



R/V *Atlantis* arrives  
in home port for  
the first time in  
April 1997.

# Replacing the Fleet

## *15 Years from Concept to Delivery*

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When R/V *Atlantis* arrived in Woods Hole for the first time on a bright, beautiful April 1997 day, it represented not only a welcome addition to the WHOI fleet but also the culmination of a 15-year UNOLS fleet modernization.

We tell this story to illustrate the time and effort involved in acquiring (or modernizing) research facilities, like research vessels, with long lead times. Ships generally have a useful lifetime of 20 years without a major upgrade. A midlife refit, including refurbishing all major systems, will usually extend that lifetime by about 10 to 15 years.

In the early 1980s, the academic fleet was facing a crisis. All of its large research ships either needed immediate replacement or soon would (see top

figure opposite). This fleet of large ships, built by the Navy as part of its long-standing policy of outfitting US oceanographers with quality research vessels, represented a huge investment. Its modernization would require considerable effort, commitment, and money.

The endeavor kicked off in grand fashion when in July 1984 Secretary of the Navy John Lehman and Chief of Naval Operations Admiral James Watkins announced their "Navy Policy on Oceanography." It stated, in part, "*Oceanographic research ship will be procured.* Navy will include \$35M in the ...87 budget for the procurement of a Navy-owned oceanographic research ship to be utilized by the civilian academic oceanographic research community with



SHIP		Operator	Built	Age in 1983
<i>Conrad</i>		Lamont-Doherty Geological Observatory	1962	21 years
<i>Thompson</i>		University of Washington	1965	18 years
<i>Washington</i>		Scripps Institution of Oceanography	1965	18 years
<i>Melville</i>		Scripps Institution of Oceanography	1969	14 years
<i>Knorr</i>		Woods Hole Oceanographic Institution	1970	13 years
<i>Gyre</i>		Texas A & M	1973	10 years
<i>Moana Wave</i>		University of Hawaii	1973	10 years

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a target IOC (Initial Operational Capability) of 1991... The Oceanographer of the Navy and the Chief of Naval Research will jointly develop an oceanographic research ship construction program to be submitted to the Chief of Naval Operations in time for (fiscal year 1987 budget submission). The objective of the program is to insure appropriate deep ocean research platforms are available to meet Navy operational and research requirements." In the

following months, this initiative was fleshed out and developed by the Oceanographer of the Navy, the Office of Naval Research (ONR), and the Naval Sea Systems Command, with significant input from the oceanographic community through UNOLS (University-National Oceanographic Laboratory System), an association of ocean science institutions that operate and use the US academic research fleet.

## US Navy AGORs\*

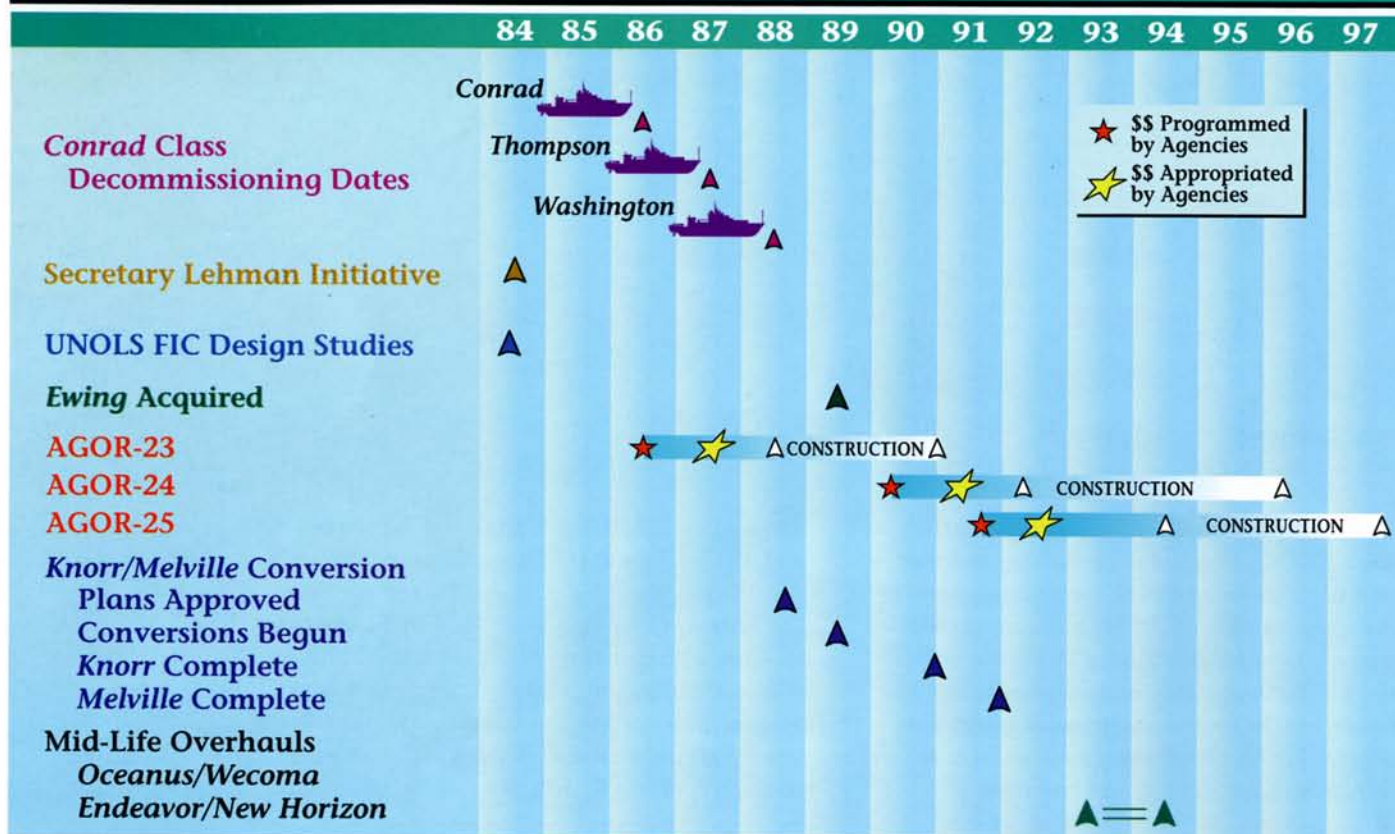
(AGOR: Auxiliary General-purpose Oceanographic Research vessels)

NO.	NAME	LENGTH	LIFE SPAN	OPERATING INSTITUTION
1	<i>Gibbs</i>	311'	1944-82	Seaplane tender <i>San Carlos</i> 1944-58, Hudson Labs of Columbia University 1958-68, Naval Research Labs 1968-82
2	<i>Manning</i> (ex T-514)	65'	1953-70s	Army T-514 cargo boat 1953-55, Hudson Labs and Crumb School of Mines, Columbia University 1955-70s
3	<i>Conrad</i>	208'	1962-89	Lamont-Doherty Geological Observatory, Columbia University
4	<i>Gilliss</i>	208'	1963-84	Military Sealift Command for West Coast Navy labs
5	<i>Davis</i>	208'	1963-80	Military Sealift Command for West Coast Navy labs
6	<i>Sands</i>	208'	1964-79	Military Sealift Command for East Coast Navy labs
7	<i>Lynch</i>	208'	1965-91	Military Sealift Command (MSC) for East Coast Navy labs
8	<i>Eltanin</i>	266'	1957-72	Navy cargo ship 1957-62, NSF Antarctic research 1962-72
9	<i>Thomas G. Thompson</i>	208'	1965-91	University of Washington
10	<i>Thomas Washington</i>	208'	1965-92	Scripps Institution of Oceanography, UC-San Diego
11	<i>Mizar</i>	266'	1957-90s	Navy cargo ship 1957-64, MSC for various commands 1964-90s
12	<i>DeSteiguer</i>	208'	1969-92	Military Sealift Command for West Coast Navy labs
13	<i>Bartlett</i>	208'	1969-93	Military Sealift Command for West Coast Navy labs
14	<i>Melville</i>	279'	1969-2014	Scripps Institution of Oceanography, UC-San Diego
15	<i>Knorr</i>	279'	1970-2015	Woods Hole Oceanographic Institution
16	<i>Hayes</i>	246'	1971-pres.	Military Sealift Command for Naval Research Laboratory
17	<i>Chain</i>	213'	1944-79	Woods Hole Oceanographic Institution (1958-79)
18	<i>Argo</i>	213'	1944-70	Scripps Institution of Oceanography, UC-San Diego (1959-70)
19	} AGORs 19 and 20 were cancelled and not built			
20				
21	<i>Gyre</i>	182'	1973-2003	Texas A&M University
22	<i>Moana Wave</i>	210'	1973-2004	University of Hawaii
23	<i>Thomas G. Thompson</i>	274'	1991-2021	University of Washington
24	<i>Roger Revelle</i>	274'	1996-2026	Scripps Institution of Oceanography, UC-San Diego
25	<i>Atlantis</i>	274'	1997-2027	Woods Hole Oceanographic Institution

\*Sources include: Office of Naval Research, Navy Contemporary History Branch, *Oceanographic Ships Fore and Aft* by Stewart B. Nelson (1971), *The Ships and Aircraft of the US Fleet* by Norman Polmar (1981), *Jane's Fighting Ships 1988-89*.



## Recent UNOLS Fleet Modernization



A giant crane lifts *Knorr* in 1989 as the ship's refit begins at McDermott Shipyards in Amelia, Louisiana.

Elements of the UNOLS Fleet Modernization Plan included:

- Retiring four older AGORs, *Conrad*, *Thompson*, *Washington*, and *Gyre* (AGOR is Navyspeak for Auxiliary General-purpose Oceanographic Research—see figure on page 13 for list of AGORs),
- acquiring new vessels (AGORs 23, 24, and 25),
- initiating major conversions for *Knorr* and *Melville* (later this was extended, with National Science

Foundation (NSF) funding, to include the intermediate-sized vessels *Oceanus*, *Endeavor*, *Wecoma*, and *New Horizon*), and

- a major overhaul for *Moana Wave*.

Time lines for most of this effort are shown above.

The *Knorr/Melville* conversions were prompted by poor reliability of the ships due to propulsion plant design. Both were experiencing ten months mean time between drydockings. In addition, they were too noisy for acoustic operations, an essential element of oceanographic research, and too small and lacked the seakeeping qualities to accommodate large science parties for long periods to carry out the global scale programs then being contemplated, especially the World Ocean Circulation Experiment (WOCE) and the Joint Global Ocean Flux Study (JGOFS).

The scope of the *Knorr/Melville* conversion effort was defined by representatives of the operating institutions (WHOI and SIO) and ONR with inputs from NSF, UNOLS, and the user community. This group recommended that the ships be:

- reengined (converted from direct-drive cycloidal to quieter, more reliable diesel electric engines with azimuthing Z-drives),
- repiped, and
- rewired. (Note: It is no secret that this project had a few bad moments and took longer and cost more than was planned—but it is not the purpose of this article to delve into those issues!)

The figure opposite above compares the pre- and



Courtesy of McDermott Shipyards



post-conversion characteristics of the two vessels.

After their conversions (and a great deal of TLC from the operating institutions and their dedicated crews), these virtually new ships have performed magnificently. The proof of this assertion is in their post-conversion performance: Both ships have since spanned the globe reliably and served science capably. The objectives of the conversions have been tested and exceeded. Both vessels have carried large science parties on long cruises in waters that would have exceeded their preconversion capacities (see cruise track chart, below, and Labrador Sea article on page 18).

The Navy plan that grew out of the Lehman/Watkins initiative called for building three new ships and eventual replacement of all five existing AGORs. (This plan has gone through several modifications since its adoption—notably Lamont-Doherty Earth Observatory of Columbia University, operator of *Conrad* (AGOR-2), opted to acquire, with NSF support, a used vessel that was renamed *Maurice Ewing* for a noted geophysicist and Lamont Director. *Gyre* was transferred to the state of Texas and remains in service. The fate of *Moana Wave* is pending, but it will probably be replaced by another AGOR currently in the design stages.

The Lehman/Watkins oceanography initiative had enthusiastic community support. The UNOLS Fleet Improvement Committee (FIC), with major inputs from potential users, wrote a series of

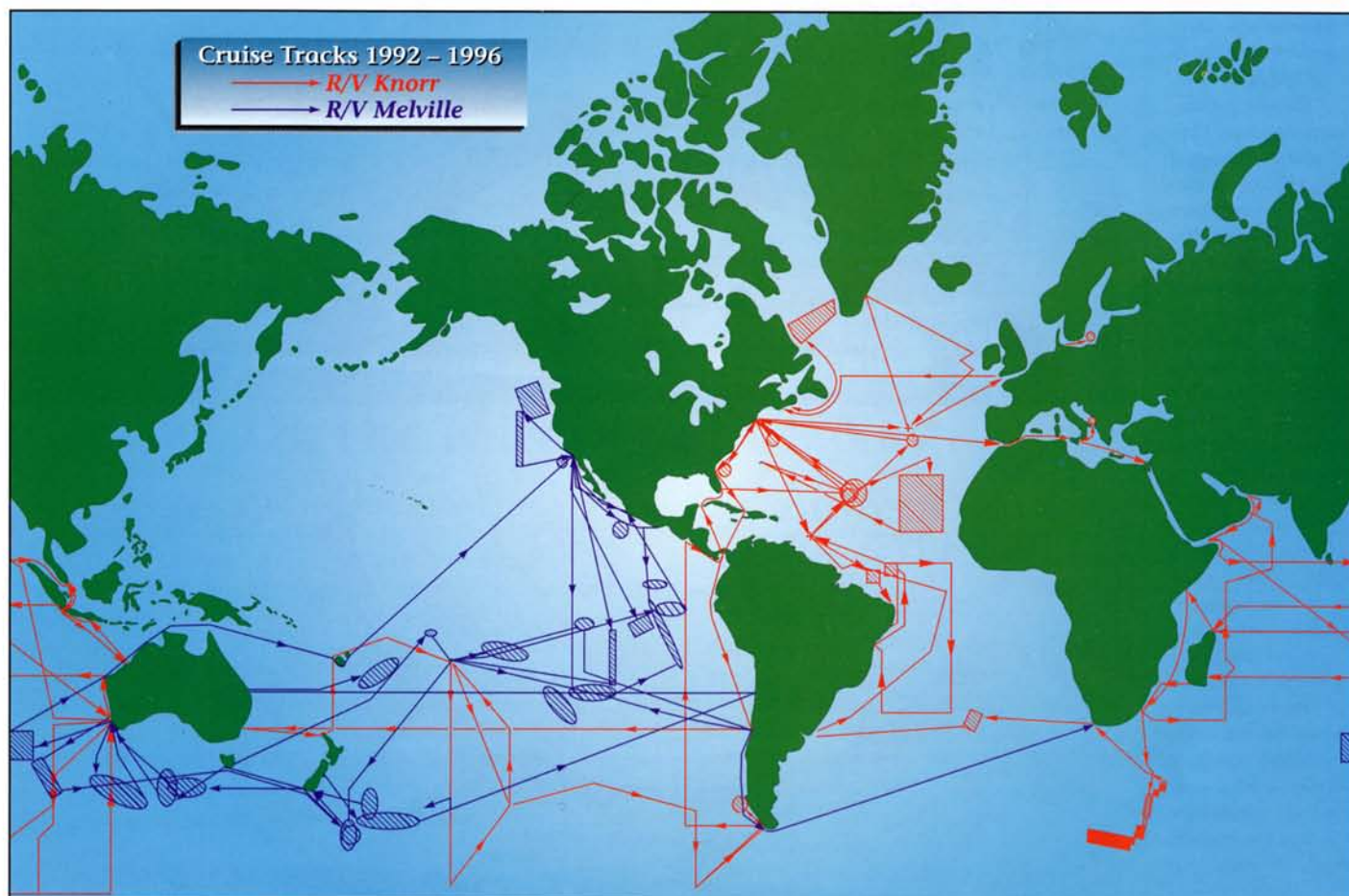
## R/V Knorr Characteristics Before and After Refit

	Former	New	Change
Length Overall (feet)	245	279	+34
Beam (feet)	46	46	-
Draft (feet)	16	15.5	-.5
Full Load Displacement (tons)	2,415	2,670	+255
Propulsion Horsepower	2,800	3,000	+200
Cruising Speed (knots)	10	12	+2
Maximum Speed (knots)	12	14	+2
Fuel Capacity (gals)	122,000	155,000	+33,000
Cruising Range (miles)	10,000	12,000	+2,000
Crew	25	23	-2
Scientists	24	34	+10
Lab Space (sq. ft.)	1,540	3,130	+1,590
Science Storage (sq. ft.)	1,020	1,776	+756
Main Deck Working Area (sq.ft.)	3,424	3,764	+340

Fritz Heide

scientific mission requirement statements that were used by Navy officials to compose documents that led to awarding of a contract to Halter Marine Inc. of Moss Point, Pascagoula, Mississippi, for construction of the lead ship in the new AGOR-23 class. Through competitive bidding, ONR selected the University of Washington as the operator of the new ship. It would replace and bear the same name as

*Knorr* and *Melville* have ranged the world ocean since their refits.



Jayne Doucette



R/V *Thomas G. Thompson* (AGOR-23) was the first of the new class of AGORs to be built. The ship was delivered to the University of Washington in 1996.

AGOR-9, *Thomas G. Thompson*. The contract was let in June 1988 and the ship was completed and put into service on 8 July 1991.

In FY '91 and FY'92, Congress appropriated funds for AGORs 24 and 25 respectively to complete the class. Again ONR solicited bids for operator institutions. The Scripps Institution of Oceanography, University of California, San Diego, was awarded operation of AGOR-24 to replace *Thomas Washington*. The new ship was named *Roger Revelle* after Roger Randall Dougan Revelle, a distinguished Scripps graduate (Ph.D., 1936) and former director (1951-1964), who died in 1991 at age 82.

Woods Hole Oceanographic Institution also submitted a bid for one of the AGORs. Our proposal involved taking *Atlantis II* out of service, selling it, and converting *Knorr* to be the support ship for *Alvin*. Eventually this plan was modified at the Navy's behest to make the new *Atlantis* the

National Deep Submergence Support Ship instead of *Knorr*. There followed some remarkable cooperation and rapid action between federal agencies (especially ONR and NSF), the Naval Sea Systems Command, the shipbuilder, and WHOI to change

the ship's mission statement and the associated SOR (the governing document for building *Atlantis*) to develop a ship change proposal and negotiate a price. All this was accomplished without delaying completion of the ship. In fact, *Atlantis* was completed ahead of

schedule. In my experience, this sort of major change late in the construction of a ship with the customer (WHOI) providing equipment (the *Alvin* A-frame) as well as technical and design advice and guidance is unprecedented. It is a tribute to all involved that this effort turned out so well.

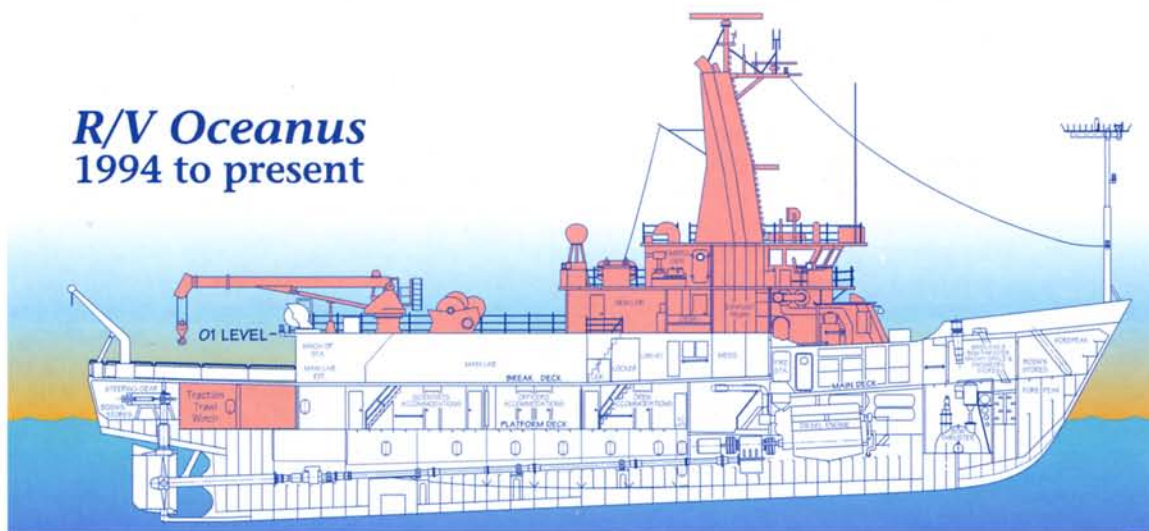
During the construction of the large ships, WHOI Marine Operations Manager Joe Coburn and the other operators initiated a plan for major



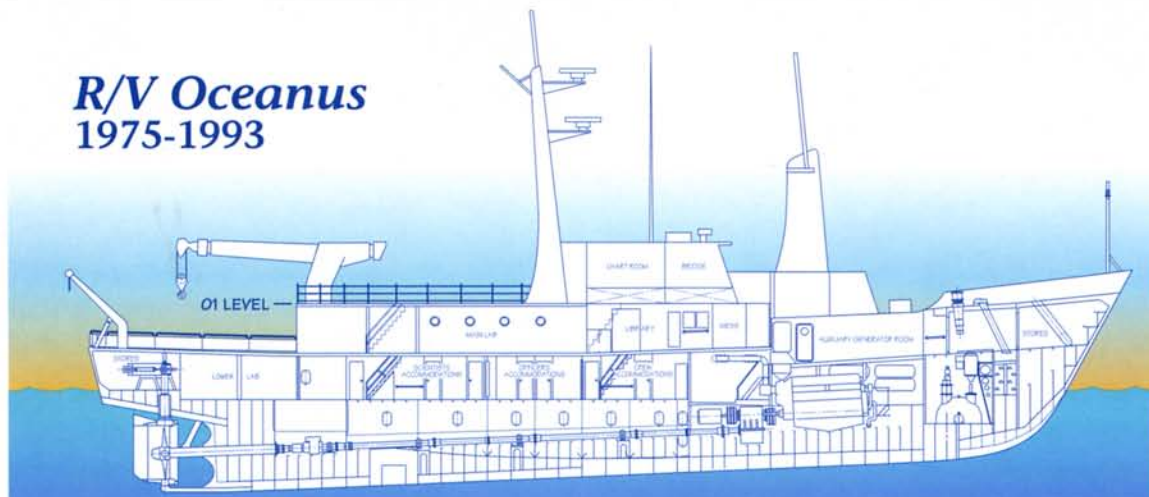
Courtesy of University of Washington

Midlife refit upgrades to *Oceanus* completed in 1994 included a one-third increase in laboratory space, from 1,054 to 1,390 square feet. Science berthing increased from 12 to 15, and an additional 4 berths are also available in a portable van. The heating-ventilation-air conditioning system was fully replaced, and new refrigerators and a freezer were installed along with new main and auxiliary exhaust systems. The ship was equipped with a rebuilt reduction gear, a new crane, a bigger A-frame, a new capstan, a new anchor windlass, and a new emergency generator. The main engine was overhauled and upgraded, and a new structure (forward shaded area) was built to house the pilot house, chart room, and communications room.

## R/V *Oceanus* 1994 to present



## R/V *Oceanus* 1975-1993



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midlife refits of the *Oceanus* class ships: *Oceanus* (WHOI), *Endeavor* (University of Rhode Island), and *Wecoma* (Oregon State University), built in the mid 1970s. This effort was vetted by the UNOLS Fleet Improvement Committee and supported, at a fixed cost of \$3 million each by NSF, owner of these ships. The figure opposite below shows the work involved for *Oceanus*.

WHOI and URI cooperated in developing detailed design and contract specifications. NSF and the operators agreed to space these midlife overhauls over three years. They were completed in 1993 (*Endeavor*) and 1994 (*Oceanus* and *Wecoma*). The work packages were tailored to the individual ships (each ship of the class had differences) and to the ships' perceived clientele. WHOI emphasized open deck area to support mooring work and physical



Roger Archibald

oceanographers. The work on *Endeavor* was similar to that on *Oceanus*, except that *Endeavor's* after-deck was also extended. *Wecoma's* refit was limited to work below the 01 deck.

In 1996, the Scripps ship *New Horizon* was overhauled, completing the UNOLS intermediate-class modernization.

There is a very important lesson here. This process took 13 years to complete from the time it was endorsed by Navy leaders, who were responding

to oceanographic community suggestions. Even with full support and high priority in Washington from both the Federal agencies and Congress, replacement of ships is a decadal process. Given a nominal ship service life of about 30 years, planning for ship replacement must begin before the ships to be replaced are 20 years old. ■

AGOR-25 was launched in February 1996 and delivered to WHOI in 1997. It continues the *Atlantis* tradition begun when the Institution was founded in 1930.



Rudolf Thompson

## On the Naming of US Navy Ships

Generally, the Secretary of the Navy authorizes the naming of a Navy ship based on recommendations from the Naval Historian and a board convened to review naval vessel names. Individuals involved with Navy oceanography, meteorology, mathematics, and astronomy have usually been favored in the naming of ships. In the cases of the three newest AGORs, this tradition was expanded to include the traditions and sentiments of the operating institutions: Thomas G. Thompson founded oceanography at the University of Washington, Roger Revelle was long-time director of the Scripps Institution of Oceanography, and the Woods Hole Oceanographic Institution has had a ship named *Atlantis* since its founding in 1930. Because Navy tradition does not include the numbering of ships, the WHOI vessel is called simply *Atlantis* rather than *Atlantis III*.

In honor of 1998 as the United Nations-designated Year of the Ocean and to encourage young people's interest in ships, oceanography, maritime studies, and use of the Internet, Oceanographer of the Navy Rear Admiral Paul Tobin initiated a different ship naming procedure for the Navy's newest T-AGS 60 class oceanographic survey ship. Teams of elementary and secondary school students are encouraged to submit names for the ship, scheduled for launch in late 1998, along with educational projects to support and justify their proposed name. Projects were to begin in September 1997 and be submitted to a state Navy League office by December 31, 1997.

Further information on the contest is available on the World Wide Web at the following address:

<http://oceanographer.navy.mil/TEXT/contest.html>