FEDERAL FLEET STATUS REPORT:
CURRENT CAPACITY AND NEAR-TERM PRIORITIES

PRODUCT OF THE

Interagency Working Group on
Facilities and Infrastructure

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Executive Summary

The Federal Oceanographic Fleet (Fleet) is a critical national infrastructure that supports Federal agency and academic oceanographic operations, surveys, research, and polar ice-breaking capability across a broad spectrum of national needs. Ships provide access to the world's oceans and Great Lakes, and enable data collection and research for thousands of stakeholders from academia, government, and the public sector. The Nation had an oceanographic Fleet of 35 vessels at the end of fiscal year (FY) 2015[1], but Fleet size is projected to decline to 18 vessels by FY 2030 absent further investment.

This report, prepared by the Interagency Working Group on Facilities and Infrastructure (IWG-FI), updates the May 2013 *Federal Oceanographic Fleet Status Report* based on retirements and new capacity. This government-wide analysis of priorities, activities, and needs ensures that oceanographic agencies have the information necessary to make informed, coordinated, and cost-effective Fleet investments that maximize the entire Fleet's ability to support high priority research and surveys.

In April 2015, the IWG-FI generated a baseline on Federal oceanographic research and survey activities from FY 2010–2014. The IWG-FI determined that Science and Technology (Research), primarily supported by the National Science Foundation (NSF) and the Office of Naval Research (ONR), and Resource Management (Surveys), conducted by the National Oceanic and Atmospheric Administration (NOAA), are equally important Tier One Priority Activities. The Sub-categories of Earth System Sciences, Polar Research, Living Marine Resource Surveys, and Hydrographic Surveys were identified as the Nation's highest-priority and most important ocean-science activities within these two categories. Subsequently, the IWG-FI used the baseline information to compare the current capacity of the Fleet with the needs projected by agencies to support their oceanographic research and survey priorities.

NSF is in the final design phase of planning for construction of two Regional Class Research Vessels (RCRV). Funds to initiate construction of two RCRVs are included in the FY 2017 President's Budget for NSF. Additionally, ONR is planning to extend the operational lifetime of two Navy-owned Global Class ships. The Research Vessel (R/V) *Thomas G. Thompson* and R/V *Roger Revelle* are both funded for mid-life refits. NOAA plans to use funds appropriated in FY 2016 to begin design and construction of a Regional Survey Vessel (RSV), and the FY 2017 President's Budget includes funds to complete construction of that ship, as well as an additional $100 million in mandatory funding to acquire a second RSV. The RSVs will be optimized for operation in coastal waters, bays, and estuaries, and will support fishery surveys critical to species management, habitat and hydrographic surveys, and disaster response.

The United States Coast Guard (USCG) is acquiring a new heavy polar-class icebreaker and currently plans to sustain current icebreaker capacity at least until the new ship is deployed. The FY 2017 Budget includes $150 million to complete the design activities required to award a production contract by FY 2020.

With these initial investments to support the construction of two RCRVs and two RSVs, the mid-life refits of two global class ships, and the sustainment of polar icebreaker capacity, the Fleet size is projected to

[1] For the purpose of this report, we have excluded Military Survey Ships (TAGS) from the Fleet, although they were included in the May 2013 *Federal Oceanographic Fleet Status Report*.

be 22 ships by FY 2030 compared to 18 ships without investment. This projected reduction in Fleet capacity, however, will still result in a decrease in support for all Federal agencies' Tier One Priority Marine Science Activities. The geographic regions most affected will be the United States Arctic/Alaska, Gulf of Mexico, Atlantic, and the Pacific Islands/Hawaii.

This report concludes that given these findings, the most important first step to address emerging gaps in the Fleet will be to invest in Regional Class vessels, starting with the four mentioned above. These new ships will support documented ocean-survey and research requirements to increase operations in near-shore coastal and estuarine waters, and will be the most cost-effective investments to increase the capacity of the Fleet.

While the near-term focus is on modernizing the fleet with Regional Class capabilities, however, the IWG-FI and member agencies have also documented continuing requirements and emerging gaps for Ocean and Global Class vessels to support agency activities and will need to further assess Fleet condition and plan for future capabilities. The IWG-FI therefore also recommends that member agencies continue to take a disciplined and coordinated planning approach towards identifying core mission requirements and matching these to advancements in ship design and technologies that maximize at-sea data-collection abilities and accomplish the mission in a safe and cost-effective manner. As such, Federal oceanographic agencies may release their own specific and more detailed modernization plans informed by the findings of this report.

Introduction

The Federal Oceanographic Fleet (Fleet) is a critical national infrastructure that supports Federal agency and academic oceanographic operations, surveys, and research across a broad spectrum of national needs. Ships provide access to the world's oceans and Great Lakes, and enable data collection and research for thousands of stakeholders from academia, government, and the public sector. The Nation had an oceanographic fleet of 35 vessels at the end of fiscal year (FY) 2015, which is projected to decline to 18 vessels by FY 2030 absent additional investment.

Given advances in efficiency and technology, modernizing the Fleet and addressing emerging gaps should not require that each retired vessel be replaced with a similar class vessel. However, modernization will require Federal partners to continue their successful coordinated strategies, including leveraging remaining assets, achieving synergies through collaborative mission planning and the use of multi-mission capable platforms, and implementing the most cost-effective investment strategies, factoring in both upfront acquisition costs and longer-term operations and maintenance for assets designed for a 25-30 year service life.

This report acknowledges the continued value and importance of federal agency collaboration on the use and operation of the Fleet in order to maximize the effectiveness of limited at-sea resources.

As an update to the National Ocean Council's May 2013 *Federal Oceanographic Fleet Status Report*, the Office of Science and Technology Policy (OSTP) requested the Subcommittee on Ocean Science and Technology's Interagency Working Group on Facilities and Infrastructure (IWG-FI) to complete two tasks:

- Task One: Generate a government-wide baseline on FY 2010–2014 Federal oceanographic research and survey activities; and
- Task Two: Document the current capacity of the Fleet and prioritize Fleet activities based on national ocean priorities.

Since the release of the May 2013 *Federal Oceanographic Fleet Status Report*, the Fleet has experienced both retirements and new capacity. This government-wide analysis of priorities, activities, and needs ensures that oceanographic agencies have the information necessary to make informed, coordinated, and cost-effective Fleet investments that maximize the entire Fleet's ability to support high-priority research and surveys.

For the purpose of this report, the Federal Oceanographic Fleet excludes the Military Survey Ships (TAGS) included in the May 2013 *Federal Oceanographic Fleet Status Report*. (This exclusion is due to restrictions on data sharing.) The Fleet referred to in this report is composed of the subset of Fleets known as the United States Academic Research Fleet (ARF) scheduled through the University National Oceanographic Laboratory System (UNOLS), the National Oceanic and Atmospheric Administration (NOAA) research and survey Fleet, and the U.S. Coast Guard (USCG) polar icebreakers and vessels chartered by the National Science Foundation (NSF).

Task One was completed in April 2015. Figure 1 shows the FY 2010–FY 2014 Baseline Summary of Fleet activities grouped into Categories and Sub-Categories. The activities are described in terms of Fleet Days

at Sea (DAS) and Operating Days (OD) by Category and Sub-Category. The distinction between DAS and OD is that OD includes days in which vessels are staged in ports other than homeport. NOAA uses DAS and UNOLS uses OD as a baseline for planning and accounting. The IWG-FI identified the activity and priorities based on validated agency requirements, the current capacity of the Fleet, and projected gaps through FY 2030. Two activities, Science and Technology (Research) and Resource Management, have the largest number of funded days and are the highest priorities Fleet-wide.

The three priority tiers are:

Tier 1:
- Science and Technology (Research), including Earth Systems Science and Polar
- Resource Management (Survey), including Living Marine Resource Surveys and Hydrographic Surveys

Tier 2:
- Mission Support, including Ship Maintenance and Readiness and Antarctic Research Station Logistics

Tier 3:
- Education and Outreach

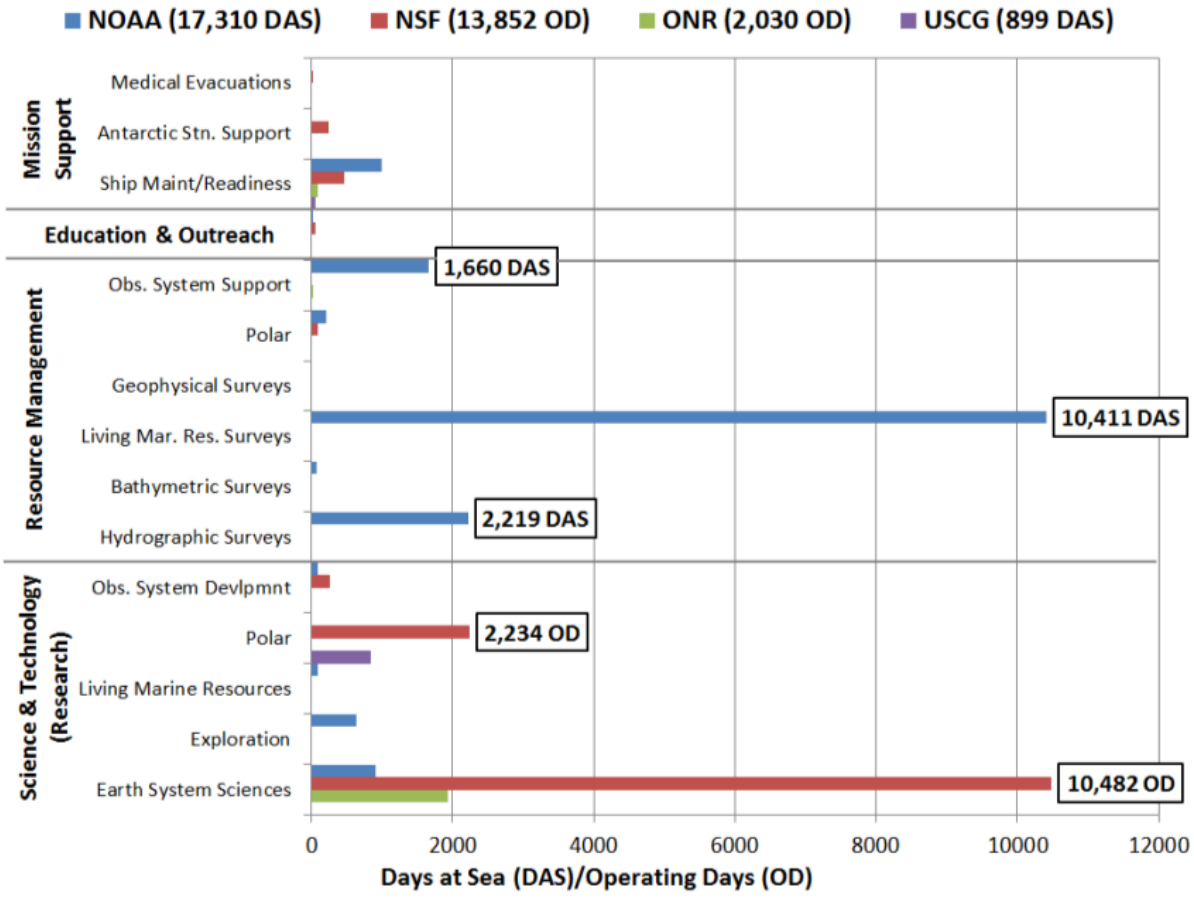


Figure 1. FY 2010–FY 2014 Baseline Summary of Priority Activity Tiers

These results reflect requirements of IWG-FI Federal agencies including NSF, NOAA, ONR, and USCG. Assistance was provided by the UNOLS office, which provides coordination and scheduling support for the

ARF. This report explains the current and emerging capacity of the Fleet and its projected capacity through FY 2030. It describes gaps in terms of overall capacity loss, the loss by Class of vessel, the impacts to Priority Tiers, and the most impacted regions.

Fleet Capacity

Current Capacity (FY 2015)

As described in the *Federal Oceanographic Fleet Status Report*, capacity is the ability of the Fleet to support Federally-funded projects in a timely and cost-effective manner. Capacity is determined by considering a combination of factors: total operating budget; total number of ships in the Fleet (or in a particular Class of ships in the Fleet); each ship's design, size, range, and endurance; total number of available science berths; ships' mission configurations; and the Fleet's geographic distribution. Fleet capacity impacts the science that can be conducted based on the ship's sampling capabilities, number of operating days available, science-party size, maximum cruise lengths, and the ability to operate in certain areas. Current capacity assumes the maximum operating tempo in DAS or OD per year. The operating tempo varies between 180 and 300 days per year depending upon ship design, age, work region, and overall condition. Capacity is defined as the maximum expected operating tempo unconstrained by funding. Downsizing the Fleet would further reduce its operating tempo, hindering its ability to meet priority requirements.

In FY 2015 the Nation had a Fleet of 35 oceanographic research and survey vessels (Table 1). The distinction between research and survey is described in Appendix I, and additional information can be found in the May 2013 *Federal Oceanographic Fleet Status Report*. The Fleet is composed of ships greater than 40 meters (130 feet) in length that are owned and operated or leased by the Federal government, along with those State- or institutionally owned ships within the ARF (NOAA Ship *Ferdinand R. Hassler*, 37.7 meters in length, is also included). The current capacity of the Fleet consists of three ship Classes based primarily on size—Global, Ocean/Intermediate, and Regional. Table 1 also shows the primary activity Sub-Category supported by each ship and illustrates how Research ships are essential for Earth System Science missions and Survey ships for Living Marine Resources and Hydrographic Surveys.

Emerging and Projected Capacity (FY 2016)

In recent years, the Federal agencies have worked to "right-size" the Fleet. Defining the Fleet size that can be effectively operated within available budgets has required that older, less capable and/or efficient ships, or ships with low demand, be retired as newer, state-of-the-art, more capable ships prepare to come on-line. In FY 2012 NSF retired the Ocean/Intermediate Class R/V *Wecoma*. In FY 2015, the Global Class research vessels R/Vs *Melville* and *Knorr* were retired after 45 years of service, Regional Class R/V

Table 1. Federal Fleet Capacity FY 2015

Ship/Class	Partner	Ship Age	Annual Capacity (DAS/OD)	Research or Survey Ship	Mission Categories				
					Resource Mgmt		Science & Technology (Research)		
					LMR Surveys	Hydro	Earth System Sc	Polar	Exploration
Global Class									
Atlantis	ONR	18	300	R			x		
*Healy**	USCG	15	235	R			x	x	
*Joides Resolution**	ODL	27	235	R			x		
Knorr	ONR	45	300	R			x		
*Laurence M. Gould**	ECO	18	235	R			x	x	
Marcus G. Langseth	NSF	24	300	R			x		
Melville	ONR	46	300	R			x		
*Nathaniel B. Palmer**	ECO	23	235	R			X	x	
*Polar Star**	USCG	39	235	R				x	
Roger Revelle	ONR	19	300	R			x		
Ronald H. Brown	NOAA	19	235	R	x	x	x		
Sikuliaq	NSF	1	300	R			x		
Thomas G. Thompson	ONR	24	300	R			x		
Ocean/Intermediate Class									
Atlantic Explorer	BIOS	33	180	R			x		
Bell M. Shimada	NOAA	7	235	S	x				
Endeavor	NSF	39	230	R			x		
Fairweather	NOAA	48	235	S		x			
Gordon Gunter	NOAA	26	235	S	x				
Henry B. Bigelow	NOAA	10	235	S	x				
Hi'ialakai	NOAA	31	235	S	x				
Kilo Moana	ONR	13	280	R			x		
Nancy Foster	NOAA	25	235	S	x				
Oceanus	NSF	40	210	R			x		
Okeanos Explorer	NOAA	27	235	R	x	x			x
Oscar Dyson	NOAA	12	235	S	x				
Oscar Elton Sette	NOAA	28	235	S	x				
New Horizon	SIO	37	230	R			x		
Pisces	NOAA	8	235	S	x				
Rainier	NOAA	48	235	S		x			
Reuben Lasker	NOAA	3	235	S	x				
Thomas Jefferson	NOAA	24	280	S		x			
Regional Class									
Ferdinand R. Hassler	NOAA	6	235	S		x			
Hugh R. Sharp	UD	10	230	R			x		
Oregon II	NOAA	48	235	S	x				
Point Sur	NSF	34	180	R			x		
Total # of Ships	35								

**NSF chartered vessels*

Point Sur was retired after 34 years of service, and R/V *New Horizon* was retired after 37 years of service. Work previously done on RVs *Knorr* and *Melville* will be supported by two newly constructed Ocean Class vessels, R/Vs *Neil Armstrong* and *Sally Ride,* which will begin their first year of operations in FY 2016.

Since 2011, NOAA has retired one Regional Class and three Ocean Class vessels. In FY 2012, NOAA activated a Regional Class vessel, NOAA Ship *Ferdinand R. Hassler,* and in FY 2015 activated one newly constructed Ocean Class Fisheries Survey Vessel, the NOAA FSV *Reuben Lasker*.

NSF's RCRV-1 will be operated by Oregon State University and will service the west coast of the United States after acceptance into the ARF Fleet, expected in 2022. RCRV-2 will service the east coast and Gulf of Mexico starting in 2023, but the operator has not been selected.

It is expected that NOAA's first RSV (RSV-1) will enter service in 2024 in the Gulf of Mexico region. In order to take full advantage of the requirements driven design of RSV-1, RSV-2 is expected to enter service in 2025 in the Hawaiian and Pacific Islands region. Assets currently serving these regions will either be retired or reallocated to service another location based on needs of the Fleet at that time. Similar to RCRVs, NOAA plans to make use of the first year of service to effectively transition the ship into full operations.

The definitions of each ship Class have also been reevaluated, as state-of-the-art ship equipment makes smaller size vessels more capable. For example, NSF and NOAA envision that more cost effective Regional Class ships will be working outside their traditional areas, as defined in the *Federal Oceanographic Fleet Status Report*. Updated definitions are listed below.

Global Class ships are the largest and most capable with the ability to work worldwide with large scientific parties and the longest endurance.

Ocean Class ships are slightly smaller than Global Class vessels and are highly capable but typically work within an ocean basin. The Ocean Class ships have slightly shorter endurance but are state-of-the-art platforms. This Class includes the older and less-capable "Intermediate" ships that are being phased out as they reach their End of Service Life, and the term "Intermediate" is being eliminated from the Class title.

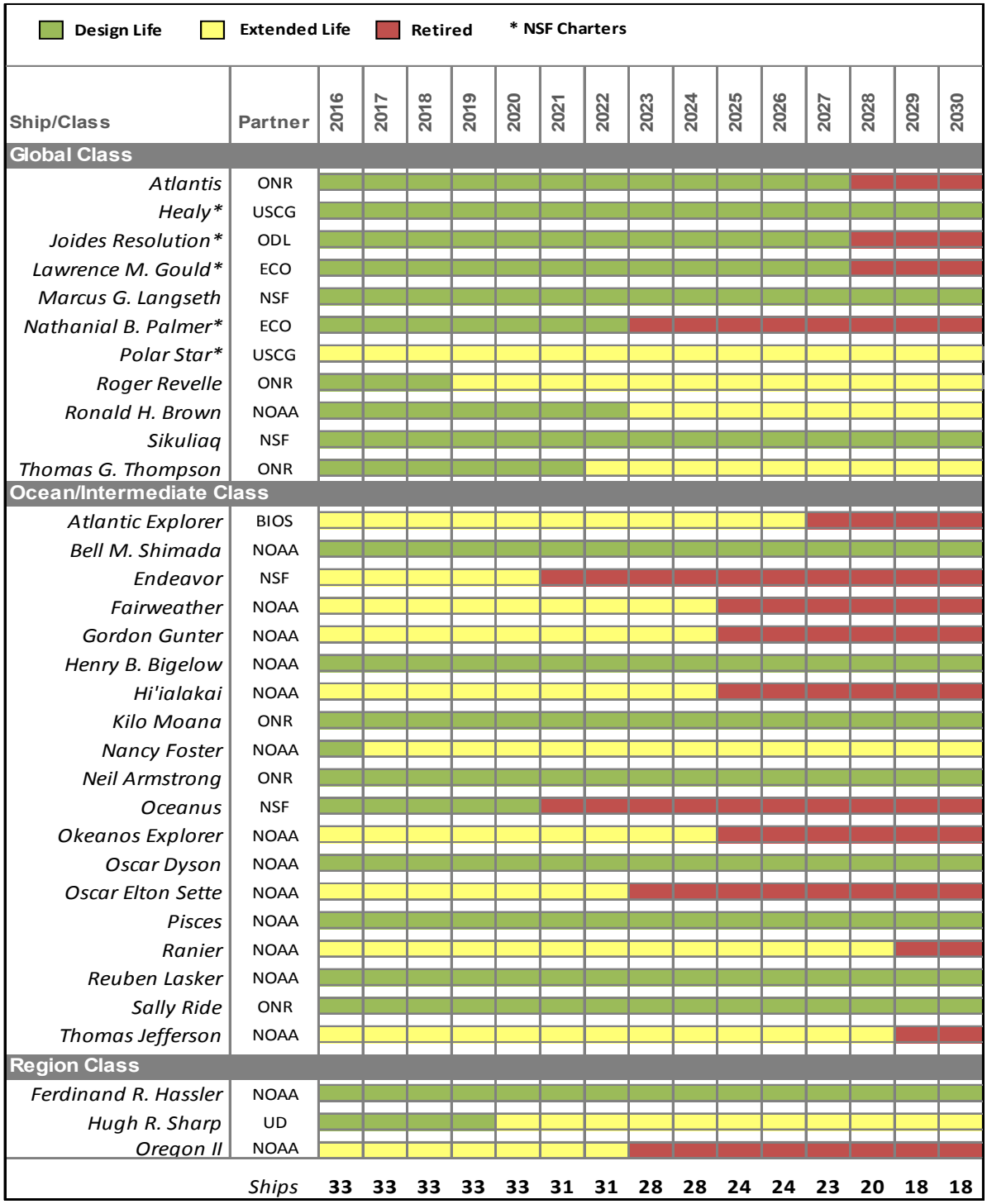
Regional Class ships are smaller than Ocean Class vessels and are optimized for operation in coastal waters, bays, and estuaries. They will be capable of supporting work previously done on the Intermediate Class ships.

Projected Gaps without Modernization

Table 2 shows the projected Fleet capacity without the acquisition of new vessels, service-life extensions, or refits (e.g., RCRVs, RSVs). In Table 2, a ship's 30-year design life is indicated in green. Ships that will need a Service Life Extension, or that are already in their extended-life period, are indicated in yellow. Red lines indicate the anticipated end of useful service life, though dates can be extended based on the material condition of the vessel. Note that though the service lives of the *RVIB Nathaniel B. Palmer* and *ARSV Laurence M. Gould* are predicted to end as indicated, NSF has no plans to discontinue providing contracted research vessels to support science in these regions.

ONR owns the Global Class vessels R/Vs *Thomas G. Thompson*, *Roger Revelle,* and *Atlantis*, which have Projected End of Service Lives of 2021, 2026 and 2027, respectively. The FY 2013, FY 2015, and FY 2016 Defense Appropriations Acts provided funding to conduct mid-life refits and service-life extensions for R/Vs *Thomas G. Thompson* and *Roger Revelle*. Previous service-life extensions of Navy research vessels have extended their useful service life to 45 years, as in the cases of recently retired R/Vs *Knorr* and

Table 2. FY 2016–FY 2030 Projected Federal Oceanographic Fleet Capacity without construction of RCRV/RSV



Melville. As defined by the ARF's science-mission requirements in 2003, ONR funded the acquisition of two Ocean Class R/Vs, *Neil Armstrong* and *Sally Ride*, which are scheduled to join the ARF in 2016.

Nonetheless, between FY 2021 and FY 2025, 10 vessels are scheduled for retirement as they reach their Projected End of Service Life. Between FY 2026 and FY 2030, an additional six vessels will reach their Projected End of Service Life. Because it typically takes approximately 10 years to design and build a new vessel, it is critical that this process begins now. Without replacement or Service Life Extension, the size of the Fleet by FY 2030 will be 18 vessels, which represents a capacity reduction of nearly 50 percent.

Modernization Needs

Right-sizing the Fleet is a crucial and continuous effort by Federal agencies to manage costs, to match at-sea capabilities with mission requirements, and to maintain or replace current capabilities. Success in this endeavor requires accommodation of available tools and technologies and integration of these via a systems-based approach to optimize safety, cost, and value.

Based on analysis of the current and projected Fleet status and mission-critical requirements, the IWG-FI has identified acquisition of new Regional Class vessels as a near-term priority for Fleet modernization. Typically smaller, with a shallower draft than their Ocean Class counterparts, these vessels will ensure improved access to near-shore, estuarine regions, as well as Great Lakes and proximate offshore waters. These regions are becoming increasingly important for surveys and research that support the Nation's coastal-resilience priorities.

New Regional Class ships are likely to be significantly more capable than existing Regional Class vessels, with length and berthing capabilities similar to some existing Ocean Class ships. These anticipated features reflect the need to address more complex, multi-disciplinary science questions in coastal regions. These new ships will also be less expensive to build than Ocean Class ships, more fuel efficient to operate, and have less-significant environmental impacts.

The multi-year planning process for NSF's ARF Regional Class Research Vessels (RCRV) to support the ocean-science community's research and technology portfolio included IWG-FI member agencies, academia, and many other stakeholders. In May 2015, the National Science Board authorized NSF to include construction of two RCRVs in future budget requests. This NSB approval is in concurrence with Recommendation #5 in the National Academy of Sciences' report *Sea Change: 2015-2025 Decadal Survey of Ocean Sciences*. These ships are essential to support science-based understanding of the ocean, including all eight of the "priority science questions" posed by *Sea Change*. The President's FY 2017 Budget includes funding to initiate construction.

NOAA has tracked the RCRV design as a candidate template for its own Regional Survey Vessel (RSV) and as a means of potentially reducing costs. However, based on a NOAA analysis conducted in FY 2014, the current RCRV design requires expensive hull modifications and does not have sufficient power to satisfy a critical NOAA requirement for fish trawling. NOAA is therefore proceeding with an independent RSV design, though it will continue to track the applicability of other RCRV features such as energy-efficient components, use of telepresence, and other mission-unique capabilities for possible use on the RSV.

In FY 2016 NOAA will begin a requirements-based engineering and design analysis to determine the specific capabilities of the RSV. Identified capabilities will be translated into concept design and specifications. The RSV will be a multi-use platform designed to conduct a range of surveys throughout the United States coastal waters and proximate ocean areas.

The NOAA FY 2017 budget request includes $24 million, which, when combined with the $80.1 million received in FY 2016, will allow NOAA to complete design, acquisition, and construction of the first RSV. To further sustain Fleet capabilities, the FY 2017 Budget also includes $100 million in mandatory funding to build on procurement efficiencies and deliver a second RSV. Although NOAA will need to complete specific engineering requirements to accurately define costs, the FY 2016 and FY 2017 funds will ensure that Fleet modernization moves forward, and that emerging gaps in capacity to conduct fish surveys, hydrography, and oceanographic research will be reduced.

These two RSVs will be the first vessels of their class at NOAA capable of interdisciplinary and general-purpose oceanographic research, and will enable NOAA to conduct surveys in near-shore waters where larger-class ships are unable to operate. The specific design will be based on primary mission capabilities, regional drivers, and observational requirements. This construction will contribute to NOAA's priority of achieving organizational excellence by restoring mission capacity and expertise, while at the same time positioning the NOAA Fleet for long-term, sustainable support of NOAA Line Office priority mission requirements for at-sea data collection and in situ observations.

In addition, the USCG is acquiring a new heavy polar-class icebreaker and currently plans to sustain current icebreaker capacity at least until the new ship is deployed. The President's FY 2017 Budget includes $150 million to complete the design activities required to award a production contract by FY 2020.

While the near-term focus is on modernizing the Fleet with regional-class capabilities, the IWG-FI and member agencies have also documented continuing requirements and emerging gaps for Ocean and Global Class vessels to support agency activities and will need to further assess Fleet condition and plan for future capabilities. For example, agencies will continue to need Global and Ocean Class vessels to access distant ocean regions—including remote areas of the Exclusive Economic Zones in the Atlantic, Pacific, Alaska and the Arctic— for surveys and research.

The IWG-FI recommends that member agencies continue to take a disciplined and coordinated planning approach towards identifying core mission requirements, and matching these to advancements in ship design and technologies that maximize at-sea data collection abilities via an optimal platform to safely and cost-effectively accomplish the mission.

Future Changes in Capacity

The Fleet partners developed a methodology to determine the Fleet's capacity change through FY 2030 by Priority Activity Tier, vessel class, and geographic region. Figure 2 shows the projected Fleet capacity, including the proposed two RCRVs, two RSVs, and two Global Class ship mid-life refits.

Figure 3 illustrates the regional impact of ship retirements and planned additions on the Federally-owned Fleet capacity. For NOAA, it is assumed that ships will operate in regions where they have traditionally

operated. Future deployment of the ARF is less predictable and ARF regional allocation will change to accommodate annual science proposal awards, research objectives, and mission priorities. In Figure 3,

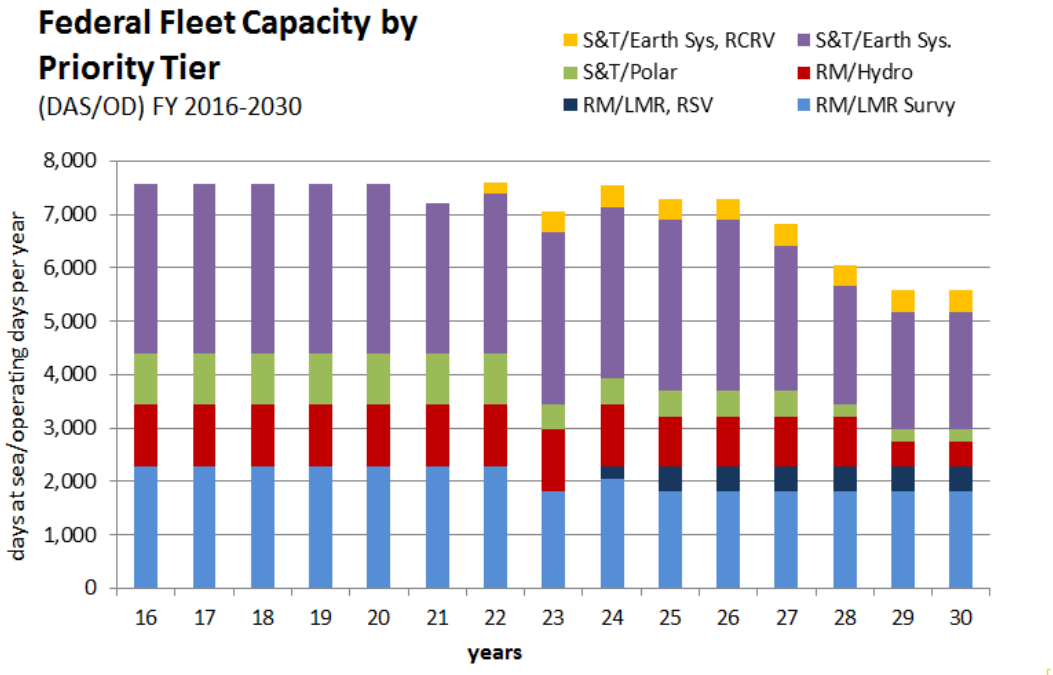


Figure 2. Projected Fleet Capacity by Priority Activity Tiers Including Proposed New Investment. Incremental additions of Days-At-Sea/Operating Days from new RCRVs and RSVs are highlighted.

baseline information on ships traditionally operating in multiple regions was taken into account. Ships operating in many different locations across the globe on an annual basis were summarized in the "Global" classification.

Additional Actions to Improve Efficiency and Increase Capacity

Through the IWG-FI, the Federal agencies are continuing to refine overall management and deployment of the Fleet in order to optimize the application of limited resources to mission priorities, fully leverage operational expertise, and increase the Fleet's capacity by introducing new ships and associated technologies.

Interagency Coordination

Through the IWG-FI, there has been a significant increase in overall agency coordination and collaboration, including jointly evaluating ship retirement, refining Fleet scheduling and mission planning, and proceeding with design and construction of new ships. For example, as of 2013, a sophisticated web-

based Fleet scheduling portal has increased the efficiency of mission planning among agencies, including sharing of platforms and Regional Class vessels, and joint mission execution. As new ship designs are considered, NSF has participated in the design reviews for the two Ocean Class research vessels currently under construction by the Navy. The Navy and NSF also collaborated on Fleet upgrades to over-the-side

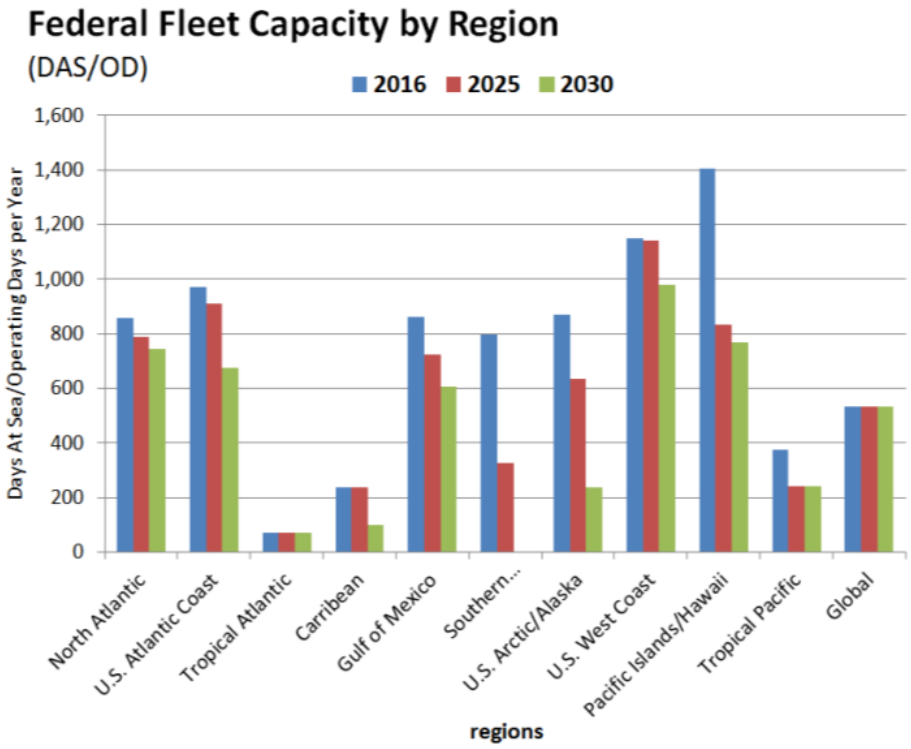


Figure 3. FY 2016–FY 2030 Projected Fleet Capacity by Region Including Proposed New Investment from RCRVs and RSVs

handling equipment to reduce the number of personnel required on deck during science operations and to further improve safety. NOAA and NSF are collaborating on ship designs, and the USCG has established an Integrated Product Team, inviting representatives from NSF, NOAA, and other agencies to assist with the development of the multi-agency requirements for a new heavy polar icebreaker.

In FY 2016, NOAA and NSF established a no-cost exchange or barter of ship time aboard equivalent Global Class ships for scientific missions in the Pacific. This agreement is a cooperative effort to continue to find and foster efficiencies in scheduling and to provide precedent for future exchanges. The FY 2016 missions identified for the exchange will be conducted on the NOAA Ship *Ronald H. Brown* and the ARF ships R/Vs *Roger Revelle* and *Thomas G. Thompson*.

New Technologies

New technology will expand science at sea for the modernized research fleet, potentially reducing DAS/OD requirements but also enabling smaller ships to perform larger missions. Unmanned assets such as Autonomous Underwater Vehicles (AUVs), gliders, Unmanned Aerial Systems (UASs), and Unmanned Surface Vehicle (USVs) will not preclude the need to go to sea but will enable measurements at temporal

and spatial scales beyond current capabilities. High-bandwidth communication between ships and the shore will support telepresence, or virtual participation, allowing broader participation by individuals who cannot otherwise go to sea due to physical or ships' berthing limitations. These types of technologies will also allow expanded simultaneous multi-mission operations on new vessels. Advances in green technology will also be incorporated into new ship construction, which will produce ships that are more energy efficient and have reduced environmental impacts when compared to older vessels reaching the end of their service life.

Charters

Maintaining a solid capacity to charter vessels for compatible mission requirements is an essential component of cost-effectively managing the at-sea science needs of the Federal government. For example, NSF charters vessels for requirements that cannot be met by UNOLS vessels, in particular for ocean drilling and research in Polar regions. NSF plans to continue providing contracted vessels to support science programs in these important regions through 2030. NOAA makes extensive use of charters, particularly for missions with a small science party, and short cruises that do not require specialized equipment. Other limiting factors include annual funding, charter availability, and cost effectiveness. For example, while commercially available fishing charters can conduct some fisheries-survey missions at NOAA, a trend worldwide is to bundle missions to provide more comprehensive ecosystem-level information. Such cruises require an acoustically quiet ship with multi-beam hydro-acoustic gear to record fish and zooplankton biomass; a capability to deploy trawl nets, plankton tows, and instrument drops (all of which require separate winches); multiple sighting stations for marine-mammal and sea-bird observations; quarters for up to 14 scientists so that surveys can be conducted around the clock; and endurance of a month or more. Currently few commercial vessels are available to meet these varied and complex scientific requirements. The sustained experience NOAA gains from maintaining a core capability also allows NOAA to be a smart consumer when using charters or partnerships to augment its data-collection needs.

Leveraging Expertise

The IWG-FI will continue to share information and provide opportunities for cross-agency collaboration on fleet-improvement initiatives. The UNOLS Research Vessel Operators Committee (RVOC) serves as a forum to broadly share information and solicit feedback on plans and activities related to vessel operations, maintenance, and capital improvements.

Ultimately it is important to note that discussions about how we can most effectively continue to acquire information about the Nation's coastal and ocean waters are about capabilities or means to acquire information and not about ships. Oceangoing ships will undoubtedly continue to be critical and indispensable tools for addressing the majority of Federal ocean science, management, and protection priorities for the foreseeable future. However, ships are deployed as a means to an end, and as such their use and capabilities will continue to evolve in conjunction with evolving needs.

Conclusions

To responsibly address Congressional mandates and the Nation's ocean-science priorities, Federal agencies have extensive research and survey requirements to support the protection of the Nation's and the world's oceans. The systematic modernization and sustainment of the Federal Oceanographic Fleet (Fleet) is necessary to carry out these responsibilities and will complement advances in remote sensing and autonomous observing networks. This report documents the state of the Fleet as of July 31, 2015 and identifies the gaps in capacity for conducting priority missions that will result without capital investments. The baseline analysis conducted demonstrates that current requirements for survey and research exceed the capacity of the current Fleet. This capacity gap grows wider as ships reach their End of Service Life and are retired.

This report concludes that the most important first step to address emerging gaps in the Fleet in the near term will be to invest in Regional Class Vessels. These ships will support documented ocean survey and research requirements to increase operations in near-shore coastal and estuarine waters and will be the most cost-effective investments to increase the capacity of the Fleet. The IWG-FI has also documented continuing requirements and emerging gaps for Ocean and Global Class vessels and recommends that member agencies further evaluate fleet conditions and plan for future capabilities.

Right-sizing the Fleet is a crucial and continuous effort by Federal agencies to manage costs, to match at-sea capabilities with mission requirements, and to maintain or replace current capabilities. Balancing these factors requires a systems-based approach to optimize safety, cost, and value. In pursuit of these goals, Federal oceanographic agencies may release their own specific and more detailed recapitalization plans informed by the findings of this report.

Appendix I

The Federal Oceanographic Fleet is divided into Research and Survey categories, based on their primary purpose and capabilities.

Research ships carry a broad array of scientific instrumentation, winches, wires, cranes, and articulating frames capable of supporting activities such as water-column and seafloor sampling, monitoring, and acoustic and bathymetric mapping. Laboratories equipped with sophisticated analytical equipment and computers allow preliminary data analysis and sample storage while underway. Data collected often provide real-time input into cruise execution, enabling scientists to make adjustments to mapping or sampling plans. Most vessels are multipurpose and are able to conduct a variety of research activities during a single expedition. Some research ships are specialized, having the ability to conduct multichannel seismic operations, deploy and recover human-occupied vehicles, recover long sediment and rock cores, and conduct ocean-drilling experiments in all parts of the ocean, or to operate at high latitudes in the Arctic and Antarctic Oceans.

Survey ships acquire a wide range of oceanographic, atmospheric, hydrographic, fisheries-stock-assessment, ecosystem, and habitat data in direct support of resource-management and monitoring programs. The majority of today's survey ships are specially designed to meet specific mission requirements. NOAA's Fisheries Survey Vessels (FSVs) have been acoustically quieted in accordance with standards defined by the International Council for Exploration of the Seas, while others have been equipped to collect high-resolution bathymetry, gravity, and magnetic data to enable construction of detailed seafloor maps.

Appendix II

The impact on priority tiers was calculated by projecting a baseline Fleet capacity through FY 2030 without modernization, using each ship's maximum annual operating tempo. The annual decline in capacity is indicated both by a decline in total DAS/OD moving from left to right and red bars in Table 3. In Table 3, a ship's 30-year design life is indicated in green. Ships that will need a Service Life Extension or are already in their extended life period are indicated in yellow. Red lines indicate that a ship will be retired at the end of its useful service life. Ships were clustered into priority tiers based on their primary mission, however, some ships' second tier requirements were also considered for the purpose of constructing this Table. This enabled the IWG-FI to quantify and summarize the impact to each Tier One Priority Activity as seen at the bottom of the Table. This data was used to create figure 2.

Table 3. IWG-FI Method for Quantifying Impact on Priority Activity Tiers

max tempo	ship	partner	priority tier	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
180	*Atlantic Explorer*	BIOS	S&T/Earth Sys	180	180	180	180	180	180	180	180	180	180	180				
300	*Atlantis*	ONR	S&T/Earth Sys	300	300	300	300	300	300	300	300	300	300	300	300			
230	*Endeavor*	NSF	S&T/Earth Sys	230	230	230	230	230										
230	*Hugh R. Sharp*	UD	S&T/Earth Sys	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230
235	*Joides Resolution*	ODL	S&T/Earth Sys	235	235	235	235	235	235	235	235	235	235	235	235			
280	*Kilo Moana*	ONR	S&T/Earth Sys	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280
300	*Marcus G. Langseth*	NSF	S&T/Earth Sys	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
300	*Roger Revelle*	ONR	S&T/Earth Sys	300	300	300	300	300	300	300	300	300	300	300				
280	*Sally Ride*	ONR	S&T/Earth Sys	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280
300	*Sikuliaq*	NSF	S&T/Earth Sys	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
			TOTAL	**2,635**	**2,635**	**2,635**	**2,635**	**2,635**	**2,405**	**2,405**	**2,405**	**2,405**	**2,405**	**2,405**	**1,925**	**1,390**	**1,390**	**1,390**
210	*Oceanus*	NSF	S&T/Earth Sys, Obs Sys	210	210	210	210	210										
280	*Neil Armstrong*	ONR	S&T/Earth Sys, Obs Sys	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280
300	*Thomas G. Thompson*	ONR	S&T/Earth Sys, Obs Sys	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
			Earth Systems (70%)	**553**	**553**	**553**	**553**	**553**	**406**	**406**	**406**	**406**	**406**	**406**	**406**	**406**	**406**	**406**
			Obs Systems (30%)	**237**	**237**	**237**	**237**	**237**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**	**174**
235	*Healy*	USCG	S&T/Polar	235	235	235	235	235	235	235	235	235	235	235	235	235	235	235
235	*Laurence M. Gould*	ECO	S&T/Polar	235	235	235	235	235	235	235	235	235	235	235	235			
235	*Nathaniel B. Palmer*	ECO	S&T/Polar	235	235	235	235	235	235	235								
235	*Polar Star*	USCG	S&T/Polar	235	235	235	235	235	235	235								
			TOTAL	**940**	**940**	**940**	**940**	**940**	**940**	**940**	**470**	**470**	**470**	**470**	**470**	**235**	**235**	**235**
235	*Ronald H. Brown*	NOAA	RM/LMR Survey, Obs Sys	235	235	235	235	235	235	235	235	235	235	235	235	235	235	235
			LMR Survey (70%)	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**	**165**
			Obs Sys Support (30%)	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**	**71**
235	*Bell M. Shimada*	NOAA	RM/LMR Survey	235	235	235	235	235	235	235	235	235	235	235	235	235	235	235
235	*Gordon Gunter*	NOAA	RM/LMR Survey	235	235	235	235	235	235	235	235	235						
235	*Henry B. Bigelow*	NOAA	RM/LMR Survey	235	235	235	235	235	235	235	235	235	235	235	235	235	235	235
235	*Hi'ialakai*	NOAA	RM/LMR Survey	235	235	235	235	235	235	235	235	235						
235	*Oregon II*	NOAA	RM/LMR Survey	235	235	235	235	235	235	235								
235	*Oscar Dyson*	NOAA	RM/LMR Survey	235	235	235	235	235	235	235	235	235	235	235	235	235	235	235
235	*Oscar Elton Sette*	NOAA	RM/LMR Survey	235	235	235	235	235	235	235								
235	*Pisces*	NOAA	RM/LMR Survey	235	235	235	235	235	235	235	235	235	235	235	235	235	235	235
235	*Reuben Lasker*	NOAA	RM/LMR Survey	235	235	235	235	235	235	235	235	235	235	235	235	235	235	235
			TOTAL	**2,115**	**2,115**	**2,115**	**2,115**	**2,115**	**2,115**	**2,115**	**1,645**	**1,645**	**1,175**	**1,175**	**1,175**	**1,175**	**1,175**	**1,175**
235	*Fairweather*	NOAA	RM/Hydro	235	235	235	235	235	235	235	235	235						
235	*Ferdinand R. Hassler*	NOAA	RM/Hydro	235	235	235	235	235	235	235	235	235	235	235	235	235	235	235
235	*Nancy Foster*	NOAA	RM/Hydro	235	235	235	235	235	235	235	235	235	235	235	235	235	235	235
235	*Rainier*	NOAA	RM/Hydro	235	235	235	235	235	235	235	235	235	235	235	235	235		
235	*Thomas Jefferson*	NOAA	RM/Hydro	235	235	235	235	235	235	235	235	235	235	235	235	235		
			TOTAL	**1,175**	**1,175**	**1,175**	**1,175**	**1,175**	**1,175**	**1,175**	**1,175**	**1,175**	**940**	**940**	**940**	**940**	**470**	**470**
235	*Okeanos Explorer*	NOAA	S&T/Exploration	235	235	235	235	235	235	235	235	235						
	TOTALS BY MAJOR CATEGORIES		RM/LMR Survey	2,280	2,280	2,280	2,280	2,280	2,280	2,280	1,810	1,810	1,340	1,340	1,340	1,340	1,340	1,340
			RM/Hydro	1,175	1,175	1,175	1,175	1,175	1,175	1,175	1,175	1,175	940	940	940	940	470	470
			S&T/Polar	940	940	940	940	940	940	940	470	470	470	470	470	235	235	235
			S&T/Earth	3,188	3,188	3,188	3,188	3,188	2,811	2,811	2,811	2,811	2,811	2,811	2,331	1,796	1,796	1,796

Acronyms

ARF	Academic Research Fleet
ARSV	Antarctic Research and Supply Vessel
AUV	Autonomous Underwater Vehicle
DAS	Days at Sea
FSV	Fisheries Survey Vessel
FY	Fiscal Year
Hydro	Hydrographic Survey
IWG-FI	Interagency Working Group on Facilities and Infrastructure
LMR	Living Marine Resource
NOAA	National Oceanic and Atmospheric Administration
NSF	National Science Foundation
ONR	Office of Naval Research
OD	Operating Days
OSTP	Office of Science and Technology Policy
OSV	Ocean Survey Vessel
RCRV	Regional Class Research Vessel
RM	Resource Management
RSV	Regional Survey Vessel
R/V	Research Vessel
RVIB	Research Vessel Ice Breaker
S&T	Science and Technology
TAGS	Military Survey Ships
UAS	Unmanned Aerial System
UNOLS	University-National Oceanographic Laboratory System
U.S.	United States
USCG	United States Coast Guard
USV	Unmanned Surface Vehicle