Advanced Communications for
REMOTE OCEAN PLATFORMS IN THE COMING 15 YEARS

Long-term measurements in the oceans are becoming a scientific and civil imperative that is having a profound impact on oceanscience and particularly seagoing oceanography. Ocean observatories such as NSF’s Ocean Observatories Initiative (OOI) and NOAA’s Integrated Ocean Observing System (IOOS) are providing means for making measurements of change over decadal time scales, a practice of great importance for understanding climate variability and change as well as potential for natural disasters such as tsunamis. At the same time the costs for operating ships at sea are increasing quickly (fuel, personnel, capability) and pressure is mounting to targetted community measurements in which data collected are available openly. Both of these trends drive efforts to enhance communications at sea in coming decades. Ships are now platforms for deployment and testing of new sensors that might be later deployed at fixed observatories and observatories are increasingly common; communications to these remote sites become increasingly important. Streamed real-time data from a ship or observatory allow for rapid response to new data and greater flexibility in how the science facility can be used by the community. Cost effective transfers of large blocks of data with high reliability including surety of data return, coupled with real-time streams, allow data to be analyzed quickly by shore experts and even machine-to-machine interactions, and improve the quality of information derived from science programs. For those scientists working at sea, robust communication with shore will allow for increased contributions to ongoing programs afloat. Satellite bandwidth today is still largely too expensive for personal work by individual investigators, but bandwidth will gradually decrease in price as new spacecraft are launched and more commercial operators offer service at sea. Whether paid by the minute, byte, or month, satellite communications will make increase the quality of research by making data available to a wider audience. We shall review the current use of HiSeasNet for these purposes and present anticipated enhancements of bandwidth by government and industry for the foreseeable future.

COMMUNICATIONS SATELLITES HISTORICAL HIGHLIGHTS:
- 1964: First commercial communications satellite, COMSAT’s EATH BIRD, launched
- 1976: MARSAT launched for mobile satellite communications at sea
- 1998: Iridium phone service begins
- 2000: Globalstar data service begins
- 2000: 2nd Gen Tracking and Data Relay Satellite System (TDRSS) satellites launched
- 2001: Iridium 2.4kbps data service begins
- 2002: Inmarsat F77 MPDS (by-the-byte) service begins
- 2007: Inmarsat Fleet Broadband service begins
- 2008: Iridium OpenPort (128kbps) service begins

USES OF COMMUNICATIONS FOR REMOTE PLATFORMS INCLUDE:
- Real-time data feeds to shore
- Data quality monitoring
- Instant event detection and early warning
- Input to modeling needs
- Remote control of instruments and autonomous vehicles from shore
- Basic communications between scientists at sea and shore
- Live public outreach from sea
- Leverage shore compute and personnel resources for responding quickly to science observed at sea
- Science program directed by staff and resources on shore

OBSERVATORIES WITH NEEDS FOR NEAR-REAL-TIME DATA RELAY TO SHORE:
- Research vessels
- Ocean Observatories Initiative (OOI)
- Integrated Ocean Observing System (IOOS)
- Global Earth Observation System of Systems (GEOSS)
- Cabled observatories

HiSeasNet provides sea-going scientists with real-time access to shore support resources including people, model output, satellite imagery, computer farms, storage clouds, etc. It is also used to stream shipboard data to shore for instant analysis, publication, and quality assurance. Anything based on IP, streamed media, videoconferencing, etc.

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RECENT SATELLITE MARKET CHANGES INCLUDE:
- Launch of NS-9: High power C-band service
- Launch of Telstar 11: Ku-band over the Atlantic Ocean
- Fleet Broadband service: By-the-byte, global, any time data service up to 63kbps, small antennas

HiSeasNet bandwidth is expected to increase as prices continue to come down. Coverage areas will increase on a temporary basis.

The future of communications will see:
- More Ku-band ocean satellite coverage for small antennae driven by market for aircraft and vessel fleet communications
- Greater competition in the satellite market
- Greater efficiency in data acceleration
- More high-speed bulk data transfers (e TDRSS)
- More cabled observatories online
- Cheaper satellite services
- With new generations of satellites out now, capacity will increase, but gradually