ROGER REVELLE
MIDLIFE REFIT OVERHAUL

RVOC
19 APRIL 2018
Ship Check: 3D Scanning

For specialized project sites that either lack sufficiently detailed plans or require a high level of layout accuracy. Scans provide the basis for development of the virtual model for unparalleled accuracy.

**Scanning**

- Infrared laser scanner with 2mm accuracy at a range of 330m
- Multiple scans are combined creating encompassing scan of ship spaces

**Modeling**

- 3D models reference scan data creating precise representations
- Actual scan data overlays 3D model data showing as-is and to-be conditions
**Roger Revelle Three Major Changes**

### Repower
- 4 vs 6 engines
- Common Bus vs. Split Bus
- AC vs DC; Drives and Motors
- New Propulsion Transformers
- Generator Freshwater Cooling
- PM Motor Freshwater Cooling

### Bow Thruster Replacement
- ZF Marine vs Tees White Gill

### Gondola
- Suspended sensor housing vs hull mounted. Improved performance via reduced bubble over arrays.
## Scope of Work

<table>
<thead>
<tr>
<th>Priority</th>
<th>WP</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Repower</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Bow Thruster Replacement</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>Z-Drive Inspection and Maintenance</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>Ballast System Piping</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>Ballast Treatment System Installation</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>Firemain System Piping</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>Potable Water System Modifications</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>Chiller Replacement</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>Sewage System and Drain Replacement</td>
</tr>
<tr>
<td>1</td>
<td>14</td>
<td>Ship Stores Refrigeration Equipment Replace</td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td>Ballast System Piping</td>
</tr>
<tr>
<td>1</td>
<td>16</td>
<td>oily Water System Piping</td>
</tr>
<tr>
<td>1</td>
<td>17</td>
<td>Firemain System Piping</td>
</tr>
<tr>
<td>1</td>
<td>18</td>
<td>Uncontaminated Sewalwater System Modifications</td>
</tr>
<tr>
<td>2</td>
<td>10A</td>
<td>A/C Spaces General</td>
</tr>
<tr>
<td>2</td>
<td>10B</td>
<td>HVAC Controllers Upgrades</td>
</tr>
<tr>
<td>2</td>
<td>10C</td>
<td>AHU 5 Zone Redesign</td>
</tr>
<tr>
<td>2</td>
<td>10E</td>
<td>AHU 2 MakeAir Upgrades</td>
</tr>
<tr>
<td>2</td>
<td>11A</td>
<td>HVAC MakeAir Upgrades</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>Crane Replacement</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>Science Refrigeration System Modifications</td>
</tr>
<tr>
<td>3</td>
<td>17</td>
<td>General Maintenance</td>
</tr>
<tr>
<td>3</td>
<td>27</td>
<td>Bridge Wing Console Maintenance</td>
</tr>
<tr>
<td>3</td>
<td>28</td>
<td>Exterior Ballast and Fuel Tank Vent Modifications</td>
</tr>
<tr>
<td>3</td>
<td>11C</td>
<td>Laundry Room Dryer Vent Modifications</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>Dial Telephone System Modifications</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>Navigation Lighting System Modifications</td>
</tr>
<tr>
<td>4</td>
<td>21</td>
<td>Fire Detection System Modifications</td>
</tr>
<tr>
<td>5</td>
<td>24</td>
<td>Aft Control Station Console Removal</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>Computer Life Console Modifications</td>
</tr>
<tr>
<td>4</td>
<td>29</td>
<td>Hydraulic Oil Transfer Pump Installation</td>
</tr>
<tr>
<td>4</td>
<td>31</td>
<td>Bosun Stores Access Modifications</td>
</tr>
<tr>
<td>4</td>
<td>33</td>
<td>Anchor and Chain Maintenance</td>
</tr>
<tr>
<td>4</td>
<td>100</td>
<td>Bow Thruster Room Air Conditioning</td>
</tr>
<tr>
<td>4</td>
<td>118</td>
<td>Generator Room Supply Fan Noise Mitigation</td>
</tr>
</tbody>
</table>

### 15 WPs. Criteria:
1. Considered critical to extending life
2. Or required to facilitate work that is critical
3. Or directly traceable to “green” goals

### 9 WPs. Criteria:
1. Considered a major contributor life-extension
2. And best completed while other invasive work is ongoing

### 4 WPs. Criteria:
1. Reduces inspection risk
2. Or improves science capability

### 11 WPs. Criteria:
1. Considered a non-major contributor to life extension
2. And more easily completed during future maintenance windows

Not shown in table is the Contract Technical Specification, S-01 (different from a Work Package).

It directs the contractor on general administrative, technical and testing requirements related to the project.
California-based Intermediate Class & smaller ships

Research vessels able to carry out California's local research and education needs have decreased from 3 to 1, with the last remaining ship approaching the end of its service life. **A new vessel is needed.**

**INTERMEDIATE**
- R/V New Horizon
- 170 feet / 40-day endurance
- 12 crew / 19 scientists

**REGIONAL**
- R/V Pt Sur
- 135 feet / 21-day endurance
- 8 crew / 12 scientists

**LOCAL / COASTAL**
- R/V Robert Gordon Sproul
- 125 feet / 14-day endurance
- 5 crew / 12 scientists

---

**Needed 2020 onward**
Collaborating on a shared research vessel

Vision: establish a new kind of partnership within California, involving public and private universities, research institutions, state agencies and non-governmental organizations to support a new California Coastal Research Vessel (CCRV) for seagoing education and research.

Efforts to date:

• Moss Landing Marine Laboratories (California State University) and the Scripps Institution of Oceanography (University of California) have agreed to collaborate jointly on this effort.

• Committed significant seed funding from each institution

• Assembled Scripps Small Ship Task Force to define institutional needs

• Sent Dear Colleague letter to 100+ ship users statewide to solicit input

• Scripps began a DOT-sponsored feasibility study (with Sandia National Labs) of a zero-emission research vessel (ZERo/V), including conceptual design
Hydrogen Fuel Cell Use in Maritime Applications

**H₂ Fuel Cell Power Provides:**

- Zero emissions
- No fuel Spills
- Quiet Operation

**Hydrogen Fuel Cell**

\[
2 \text{H}_2 + \text{O}_2 \rightarrow 2 \text{H}_2\text{O}
\]
**ZERO-V: Trimaran DESIGN**

Zero/V Mission
- Zero emissions
- General purpose R/V
- Coastal operations – CA
- 2500 nm range
- Dynamic positioning
- 18 scientists, 11 crew
- Large lab spaces
- Large working deck
- Substantial over-the-side handling systems
- Low underwater noise
- Capable hydro acoustic suite

Vessel Particulars
- Length: 170'-0"
- Beam: 56'-0"
- Draft: 12'-0"
- Depth: 21'-0"

Fuel Cell Power: ~ 1.4 MW
LH₂: ~ 8,000 kg