

ABSTRACT FORM

(Please note: The complete abstract should be limited to three pages, if possible.)

Project Title: 902100 Telepresence on MBARI research vessels

Expected Project Duration (in years): 2

PI	Project Manager	Lead Scientist	Lead Engineer
Kakani Katija	Eric Martin	Heidi Cullen	David Caress

(Indicate individuals appropriate for your project. Not all projects need all four positions filled in.)

Project Description:

A perennial challenge that the oceanographic research community is trying to address is how to effectively engage participation in and expand access to ocean exploration and discovery. While MBARI is fortunate to have a highly regarded marine operations program and consistent access to the sea, scarce seagoing resources are a significant limiting factor for many members of the research community. Additionally, livestreamed outreach capabilities that enable real-time participation and observation of research cruise operations - part of David Packard's original vision for MBARI - have been shown to have measurable impact on public engagement and support for ocean science and conservation (e.g., E/V Nautilus, NOAA's Okeanos Explorer). Therefore, there is a significant value to increasing participation and involvement in research cruises at MBARI through either increased engagement of external collaborators or more broadly through outreach.

Telepresence is a promising modality that can augment both science engagement and public outreach, and has been gaining traction in the oceanographic community in recent years. This project seeks to design, acquire, and implement telepresence on MBARI research vessels for both use cases. Based on recent scoping efforts motivated by addressing science party limitations due to COVID-19, we have identified solutions that address both science operational capability and public outreach. These solutions require minimal resources to implement telepresence on both of MBARI's research vessels, and largely leverages existing hardware and data pathways. This effort is especially timely given global uncertainty around COVID-19, as well as the potential for playing a significant role in the Monterey Bay Aquarium's upcoming exhibit - *Into the Deep: Exploring Our Undiscovered Ocean*, launching in March 2022.

In addition to the project description above, please provide one (1) paragraph addressing each of the following topics:

Fundamental Problem

What's the grand challenge this work addresses? Why should we care? What makes this work relevant to MBARI?

This work addresses the grand challenge of increasing access and engagement in ocean sciences, exploration, and discovery, without significantly impacting resources and science and engineering missions while at sea. Telepresence presents a strategic opportunity to engage external science partners while also promoting ocean science and conservation through public audiences and outreach. This effort is relevant in that it can provide the capabilities that facilitate broader science/engineering partnerships, as highlighted in the Technology Roadmap, and enable a persistent presence and sustained involvement in ROV operations.

Technology

What engineering & technology is needed to move forward (e.g., sensor, platform, ship, de novo R&D)?

Our efforts will focus on leveraging existing technologies on MBARI's current research vessels. Surveying the specific science and outreach requirements of MBARI collaborators and users, we will aim to find appropriate tools that we can integrate in each ROV control room. While online streaming has evolved into a ubiquitous consumable for the internet, there remain technical challenges with reducing latencies for operational use. Latencies will inherently compromise collaborator contributions, but initial testing has proven that those can be reduced in exchange of video clarity. Since initial scoping efforts have determined that both ships possess ship-to-shore telecommunication systems capable of meeting requirements, innovation will occur in developing tools to emplace remote users in the control room, providing context, and allowing for remote contributions.

Data

What data will be generated? How will they be managed? Visualization and IP considerations?

We do not anticipate generating significant amounts of data. Some outreach sessions, where vehicle video and auxiliary feeds overlaid with ITD employee commentary, will be recorded and posted either on social media or other web platforms (e.g., MBARI's YouTube channel). We will scope solutions that implement existing embargoes on certain data, and be cautious about the broadcast of site locations during live video events.

Intellectual Property (IP) Considerations

Do you anticipate a need for a cooperative research and development agreement or licensing arrangement with an external entity? Will the work potentially result in a patentable product or service? Will novel IP be created, and how might it be disseminated (e.g., license agreement and/or collaborations)?

For additional guidance please review MBARI's intellectual property internal web page:
<https://mwww.mbari.org/itd/ip/>.

We do not anticipate having any IP considerations for this project, as this is primarily integration focused. If potential collaborations with the University of Rhode Island's Innerspace Center are pursued, we will have to address IP concerns with any integrated components that we wish to be shared.

Anticipated Impact

Who are the consumers of the instruments, methods, technology, and data that will be generated within and beyond MBARI? Will the project create tangible connections with other organizations (e.g., academic, NGO, MBA, MBNMS, state or federal agency)?

Consumers of telepresence will include MBARI engineers, scientists, marine operations, and communications personnel for enhanced participation in ROV dives as well as outreach to the general public. The project will create tangible connections, not only with MBARI external collaborators, but with organizations like MBNMS, MBA, and any other group that would like to participate in MBARI research cruises remotely.

Anticipated Outreach Needs

Thinking about the audiences/consumers you highlighted in the question above, do you anticipate needing to create outreach assets to help increase your impact? If so, please specify whether you anticipate needing to work with ITD and also specify what type of asset (graphic, animation, video, etc.) you might need.

As this effort will result in outreach deliverables, we anticipate requiring significant outreach assets to increase our project's impact. For example, during selected dives, we are anticipating streaming ROV video and ancillary data (with control room audio) to YouTube or Facebook Live, with members of ITD narrating the dive in real-time for public audiences. These activities may be conducted in conjunction with MBA for their *Into The Deep* 2022 exhibit.

Please provide an overall, high-level estimate of resources envisioned for this project in 2020 to help give a sense of the size of the proposed effort. Detailed scoping is not needed at this stage. Simply mark the appropriate box below.

Budget Category	Minimal	Medium	Significant
Labor		x	
Expense		x	
Ship/Assets	x		

If you anticipate a large ramp-up or increase in resource requests in future years of the project, please include that information below.

Not applicable.