Connecting With Customers Conference 2009

Fundamentals of Inmarsat Seminar

"*Inmarsat 101*"

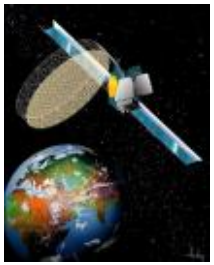
4 March 2009

Seminar Introduction

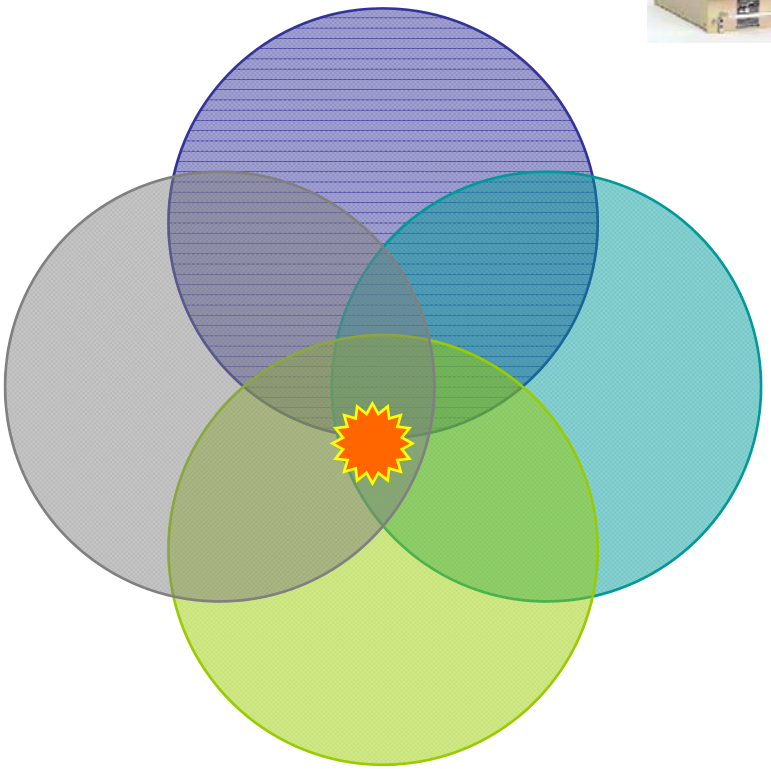
- Designed to Provide ***Fundamentals*** of Aeronautical Inmarsat Systems and Operations
- “Big Picture” Perspectives
- Designed to Fill in Gaps and Reinforce Experiences
- Six Hour Course Condensed Into 45 Minutes!

Elements Are Symbiotic

Equipment



Satellite

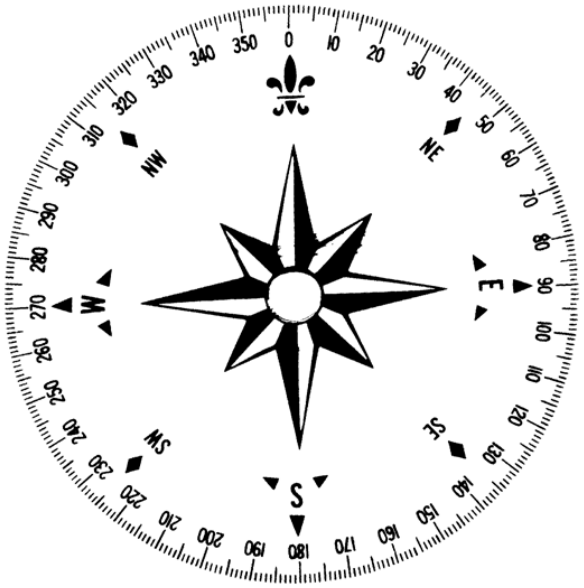


Installation & Integration

Terrestrial Network

Situational Awareness

- Most Important Element of Successful Inmarsat Communications
- You Absolutely Must Know:
  - Where You Are…
  - Where You're Headed…
  - What Resources Are Available…
  - What Equipment/Software You Have…
  - What Its Capabilities Are…
  - How It's Integrated On Your Aircraft…
  - Physics and Inherent Limitations…
- Mitigate And/Or Overcome Problems & Limitations



Executive's Expectations

Business Aviation/Government

To Continue To Execute Their Roles and Responsibilities
Regardless of Location…in their Home, Office or
at FL370 Halfway Around the World…

Who Uses Inmarsat Aero?

- Business Aviation (Some Commercial Aviation)
- US Government
  - Military
    - USA, USAF, USN, USMC, USCG
  - Federal
    - State Dept, FBI, DHS, USCBP, DIA, CIA, ???
- Foreign Governments

We're In A Transitional Phase…

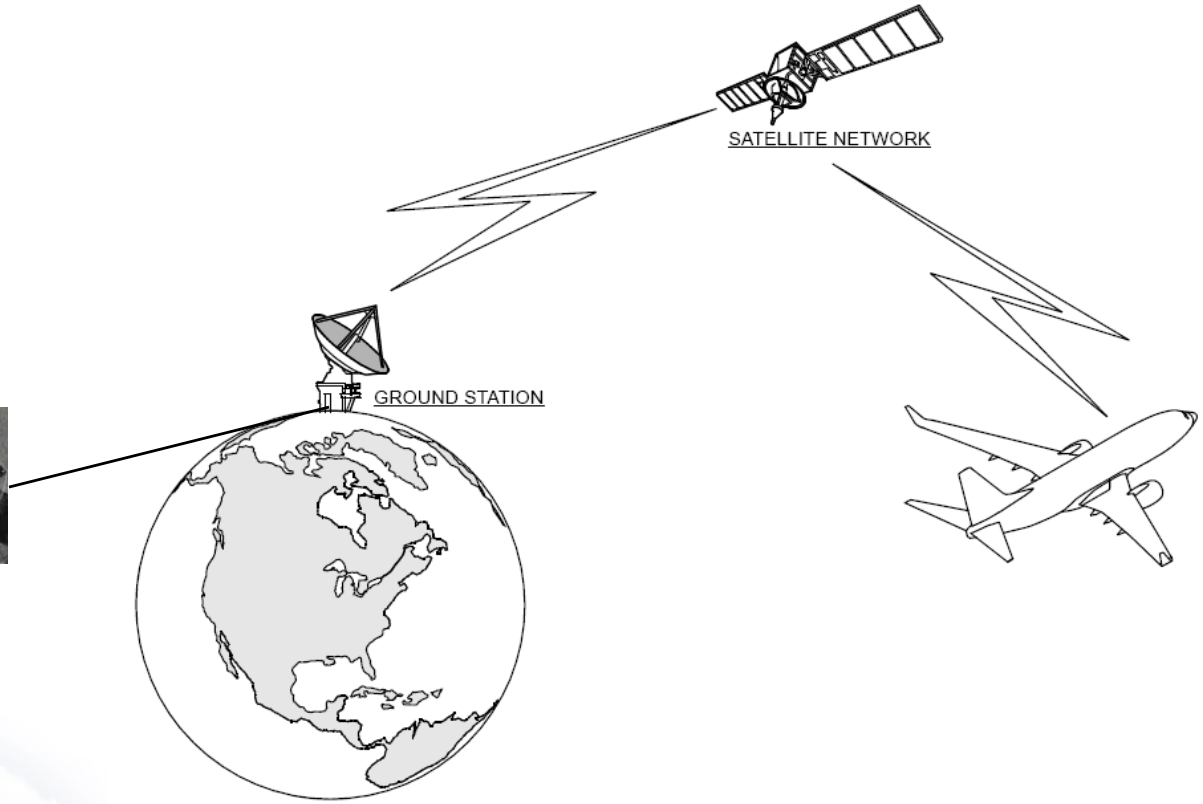
- Inmarsat is Undergoing a Significant Transition With I-3 and I-4 Services
- Bottom Line: *Inmarsat's Current Services Will Be Supported With a Mixture of the Old and New Generational Satellites*

Before We Start …

- Inmarsat is a ***Commercial*** Enterprise
- It is **NOT** DOD Owned or Operated
- It is In Business to:
  - #1: Provide a Safety Service
  - #2: To Generate Revenue
- As With a Cellphone Company's Network, It Is Not 100%

But, If You Understand the Rules and How Everything Works Together, Learn And Apply the Techniques, Learn to Identify, Mitigate and Deal With the Limitations and Constraints, Inmarsat Offers a Powerful Resource Unlike Any Current Communications System…

Inmarsat: As Basic As It Gets !



Segments

- Terrestrial
  - Ground/Land Earth Stations / Satellite Access Stations
  - Public Switched Telephone Network (PSTN)
  - Integrated Digital Switched Network (ISDN)
  - Internet
  - Government: *NIPR*Net, *SIPR*Net, JWICS, Etc.
- Space
  - Satellite Vehicles
- Aeronautical / Mobile Platforms

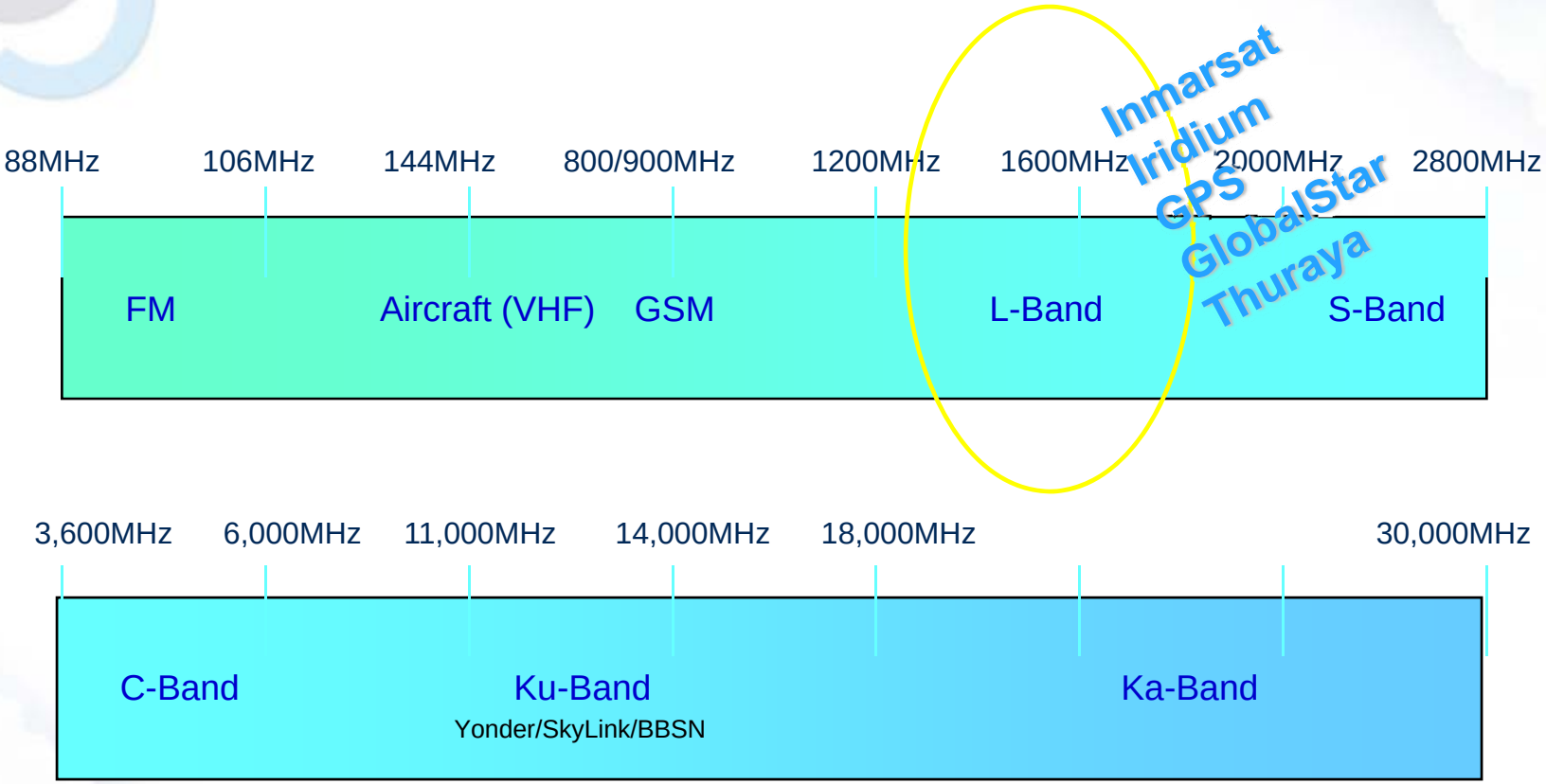
Inmarsat Services

- Maritime
  - Fleet 77
  - Fleet 55
  - Fleet 33
  - FleetBroadband
- Land Mobile
  - INMARSAT A, B, C, D+
  - mini-M
  - M4/Global Area Network
  - Broadband Global Area Network
- **Aeronautical**

Types of Aeronautical

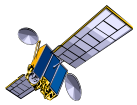
- **Aero-C**: Messaging and Data-only Reporting Satellite Communication Service
- **Aero-H**: Phone, Fax and Data Transmission via Satellite Global Beams
- **Aero-H+**: Phone, Fax and Data Transmission via Satellite Spot and Global Beams (*Non-secure Only*)
- **Aero-I**: Phone, Fax and Data Connections via Spot Beams (*Non-secure Only*)
- **Aero mini-M**: Single Channel Satellite Communication System
- **Swift 64**: Mobile ISDN Service
- **SwiftBroadBand**: Mobile Packet IP and Circuit Switched

Frequency Band



L-Band (1525 - 1660.5 MHz)

Service Allocation



1525 - 1660.5 MHz

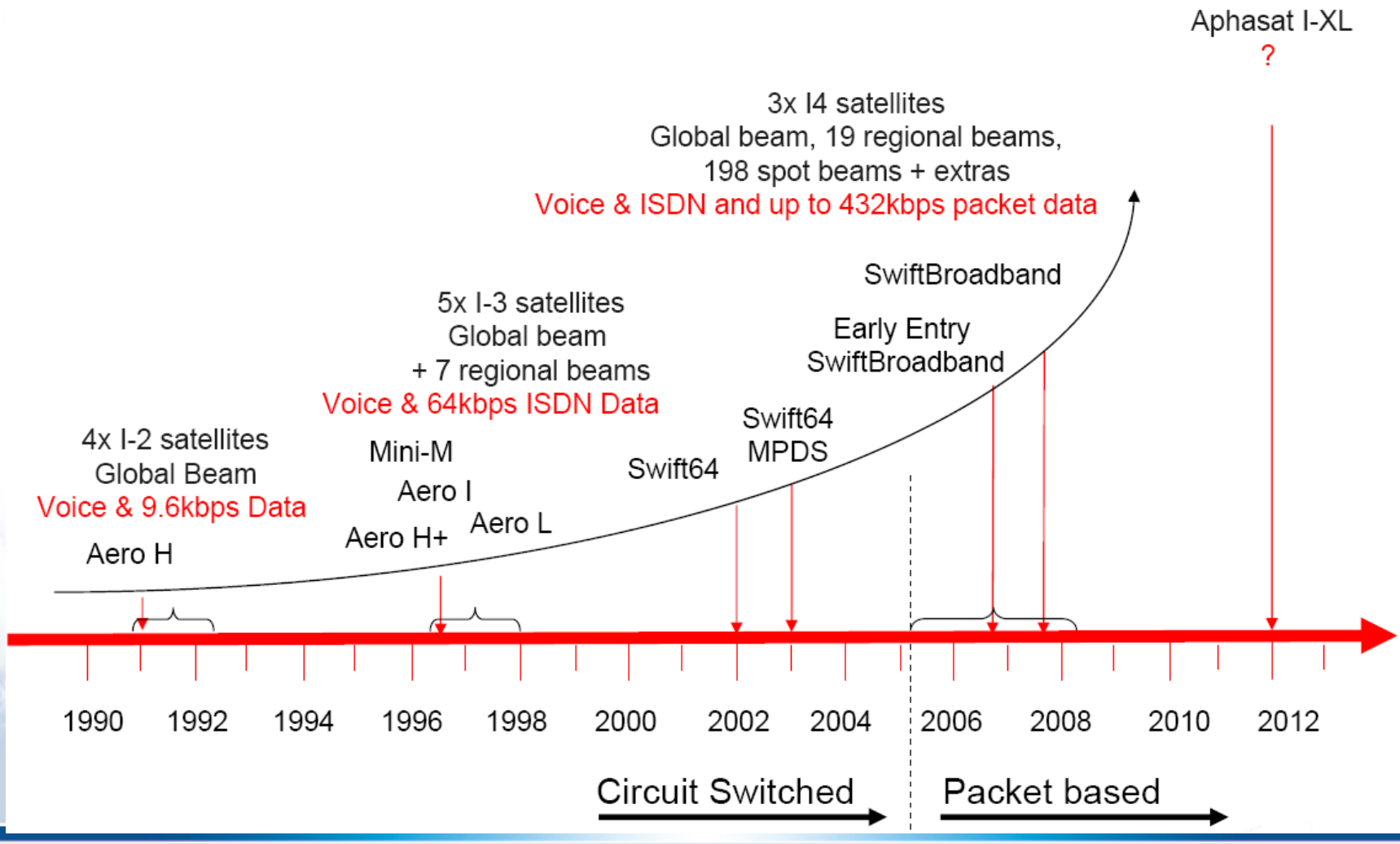
MARITIME | ***AERONAUTICAL*** | LAND-MOBILE

Aero-H/H+ | Aero-I | Swift 64 | Aero-M | SBB

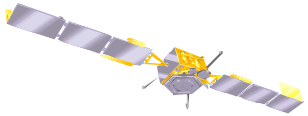
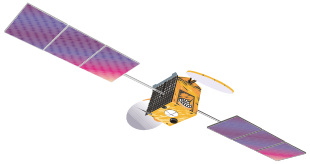
For The Cockpit

- Datalink (Data-2/Data-3)
- Air traffic services datalink
  - Flight plans
  - Weather
  - Etc.
- Electronic Flight Bags
- Routine Air Traffic Services Comms
- Distress Communications

Inmarsat Satellite Services …Then and Now



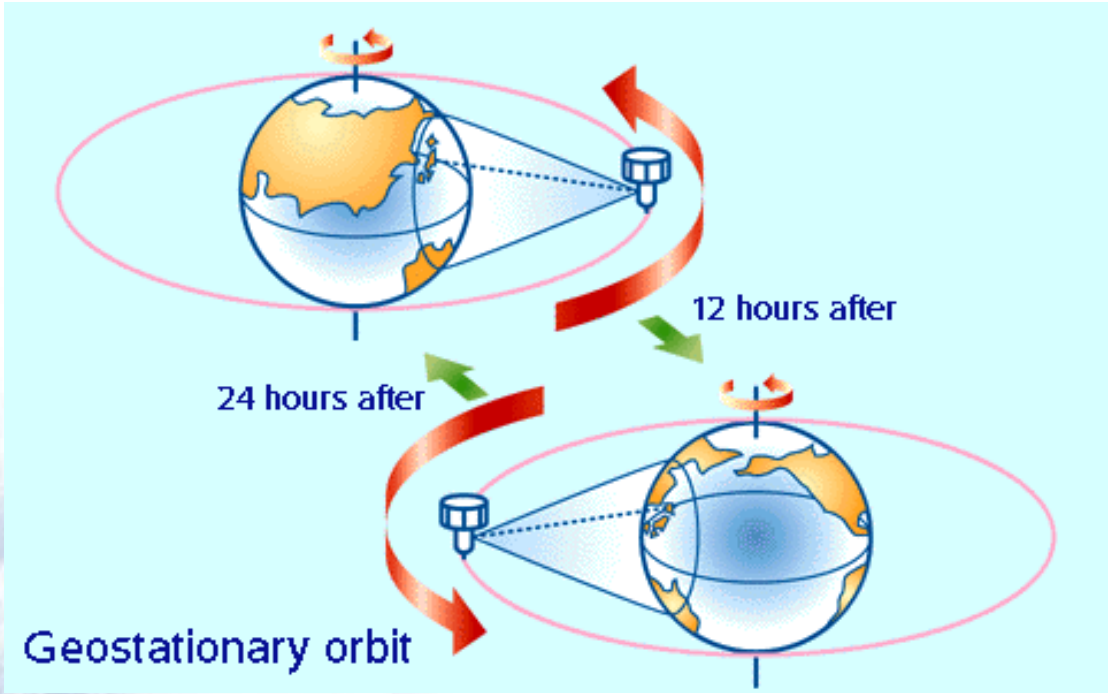
Satellite Generation Comparison

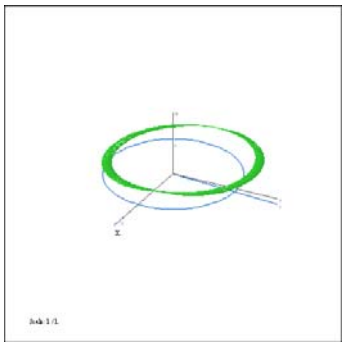
	Inmarsat-2	Inmarsat-3	Inmarsat-4
			
No. of satellites	3 of 4	5	3
Coverage	Global beam	7 wide spots + global beam	200 narrow spots + 19 wide spots + global beam
Mobile link EIRP	39dBW	49dBW	67dBW
Satellite dry mass	700kg	1000kg	2700kg
Solar array span	14.5	20.7m	48m

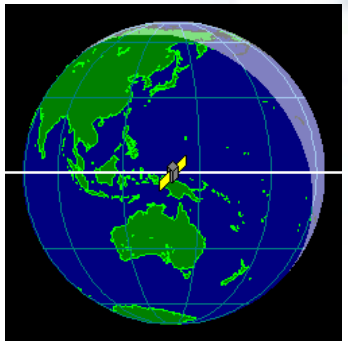
Service Summary Comparison

- **Aero-H**
  - Process Non-secure & Secure Phone Calls
  - Send and Receive Non-secure & Secure Fax
  - Send and Receive Non-secure & Secure Serial Data (e.g. ViaSat)
  - 9.6/4.8kbps voice quality, lower cost per minute
- **Swift 64**
  - Process Non-secure & Secure Phone Calls
  - Send and Receive Non-secure & Secure Fax
  - Send and Receive Non-secure & Secure TCP/IP Data
  - 64kbps voice and data quality, higher cost per minute
- **SwiftBroadband**
  - Packet switched
    - IP based
    - Always on
  - Services
    - Up to 432kbps
    - Streaming classes
      - 32, 64, 128kbps (up to 224kbps)
    - ISDN
    - Voice
    - SMS
  - Coverage
    - Global through narrow spot beams

Geosynchronous Satellite Constellation

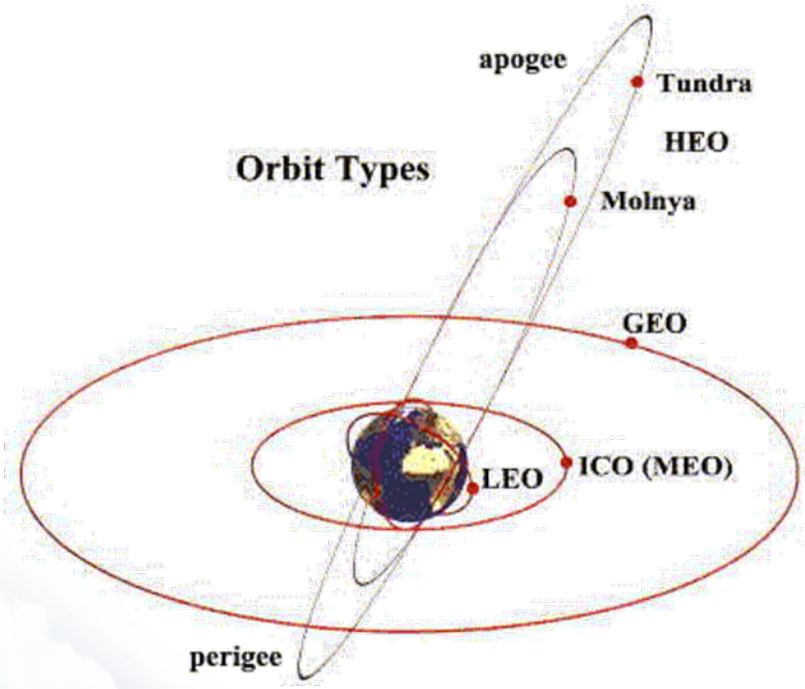


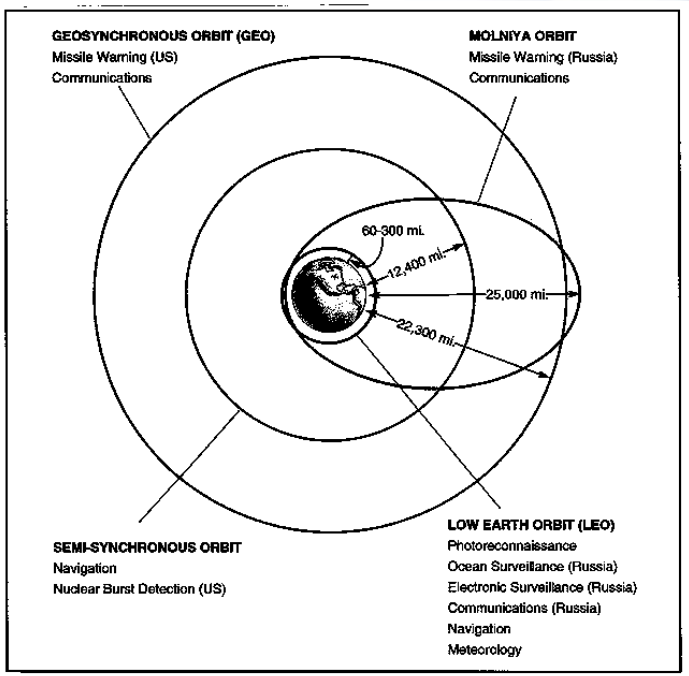




- Satellite is orbiting directly over the equator
- Remains in geosynchronous orbit with the earth's rotation
- Appears stationary relative to a point on the Earth's surface

Other Orbits





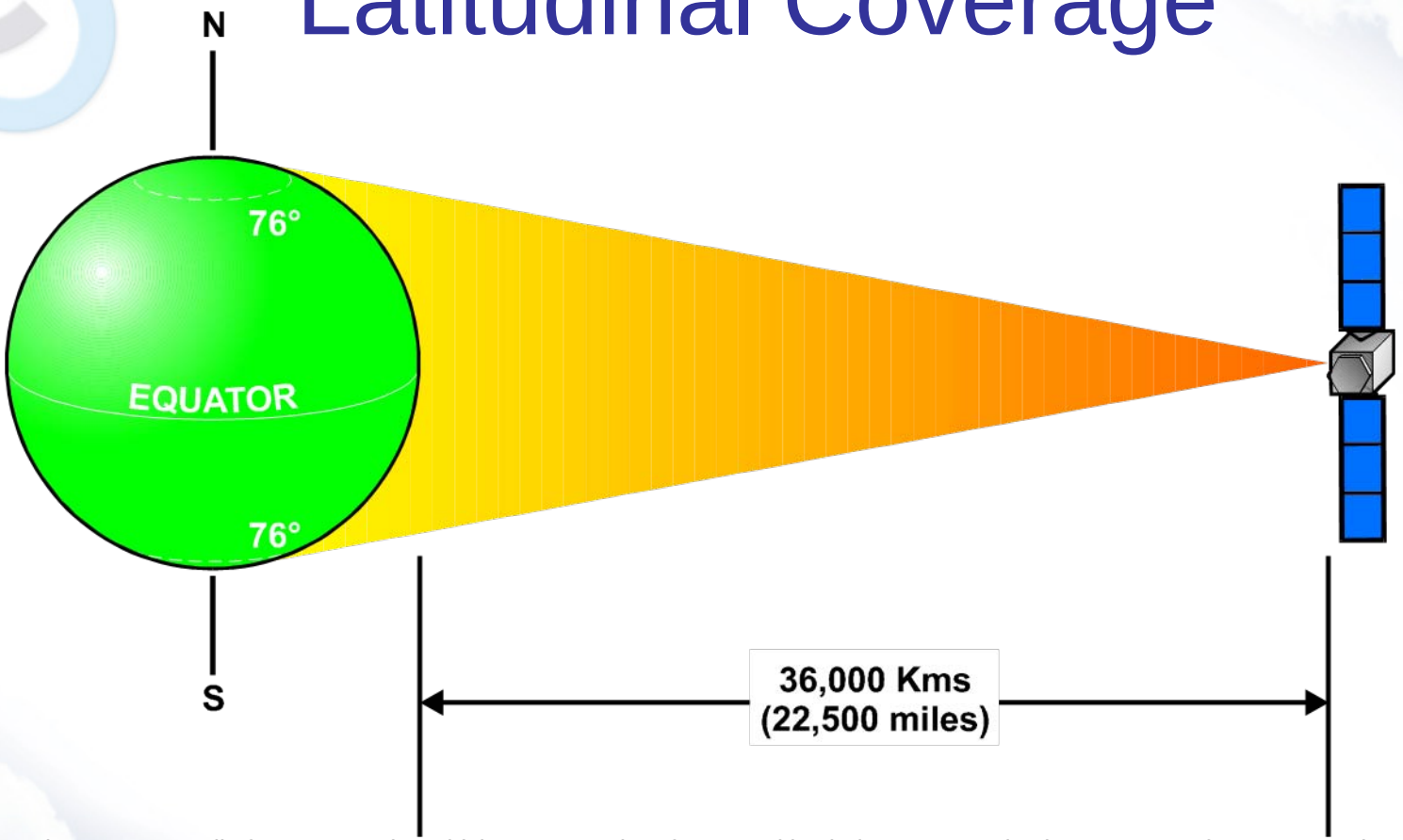
Adapted from "Satellites and Anti-Satellites" by Ashton B. Carter, *International Security*, Spring 1986.

Globalstar

iridium

THURAYA

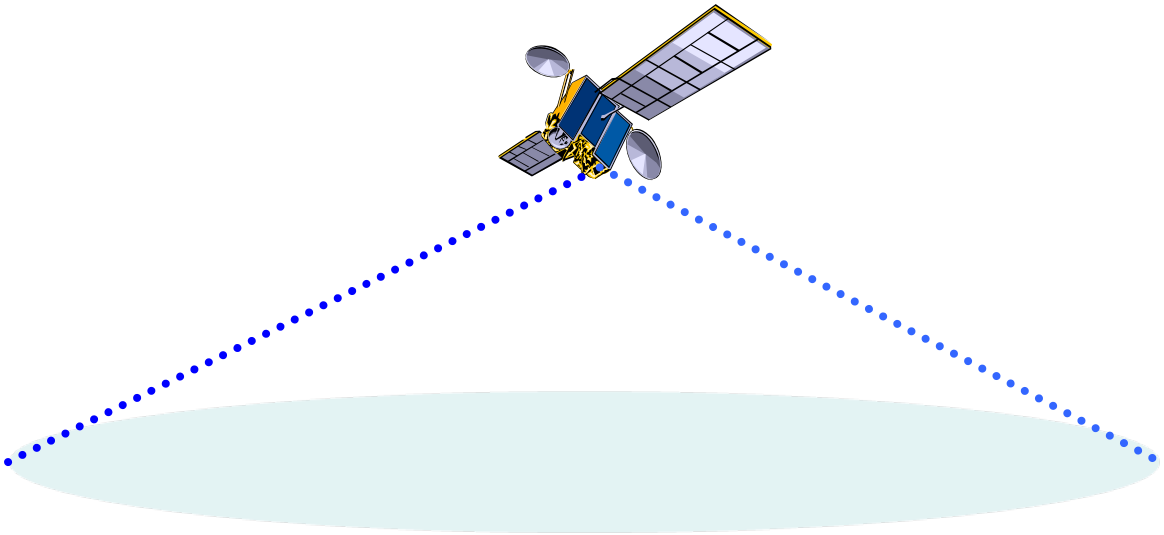
Latitudinal Coverage



The earth generates radio frequency noise which can cause interference with wireless communication systems. If any antenna is pointing too low over the horizon then at a certain elevation the noise generated by the earth will increase to such a level relative to the communications signal as to render the communications link unusable. The antenna elevation angle at which this occurs is about 5º and for a geostationary satellite this corresponds to a latitude of about 76º. Therefore, the limit of coverage of the Inmarsat satellites (and in fact any geostationary satellite system) is about 76ºN and 76ºS. For aeronautical antennas the latitude limit increases to about 82.5º.

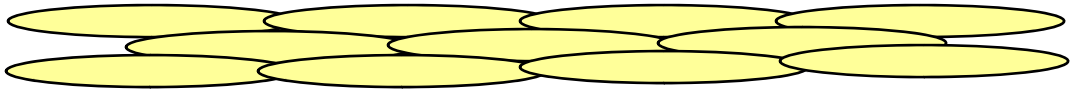
I-3 Beams

- **AOR-E**
- **POR**
- **IOR**



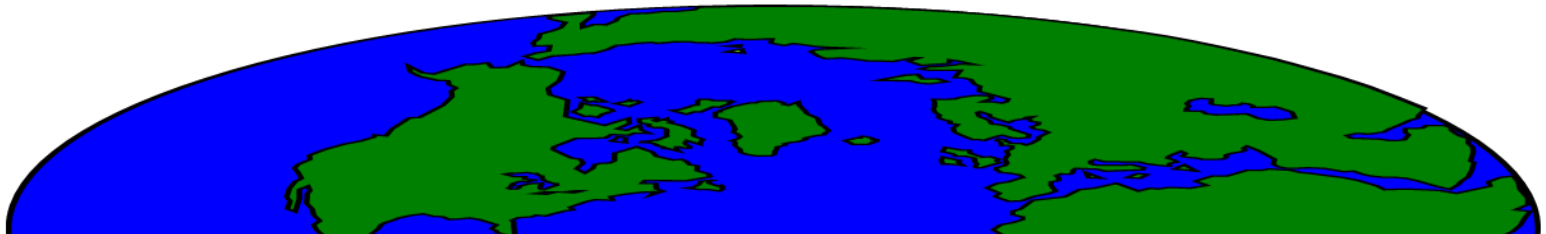
Global

Aero-H/H+/I



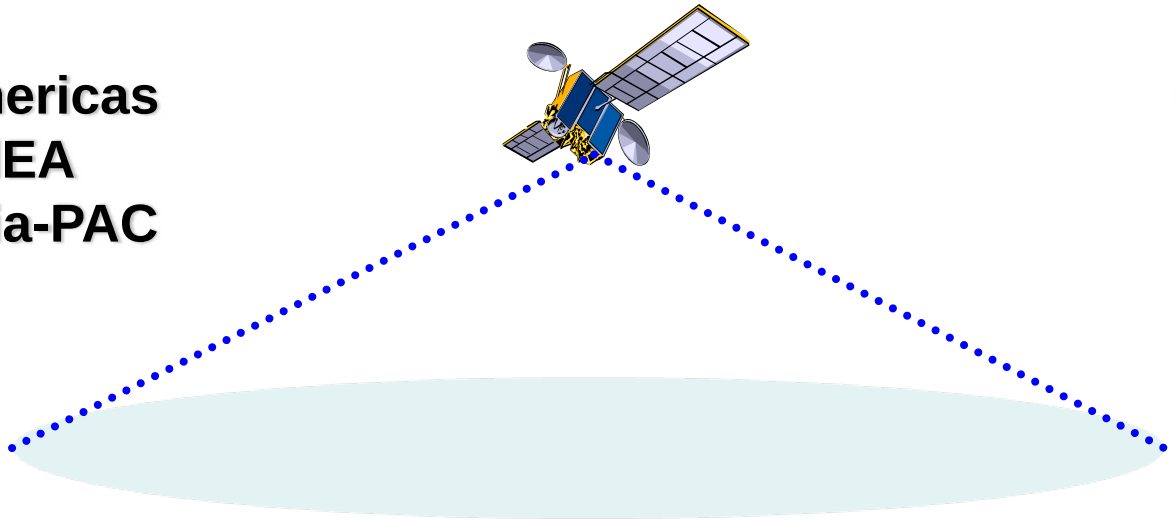
Spot

Swift64



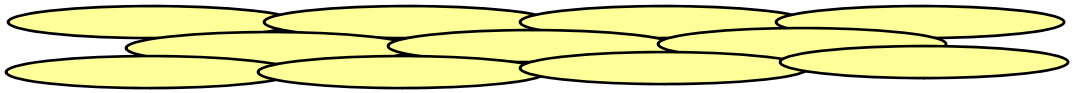
I-4 Beams

- **Americas**
- **EMEA**
- **Asia-PAC**



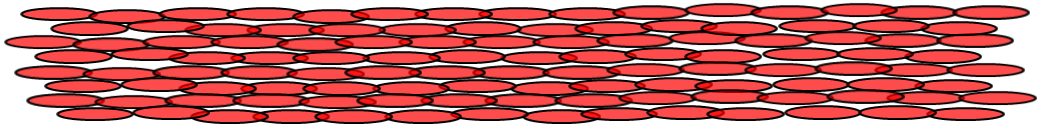
Global
(1)

“Stationkeeping”



Regional
Spots
(19)

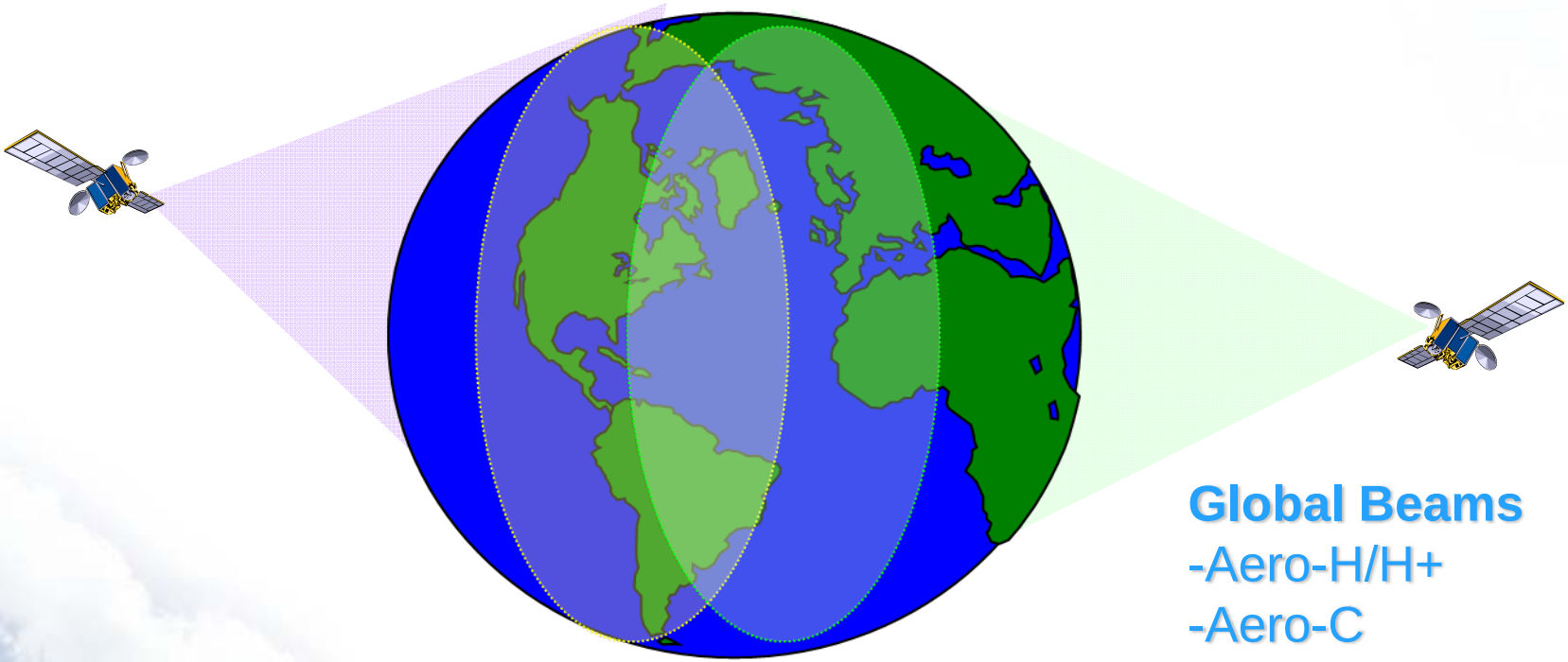
Aero-H/H+/I



Narrow
Spots
(~200)

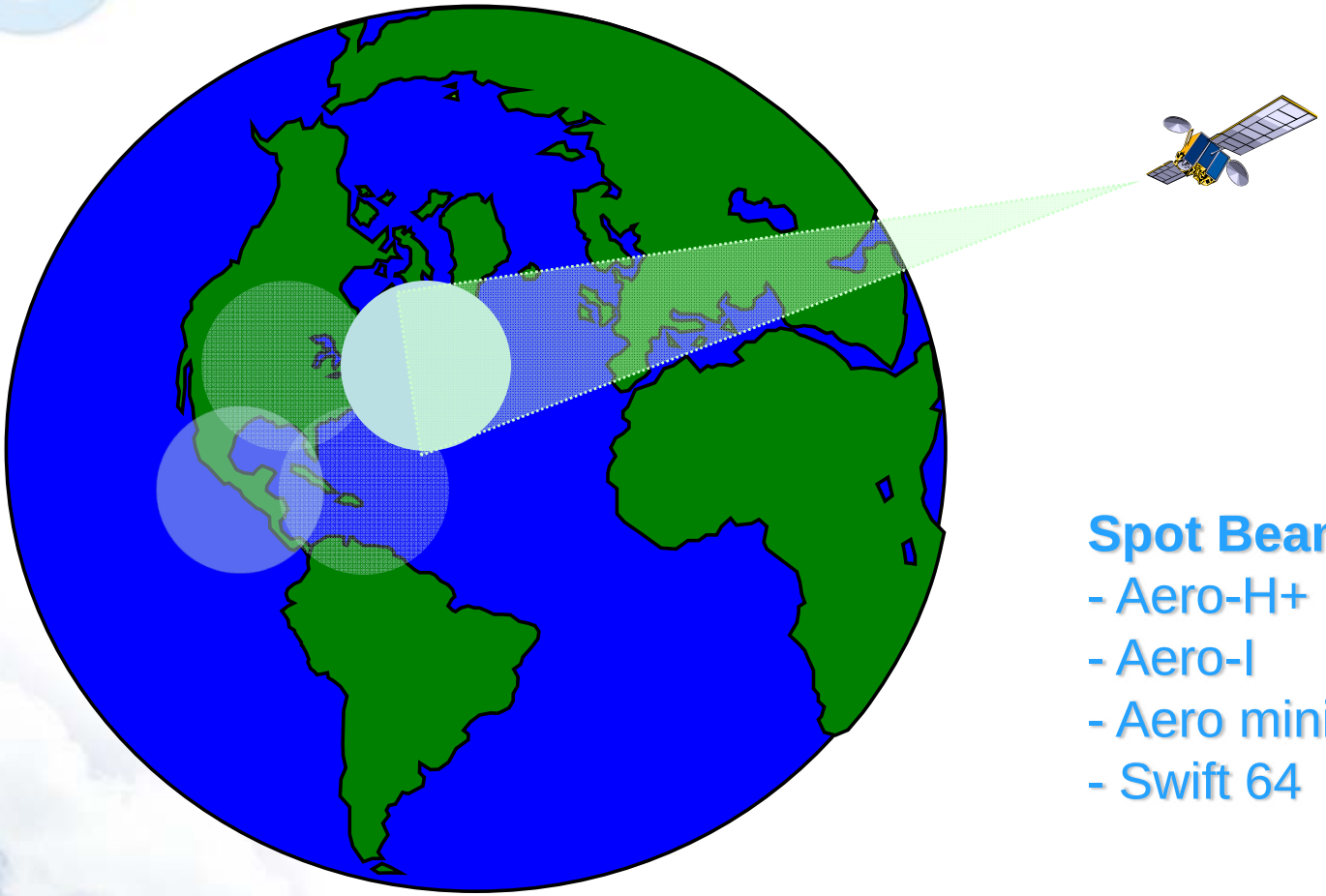
BGAN/SwiftBroadband/FleetBroadband

Satellite Footprints (I-3)



Global Beams
-Aero-H/H+
-Aero-C

Satellite Footprints (I-3)



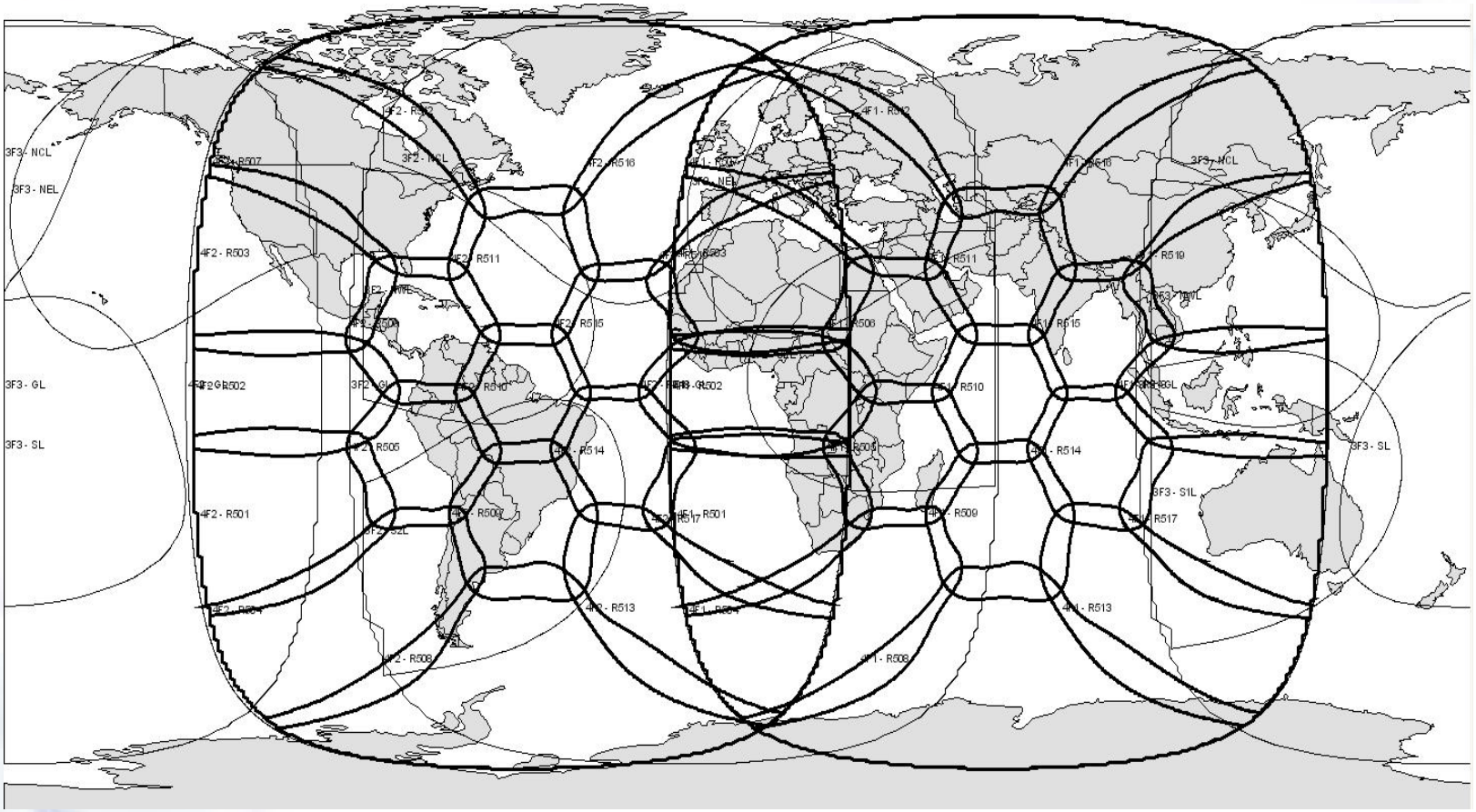
Spot Beams

- Aero-H+
- Aero-I
- Aero mini-M
- Swift 64

A Note on The “Old” Atlantic Ocean Region Coverage

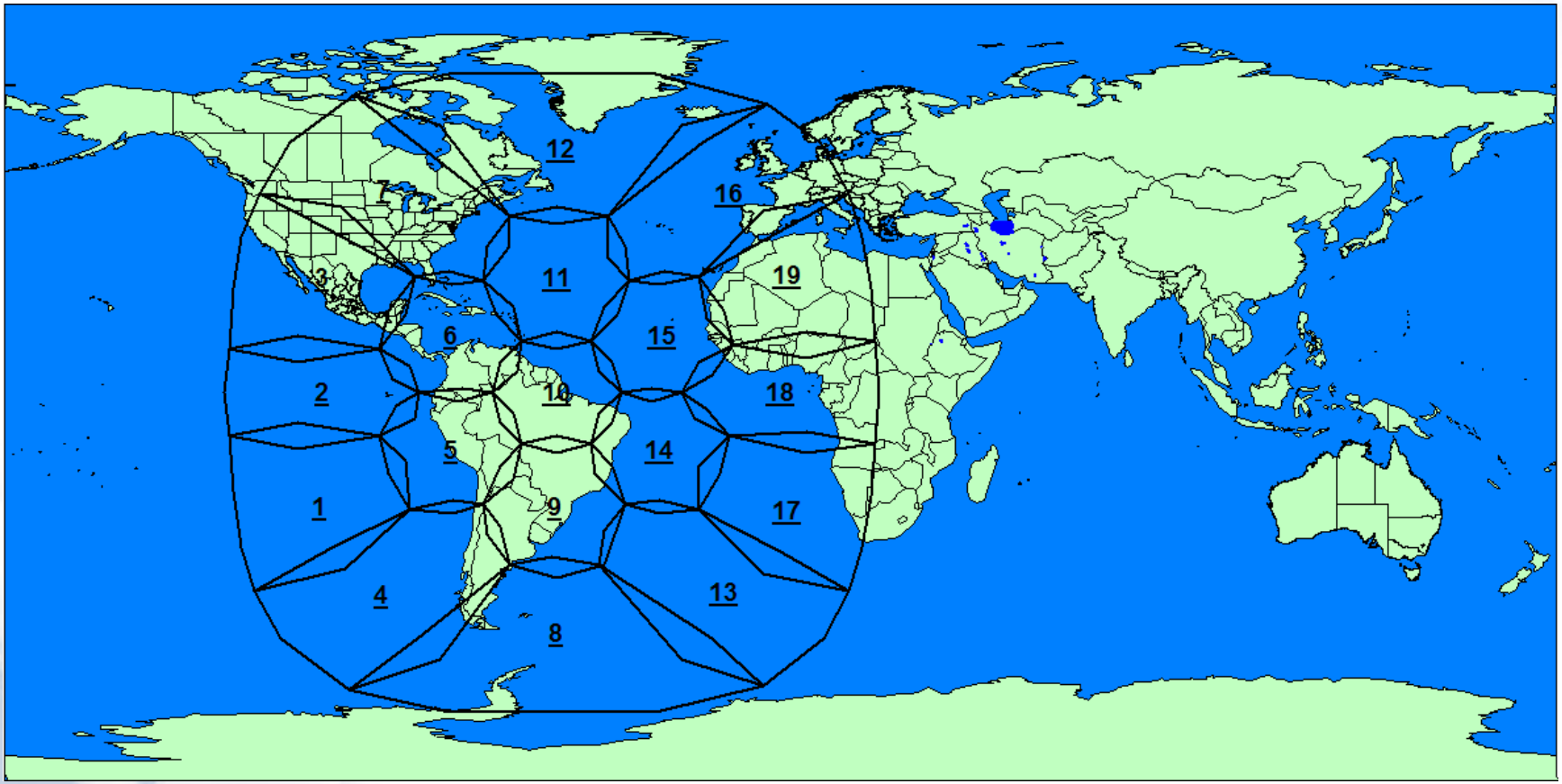
I-4 F1/F2
Regional Spot Beams

F2 F1



NOT ACTUAL POSITIONS – FOR DISCUSSION AND DEMONSTRATION ONLY

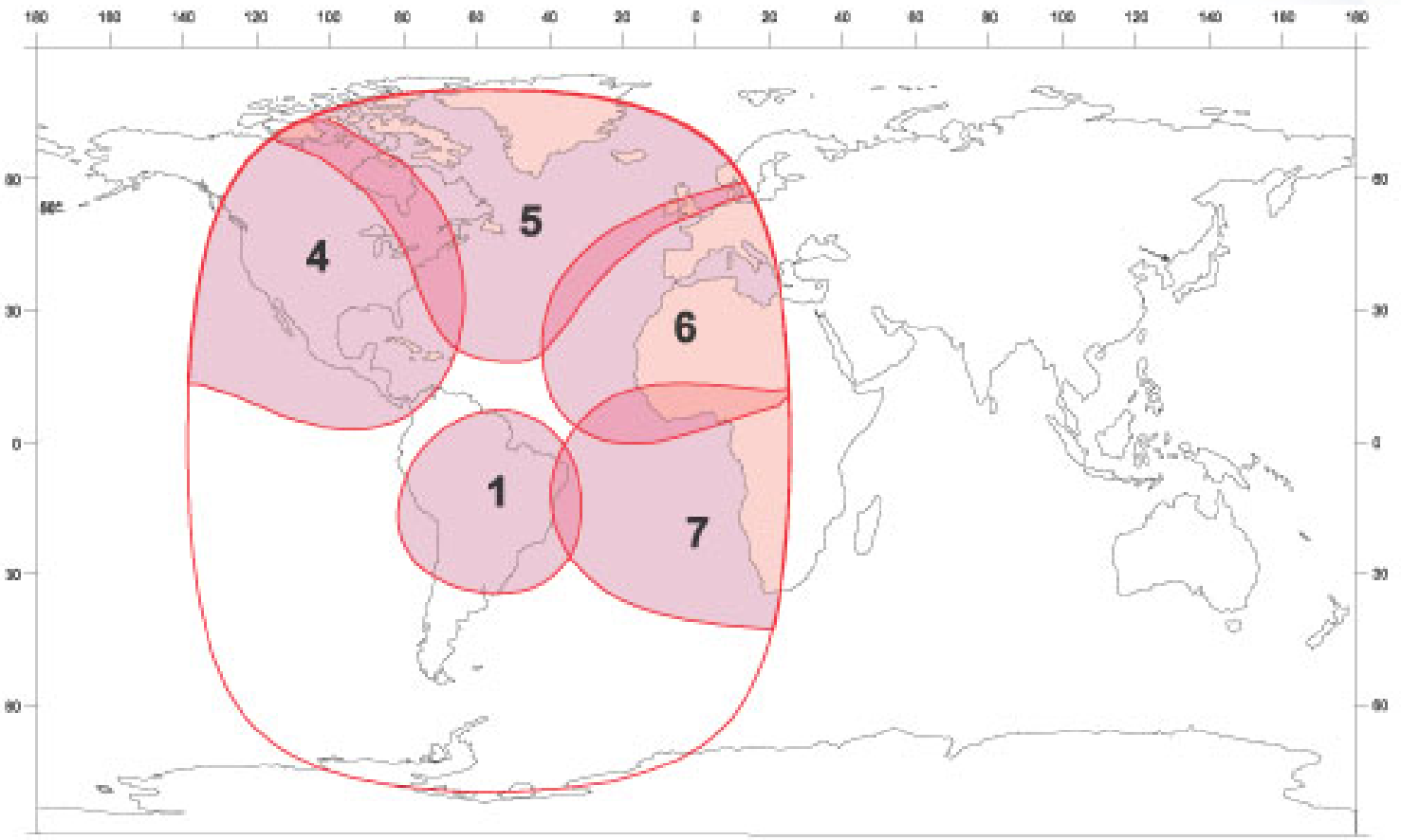
I-3 Atlantic Ocean Region West



Where We Are As of 24 February 2009 …

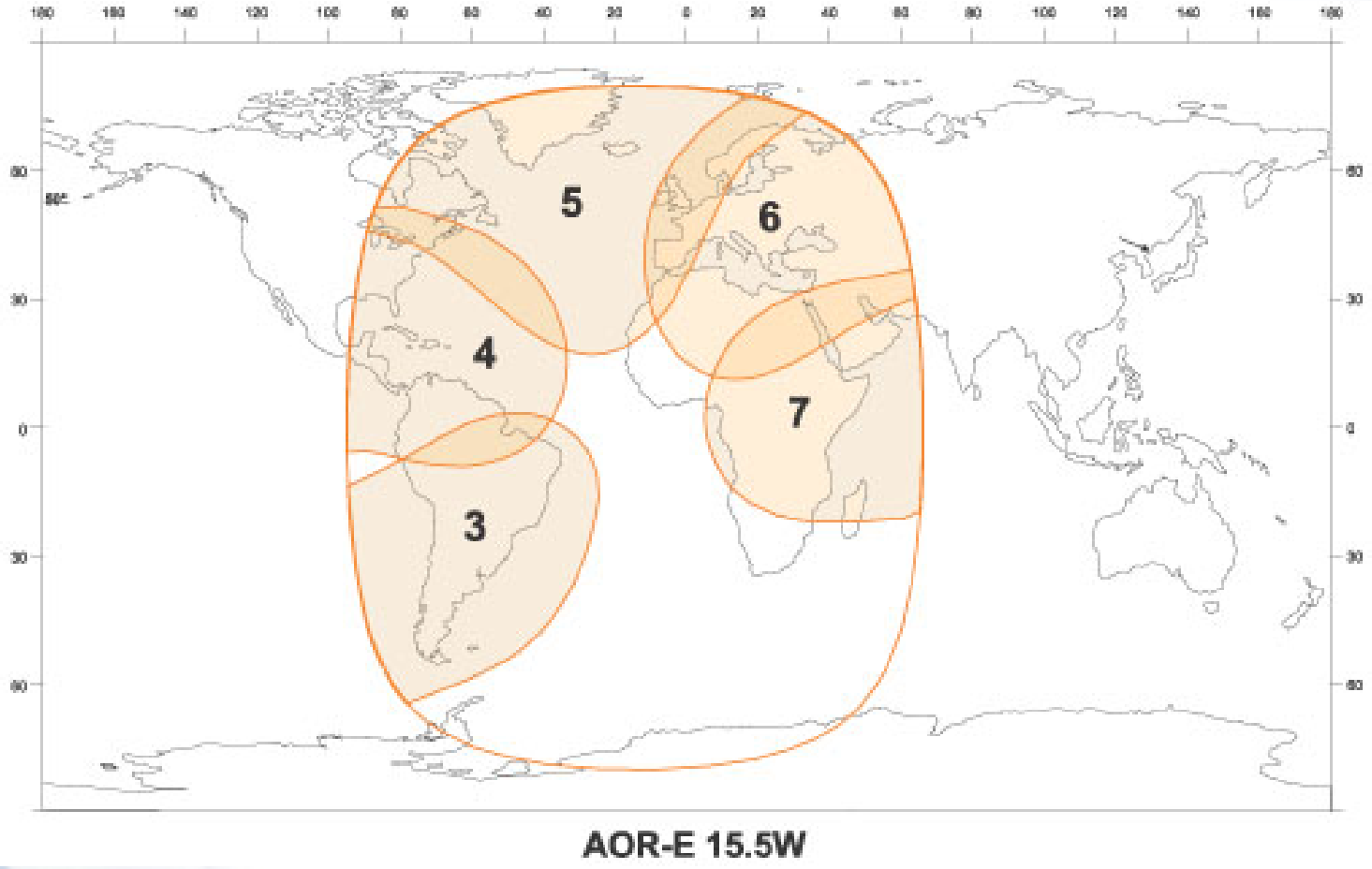
Atlantic Ocean Region – West

Inmarsat Generation 3



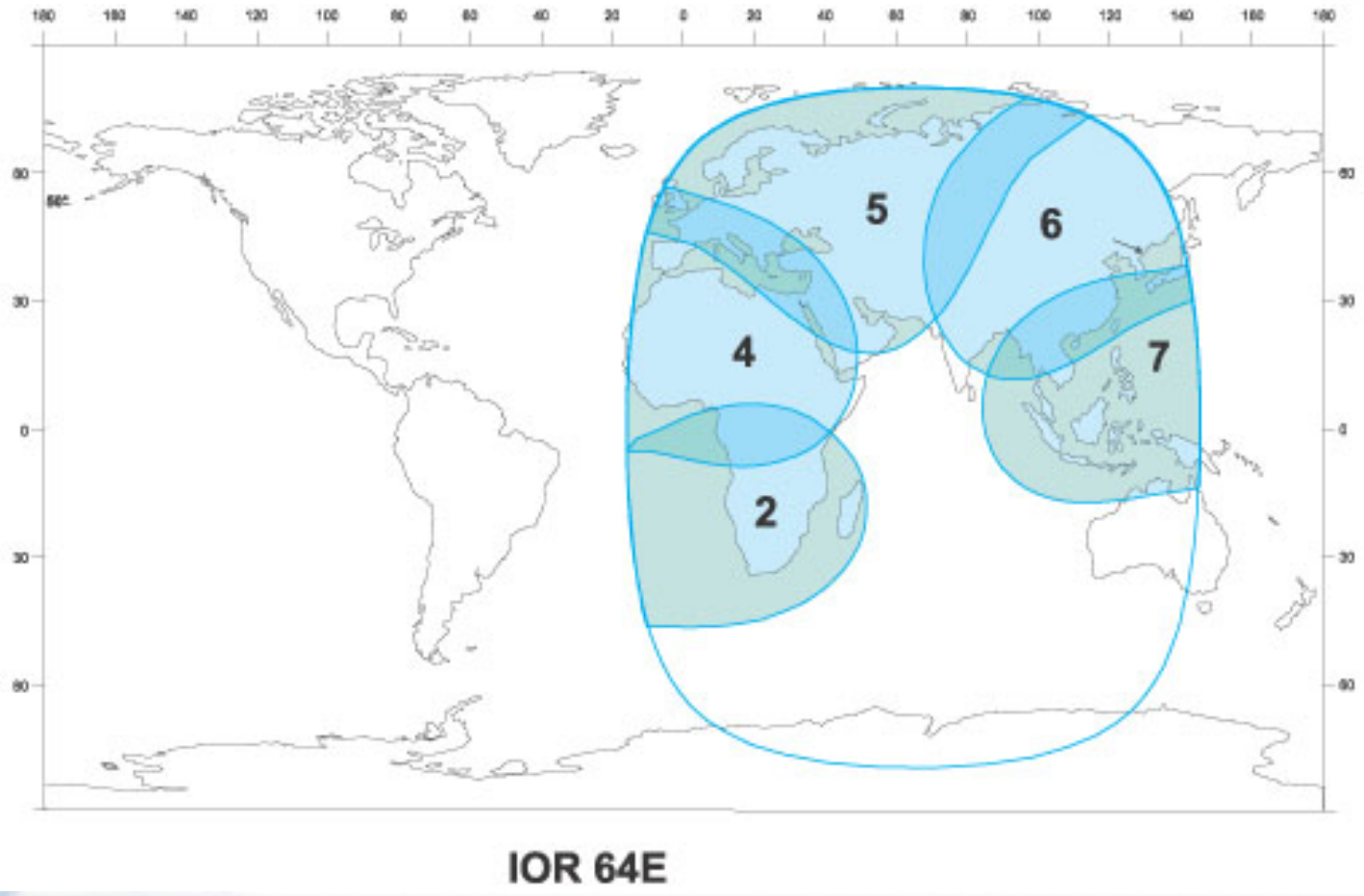
Atlantic Ocean Region – East

Inmarsat Generation 3



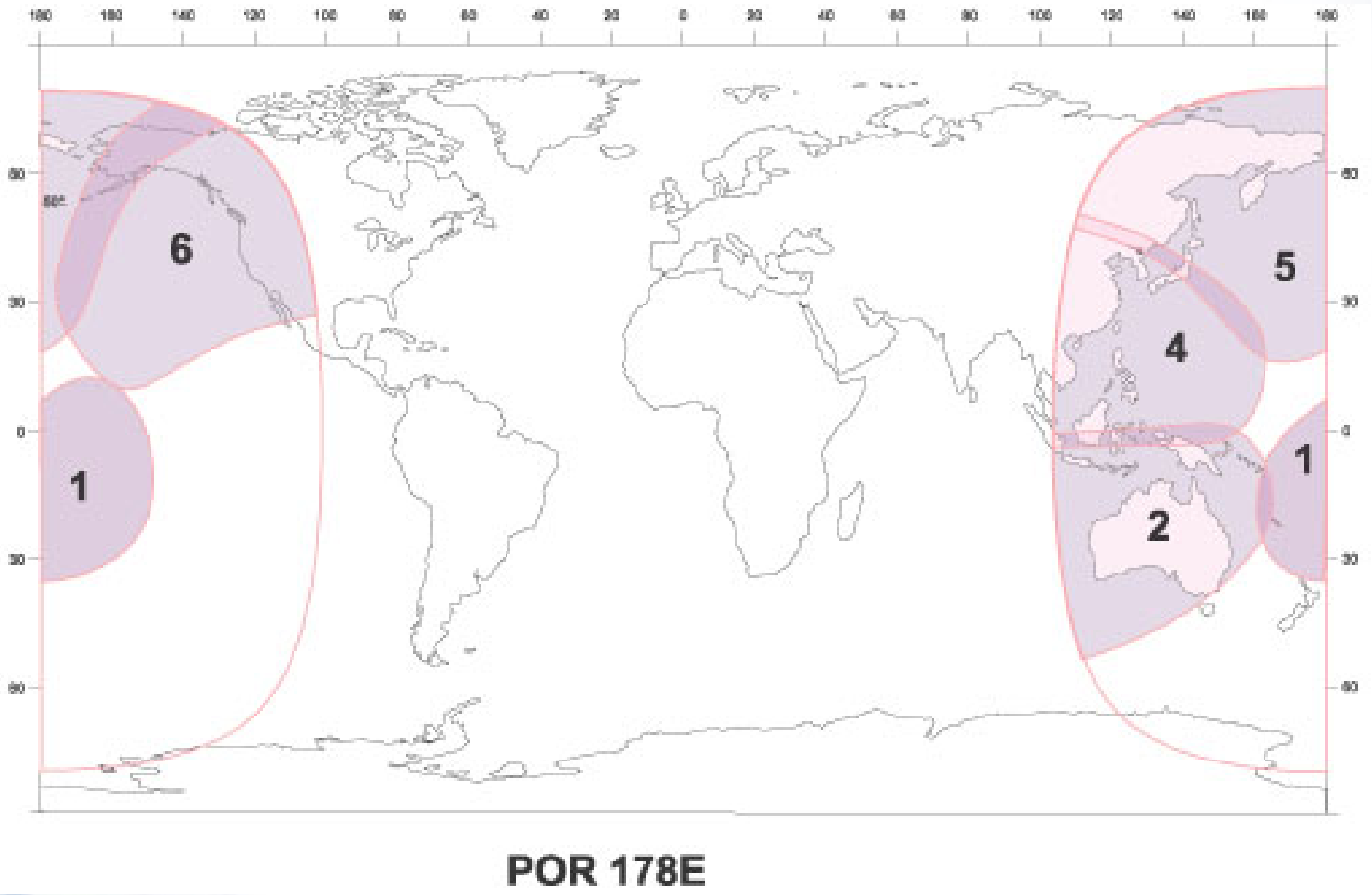
Indian Ocean Region

Inmarsat Generation 3

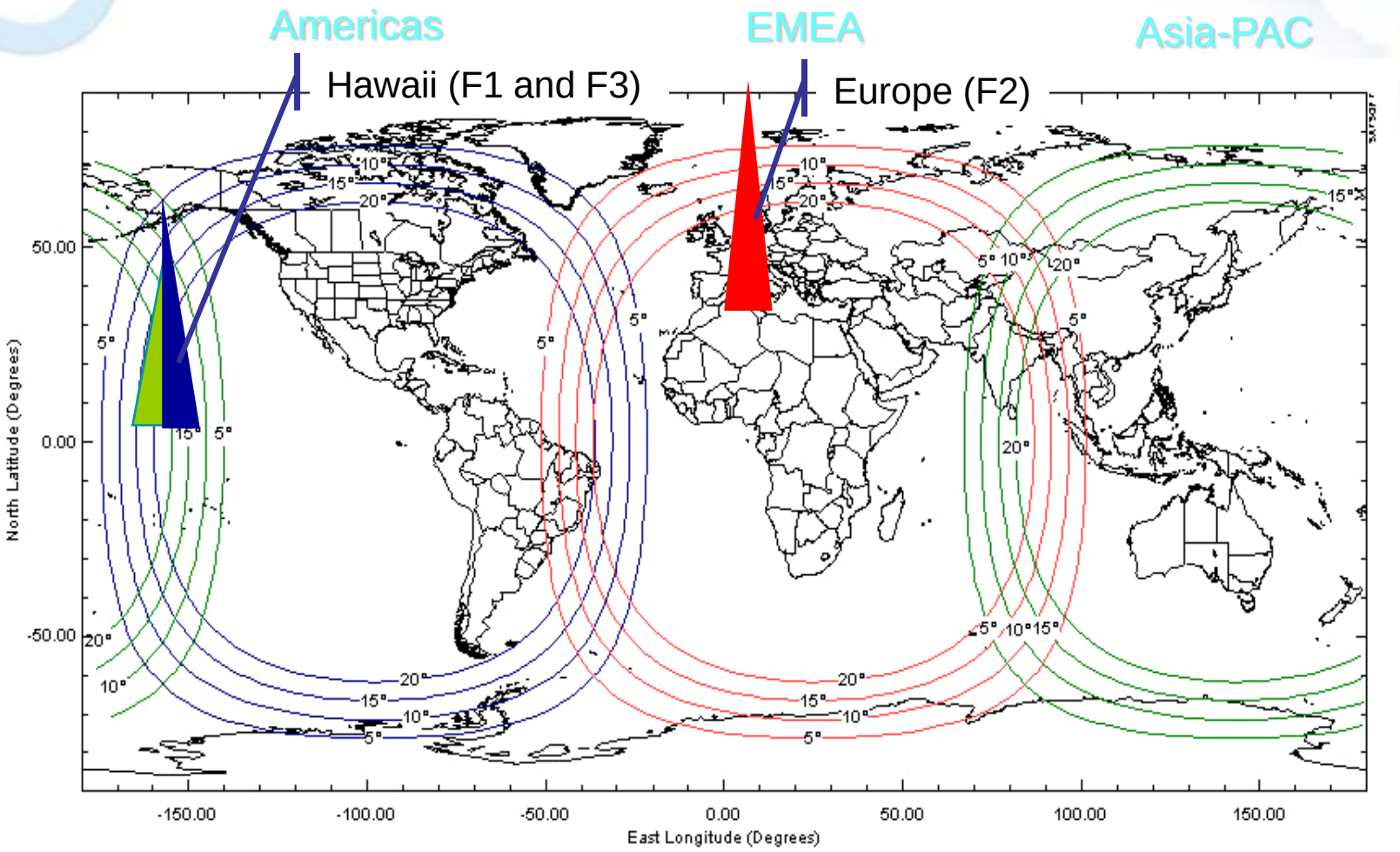


Pacific Ocean Region

Inmarsat Generation 3

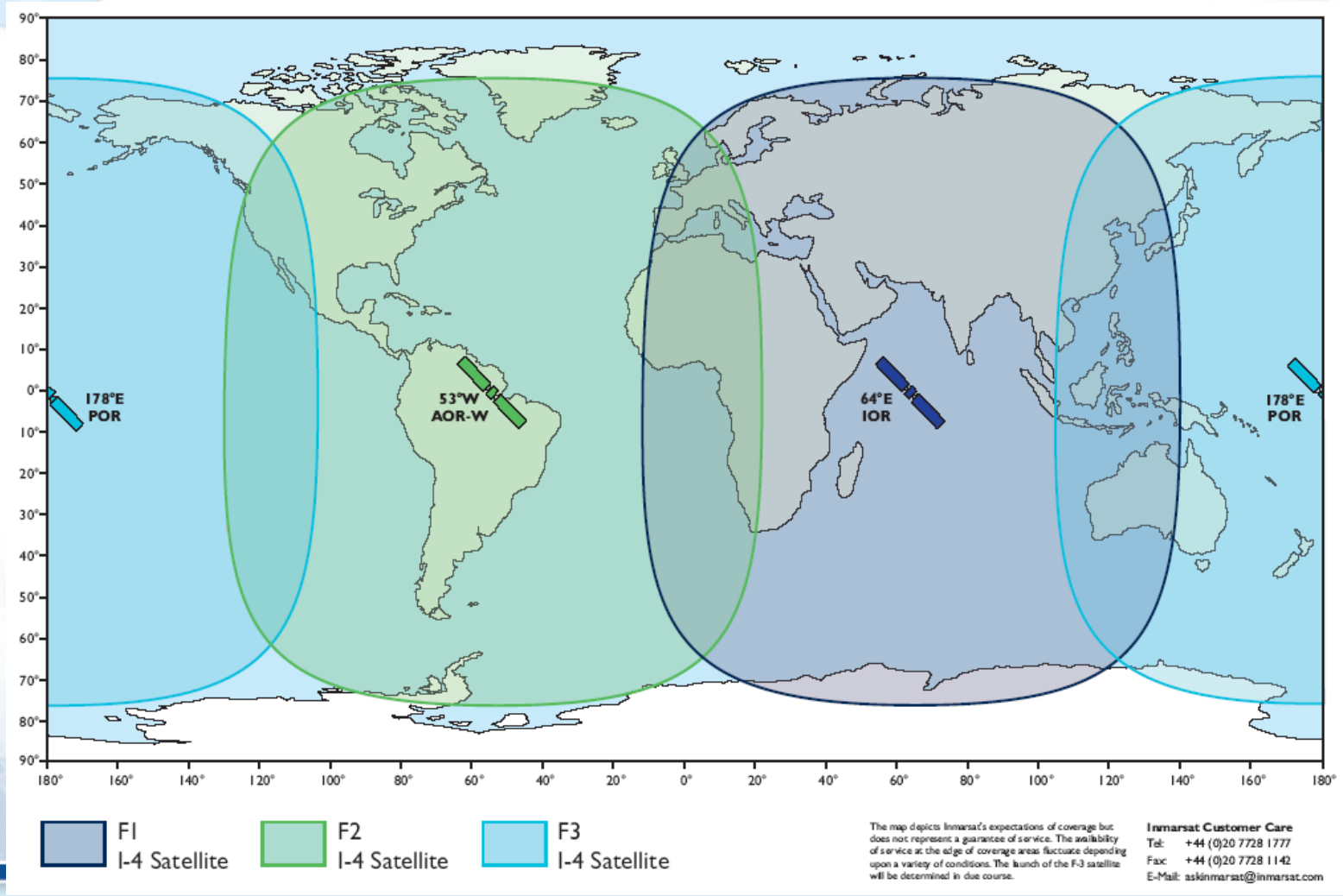


SwiftBroadband Coverage

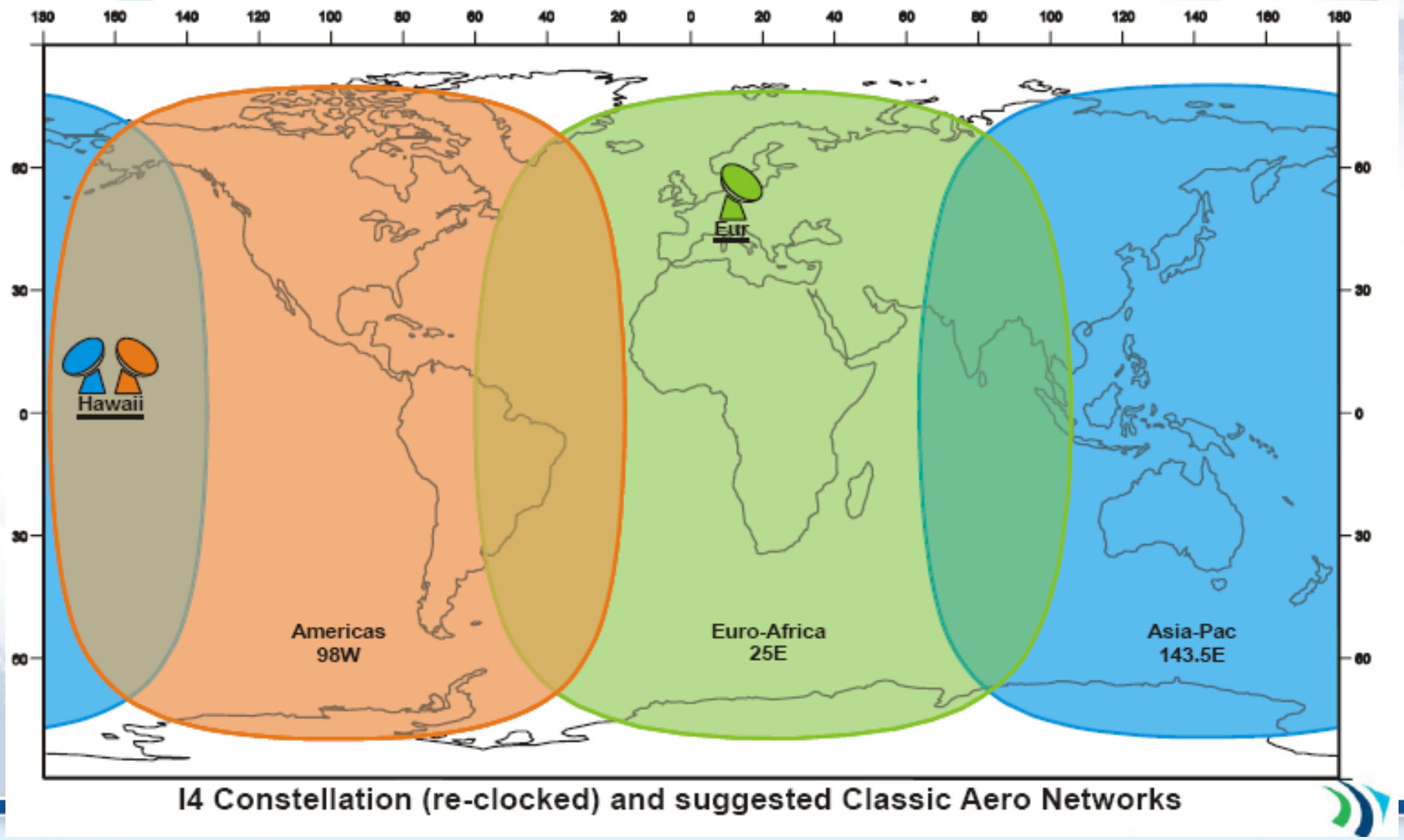


*** Satellite and SAS locations plans are always subject to change by Inmarsat**

Inmarsat I-4 Satellites (Old Positions)



1Q/09 I-4 Positions
(New Positions)



I4 Constellation (re-clocked) and suggested Classic Aero Networks

Land Earth Station Operators (LESOs)

- Inmarsat wholesales satellite capacity to LESOs
- LESOs provide end-users with end-to-end services through both direct and indirect sales

VIZADA

STRATOS

SITA

Satellite GES/LES/SAS Services

I-3 GES (Present and Future)	Aero H	Aero H+, Aero I Mini-M	Swift 64 (S64)	SwiftBroadband (SBB)	FDF/ Data 2
Aussaguel	✓	✓			✓
Santa Paula	✓	✓	✓		✓
Southbury			✓		
Auckland			✓		
Perth	✓				✓
EIK	✓	✓	✓		✓
I-4 SAS	**Aero H**	**Aero H+**	**Swift 64 (S64)**	**SwiftBroadband (SBB)**	**FDF/ Data 2**
Burum		✓		✓	✓
Fucino		✓		✓	✓
Paumalu		✓		✓	✓

Processes

- Commissioning
- Registration/Activation
- Owner’s Requirements Table
- The Phone Call…

Aero Commissioning

- Inmarsat Requirements
  - Inmarsat Registration for Service Activation of Aircraft Earth Station (AES) and Satcom Direct Application
  - Inmarsat Terms & Conditions
- Inmarsat Activation Terminology
  - PSA Point of Service Activation
    - PSAs are Authorized to Activate INMARSAT Terminals
  - ISP Inmarsat Service Provider
    - ISPs Have Contracts With Multiple LESOs
  - AA Accounting Authority
    - AAs Are a Billing End Point and ALL Apply a % Markup on Charges
    - An organization nominated on an Inmarsat Service Activation Registration Form (SARF) to administer the billing and settlement of the communications charges incurred by an Aero/Mobile Earth Station (AES/MES).

PSA Functions

- Perform electronic transmissions to Inmarsat for service activation information.
- Perform periodic follow-up that such information is up to date.
- Respond to customer queries on service activation, Inmarsat systems and services in general.
- Assist in the prevention of fraud within the Inmarsat system.
- Provide necessary information relating to distress and safety.
- Ensure that MES owner/operator signs the Inmarsat Terms and Conditions for utilization of the Inmarsat Space Segment.
- Provide information to appropriate governmental agencies for Maritime MESs.

Some PSAs may have a monopoly in certain regions/countries (Germany, Italy, Brazil).
Satcom Direct works closely to ensure systems are activated as soon as possible !!!

“Things That Can Bite You” Category Types

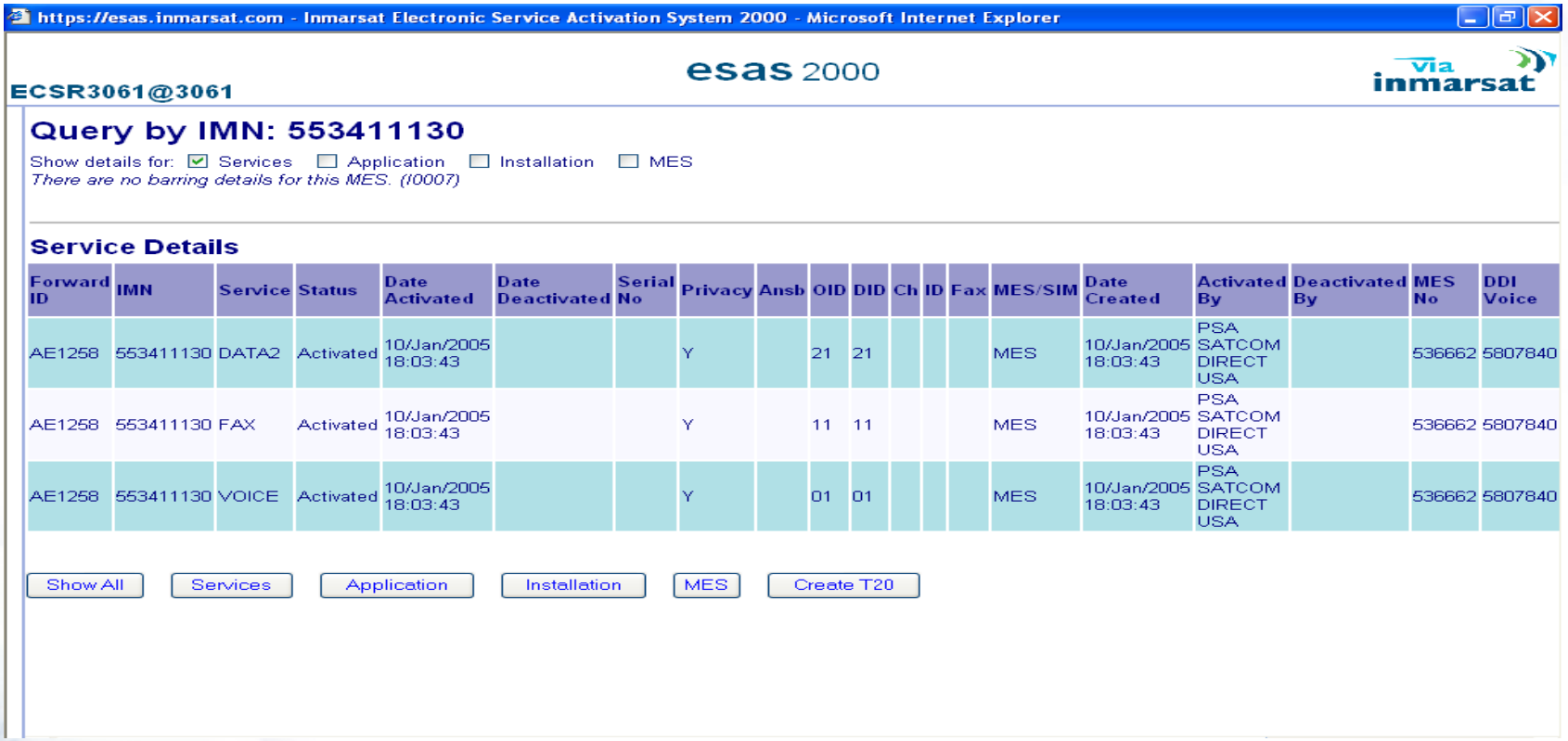
- Category “A”
  - Terminal is Independent and Stand-alone
- Category “B”
  - Shared With SDU
  - Terms:
    - Co-operative
    - Shared
    - Compatible
- It is CRITICAL The Proper Category is Registered With Inmarsat Through Satcom Direct !!!
  - Call if You Have Any Question About Your Mod or Configuration

“Things That Can Bite You” AES Classes

- **Class 1**: LGA; low rate packet-mode data (AFIS/ACARS)
- **Class 2**: HGA/IGA; circuit-mode service for telephony, circuit-mode data, voice, fax, PC
- **Class 3**: HGA/IGA; circuit-mode and packet-mode service for telephony, packet-mode data and circuit-mode data service (Class 2 plus AFIS/ACARS)
- **Class 4**: HGA/IGA; packet-mode data service for data service only (AFIS/ACARS)

Inmarsat Activation - ESAS

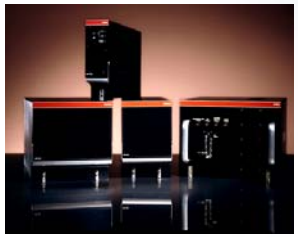
Inmarsat Activation - ESAS



Forward ID	IMN	Service	Status	Date Activated	Date Deactivated	Serial No	Privacy	Ansb	OID	DID	Ch	ID	Fax	MES/SIM	Date Created	Activated By	Deactivated By	MES No	DDI Voice
AE1258	553411130	DATA2	Activated	10/Jan/2005 18:03:43			Y		21	21				MES	10/Jan/2005 18:03:43	PSA SATCOM DIRECT USA		536662	5807840
AE1258	553411130	FAX	Activated	10/Jan/2005 18:03:43			Y		11	11				MES	10/Jan/2005 18:03:43	PSA SATCOM DIRECT USA		536662	5807840
AE1258	553411130	VOICE	Activated	10/Jan/2005 18:03:43			Y		01	01				MES	10/Jan/2005 18:03:43	PSA SATCOM DIRECT USA		536662	5807840

Typical Terminal Types

Aero-H/H+/I	Swift 64 (HSD)
Rockwell-Collins	Rockwell-Collins
Honeywell	Honeywell
Chelton	EMS Technologies
Thrane & Thrane	Thrane & Thrane
	Chelton



Aero-H/H+ Terminal Example

- Terminal Components for Typical Aero-H/H+
  - Satellite Data Unit
  - Radio Frequency Unit
  - High Power Amplifier
  - Cabin Interface Unit (R-C)
  - Control Display Unit (DLC-800, MIDU, GUI, etc.)
  - High Gain Antenna System
    - High-Gain Antenna(s)
    - Beam Steering Unit
    - Low-Noise Amplifier/Diplexer
    - High-Power Relay
    - Combiner

Satellite Data Unit

- Primary Interface to Other Subsystem Components
- Contains All Data Processing Functions, Modems, Codecs and Channel Tuning Synthesizers
- Interfaces With All Applicable Aircraft Systems
- Provides Multiple (High Gain & Low Gain) Channels of Operation

AES System Table

- For Each Satellite:
  - Satellite Identity
  - Satellite location, orbit inclination and right-ascension epoch
  - Satellite identifying P-channel frequency (1)
  - Satellite identifying P-channel frequency (2)
- For Each Satellite Region:
  - System table revision number
  - Satellite identity for system table segment
  - R and T-channel EIRP levels
- For Each GES in the Satellite Region:
  - GES identity
  - P*smc* and R*smc*-channel frequencies
  - Table indicating which spot beams are supported by the GES

Radio Frequency Unit

- Converts Wideband IF From SDU to L-Band For Delivery to the HPA for Transmit Operation
- Accepts Amplified L-Band Signal From the LNA/Diplexer and Down-Converts to VHF IF for SDU
- Provides the High Stability Frequency Reference (2016 MHz)
  - Oven-controlled crystal oscillator (OXCO)
- Operates in the Full Duplex Mode

High Power Amplifier

- Class A, 40-60 Watt Linear High-Power Amplifier
- Required for simultaneous multi-channel operation of the INMARSAT AeroH/H+ services.
- Added Robustness Allows Operations Over Multiple Channels in Marginal, Edge of Coverage, Environments (Approx 82N/S)

Power Control

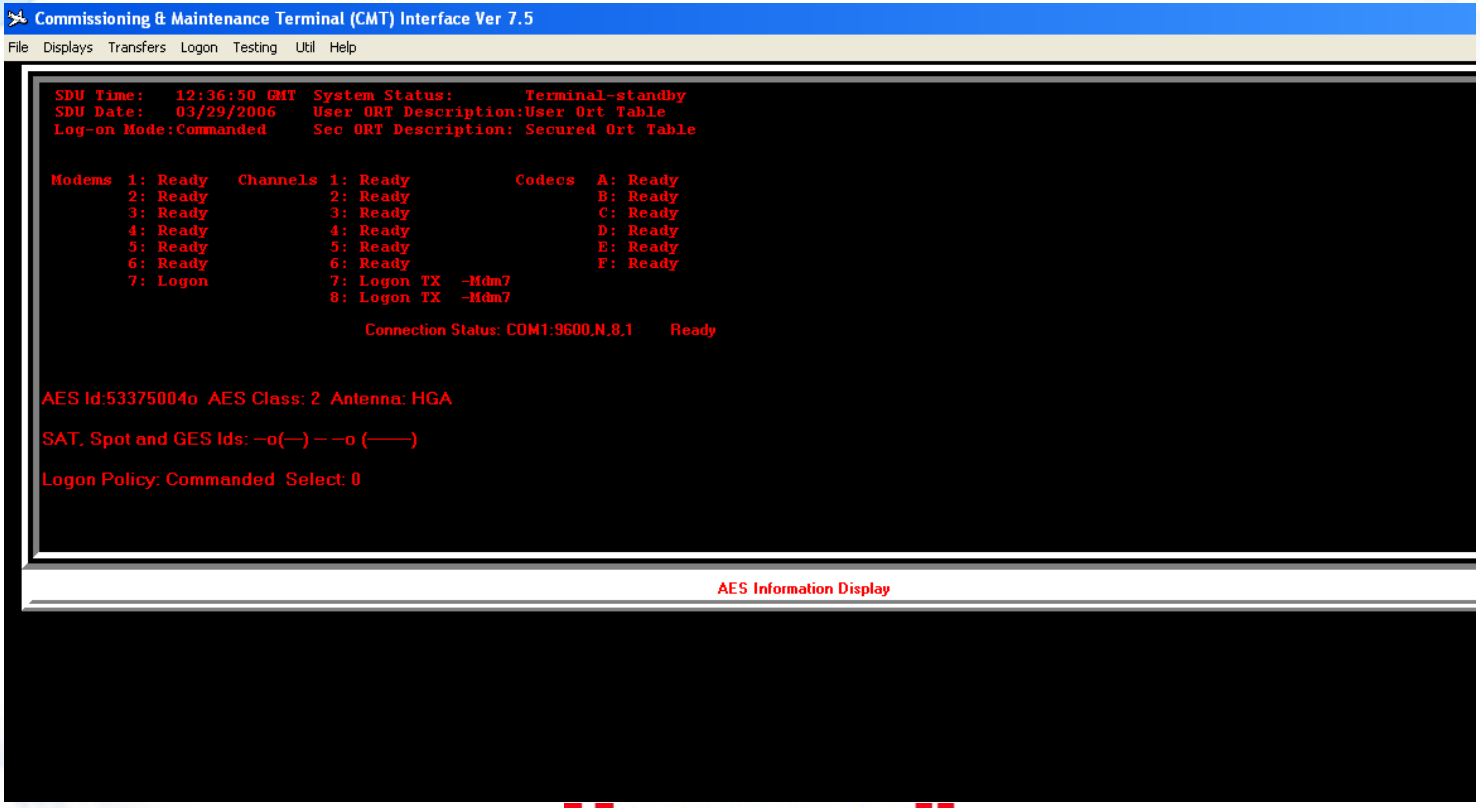
- Necessary to conserve L-band power on the satellite
- Enables an AES to provide multiple channels when conditions are favorable
- Enables an AES to provide minimal channels when conditions are not favorable

AES User Interfaces

MCDU/MIDU

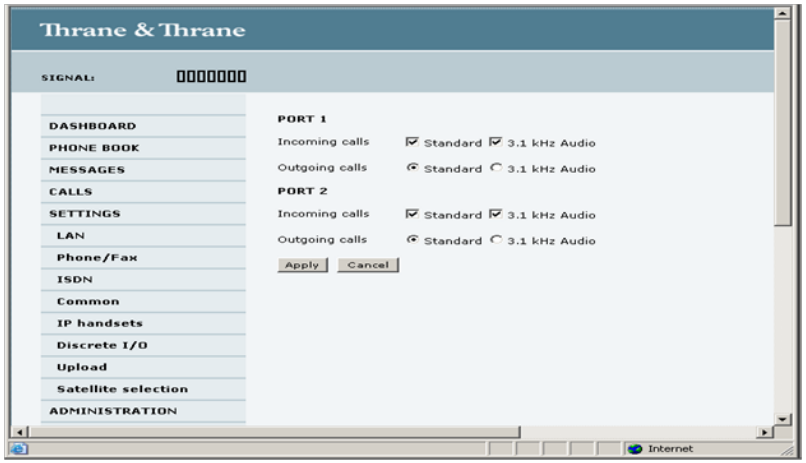
DLC

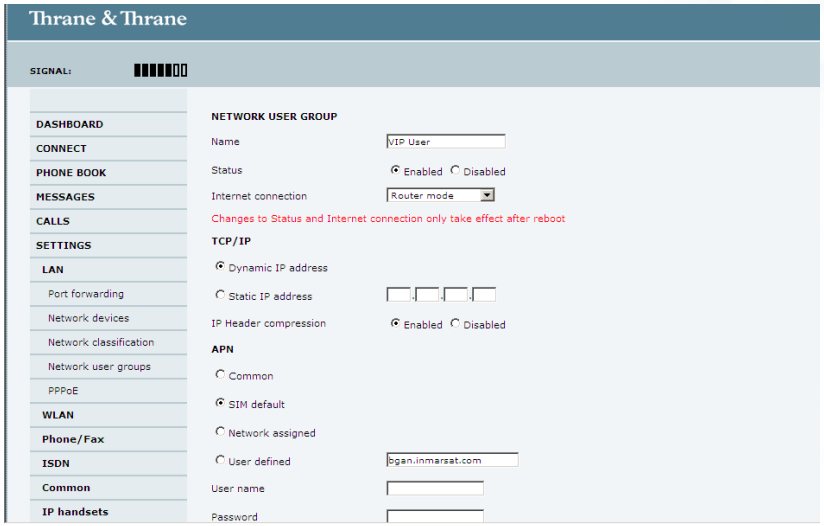
MCS-6000 CMTI

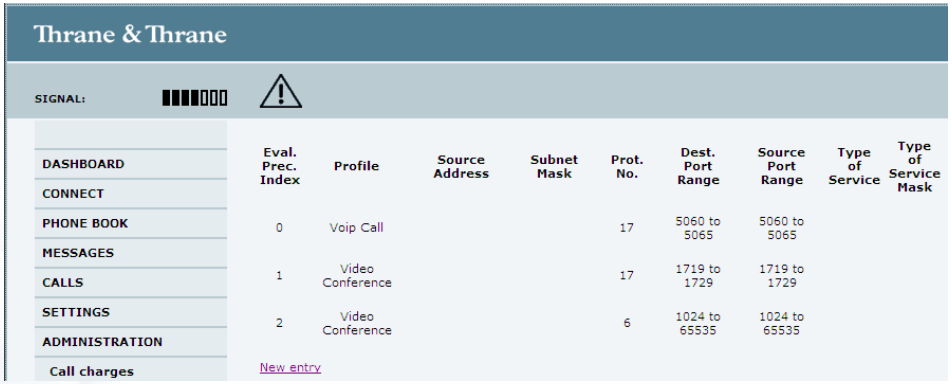


Honeywell

SwiftBroadband Interface Example







Swift 64 and SBB Terminals

- EMS
  - HSD-128
  - HSD-X
  - HSD-400

- Honeywell HD-128

- Thrane & Thrane Aero-SB Lite

SBB-Approved Terminals

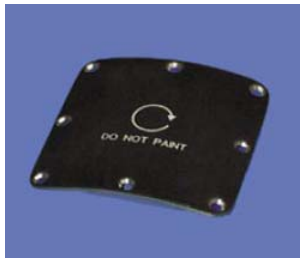
Assessment Number	Manufacturer	Avionics/HPA	Antenna	DLNA	Class	Associated Services
S6ES01	EMS Technologies	HSD-400i	AMT-50	COM Dev Type F ARINC 741 Type A (Cambridge)	6 (multi-channel)	Swift64
S6ES02	EMS Technologies	HSD-400	AMT-50	COM Dev Type F ARINC 741 Type A (Cambridge)	6 (multi-channel)	Swift64
S6ES03	EMS Technologies	HSD-400i	AMT-3800	COM Dev Type F ARINC 741 Type A (Cambridge)	6 (multi-channel)	Swift64
S6ES04	EMS Technologies	HSD-400	AMT-3800	COM Dev Type F ARINC 741 Type A (Cambridge)	6 (multi-channel)	Swift64
S6ES05	EMS Technologies	HSD-440	AMT-50	COM Dev Type F	6 (multi-channel)	Aero Classic, Swift64
S6ES06	EMS Technologies	HSD-440	AMT-3800	COM Dev Type F ARINC 741 Type A (Cambridge)	6 (multi-channel)	Aero Classic, Swift64
S6HW01	Honeywell Aerospace	HD-710 (standalone)	AMT-50	COM Dev Type F	6 (multi-channel)	Aero Classic, Swift64
S6HW02	Honeywell Aerospace	HD-710	AMT-50	COM Dev Type F	6 (multi-channel)	Aero Classic, Swift64
S6HW03	Honeywell Aerospace	MCS-7163 (MCS-6000/3000 + HD-710)	HGA-6000	COM Dev Type F	6 (multi-channel)	Aero Classic, Swift64
S6HW04	Honeywell Aerospace	MCS-7147 (MCS-7000/4000 + HD-710)	HGA-6000	COM Dev Type F	6 (multi-channel)	Aero Classic, Swift64
S6HW05	Honeywell Aerospace	MCS-7120 (HD-710 standalone- SBB/S64/Classic)	HGA-6000	COM Dev Type F	6 (multi-channel)	Aero Classic, Swift64
S6RK01	Rockwell Collins	SRT-2100B	AMT-50	COM Dev Type F	6 (single channel)	Aero Classic, Swift64
S7TT01	Thrane & Thrane	TT-5040A	TT-5006A	Thrane & Thrane Type S	7 (single channel)	
S7ES01	EMS Technologies	HSD-400i	AMT-3500	COM Dev Type F ARINC 741 Type A (Cambridge)	7 (single channel)	
S7TH01	Thales Avoinics	TopFlight	AMT-3500	COM Dev Type F Thales ARINC 741 Type A	7 (single channel)	

* As of Feb 09

Antennas

Antenna Nominal Gain Values

- Low-gain: 0 dBi



- Intermediate-gain: 6 dBi

- High-gain: 12 dBi

SwiftBroadband

Class 6

- High Gain Antenna
- Services

Voice 4kbps

SMS

+

ISDN

3.1KHz Audio

ISDN RDI

ISDN UDI

+

Streaming IP

32kbps

64kbps

128kbps

+

Standard IP

Up to 432kbps

SwiftBroadband

Class 7

- Intermediate Gain Antenna
- Services
- No ISDN

Voice 4kbps

SMS

+

Streaming IP

32kbps

64kbps

[128]kbps

+

Standard IP

Up to 332kbps

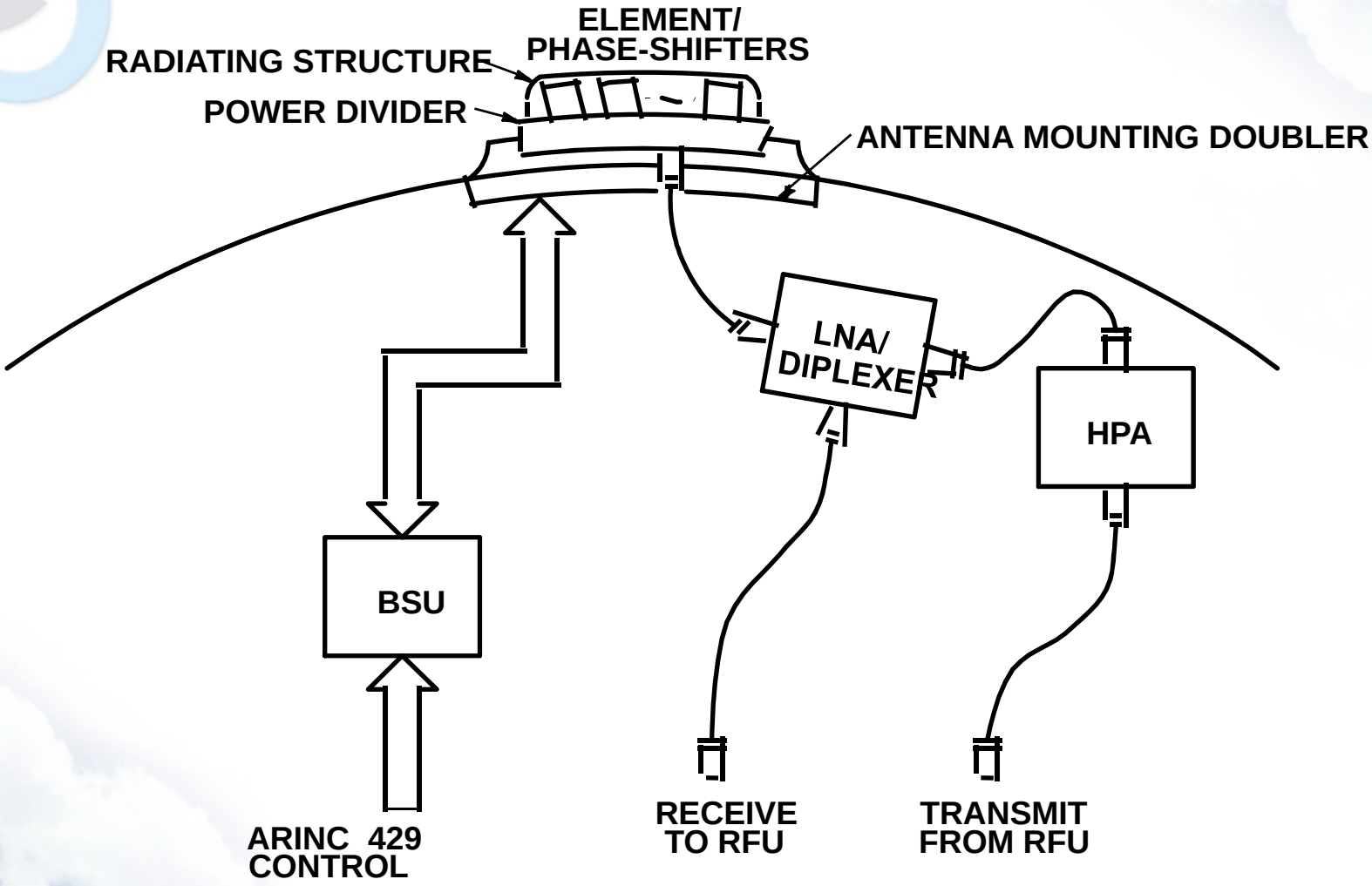
Depends on degradation

SwiftBroadband Product Specifications Matrix

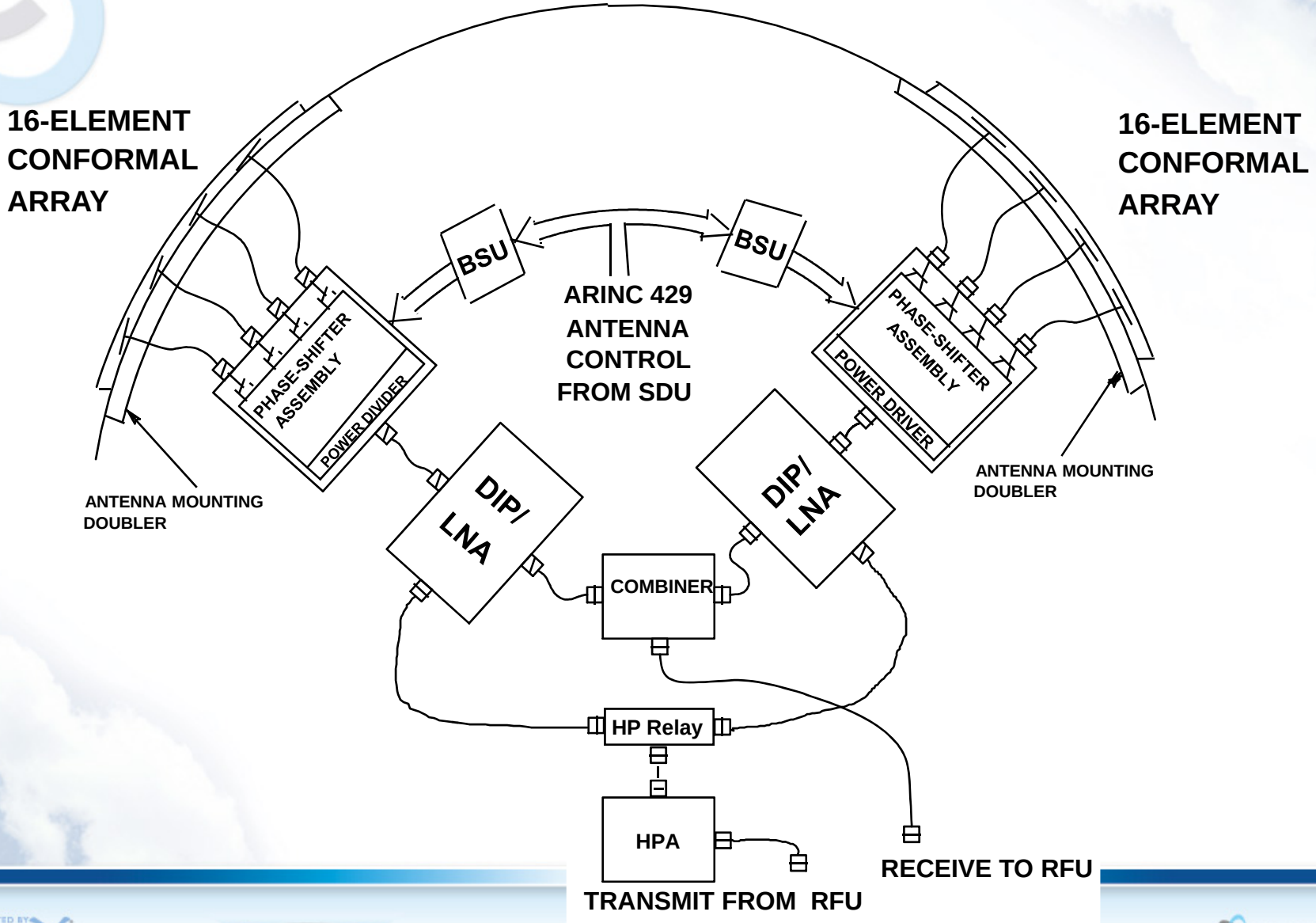
	6	7
Hardware Definition	**SwiftBroadband Class 6 (HGA)**	**SwiftBroadband Class 7 (IGA)**
Antenna (Examples of commercial antennae)		
Antenna G/T (at 5° elevation)	**-13 dB/K**	**-19 dB/K**
EIRP	**20 dBW**	**15.1 dBW**
CS Voice	Yes	Yes
Standard IP: Kbps Shared / best efforts physical layer*	**up to 432**	**up to 332**
Typical Standard IP Performance Kbps	**150-300**	**100-200**
ISDN	Yes	No
I.P. 'Streaming Mode' Guaranteed Throughput, Kbps	**32, 64, 128**	**32, 64, [128]**
I.P. 'Streaming Mode' Maximum, assuming multiple PDP contexts	**[224]**	**[160]**

All performance depending on AES characteristics and elevation / [ ] at high elevation

HGA Top Mount Installation



Side Mounted HGA Installation



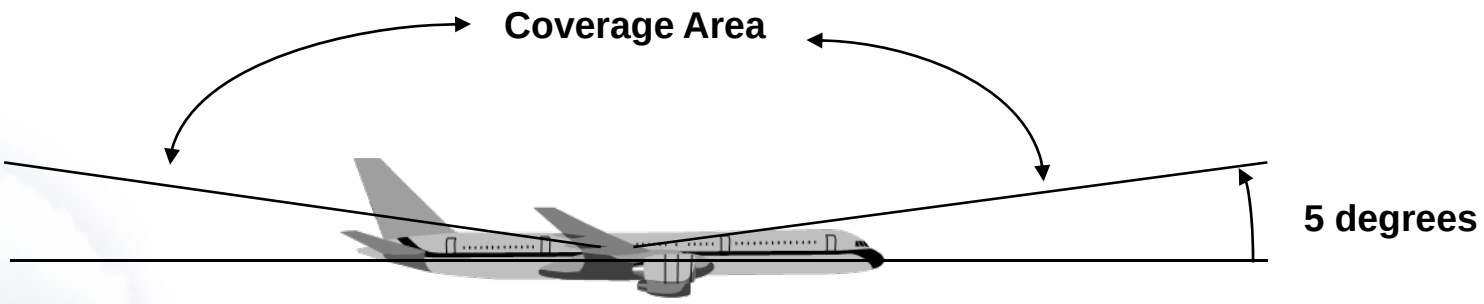
Antenna Subsystem Components

- Low Noise Amplifier/Diplexer
  - LNA amplifies weak L-band signal from antenna
  - Compensates for line losses to RFU
  - Diplexer provides isolation between transmit and receive lines for FDX operation

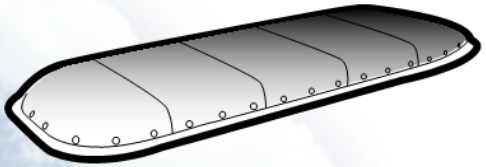
- Type “A”
- Type “F”

Antenna Coverage

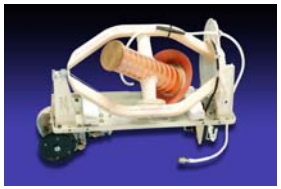
- Coverage Zone is the Hemisphere Above the Aircraft
  - Specified coverage (e.g., 12 dBi) must be maintained over 75% of the upper partial hemisphere from 5 to 90 degrees of elevation and all angles of azimuth
    - HGA cannot used as an HGA if gain drops below 7 dBi
    - Can still be used as a steerable LGA below 7 dBi
  - There will be keyholes (zones with poor or no coverage)
  - As antenna gain decreases due to attitude/location changes, TX power must be increased to maintain BER
  - All 40 Watts may be needed for the one data channel at edge of coverage



Typical Antenna Types



Aero-H/H+/I/Swift64
Ball Conformal
RACAL/Thales Tail Mount
OmniPless
TECOM
Chelton
EMS

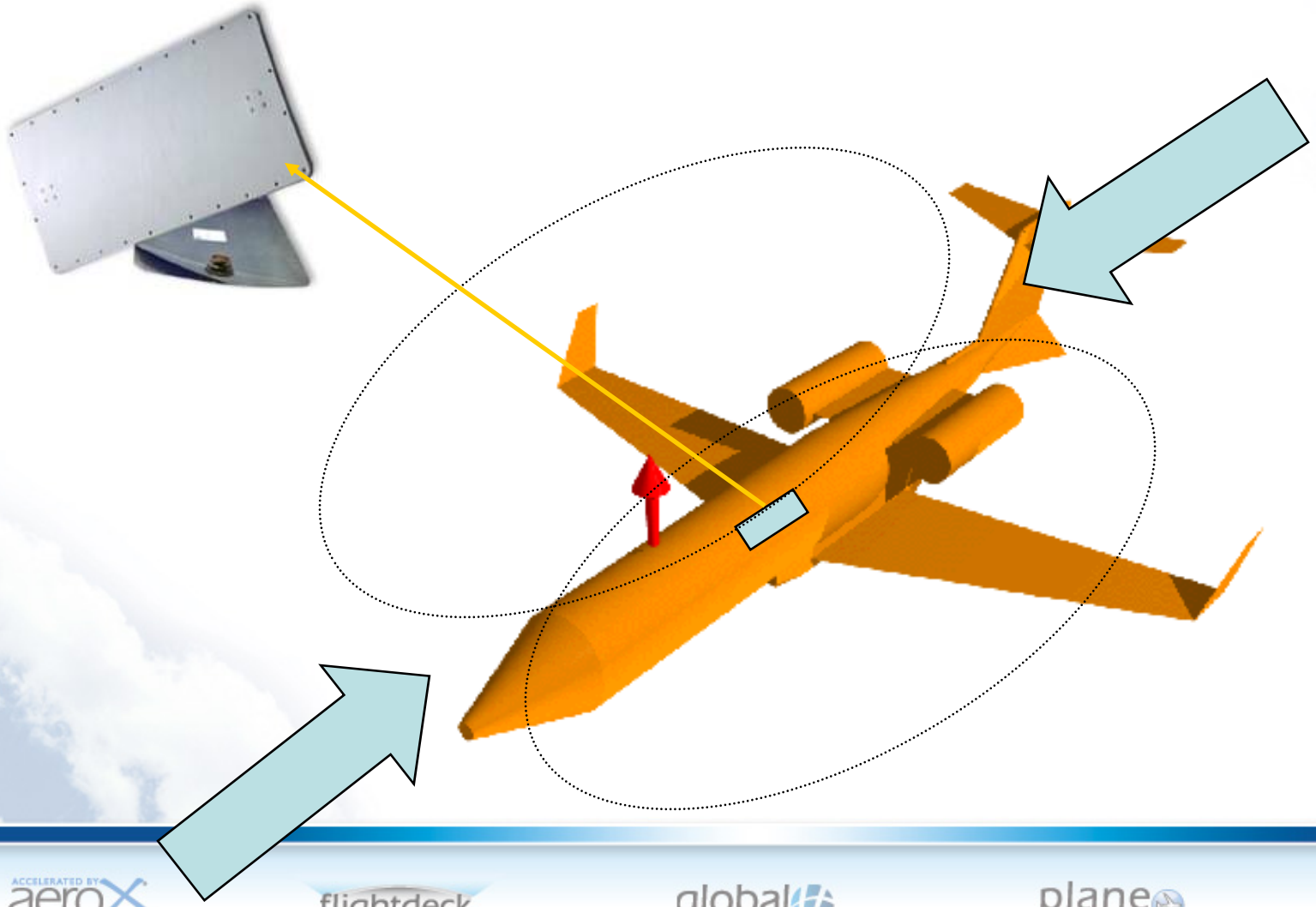


SBB-Approved Antennas

Assessment Number:	Model Name (Mounting):	Manufacturer Class: Single/Multi	Class:	Single/Multi:	Part Number:	Restrictions/Comments:
AHCH04	HGA7001 (Top Mount)	Omnipless Chelton Satcom Inc	6	Multi	Omnipless: 677A0173 Chelton: 804100015	7 th Order IM Compliant ARINC 781, Phased Array
AHES02	AMT50 (Tail Mount)	EMS Technologies Inc	6	Multi	0476A00377	9 th Order IM Compliant. ARINC 741, Mechanically Steered
AHES01	AMT3800 (Top Mount)	EMS Technologies Inc	6	Multi	1242A0010D00	onwards 9th Order IM Compliant ARINC 781, Phased Array
AICH01	IGA5006 IGA5006A (Top/Tail)	Omnipless Chelton Satcom Inc Thrane & Thrane	7	Single	Omnipless (5006): 677A0002 Chelton (5006): 1010100 Thrane (5006A): 405006APMA	Single SBB or Classic only. Mechanically Steered
AHBA01	Airlink HGAS (Dual Side Mount)	Ball Aerospace & Technologies Corp	6	Multi	HGA: 513738506 to 518 (inc) BSU: 513739509xx or 510xx Cable Assy: 510733500 to 510 or 513881500 to 509	15 th Order IM Compliant. ARINC 741, Phased Array
AHCH01	HGA6000 HGA6500 (Tail Mount)	Omnipless Chelton Satcom Inc	6	Multi	HGA6000: 677A0161 HGA6500: 677A0189	ARINC 741, Mechanically Steered ARINC 741/781, Mechan' Steered 7th Order IM Compliant
AICM01	SatLite (Top Mount)	CMC Electronics	7	Single	TBA	Single SBB or Classic only. ARINC 741/781, Phased Array
AIES01	AMT3500 (Top Mount)	EMS Technologies Inc	7	Single	1242A201001	Single SBB or Classic only. ARINC 741, Phased Array
AHCM01	CMA2102SB (Top Mount)	CMC Electronics Inc	6	Multi	100602198003	11 th Order IM Compliant ARINC 741, Phased Array

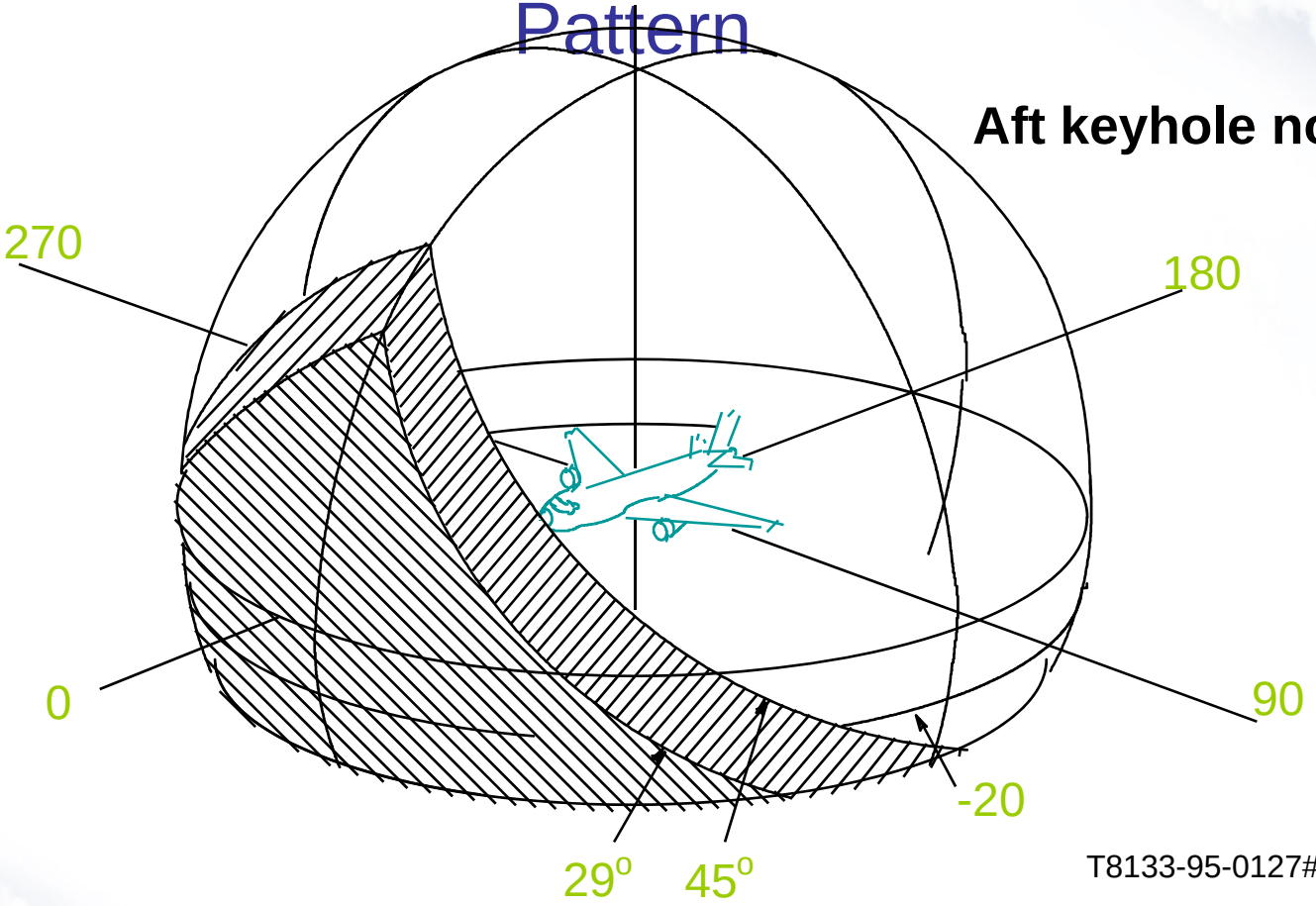
* As of Feb 09

Conformal Antenna Keyhole Effects



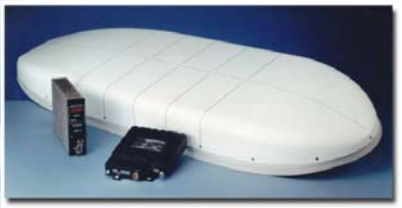
Typical Side Mounted Antenna Pattern

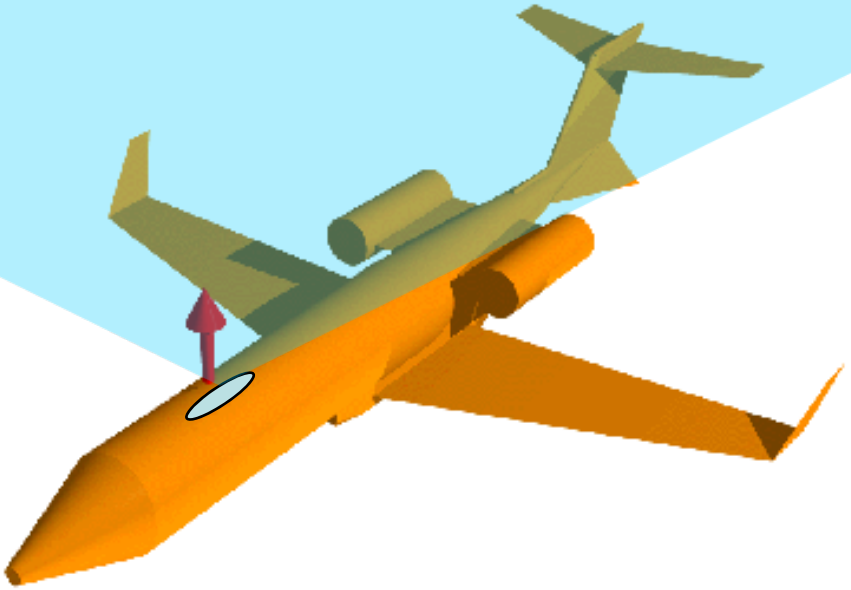
Aft keyhole not shown



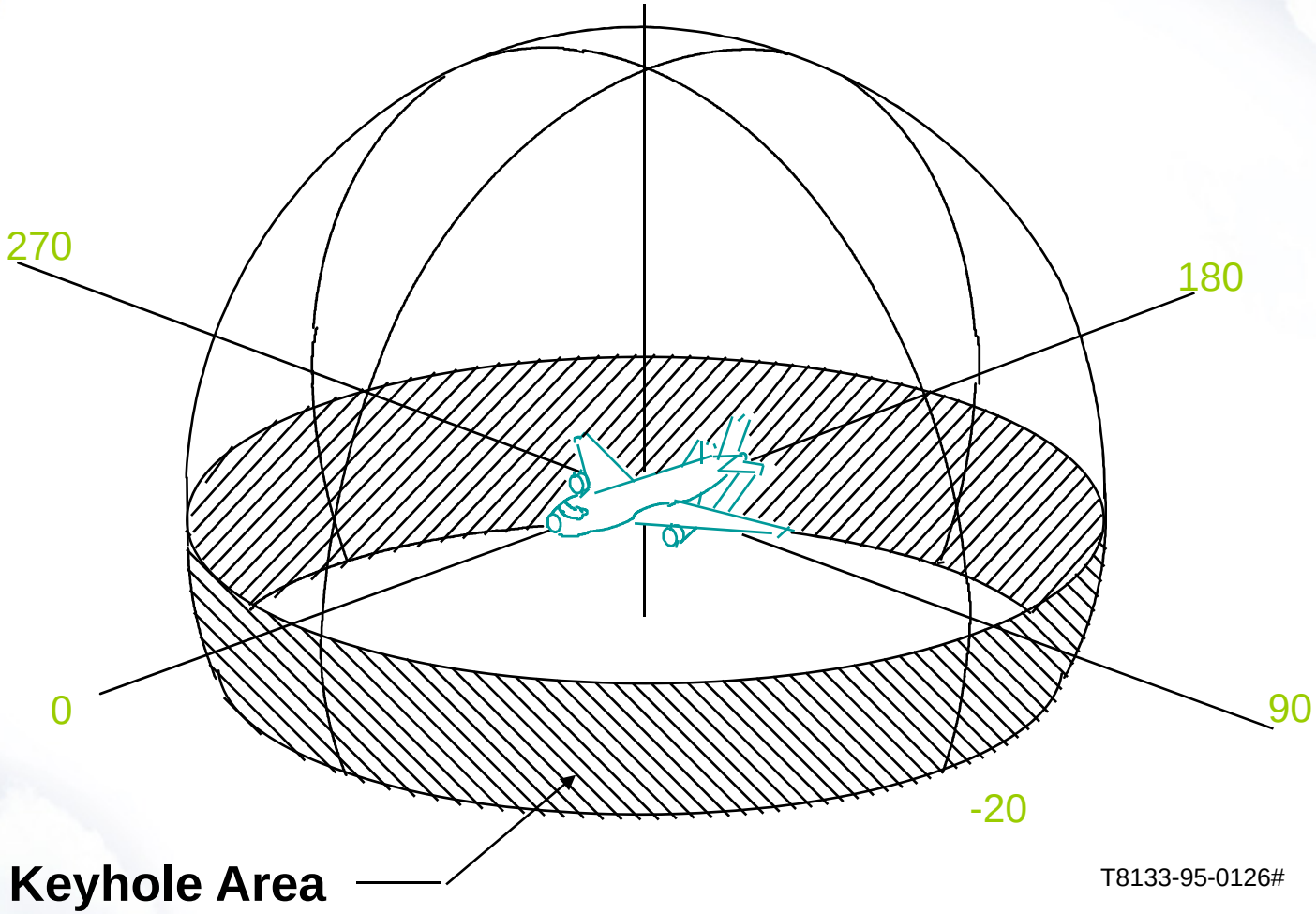
Uses two BSUs & DLNAs -- one side in use at a time (BSU decides which)
May provide better coverage at low elevation angles (e.g., arctic routes)

Centerline Topmount Antenna

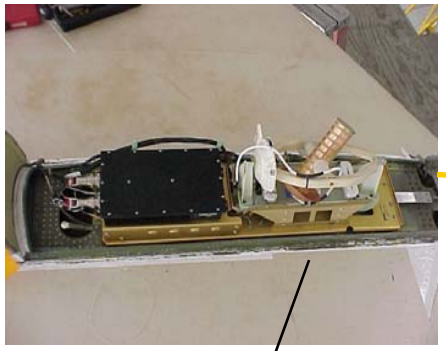


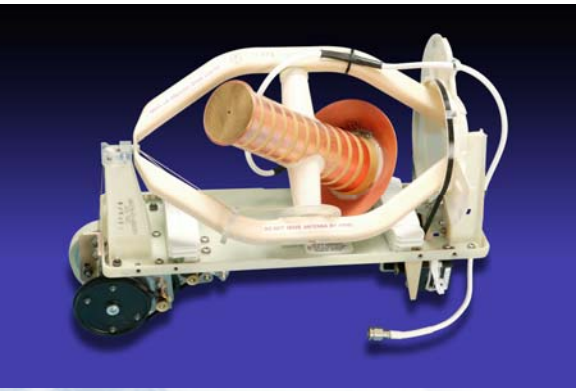


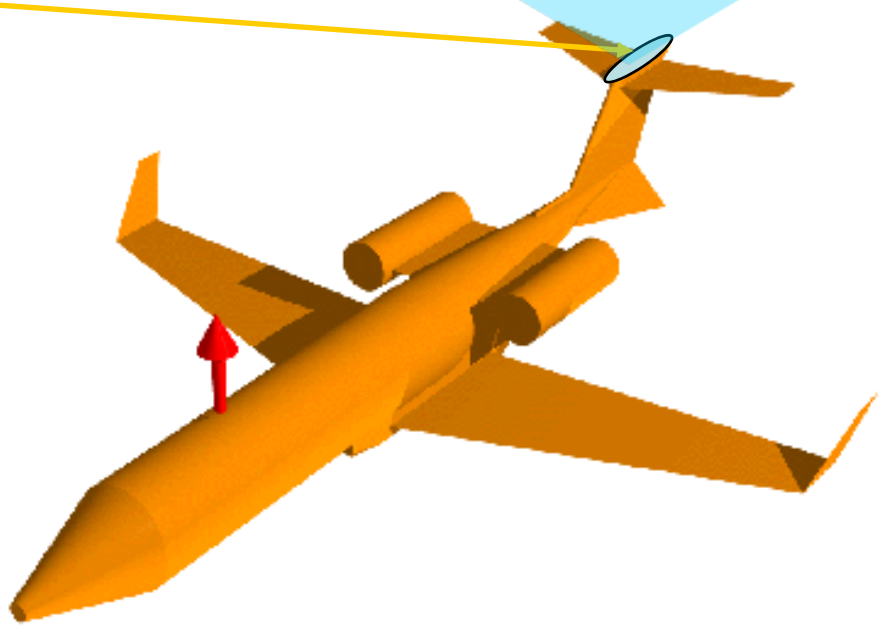
Top Mounted Antenna Coverage



Tail-Mount Antenna

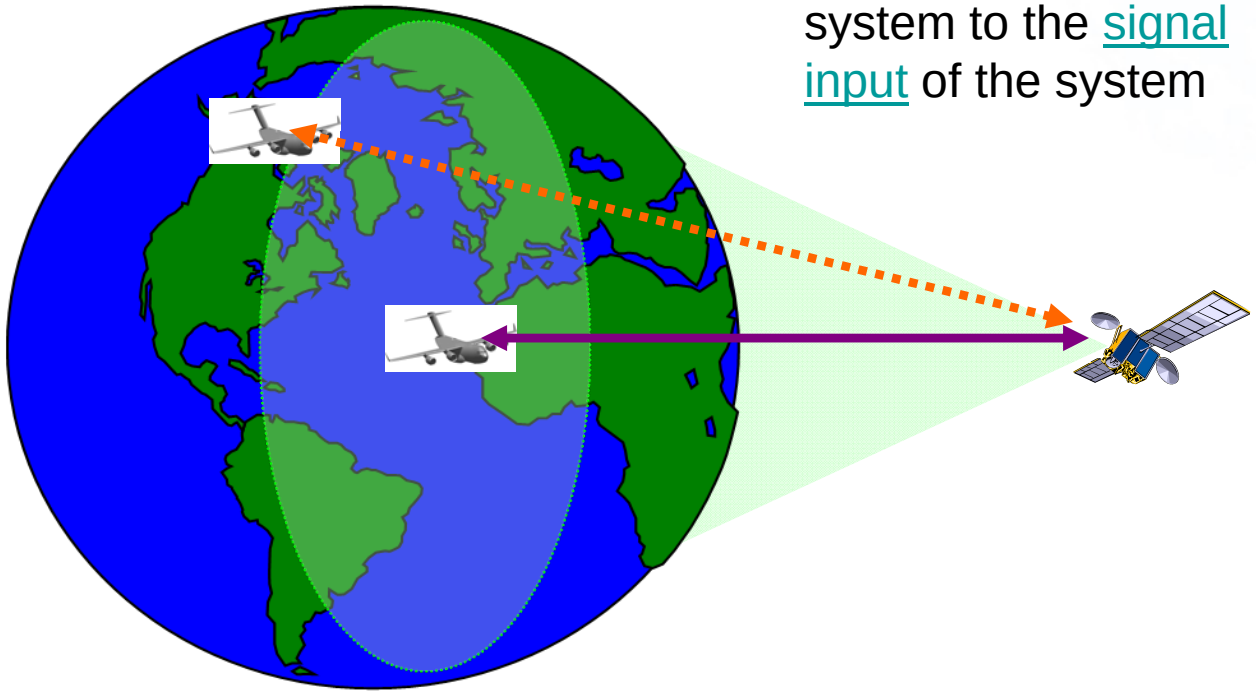


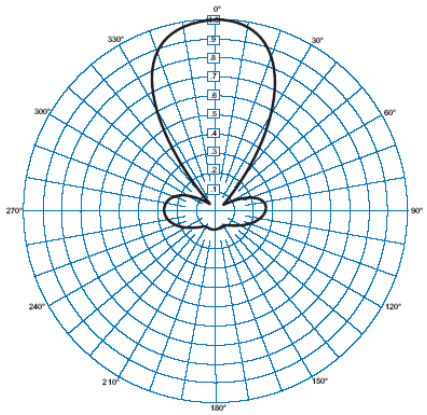




Gain

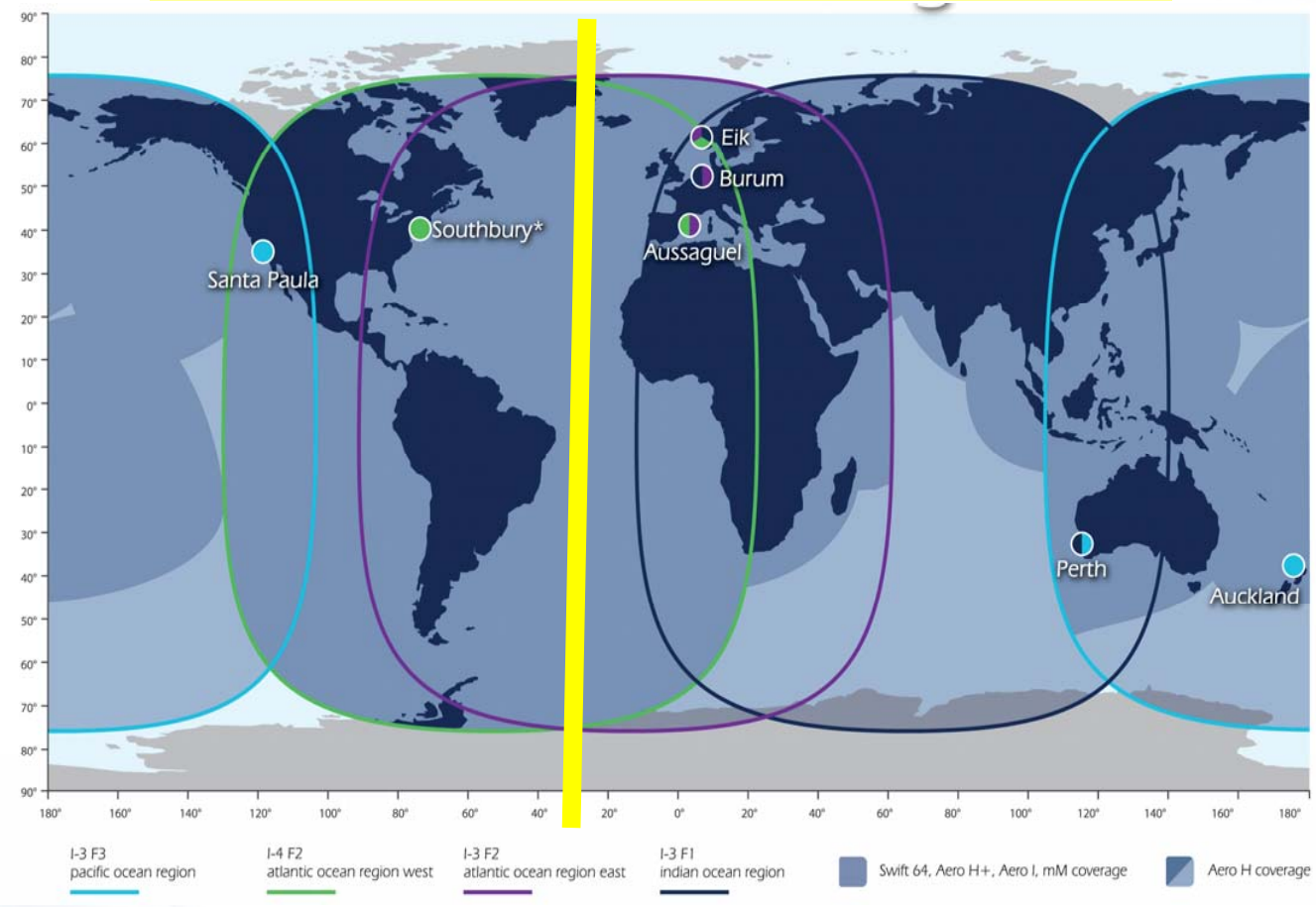
Gain is usually taken as the mean ratio of the signal output of a system to the signal input of the system





Transition Points

Ex: Transition Point Traversing AOR to AOR-E



The Phone Call…

ATG & GTA

- **Air-to-Ground Calling**
  - Fairly Simple and Straightforward
  - Secure and Non-Secure
- **Ground-to-Air Calling**
  - Voice
    - Very Complicated, i.e., Ocean Region, GES, etc.
    - Secure and Non-secure
  - Faxing
    - Very Difficult for Users
    - Secure Routing Issues
  - AESID and DDI
    - Which One to Call
- **Stratos, Vizada, Others**
  - No Special Technical Support Services for Aero
  - Charges Full Tariff Rates From LES

Dialing

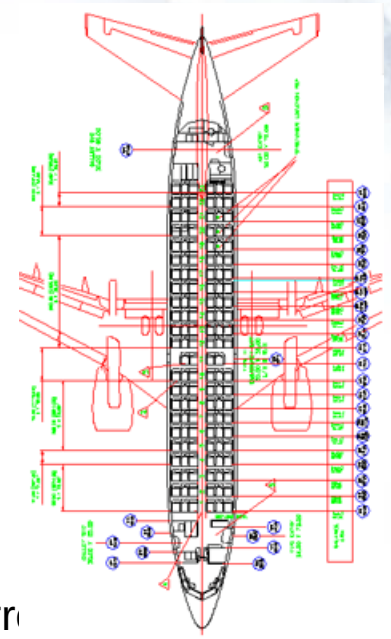
- Dial Sequence
  - 00: INMARSAT Prefix
  - 1: Country Code for US; “49” for Germany, etc.
  - 301: Area or Other Country Element Code
  - 981: Local or City Code
  - 5058: Telephone Number
  - #: Initiates the Call; If Not Pressed, Call Will Begin in 10 Seconds
- Dial Tone is Silenced When First Digit is Entered
- After the # is Entered, the Calling Party Will Hear Progress Tones
- Once a CONNECT Message is Received the LES Will Generate Ring Tones From PSTN

Progress Tones

"Audible Situational Awareness"

TONE	FREQUENCY	TIME
Dial Tone	350 and 440 Hz	Continuous
Interrupted	Simultaneous 350 and 440 Hz	750 ms on, 250 ms off
Busy	425 Hz	500 ms on, 500 ms off
Network Busy	425 Hz	250 ms on, 250 ms off
Failure	350 Hz for 500 ms 450 Hz for 500 ms	Alternating
Call Proceeding	350 Hz	250 ms on, 2 seconds off
Ring	425 Hz	1.5 seconds on, 3.5 seconds off

AES-ID and DDI

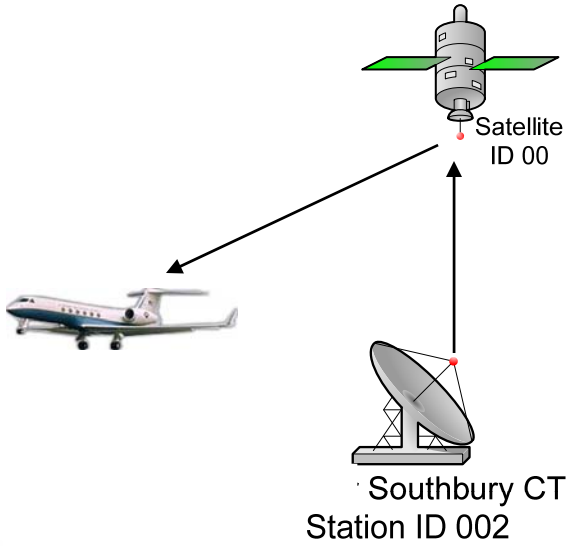


- Up to 6 Different Channels
  - Aircraft Earth Station Identification
  - Main AES-ID to Reach Aircraft
    - Same as ICAO / Mode-S / Octal
    - Example: **53402371**

  - Direct Dial Interface (DDI)
    - Used to Reach Individual Handsets
    - Six Digits Plus Two Digit Extension
    - Not All GES May Have AES-ID and DDI Numbers Corr (Valid)
    - H+/I GTA Faxing Will Not Work if Wrong DDI is Used
    - Example: 58001234

NOTE: When calling the AES-ID, all phones will ring. By using the DDI, only that specific Handset will ring.

GTA Calling via Satcom Direct



Ops Center retrieves DDI and Terminal ID from Satcom Direct database, sends call request for AES directly to GES where AES is logged on

Satcom Direct Ops Center

"You have reached aircraft 1677.

To call the CSO, press 1.

To place a secure call, press 2."

321.751.7859

321.751.7859

Owner Requirements Table (ORT)

- What Is an ORT?
  - The Main Configuration Setup
  - Usually Entered Into Database During Commissioning
- SDU
  - Customer-Preferred Service Provider Information
  - Telephone System Configuration Information
- Importance
- Who Maintains?

OPSEC Reminders

- Non-secure Aero-H and Swift64 Can Be and Will Be Monitored
- Internet Access
  - 28# Accesses the WWW (and all that goes with it!)
    - For LES 002, Stratos Acts as ISP
    - For LES 001, Vizada Acts as ISP

Service Terms

Land-Mobile Service	Aeronautical Service	Maritime Service
Global Area Network (GAN) or "M4"	Swift 64	Fleet 33/55/77
Broadband Global Area Network (BGAN)	SwiftBroadband	FleetBroadband

* Swift 64 sometimes referred to as "HSD" or ISDN

Swift64 Applications

- Non-secure and Secure Voice
- Non-secure and Secure P-P/Serial Data
- Non-secure and Secure IP Data
- Imagery
- Video Teleconferencing
- Medical Telemetry

Swift64
High Speed Solutions

- Two Types of Service:
  - Circuit Mode/Circuit Switched (Dedicated Line)
    - User “Owns” the Channel
    - ISDN (Integrated Services Digital Network)
  - Mobile Packet Data Service (Shared Bandwidth)
    - Multiple Users in Same Ocean Region May Share Channel
    - Packet Data Service Using Internet Protocol (IP)
- Limited to the Areas Supported by Spot Beams

Swift64 Circuit Mode

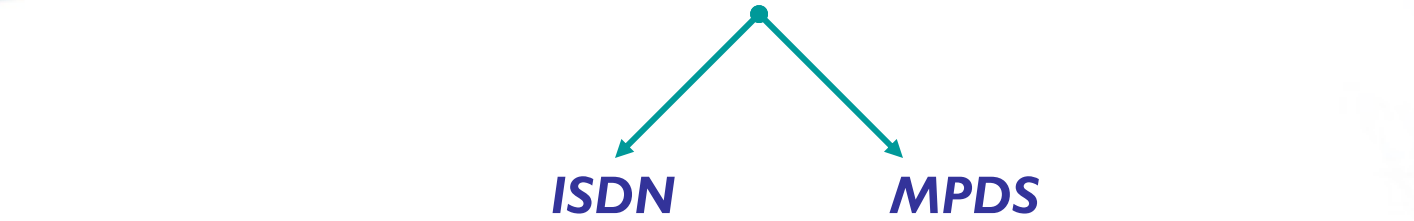
- ISDN is a Digital Telephone Circuit That Can be Used for Voice, Fax, and Data Communications
- Faster Data (Usually From One to Four 64 Kbps Channels Which Can be “Bonded” Together)
- Users Pay a Per Minute Price for Exclusive Use of the Channel While in Circuit Mode

Swift64 MPDS

(Mobile Packet Data Service)

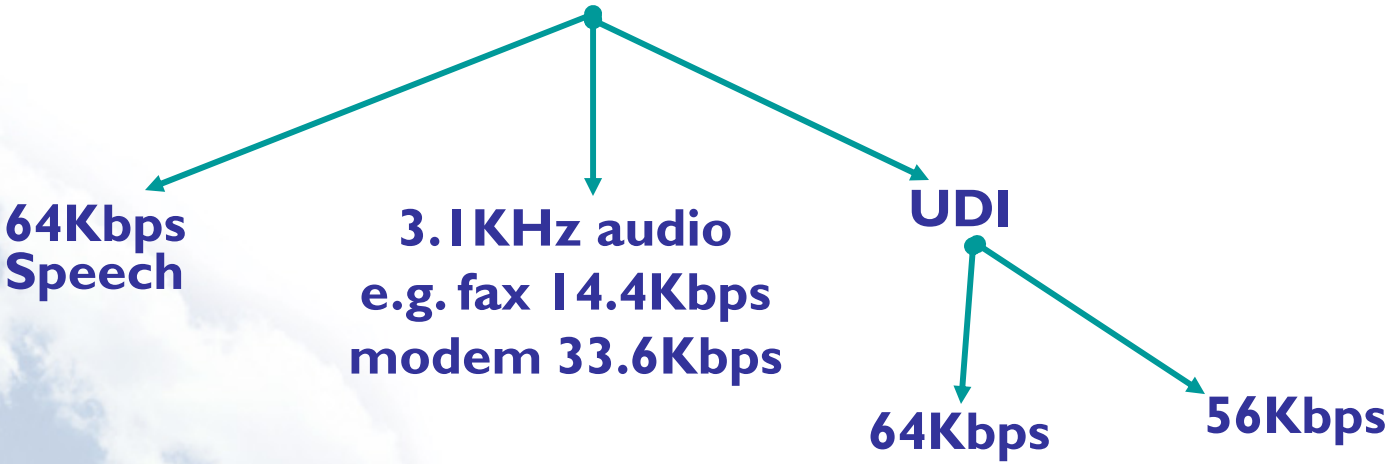
- Packet Data Service Using Internet Protocol (IP)
- Users are Charged per Mbits of Data Sent or Received Not for the Time They are Connected
  - "Always On"
  - May be More Cost Effective Depending on Application
  - Used More in Business Aviation and Maritime Applications

Swift64



- *Per Minute connection*

- *Per Megabit Transfer*



A Glimpse of the Future

(Well, Actually Now…)

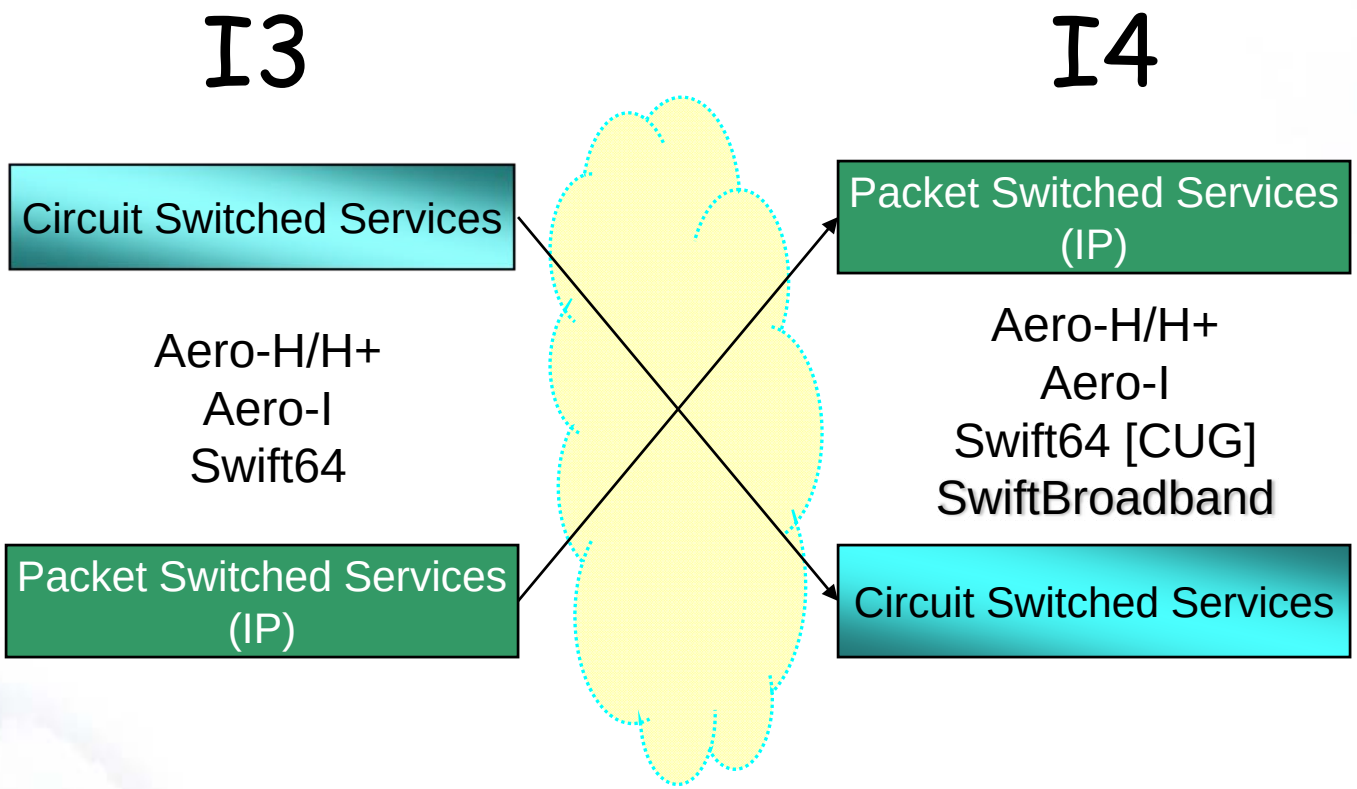
- 4th Generation Inmarsat
  - F1 Launched 11 March 2005
  - F1 On Station 28 May 2005 in IOR
  - F2 Launched 8 Nov 2005
  - F2 On Station March 2006 in AOR
  - F3 Launched 10 Aug 2008

- All On Station and Service Available Worldwide as of 24 February 2009
  - Americas
  - Europe, Middle East, Africa (EMEA)
  - Asia-Pacific

Satellite Access Stations

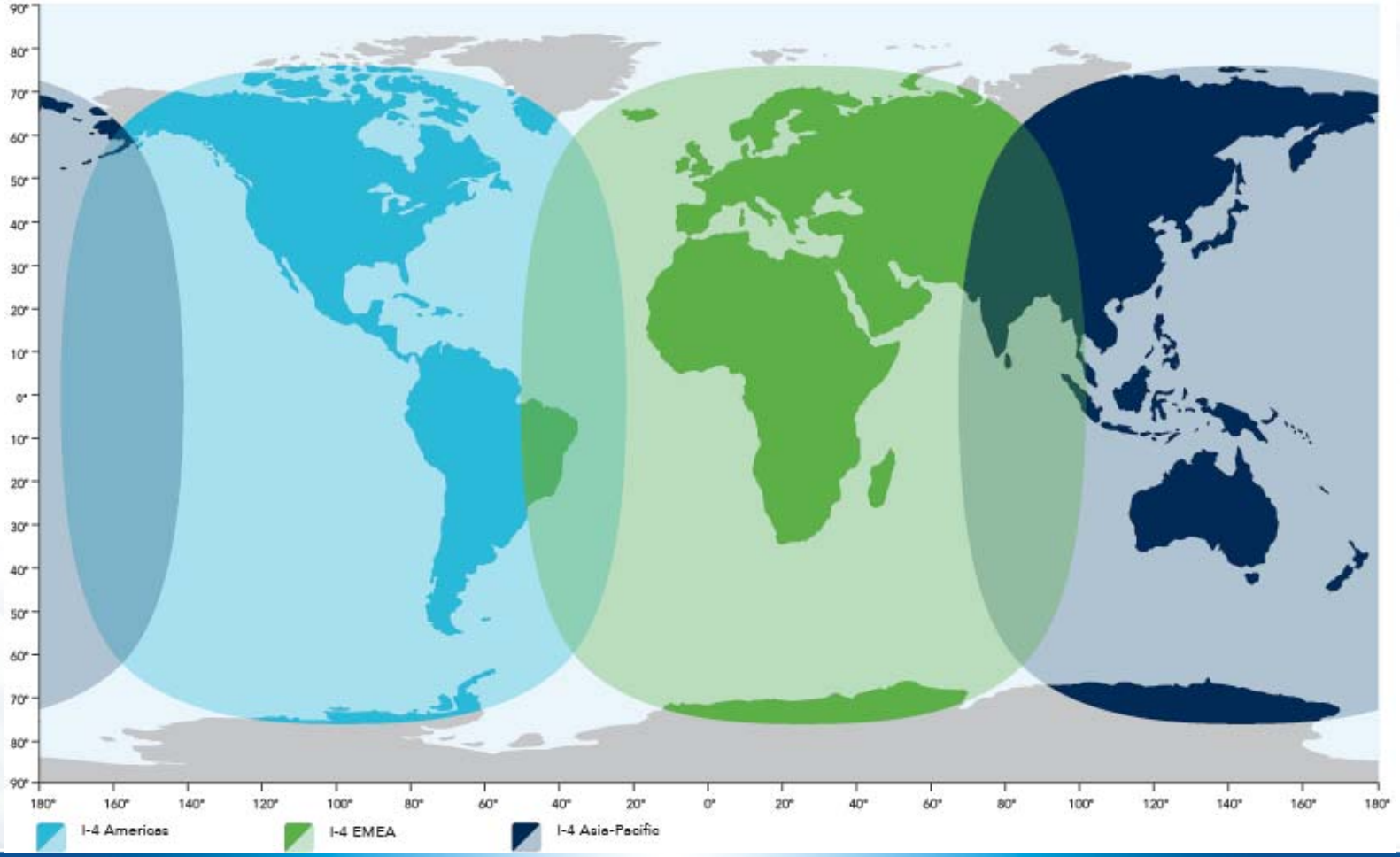
- Three Satellite Access Stations (SAS)
  - Fucino, Italy
  - Burum, Netherlands
  - Paumalu, Oahu, Hawaii

Transition to I4

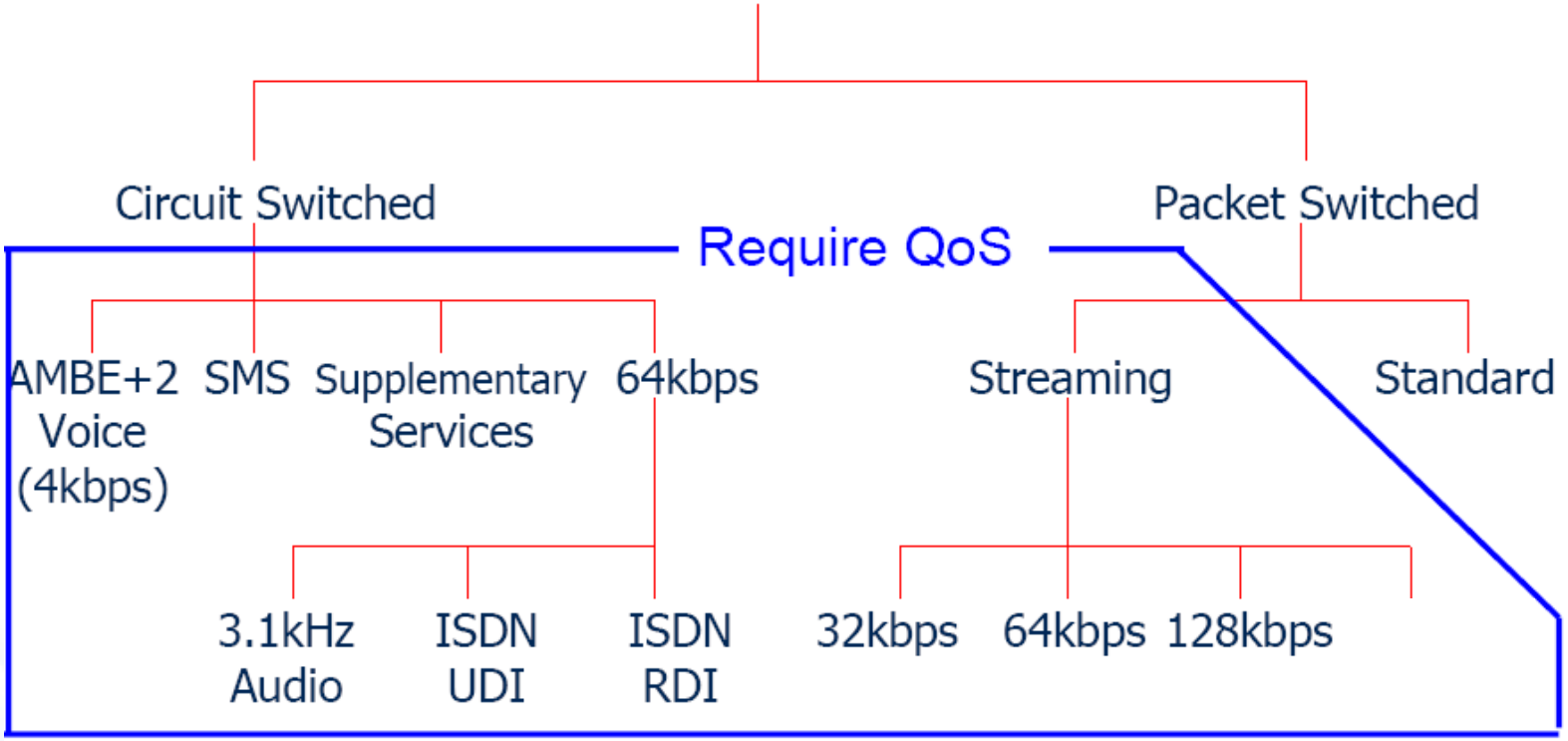


I-4 Coverage

(As of 24 Feb 2009)



SwiftBroadband – Two Services



Network supports CS & PS service to terminal simultaneously. Only 1 CS service (plus SMS & supplementary services) is supported at any one time.

SwiftBroadband

- Standard Service Offered by Inmarsat Will Allow Customers Access to an Unlimited Range of IP Based Services, Such as:
  - Email Access
  - LAN Access
  - File Transfer
  - Internet Access
  - Audio and Video broadcast
  - Video Conference
  - Secure IP-based Connections

Service Summary Comparison

- **Aero-H**
  - Process Non-secure & Secure Phone Calls
  - Send and Receive Non-secure & Secure Fax
  - Send and Receive Non-secure & Secure Serial Data (e.g. ViaSat)
  - 9.6/4.8kbps voice quality, lower cost per minute
- **Swift 64**
  - Process Non-secure & Secure Phone Calls
  - Send and Receive Non-secure & Secure Fax
  - Send and Receive Non-secure & Secure TCP/IP Data
  - 64kbps voice and data quality, higher cost per minute
- **SwiftBroadband**
  - Packet switched
    - IP based
    - Always on
  - Services
    - Up to 432kbps
    - Streaming classes
      - 32, 64, 128kbps (up to 224kbps)
    - ISDN
    - Voice
    - SMS
  - Coverage
    - Global through narrow spot beams

On-Site Training

- Available At Your Location
- Course Cost: FREE
- Request Travel & Per Diem
- Contact Satcom Direct to Discuss

If you'd like the full familiarization course conducted at your facility, please contact me at 703.549.3009 or emoren@satcomdirect.com

Summary

- Poised to Support Business Aviation, Government and Military Customers With Existing and Emerging Aeronautical Satellite Services
- Training Center of Excellence
- **Our #1 Priority is to Keep You Connected!**

Questions?