U.S. Navy Global Class AGOR Mid-Life Refits
Managed by the Office of Naval Research (ONR)

AGOR 23 – Thomas G Thompson
University of Washington (UW)
Shipyard 6/16 – 12/18 Completed

AGOR 24 – Roger Revelle
UCSD - Scripps Institution of Oceanography (SIO)
Shipyard 4/19 – 4/20 Awarded & Scheduled

AGOR 25 - Atlantis
Woods Hole Oceanographic Institution (WHOI)
Shipyard 5/20 – 5/21 planned
Why a Mid-life Refit?

• Three U.S. Navy Global Class Research Vessels (AGOR 23 Class) designed for 30 year service life
  – Thompson delivered in 1991 was approaching 25 years old
  – Revelle delivered in 1996 past mid-life at 22 years
  – Atlantis delivered in 1997 also past mid-life at 21 years
  – All three vessels well past mid-life at start of mid-life shipyard period

• U.S. Navy had just built two new Ocean Class RVs with no current plans by the Navy to build new Global Class vessels.

• All three ships were in good shape structurally and all serve as excellent platforms for conducting deep water integrated science

• Primary goals of Mid-Life Refit are to replace obsolete systems, improve maintainability and efficiency, meet current environmental regulations and extend the service life to 45 years
Core Elements of Refit

• Repower with Tier 3 Diesel Generators using two large (CAT 3516) and two small (CAT C32) with water cooled alternators on an integrated bus, replacing six diesel generators on a split bus.
• All new switchboards, power management system, automation and alarm system.
• New DC drives and overhauled DC motors on Thompson; New AC motors and drives on Revelle and Atlantis. Retain Z-Drives on all.
• Overhaul and new mounting plate for bow thruster on Thompson; New retractable bow thrusters (ZF marine) that are a tunnel thruster in retracted position for Revelle and Atlantis.
• Bring key systems in line with current environmental regulations: HVAC and refrigeration systems, Oily Water Separator, Marine Sanitation Device and Ballast Water Treatment System.
• Refurbish or replace piping, steel plating, overheads, lighting, and many other auxiliary and science systems. New Gondola on Revelle
Timeline - Milestones

◆ AGOR 23 – Thompson (Actual)
  ✓ Shipyard Contract awarded (Vigor Seattle) 24 Aug 2015
  ✓ Entered shipyard 16 June 2016
  ✓ Shipyard Delivery to UW 19 Dec 2017
  ✓ Shakedown cruises late Dec 2017 & early Jan 2018
  ✓ NSF Inspection 23-25 Jan 2018
  ✓ Returned to science Feb 2018 starting with transit to New Zealand & first science cruise at Kermadec Trench

◆ AGOR 24 – Revelle (Planned)
  ✓ Shipyard Contract awarded (Vigor Portland) 3 July 2018
  ✓ Planned start of shipyard period 15 April 2019
  ✓ Planned Delivery back to SIO 14 April 2020

◆ AGOR 25 – Atlantis (Tentative)
  ✓ Planned release of Shipyard RFP early 2019
  ✓ Planned Shipyard Contract start Spring 2019
  ✓ Planned start of shipyard period May 2020
  ✓ Planned Delivery back to WHOI May 2021
  ✓ Overhaul of DSV Alvin to be coordinated with Atlantis out of service period.
Funding

• **Thompson**
  – Specific funding for Mid-Life refit from U.S. Congress; Additional ONR funding; National Science Foundation (NSF); UW and Operating Funds programmed for Major Overhaul. ONR and NSF equipment and instrumentation grants completed during mid-life such as winch upgrades, gyro installation and new rescue boat are included.

• **Revelle**
  – Specific funding for Mid-Life refit from U.S. Congress; ONR, NSF, SIO and Operating Funds programmed for Major Overhaul. ONR and NSF equipment and instrumentation grants for projects to be completed during mid-life such as new Multibeam systems and installation of Gondola are included.

• **Atlantis**
  – Specific funding for Mid-Life refit from U.S. Congress; ONR. Additional funds from WHOI, NSF, operating funds and ONR/NSF equipment and instrumentation grants is anticipated.
## Lessons Learned - Changes

<table>
<thead>
<tr>
<th>Issue on <em>Thompson</em> Mid-Life</th>
<th>Mitigation/Changes for <em>Revelle</em>/<em>Atlantis</em></th>
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</thead>
<tbody>
<tr>
<td>Notching/Power Quality</td>
<td>Line Filters on <em>Thompson</em>; AC motors and Drives on <em>Revelle</em>/<em>Atlantis</em></td>
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<tr>
<td>Delays due to Motor Overhauls</td>
<td>New 2230kW/3000HP AC Motors on <em>Revelle</em>/<em>Atlantis</em></td>
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<tr>
<td>Delays due to late dry docking to repair leaking resulting from previously unidentified corrosion in the bow thruster mounting plate.</td>
<td>New bow thruster including all new hull structure. New thruster has seal instead of packing gland. Better performance and reduced noise</td>
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<td>Delays due to late identification of steel replacement requirements</td>
<td>Extensive inspection and steel gauging prior to shipyard, thorough inspection immediately after removals</td>
</tr>
<tr>
<td>Structural modifications due to size of Generator sets, water cooled alternators</td>
<td>Complete detailed contract design, equipment specification, different alternator supplier such that all new equipment fits without structural mods</td>
</tr>
<tr>
<td>Change orders to replace old cable planned to be re-used but couldn’t</td>
<td>All wiring/cables that will be affected by new equipment will be replaced with new</td>
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10/15/2018
# Lessons Learned - Changes

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<td>High Cost of Crane Overhauls</td>
<td>New Crane purchase and installation</td>
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<td>Insufficient time programmed for test and trials by Shipyard</td>
<td>Contract requirements for test and trials plan as an early deliverable.</td>
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<td>Delays by shipyard in completing detailed design and construction drawings</td>
<td>Design and Engineering completed by SIO and WHOI to at least 95% level and award of shipyard contract with sufficient time to complete final construction design work.</td>
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<td>Integration of new and old systems</td>
<td>Propulsion control system upgrades and other bridge systems completed prior to mid-life; requirement for an integration plan from the shipyard as an early deliverable.</td>
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<td>Lack of schedule updates from shipyard</td>
<td>Early enforcement of shipyard scheduling deliverables and updates</td>
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Empty Engineroom

First Generator being removed in dock through side of lower engineroom

First New Generator moving in
Bad old stuff – piping & wires
Completely updated Pilothouse

New propulsion plant
New Caterpillar diesel generator sets

New Switchboards in place
Thompson

Refurbished hydro-winches in place

Cables prepared for feeding into switchboards

Cable connections in new generator

New piping systems
Questions?

Thompson Back in Operation! Revelle & Atlantis Next

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