A banner image for HiSeasNet featuring a satellite in the top left, a person's silhouette on the right, and a dark background with a blue glow.

# HiSeasNet

INTERNET FOR OCEANOGRAPHIC SHIPS AT SEA

## HiSeasNet

*Any Ocean Any Data Any Time*  
**Systems Architecture and Operation**

**Kevin Walsh**

**Scripps Institution of Oceanography**

**[kwalsh@ucsd.edu](mailto:kwalsh@ucsd.edu)**

**RVTEC Update 2017**

# HiSeasNet – 5 earth radii View



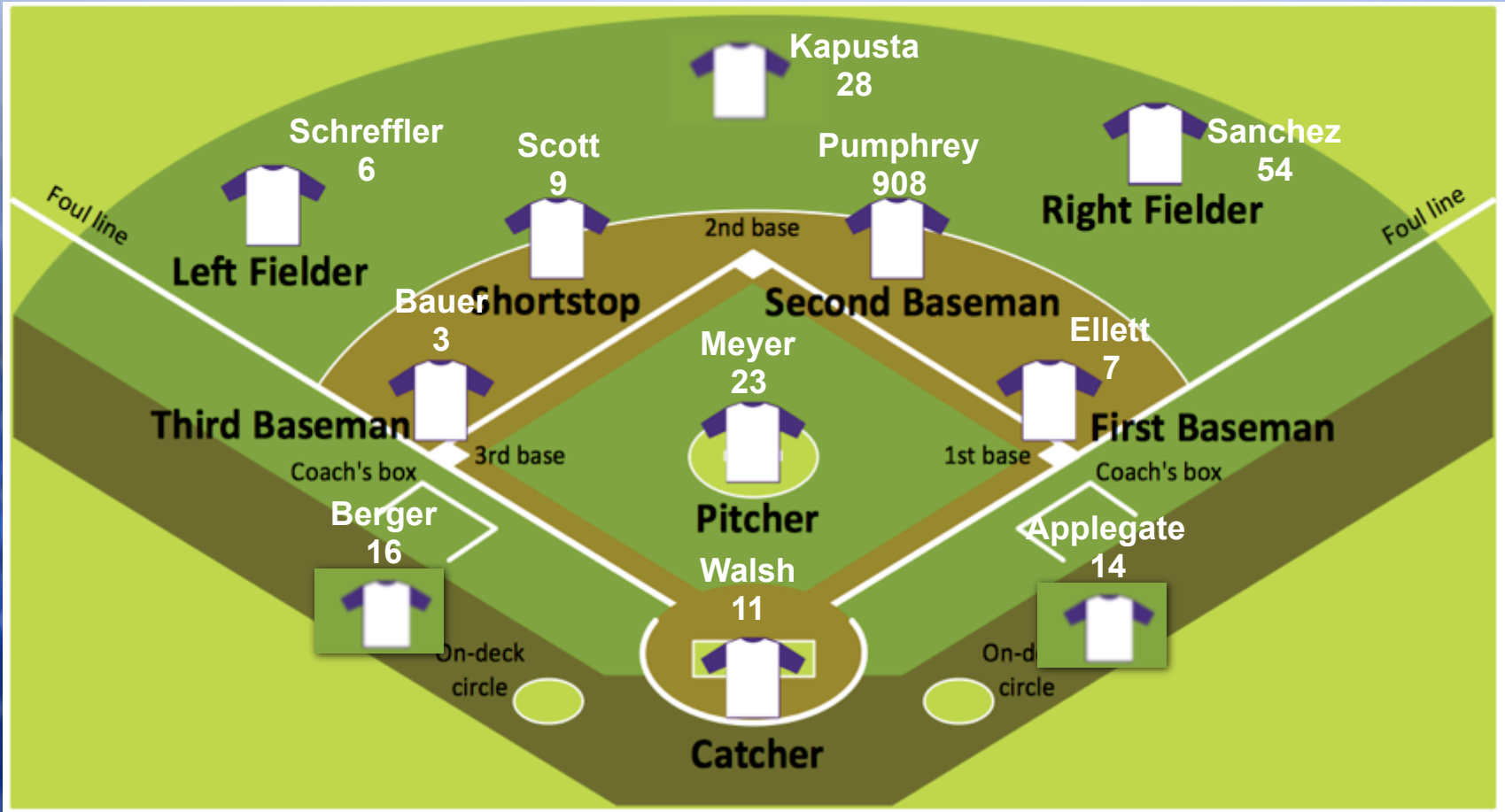
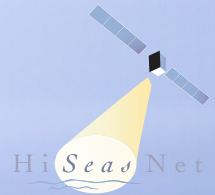
- ◆ **HiSeasNet: Changes during 2017**
  - ◆ Now a specialized service under Shipboard Technical support
  - ◆ Leadership from Ship Operations & Marine Technical Support
- ◆ **Support Team**
- ◆ **Ships Served**
- ◆ **Ocean Areas of Operations**
- ◆ **Systems of Systems Operation**
- ◆ **Bandwidth Expansions and 18 MHz prototype**
- ◆ **What's next: Life cycle replacements and engineering for uninterrupted Internet access**

# About HiSeasNet



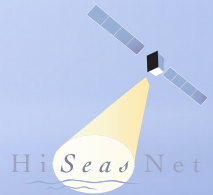
- ◆ **UC San Diego - SIO SOMTS based project to bring full-time, scalable bandwidth Internet connections to ships at sea in the University-National Oceanographic Laboratory System (UNOLS) community.**
- ◆ **Currently twelve ships**
  - ◆ **Two with C and Ku systems, Six with C, 3 with Ku only**
- ◆ **Lease dedicated space segment on global C-band, and Ku footprints that cover the majority of the Atlantic, Pacific and Indian Oceans**
- ◆ **Use five satellites: IS-23 (Atlantic), IS-34 (Atlantic), IS-18 (Pacific), Eutelsat 115 (Pacific), IS-903 (Indian) Operate and maintain the earth station on the roof of San Diego Supercomputer Center at UC San Diego**
  - ◆ **Two 7.2 meter dishes for C-band and one 3.8 meter Ku-band**
  - ◆ **Network Access Point for commercial ISPs, CENIC, Pacific Wave, and Internet2**

# HiSeasNet Support Team



HiSeasNet Support Line (858)822-3356 [hiseasnet@ucsd.edu](mailto:hiseasnet@ucsd.edu)

# Ships Served by HiSeasNet



R/V Atlantis



R/V Neil Armstrong



R/V Marcus G. Langseth



R/V Atlantic Explorer



R/V Roger Revelle



R/V Sikuliaq



R/V Oceanus



R/V Thomas G. Thompson



R/V Sally Ride



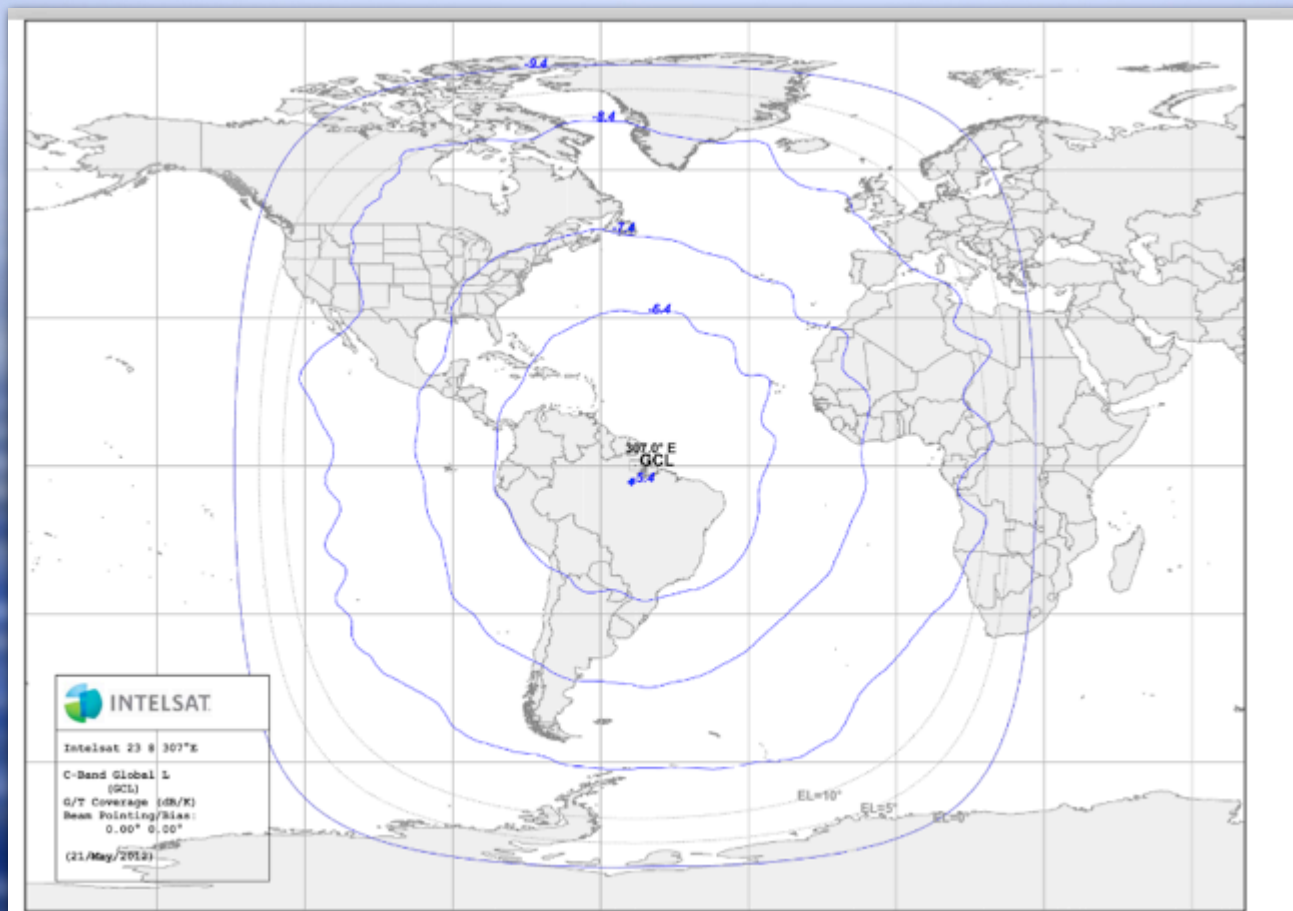
R/V Walton Smith



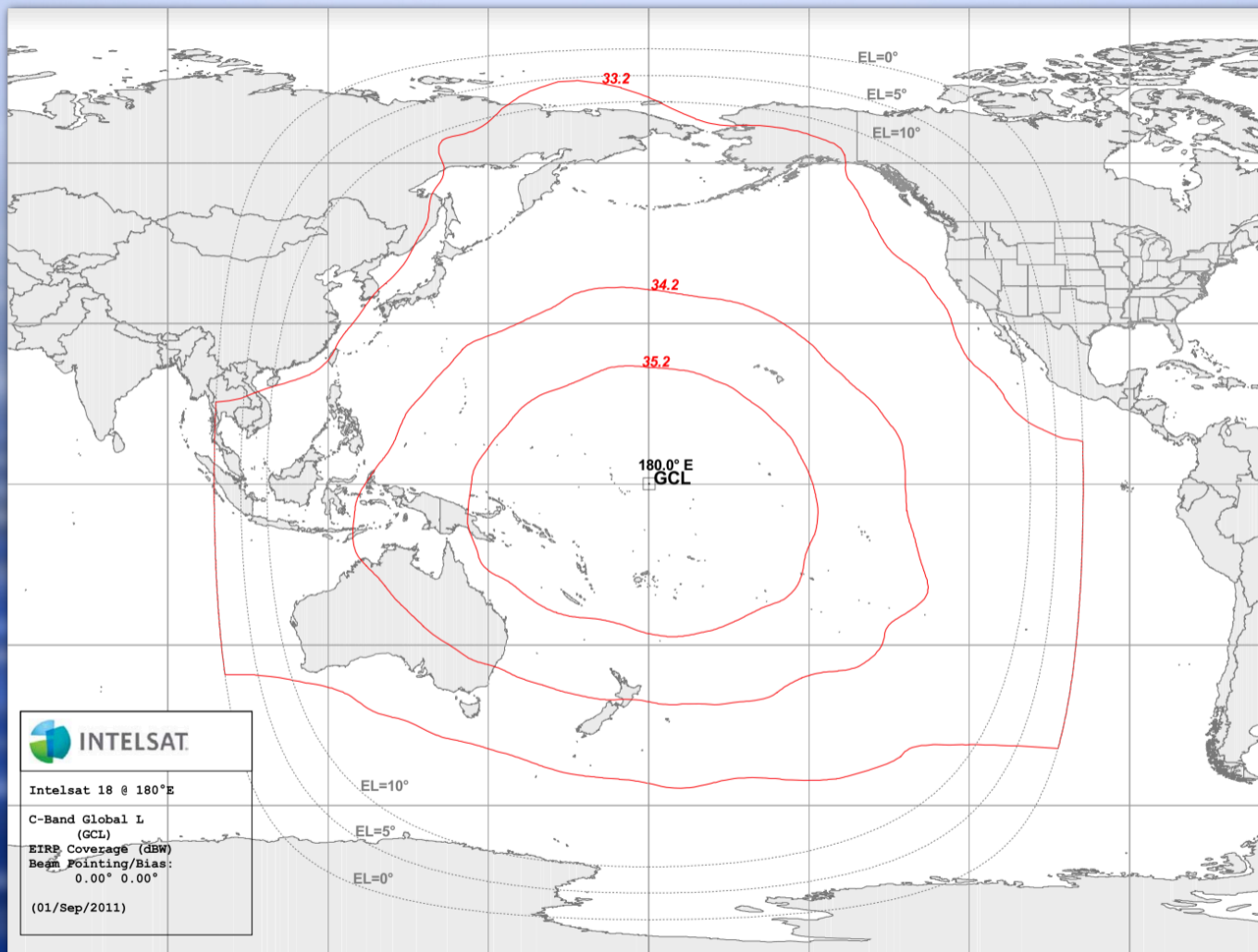
R/V Kilo Moana



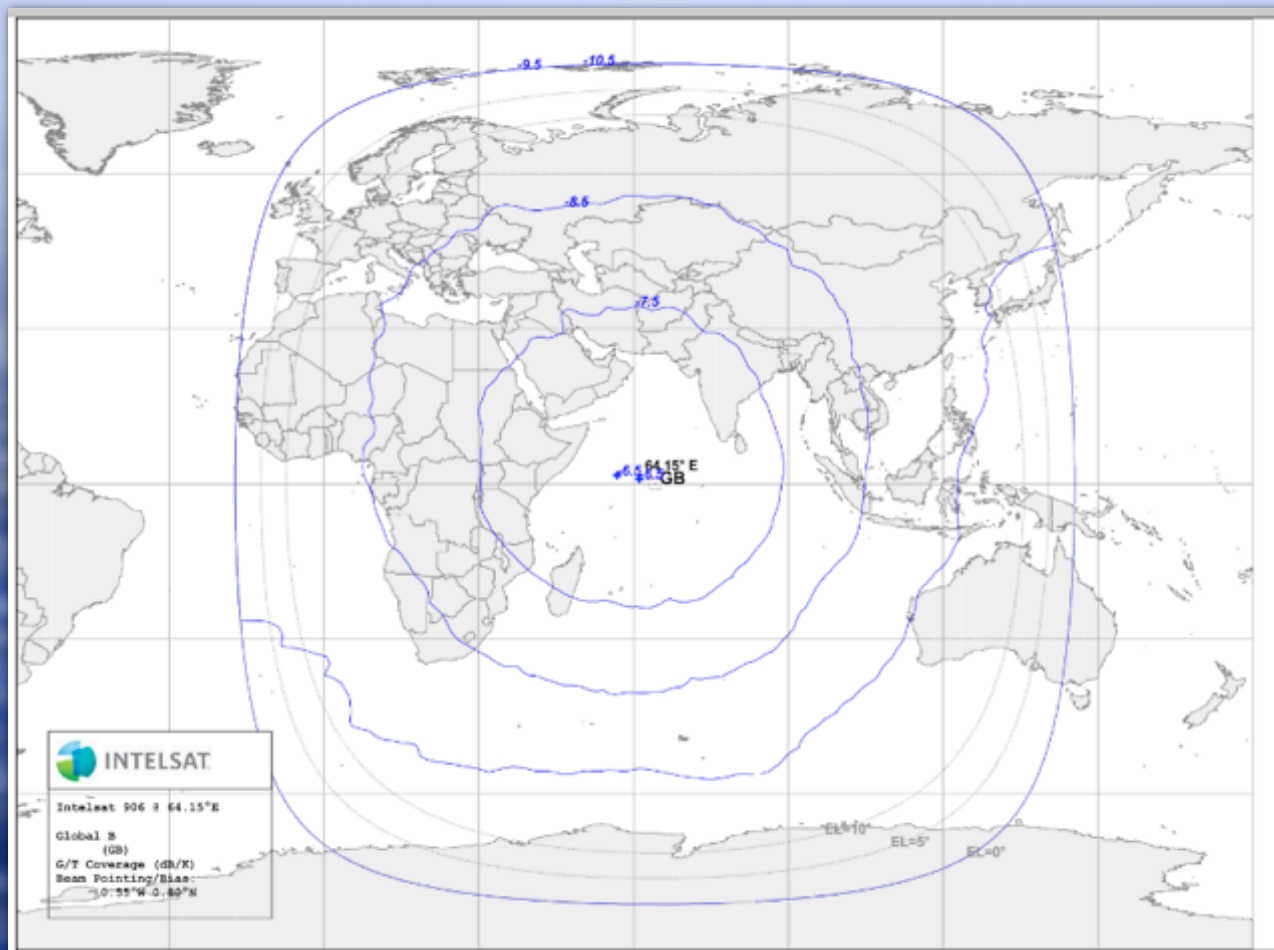
R/V Endeavor



## Global Atlantic C-band Beam

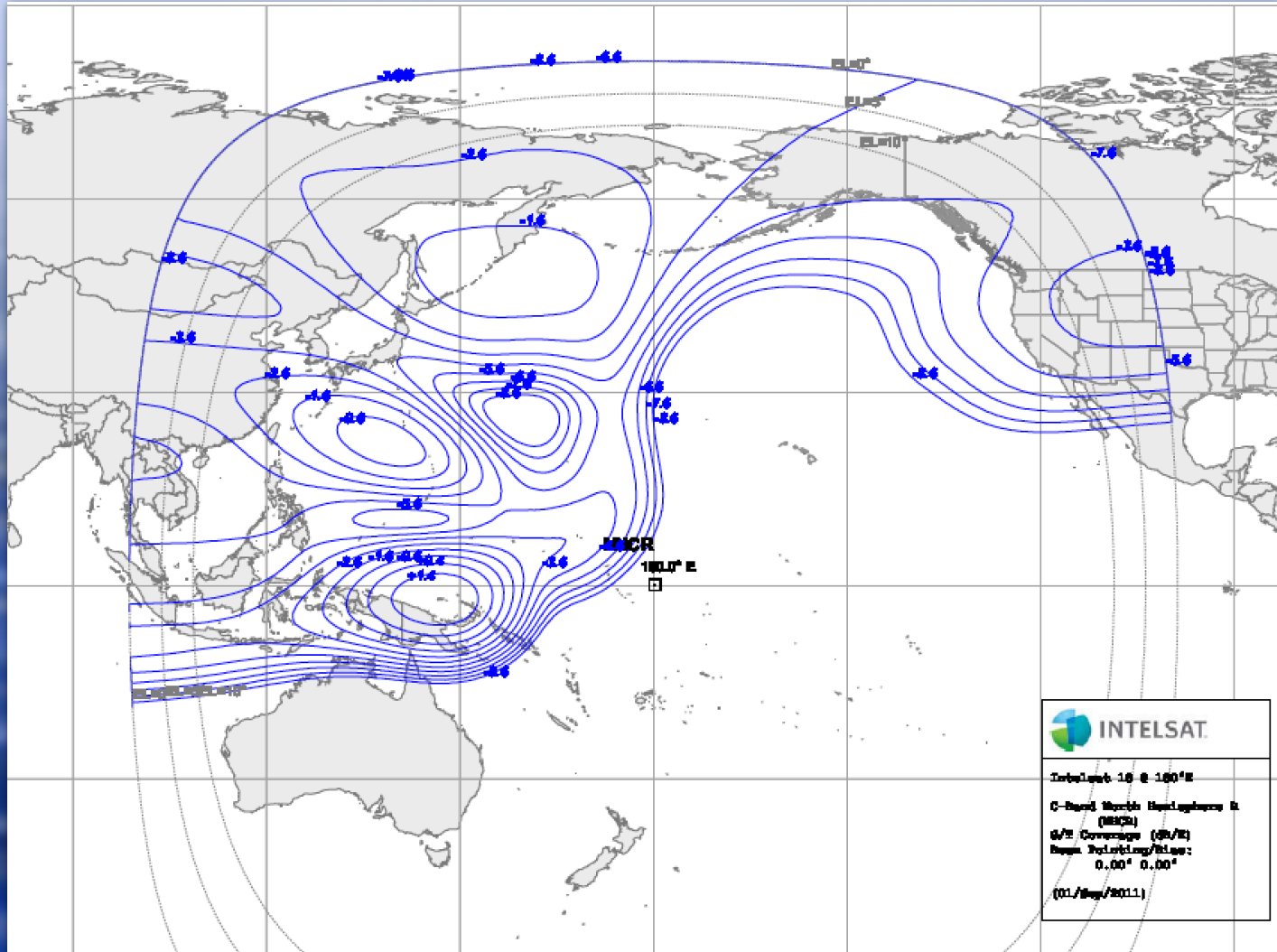


## Global Pacific C-band Beam

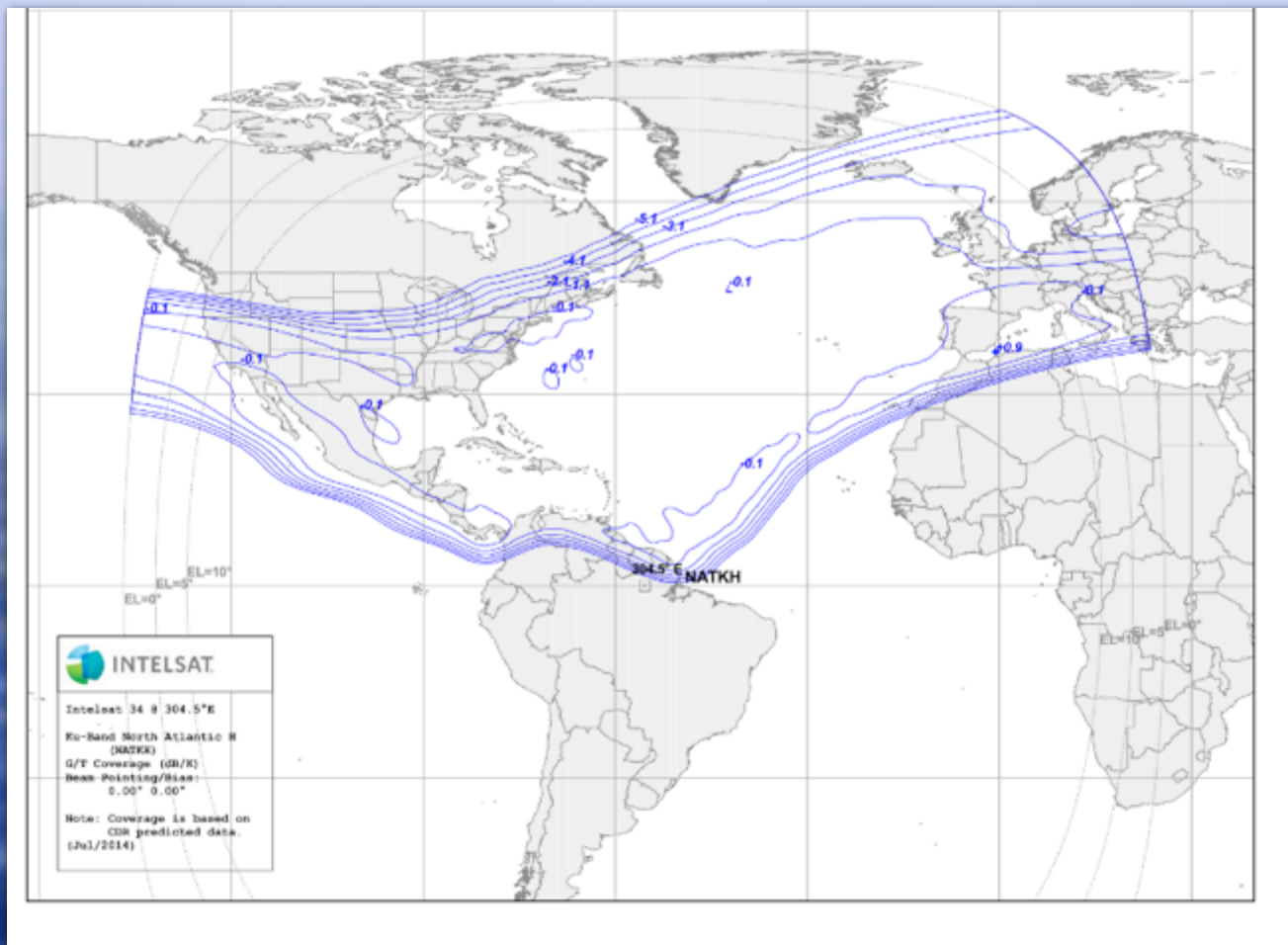


## Global Indian Ocean C-band Beam

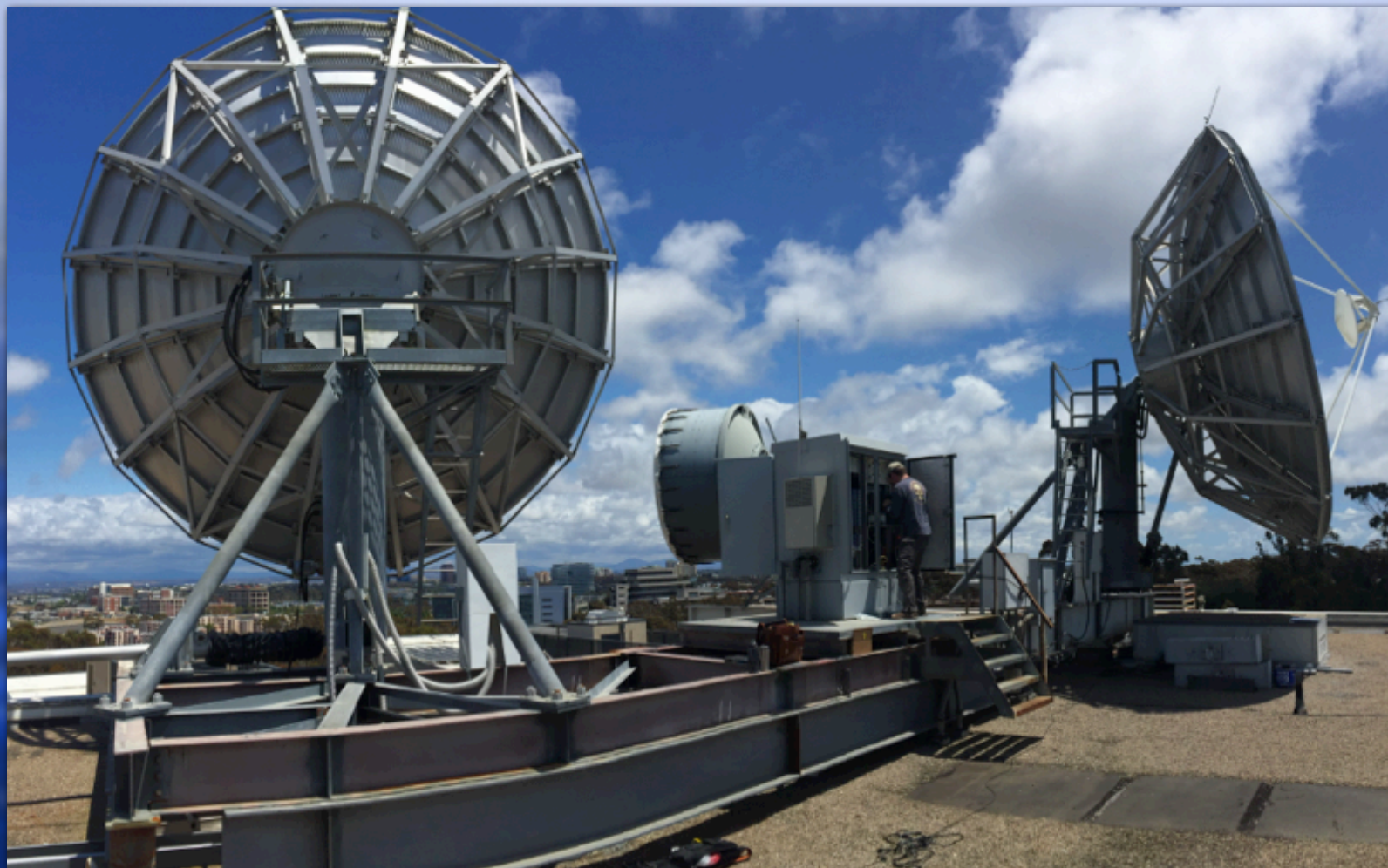




# IS-18 North Hemi C-Band

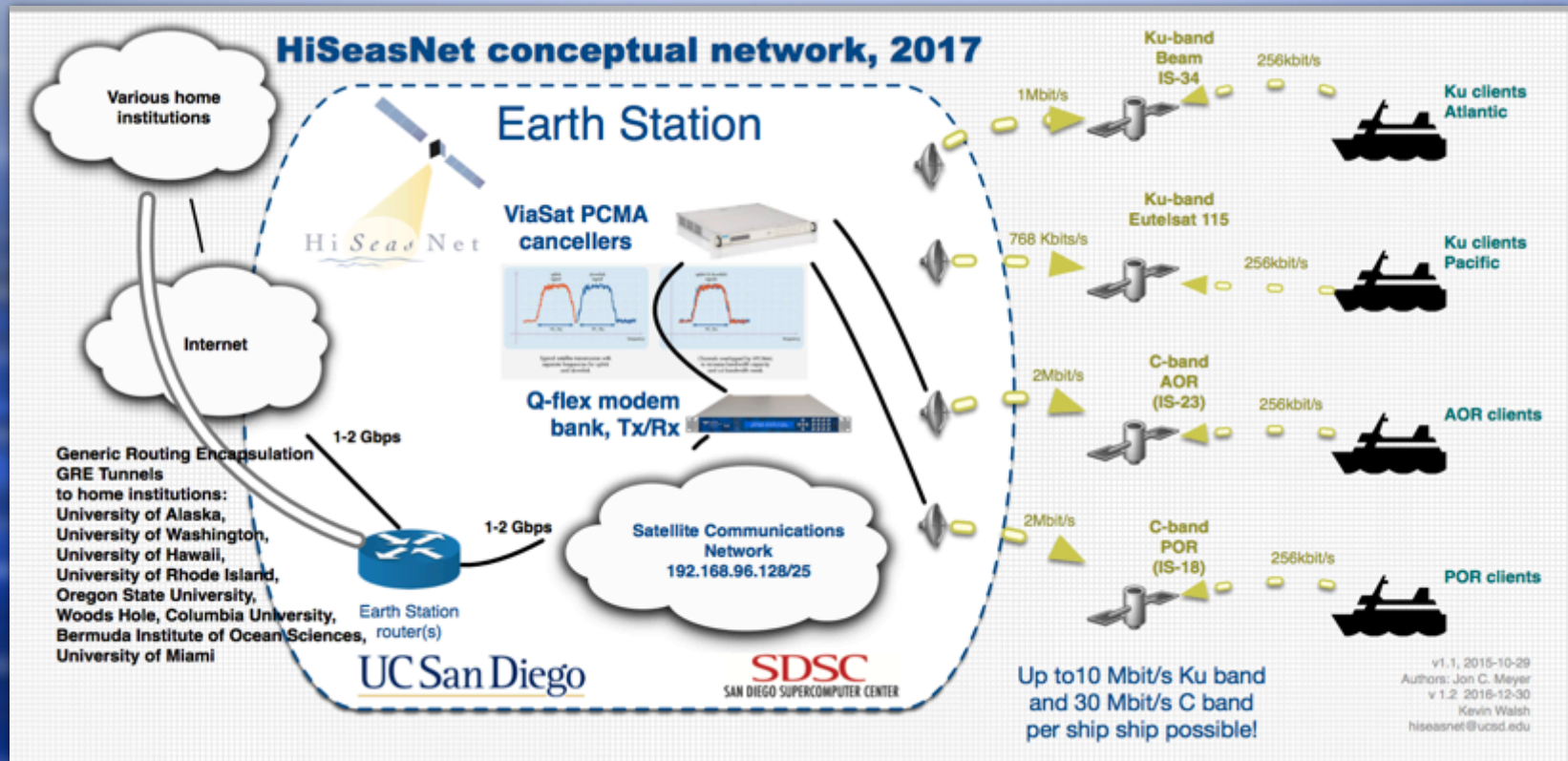


## Northern Trans -Atlantic Ocean Ku-band Beam

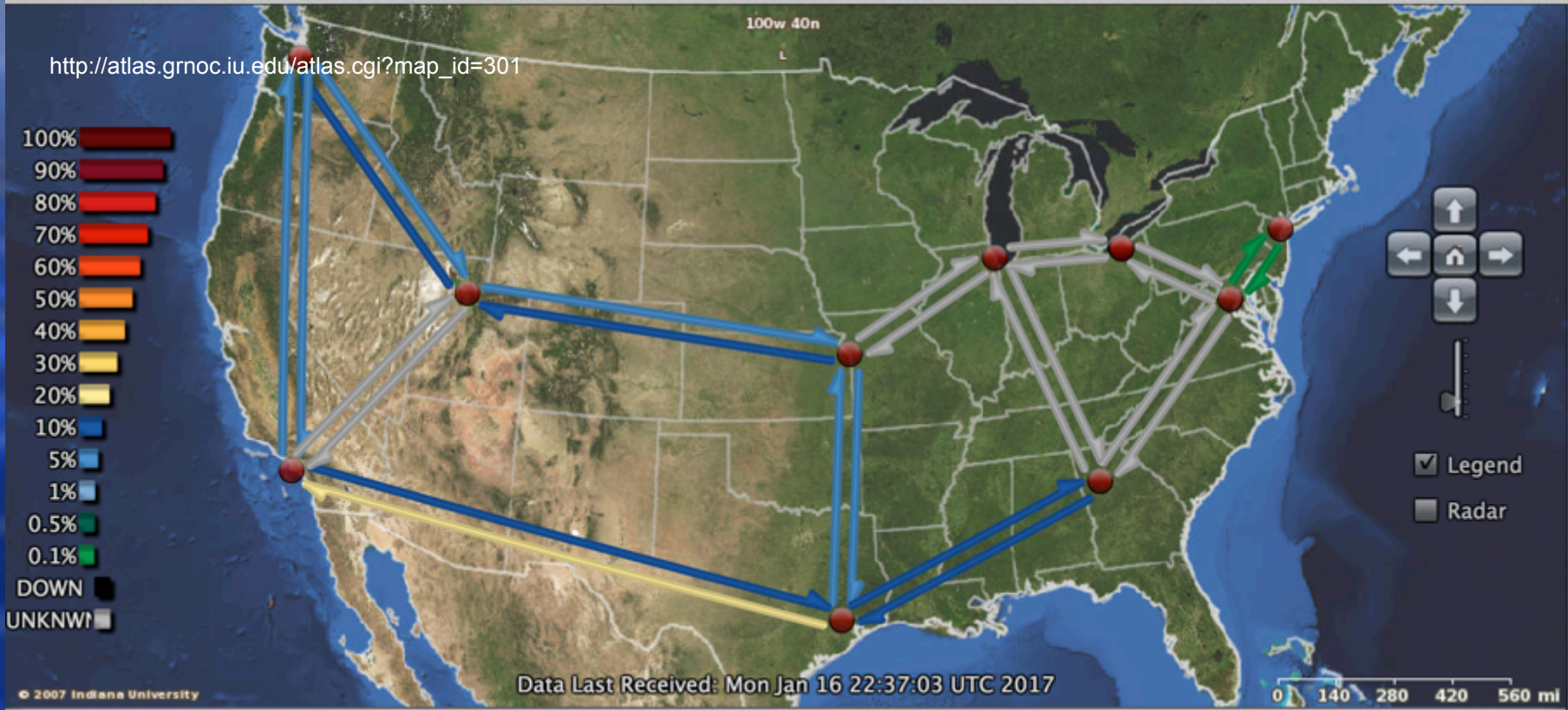


**Nice day at the Earth Station**

# HiSeasNet Conceptual Architecture



# Internet 2 US Backbone





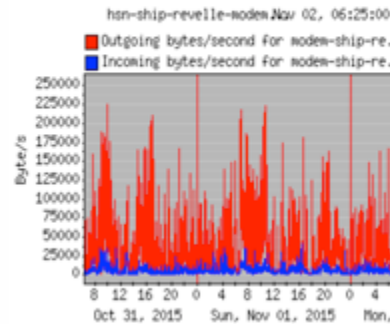
## HiSeasNet Earth Station customer informational graphs

Customer: **---** Time steps: **Daily** Image resolution: **medium** Go Generated Mon, 02 Nov 2015 06:20:51 +0000

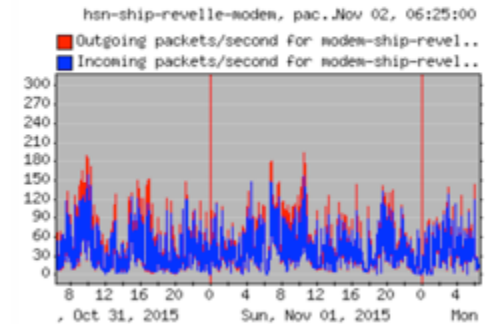
- Please select a customer:
- R/V Atlantic Explorer (BIOS)
  - R/V Atlantis (WHOI)
  - R/V Endeavor (URI)
  - R/V Kilo Moana (UH)
  - R/V Marcus G. Langseth (LDEO)
  - R/V Oceanus (OSU)
  - R/V Pelican (LUMCON)
  - R/V Roger Revelle (SIO)
  - R/V Sikuliaq (JAF)
  - R/V Thomas G. Thompson (UW)
  - R/V F.G. Walton Smith (RSMAS)

- Time steps:
- 1 minute
  - 5 minutes
  - 10 minutes
  - 30 minutes
  - 1 hour
  - 2 hours
  - 6 hours
  - 12 hours
  - Daily**
  - Weekly**
  - Monthly
  - Yearly

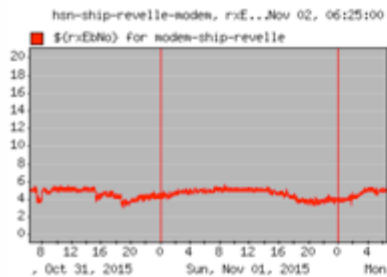
ship Bytes/second (bit/second + 8)



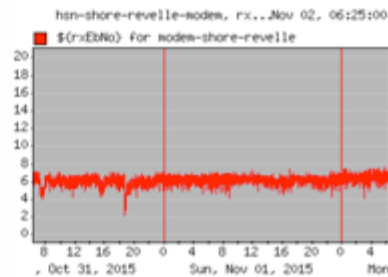
ship Packets/second



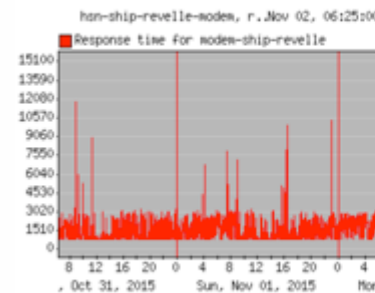
ship Rx Eb/N0 (dB - Signal:Noise)



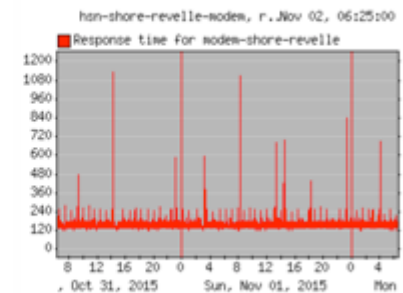
shore Rx Eb/N0 (dB - Signal:Noise)



ship Response Time (milliseconds)



shore Response Time (milliseconds)



# Slack - Collaboration and Situational Awareness



The image displays a collage of Slack interface elements:

- Channel List (Left):** Shows channels like #earth\_station\_ops, #general, #hsnadm\_notify, and #rvtec. Direct messages are listed below, including slackbot, alant, dswensen, and mhuey.
- Bot Notification (Center):** A notification from the HiSeasNet InterMapper bot: "Warning: modme-ship-sikuliaq (192.168.96.198) Address: 192.168.96.198 Probe Type: SNMP Teledyne Q-Flex satellite modem probe (port 161 SNMPv2c) Device Status: Warning Last Time Down: 11 hours, 19 minutes, 40 seconds SysUpTime: 10 days, 1 hour, 41 minutes, 46 seconds Device Condition: Rx signal below threshold. Threshold: -54.1575 Counts: Down: 295, Critical: 12, Alarm: 9".
- Message Thread (Bottom Left):** A conversation between mhuey and kwalth discussing XMPP and modem status. mhuey says: "(FYI, I have the memory stick prepped, and have turned the modem's TX off)". kwalth replies: "Hi -good deal. Please stand by for Jon to arrive." mhuey says: "Ok. FYI, I'm on the XMPP client. Should I use the other Slack format?". kwalth replies: "looks like Jon is online". mhuey says: "XMPP should be fine". kwalth says: "Ok.". mhuey says: "I'm still loading -- FBB is slow. Verrrry slow."
- Channel View (Right):** A view of the #earth\_station\_ops channel showing a "reconnecting in 201 seconds... retry now" banner and a message from kwalth: "try that - cannot see the application icon just the folder on the desktop that looks like the install folder". Below it, a message from jmeyer: "Kevin -- DacRemP (DAC Remote Panel) can be seen here.... https://wiki.hiseasnet.ucsd.edu/pages/viewpageattachments.action?pageId=458806". Another message from kwalth: "FYI - Spoke to Lianne at CommSystems to ask her to alert Hugo latest info from Atlantis". A final message from kwalth: "spoke with Hugo. Maint visit for pedestal replacement was missing blockage values. Visit from 2013 had Azimuth Blackout Limit 1 AZ LIMIT 1 0340 Azimuth Blackout Limit 2 AZ LIMIT 2 0357".

# Industry standard workflow processes



[Edit](#) [Comment](#) [Assign](#) [More ▾](#) [Start Progress](#) [Close Issue](#)

### Details

Type:	<input checked="" type="checkbox"/> Task	Status:	<b>OPEN</b> <a href="#">(View Workflow)</a>
Priority:	Major	Resolution:	Unresolved
Component/s:	<a href="#">R/V Roger Revelle</a>		
Labels:	<a href="#">ebno drops</a> <a href="#">troubleshooting</a>		
Operational categorization:	Process Request - Audit		

### Description

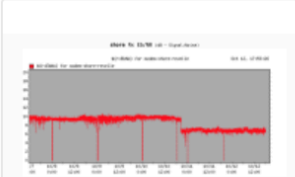
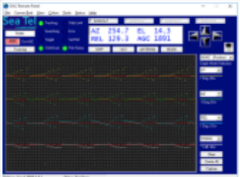
We have been observing short duration loss of shore EbNo and occasional demod unlock from Revelle. Lasts a matter of seconds. May be a reoccurrence of what we saw back in early July.

Checked Sally Ride and Sikuliaq on same beam and they are not experiencing the same problem symptoms. So, isolated to the Revelle. See momentary EnNo drop on modem and see carrier level reduced.

Captured on video. See [https://www.dropbox.com/s/3sqq7uc1oxudhnr/Revelle\\_ShoreModem\\_SpecAnn\\_2023\\_08222017.mov?dl=0](https://www.dropbox.com/s/3sqq7uc1oxudhnr/Revelle_ShoreModem_SpecAnn_2023_08222017.mov?dl=0)

### Attachments

Drop files to attach, or [browse](#).





# 18 MHz Prototype



- ◆ RV Sally Ride, RV Sikuliaq, and RV Roger Revelle
- ◆ Multiple back-to-back Jason cruises on Revelle
- ◆ Several use cases to divide up the 18 MHz:
  - ◆ Shared 21.5 Mbit shore to ships with 1 Mbit to 1.5 Mbit ship to shore
  - ◆ 11.4 Mbit shore to ships with 10.5 Mbit ship to shore for Revelle and 1 Mbit ship to shore for Sally Ride and Sikuliaq
  - ◆ 11.4 Mbit shore to ships with 10.5 Mbit ship to shore for Sally Ride and 1 Mbit ship to shore for Revelle and Sikuliaq

# 18 MHz Lessons Learned



- ◆ **Increased bandwidth enhances science mission success**
- ◆ **Improves scientific party and crew morale and welfare**
- ◆ **Reduces burden on shipboard computer resource staff**
- ◆ **Enables shore based management of shipboard networking equipment**
- ◆ **Enables shore based management of shipboard systems**
- ◆ **HSN scalable architecture verified and tailored per use case (JASON on Revelle, CASPER on Sally Ride)**

# Intelsat Updates

Dan Lesmez

# Defining High Throughput Satellites

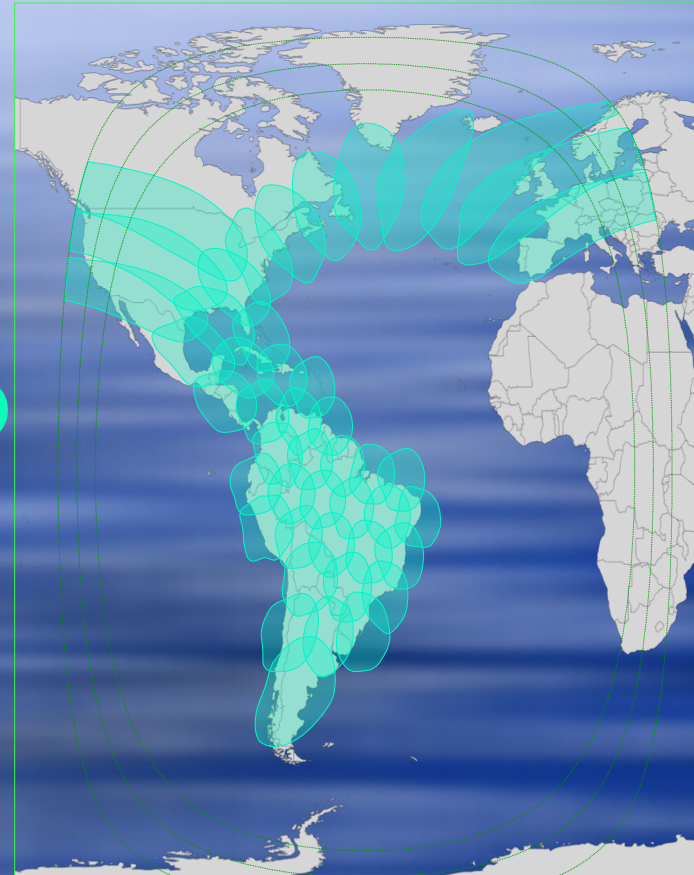


*From Wide Beams to Spot Beams*



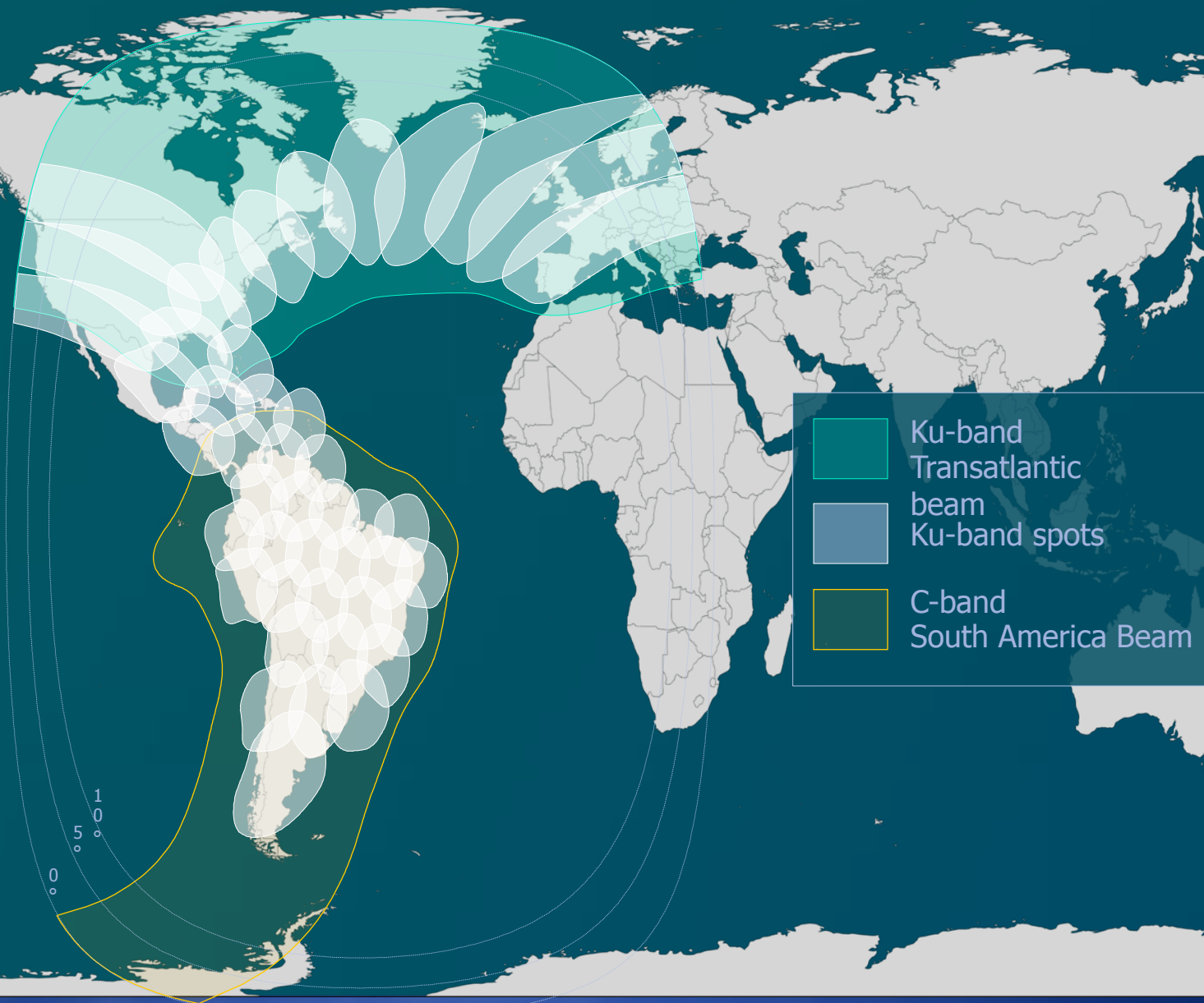
**Modern traditional satellite IS-34**

**AND**



**High Throughput Satellite IS-29e**

# Intelsat 29e - 310°E [in service]



# Intelsat IS-29e Epic<sup>NG</sup> Test Results

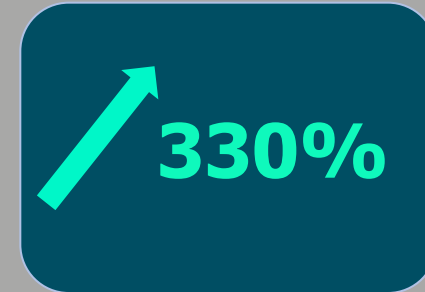


*Increased **link margins**, increased **spectral efficiency** and/or **higher Mbps throughput***

With deployed hardware



With new generation modems



# Intelsat Space Segment Roadmap

## LAUNCH & DESIGN PHASE

LEO HTS

- › Pole-to-pole coverage
- › Small terminals, low latency

More GEO HTS

- › Software defined payloads with flexible coverage, power and connectivity

- › HTS satellites fully contracted
- › OneWeb design and implementation



## COMPLETED

HTS High Throughput Satellites (GEO)

- › HTS spots positioned in high traffic areas
- › Complementing first layer not replacing it
- › Provides depth of coverage

- › 5 HTS satellites launched



## COMPLETED

WIDEBEAM SATELLITES

- › Uniform quasi global coverage
- › Base layer of the network
- › Provides breadth of coverage

- › 50+ satellites
- › 100% complete



Up through 2015

2016-2017

2018 onwards

# OneWeb

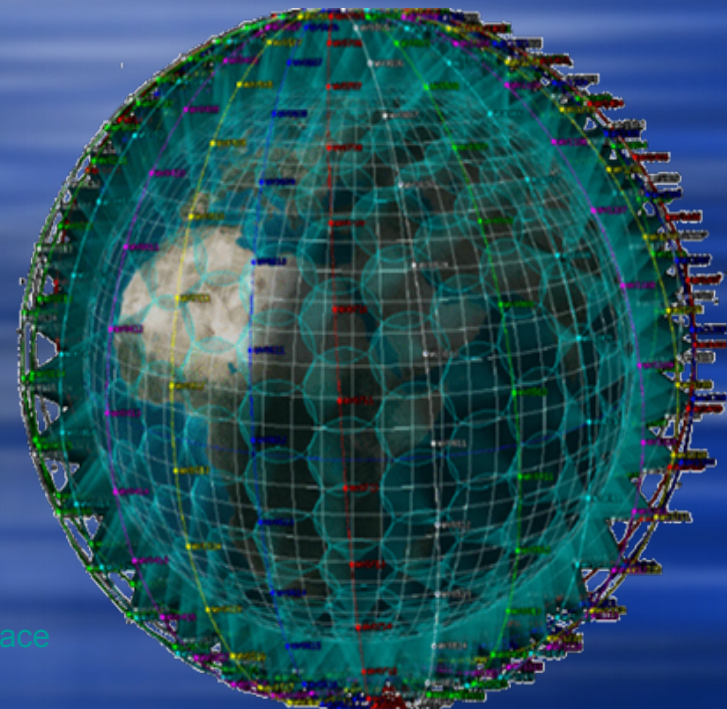
*First fully global, pole-to-pole high throughput satellite system*



**Total Throughput  
of the system:**

**5 Terabits per Second**

- ◆ The OneWeb satellite constellation
- ◆ 700 satellites  
(Constellation – 18 planes of 36 satellites)
- ◆ Low latency (<30ms round trip delay)
- ◆ Look angles > 57°



Credit: Airbus Defence and Space



# 2017 Incremental Progress



- ◆ Completed SatMex to IS-34 Ku band transition
- ◆ Achieved C-Ku ship parity (2Mbit x 256K)
- ◆ Rolled Atlantic Explorer into baseline HSN
- ◆ Upgraded Amp/BUC on Kilo Moana
- ◆ Upgraded Amp/BUC on Sikuliaq
- ◆ Replaced pedestal on Langseth (not trivial)
- ◆ Completed engineering for dual C/Ku for Tommy Thompson
- ◆ Upshot: Most ocean class ships capable of 25 Mbit bi-directionally

# What's Next 3 to 5 Years = Bandwidth + Life cycle replacements



- ◆ **More bandwidth for C and Ku**
- ◆ **Pacific Ku service for Earth Station**
- ◆ **RF over Fiber to move shore modems to SDSC machine room**
- ◆ **Life cycle replacement for Tommy Thompson – Sea Tel 9711 C and Ku**
- ◆ **Dual radome treatment for Neil Armstrong**
- ◆ **Dual radome treatment for Sikuliaq**
- ◆ **Life cycle C/Ku upgrade for Roger Revelle**
- ◆ **Life cycle C/Ku upgrade for Atlantis with Revelle style radome placement**
- ◆ **Next generation antennas for Ku ships**
- ◆ **Prototype testing of LEO satellites**
- ◆ **Upshot: Increased performance and uninterrupted Internet access for ocean class ships**



**We are all made of stars.**  
*-Moby*

**Thank you for your attention.**