Technology in the Cabin

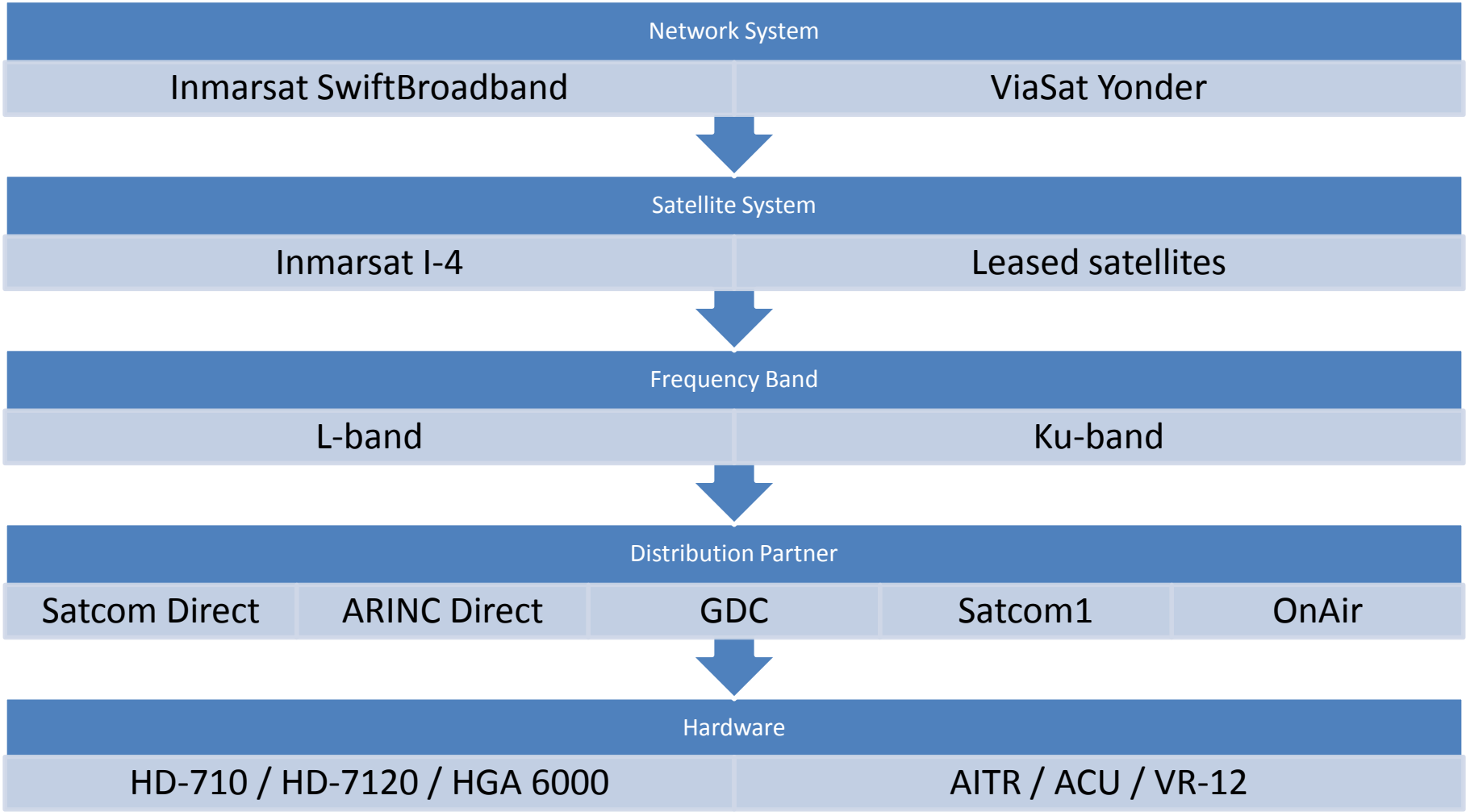
Speakers

- Bethany Davis — Gulfstream
- Chris Kissinger — Boeing

Agenda

- Connectivity Systems
  - Honeywell Inmarsat SwiftBroadband
  - Honeywell Inmarsat (Ka)
  - ViaSat Yonder (Ku)
  - Gogo Business Aviation ATG
- Flight Department Implications

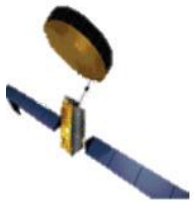
Connectivity Tiers for Today's Satellite Systems



Inmarsat Constellation Review

Inmarsat-3
Launched 1996-98

~2018



Inmarsat-4
Launched 2005-08

~2023

Lifespan of current fleet

Alphasat
L-band satellite 2013

~2028

Inmarsat-5
4 Ka-band satellites 2013-2015

Source: Inmarsat

SWIFTBROADBAND

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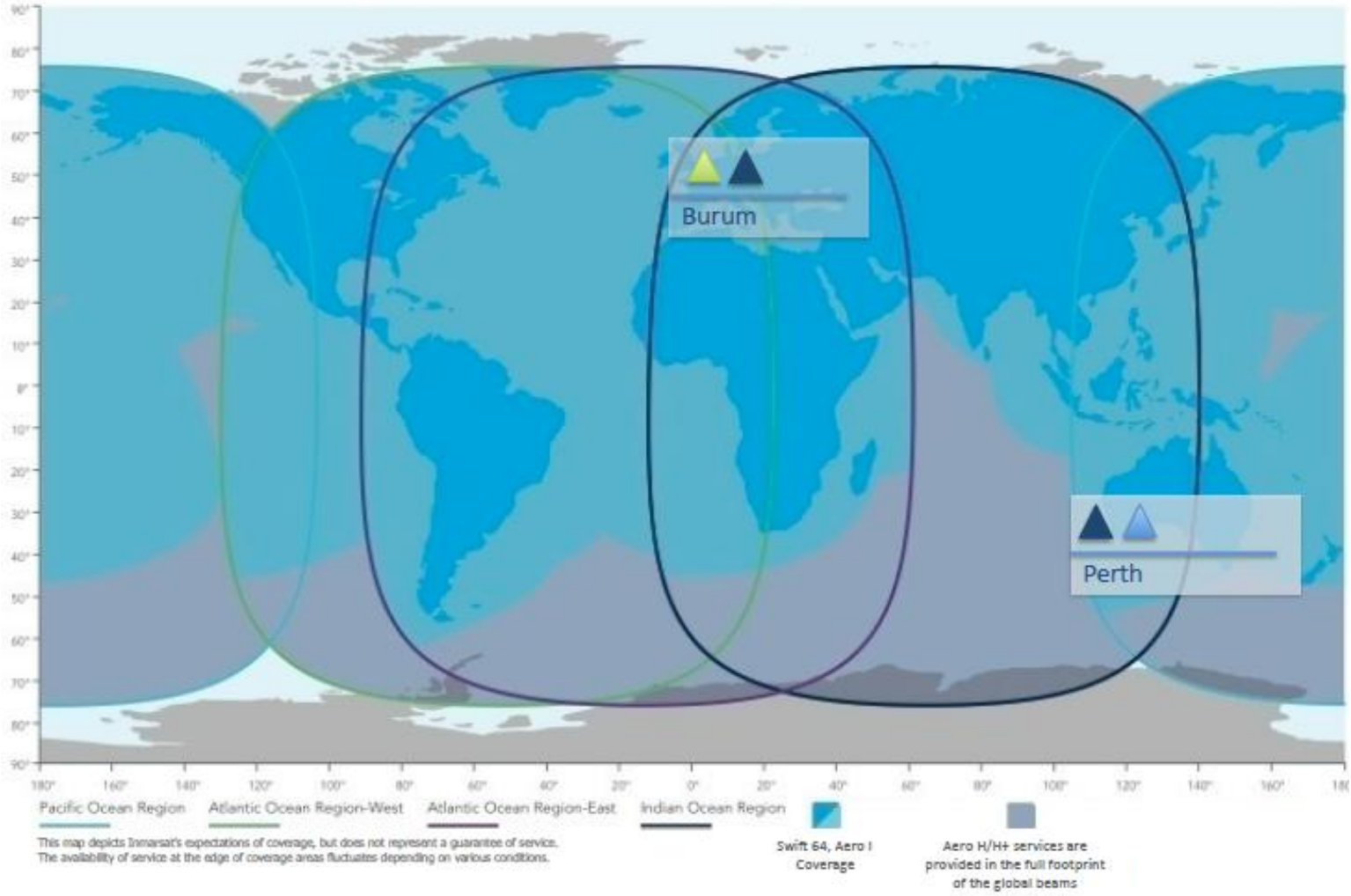
SwiftBroadband Passenger Experience

- Operates without altitude limitation
  - While on the ground and in the air
  - Lacks polar coverage and gaps at high latitudes
- Data Speeds up to 432 kbps

Supported Applications	Not Supported / Not Assured
Web browsing	Video conferencing/streaming
Email	VPN

I-3 Classic Aero Coverage Map



Source: Inmarsat

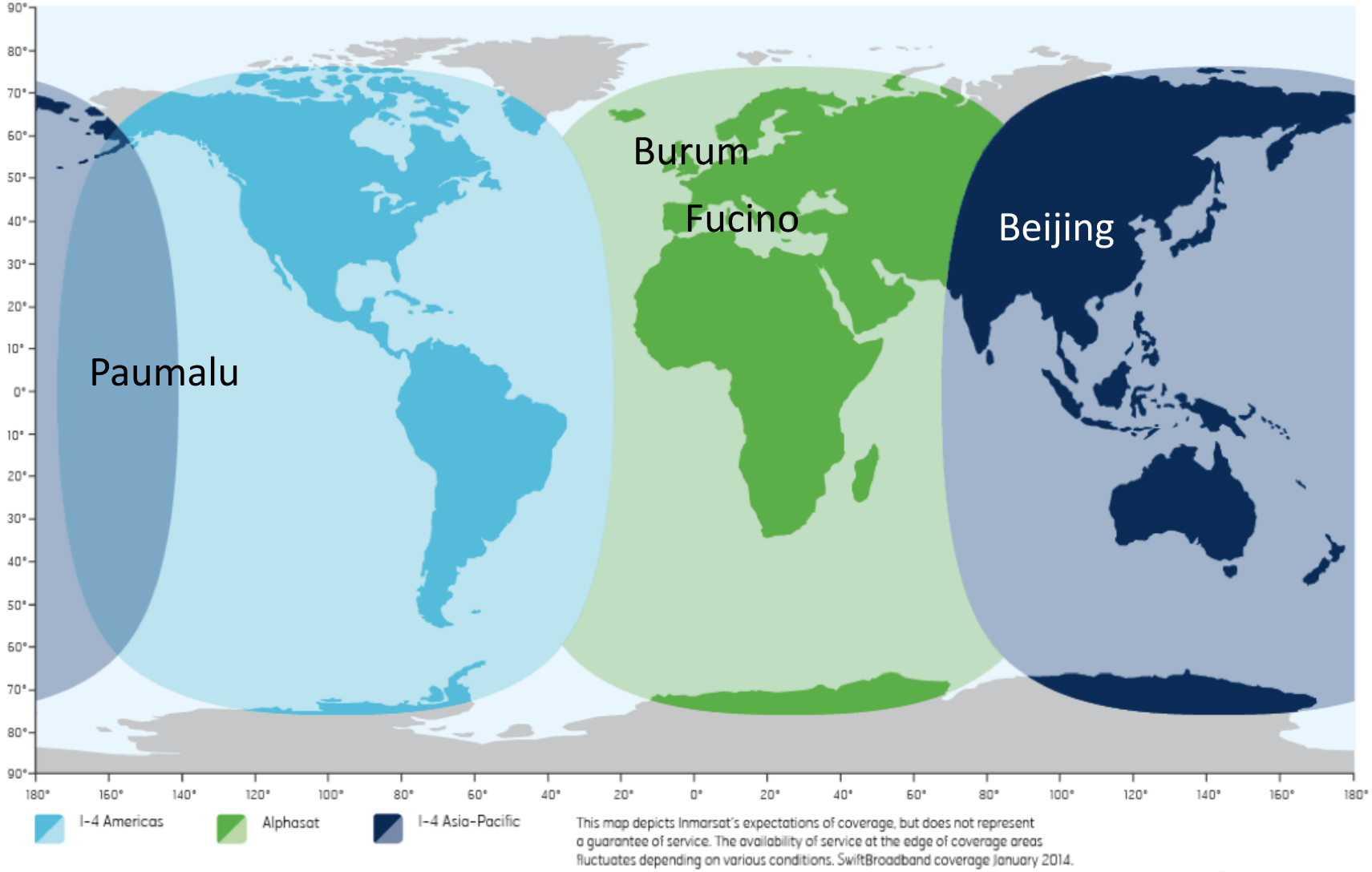
I-3 Ground Stations

Indian Ocean Region (IOR)
Pacific Ocean Region (POR)
Perth, Australia

Atlantic Ocean Region – East (AOR-E)
Atlantic Ocean Region – West (AOR-W)
Burum, The Netherlands

Source: Inmarsat

I-4 SwiftBroadband Coverage Map



Source: Inmarsat

I-4 Ground Stations

EMEA
Fucino, Italy
Burum, The Netherlands

AMER & APAC
Paumalu, Hawaii

MCN
Beijing, China

All SBB communications inside mainland Chinese airspace routed through Beijing SAS as of July 15, 2014

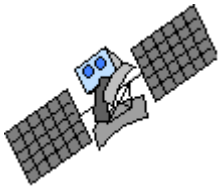
Source: Inmarsat

AlphaSat Launch Update

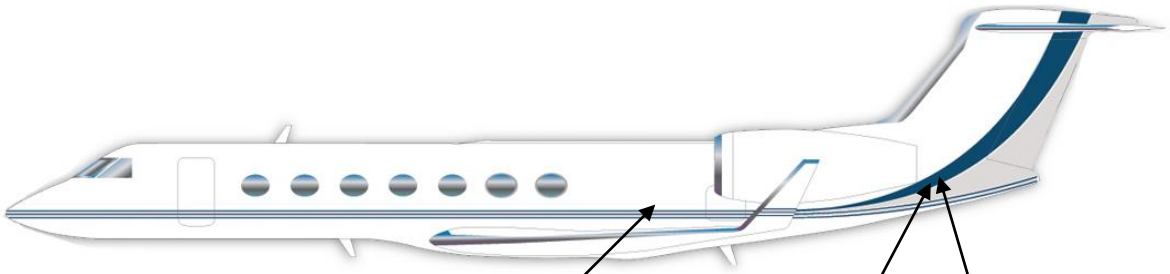
- AlphaSat launched in Europe on July 25, 2013
- Replacing the EMEA satellite beginning March 2015
- ORT tables may need updating
- Hardware may require software updates
- Service Information Letters published by Honeywell, Rockwell Collins and Satcom Direct

SwiftBroadband Component Locations

HGA 6000 (806-10-0001)
High Gain Antenna



Satellite Link



CNX-200

w/Cabin Network

Xcelerator

SD-700 Satellite Data
Unit (7516118-27011)

HD-710 High Speed
Data Terminal

SwiftBroadband Process Flow

Smartphone / Tablet / Laptop
- Internet enabled device

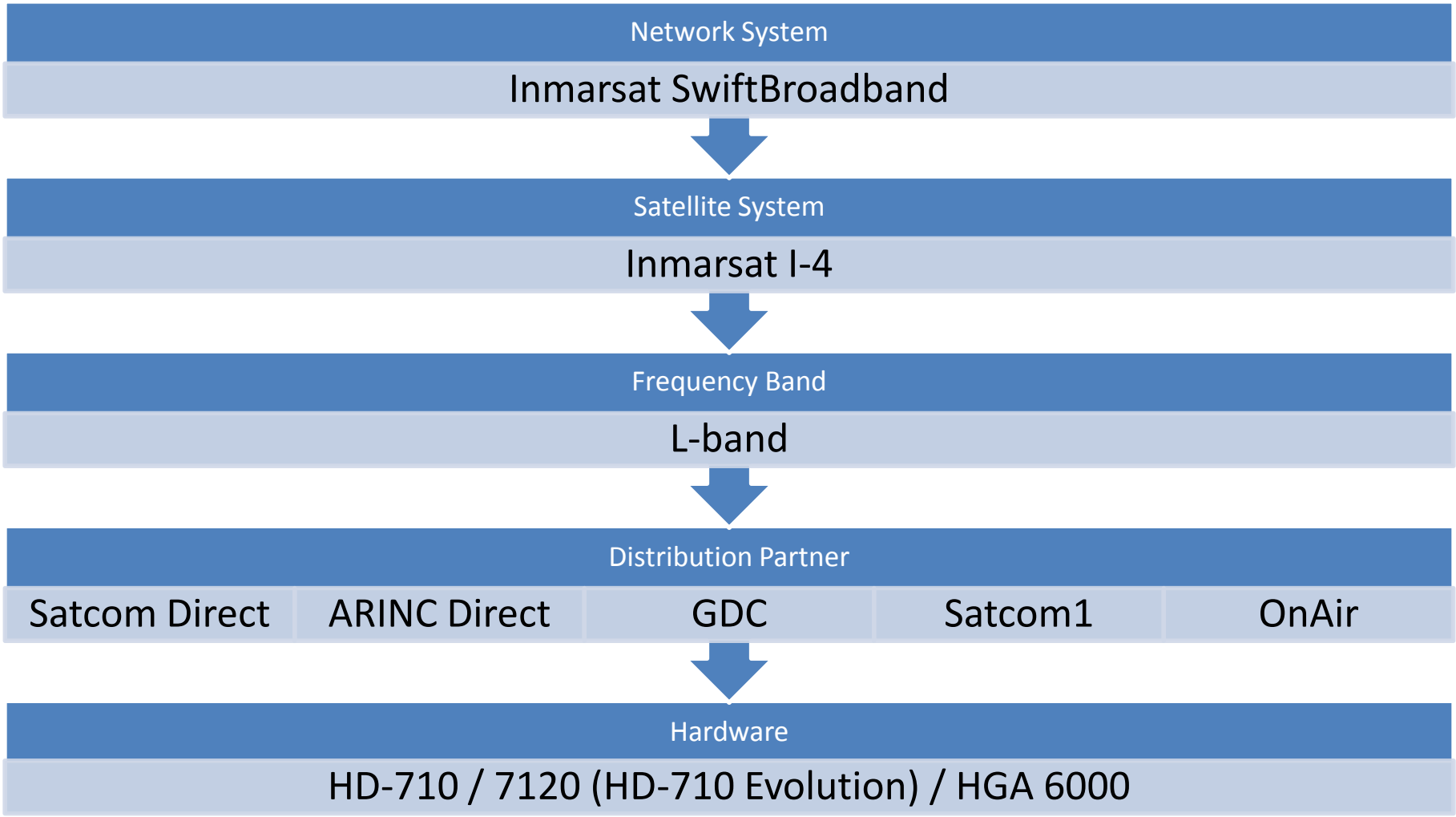
Gen 4 Server
- Wireless Access Point
- Gulfstream-designed product

CNX 200 Router
- Compresses data, text in email

7120 Transceiver
- HD-710 evolution
- Combination of High Power Amplifier (HPA) & Satellite Data Unit (SDU)

Antenna
- HGA 6000 (806-10-1001-5)
- High Gain Antenna

SwiftBroadband Connectivity Tiers



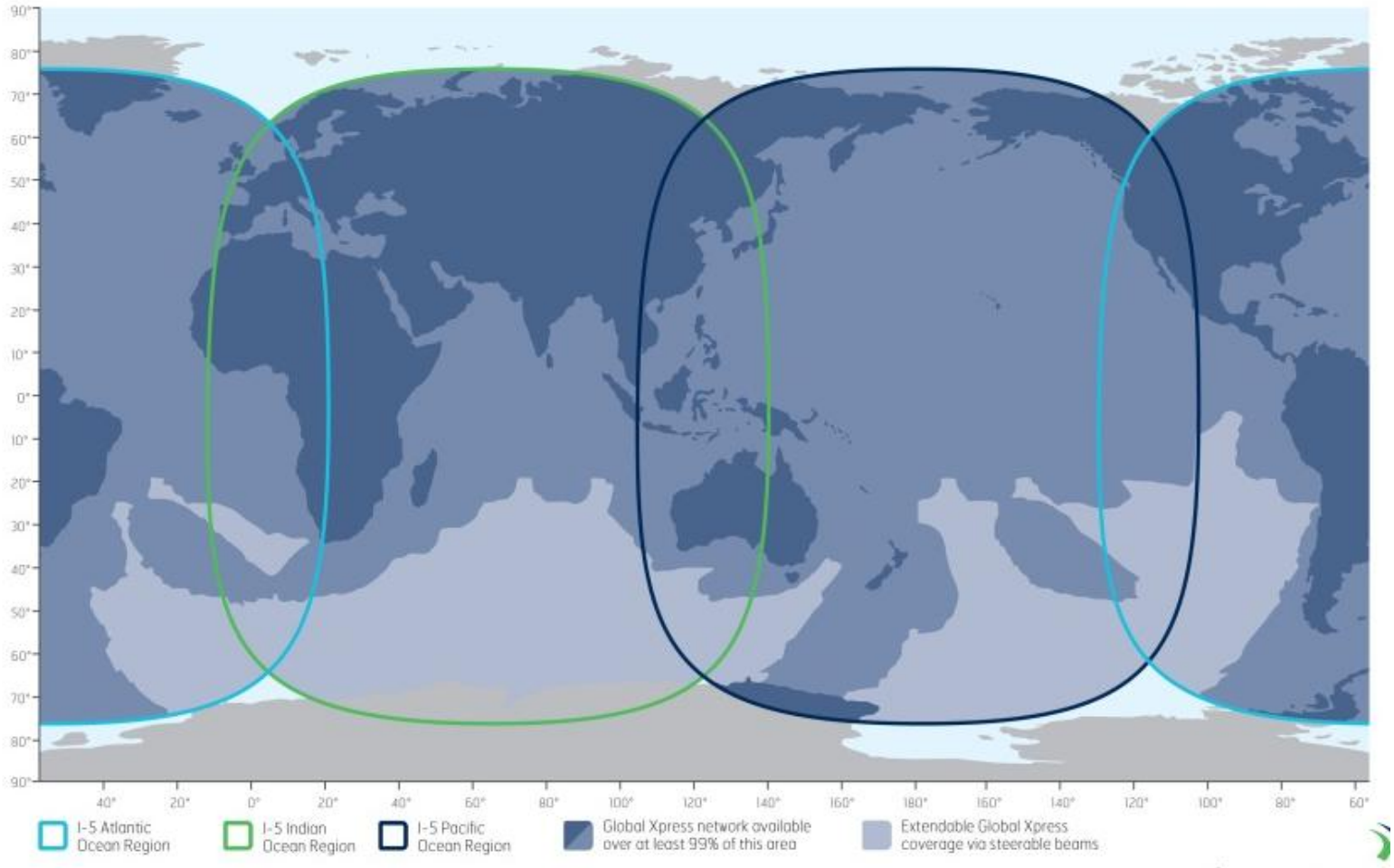
INMARSAT JETCONNEX (KA)

Ka-band Passenger Experience

- Global coverage
  - Constellation of three dedicated satellites
  - Doubled up coverage in anticipated high traffic regions
- Service Guarantees
  - Packages will be covered by guarantees for availability and performance

Supported Applications	
Web browsing	Video conferencing
Email	Video streaming
VoIP	

I-5 GX (Ka) Satellite Coverage Map



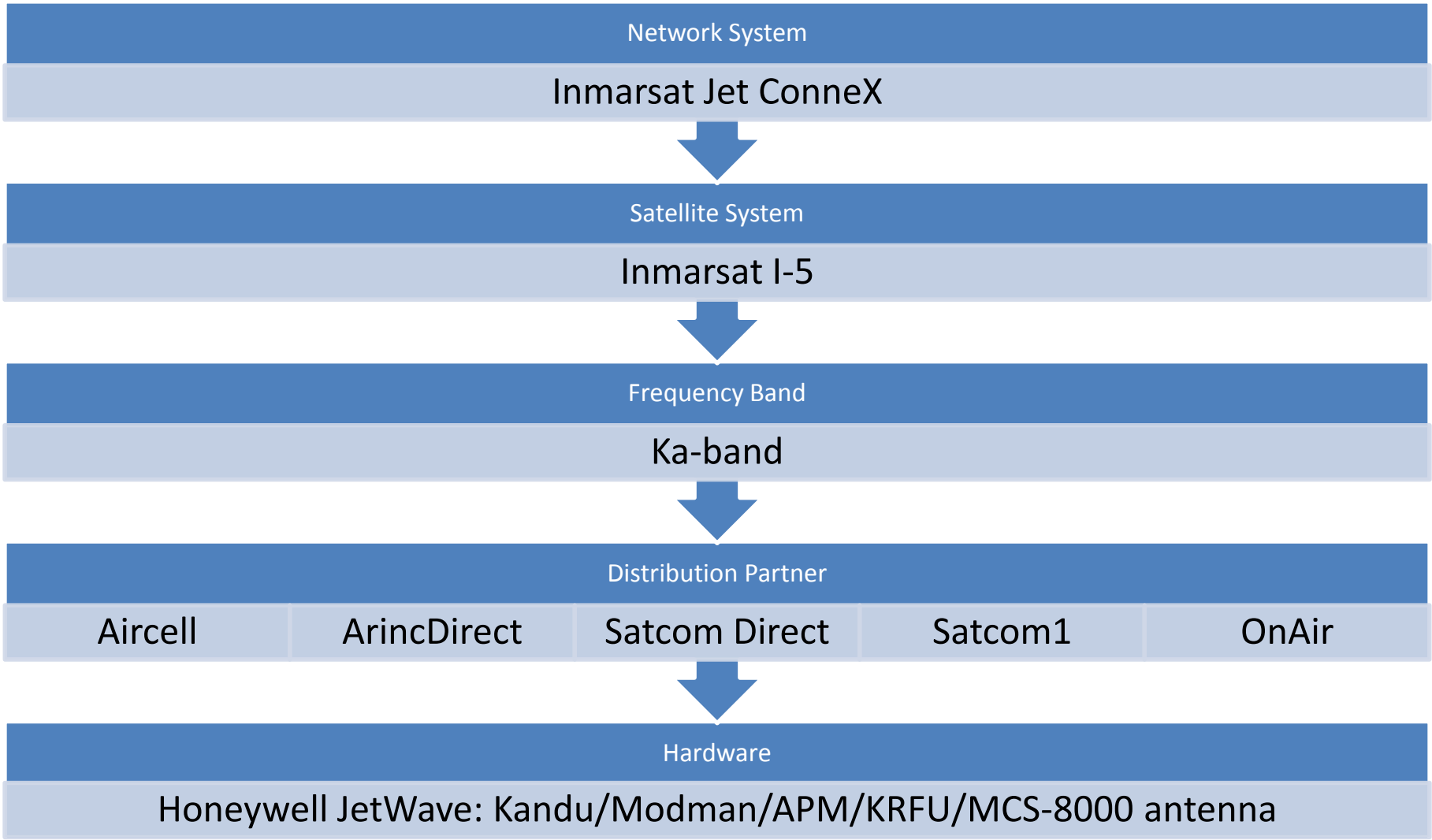
I-5 Ground Stations

Indian Ocean Region (IOR) Nemea, Greece & Fucino, Italy	Atlantic Ocean Region (AOR) Lino Lakes, USA & Winnipeg, Canada	Pacific Ocean Region (POR) Warkworth & Auckland, New Zealand

Source: Inmarsat

Global 5000/6000 Ka Component Locations

Inmarsat Ka Connectivity Tiers



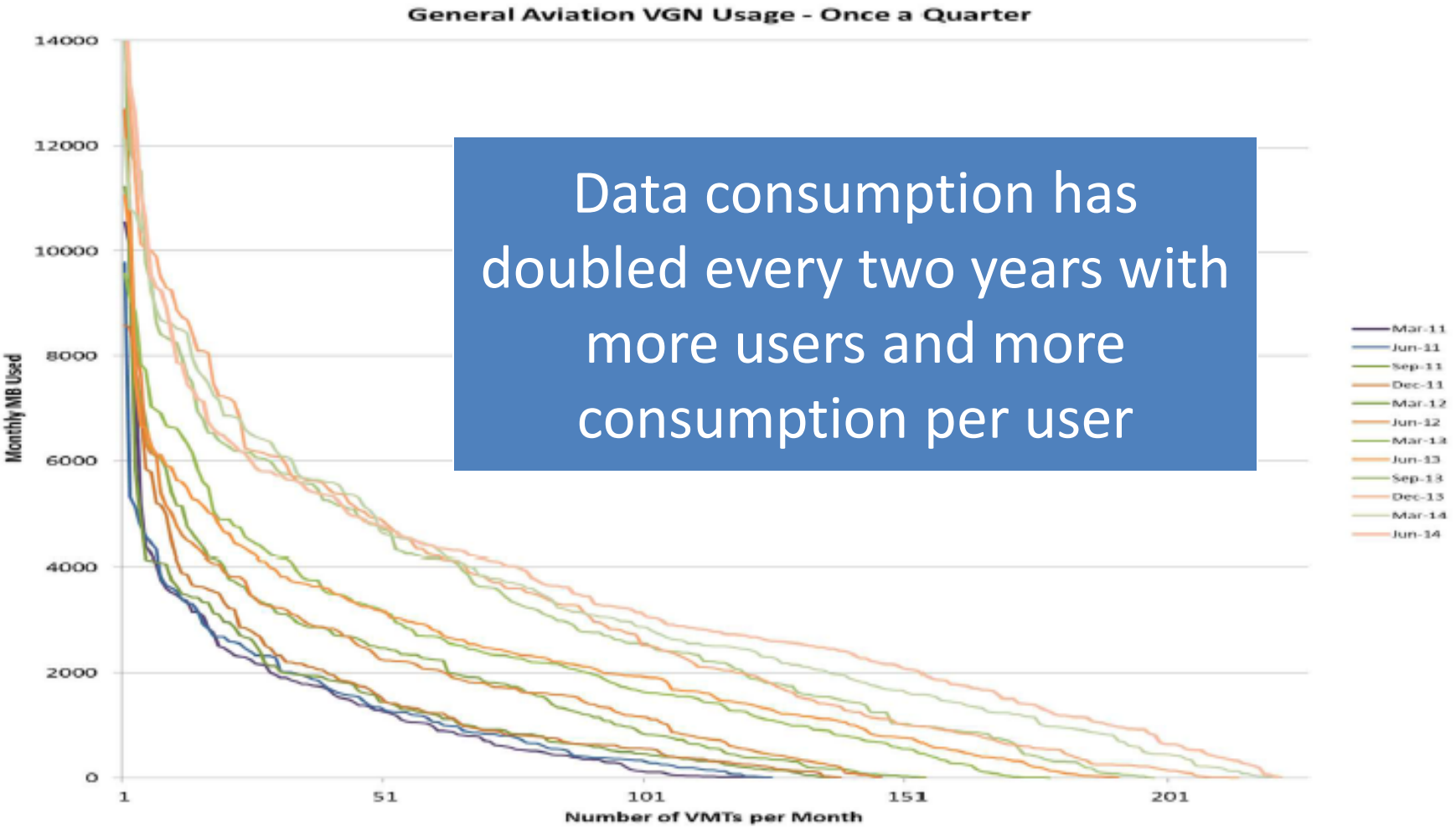
VIASAT (KU) YONDER “BBML”

Ku-band Passenger Experience

- Operates without altitude limitation
  - While on the ground and in the air
  - Regional Coverage, mostly over populated land masses
- Typical data speeds 4 Mbps shared capacity per region

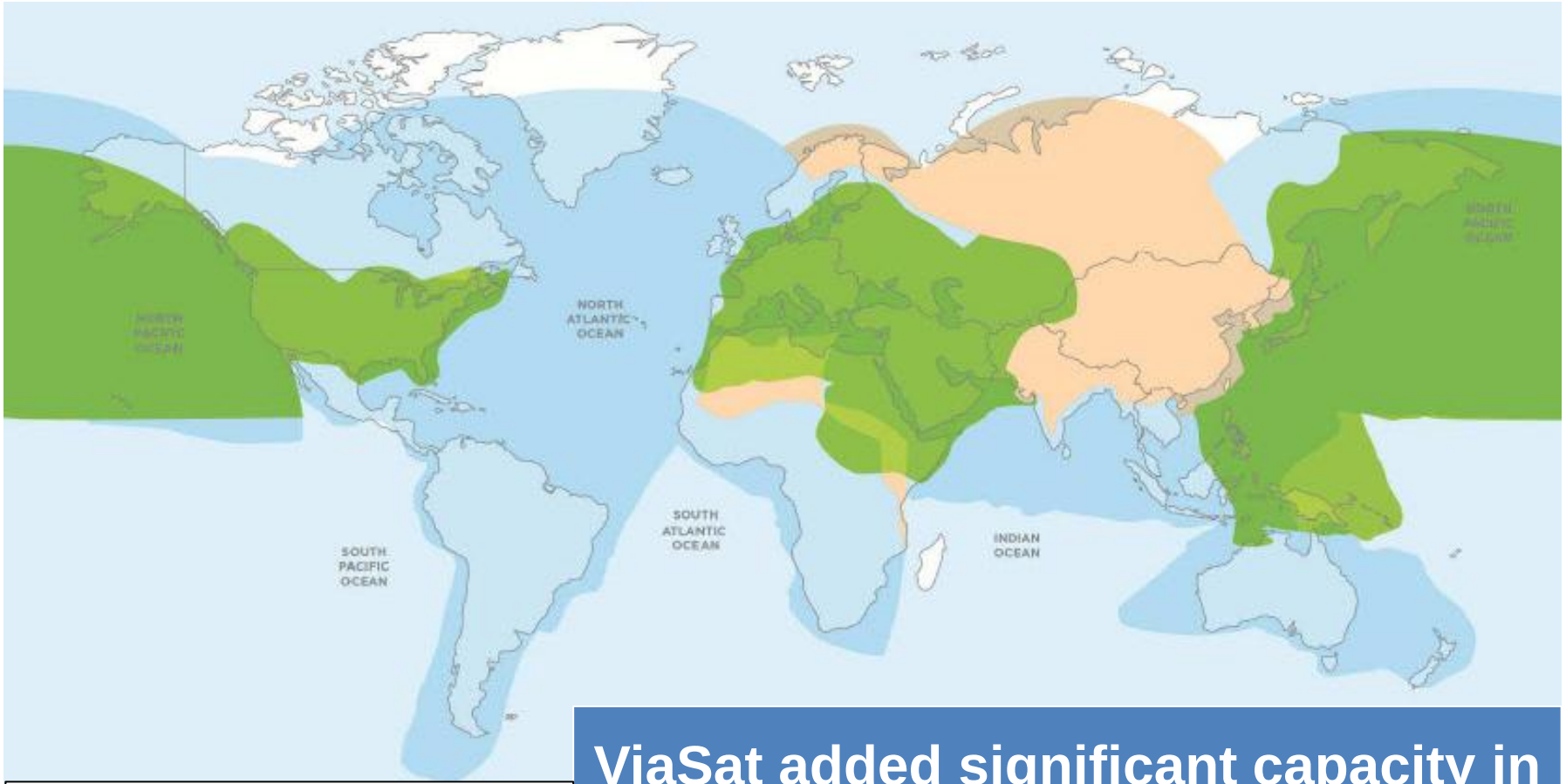
Supported Applications	Not Supported / Not Assured
Web browsing	Video conferencing
Email	Video streaming
VoIP	

Data Consumption Increasing Exponentially



Data consumption has doubled every two years with more users and more consumption per user

ViaSat Ku-band Yonder Satellite Coverage Map



ViaSat Yonder Coverage Legend

- **2013 Overlay Bandwidth**
- As of end 2012
- **Future**

ViaSat added significant capacity in 2013 – Green Overlay Bandwidth

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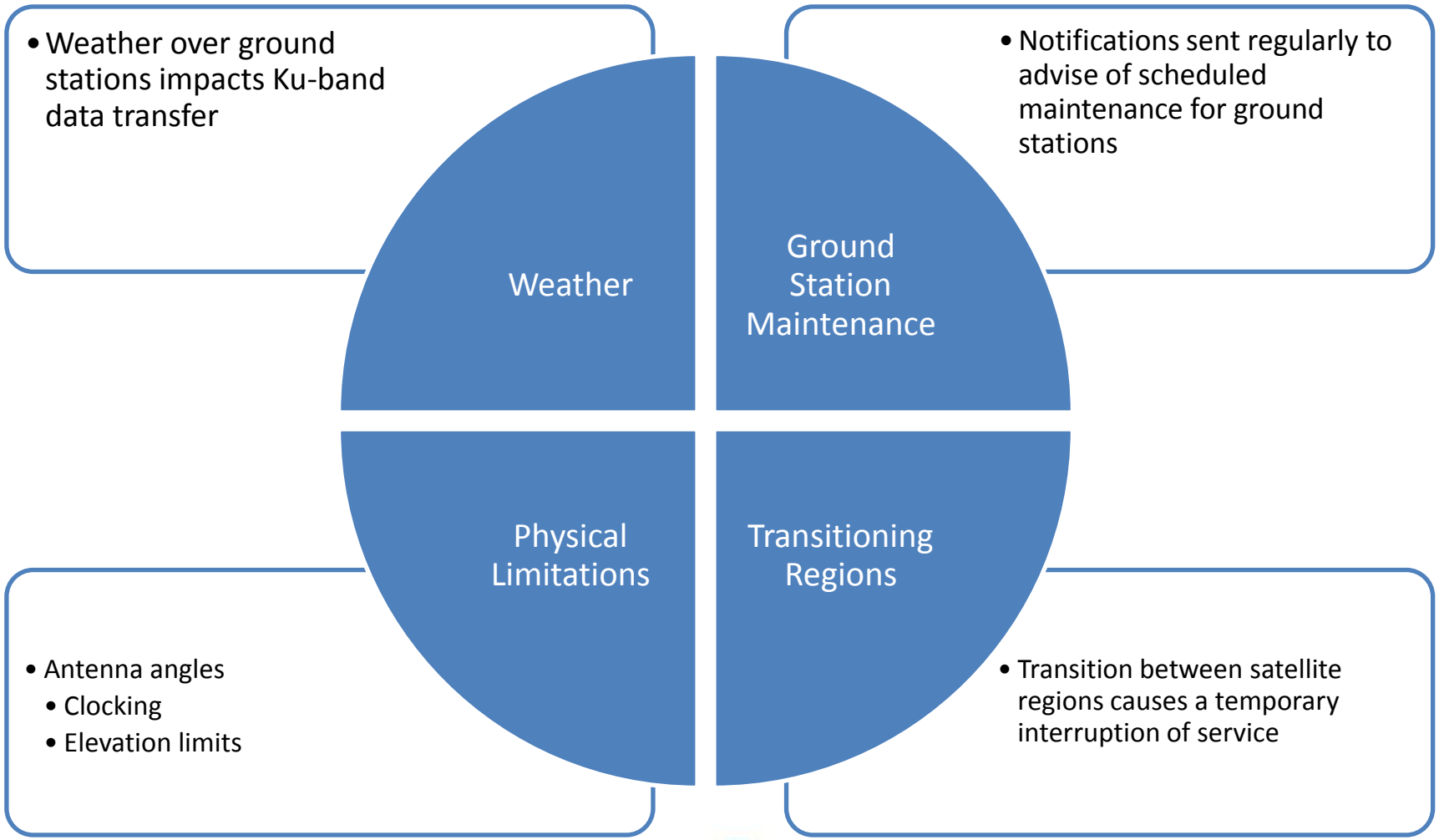
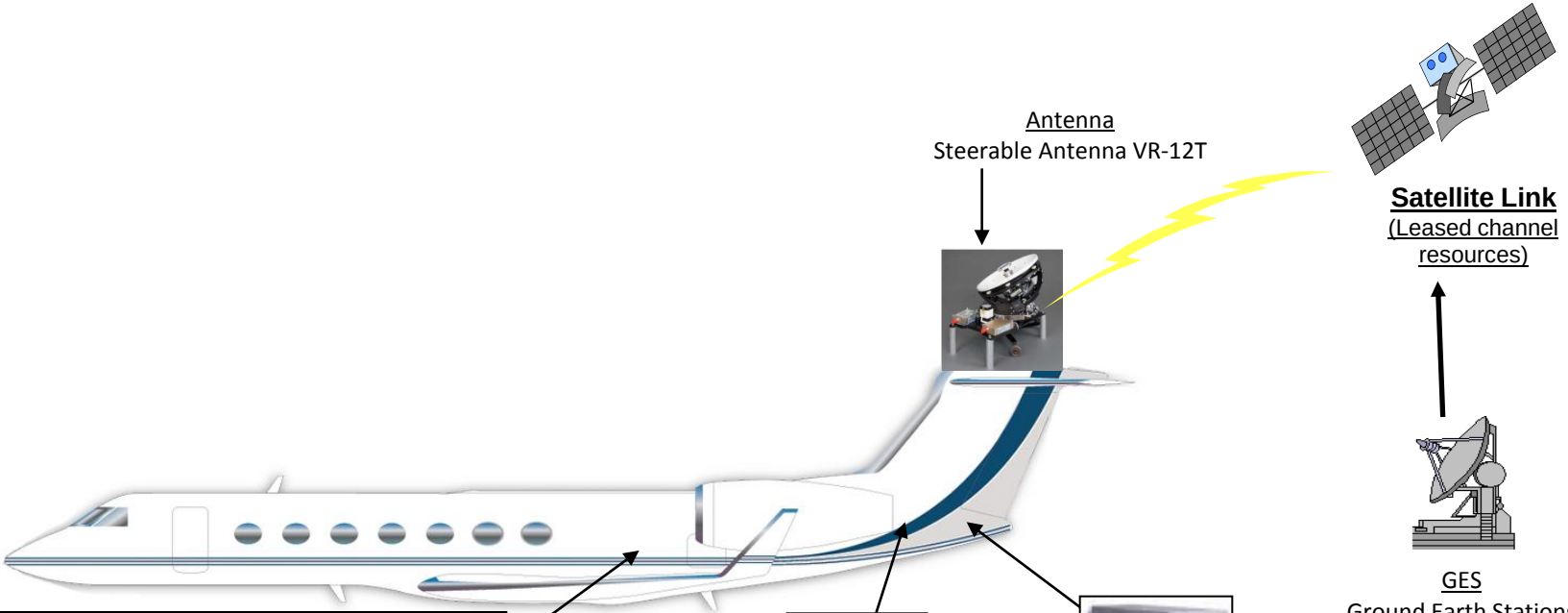
Examples of System Interruptions & Limitations



System Physical Limitations: Antenna Angles

Antenna System	Min Elevation Angle 5°	Max Elevation Angle 85°
General Scenario	Impact at very high or very low degrees of latitude	Impact at Equator where satellite is directly overhead
Example	In Alaska while maneuvering in the air or on ground near buildings	Brazil has holes of coverage on east coast and near Amazon

G450/G550 Ku Component Locations



Antenna
Steerable Antenna VR-12T

Satellite Link
(Leased channel resources)

GES
Ground Earth Stations
(Leased by the Service Provider)

ACU

Antenna Control Unit

AITR

Airborne Integrated Transceiver / Router

Server is located in the Aft RH Closet (includes Wireless Access Point)

Advanced
Cabin Server

ViaSat (Ku) Process Flow

Phone Tablet Laptop
- Internet enabled device

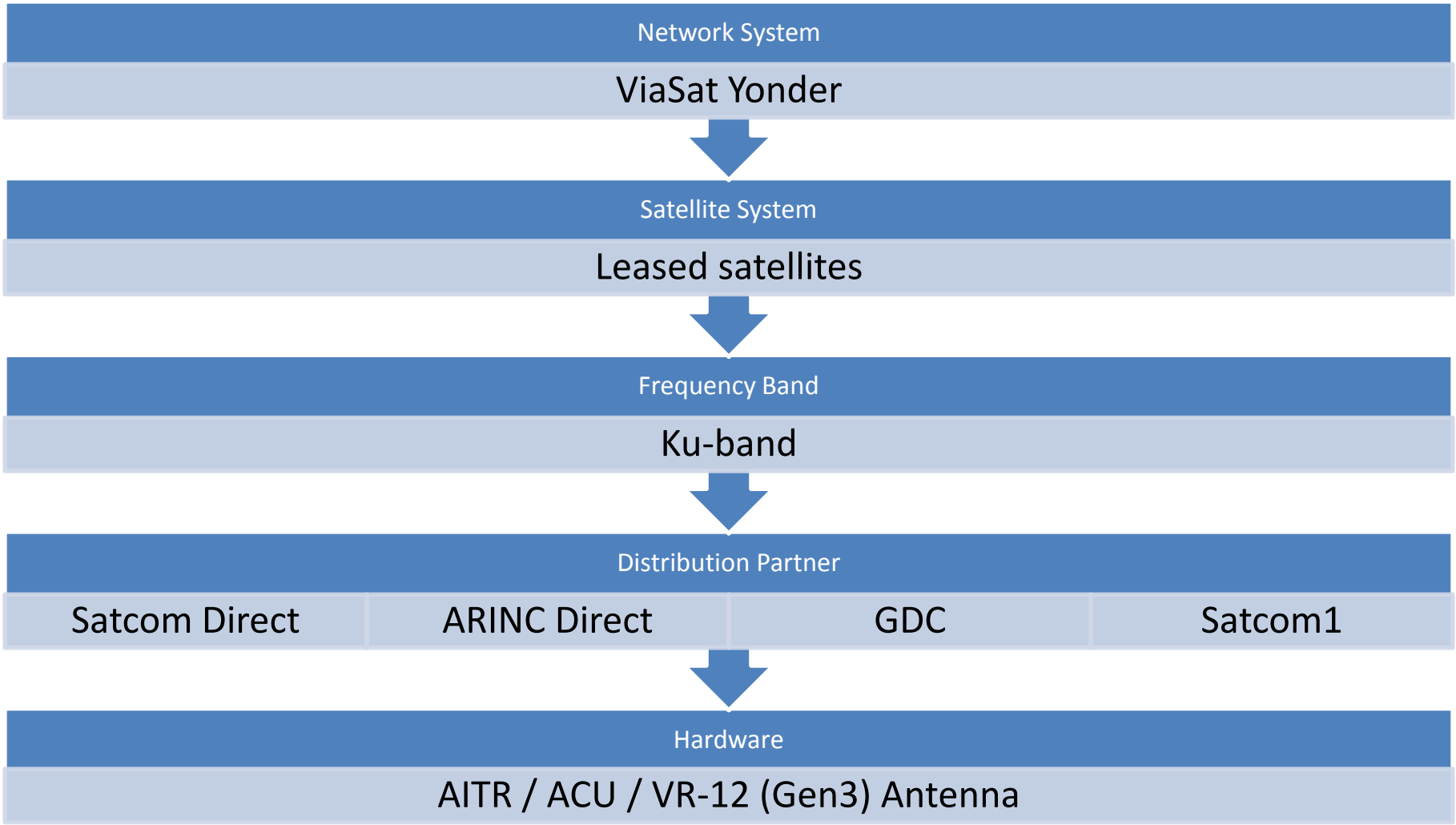
Gen 4 Server
- Gulfstream -designed product
- Wireless access point

AITR
- Modem
- Router
- ViaSat designed product

ACU
- Antenna control unit
- Points antenna

VR-12 Antenna
- 11.5-inch antenna

ViaSat Ku Connectivity Tiers



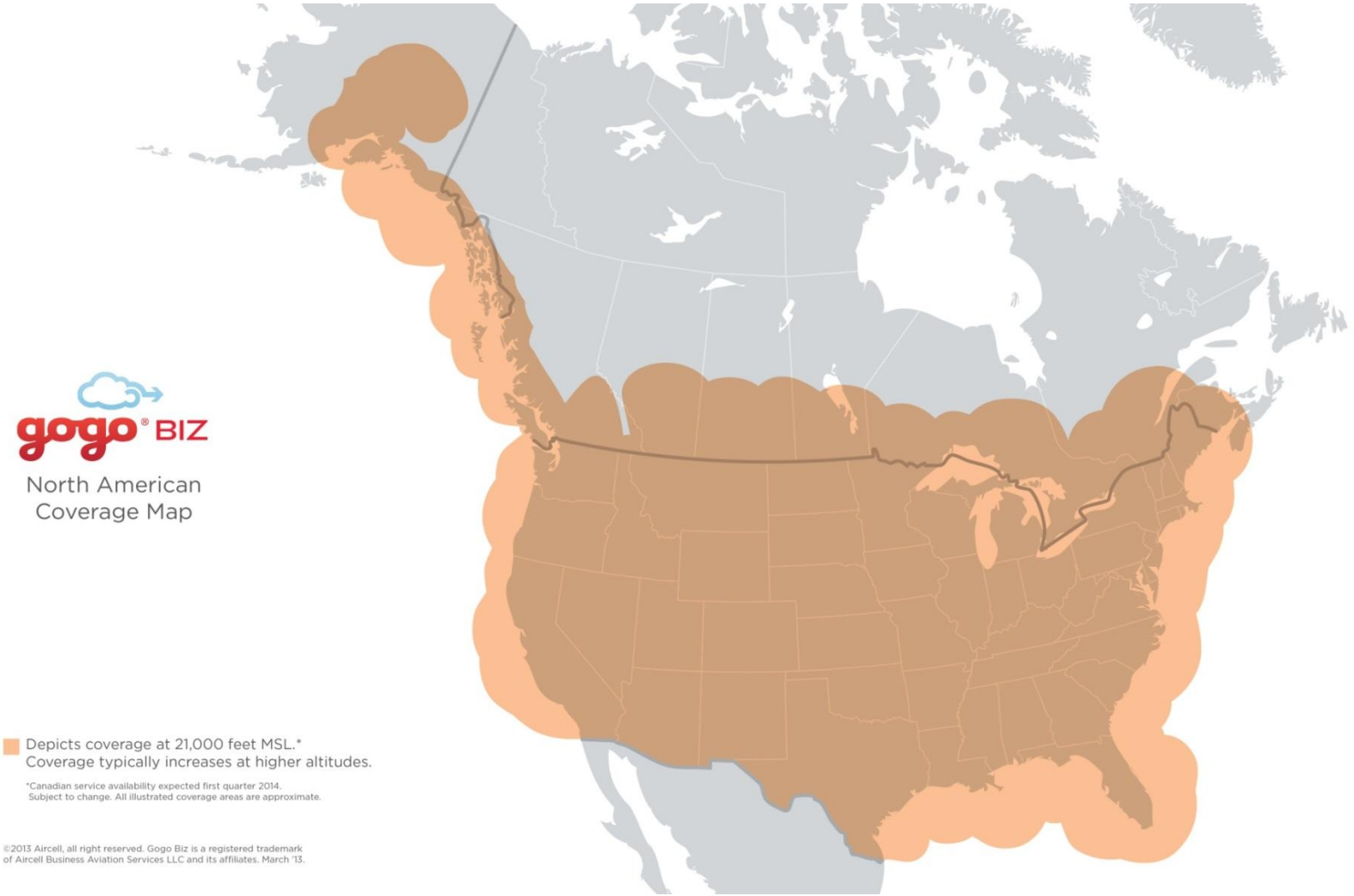
GOGO BUSINESS AVIATION ATG

Gogo Biz ATG Passenger Experience

- Alaska, Continental U.S. and Canadian coverage and up to 200 miles offshore in some areas
- Canadian coverage went live on April 1, 2014
  - Seamless service on cross-border flights
- Designed to perform at and above 10,000 ft AGL
- Data Speed up to 3.1 Mbps

Supported Applications	Not Supported / Not Assured
Web browsing	Video conferencing
Email	Video streaming
VPN	

Gogo Biz Coverage Map



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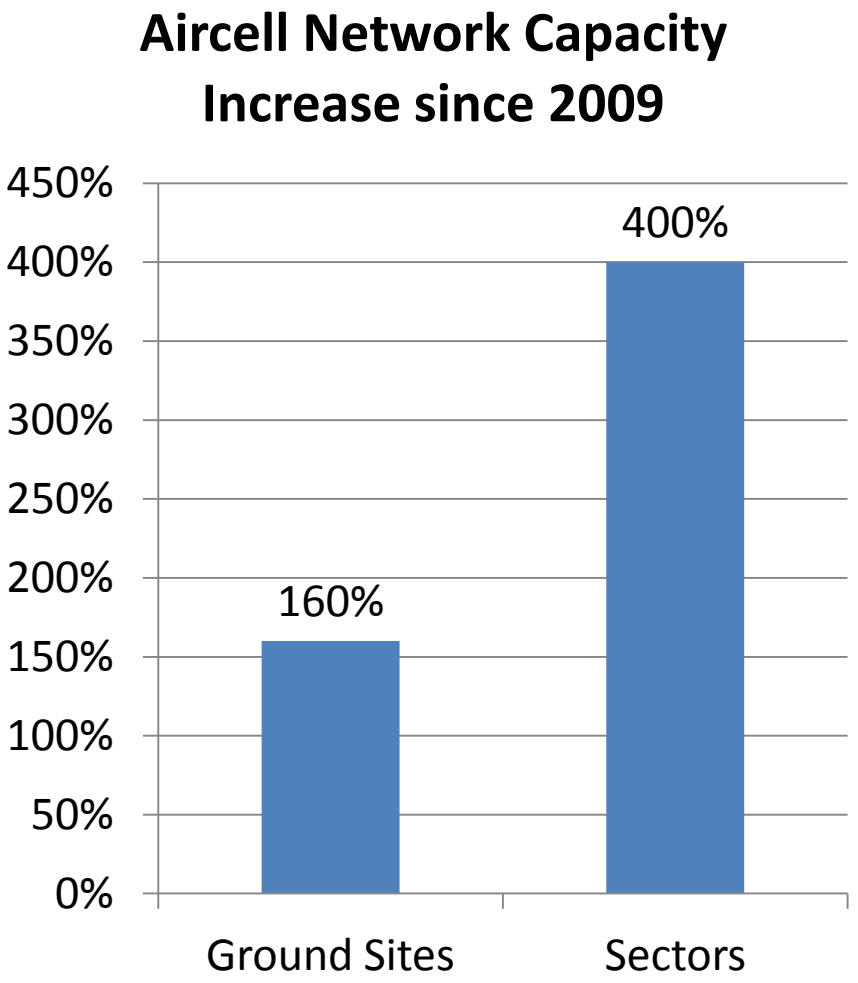
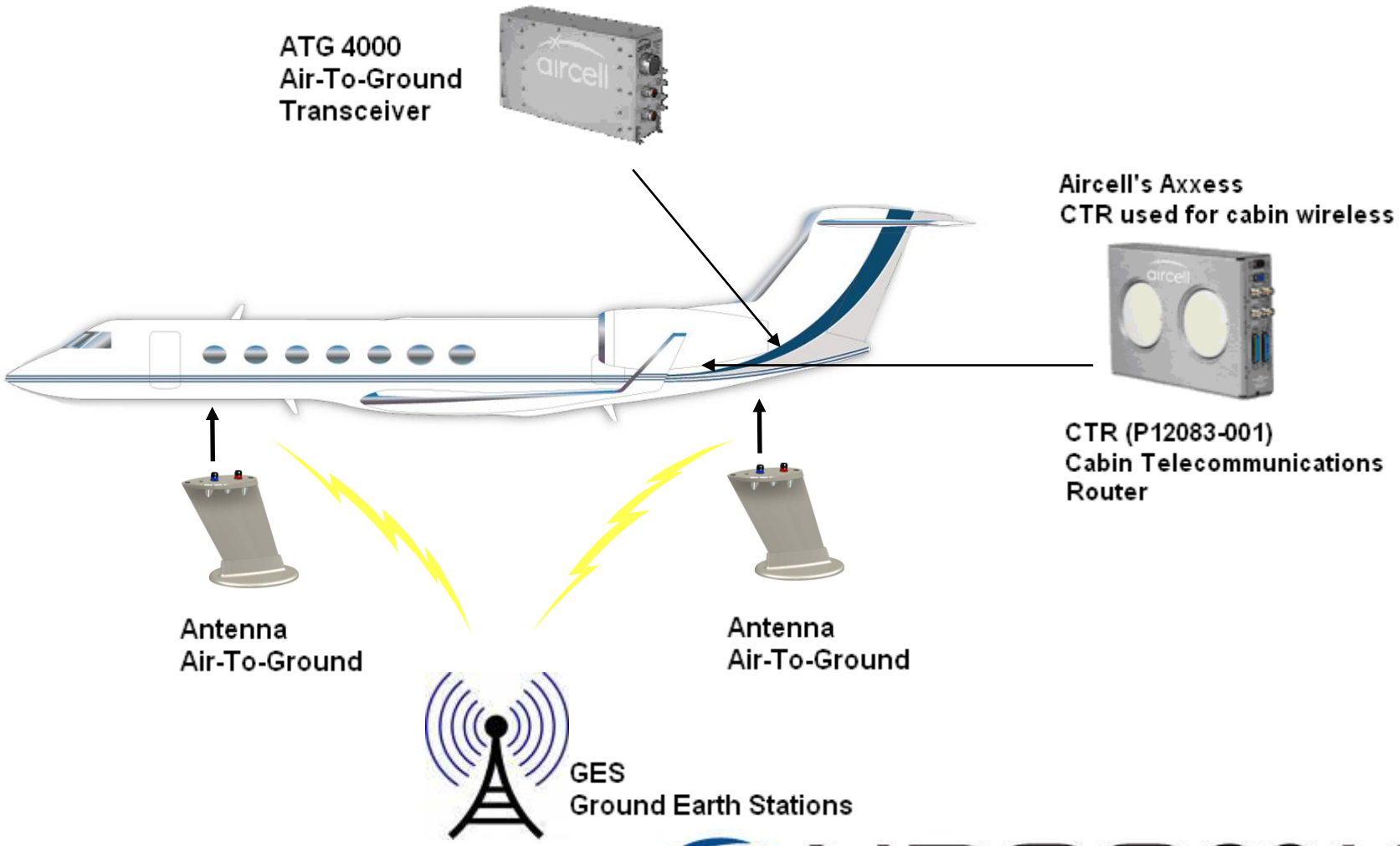
Gogo Biz ATG Network and Capacity Increases

- Internet communication via an air-to-ground network
- Version of mobile technology used in ground cellular networks
- Integrates with Aircell Axxess cabin system

Aircell has more than 200 ground sites



G450/G550 Gogo Biz ATG Component Locations



Gogo ATG Process Flow

Smartphone Tablet Laptop
- Internet enabled device

Gen 4 Server
- Gulfstream-designed product
- Wireless access point

CTR
- Cabin Telecomm-unications Router

ATG 4000
- Air-to-Ground transceiver

Antennas
- Two antennas located under the fuselage

Connectivity SystemsSummary

- Honeywell Inmarsat SwiftBroadband
- Honeywell Inmarsat (Ka)
- ViaSat Yonder (Ku)
- Gogo Business Aviation ATG

Now discuss how these technologies affect your flight department using Boeing's EFO as a case study

Boeing EFO Aircraft Configurations

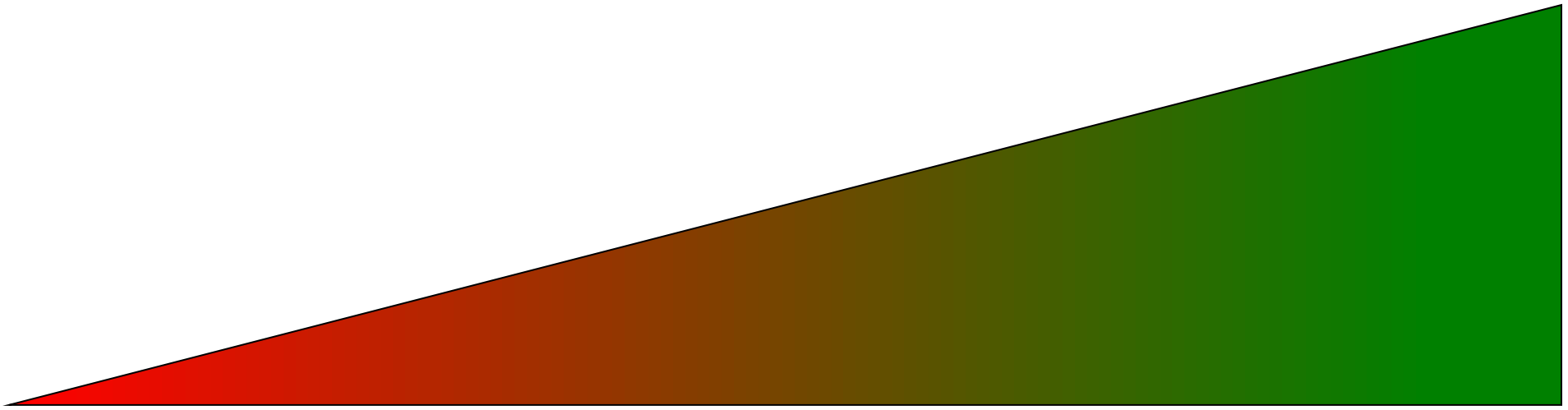
❑ Challenger Aircraft

- Aircell Broadband (Above 10k AGL and US Coverage only)
- Swift Broadband (Below 10k)
- Aircell Iridium Phone system
- ISDN Phone
- Rockwell Collins Airshow 4000ISDN P
- Samsung CLX-3170 Laser Printer/Copier/Scanner/FAX

❑ BBJ's

- Aircell Broadband (Above 10k AGL and US Coverage only)
- Swift Broadband (Primary)
- Swift64 (Backup)
- TrueNorth Iridium Phone system
- ISDN Phone
- Rockwell Collins Airshow 4000
- Custom Control Concepts AVOD and Cabin Management system
- Samsung CLX-3170 Laser Printer/Copier/Scanner/FAX
- *BBJ has DirecTV (This is the only aircraft in the fleet with DirecTV)

Connectivity Options



Current | Available | **Future**

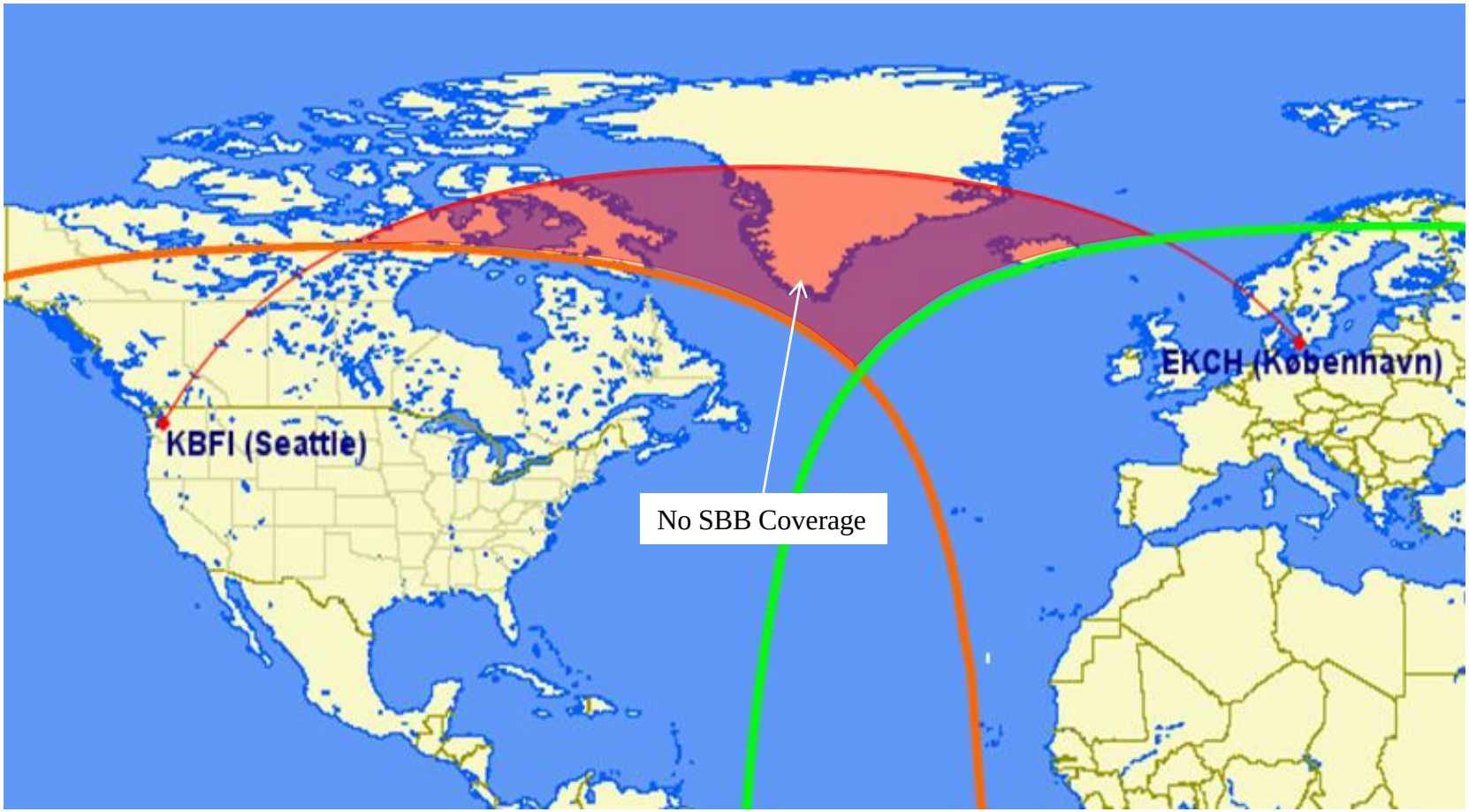
SPEED

Inmarsat Swift 64	**Inmarsat SBB**	**Aircell Broadband**	Ku Band	**Inmarsat HDR**	**AT&T 4G LTE**	**Inmarsat GX-Ka**	**Inmarsat ACGC**
(128-256 kbps) Backup Only	(430 kbps)	(1,500 – 2,300 kbps) *CONUS only coverage*	(3,000 – 10,000 kbps)	(800 kbps)	7,500-10000 kbps *CONUS only coverage*	(28,000 – 200,000 kbps)	(Gigabyte)
2000	2006	2009	2000	2014	2015	2015	2017

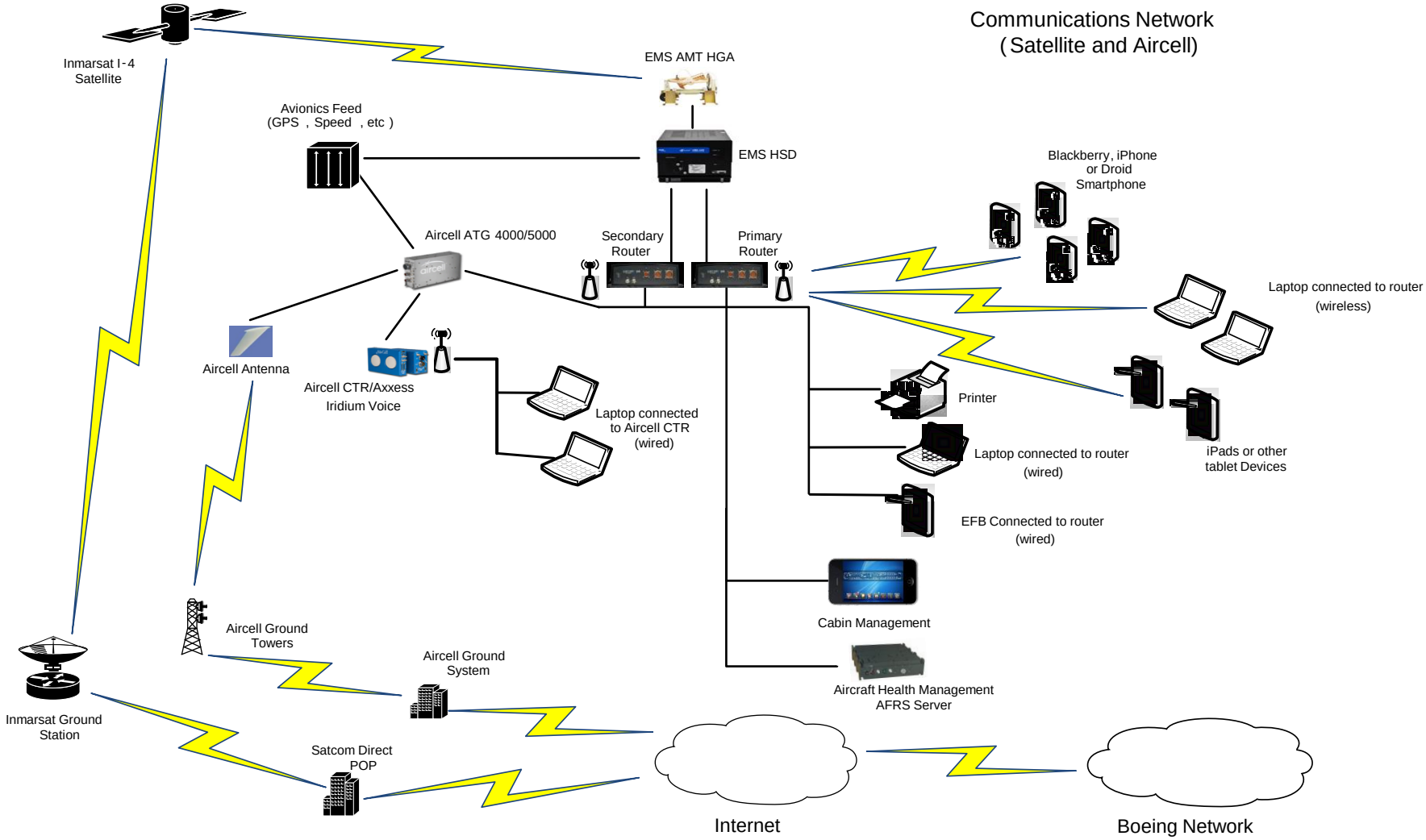
International Coverage map

N836BA SBB Coverage Map

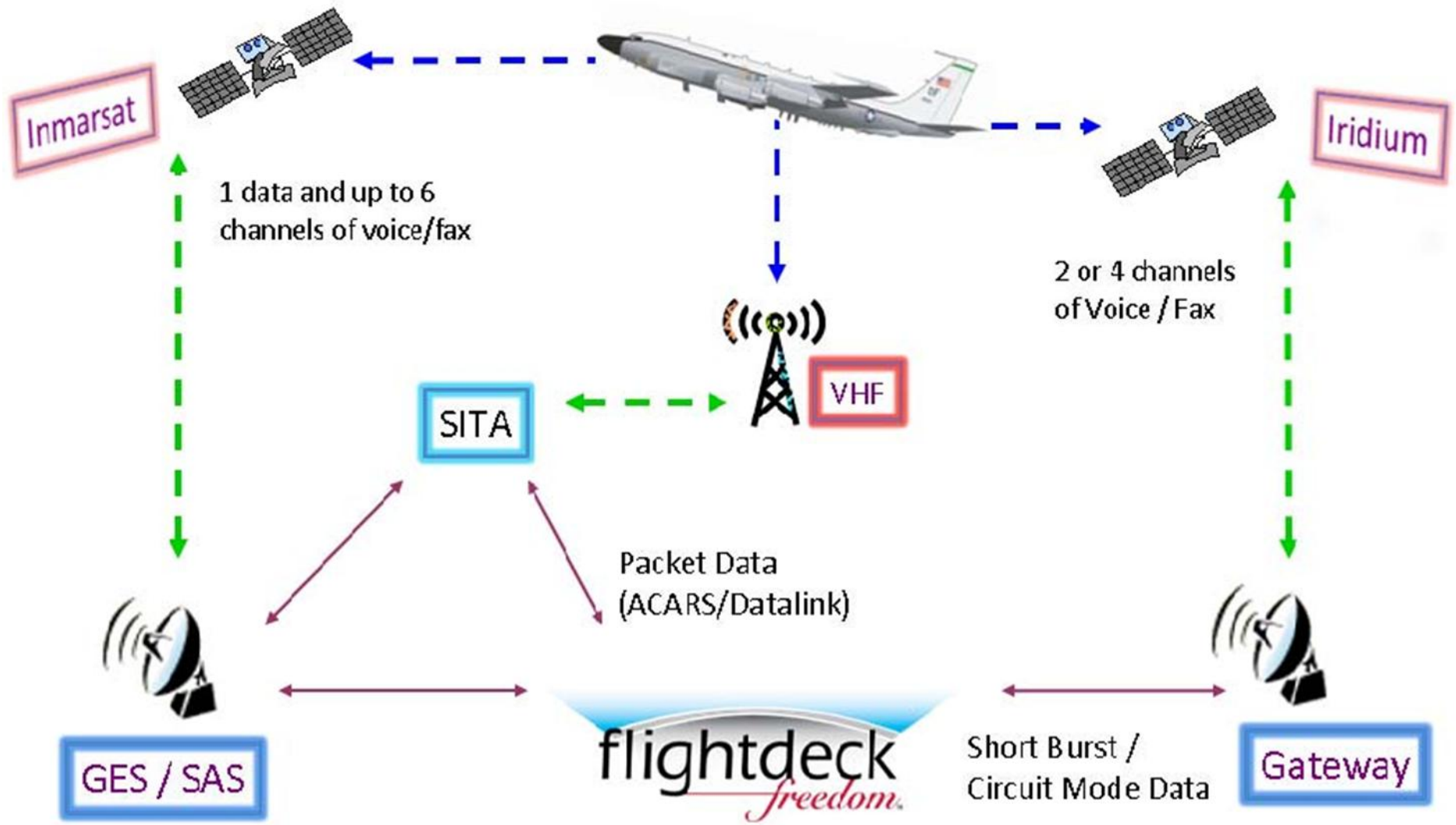
Copenhagen to Seattle



Aircraft Network Architecture

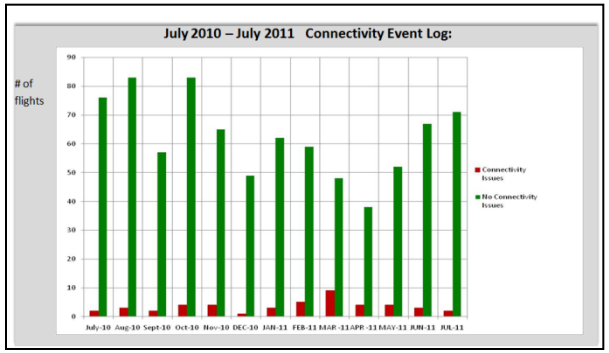


Inmarsat–Swift Broadband Data Link



Partner Relationship

Passenger Experience



Boeing recognized as innovative industry leaders
- Aircell, Inmarsat, Satcom Direct & Honeywell
- Beta testing of hardware, software and new service offerings
- Advanced system architecture built into Boeing systems

Education & Training
- Update passenger reference materials
- Flight Crew recurrent training
- Educate ECST on aircraft system changes
- ECST focal ensure Executive hardware properly configured for EFO aircraft usage

Performance & Reliability Monitoring
- Monthly connectivity performance review
- Partnering to ensure proactive handling of issues and improve the passenger experience
- During benchmarking NO other peer flight department is capturing specific metric data

Monitor and optimize the passenger onboard connectivity experience

Summary

- Connectivity Systems
  - Honeywell Inmarsat SwiftBroadband
  - Honeywell Inmarsat (Ka)
  - ViaSat Yonder (Ku)
  - Gogo Business Aviation ATG
- Flight Department Implications