

DESSC Subcommittee on Telepresence-Enabled Science Missions: Mandate

- Draft a paper that provides guidance to potential telepresence science users. It would describe:
 - Telepresence-enabled science missions
 - Modes of operations
 - End user expectations
 - Operational perspectives – looking at reduced berths
 - Limitations
 - Products
 - Time management considerations
 - Logistical considerations
 - Recommendations on the utility of telepresence

Subcommittee on Telepresence-Enabled Science Missions: Participants

- Participants
- Chris German, Chair
- Dwight Coleman – URI/Inner Space Center
- Amanda Demopoulos - DeSSC
- Dave Emerson – DeSSC
- Nick Hayman - DeSSC
- Matt Heintz - NDSF
- Jon Howland - NDSF
- Carl Kaiser – NDSF
- Amanda Netburn – NOAA/Early Career
- Anna-Louise Reysenbach – DeSSC Chair
- Pete Girguis – Past DeSSC Chair
- Annette DeSilva – UNOLS (*ex-officio*)

Proposed Outline: Deep Sea Research *Methods* Paper

- Introduction
- Methods: Modes of Operation; Case studies for each.
- Results: Outcomes; Positive & Negative.
- Discussion: Recommendations for future science users
- Summary

Methods: Modes of Operation

1. ROV Operations

- Lead scientist at sea, co-located research team on shore
- Lead scientist at sea, distributed research team on shore

Or...

- Lead scientists on shore, co-located research team on shore
- Facilitators at sea, lead scientist & distributed team on shore

2. AUV Operations

- Science leads on shore, co-located research team on shore
- Science leads on ship, co-located secondary team on shore
- Sharing of data via internet to scientists on shore

3. Night Programs

- Shore-directed CTD operations
- Shore-directed Multibeam swath mapping

Results: Benefits

- A huge pool of scientists is available on shore to contribute to the intellectual expertise of a cruise.
- Telepresence allows each shoreside scientist to participate in only those portions of a cruise that are of interest/relevance.
- Telepresence offers more opportunity for accessibility to cruises: huge potential to improve diversity/career opportunities.
- Telepresence allows more opportunity for rescoping the science program in response to discoveries made at sea – especially when pertinent expertise is not represented among the shipboard team.
- Allows shore scientists, less taxed by seagoing activities, to provide fresh perspective and data advice/guidance to the shipboard team. Especially valuable on long/demanding cruises.
- The organized data streams that are important for an effective telepresence-enabled cruise can also make for well-archived data.

Results: Challenges

- Decentralized planning requires care, can be inefficient.
- Multiple opinions, some based on less context than others, adds complication to decision-making.
- Substantial communication effort required to keep shore party informed as well as to plan forward.
- Part-time participants ashore can be disruptive to achieving overall cruise objectives if they lose track of “big picture”.
- Situational awareness ashore is much less than at sea (easily overlooked by busy ship team; frustrating on shore)
- Ship-based team typically even less aware of shore team.
- Participants ashore can be unreliable due to competing professional/personal commitments, not experienced at sea
- At sea, being constantly “overwatched” can be draining.

Discussion: *Toward* Recommendations

- Effective telepresence requires detailed dive planning.
- NDSF dives would benefit from that level of discipline too: Sentry requires it / best use of Alvin / Jason more effective.
- Effective use of Telepresence also requires **two-way** communications: not just ship to shore but also shore to sea.
- To broaden *awareness* of Telepresence, could be good to do more to socialize cruises via DeSSC mailing list.
- But, to use telepresence for *research*, easiest path to success: restrict to hand-picked extension of at sea team.
- Effective use of telepresence remotely might come from those who have had at least some experience both at sea AND in a structured on shore environment (e.g. ISC).

An Idealized NDSF Telepresence Capability

- Shore participant is an active team member, on call 24/7 and with recognized/designated observation hours/shifts.
- On shore participants advise but cannot out-rank at sea participants over final decisions (situational awareness)
- Active participation from shore in all of:
 - science meetings (dive planning/post-dive evaluation)
 - vehicle & instrument preparation (incl. trouble shooting)
 - real-time engagement in dive progress (video, nav. GUI)
 - monitoring post-dive sample handling/lab. processing
 - active participation in data manipulations/documentation

The Elephant in the Fleet: Bunk Space

- Effective telepresence could free up more time for **sample processing** by those at sea = more effective use of bunk-space?
- In 24h Jason ops, the back row of the control van consumes 72 person hours of effort per day working with **digital** information.
- If communications are robust and reliable, there is scope to port at least some of the scientific observations from ROV dives and analysis of data collected during AUV dives to shore.
- Porting some levels of data QA/QC ashore could help NDSF. But it should not be assumed that individual staff ashore would then be available to support the cruise on the same basis (16h/day, 7d/week)

However...

- Less staff at sea = less expertise when things need fixing.
- Facilitating telepresence may need dedicated support at sea.
- Shore-based teams may also need added technical support.