SITA Data Link

ICAO NAM/CAR/SAM DATA LINK WORKSHOP
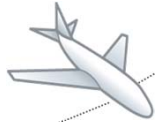
Saint Martin, 18 to 21 April 2016

SITA Aircraft Cockpit Data Link Service
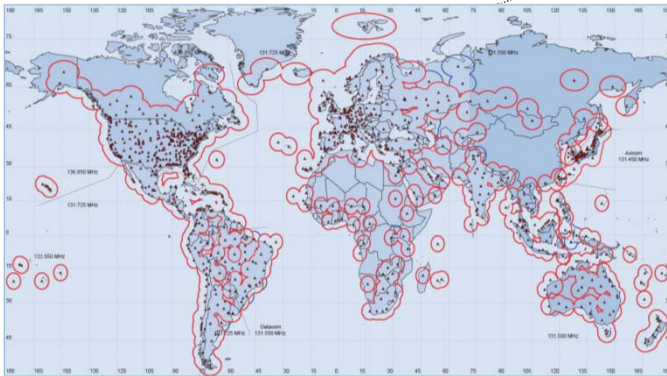
Inmarsat

AIRCOM user aircraft
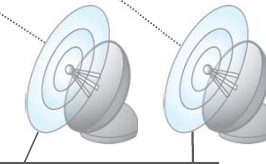- 10,000+ air transport aircraft
- 4,000+ business/government

Iridium

**Satellite Voice/Data**

1600 VHF Data Link Radios

AIRCOM user traffic/month
- VHF link: 60m messages
- Satellite: 20m messages
- ACARS message av. length ~ 1 kilobit

150 airlines – passenger & cargo
10 government aircraft operators
5 business jet service providers

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# SITA implementation of ICAO VHF Digital Link

- 1978: Airline community defined VHF ACARS
  - ACARS avionics used voice radios limiting to MSK modulation at 2.4 kbit/sec data rate
  - VHF channel scarcity required all Aircraft in common coverage share channel

- 1991-96: ICAO standardized VHF Digital Link (VDL)
  - VDL capacity is 31.5 kbit, max within constraints:
    - D8PSK modem latest tech in 1990s
    - Avionics radio max power ~ 10W
    - VHF channel width 25 KHz
    - Minimum range 200 nautical miles

- Since 2000:
  - ACARS avionics were modified to use VDL when in coverage of a VDL ground station
  - SITA began adding VDL radios to existing stations and keeps adding VDL coverage where needed
  - ACARS avionics fall back to VHF analog low speed outside VDL station coverage

VDL

VHF

ATC
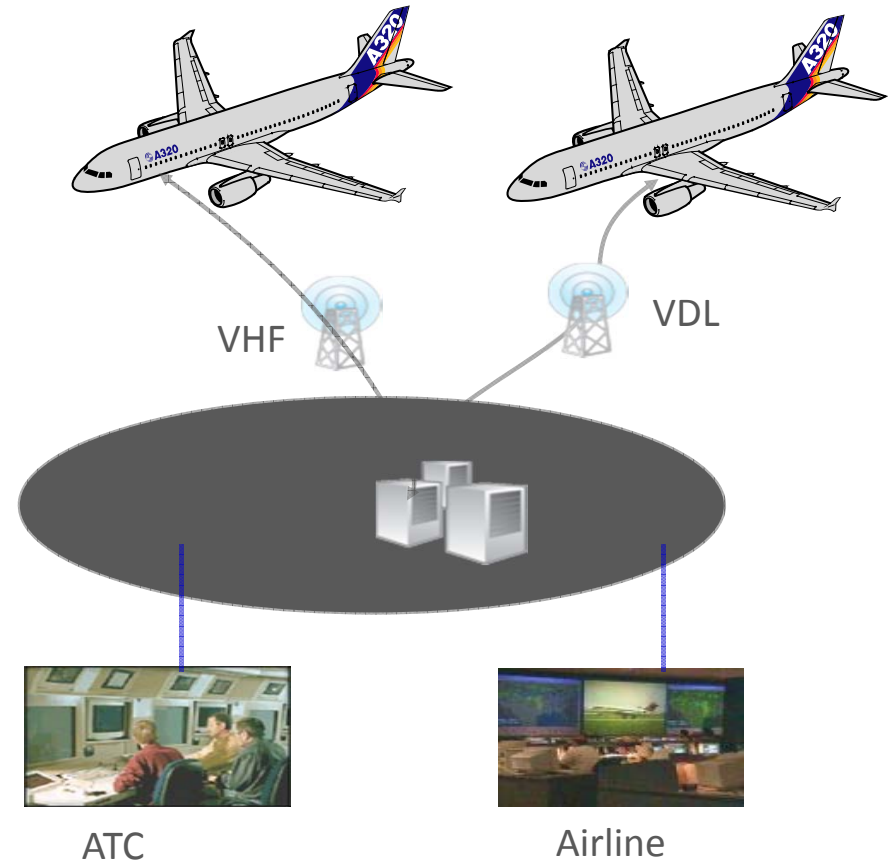
Airline

ATS Data Link

ATC Sharing of airline data link networks

- ICAO on adopting the FANS concept in 1988 agreed to ATC/airline sharing of data link avionics & networks

- SITA adapted airline VHF & satellite data link to meet emerging ATC needs

- SITA has partnered with ANSPs worldwide to share data link technology

ATC

Airline
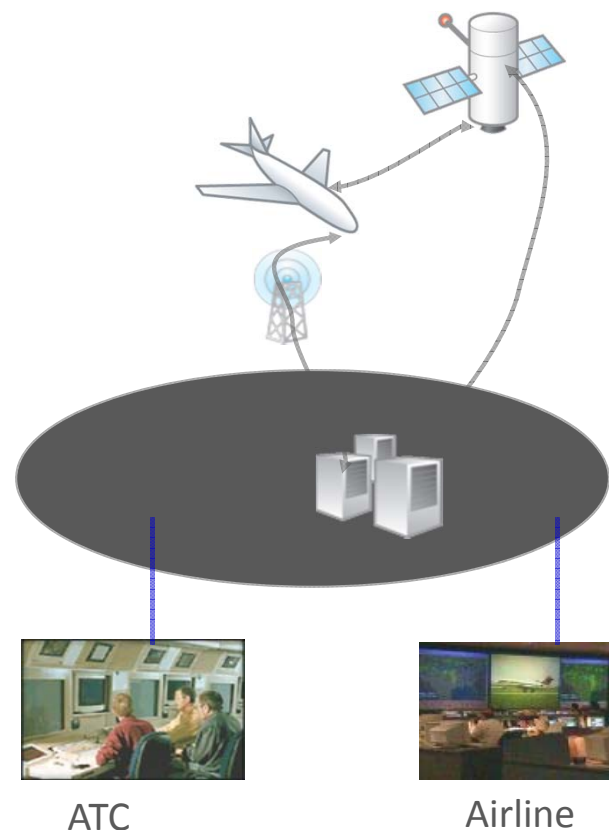
ATS Data Link Short/Long Haul

ATC in oceanic & remote airspace previously used only HF voice so data link equipage revolutionized operations

1991: original ICAO FANS Committee definition of Controller Pilot Data Link & Automatic Dependent Surveillance

1992: Boeing use RTCA & AEEC work to define FANS-1 ADS & CPDLC package using ACARS

1992: ANSPs started Depart. Clearance/ATIS using VHF data link already on short haul fleet

Today: most long haul aircraft have Boeing/AIRBUS FANS avionics combined with satellite link for oceanic ATC

Today: FAA Next Gen domestic CPDLC using FANS-1/A over VHF link will drive future short haul equipage

ATC in continental airspace uses VHF voice & radar so need for data link is to off load routine communications

ATS use of ACARS

- ACARS had been defined by the airline community in 1979 before the FANS committee proposed its use for ATC

- ACARS was installed by airlines first to support operational control and flight dispatch and engine reporting

- ACARS first use for Air Traffic Control was to transport long messages for which delays have limited safety impact
  - North Atlantic Oceanic Clearances
  - FAA Pre Departure Clearance
  - European Departure Clearance
  - Automatic Terminal Information Service
  - Message delivery via to cockpit printer was better than pilots writing down by hand long messages received via voice radio

- Boeing in 1995 added ATC FANS-1 Package providing ADS/CPDLC to the Flight Management System

- FANS-1 used an extra protocol layer on top of ACARS but required no change to ACARS avionics or networks

- ATC community used FANS-1 capability as foundation for developing performance based ADS/CPDLC operations

- FANS initial use was in oceanic & remote airspace requiring ACARS avionics to be connected to Inmarsat satellite avionics

- FANS communications automatically get better performance on aircraft with ACARS avionics upgraded to use VDL

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ATS Data Link use of ICAO ATN Standard Networks

- 2009 European Union Regulation said:
  - The protocols defined by ICAO based on the Aeronautical Telecommunication Network (hereinafter ATN) and the very high frequency digital link Mode 2 (hereinafter VDL 2) are currently considered to be the only validated solution for harmonised deployment. Member States should therefore ensure the availability of this solution.

- European regulation required CPDLC only support four transactions
  - Data Link Comm Initiation Capability (DLIC)
  - ATC Comm Management service (ACM)
  - ATC Microphone Check service (AMC)
  - ATC Clearances and Information service (ACL)

- European ATN CPDLC implementation showed protocol used up VDL network capacity & created performance issues

- ATN Protocol Issues
  - ICAO ATN was based on ISO standards later abandoned by telecom industry which preferred ad hoc Internet standards
  - ICAO ATN was intended to be used for ground communications including AMHS but instead it has used IP networks
  - ICAO ATN planned usage has been reduced to CPDLC, as required by 2009 European regulation
  - ICAO ATN is more complex than needed for CPDLC, causing routing data to be 90% of traffic on VHF links
  - ICAO ATN standard revision has started which will probably define Internet Protocol use instead of ISO OSI standards

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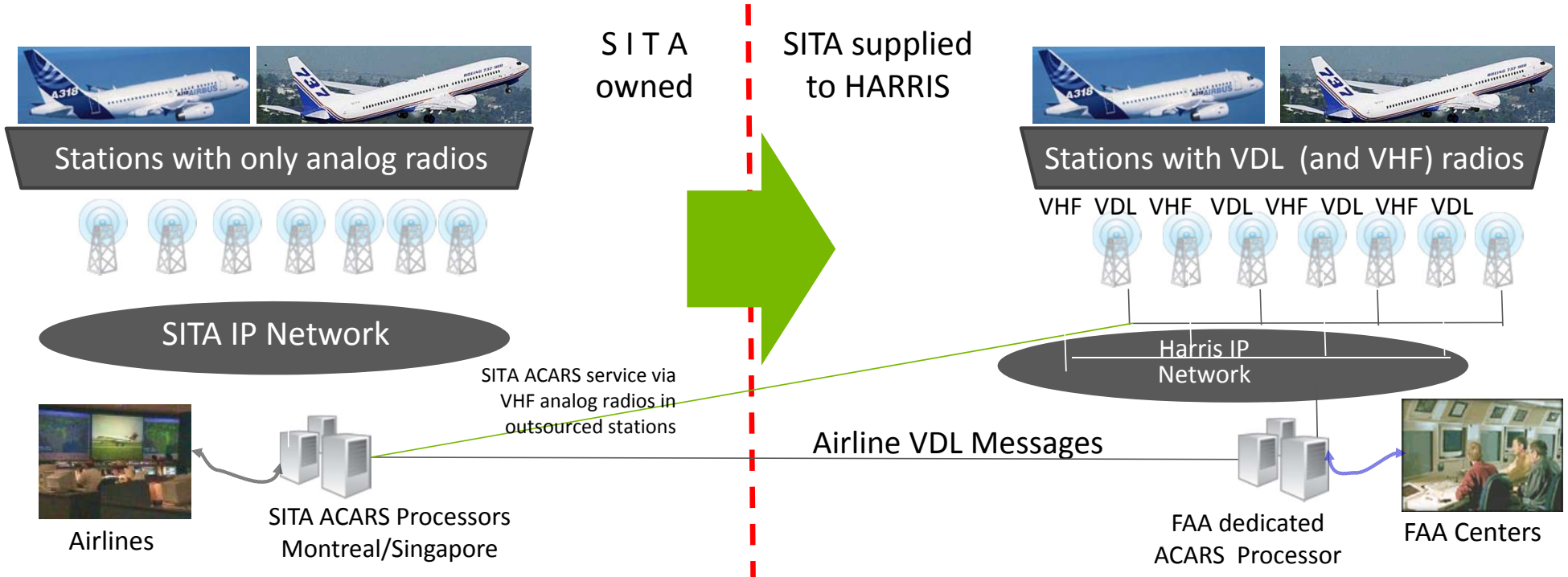
FAA Domestic Data Link use of ACARS

- FAA NextGen Data Comm program uses FANS/ACARS instead of ATN
  - FAA preferred FANS because it was implemented in Boeing 737 Flight Management System
  - FAA Data Comm 4D four dimensional trajectory management requires Flight Management System access
  - European CPDLC did not require Flight Management System access and were implemented in B737 ACARS avionics
  - Boeing 737 Flight Management System is based on long haul implementation that supports all CPDLC transactions

- FAA domestic use will cause US airlines to put FANS on short haul aircraft that fly to Caribbean and Central America
  - FAA CPDLC experience will probably lead to a performance based approach to air-ground data link networks
  - FAA will not go back to the European version of ATN CPDLC limited to four transactions
  - FAA plans ATN support after 2020 but that may be after standard is revised to replace ISO protocols with IP protocols
  - FAA may never implement the ICAO ATN version based on ISO standards that was required by the 2009 Europe regulation

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# SITA VHF Data Link Network Partnerships with ANSPs

SITA/Harris FAA VHF Data Link Network

- FAA in 2012 selected Harris Corp as Data Comm Network Service supplier
  - Harris in 2013 contracted SITA to buy VHF stations & ACARS processor.
  - As FAA expands, Harris replaces SITA stations with Harris VHF stations
  - Harris provides network usage to SITA for airline communications service.

S I T A owned

SITA supplied to HARRIS

Stations with only analog radios

Stations with VDL (and VHF) radios

VHF VDL VHF VDL VHF VDL VHF VDL

SITA IP Network

Harris IP Network

SITA ACARS service via VHF analog radios in outsourced stations

Airline VDL Messages

Airlines

SITA ACARS Processors Montreal/Singapore

FAA dedicated ACARS Processor

FAA Centers

SITA Brasil VHF stations & ATC sharing

- DECEA Brazil awarded SITA concession to deploy national VHF data link network:
  - 51 VHF stations at 47 sites covering entire Brazilian airspace above FL245.
  - ACARS processor in Rio de Janeiro to ensure independence from external systems.

- DECEA Brazil also acquired SITA ATS Data Link application systems:
  - SITA D-ATIS and Departure Clearance systems
  - ATN router for initial air-ground ATN trials.

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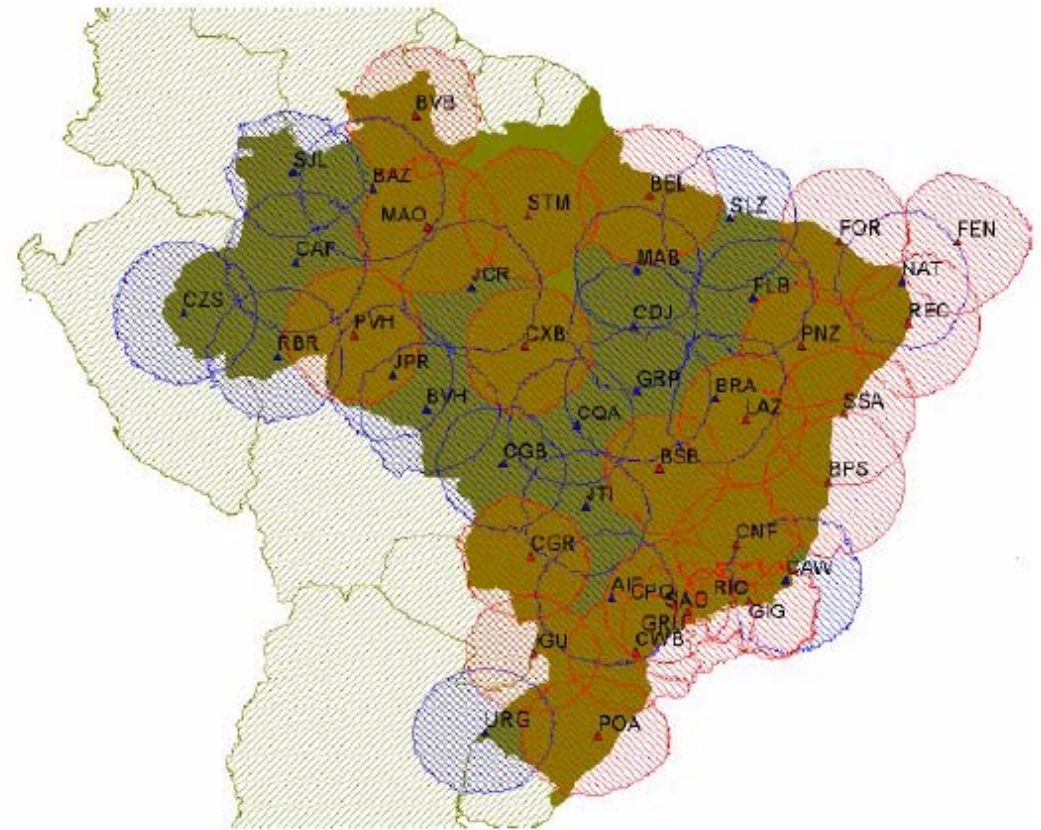
ANSP Regional network use of SITA Data Link

- Since Oct2015, SITA and DGAC CHILE are performing trials to REDDIG network to access SITA Data Link services.

- REDDIG Coordination Committee and ICAO are following up with both SITA and DGAC for the obtained results and so far, it has been considered that the process for performance of test to access the data link information from ACC oceanic Chile through REDDIG II to Recife REDDIG II node and then through SITA network to the new processing center of Rio in Brazil has been performed succesfully (RCC/19 RLA/03/901 Final report).

- The trials will continue until May/2016 and SITA and DGAC are requested to show final results and to demonstrate the study of cost benefit using REDDIG II to transport data link service.

DSNA FRANCE
FIR ROCHAMBEAU
ACC CAYENNE

DECEA BRASIL
ACC AO
SOUTH ATLANTIC

COCESNA
FIR CENTROAMERICANA
ACC CENAMER
PACIFIC

DGAC CHILE
OCEANIC SECTOR
SOUTH PACIFIC

DINACIA URUGUAY
ACC MONTEVIDEO
SOUTH ATLANTIC

DGCTA ARGENTINA
EZEIZA/CMD RIVADAVIA
SOUTH ATLANTIC

Caribbean Region
Air Traffic Control
Data Link Opportunity

# Caribbean current Data Link Status

- Caribbean phase 1 ATS Data Link uses "Future Air Navigation Systems" (FANS) with long haul aircraft on European routes or North/South America crossing

- ANSP use of FANS requires complex (and expensive) ground system to communicate with FANS avionics

- ANSPs cannot currently use FANS with short haul aircraft because very few are equipped with FANS avionics

Airport Tower Simple ACARS Usage

ANSPs could use ACARS VHF data link stations to communicate with most aircraft at their airports

- ANSPs could use basic ACARS to deliver ATIS and Volmet to aircraft cockpit printers

- ANSPs can use most existing ATIS systems to output text to an ACARS request/response server

- ANSPs ATIS data link would enable relatively easy learning of data link technology

SITA VHF data link ground stations on Carribean islands
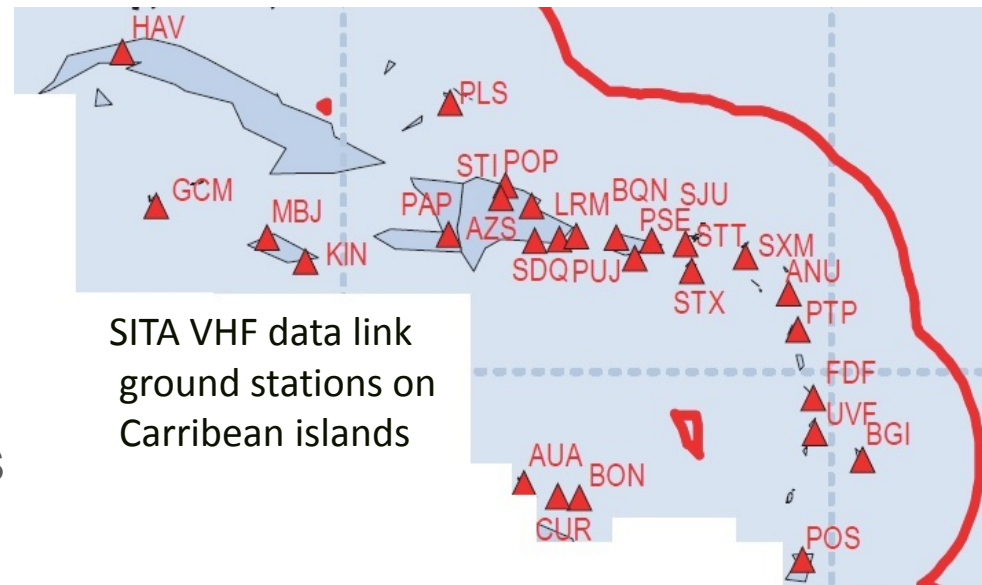
ANSP ATIS Data Link – Brazil example

SITA ATIS for DECEA Brazil

Phase 1: SITA ATIS servers in S. Paulo

& Rio de Janeiro

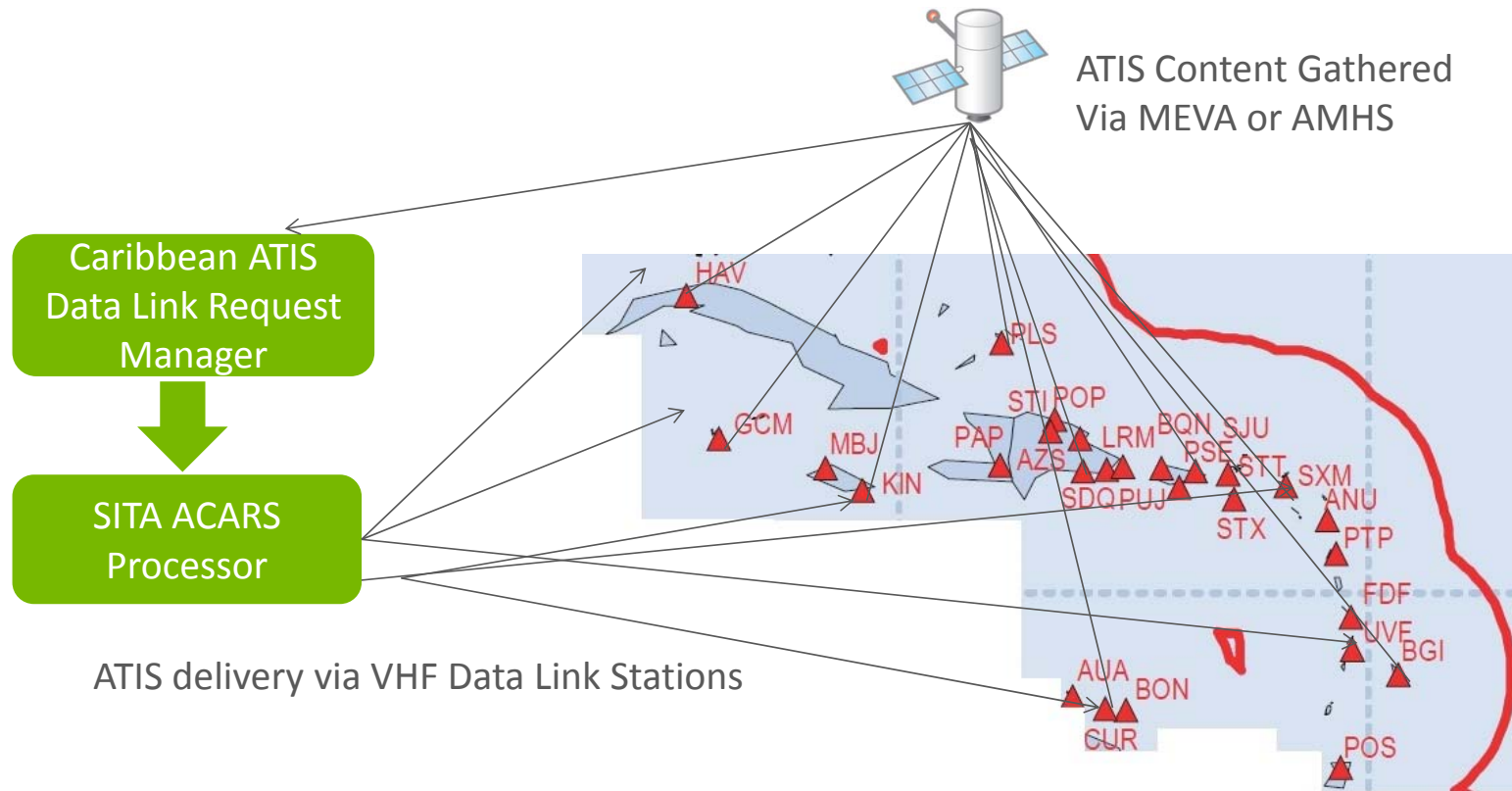**Phase 2: Central ATIS server**

supporting 23 more airports

ACARS Data Link Processor

Central ATIS
Data Link Request Manager

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Caribbean ATIS via ACARS Concept

ATIS Content Gathered Via MEVA or AMHS

Caribbean ATIS Data Link Request Manager

SITA ACARS Processor

ATIS delivery via VHF Data Link Stations

Map labels: HAV, PLS, GCM, STI, POP, PAP, MBJ, LRM, BQN, SJU, AZS, PSE, STT, KIN, SDQ, PUJ, SXM, ANU, STX, PTP, FDF, UVE, BGI, AUA, BON, CUR, POS

- Pilot ACARS access to ATIS would expand organically as each additional airport becomes able to provide content (links shown are just examples to show the concept)

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CONCLUSION

- ANSPs in North and South America are already using SITA aircraft data link technology and networks.

- Caribbean ANSPs could today access most aircraft at their airports via VHF data link stations already in place.

- ATIS delivery via data link has minimal impact on tower controllers and is best path to trigger implementation.

- SITA offers Caribbean region central ATIS data link server to minimize local work needed at each airports.

- Caribbean ANSPs could also agree to perform SITA trial with MEVA II in order to validate the ANSP use of MEVA to transport data link service in the region.

- ANSP experience of data link usage will remove the mystery and open up the next steps.
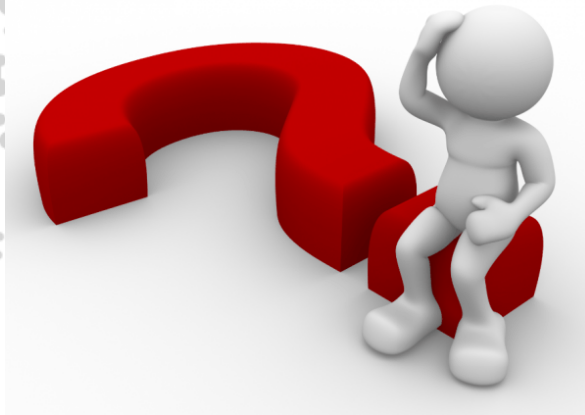
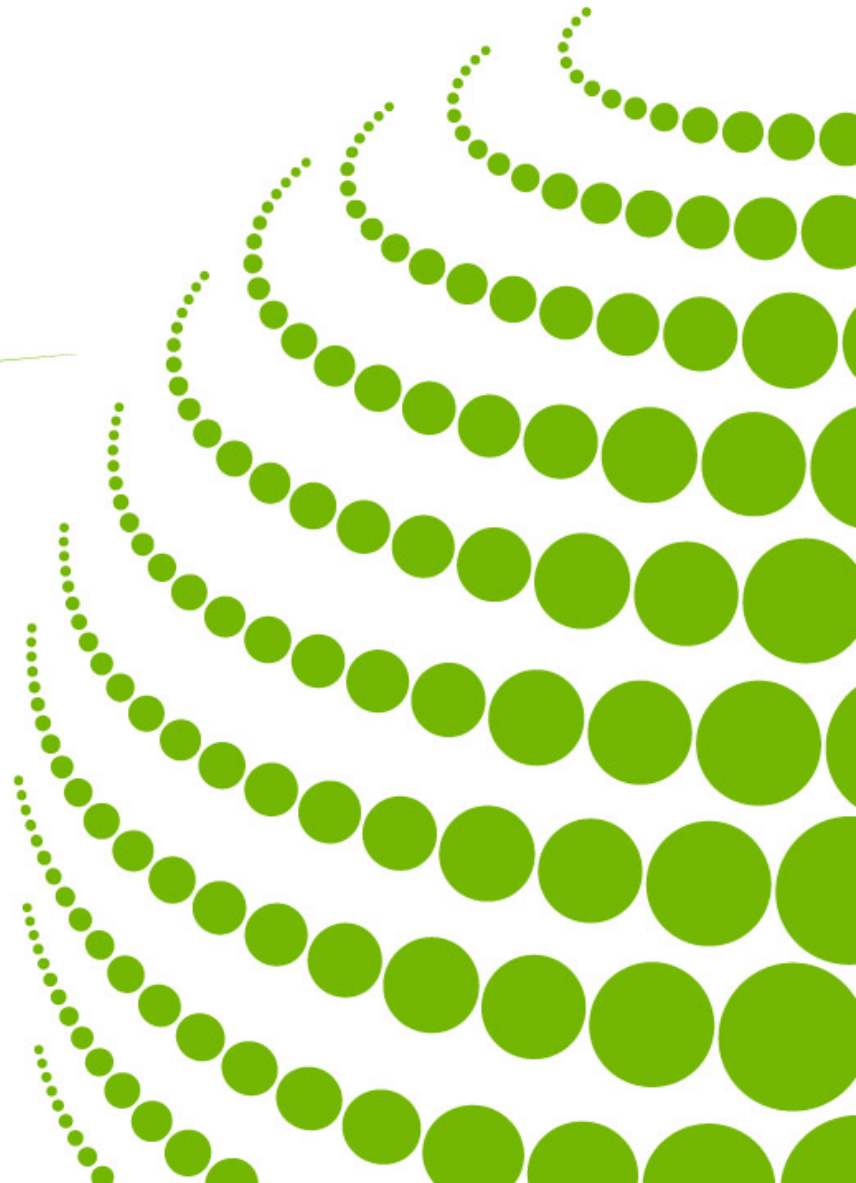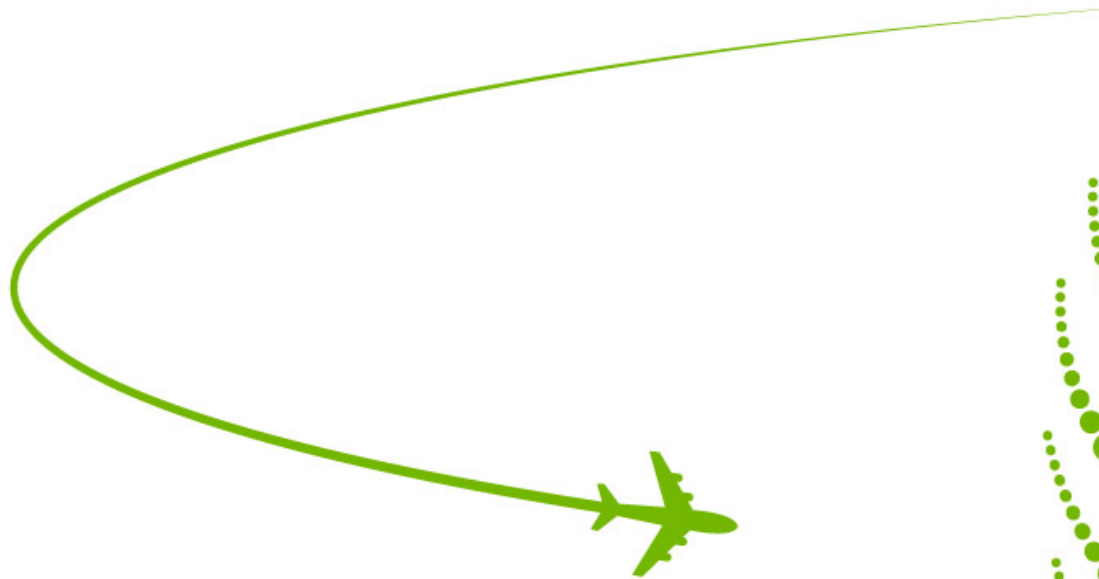**Philip Clinch**
AIRCOM | Vice President, Aeronautical Services

SITA OnAir
3100 Cumberland Boulevard
Atlanta, GA 30339, USA

Simply connect to
www.sitaonair.aero