Aviation Management
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Aircraft Access to SWIM

AXIM Transport and Display

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Aircraft Access to SWIM

- Aircraft Access to System Wide Information Management is a program in a research and development stage to enable airborne aircraft to lever their commercial terrestrial and satellite communications links to access FAA's aeronautical, weather and traffic flow management information as well as exchange pertinent real-time operational data.
- This program is not intended to replace other FAA programs, such as DataComm for ATC command and control, but to provide supplemental information for enhanced situational awareness.

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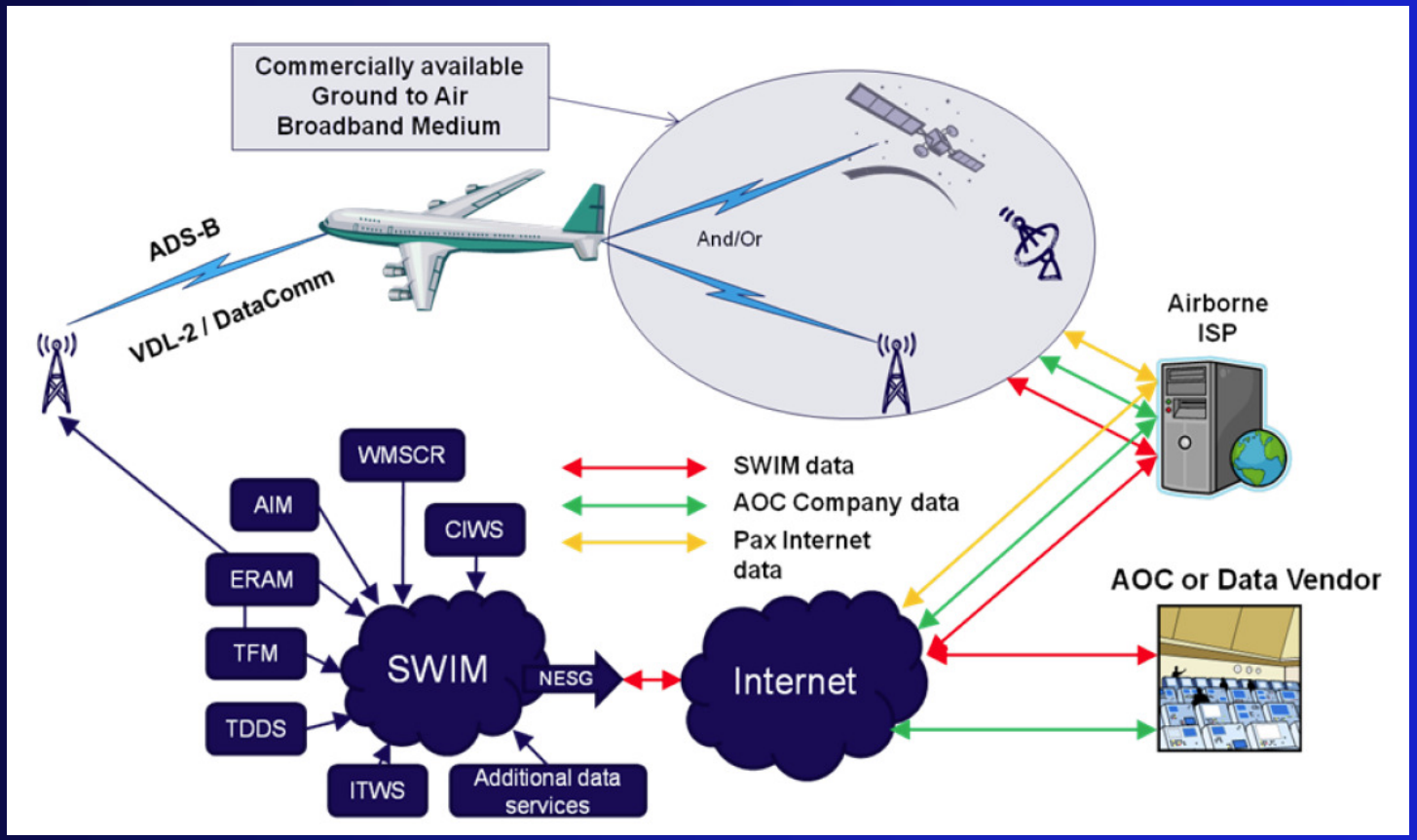
Aircraft Access to SWIM

- Key Elements
  - FAA Data Providers
    - Aeronautical Information
    - Traffic Flow Management Information
    - Weather Information
  - Data Content Managers
    - Access, process and disseminate data products from FAA and end users
    - Create applications as needed
  - Data Transport Providers
    - Provides commercial terrestrial and satellite links to and from the aircraft and ground infrastructure
  - End Users
    - Airline, Business Aviation, General Aviation and Military Aviation Pilots

Aircraft Access to SWIM

- Concept Architecture



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- FAA Data Provider Products
  - Aeronautical Information Management (AIM)
    - Real-time Textual and Graphical NOTAMS
    - Real-time Airport Field Condition Reports
    - Contemporaneous Electronic Aeronautical Charts and Data
    - D-ATIS (Digital Automatic Terminal Information Service)

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- FAA Data Provider Products
  - Traffic Flow Management (TFM)
    - Airspace flow programs (AFP)
    - Airborne holding
    - Real-time airspace status (Special Use Airspace)
    - Real-time airport delay and capacity status
    - Expect Departure Clearance Time (EDCT)
    - Arrival or departure sequence and queue
    - Deicing routes and sequence and queues
    - ATC sector loading

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- FAA Data Provider Products
  - Weather Information (Wx)
    - Real-time NEXTRAD weather radar mosaics
    - Real-time AWOS/ASOS METARS with 15 minute, 30 minute, 60 minute and 4 hours trends with minimum and maximum values
    - Real-Time Integrated Terminal Weather System (ITWS) display or data
    - Real-Time Runway Visual Range (RVR)
    - Braking Action (Send and Receive)
    - Pilot Reports (Send MDCRS and Receive)
      - Wind
      - Turbulence
      - Icing
      - Temperature
      - Humidity

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- Data Content Manager Capabilities
  - Extensive FAA Program Experience (CSC, Harris, WSI, etc.)
    - TFM-M, NextSim, TMA, ERIDS, DUATS, REACT
    - FTI, WARP
    - ETMS, ADS-B, ATCSCC
  - Qualifications (WSI, Harris, CSC, etc.)
    - FAA QICP and EWINS for weather services
    - Airlines, business and general aviation knowledge and experience
      - Airline Operational Control (AOC)
      - Weather in the cockpit
  - 99.99+% reliability for weather and ATC commands

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Aircraft Access to SWIM

- Data Content Manager Capabilities
  - Extensive Commercial Data Management Experience for Mobility Services

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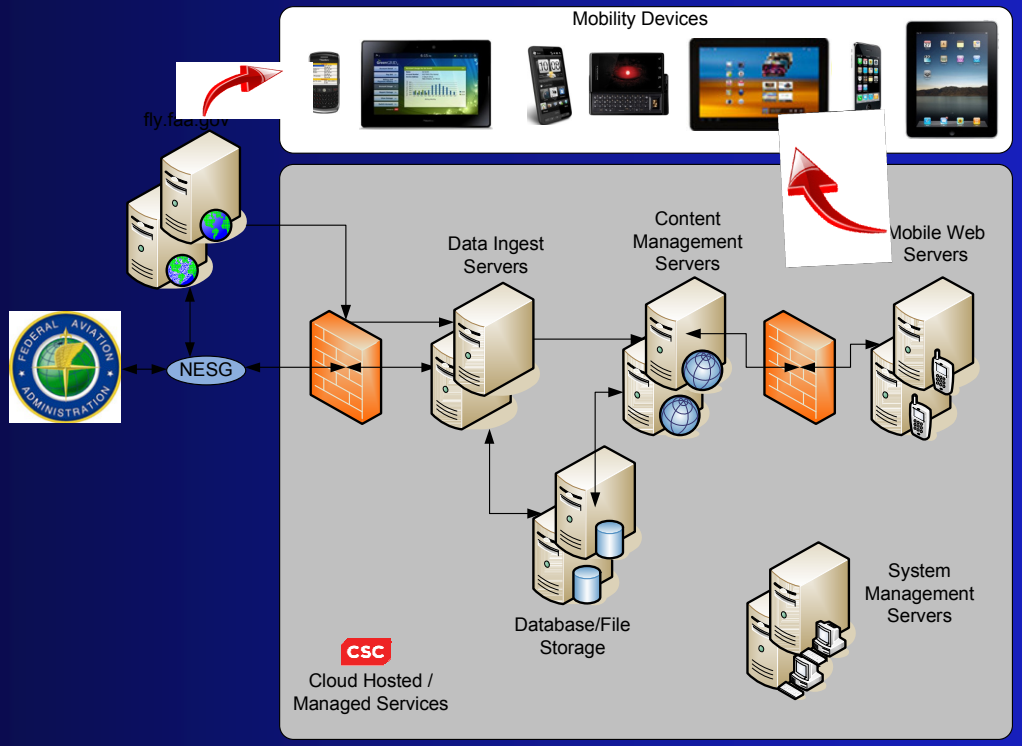
Data Content Manager Capabilities

SWIM System Architecture Designs (CSC)



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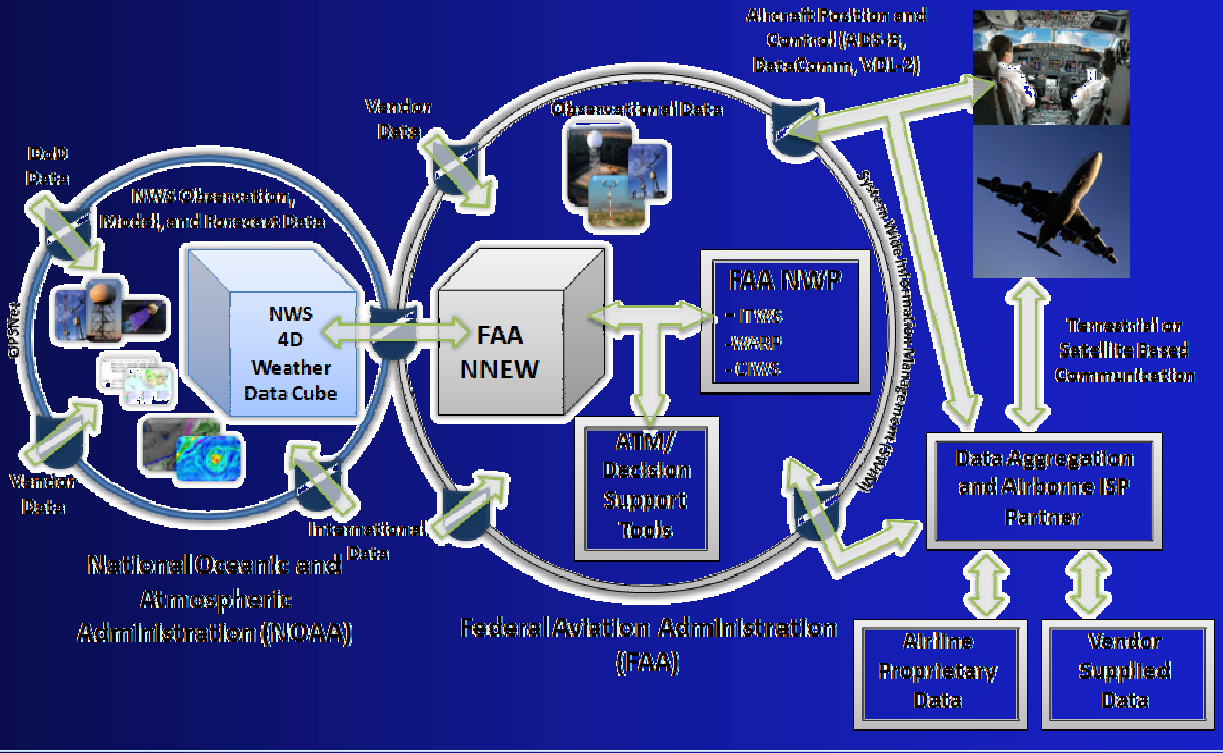
- Data Content Manager Capabilities
  - SWIM System Architecture Designs (WSI)



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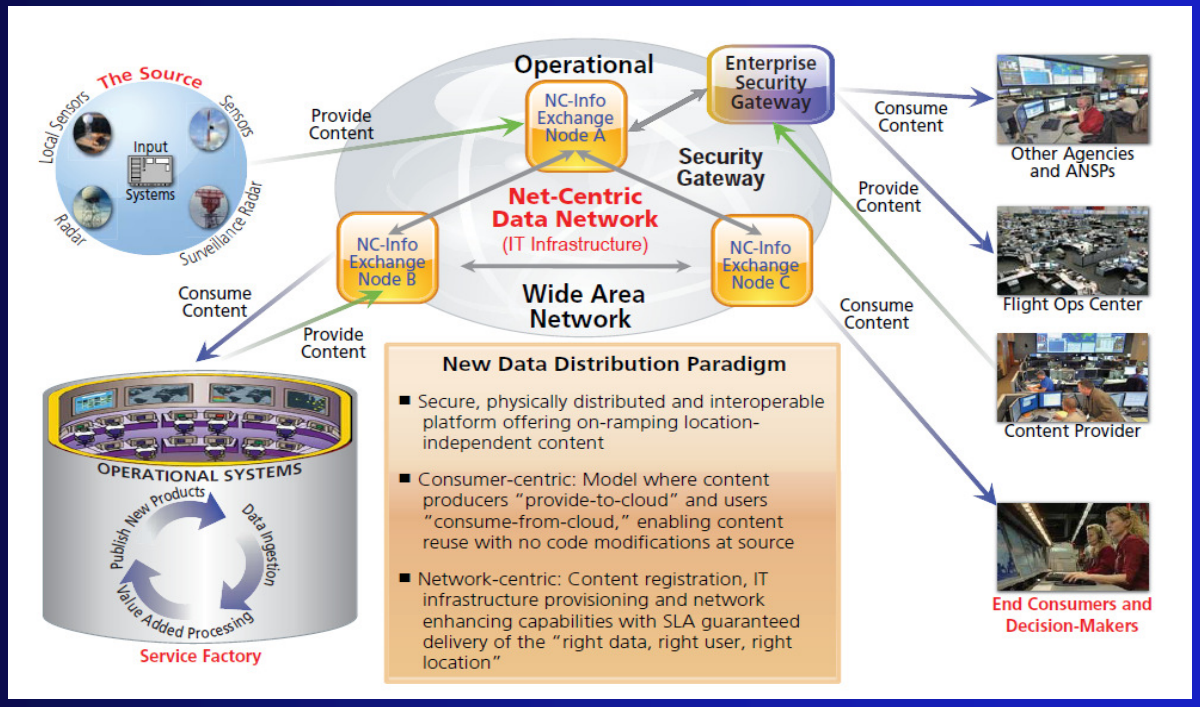
Data Content Manager Capabilities

SWIM System Architecture Design Concepts (Harris)



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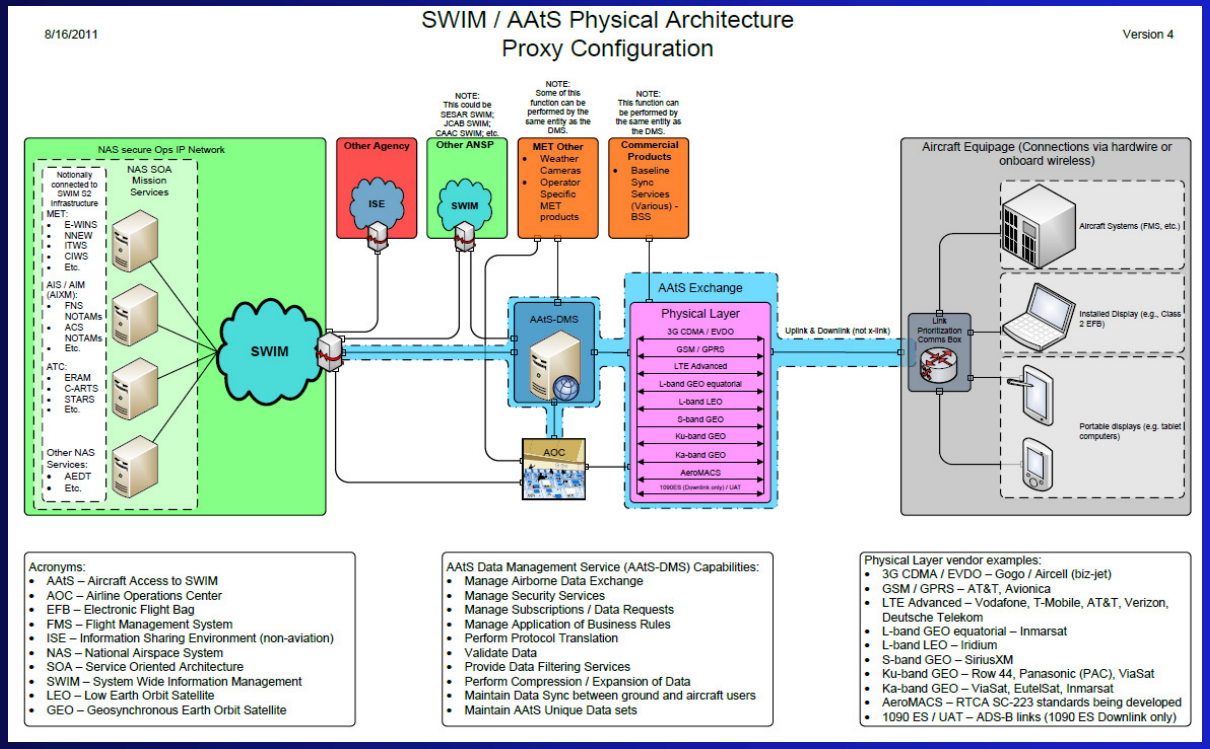
Data Content Manager Capabilities

SWIM System Architecture Designs (RTCA SC223)



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GoGo Data Transport Capabilities

DELTA
569 *Gogo-equipped aircraft*
Full fleet

AirTran
140 *Gogo-equipped aircraft*
Full fleet

Virgin america
39 *Gogo-equipped aircraft*
Full fleet

AA AmericanAirlines
226 *Gogo-equipped aircraft*

UNITED
13 *Gogo-equipped aircraft*

U·S AIRWAYS
51 *Gogo-equipped **aircraft***

AIR CANADA
2 *Gogo-equipped aircraft*

FRONTIER
Launching in 2011

Plus about 4,000 GA Aircraft

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GoGo Data Transport Capabilities

- Today, EVDO Rev A Terrestrial Cell
  - 3.1Mbps to the aircraft / 1.8 Mbps from the aircraft
- Tomorrow, EVDO Rev B Terrestrial Cell
  - 9.8 Mbps to the aircraft / 4.8 Mbps from the aircraft
  - ARINC 429 Interface
- Ku- or Ka- (airline chooses) Satellite Third Party Services
  - Ka- will be faster with small antennas, performance due to weather attenuation biases to enroute, nevertheless uncertainties exist that cloud cost assumptions
- Currently operate about 150 cell sites, most of which have six sectors
  - 1 Terabyte server, Air-to-ground modems, 3G modems that operate when the aircraft is on the ground
- Several wireless access points in the cabin, in addition to external antennas, including independent GPS. Phone/controller in the cabin and in the cockpit

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- GoGo Data Transport Capabilities
  - Cellular service connectivity provided throughout all phases of flight based on network availability (ground, departure, enroute, arrival, ground)
  - Provides VPN subnet for Federal Air Marshall communications
  - Primary server (ACPU) as the multi-function communications unit (CMU)
  - ARINC 429 interface standard for an avionics data bus local area network
  - GigE/FE (1000/100Mbps) ethernet connection allows other boxes (like EFB server) to connect at high speeds without relying on wi-fi
  - DO 178 level E certification

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GoGo Data Transport Capabilities

- Wi-fi supported: 802.11 a/b/g/n
- Links to terrestrial modem (Today, 3G EVDO Rev-A)
- CWAP can be configured to work as a wi-fi client at the gate (upload information on to the aircraft)
- Separate and non-beaconed SSID, VLAN and security/encryption are available
- Work directly with airlines to provide end-to-end solutions
- Availability 99%+ with reliability of 25,000 hours MTBF, and latency is less than 200 milliseconds, with zero packet loss.
- Depending on the application, network priority can be configured by users and subnets can be created.

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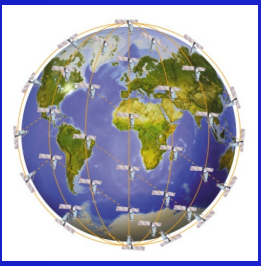

Iridium Data Transport Capabilities

- Iridium is a fast growing provider of mobile voice and data communications services via 66 low-earth orbit (LEO) satellites
- Strong Customer Base – Serves 478,000 subscribers across the land, sea and air (as of June 30, 2011)
- Iridium NEXT – Fully financed program to replace entire satellite constellation in 2015 – 2017 for operation through 2030
- Iridium technology utilizes antenna and radio components that are compatible with nearly any aircraft, GA to jumbo jet
- Iridium currently has more than 30,000 aviation subscribers
- Authorized by the FAA for FANS communications, Iridium consistently achieves availability metrics of 99.99+% or above

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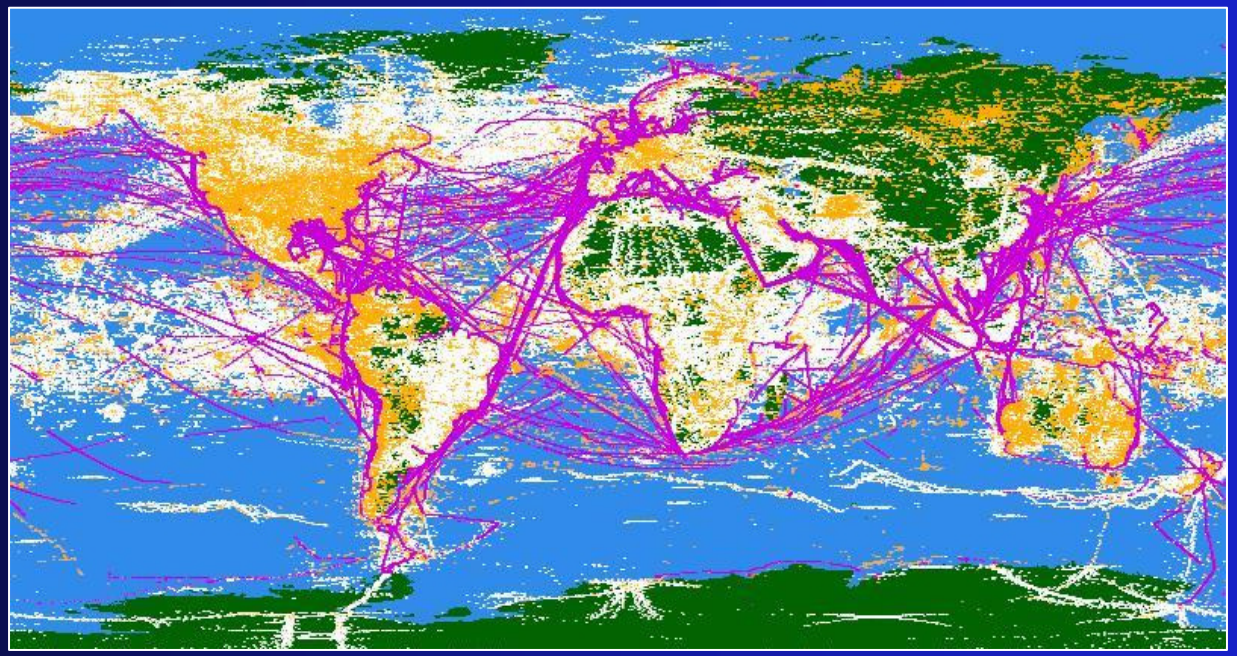
Iridium Data Transport Capabilities

- Iridium's network serves 100% of the globe, including oceans, polar and remote regions. Iridium is the only commercial communications network that provides fully global coverage from tarmac to en route



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Iridium Data Transport Capabilities

- LEO Advantages – The Iridium network stands apart from MEO and GEO systems – shorter distance to satellites enables smaller antennas, lower power and lower latency performance
- Cross-Link Architecture – Cross-linked “mesh” architecture delivers superior availability, efficiency, flexibility and reliability
- Global Footprint – Polar orbit constellation with inter-satellite links provides fully global coverage, through all phases of flight, including Polar regions
- Iridium NEXT – Full backward compatibility enables continued operation beyond 2030, with opportunities for new and enhanced services
- Approved of ATC Command and Control Messaging for Oceanic FIRs (Normative Index DO262/DO270)

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Iridium Data Transport Capabilities

- Thales Alenia Space the prime contractor for 81 new satellites
  - 66 operational satellites to replace current constellation
  - 6 in-orbit spare satellites, 9 ground spares
- Compatible with current constellation to simplify network transition and continuity; maintaining Iridium's unique architecture and advantages
- Iridium NEXT features many enhancements, including higher data speeds and subscriber capacity. Iridium currently offers four distinct data services which can be used independently or collectively to optimize data delivery
  - Current IP is "Open Port" to 128 kbps
  - Upgraded "Open Port" will provide up to 512 kbps

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- Illustrative End Users
  - United / Continental Airlines
    - First to install EFBs with Class III on 747-400s with single type C application. Class III systems are in Continental 777s for charts and manuals
    - United purchased 11,000 iPads for both United and Continental pilots to be mounted as Class II to avoid wireless issues
    - United has AirCell / Gogo on 13 757s in transcontinental service and Row 44 on a few other aircraft
    - Class I EFBs will be used in increasing numbers of applications as broadband capabilities are rolled out throughout the fleet
    - United sees no difficult technical issues in the expanded use of Class I EFBs and associated broadband capabilities. Data sharing between fleet aircraft is expected to be implemented

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- Illustrative End Users
  - Delta / Northwest Airlines
    - Although Delta is 100% equipped with AirCell / GoGo, Delta is currently using only 22 iPads spread among their many fleets with some management and some line pilots performing a step 1 of testing
    - Delta's objective is to fashion the aircraft as a "node" on its corporate data communications network for situational awareness to avoid FAA Flight Standard concerns as primary or sole source means for critical flight system functions
    - Right now their iPads have the Jeppesen Charts application and limited flight manual documentation on them. Access to the internet is restricted to above 10,000 feet. They also plan to evaluate some Samsung tablets in the same role, using the Droid Operating System

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- Electronic Flight Bag (EFB)
  - Personal Computing Device (PCD or PDA)
    - Non aviation applications
  - Class I (Portable), II (Docked) and III (Integrated in Avionics)
    - Aviation applications
  - Focus is Class I or II iPad™ EFB
    - Wireless interface issue
    - Own ship position issue
    - CHI Interface concerns
    - Pilot workload and distraction factor

Aircraft Access to SWIM

- FAA AAtS Sponsored Demonstration
  - FAA has established a funded Florida NextGen Test Bed at Daytona Beach in conjunction with Embry Riddle Aeronautical University to explore and validate NextGen concepts, technologies and solution sets
  - FAA is planning a 6 to 12 month multi-million dollar AAtS demonstration to define how to provide a connection between SWIM Service Oriented Architecture (SOA) shared NAS resources to an aircraft while on the ground or in the air:
    - Technical objectives are link performance related
    - Operational objectives are seeking improvement and efforts of situational awareness, collaboration, decision making as a result of enhanced and timely access to NAS resources
    - Procedural and policy objectives are to explore current limitations and future opportunities for pilots and operations flight control centers with greater real-time access to NAS information