ICAO NAM/CAR/SAM ATS Data Link Implementation Workshop

Manny Góngora
St. Maarten, 18-21 April 2016

Rockwell Collins

NextGen Data Comm

Rockwell Collins Proprietary Information

Rockwell Collins

Aircraft Communications and Reporting System
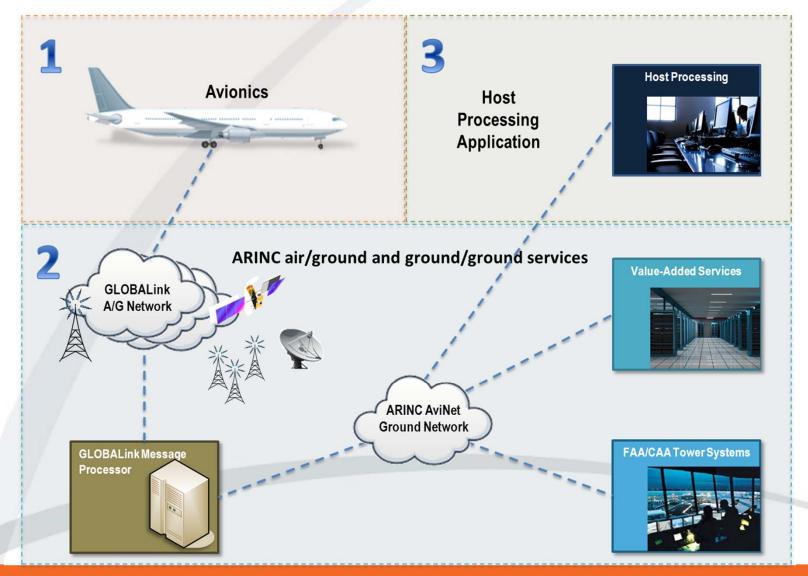
Rockwell Collins

GLOBALink/VHF Statistics:
In the beginning…

- 1978: ARINC began offering ACARS Service in the USA

- Two Customers: TWA and Piedmont Airlines

- Primary Application: OOOI Messages

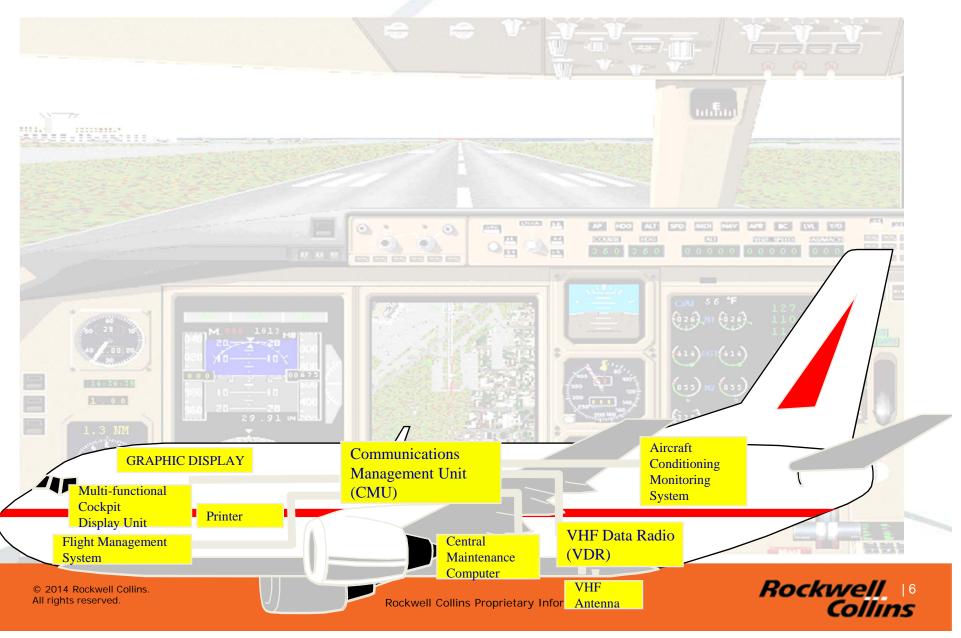- Media: VHF for domestic coverage

- Data Rate: 2400 bps

Rockwell Collins | 4

What's Needed to do Data Link?

1 Avionics

3 Host Processing Application — Host Processing

2 ARINC air/ground and ground/ground services

GLOBALink A/G Network

GLOBALink Message Processor

ARINC AviNet Ground Network

Value-Added Services

FAA/CAA Tower Systems

Rockwell Collins Proprietary Information

Rockwell Collins

ACARS Airborne Architecture

GRAPHIC DISPLAY

Multi-functional Cockpit Display Unit

Printer

Communications Management Unit (CMU)

Aircraft Conditioning Monitoring System

Flight Management System

Central Maintenance Computer

VHF Data Radio (VDR)

VHF Antenna

Rockwell Collins Proprietary Information

Rockwell Collins

Today's Data Link Applications

Preflight and Taxi Out

From Aircraft

Crew Information
Fuel Verification
Delay Reports
Out Event
Estimated Time of
   Departure

To Aircraft

Departure Clearance
D-ATIS
Weight and Balance
Runway Analysis
Flight Plan / Winds Aloft
   to FMS
Dispatch Release
Maintenance Release
Taxi Clearance
Weather

Takeoff and Departure

From Aircraft

Off Event
Destination ETA
Fuel Remaining
Special Requests
Take Off Data
Engine Data

To Aircraft

Updated Weather

En Route

From Aircraft

Position Reports
ETA Updates
Voice Requests
Engine Data
Maintenance Reports
Freetext
Weather Reports

To Aircraft

D-ATIS
ATC Oceanic Clearance
Weather Reports
Voice Request (SELCAL)
NOTAMs
Turbulence Plot
Dispatch Rereleases

Approach and Landing

From Aircraft

Provisioning
Gate requests
ETA
Special Requests
Engine Data
Maintenance info
Descent Weather reports
On Event

To Aircraft

Weather Advisories
Parking Gate/Spot
   Assignment

Post-Landing

From Aircraft

In Event
Fuel info
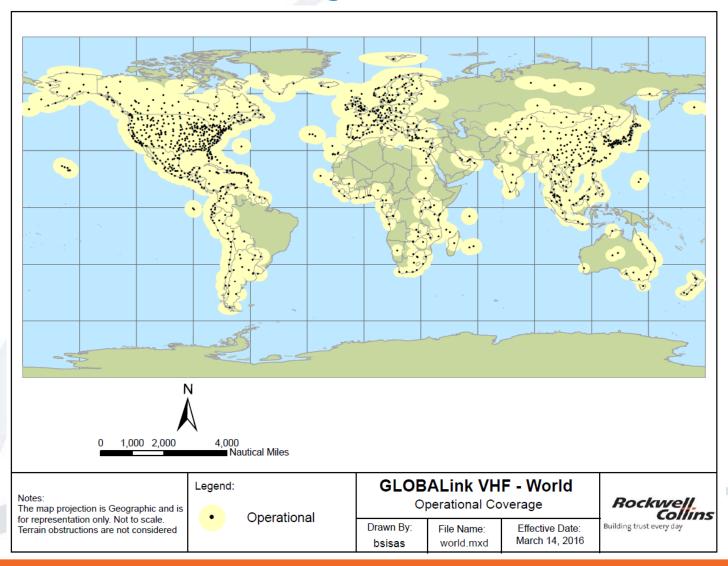Crew info
Fault data (from central
maintenance computer)

Rockwell Collins

Data Link Media

Rockwell Collins Proprietary Information

Rockwell Collins

ARINC Data Link Media
Truly Worldwide coverage

Rockwell Collins Proprietary Information

ACARS Data Link Coverage

Rockwell Collins Proprietary Information

GLOBALink VHF Coverage

GLOBALink VHF - World
Operational Coverage

Notes:
The map projection is Geographic and is for representation only. Not to scale. Terrain obstructions are not considered

Legend:

• Operational

Drawn By:	File Name:	Effective Date:
bsisas	world.mxd	March 14, 2016

Rockwell Collins
Building trust every day

Rockwell Collins Proprietary Information
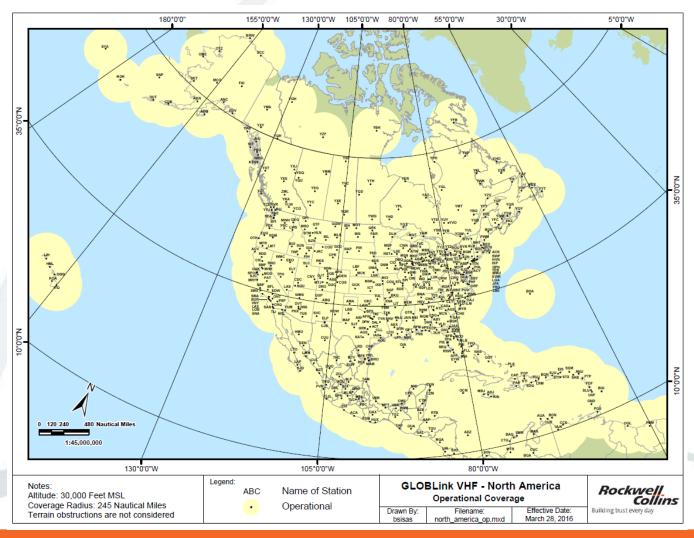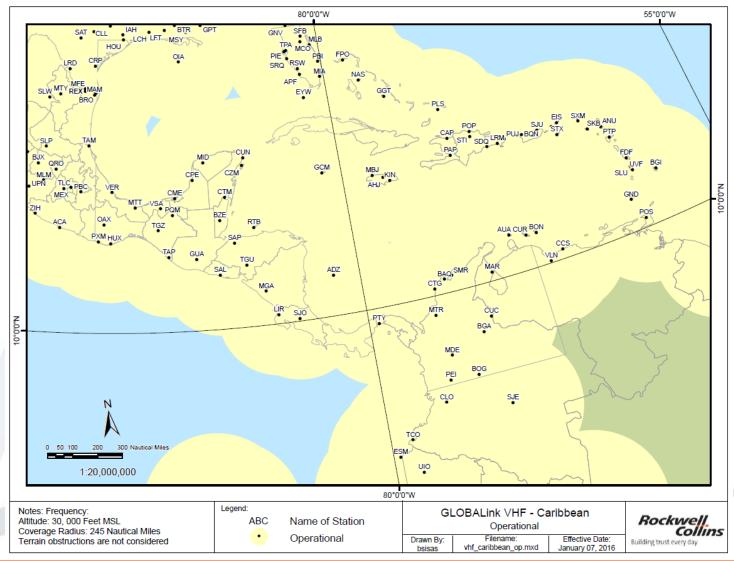
Operational Ground Stations in the Region

Mexico 50

Caribbean 37

Central America 18

South America 66

Total 171

Rockwell Collins Proprietary Information

Rockwell Collins
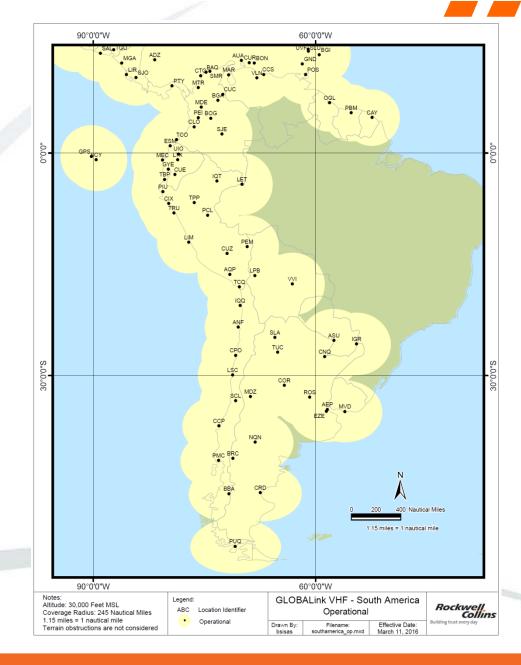
GLOBALink/VHF Coverage Map –
North America & Caribbean

Rockwell Collins Proprietary Information
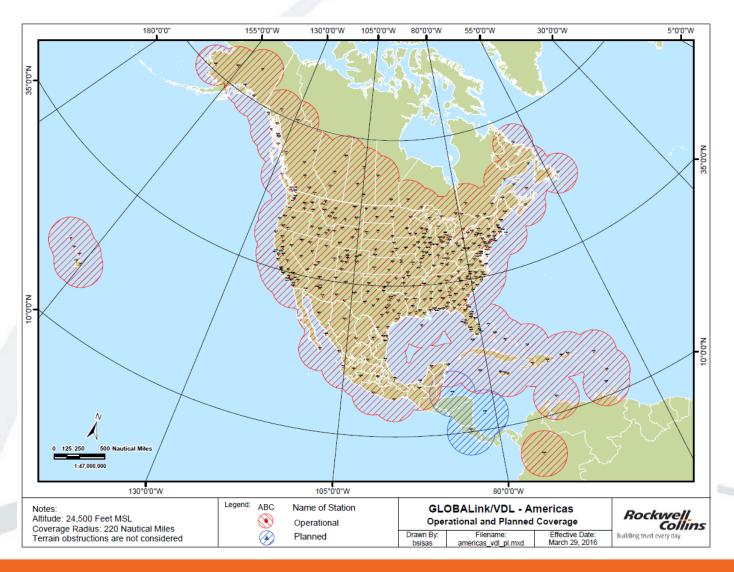
GLOBALink/VHF Coverage Map – Caribbean

Rockwell Collins Proprietary Information
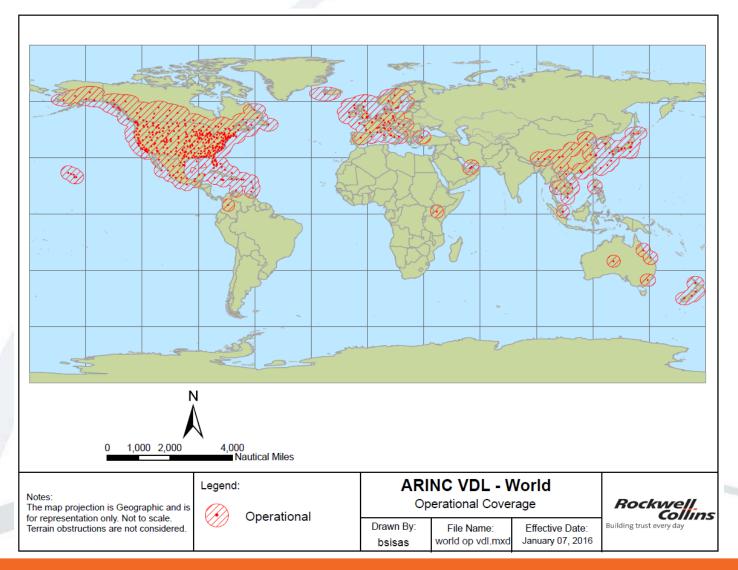
GLOBALink/VHF Coverage Map – South America

Rockwell Collins Proprietary Information

Caribbean, Central & North America VDL Coverage

Rockwell Collins Proprietary Information

World VDL Coverage

Notes:
The map projection is Geographic and is for representation only. Not to scale. Terrain obstructions are not considered.

Legend:
⊘ Operational

ARINC VDL - World
Operational Coverage

Drawn By:	File Name:	Effective Date:
bsisas	world op vdl.mxd	January 07, 2016

Rockwell Collins
Building trust every day

0 Nautical Miles scale: 0 1,000 2,000 4,000

N

Rockwell Collins Proprietary Information

Rockwell Collins

GLOBALink HFDL

Rockwell Collins Proprietary Information

Rockwell Collins
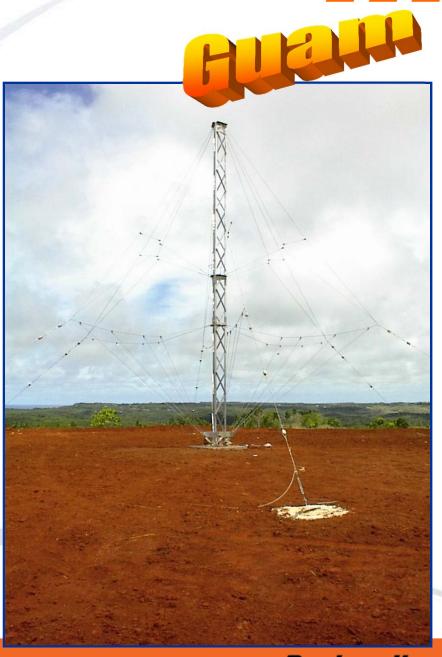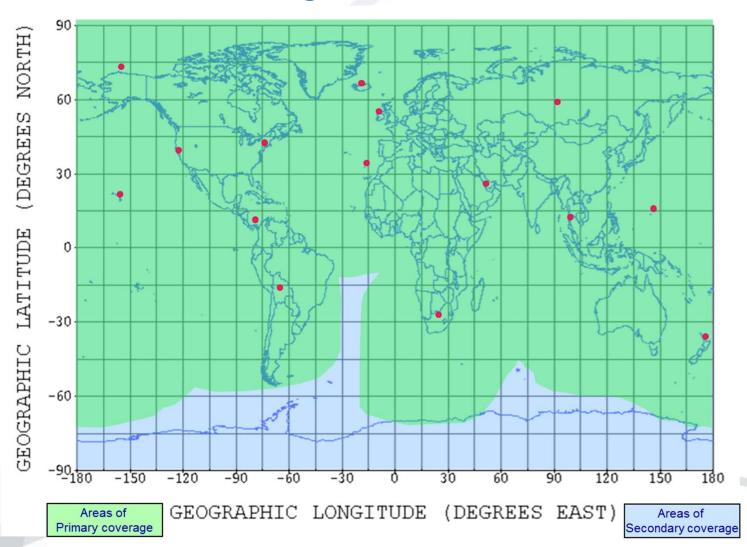
HFDL Ground Stations

- San Francisco, CA, U.S.A (H01)
- Molokai, HI, U.S.A. (H02)
- Reykjavik, Iceland (H03)
- Riverhead, NY, U.S.A. (H04)
- Auckland, New Zealand (H05)
- Hat Yai, Thailand (H06)
- Shannon, Ireland (H07)
- Johannesburg, South Africa (H08)
- Barrow, AK, U.S.A. (H09)
- Panama City, Panama (H11)
- Santa Cruz, Bolivia (H13)
- Krasnoyarsk, Russia (H14)
- Al Muharraq, Bahrain (H15)
- Yona, Guam (H16)
- Telde, Canary Islands (H17)

Rockwell Collins
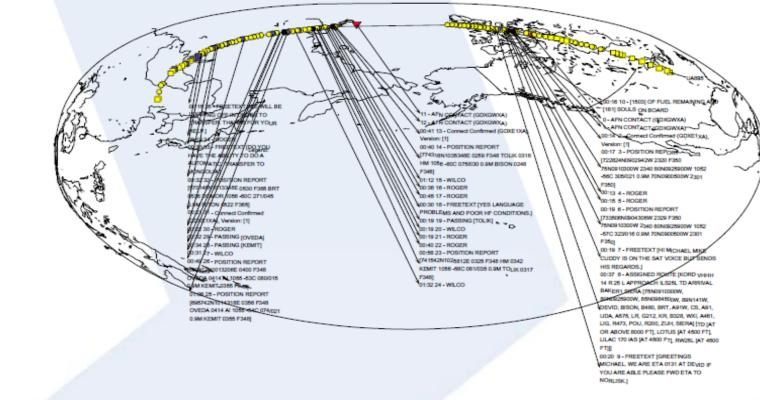
Worldwide Coverage

HF Ground Stations

Alaska
Bahrain
Bolivia
California
Canary Islands
Guam
Hawaii
Iceland
Ireland
New York
New Zealand
Panama
Russia
South Africa
Thailand

Legend

● HFDL ground station

Rockwell Collins Proprietary Information
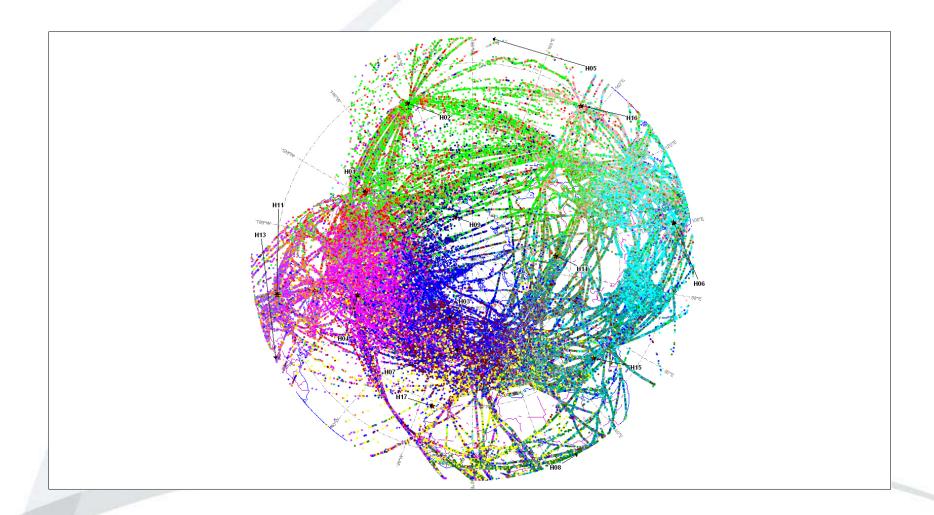
First United Polar Flight

Flight UA895 (N107UA) Chicago-Hong Kong =

Jan 20, 1999

Rockwell Collins Proprietary Information
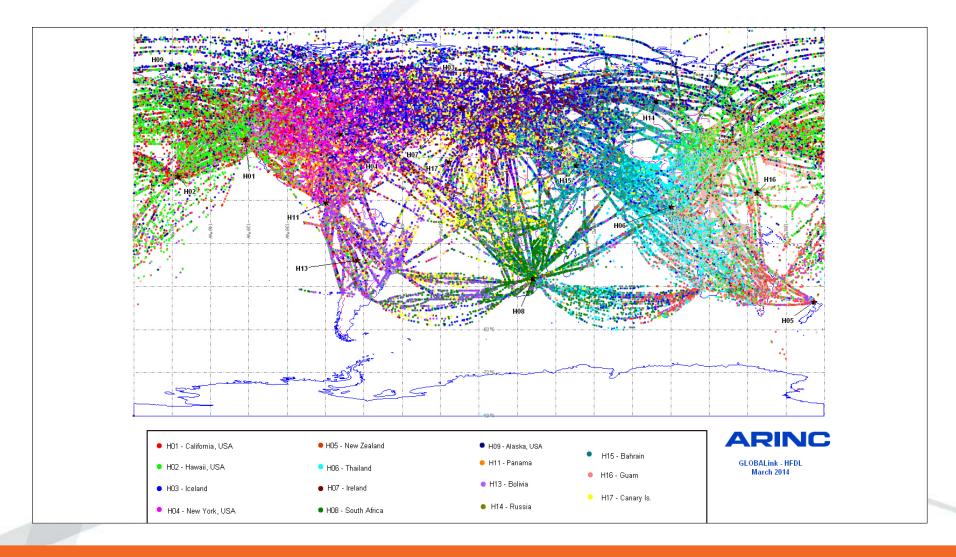
HFDL Polar Flights – September 2011

Rockwell Collins Proprietary Information

Rockwell Collins

HFDL Flights – March 2014

Map legend:
- H01 - California, USA
- H02 - Hawaii, USA
- H03 - Iceland
- H04 - New York, USA
- H05 - New Zealand
- H06 - Thailand
- H07 - Ireland
- H08 - South Africa
- H09 - Alaska, USA
- H11 - Panama
- H13 - Bolivia
- H14 - Russia
- H15 - Bahrain
- H16 - Guam
- H17 - Canary Is.

ARINC

GLOBALink - HFDL
March 2014

GLOBALink ATS Services

Rockwell Collins Proprietary Information
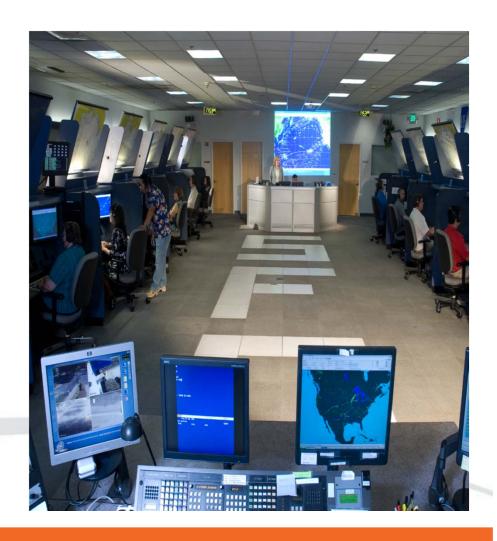
CNS/ATM Functions

- AFN – ATS Facility Notification

- CPDLC – Controller Pilot Data Link Communications

- ADS-C – Automatic Dependent Surveillance – Contract

- CADS/CFRS – Data link position reporting in the North Atlantic

- PDC – Pre-Departure Clearance in U.S. and Canada

- DCL – ARINC 623 Departure Clearance, Worldwide

- D-ATIS – Digital Automatic Terminal Information Service

Rockwell Collins Proprietary Information
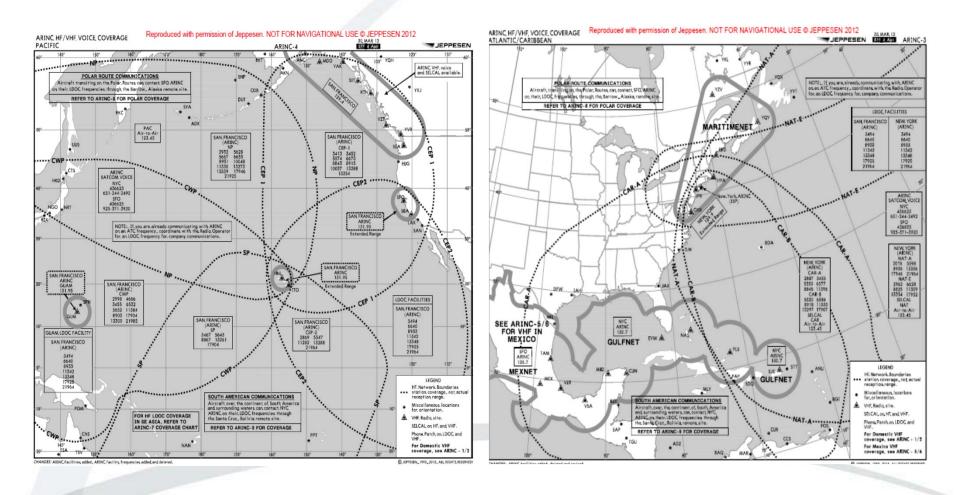
GLOBALink FAA/Airline Operation Center Communications

- Air/Ground International HF Voice Service

- New York and San Francisco Long-Distance Operational Control Facilities

- Atlantic, Caribbean, Central and South America, Pacific Oceanic Canadian and Arctic Region, Gulf of Mexico

- Airline Operations Centers messaging

Rockwell Collins Proprietary Information

Rockwell Collins

GLOBALink FAA/AOC HF/VHF Voice Coverage (NYC/SFO)

DEPARTURE CLEARANCE

Rockwell Collins Proprietary Information
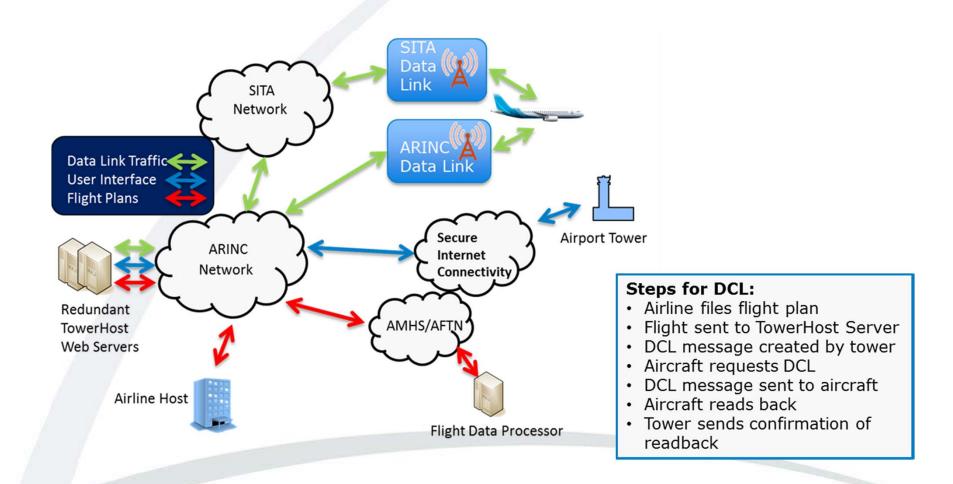
ARINC TowerHost
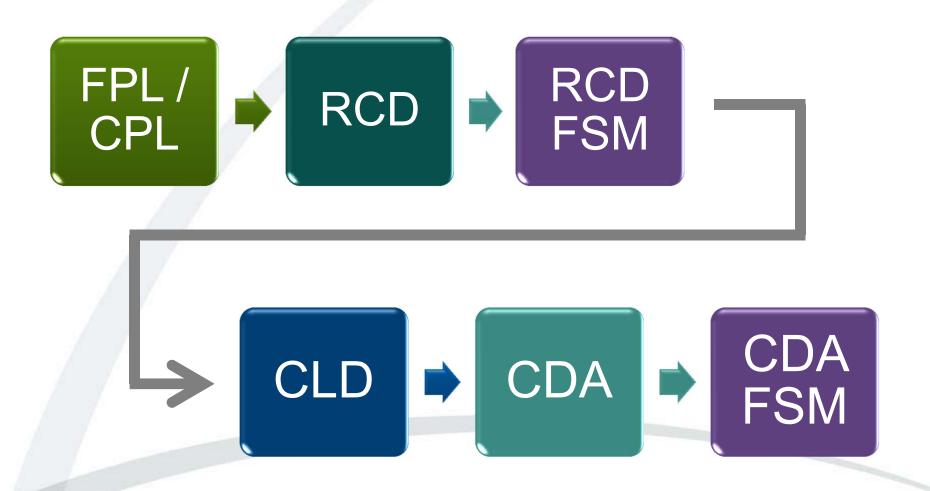
Feature Description	Benefit Achieved
Data link interface to aircraft avionics	• Improves safety by eliminating voice instructions • Reduces radio frequency congestion • Decreases tower noise
Web based user interface	• Lowers costs as no specialized hardware or software is required • Rapid deployment
Intuitive configuration screens	• Makes configurations easy to set up
Real-time monitor	• Reduces delays by easily seeing departure status

Rockwell Collins

DCL Architecture

Steps for DCL:
- Airline files flight plan
- Flight sent to TowerHost Server
- DCL message created by tower
- Aircraft requests DCL
- DCL message sent to aircraft
- Aircraft reads back
- Tower sends confirmation of readback

Rockwell Collins Proprietary Information

DCL Message Flow

Rockwell Collins Proprietary Information

Rockwell Collins

Interface Tower – Crew

ACARS PDC REQUEST
ORIG/DEST   FLT NO
1L MMMX/MMMD   AMX533   1R
    GATE NUMBER   ATIS ID
2L 53   Z   2R
    ENTER OPTIONAL FREE TEXT
3L [   ]
4L [   ]
     A/C TYPE   FORMAT FOR
5L B737   MCDU>
     RETURN TO
6L <ACARS MENU   SEND

ACARS PDC REQUEST
     ORIG/DEST   FLT NO
1L   MMMX/MMMD   AMX533   1R
     GATE NUMBER   ATIS ID
2L   53   Z   2R
     ENTER OPTIONAL FREE TEXT
3L   [   ]
4L   [   ]
      A/C TYPE   FORMAT FOR
5L   B737   MCDU>
      RETURN TO
6L   <ACARS MENU   SEND

      ACARS MSG DISPLAY
     PDC REQUEST STATUS
1L   FS1/FSM 1824   1R
     120806 MMMX
2L   AMX533 RCD RECEIVED   2R
     IF NO CLEARANCE WITHIN
3L   30 MINUTES -   3R
     REVERT TO VOICE
4L   PROCEDURES   4R

5L   5R
      RETURN TO
6L   <REC MSGS   PRINT> 6R

Rockwell Collins | 33

```
        ACARS REC MSGS
   061825
1L  < MMMX PDC 18                1R
   061824
2L  <PDC REQUEST STATUS          2R

3L

4L

5L
    -RETURN-TO----------------
6L  <ACARS MENU
```

```
         ACARS MSG DISPLAY01/03->
    MMMX PDC 18
1L  CLD 1824                     1R
    120806 MMMX PDC 181
2L  AMX533 CLRD TO MMMD OFF      2R
    05 VIA APN7A APN UT19
3L  MID
    THEN AS FILED
4L  CLIMB TO AND MAINTAIN
    ----------------------------
5L  <ACCEPT
     RETURN TO
6L  <REC MSGS           PRINT>
```

```
         ACARS MSG DISPLAY02/03->
    MMMX PDC 18
1L  ALTITUDE F270                1R
    EXPECT FLIGHT LEVEL F410
2L  SQUAWK 1372 NEXT FREQ        2R
    120.5
3L  GROUND NORTH CONTROL         3R
    121.85 / TRAFFIC AT
4L  TERMINAL 2, SOUTH RAMP,      4R
    ----------------------------
5L  <ACCEPT                      5R
     RETURN TO
6L  <REC MSGS           PRINT>   6R
```

Rockwell Collins | 34

ACARS MSG DISPLAY 03/03->
MMMX PDC 18
GATE 1-5 AND 48 -51
CONTACT RAMP 134.62 WHEN
READY TO PUSH BACK

_____

<ACCEPT
 RETURN TO
<REC MSGS   PRINT>

1L 2L 3L 4L 5L 6L
1R 2R

ACARS REC MSGS
 061828
<ATC REQUEST STATUS
 061825
< MMMX PDC 18
 061824
<PDC REQUEST STATUS

-RETURN-TO----------------
<ACARS MENU

1L 2L 3L 4L 5L 6L
1R 2R

ACARS MSG DISPLAY
ATC REQUEST STATUS
FS1/FSM 1828
120806 MMMX
AMX533 CDA RECEIVED -
CLEARANCE CONFIRMED

_____

 RETURN TO
<REC MSGS   PRINT>

1L 2L 3L 4L 5L 6L
1R 2R 3R 4R 5R 6R

DIGITAL ATIS

Rockwell Collins Proprietary Information

Rockwell Collins

D-ATIS Message Flow

ATS Server

Library of about 182 stations – U.S., Canada, Australia
Germany, Thailand, China, Aruba, Mexico
Can handle both 620 and 623 requests
Also contains TWIP (U.S. only)

StarCaster   Airport

GLOBALink Message Processor

Other DSP

623 to airport

Rockwell Collins

Interface Tower – Crew

LATCAR & GLOBAL SERVICE OVERVIEW

Rockwell Collins Proprietary Information

Rockwell Collins

First FANS 1 Flight in South America

(2 copies)

From Miami

ARINC

The First FANS 1 Flight
in South America

UAL997 (B777-200IGW)
Miami to Santiago
June 17-18, 1998

History in the Making

On June 17, 1998 UAL997, a Boeing 777 became the first FANS-1 flight to fly a route over South America from Miami to Santiago, Chile. The flight was tracked using ADS contracts from Annapolis and Lima, Peru. Controller to Pilot Data Link Communications (CPDLC) was established by ARINC from Annapolis and a handoff was made to CORPAC's, Air Traffic Control facility in Lima. Captain Phil Irwin, onboard UAL997, communicated with the Peruvian air traffic controller in the Lima ACC.
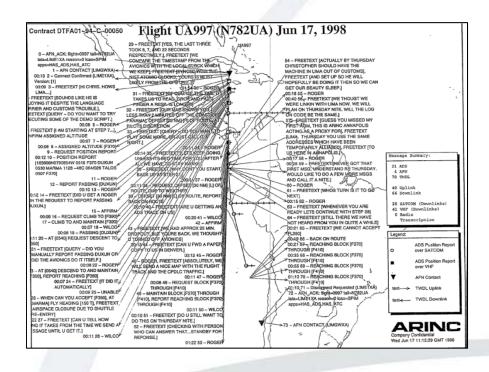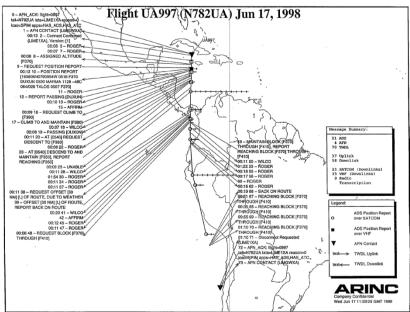

(1 copy)

To Miami

ARINC

The First FANS 1 Trials
in South America

UAL984 (B777-200IGW)
Buenos Aires to Miami
June 19, 1998

History in the Making

On June 19, 1998 UAL984, a Boeing 777 became the first FANS-1 flight to fly a route from Buenos Aires, Argentina to Miami. The flight was tracked using ADS contracts from Annapolis and Lima, Peru. Controller to Pilot Data Link Communications (CPDLC) was established by ARINC from the CORPAC Air Traffic Control facility in Lima, by Peruvian air traffic controllers. Captain Steve Forte was in command of the flight.

Rockwell Collins Proprietary Information

Rockwell Collins

First ADS-C/CPDLC

Latin America FANS Trials in Cooperation with CORPAC and United Airlines MIA - SCL

Latin American & Caribbean Highlights - ANSPS

- ARINC has a strong partnership with Air Navigation Service Providers (ANSPs) to improve Air Traffic Services with Departure Clearance (DCL), CPDLC/ADS-B, Digital ATIS (D-ATIS) & AMDAR. Examples:

  - In Mexico: Providing DCL, HF Voice and D-ATIS services at Mexico City International Airport.

  - ARINC offers DCL services at El Dorado International Airport in Bogota, Colombia and Tocumen at Panama City, Panama

  - Trinidad and Tobago ARINC provides PIARCO HF Voice and CPDLC/ADS-C

  - D-ATIS is offered at Aruba

Asia / Pacific ANSPs Partnerships

- ARINC continues its partnership with Aeronautical Radio of Thailand (AEROTHAI) and Aviation Data Communications Corporation (ADCC) to provide VHF ACARS in the Asia / Pacific region

- ADCC provides coverage within mainland China
  - VDLM2/AOA Stations now operational in Hong Kong and Beijing

- AEROTHAI provides coverage throughout most of Asia / Pacific region
  - VDLM2 AOA operational in Bangkok & Singapore
  - Continued ACARS deployments in Australia, New Zealand, Malaysia, & India

- AVICOM provides coverage within Japan
  - Long standing internetworking arrangement with ARINC
  - ARINC provided AVICOM with a replacement ACARS network
  - Deployment completed in 3rd QTR 2011 – System performance excellent

- ADCC, AEROTHAI, ARINC, and AVICOM Operate Separate CPS systems

Rockwell Collins

Manny Góngora
+1 305 263-5772
mgongora@arinc.com

Rockwell Collins Proprietary Information