Telepresence and Expanded Bandwidth Cruises 2016
Lessons Learned (or reminded of)

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Got Bandwidth?

Bandwidth is defined as the amount of data that can be transmitted in a fixed amount of time or range within a band of frequencies or wavelengths.

HiSeasNet current baseline is 2 Mbit shore to ship shared, 256K ship to shore.

HiSeasNet C band capable of 30 Mbit bi-directional, depending on your data plan.

Meanwhile in 2016, your iPhone can do 400+ Mbit.

Apple iPhone 7 Plus
A10 Fusion GPU, A10 Fusion, 128 GB NVMe (5.0 GHz)

iperf Client (transmit) TCP 1 m
Apple iPhone 7 Plus
A10 Fusion GPU, A10 Fusion, 128 GB NVMe (5.0 GHz)
## Bandwidth Expansions 2016

<table>
<thead>
<tr>
<th>Date</th>
<th>Ship</th>
<th>Bandwidth</th>
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<tbody>
<tr>
<td>HSN Expansions</td>
<td></td>
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<tr>
<td>July-Aug</td>
<td>Atlantis (Van Dover)</td>
<td>7 x 3 Mbit</td>
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<tr>
<td>June</td>
<td>Sikuliaq (Kulin)</td>
<td>3 x 2 Mbit</td>
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<tr>
<td>July</td>
<td>Sikuliaq (McGuire)</td>
<td>3 x 2 Mbit</td>
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<tr>
<td>August</td>
<td>Sikuliaq (Ittig)</td>
<td>3 x 2 Mbit</td>
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<tr>
<td>Nov- Dec</td>
<td>Sally Ride (Applegate [Jason])</td>
<td>10 x 5 Mbit</td>
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<tr>
<td>Non-HSN expansions</td>
<td></td>
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<tr>
<td>April</td>
<td>Atlantis (NTSB)</td>
<td>7 x 4 Mbit</td>
</tr>
<tr>
<td>June</td>
<td>Endeavor</td>
<td>5 x 5 Mbit</td>
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7 x 3 on the Atlantis
HiSeasNet Way Forward (modulo SATNAG guidance)

- Systems-of-Systems approach
- End-end-path test
- Application ports and protocols defined in advance
- End points defined in advance
- Bi-directional application QoS parameters defined and tested in advance – inside skin of ship and shore to ship
Telepresence Testing

- Check connectivity and bandwidth over satellite, modem to modem
- Check connectivity and/or bandwidth from point to point
- Things change between Telepresence events. Just because it worked a month ago don’t assume it will work as needed now.
- Telepresence needs the bandwidth when they need it. Be able to prioritize telepresence traffic, or limit/suspend non-telepresence traffic when needed.
Connection Testing Tools

- ping – verify connectivity and latency
- traceroute/tracert – verify network pathway
- mtr/pathping – combination of ping and traceroute
- iperf – network performance testing
  - Run as server on one side, client on other side
  - Pushes a given size of data across via either TCP or UDP for a given amount of time. Reports actuals.
- iftop - display bandwidth usage by host
Issues on R/V Atlantis

- NTSB found routing issues between Internet2 and the rest of the world
- WHOI had an old router with 10Mbps ports in line which was too slow for the satellite link (imagine that 😊)
Sikuliaq Telepresence Lessons Learned

- HiSeasNet Bandwidth Bump
  - FROM: To Ship 2 Mbps / To Shore 0.5 Mbps
  - TO: To Ship 2 Mbps / To Shore 3 Mbps
Sikuliaq Telepresence Lessons Learned

- First Cruise (Following Upgrade)
  - Successfully Sustained 2 simultaneous video streams to shore over a 2-3 week period.
- Second Cruise
  - Successful Video Streaming to shore
- Third Cruise
  - Science party wanted to use a 4 line VOIP system.
  - Installed 2 days prior to cruise with shoreline
  - Was Unable to test adequately with HSN prior to cruise
  - HSN Upgrade only upgraded to shore throughput not to ship. VOIP is bidirectional.