
HiSeasNet is a project to bring full-time low, but scalable bandwidth Internet connections to ships at sea. This allows ships to pass routine data on a more frequent or constant basis. Additionally, it allows for a slow transfer of a large quantity of data over time if bulk data transfers are needed. Bandwidth can be scaled or expanded on a per ship, per cruise basis to meet the performance requirements of more demanding applications, such as bi-directional full motion video telepresence.

The core technologies involve leased C-band and Ku-band satellite bandwidth that is paid for on a monthly basis, not by the minute or bit. HiSeasNet leases dedicated space segment on global C-Band footprints that cover the majority of the Atlantic and Pacific oceans on an annual basis, and in the Indian Ocean as required based upon the cruise tracks of the ships.

HiSeasNet broadcasts use 3 satellites full time: IS-18 (Pacific Ocean Region (POR), C-Band, 7.2m Vertex dish), Intelsat IS-23 (Atlantic Ocean Region (AOR), C-Band, 7.2m Vertex dish), and SatMex8 (Ku-Band, 3.8m Prodelin dish). IS-903 is used when ships are operating in the Indian Ocean Region (IOR). C-band ships access the satellites through SeaTel 9797 and Sea Tel 9711 IMA 2.4m antennas, while Ku-band ships use SeaTel 4996 (1.2m), 6006 (1.5m), and 4006 (0.95m) dishes.

The satellite modems in use on the ships and on shore are all Teledyne Paradise Q-Flex software defined modems, and the routers are enterprise class Cisco. The Q-Flex modems are capable of operating at data rates up to 160Mbps. HiSeasNet uses a bandwidth conservation technology known as Paired Carrier Multiple Access (PCMA) which enables more usable bandwidth for the money.

HiSeasNet maintains an earth station on the roof of the San Diego Supercomputer Center (SDSC), which is on the main campus of the University of California, San Diego. It is home to the San Diego Network Access Point (NAP) where several tier 1 commercial Internet Service Providers (ISP) peer with each other, and Internet2 peers with the University of California at 100 Gigabit/sec. HiSeasNet can then route traffic for each ship through a Generic Routing Encapsulation (GRE) tunnel to/from the home university or lab institution of each ship over Internet2. This tunnel allows for the home institution's network addresses to be used on the ship, which means the ship can be viewed as a floating lab extension by the home institution. Latency and contention are generally low and consistent, with Quality of Service (QoS) parameters applied.

HiSeasNet manages, measures, and monitors the infrastructure, including the satellite links using several technologies, including Intermapper, inMon Traffic Sentinel, and a variety of custom tools created by HiSeasNet staff. For communication and interactive troubleshooting with the RV Techs on the ship, we use Slack.

Ship specific customer views of HiSeasNet performance and health indicators are available here - https://hiseasnet.ucsd.edu/customer/?customer=atlantis&timescale=daily&resolution=640x320

Current Baseline HiSeasNet Committed Information Rates (CIR) and Maximum Information Rate (MIR) 2016

HiSeasNet C-BAND (Atlantic Ocean Region (AOR) and Pacific Ocean Region (POR))

CIR UP: 256K dedicated, per ship

CIR DOWN: 409 Kbit/s in 4 ship mode. 546 Kbit/s in 3 ship mode.

MIR: 2 Mbit shared between active ships in the AOR

MIR UP: same as CIR UP

MIR DOWN: 2 Mbit/s

We leave 20% headroom for bursting capacity.