

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

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

Lessons Learned - Changes

Issue on <i>Thompson</i> Mid-Life	Mitigation/Changes for <i>Revelle/Atlantis</i>
High Cost of Crane Overhauls	New Crane purchase and installation
Insufficient time programmed for test and trials by Shipyard	Contract requirements for test and trials plan as an early deliverable.
Delays by shipyard in completing detailed design and construction drawings	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.
Integration of new and old systems	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.
Lack of schedule updates from shipyard	Early enforcement of shipyard scheduling deliverables and updates

Thompson



First Generator being removed in dock through side of lower engine room



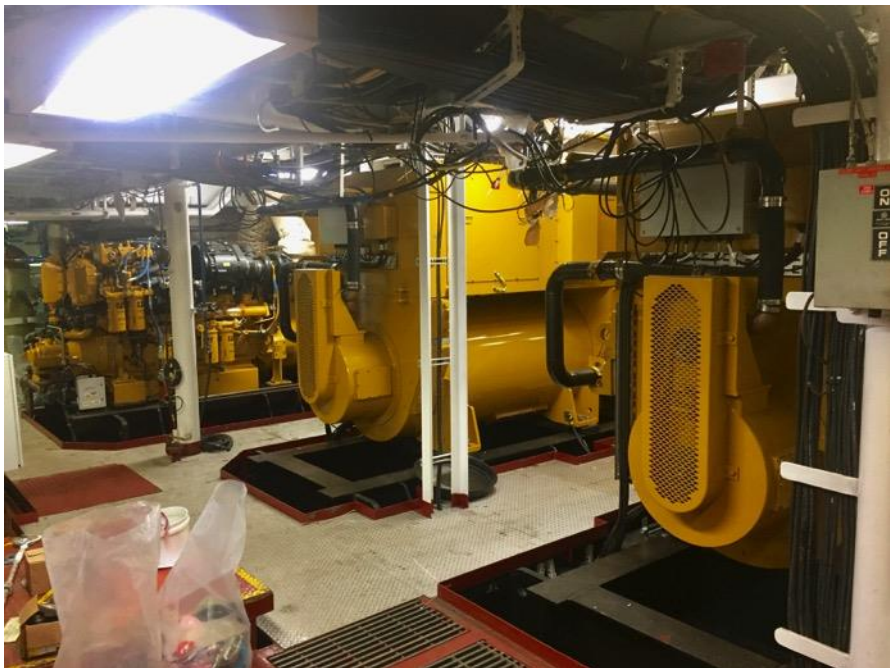
Empty Engine room



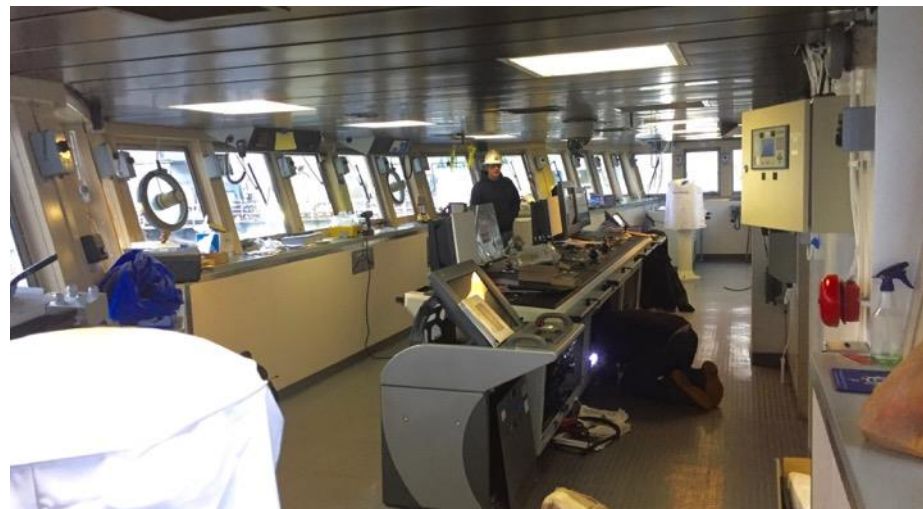
First New Generator moving in

Bad old stuff – piping & wires





New propulsion plant
New Caterpillar diesel generator sets



Completely updated Pilothouse



New Switchboards in place



Refurbished hydro-winsches in place



Cables prepared for feeding into switchboards



Cable connections in new generator



New piping systems

Questions?



Thompson Back in Operation! *Revelle & Atlantis Next*

Funding and Support provided by U.S. Congress, Office of Naval Research,
National Science Foundation, UW, SIO, & WHOI