MariPro Inc.
Lessons Learned for Designing 20+ Year Life Observatory

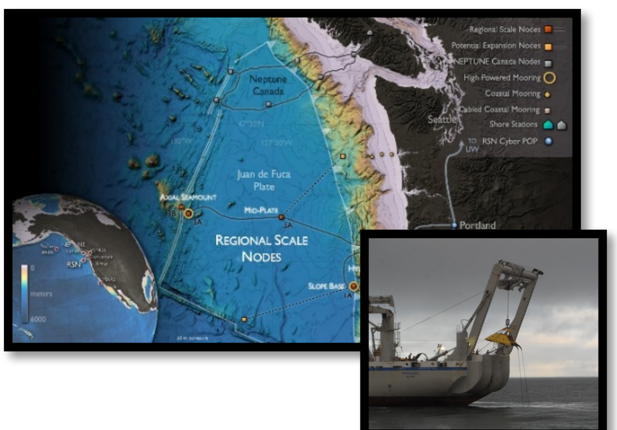
John Reardon

September 23, 2016

20+ Year Life Design

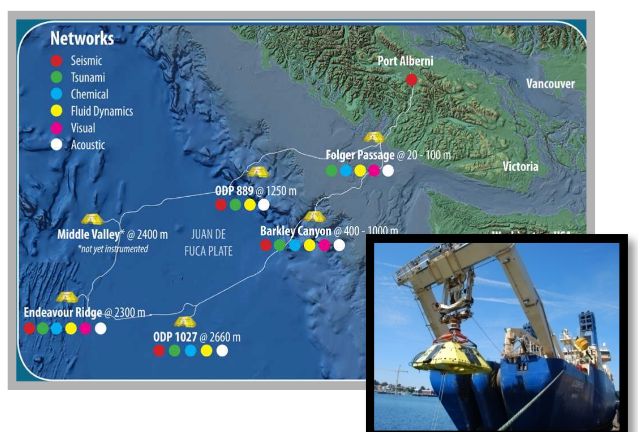
- **Problem: Node Design Criteria to Support 20+ Year Life**
- **Description: Observatory Infrastructure is Designed for 20+ Year Life and the design needs to consider all phases of the life including Installation, Operation & Maintenance.**
- **Solution: Initial Requirements and Design need to include rigorous verification program, solutions for all phases of system life and considerations for faults.**
- **Lesson Learned (Best Practice): Ensure design enables operational success and is developed and demonstrated for Installation and Maintenance.**

NSF Ocean Observatories Initiative Cabled Array (OOI- Cabled Array)



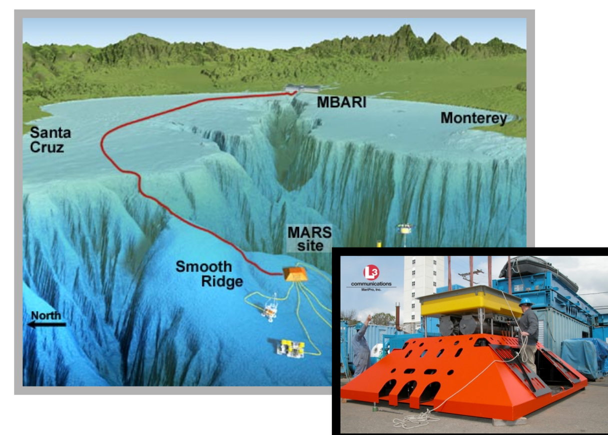
http://oceanobservatories.org/array/cabled-array/

Ocean Networks Canada – NorthEast Pacific Time-Series Undersea Network Experiments (ONC-NEPTUNE)



http://www.oceannetworks.ca/

Monterey Accelerated Research System (MARS)



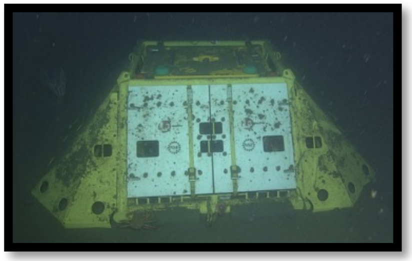
http://www.mbari.org/mars/

Node Design: Description

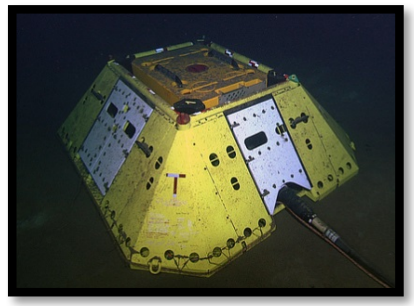
MariPro

- Small Design variations can impact system configurations.

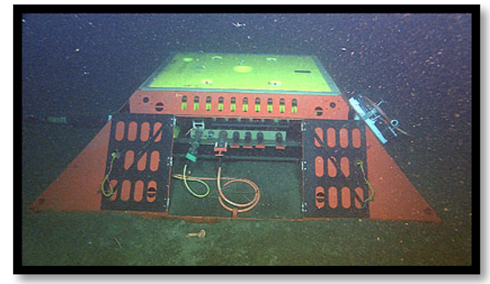
Cabled Array Shallow Water Node



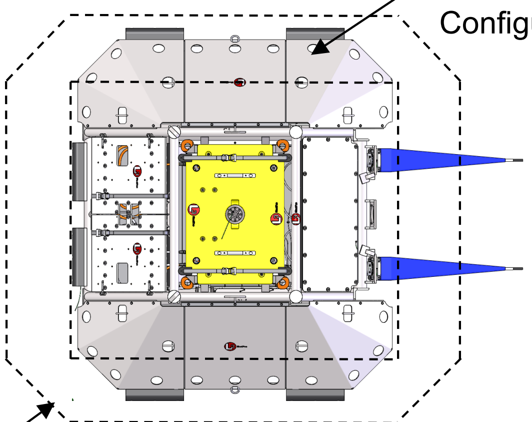
NEPTUNE Node



MARS Node

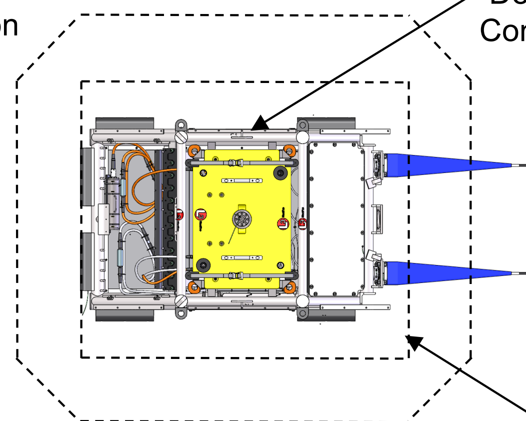


Cabled Array Shallow Water Configuration



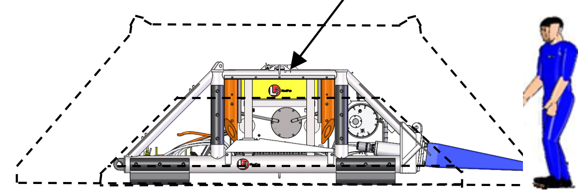
NEPTUNE

Cabled Array Deep Water Configuration



MARS

Cabled Array Elevation Profile Independent of Node Configuration



Property	Cabled Array Shallow Water	Cabled Array Deep Water	NEPTUNE Canada	MARS
Depth Rating (m)	3,500	3,500	3,500	**1,000**
Weight (lb)	13,900	10,900	25,000	**9,700**
Size (inch)	165 × 197 × 60	161 × 105 × 60	244 × 212 × 74	**184 × 153 × 45**
Envelope Volume (ft^3)	420	309	1340	**430**
Relative Added Mass	1/3	1/6	1	**1/3**
Relative Drag Area	**1/2**	**1/3**	**1**	**1/2**

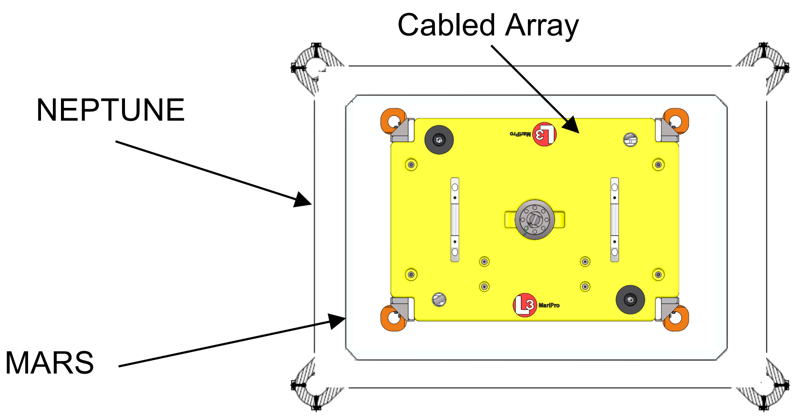
Node Design: Description

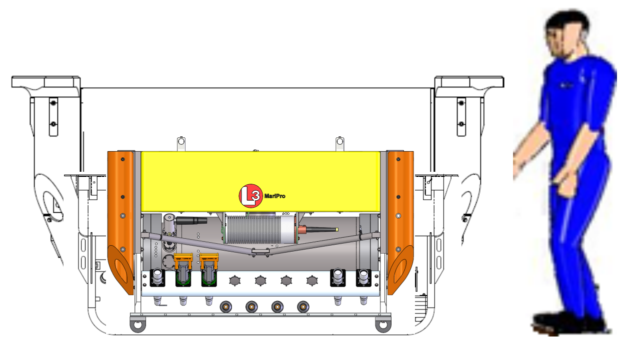
- **May Achieve similar design Requirement but implementation makes a difference.**

Cabled Array ROV Serviceable Node

NEPTUNE ROV Serviceable Node

MARS ROV Serviceable Node



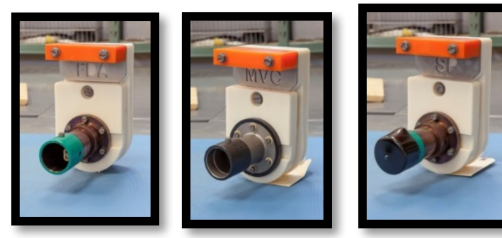


Property	Cabled Array	NEPTUNE Canada	MARS
Depth Rating (m)	3,500	3,500	1,000
Weight (lb)	3,000	11,000	4,100
Size (inch)	77 × 56 × 49	120 × 90 × 64	94 × 63 × 41
Envelope Volume (ft^3)	125	400	140
Float Volume (ft^3) (included above)	24.3	126.2	49.0
Float Density (lb/ft^3)	34	34	24

Node Design: Solution

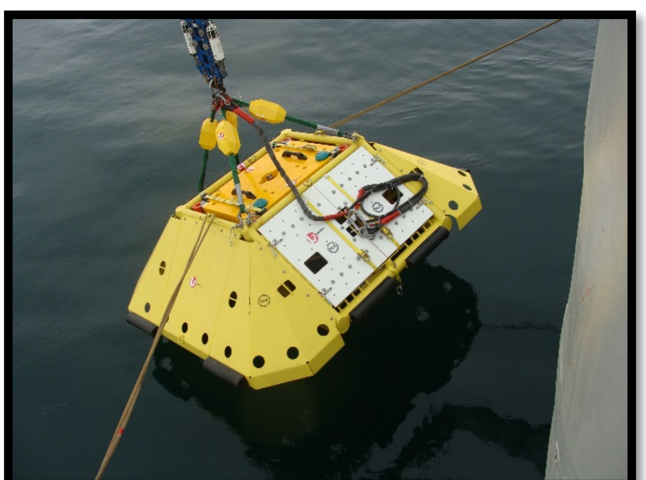
MariPro

- Need to assess true cost of design savings including service life
- Keep it simple in the water
- Ensure Installation Approach is considered from the beginning
- Features may need to be added to support best practices during Installation and repair
- Design features to allow recovery and plan for contingencies
- Robust Verification Plan that addresses installation environment

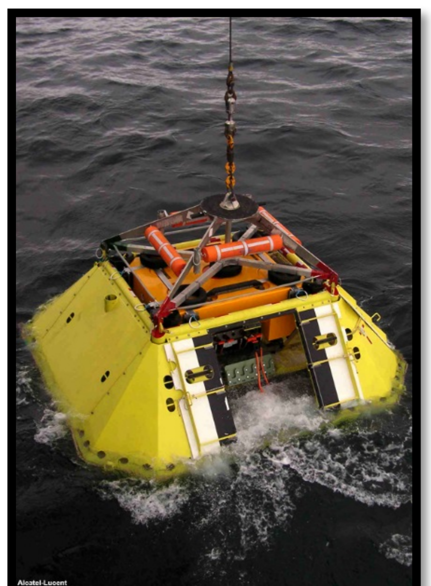


Parking Positions used during Maintenance

Cabled Array Shallow Water Node



NEPTUNE Node

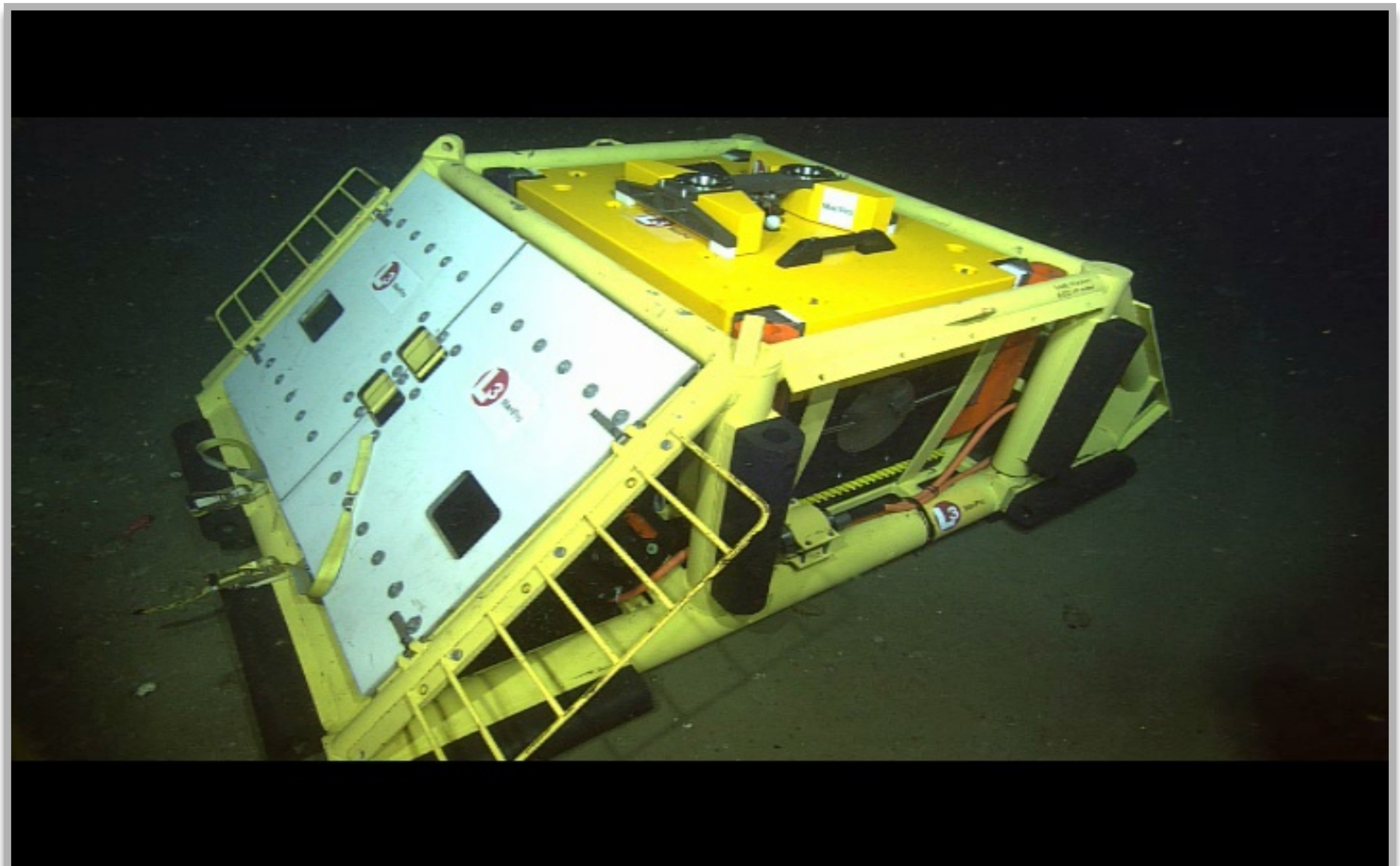


MARS Node

Node Design: Lessons Learned

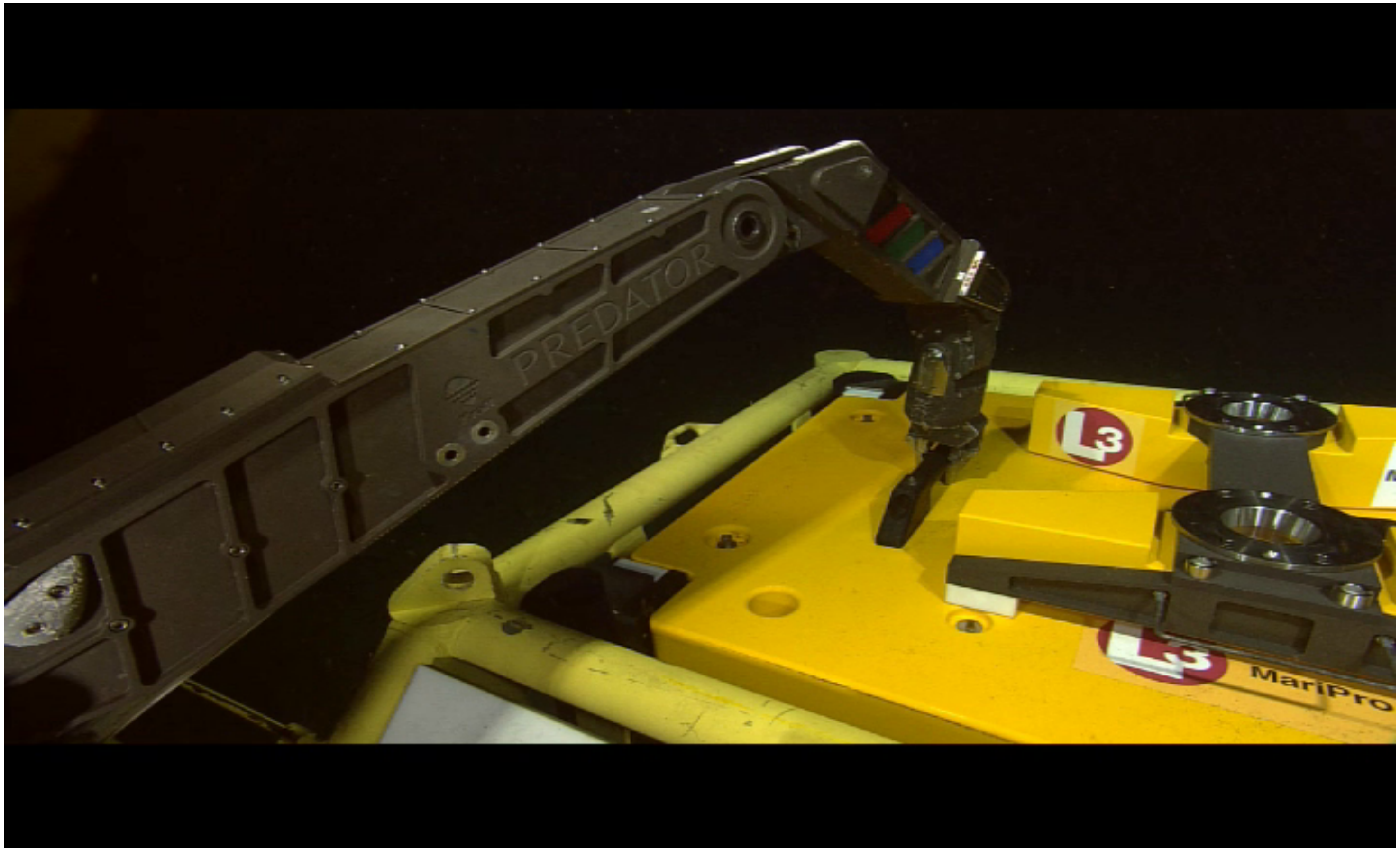
MariPro

- In-Water Testing early to Verify Equipment compatibility
- Exercise Interfaces to avoid installation complexity or maintenance challenges



Node Design: Lessons Learned

- Exercise Maintenance approach as party of initial design verification



Node Design: Lessons Learned

- Robust Design Verification considering handling on the vessel
- Consideration for Seafloor Installation environment

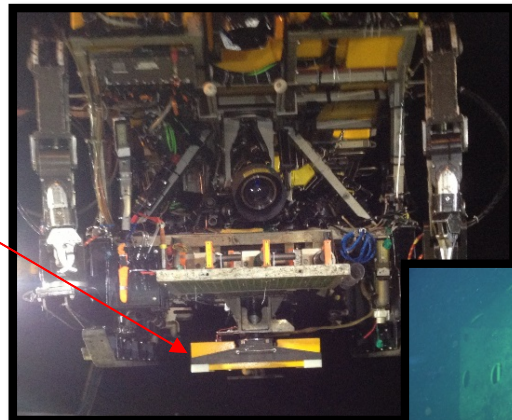
Seafloor Compatibility needs Consideration

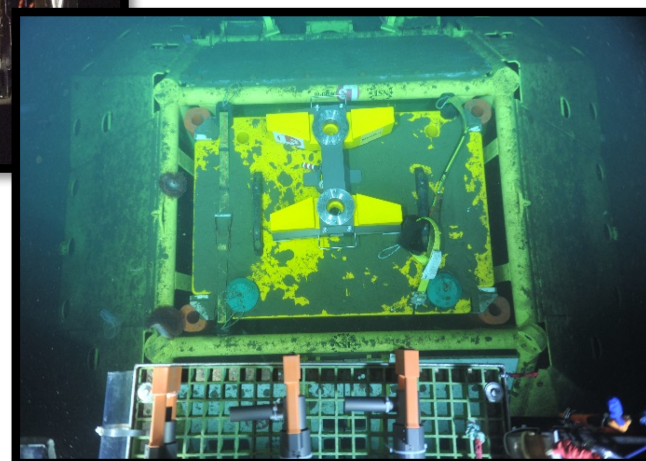
Node Design: Lesson Learned

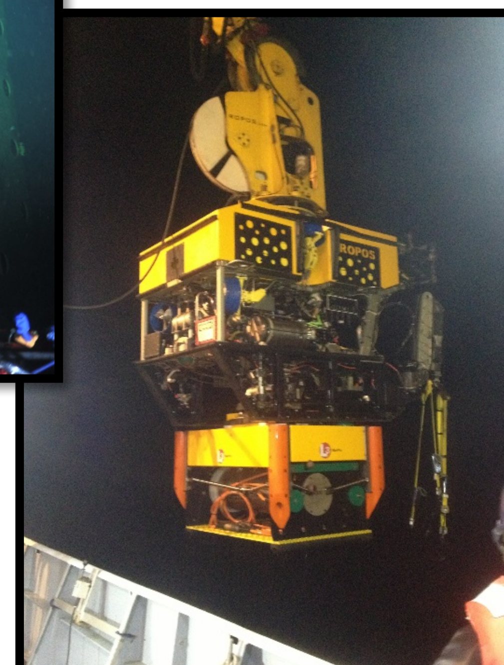
MariPro

- Science Interface Assembly (SIA) Recovery from Backbone Interface Assembly (BIA)

Docking Frame Assembly



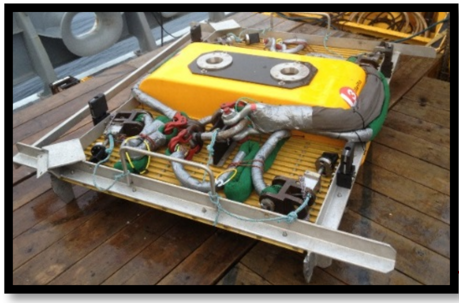




Node Design: Lesson Learned

MariPro

- **Recovery of Backbone Interface Assembly (BIA)**



Recovery Bridal Frame Assembly