consistent with RNAV using GPS |
| **7** | < 0.05 NM | Consistent with augmented GPS accuracies. |

# FANS Implementation Status

# ADS C Today



# ADS C Today - FANS



# Global Operation Data link Document (GOLD)

- **Background:** in recognition of the need to provide globally harmonized guidance on data link operations, the GOLD became effective on 14 June 2010. It superseeds FANS Operation Manual (FOM)
- **Scope:** to provide guidance and information concerning data link aspects of aeronautical activity and is intended to facilitate the uniform application of Standards and Recommended Practices contained in Annex 2 — Rules of the Air and in Annex 11 — Air Traffic Services, the provisions in the Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, Doc 4444) and, when necessary, the Regional Supplementary Procedures (Doc 7030).
- **Purpose:** it is intended to maximize operational benefits in data link operations by promoting seamless and interoperable data link operations throughout the world.
- *http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/oceanic/data_link/*

# ADS C in the CAR/SAM region

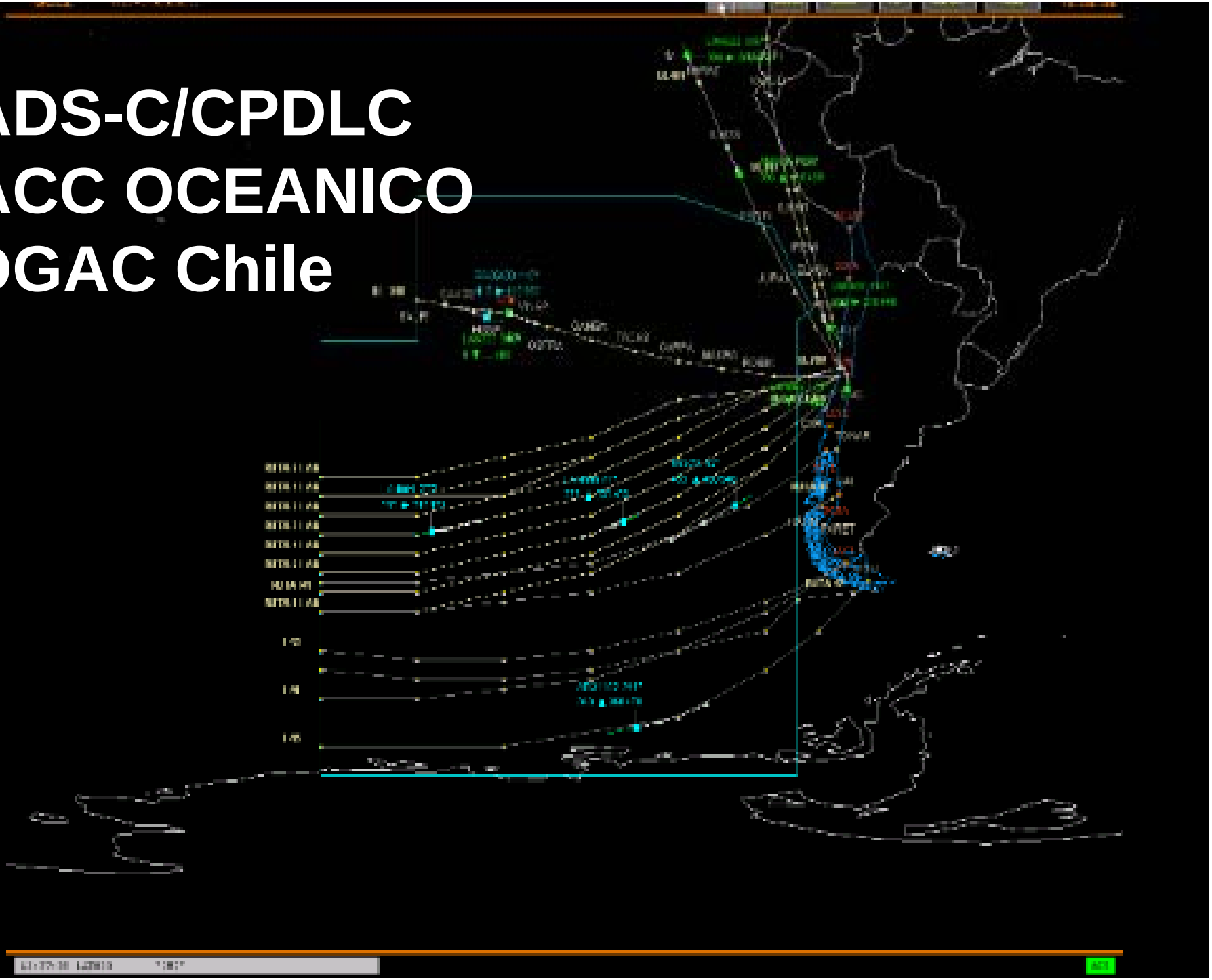
By June18th, 2007:

“Hi, Adriana
How are things with you?  All is well in your world, I hope.
Can you pls tell me what, if anything, I have to do from here in Dubai to initiate D-ATIS & DCL at Guarulhos?
Also, any word on CPDLC/ADS trials in Atlantico?

Tks & brgds,

*Grant Wilson*
*Aeronautical Services &  ATM*
*Flight Operations Support, 3rd  Floor,*
*Emirates Airline*
*PO Box 686*
*Dubai, United Arab  Emirates*

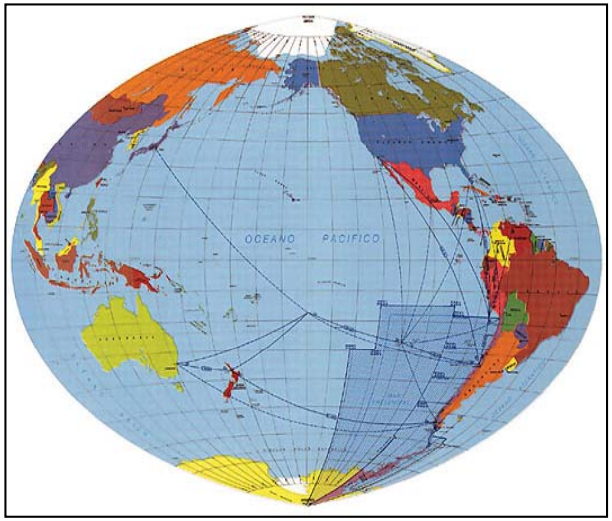
# ADS-C/CPDLC
# ACC OCEANICO
# DGAC Chile

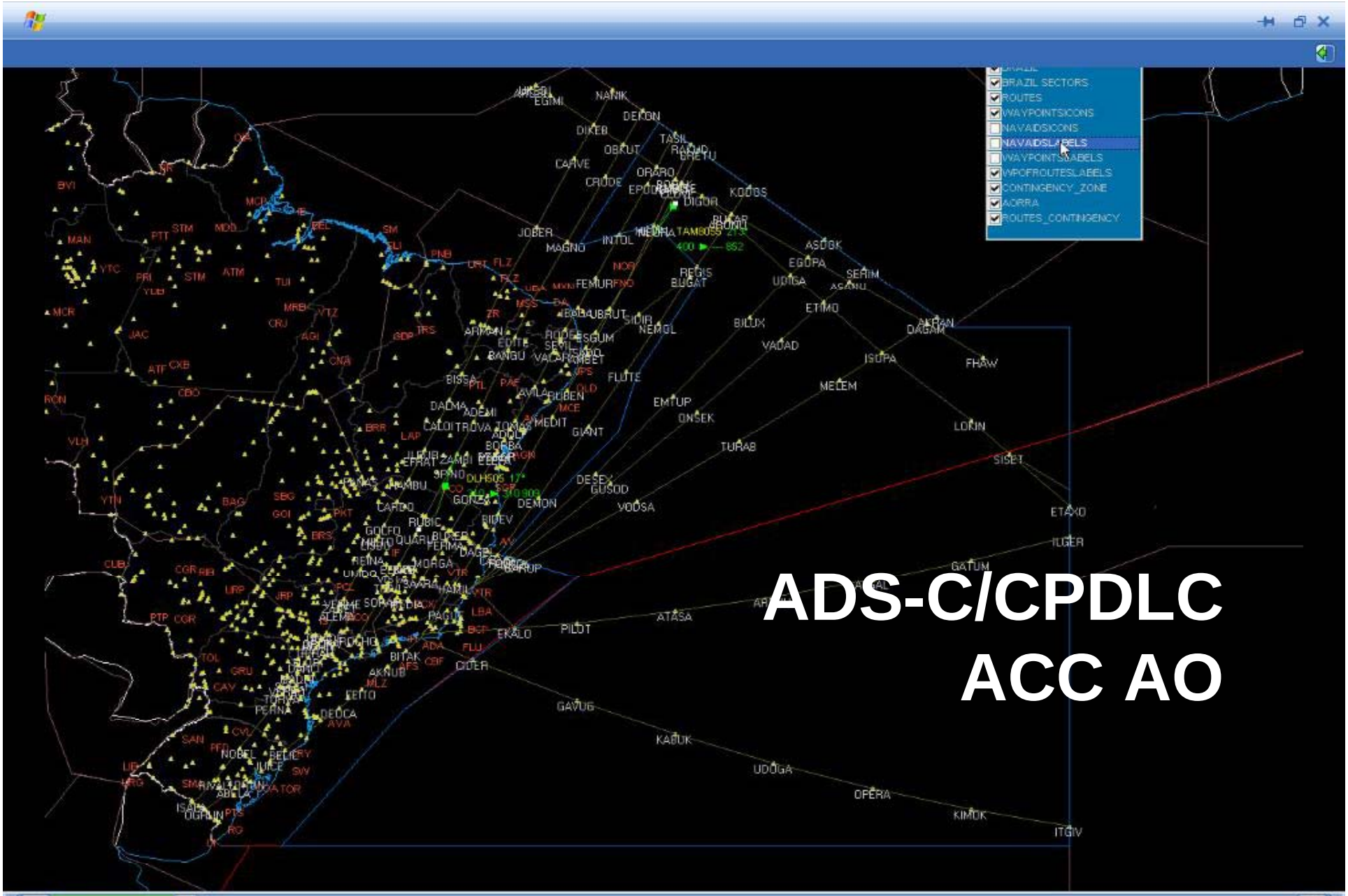


# DGCA Chile

- DGCA Chile wished to acquire some initial experience with FANS 1/A for their South Pacific airspace, besides provide better safety monitoring in the Pacific FIR under their responsibility
- Selected SITA to provide FANS trials in the Oceanic airspace in 2006.

**DGAC CHILE**
**OCEANIC SECTOR**
**SOUTH PACIFIC**





# DECEA Brasil

**SOUTH ATLANTICO**

**CINDACTA III**

**ACC Atlantico**

- Trials started in 2003 with own ADS CPDLC prototype system but it was taking too long to become an operational service
- A SITA FANS workstation was commissioned at Atlantico Area Control Center (ACC AO) by Ago2008:
  - Proven software / robust platform and dual architecture
- A new integrated ATM system supplied by Atech was commissioned by Oct09, in replacement to SITA ACW

# Performance statistics for ADS-C/CPDLC in ACC AO

- Traffic msgs:
  - JAN2007: 226
  - MAY2009: 30.716
  - JUN 1st: Air France
  - JUL 2009: 73.172
  - OCT2010: 114.349

| 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 | | | | | | 99,99% | 100,00% | 100,00% |
| VHF FANS Service Availability | | | | | | | | |
| Satellite FANS Service Availability | | | | | | 99,99% | 100,00% | 99,98% |

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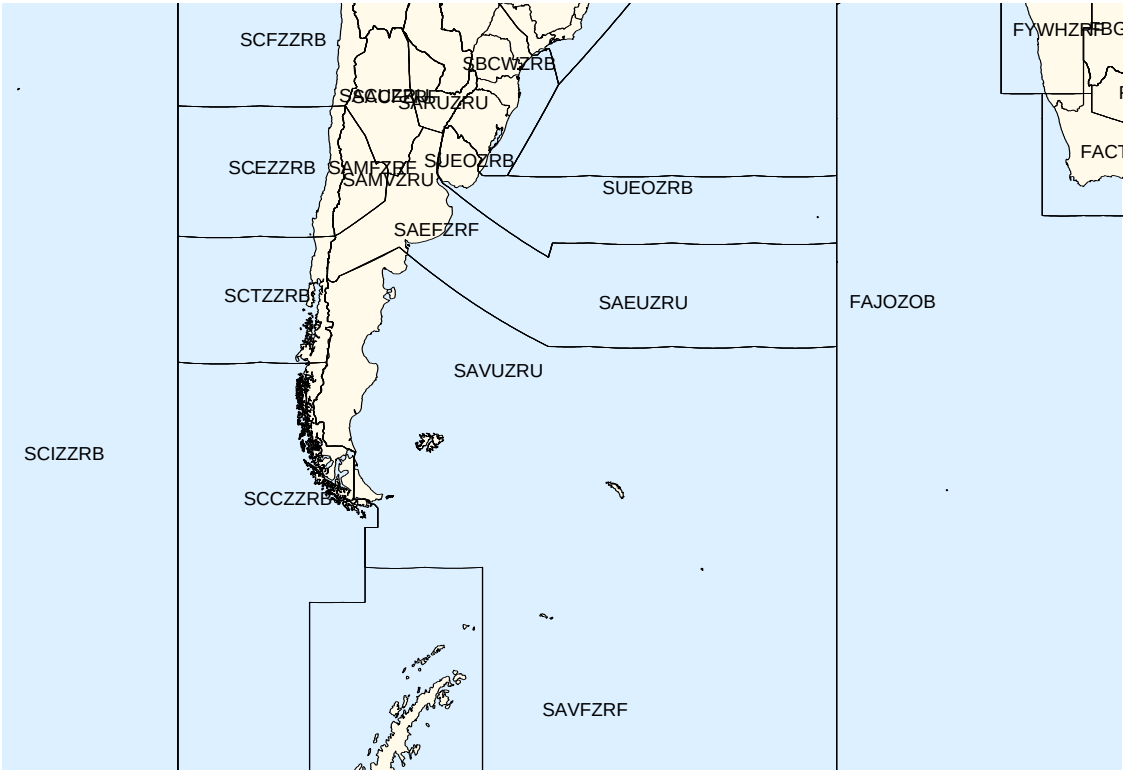
# ANAC Argentina

- A new integrated ATM system supplied by INDRA was commissioned in both Area Control Centers of Ezeiza and Comodoro Rivadavia
- ACC Ezeiza was connected to SITA AIRCOM network since May 2010
- ANAC will advise trial and operational phases planning.

**SOUTH ATLANTICO**
**ACC Ezeiza (SAEZ)**
**ACC Comodoro Rivadavia (SAVC)**

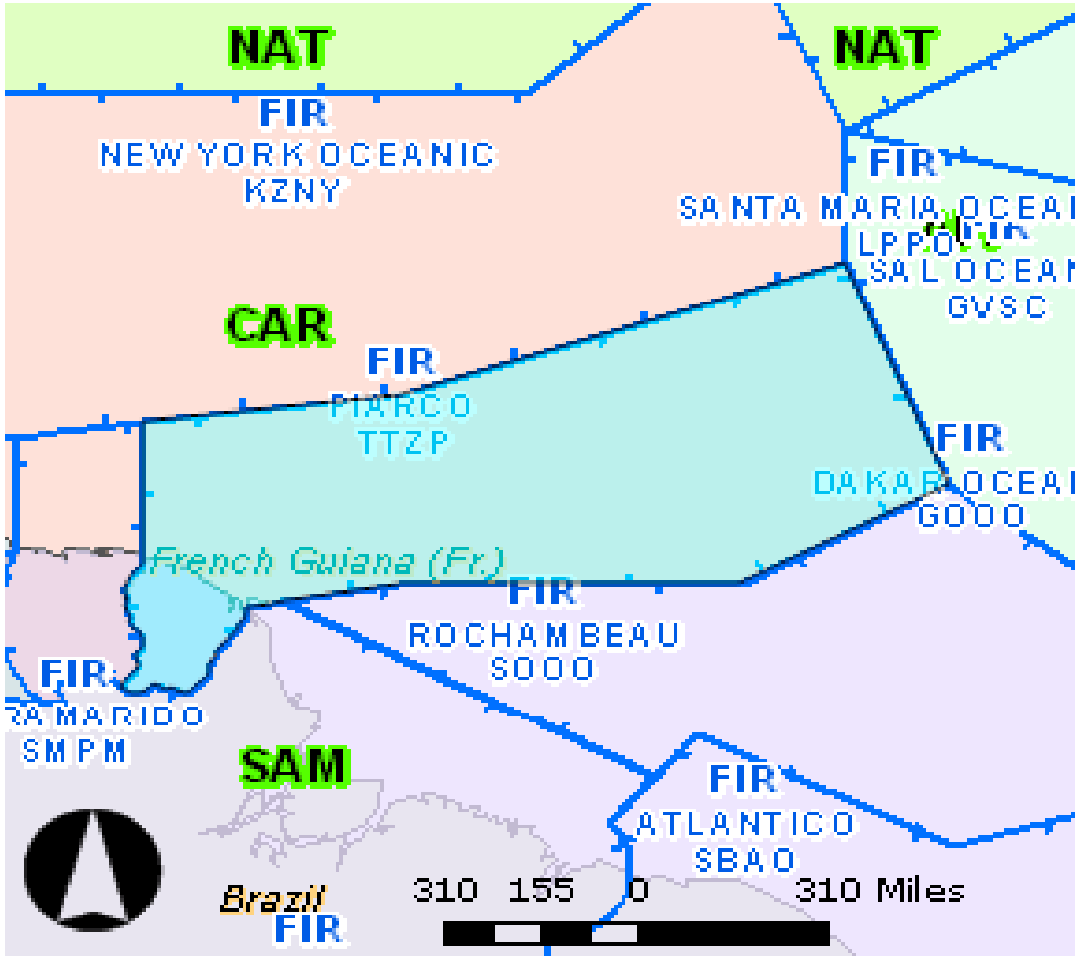


# DSNA French Guyanne

**FIR Rochambeau**

**ACC Cayenne**

- A new integrated ATM system supplied by ADACEL was commissioned in Cayenne ACC
- On going tests and integration with AIRCOM network




AIRCRAFT OPERATIONAL COMMUNICATIONS KNOW-HOW

# SAT Current Data link situation

- EUR-SAM Corridor
  - 5 air routes from SW to NE, 5% yearly growth over the last years
  - Represent most of the traffic in the SAT aera
  - FANS 1/A implementation in the SAT:
    - FANS 1/A Interoperability Team established for the SAT area, grouping ANSPs contributing to the EUR-SAM corridor and beyond in the South Atlantic
    - SITA is FANS Air/Ground Service Provider for all ANSPs

Lisbon
(NAV P)
Under Deployment

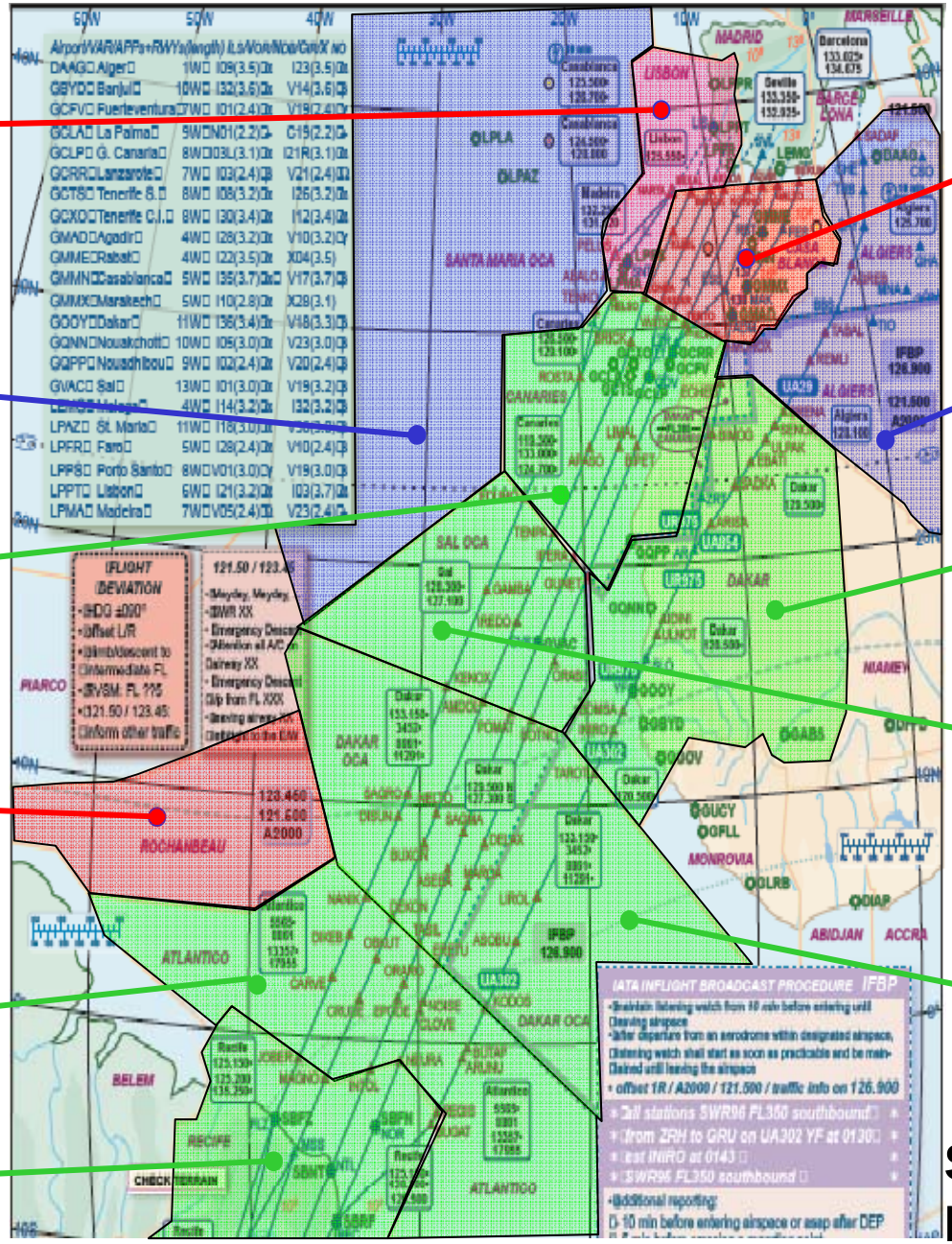
Santa Maria
(NAV P)
Operational

Canarias
(AENA)
Ops. 27 Aug 2009

Rochambeau
(DSNA)
EUR/SAM corridor
neighbouring FIR
Under Planning

Atlantico
(DECEA):
Ops. 30 July 2009

Recife
(DECEA):
Ops. 30 July 2009




Casablanca
(ONDA)
Under Planning

Algiers
(ENNA)
Operational

Dakar
(ASECNA):
Ops. 2009

SAL OCA
(ASA):
Ops. Mid 2010

Dakar OCA
(ASECNA):
Ops. 2009

# SITA FANS in the EUR-SAM Corridor

AIRCRAFT OPERATIONAL COMMUNICATIONS KNOW-HOW

# OPTIMI Project

- OPTIMI is a project launched by the SJU after Air France 447 accident.
- Objective: To assess and trial the feasibility of implementing oceanic flight tracking services in the Atlantic (NAT, EUR and AFI regions) in order to improve the accuracy with which aircraft position is known, allowing better coordination and ATS service provision in normal operations and also in cases in which un unusual event occurs
- Conclusions shall translate (by the end of 2010) into final recommendations for procedures and systems that can be implemented as of 2011
- More info on *http://www.sesarju.eu/*

# PARTICIPANTS

- CEDAR Consortium awarded with the contract for the performance of the project:
  - 5 ANSPs (AENA, DSNA, ISAVIA, NATS, NAV Portugal)
  - 2 major airlines (Air Europa, Air France)
  - 1 aircraft manufacturer (AIRBUS)
  - 1 communications service provider (SITA)
  - 1 specialist data link avionics company (FLYHT)
  - 1 specialist aviation consultancy (INECO)
  - 2 ground systems manufacturers (ADACEL, INDRA)

# SITA AIRCRAFT COMMUNICATIONS
# AIRCOM Service

AIRCRAFT OPERATIONAL COMMUNICATIONS KNOW-HOW

# SITA Ground Network


Evolved over the past 55 years to provide network services to over 220 countries

Backbone of SITA business for communications and applications:

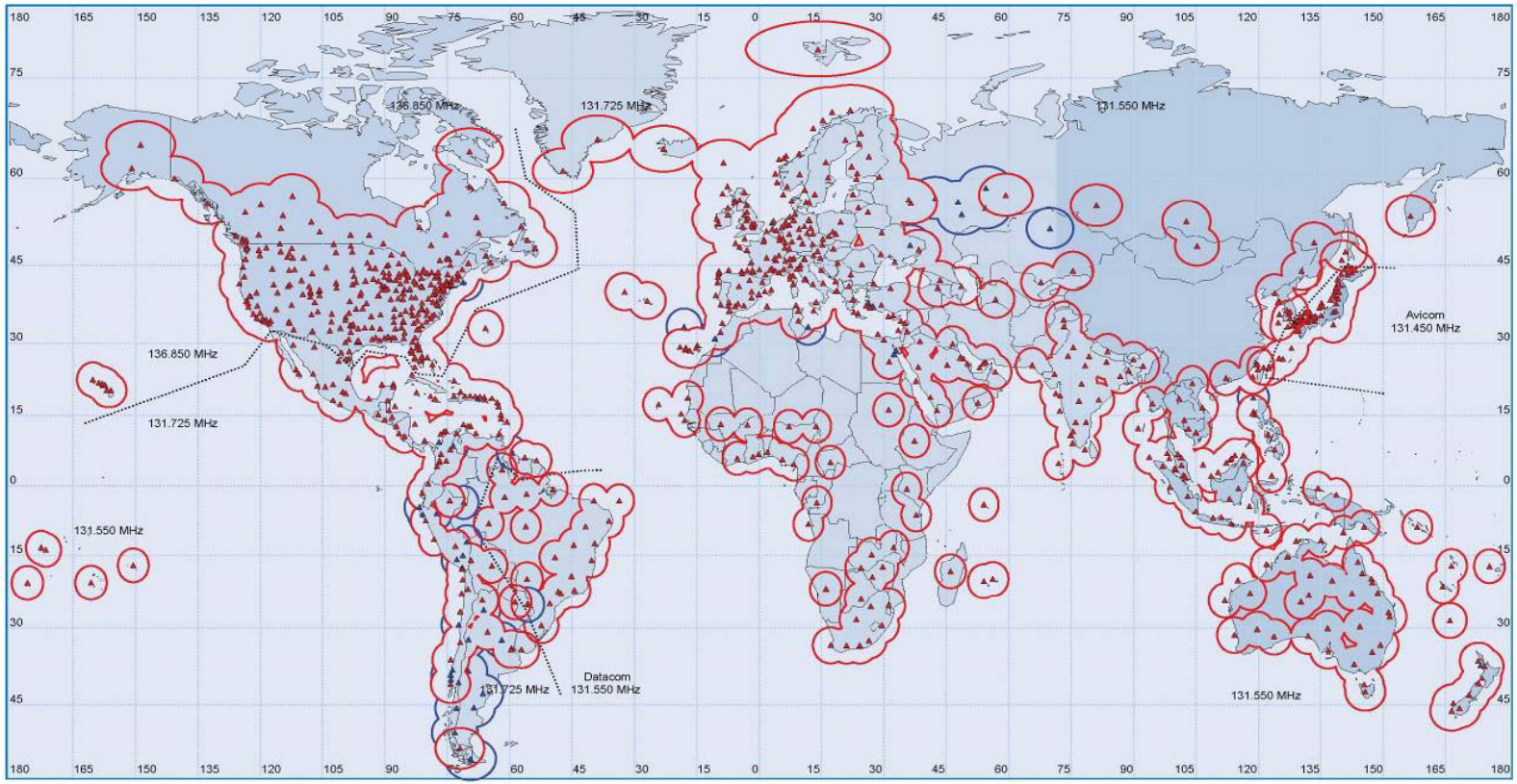
-Airports

-Airlines

-Governments

-ATC

# VHF Data link coverage *




- World's largest a/g VHF data link network with over 1280 radios worldwide in over 157 countries as of Oct 30, 2010 and growing
- 200+ airlines using AIRCOM Data link service serving 11500+ aircraft

* Maps as of March 2008

AIRCRAFT OPERATIONAL COMMUNICATIONS KNOW-HOW

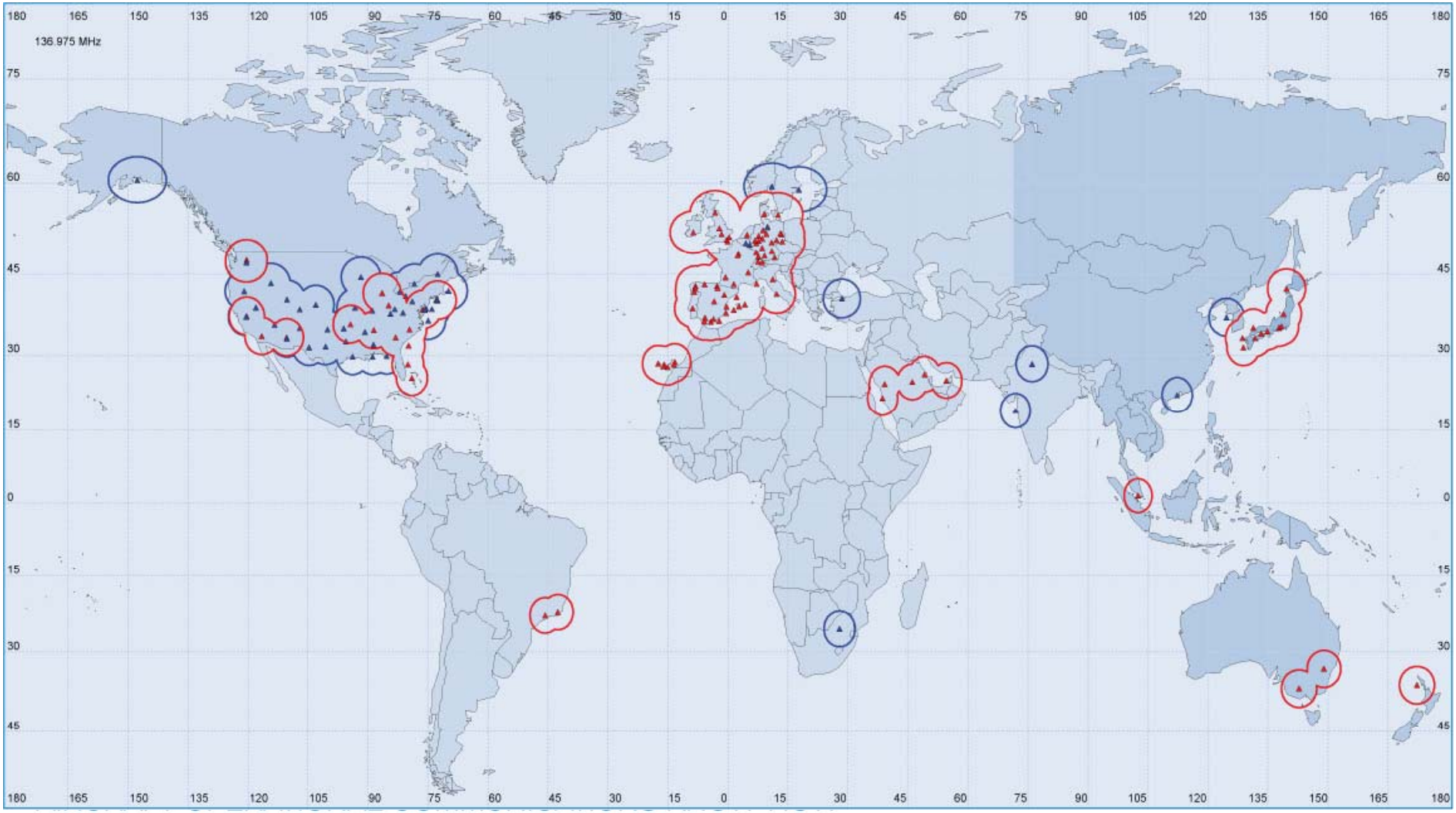
# VHF AIRCOM Service Coverage for Americas


- VHF AIRCOM Coverage in Americas as of

  Nov 5, 2010 counts on 600 Radios being 419 Radios only in US
- 9 North American airlines using SITA VHF in the US
- LAN, AVIANCA, TAM, AZUL, PLUNA, AEROLINEAS ARGENTINAS are SITA customers in the SAM region
- Internetworking with Brazilian VHF network DATACOM owned by DECEA

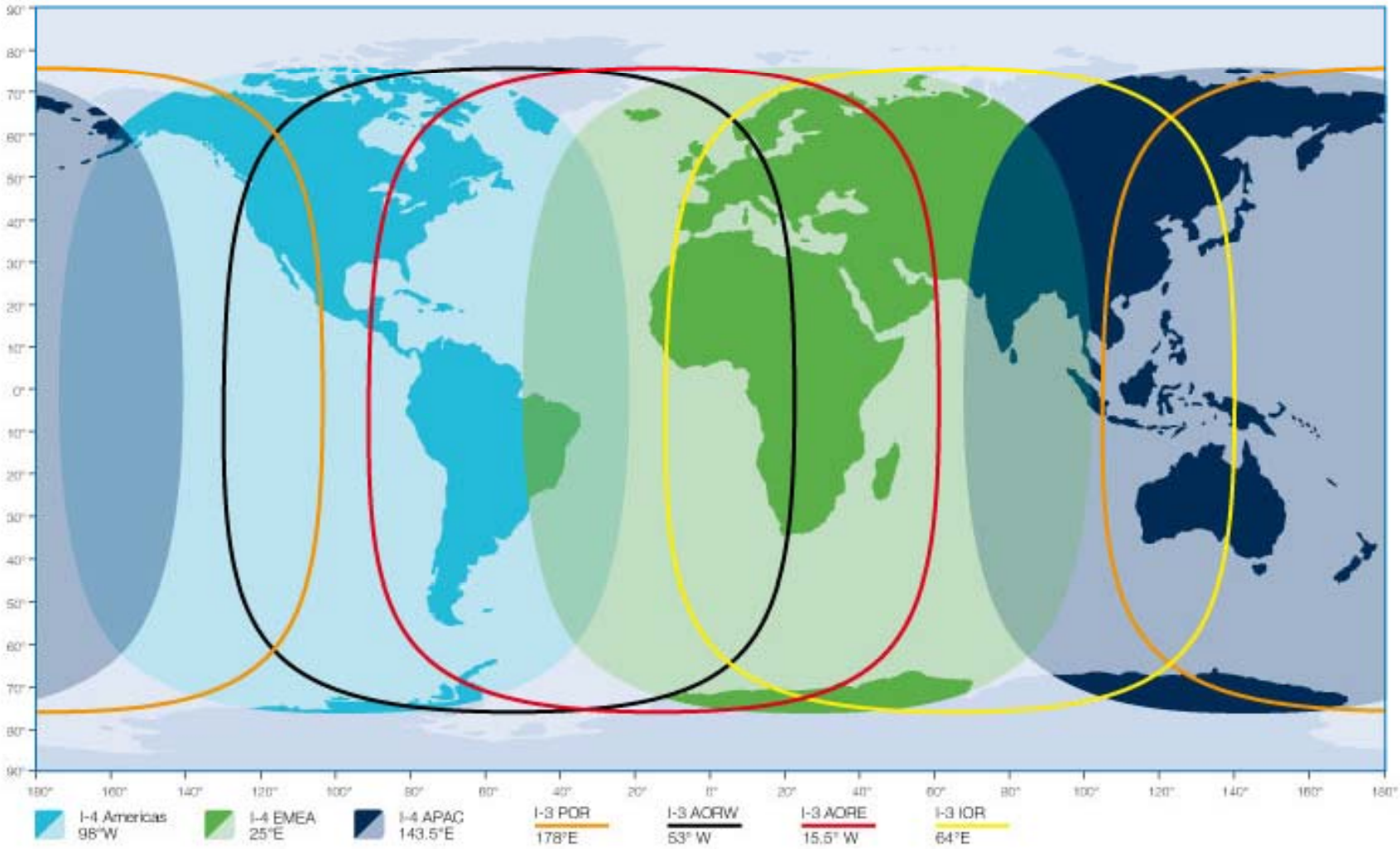
AIRCRAFT OPERATIONAL COMMUNICATIONS KNOW-HOW

# VDLm2 Coverage



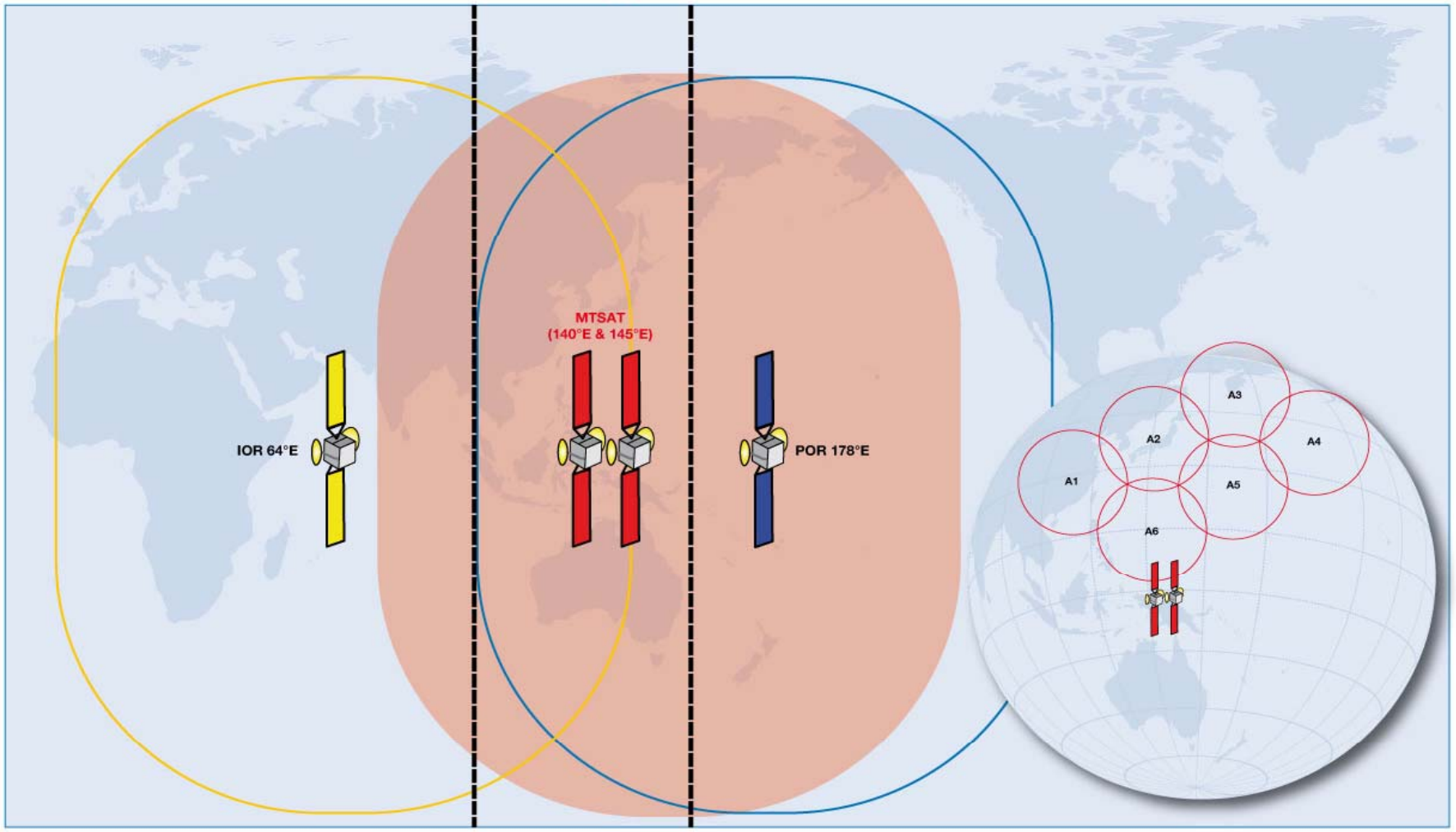
# INMARSAT AERO Classic

## AIRCOM Satellite Classic Aero Inmarsat



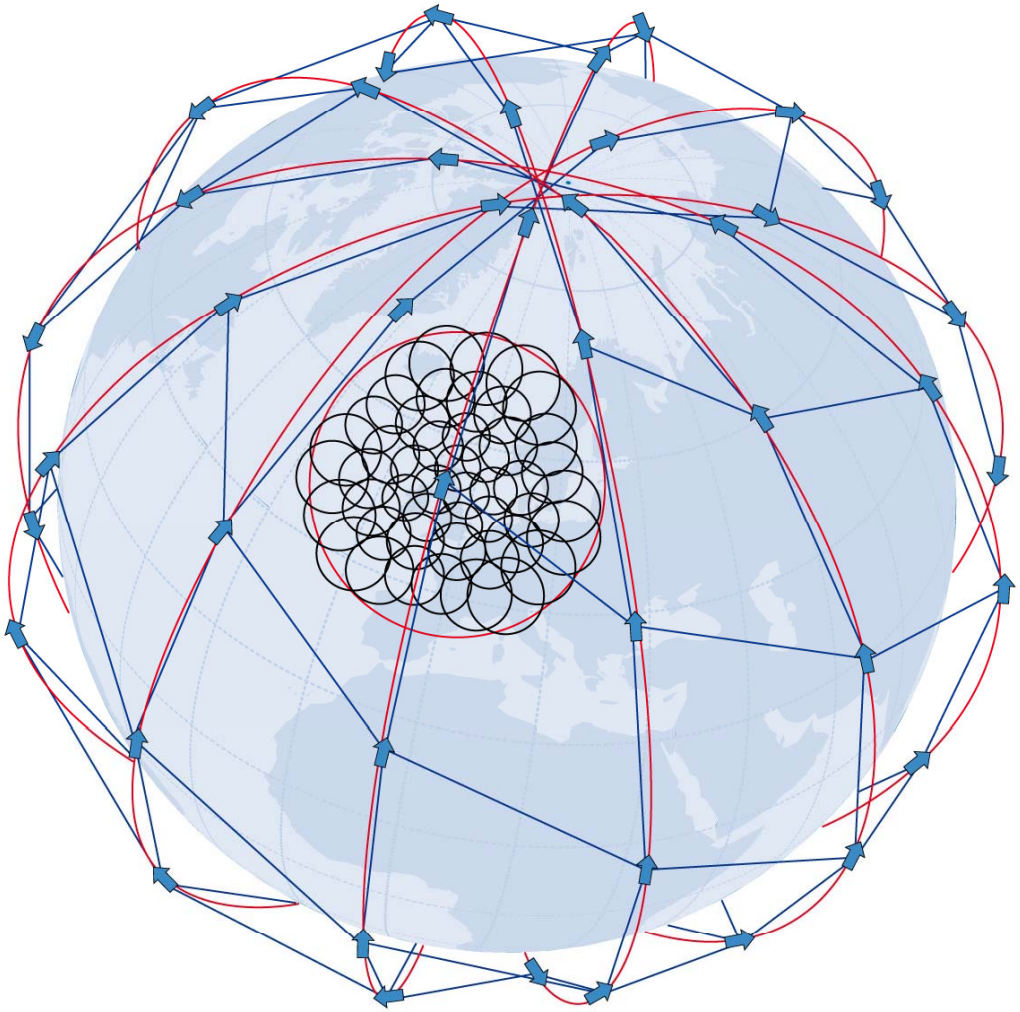
# MTSAT

AIRCOM Satellite MTSAT coverage



# Iridium

AIRCOM Satellite Iridium



AIRCRAFT OPERATION

# SITA AIRCOM ATM (Solutions & Services)

- SITA has taken steps to accelerate ATC use of data link by providing an ATS systems line of products, using AIRCOM service and infrastructure as platform:
  - Airport Tower Systems
    - Departure Clearance – “AIRCOMclever”
    - Digital-ATIS – “AIRCOMevatis”
    - Digital-VOLMET – “AIRCOMevamet”
    - Centralized ATS Server (CATS)
  - ADS-CPDLC Gateway (implementing ATN and FANS accommodation) – DL-FEP (Data Link Front End Processor)
  - DLS (Data Link Server)
  - ADS-CPDLC Workstation
- SITA is more and more recognized by Air Transport industry as enabler for CNS/ATM technologies and solutions for the benefit of airlines and air navigation services providers (ANSP)

# DGAC Indonesia ADS-B trial case

ATC GLOBAL 08
AMSTERDAM RAI • 11-13 MARCH

## Jane's ATC Global Awards 2008

### Enabling technology

#### Shortlist

- Thales – ADS-B for operational usage
- DGCA Indonesia – ADS-B trial
- Adacel Inc – Aurora software

#### Winner

**DGCA Indonesia**

The ADS-B trial in Indonesia enabled real-time surveillance data sharing between regional navigation service providers in 2007. Operational support was provided by SITA, Airservices Australia and Thales. ICAO has since formed a sub-regional task force to accelerate the implementation of ADS-B in the region, and Indonesia's DGCA is using the trial's recommendations to provide policy guidance to begin implementing ADS-B operationally in Indonesia starting in 2008.

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SITA

# SITA & CNS/ATM Development

- SITA is an ICAO member and keeps active participation and contribution to various CNS/ATM forum including:
  - ICAO Technical Panels (ACP), ICAO Planning Implementation Groups (GREPECAS, MIDANPIRG, APANPIRG…), Industry Groups (RTCA/EUROCAE, AEEC), IATA and CANSO Working Groups

# SITA FANS service performance report

Main sections of the APQP report :

- Traffic data: number of messages/by airlines
- Availability of the service (processor, VHF network, Satellite network)
- Reliability of the service (uplink success rate)
- Performance data (uplink and downlink delivery times)

# APQP – Traffic Data

- Message type

**2.1 FANS GLOBAL DATALINK TRAFFIC**

| | Ground Traffic in Messages (Uplink + Downlink) | | | Air-Ground Traffic in Blocks (Uplink + Downlink) | | |
|---|---|---|---|---|---|---|
| ATS Provider | janv-07 | 12-month average | UP/DN ratio | janv-07 | 12-month average | UP/DN ratio |
| ATS Provider | 5 727 | 7 690 | 10,56% | 4 384 | 6 790 | 12,07% |
| AFN (Log-On) | 258 | 503 | 38,71% | 190 | 444 | 40,74% |
| CPDLC | 66 | 1 193 | 65,00% | 69 | 1 129 | 76,92% |
| ADS | 5 403 | 5 993 | 9,06% | 4 125 | 5 217 | 10,35% |

- Media and Airlines

**2.2 FANS TRAFFIC BY MEDIA AND AIRLINES**

| | FANS BY MEDIA | | |
|---|---|---|---|
| ATS Provider | janv-07 | 12-month average | Percentage Total |
| VHF UP & DOWNLINK | 940 | 1 777 | 16,60% |
| Satellite UP & DOWNLINK | 3 182 | 4 468 | 56,19% |
| Internetworking : Co-DSP | 1 541 | 1 224 | 27,21% |
| | | | |
| Total FANS Traffic | 5 663 | 7 470 | 100,00% |

| | FANS BY AIRLINES | | |
|---|---|---|---|
| ATS Provider | janv-07 | 12-month average | Percentage Total |
| AFR | 2 152 | 3 543 | 37,58% |
| LAN | 1 321 | 917 | 23,07% |
| TAM | 1 027 | 1 694 | 17,93% |
| IBE | 709 | 233 | 12,38% |
| DLH | 501 | 1 214 | 8,75% |
| AEA | 15 | 67 | 0,26% |
| GS1 | 1 | 15 | 0,02% |
| LDI | 1 | 2 | 0,02% |
| | | | |
| | | | |
| Total Airlines | 5 727 | 7 690 | 100,00% |

# APQP – Availability of the service

Processor, VHF and SAT network combined availability

**3.1 AIRCOM FANS SERVICE AVAILABILITY**

| 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% | 99,98% | 99,99% |
| Satellite FANS AIRCOM Processor Availability | 0 | 0 | 0 | 0 | 0 | 100,00% | 99,98% | 99,99% |
| VHF Access Network Availability | | | | | | 99,43% | 99,65% | 99,73% |
| Satellite Access Network Availability | | | | | | 99,94% | 99,97% | 99,98% |
| VHF FANS Service Availability | | | | | | 99,43% | 99,63% | 99,72% |
| Satellite FANS Service Availability | | | | | | 99,94% | 99,95% | 99,97% |

Details: VHF stations (RGS/VGS) and SAT stations (GES)

**3.2 FANS CRITICAL RGS AVAILABILITY**

| Critical RGS Outages | # of outages | Shortest Duration | Average Duration | Longest Duration | Total Duration | Availability | 12-month average |
|---|---|---|---|---|---|---|---|
| AGP-F1 | 0 | 0 | 0 | 0 | 0 | 100,00% | 99,96% |
| BCN-F1 | 0 | 0 | 0 | 0 | 0 | 100,00% | 100,00% |
| BCN-F2 | 4 | 10 | 21 | 51 | 85 | 99,81% | 99,48% |
| BCN-F3 | 0 | 0 | 0 | 0 | 0 | 100,00% | 100,00% |
| BIO-F1 | 1 | 56 | 56 | 56 | 56 | 99,88% | 99,98% |
| BIQ-F1 | 1 | 25 | 25 | 25 | 25 | 99,94% | 99,59% |
| FAO-F1 | 0 | 0 | 0 | 0 | 0 | 100,00% | 99,76% |
| FLW-F1 | 2 | 4 | 5 | 5 | 9 | 99,98% | 99,50% |
| GRX-F1 | 0 | 0 | 0 | 0 | 0 | 100,00% | 98,15% |
| LIS-F1 | 0 | 0 | 0 | 0 | 0 | 100,00% | 100,00% |
| MAD-F1 | 0 | 0 | 0 | 0 | 0 | 100,00% | 99,99% |
| MAD-F2 | 0 | 0 | 0 | 0 | 0 | 100,00% | 99,86% |
| MAD-F3 | 0 | 0 | 0 | 0 | 0 | 100,00% | 100,00% |
| OPO-F1 | 0 | 0 | 0 | 0 | 0 | 100,00% | 99,92% |
| PMI-F1 | 0 | 0 | 0 | 0 | 0 | 100,00% | 99,79% |

**3.3 FANS CRITICAL GES AVAILABILITY**

| Satellite Access Network Availability | janv-07 | 12-month average |
|---|---|---|
| AOE2 | 99,94% | 99,98% |
| AOW2 | 99,94% | 99,97% |
| IOR2 | | |
| POR1 | | |
| Average Availability | 99,94% | 99,98% |

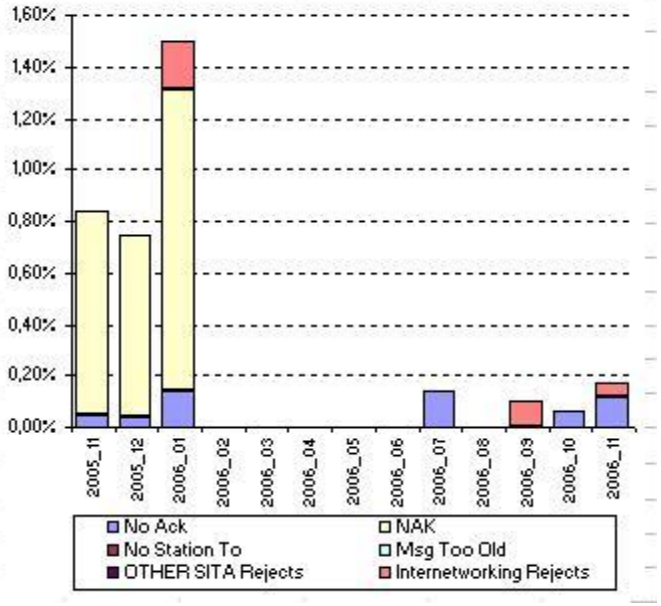
AIRCRAFT OPERATIONAL COMMUNICATIONS KNOW-HOW

# APQP – Reliability of the service

Messages delivered and reject causes

**3.4 UPLINK SUCCESS RATE**

| | ATS Provider | | |
|---|---|---|---|
| Uplink Performance | nov-06 | Last 3 Month | Last 12 Month |
| **Uplink Success Rate** | 98,84% | 99,49% | 99,49% |
| **Total (No Ack + NAK) Reject Rate** | 0,12% | 0,07% | 0,26% |
| No Ack (VHF) | 0,00% | 0,00% | 0,00% |
| NAK (VHF) | 0,00% | 0,00% | 0,00% |
| No Ack (Satcom) | 0,21% | 0,12% | 0,06% |
| NAK (Satcom) | 0,00% | 0,00% | 0,33% |
| No Station to | 0,00% | 0,00% | 0,00% |
| Not Logged On | 0,99% | 0,39% | 0,22% |
| Msg Too Old | 0,00% | 0,00% | 0,00% |
| Other SITA Rejects | 0,00% | 0,00% | 0,00% |
| Internetworking Rejects | 0,06% | 0,05% | 0,03% |

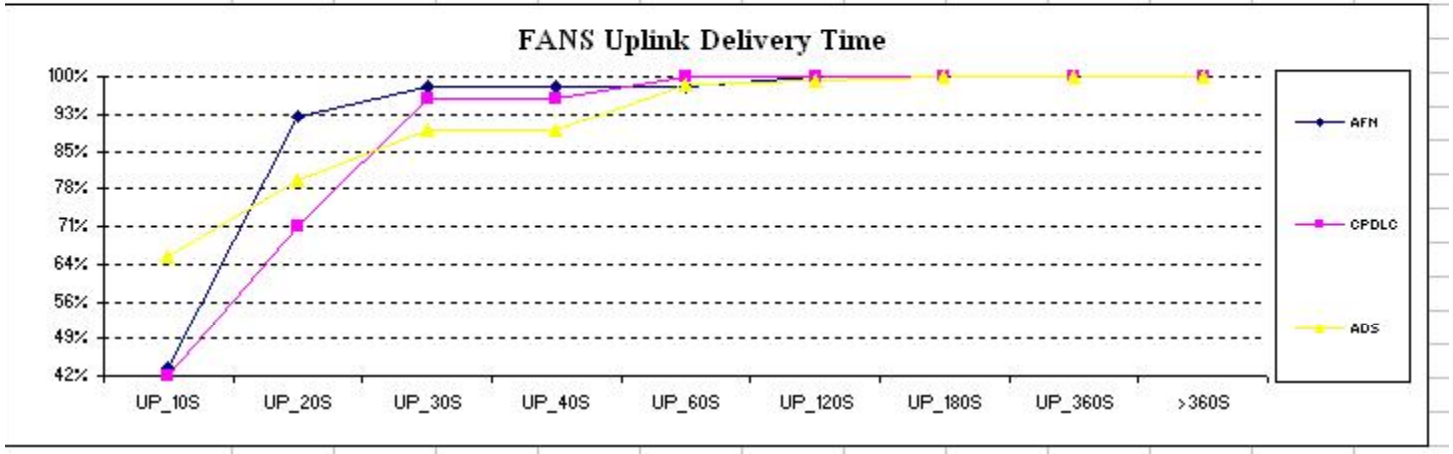


# APQP – Response time performance (1)

Uplink Delivery Time

**1.4 FANS SERVICE PERFORMANCE (VHF+SAT)**

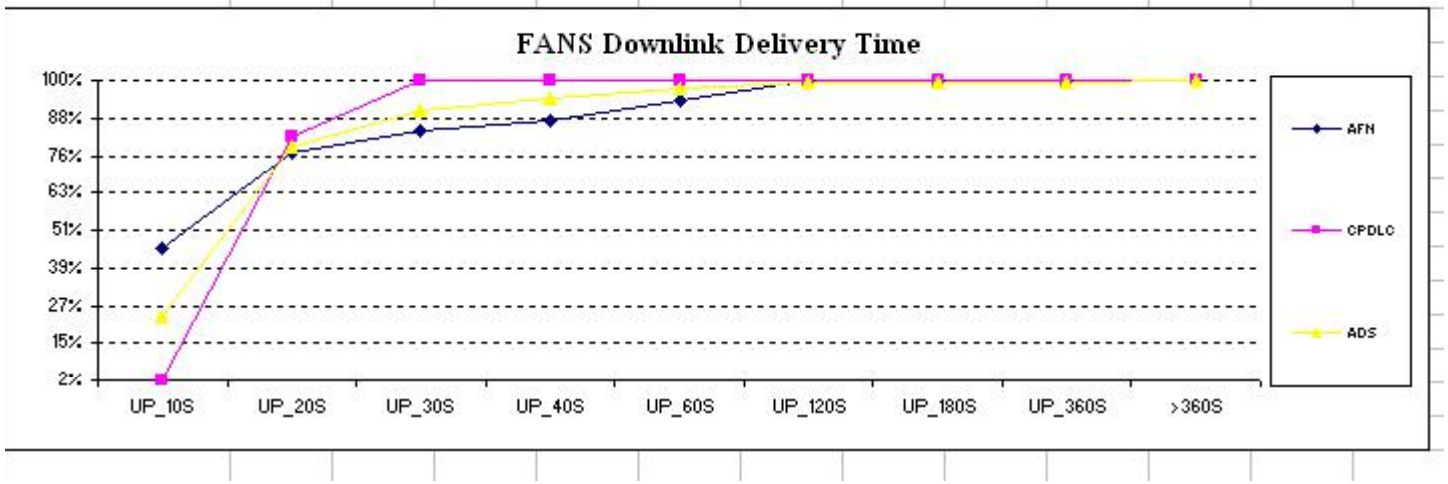
| Uplink Message Delivery Time | 10 s | 20 s | 30 s | 40 s | 60 s | 120 s | 180 s | 360 s | >360 s |
|---|---|---|---|---|---|---|---|---|---|
| ATS Provider | 60,37% | 80,85% | 90,96% | 90,96% | 98,40% | 99,47% | 100,00% | 100,00% | 100,00% |
| AFN (Log-on) | 43,14% | 92,16% | 98,04% | 98,04% | 98,04% | 100,00% | 100,00% | 100,00% | 100,00% |
| CPDLC | 41,67% | 70,83% | 95,83% | 95,83% | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% |
| ADS | 64,78% | 79,73% | 89,37% | 89,37% | 98,34% | 99,34% | 100,00% | 100,00% | 100,00% |



# APQP – Response time performance (2)

Downlink Delivery Time

| Downlink Message Delivery Time | 10 s | 20 s | 30 s | 40 s | 60 s | 120 s | 180 s | 360 s | >360 s |
|---|---|---|---|---|---|---|---|---|---|
| ATS Provider | 23,84% | 78,26% | 89,94% | 94,08% | 97,15% | 99,43% | 99,49% | 99,55% | 100,00% |
| AFN (Log-on) | 45,16% | 76,61% | 83,87% | 87,10% | 93,55% | 100,00% | 100,00% | 100,00% | 100,00% |
| CPDLC | 2,56% | 82,05% | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% | 100,00% |
| ADS | 23,27% | 78,28% | 90,05% | 94,28% | 97,25% | 99,40% | 99,46% | 99,53% | 100,00% |



# Conclusion

- SITA is a key partner for the aeronautical community in the world and in our region
- SITA is the Data Link Service provider selected by South Atlantic ANSPs to support ADS-C and CPDLC services in the oceanic airspace
- Our datalink solutions are enabling Airlines and ANSPs to improve their services, comply with ICAO recommendations, reduce costs and CO2 emissions

# Gracias!

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