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)

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

Monterey Accelerated Research System (MARS)

- [http://www.oceannetworks.ca/](http://www.oceannetworks.ca/)
- [http://www.mbari.org/mars/](http://www.mbari.org/mars/)
Small Design variations can impact system configurations.

<table>
<thead>
<tr>
<th>Property</th>
<th>Cabled Array Shallow Water</th>
<th>Cabled Array Deep Water</th>
<th>NEPTUNE Canada</th>
<th>MARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth Rating (m)</td>
<td>3,500</td>
<td>3,500</td>
<td>3,500</td>
<td>1,000</td>
</tr>
<tr>
<td>Weight (lb)</td>
<td>13,900</td>
<td>10,900</td>
<td>25,000</td>
<td>9,700</td>
</tr>
<tr>
<td>Size (inch)</td>
<td>165 × 197 × 60</td>
<td>161 × 105 × 60</td>
<td>244 × 212 × 74</td>
<td>184 × 153 × 45</td>
</tr>
<tr>
<td>Envelope Volume (ft³)</td>
<td>420</td>
<td>309</td>
<td>1340</td>
<td>430</td>
</tr>
<tr>
<td>Relative Added Mass</td>
<td>1/3</td>
<td>1/6</td>
<td>1</td>
<td>1/3</td>
</tr>
<tr>
<td>Relative Drag Area</td>
<td>1/2</td>
<td>1/3</td>
<td>1</td>
<td>1/2</td>
</tr>
</tbody>
</table>
May Achieve similar design Requirement but implementation makes a difference.

<table>
<thead>
<tr>
<th>Property</th>
<th>Cabled Array</th>
<th>NEPTUNE Canada</th>
<th>MARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth Rating (m)</td>
<td>3,500</td>
<td>3,500</td>
<td>1,000</td>
</tr>
<tr>
<td>Weight (lb)</td>
<td>3,000</td>
<td>11,000</td>
<td>4,100</td>
</tr>
<tr>
<td>Size (inch)</td>
<td>77 x 56 x 49</td>
<td>120 x 90 x 64</td>
<td>94 x 63 x 41</td>
</tr>
<tr>
<td>Envelope Volume (ft³)</td>
<td>125</td>
<td>400</td>
<td>140</td>
</tr>
<tr>
<td>Float Volume (ft³) (incl.)</td>
<td>24.3</td>
<td>126.2</td>
<td>49.0</td>
</tr>
<tr>
<td>Float Density (lb/ft³)</td>
<td>34</td>
<td>34</td>
<td>24</td>
</tr>
</tbody>
</table>
Node Design: Solution

- 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

Cabled Array Shallow Water Node

NEPTUNE Node

MARS Node

Parking Positions used during Maintenance
Node Design: Lessons Learned

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

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

Docking Frame Assembly
Node Design: Lesson Learned

- Recovery of Backbone Interface Assembly (BIA)

Recovery Bridal Frame Assembly