ABSTRACT FORM

The management team will use your responses to the prompts below to assess the scale and scope of the proposed activity for 2027, as well as gain a preliminary perspective of how the project might evolve over time and how it may intersect other ongoing or future initiatives at MBARI.

Project Title: 902712 ROV Ventana Fiber Optic Can replacement effort 2027 phase 1, 2028 phase 11, install/test early 2029.

Expected Project Duration (in years): 2-2.5 years,

PI	Project Manager	Lead Scientist	Lead Engineers
Kaya Johnson	DJ Osborne		Ethan Brandt/DJ Osborne

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

Project Overview

The Ventana subsea control system is primarily contained and divided between two large pressure cans – the Control Can and the FO Can. The Control Can (aka GSS Can) was replaced in 2014 and is holding up fairly well. The Fiber Optic Can is a different story as some of the internals have not been replaced since around 1999 and are now 27 years old. The bulkhead penetrator end was last replaced in 2008 with a slower corroding design than initially delivered. However, after 18 years, the current bulkhead penetration end is corroding and will eventually develop leaks if a replacement path is not adopted in the near future. Although there have been lots of piecemeal upgrades inside the can - the data Multiplexer, the main backplane chassis, and the corroding penetration head are all in need of replacement. Also, several of the internal boards also need updates to the layouts/designs in order to avoid relying on obsolete potentially unavailable parts.

It should be made clear that the primary purpose of this effort is to secure the continued high reliability performance of Ventana by replacing an aging pressure housing and long-past-obsolete electronics with new infrastructure. Technological advances have been significant in the last three decades and the can currently has limited ability to be upgraded. During the process of replacing this system we will be able to accomplish a host of upgrades to the telemetry can optics and electronics. This upgrade will provide a secure foundation for the subsea infrastructure for at least 10-15 years or more, allowing Ventana to continue to be a highly reliable, flexible, future proof platform.

The initial phase of this critical project has already started, we are attempting to identify the hardware and technology we plan to implement. The first phase of the project would start in 2027 where we would finalize the hardware and technology we will implement. We will hope to start the build at the end of 2027 and then continue into 2028 with the can being largely put together during the year and then tested into the fall. The can would be installed on Ventana

while the Carson is at the yard in late fall 2028/winter 2029. Some offshore sea trials would be requested during the first dives back prior to operation for science.

All the Ventana can upgrades have been accomplished by entire replacements into the existing cabling. Now some obsolete type cable interfaces may be upgraded as well, but it has been shown numerous times that the down time associated with removing, rebuilding, reinstalling and testing during a long maintenance period is not possible unless the ROV is taken out of service for months. Doing a drop in can replacement reduces ship/ROV down time considerably – furthermore almost none of the connector bulkheads are worthy of reuse anyway due to years of corrosion on the critical sealing surfaces.

Strategic Priorities and Challenges					
Innovate and Build		***Explore and Protect***		***Inspire and Engage***	
Build scalable technologies to improve ocean health assessments		Explore and observe life in a dynamic ocean		Share what we learn to inspire and inform ocean conservation	
Map the deep seafloor at high resolution		Study the impacts of climate change and other ocean threats		Make ocean science and engineering careers accessible to all	
Advance ocean-based artificial intelligence				Invest in our people and foster a diverse and inclusive workforce	

Abstract narrative:
Replacing this major piece of control infrastructure is no small task and will take at least 2.5, possibly 3 years to complete. This can currently provides the following infrastructure:

1. Switching of 24 devices/instruments/cameras for DC volt systems with ground fault checking.
2. Switching of 6 channels of 120 VAC devices with ground fault checking
3. 26 isolated serial data streams of various protocols and speeds.
4. 16 NTSC camera inputs with 8 outputs to topside using a custom switch card
5. Fiber Optic CWDM infrastructure for auxiliary HD cameras, Ethernet plant, network switches for both core vehicle and science interface needs.
6. Communication to the GSS control infrastructure with a custom Microcard using the adopted modbus standard.
7. Single full spectrum fiber available for science instruments testing.

Critically needed upgrades we are planning to secure a non-obsolete infrastructure for Ventana control IO and to meet future platform requirements include the following.

1. Upgrading to a modern multiplexer providing significant enhancement for all power and data specifications with cost effective available spares and supported hardware.
2. Increasing the number of auxiliary HD cameras from 2 to 6, providing two for science, PIV type instruments.
3. Providing a more future-proof fiber optic interface to science and engineering, including 2 full spectrum fibers for next generation through-put data needs.

4. New can mechanical design enhancements to significantly limit/prevent similar corrosion to avoid costly and unnecessary penetrator head replacement.
5. Newly specified future proof interfaces to science allowing next generation data and power feeds. Top on the list for this is an electro-optical connector interface for science.
6. Adopt and integrate a next generation fiber optic bulkhead and cable design that is most likely PBOF and repairable/rebuildable in house instead of discarding costly potted assemblies over a simple scratch on the fiber face.

The concept is to request capital improvement funds and labor support to complete this project. For 2026 we are establishing a baseline for how much hardware we can purchase in 2027 as well as brainstorming with other engineers on how to best upgrade the obsolete hardware while maintaining functionality of the existing interfaces. We would secure capital improvement funds for purchase of the bulkhead penetrations, pressure can materials, part of the Multiplexer electronics and other required identified hardware including CWDM modules, Vicor power supplies, and ethernet switches.

We will request labor allocations from a number of engineers in order to decide the best design architecture for the new can. For the electronics and fiber optics we would seek input from some combination of these engineers, Eric Martin, Chad Kecy, Paul Roberts, Paul McGill, George Stern. For mechanical design details, we intend to do the bulk of the solid works modeling and layout however we would seek backup for the stress, thermal and corrosion analysis from a combination of Andy Hamilton, Gene Massion, Justin Tucker.

We have identified a very attractive multiplexer replacement during the Oceanology conference in the UK this past spring. It is believed that some of this hardware would also be compatible with the Ricketts new control system installed during 2025. Keeping the ROV's with the same basic multiplexer has always been best practice for commonality of spares.

Is this project one of multiple projects your team plans to submit? How do you prioritize?
Typically, Ventana submits capital improvement requests every year to keep the vehicle maintained and upgraded. The amount is typically between around 100k$ to 150k$ depending on the year. This can upgrade would essentially be the same level of hardware funding requested in prior years. We anticipate approximately $250k to $300K in hardware total for this upgrade.

Project #	Project Name	Start Year	End Year	Priority (1, 2, 3, etc.)

Add additional details here, as needed:

Anticipated Shared Resource Needs

What staffing is required to advance the work in 2027? Is in-house or contract manufacturing needed? What level of ship/ROV/AUV (DMO) support is likely? Does it have an international component, including ship use? Please complete the tables as indicated, and provide any additional text in the space below.

Personnel Classification (see link)	**Estimated Resource Request***
Electrical Engineer (a week each of qty 3)	Two weeks first year, two weeks second year. At least month total, but possibly more second yr. see note on Paul McGill below.
Mechanical Engineer	Two weeks first year, one week second year.
Electronics Technician	Minor first year, major second year.
M-Techs Technician	Minor first year, minor second year.
Machine Shop fabrication.	Minor first year, major second year.

**Minor = up to a week, Major = weeks to month, Significant = more than one month*

Asset Requests*	**Estimated Request (# of days/deployments)**
e.g., (2) LRAUVs	
Ventana ROV test dive to 1600 meters	One day if things go well, two if they don't separated by a maint day.

**Ships, ROVs, AUVs, MiniROV, Wave Glider, etc.*

Add additional details here, as needed:

Involvement of Paul McGill has always been a desire for this project however we were not able to start the effort before he retired in 2025. We seek critical input from Paul McGill as a consultant or adjunct engineer on the order of a minimum of 60, possibly 80 hours of consulting labor for each year. Paul is intimate with so many details of our system having him involved will greatly benefit us in the long run.

Anticipated Expenses

What rough order of magnitude direct expense budget is anticipated?

I have started a ROM budget for this project and my best estimate at this time is roughly a max of 150K$ per year for two years for hardware.

		x
<$50K	**$50K–$100K**	**>$100K**

Add additional details here, as needed:

It is believed by the Ventana team that this effort does not need to be a full blown MBARI project. I am submitting this information to explain to the MT the situation with the Ventana infrastructure and our plan for upgrading/replacing in the near future. In general, I would plan on submitting the hardware expenses as capital purchase items during 2027/2028. I would also

plan to have my hours of support added directly to the Ventana support hours or otherwise DMO divisional in general. There have been other very similar upgrades of a high dollar amount similar to this effort follow this general process. The Ricketts did a very similar upgrade between 2022-2025 with SMD, under a capital project. (362000.87 Telemetry upgrade). It is emphasized that this project however does involve more than normal labor support hours requested than an average year.

The Ventana FO can was all built in house during 1999/2000 by Craig Okuda and Craig Dawe with significant help from a number of other techs and engineers. Note, there is no outside vendor to request an upgrade quote package. If we tried to go with an outside Vendor (not out of the question) we would need a very significant initial specification and documentation effort to even ask for a request for quote. It is also not clear what company would be appropriate to source such an effort. It is fully expected that the cost would now be significantly more than, $675K (cost of the Ricketts upgrade in 2022 money), especially as ROM quotes for the hardware alone comes in around an estimated $300K.