FINAL REPORT
OF
INDEPENDENT REVIEW TEAM
ON
NOAA FLEET RECAPITALIZATION

Independent Review Team

October 1, 2016

REPORT OVERVIEW

FINAL REPORT OF THE NOAA INDEPENDENT REVIEW TEAM

ON NOAA FLEET RECAPITALIZATION

EXECUTIVE SUMMARY

The National Oceanic and Atmospheric Administration (NOAA) is a science-based agency that requires access to the sea to perform its mission, requiring a sea-going oceanographic capability for the nation. NOAA's oceanographic fleet has been the foundation and primary source of *in situ* observational data to meet its mission needs for living marine resource management, navigational charting, weather and climate predictions, coastal management, ocean exploration and supporting ocean research. As such, NOAA has, and continues to need, a robust fleet of ships augmented by appropriate ship charters, remote sensing and other commercially-derived data.

NOAA currently operates and maintains a fleet of 16 ships with a goal of providing 235 days at sea per ship annually to meet its highest "priority one" ocean observation requirements. Eight ships in the fleet will either meet or exceed their design service life by 2028. Given the timeline of six to eight years to obtain funding, and design, build and commission new ships, NOAA has an urgent need to implement a recapitalization plan to replace up to eight ships by 2028 in order to avoid a gap in capacity and capability as ships reach the end of their design service lives. Additionally, NOAA needs to strengthen management of its operational infrastructure to support its mission; maintain in-house expertise; invest in future technology; and assure the capability for rapid response to national and natural emergencies.

Recognizing the problem with an aging fleet, NOAA prepared recapitalization plans in 2008 and 2012, but neither resulted in approval for new funding to implement a structured and coherent ship recapitalization and modernization plan. To assist in addressing the urgency of a potential gap in the NOAA fleet, identify issues with past plans and address both congressional and OMB requests for an updated recapitalization plan, NOAA commissioned a senior-level independent review team (IRT). The IRT was tasked with conducting an assessment of the health of the NOAA fleet, reviewing and recommending requirements for recapitalization, conducting an analysis of operational and maintenance practices, and assessing the state of technology infusion into ship assets. [The IRT Terms of Reference and members are provided in Appendix A.] The scope of the IRT review included seven tasks listed in the terms of reference. The IRT focused on assessments of sea-going requirements, the current state of the NOAA fleet, planning for the development of a long-term ship recapitalization plan, maintenance of the fleet and opportunities for infusion of new technologies.

The IRT conducted its review from January to October 2016, meeting every month, alternating in-person meetings with teleconferences. Briefings were provided to the IRT by the NOAA Office of Marine and Aviation Operations (OMAO) and NOAA line offices covering all aspects of ship operations and planning. In addition, the IRT received briefings on ocean observatories, the National Science Foundation's planned regional class research vessel (RCRV), the Navy's (Office of Naval Research) new oceanographic research ships AGOR 27/28, unmanned technology from the Oceanographer of the Navy, NOAA's Ocean Exploration Program, autonomous surface vehicles for charting, advanced fisheries sampling technology and mobile ship-to-shore telepresence for transmitting *in situ* observations. Finally, to better understand the funding and political issues, the IRT co-chairs met with staff from the Office of Management and Budget (OMB) and congressional appropriations committees with oversight of NOAA's budget.

The IRT report provides key findings and identifies significant issues facing NOAA's ship recapitalization planning. A key deficiency has been the lack of a recent approved and funded plan that addresses the need for a multi-mission core capability and capacity to meet mission needs. The IRT identified numerous actions and has provided a series of recommendations consistent with its findings that are required to successfully implement a structured fleet recapitalization plan that has the potential for success, and for NOAA to address concerns identified by OMB and congressional committees. In response to a preliminary IRT recommendation, NOAA senior leadership directed the organization of a "Tiger Team" to address the lack of a consistent recapitalization plan with a timeline for ship construction to support NOAA's mission. The IRT supported that planning effort with overall guidance, and reviewed and provided feedback on the initial draft fleet plan.

The IRT found that the Tiger Team's draft fleet report and recapitalization plan to be responsive, and an important step in addressing the IRT's key findings and recommendations. It addresses the sequencing of a modern, core multi-mission fleet that is appropriate in scale and scope to satisfy currently implemented priority one ocean observation requirements. However, for the plan to be successful, it must be supported by funding for recapitalization and operation and maintenance of the fleet at its capacity.

Additional findings include: NOAA has the capability for prioritizing requirements for allocating Days at Sea (DAS); full utilization of the fleet is limited by funding and abnormally high maintenance resulting from an aging fleet; utilization of the Navy's recently constructed multi-purpose AGOR 27/28 research ships is the most expeditious means to initiate new ship recapitalization; the balance between NOAA fleet and charter vessels is appropriate and helps mitigate risk; NOAA is conducting a fleet-wide material condition assessment which will inform decisions for service life extension and maintenance priorities for some vessels; new unmanned systems technologies will offer capabilities to enhance, but not replace ships; and emerging technologies will influence ship design with mission tailored platforms.

The IRT's specific recommendations to address the overall findings are the following:

- Immediately develop and implement a recapitalization plan using a "Tiger Team" for a multi-mission fleet to meet well-defined priority one requirements. The plan should:
    - Assess capabilities for a mix of multi-purpose, single purpose, shallow draft, smaller (40 meters or less) and charter vessels to meet priority one requirements
    - Present a clear plan for a sequence of ship replacements
    - Note: The IRT reviewed the resulting September 2016 Tiger Team draft recapitalization plan and utilized it in the preparation of this final IRT report
    - Recapitalization plan needs to be a living document, with a process to reevaluate every two years
- Final approved fleet recapitalization plan must be supported by funding for ship construction and utilization, building on the FY16 NOAA budget, which contained significant ship construction funds
- NOAA leadership needs to develop and strongly advocate a multi-year capital acquisition plan which enables multi-year, multi-ship acquisition contracting
- NOAA leadership needs to routinely review metrics associated with implementation of the recapitalization plan similar to other major acquisition programs

- Initiate actions to procure general purpose oceanographic research vessels as the first step in a fleet recapitalization plan based on the AGOR 27/28 specification
- Concurrently start mission and concept ship design(s) to meet requirements that are not met with the AGOR specification
    - Consider alternate data acquisition technologies, or smaller vessels
    - Assess domestic and international design for ships constructed in the past five years
    - Minimize the number of ship classes to achieve economies of scale
    - Ship design must be flexible to incorporate potential for unmanned surface, underwater and aerial systems (ASV/AUV/UAS) in future ships
    - Include life cycle considerations
    - Optimize acquisition strategy and minimize cost by procuring at least two ships of common design from the classes of ships identified in the draft fleet recapitalization plan (i.e., Classes A, B, and C)
    - Implement lessons learned and assessment from recent acquisitions
- Establish comprehensive benchmarking study of fleet maintenance and crewing against other federal ships and assess best commercial practices; include independent expertise
- Ensure ship and shore side fleet readiness responsibilities are better aligned and funded to utilize standard/best practices to manage maintenance requirements and infrastructure to ensure a high state of readiness
- Establish a NOAA-wide policy for vessel chartering to address vetting with OMAO for availability of NOAA ships, potential for long-term charters, and legal constraints

The Nation is highly dependent on information gathered by the NOAA fleet to inform a variety of critical mission responsibilities including living marine resource management, navigational charting, weather and climate predictions, coastal management and ocean exploration. Implementation of the fleet recapitalization plan developed by the NOAA Tiger Team and the additional recommendations by the IRT should assure a robust, agile, capable and mission-ready fleet of ships to meet these critical national missions in the future and avoid a capacity gap from the loss of ships.

The IRT acknowledges the outstanding support provided by OMAO and the encouragement and support of NOAA senior leadership in the conduct of this review.

Independent Review Team
NOAA Fleet Recapitalization Report

OCTOBER 1, 2016

Report Overview

- Executive summary (separate document)
- IRT Terms of Reference Objectives
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- IRT Terms of Reference Tasks
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- Current Budget Background
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Independent Review Team (IRT) Terms of Reference Objectives

- The National Oceanic and Atmospheric Agency (NOAA) requested a senior-level independent review team (IRT) to:
  - ***Assess the health*** of the **NOAA fleet** of oceanographic vessels, ***requirements*** for recapitalization and analysis of ***operations***, ***maintenance and practices,*** and ***technology infusion***
  - ***Consider*** data collection ***requirements*** that need access to the ocean; applicable ***technologies*** and relationship to requirements; appropriate fleet ***size and composition;*** and ***potential alternatives*** to meet NOAA's multi-mission at sea requirements

Note: See Appendix A for complete terms of reference

IRT Members

Dick West, RADM, United States Navy (ret)

Robert Winokur, Senior Advisor, Michigan Tech Research Institute, NOAA National Environmental Satellite, Data, Information Service (NESDIS)

Fred Byus, RDML, United States Navy (ret), Vice President and General Manger, Battelle Mission and Defense Technologies

Dr. John Hughes-Clark, Professor, University of New Hampshire

John Crowley, RADM, United States Coast Guard (ret), National Association of Waterfront Employers

Bauke (Bob) Houtman, Head, Integrative Programs Section, National Science Foundation

Dr. Steve Murawski, Professor, University of South Florida

Blake Powell, President, JMS Naval Architects

Dr. Nancy Rabalais, Professor, Louisiana State University, Louisiana Universities Marine Consortium

Robert (Tim) Schnoor, Ocean Research Facilities Manager, Office of Naval Research

Dr. Steve Ramberg, Distinguished Research Fellow, National Defense University, Penn State University

Dick Vortmann, President and CEO (ret), National Steel and Shipbuilding Company (NASSCO)

NOAA Liaisons:
CAPT Nancy Hann, Chief of Staff, Office of Marine and Aviation Operations (OMAO)
LT Richard Park, Flag Aide to Director NOAA Corps and OMAO
LT Zachary Cress, Flag Secretary, OMAO

IRT Terms of Reference Tasks

IRT will assess:

1. Current fleet composition and capabilities
2. Long-term recapitalization planning based on NOAA's at sea data collection requirements
3. Utilization of alternatives to the NOAA fleet (commercial contracting, Academic Research Fleet, other public-funded vessels) to meet requirements
4. Current operational systems (crewing, scheduling)
5. Current maintenance practices
6. Technology readiness and infusion (instrumentation and mechanical)
7. Risk identification, mitigation and management planning

IRT Process

- Met monthly in person and via teleconference calls for background and fact finding briefings and discussion
  - Jan 20-21, March 10-11, May 10-11, July 13-14, September 14,15 2016 (in-person meetings)
  - Feb 16, April 13, June 14, August 23 2016 (teleconferences)
- Reviewed Office of Marine and Aviation Operation (OMAO) plans for and current status of ship, requirements, recapitalization and acquisition approaches
- Received briefings from NOAA line offices on ship requirements and utilization
- Received briefings on: ocean observatories (Integrated Ocean Observing Systems (IOOS), Ocean Observatories Initiative (OOI), Argo), U.S. Navy Auxiliary General Oceanographic Research (AGOR) vessels 27/28, National Science Foundation (NSF) Regional Class Research Vessel (RCRV) and NOAA's Ocean Exploration program
- Met with Senate and House Appropriations Committees and Office of Management and Budget (OMB) staff
- June 30, July 13, July 21, August 19 – Briefed NOAA ship recapitalization planning Tiger Team
- July 15 – Briefed NOAA leadership and updated report based on feedback
- August 18 – Briefed Department of Commerce and NOAA chief financial officers (CFO) and staff
- September 14 – Received briefing on Tiger Team draft recapitalization report; completed IRT report
- October – Brief NOAA leadership and issue final report

Note: See Appendix B for details

Acknowledgements

The IRT acknowledges the outstanding support provided by the Office of Marine and Aviation Operations (OMAO) and background information provided during numerous briefings by and discussions with OMAO, along with its quick response to questions

The IRT also appreciates the information provided by numerous briefers from OMAO and the NOAA line offices, and invited external presenters, the National Science Foundation (NSF), the United States Navy, (USN), the University of Rhode Island (URI) Inner Space Center, and IRT experts

Backdrop and Overarching Context

- NOAA needs to:
  - maintain a capable fleet to gather the information to inform a variety of critical mission responsibilities in the oceans which are important to providing products and services for the Nation
  - maintain access to the sea to perform its mission and provide an enabling capability for the nation
  - maintain a core robust fleet of ships augmented by appropriate charters, remote sensing and commercial data to meet its mission
  - maintain management of the operational infrastructure needed to support its mission; maintain in-house expertise; invest in future technology; and ensure the capability for rapid response to national and natural emergencies
  - modernize its oceanographic fleet to avoid a gap in capacity and capability as ships reach their end of design service life

Current Budget Background

- IRT received information during discussions with NOAA, Office of Management and Budget (OMB) and congressional appropriations staff that indicated administration and congressional support for NOAA ship recapitalization, pending preparation of a fleet plan
- FY16: Appropriations - $80M for new vessel construction
  - Congress assumed a design based on the Navy's Auxiliary General Oceanographic Research (AGOR) vessel
  - Ship specifications, based on the AGOR, shorten acquisition time and program cost for a multi-mission NOAA ship
  - Conflicting message and direction between NOAA, OMB, and Appropriations Committees over an ocean (i.e., AGOR) or regional class ship as the first ship in recapitalization plan resulted in FY16 funding for a NOAA ship being held by the Senate pending ship recapitalization plan
- FY17: President's Budget - $24M; Senate - $75M; House - $0; final (pending conference) -TBD

IRT Key Findings

- A modern core fleet with multi-mission capability is required to meet mission requirements for use in surveys, research and unplanned surge requirements from ocean/coastal disasters
- Current fleet of ships is aging and needs recapitalization starting immediately with up to eight ships reaching or exceeding end of design service life by 2028
- NOAA has no approved fleet recapitalization and modernization plan to address future ship needs to accomplish its mission
- A structured process to identify requirements for “Days At Sea” is in place but lacks the methodology to define the needed fleet capabilities and composition
- Current fleet is underfunded for operations and consequently underutilized
- Lost time due to maintenance is abnormally high
- New observing technologies will be mainly “force multipliers” and use of autonomous systems should be factored into ship designs

IRT Key Recommendations

- Immediately develop and implement a recapitalization plan for a right-sized core fleet that provides mission capacity and capabilities which considers a mix of multi-purpose and mission specific ships, charters, and time phasing for prioritized ship replacements to avoid a gap in operational capabilities
- Initiate actions to procure a general purpose oceanographic vessel, leveraging the AGOR specifications, as the first step in a recapitalization plan
- Start mission and concept designs to address capabilities not met with the AGOR specifications
- Conduct independent benchmarking of maintenance and crewing processes against industry best practices
- Senior NOAA leadership should commit to a stable, multi-year funded capital acquisition plan and funding to fully utilize and maintain the fleet as stewards of this national capability

Task 1 Findings:
Current Fleet Composition and Capabilities

- NOAA fleet consists of 16 ships of varying capability and age from 3 to 48 years old (Figures 1 - 3)
  - Multiple ships operating well beyond their design service life and are at risk of loss of service
- Current fleet is a mix of mission-built ships and converted USN anti-submarine warfare (ASW) surveillance ships
  - Fleet was not structured using a coherent fleet architecture plan
- NOAA needs to maintain a modern core fleet capability to meet mission requirements in order to:
  - Maintain government mission proficiencies in new technologies and expertise for efficient procurement vessel services
  - Provide surge capability to meet emergencies, such as Hurricanes Katrina and Sandy, and Deepwater Horizon
  - Maintain unique capabilities not readily chartered, e.g. acoustically quiet ships, etc.

Task 1 Findings (continued):
Current Fleet Composition and Capabilities

- NOAA has a robust process for prioritizing requirements for Days at Sea (DAS) ship time from the Line Offices (Figures 4 and 5)
  - Unconstrained 15,245 DAS requirement identified prior to line office 1-n prioritization
  - Only 8700 DAS were actually requested and of those only 5100 (59%) are actually performed (2900 on NOAA ships and 2200 on charters)
  - Impact of not meeting all priority one DAS requirements is not identified
- Current fleet has about 800 days of idle capacity or "white space" in the fleet allocation plan and ship schedules which does not include mobilization and demobilization (Appendix C)
  - Idle capacity results in average utilization of about 190 DAS per ship versus the target of 235
  - Accounting for mobilization and demobilization reduces idle capacity to about 670 DAS
  - Notional ship schedule prepared by OMAO for the IRT indicates that with additional funding (estimated $20 - 25M per year), some of the idle capacity can be utilized to meet priority one requirements
  - Some idle capacity will remain due to mismatch in required individual vessel capabilities and geographic/temporal constraints
  - Reducing the white space increases the risk of breakdowns in an aging fleet

Task 1 Findings (continued):
Current Fleet Composition and Capabilities

- Ship retirements removed about 750 DAS from available fleet capacity from 2010 to 2014 – impact from loss of capacity is not obvious
- Current ship allocation process does not include ships less than 40 meters to meet priority one requirements
- Existing inventory of small boats resides within the line offices and an assessment should be conducted to determine if they can be used to satisfy some priority one requirements

Current NOAA Fleet

Missions

OR – Oceanographic Research

FR – Fisheries Research

HS – Hydrographic Surveys

EA – Environmental Assessment

Vessel	Length (ft)	Mission	Home Port	Launch Date
Rainier	231	HS	Newport, OR	1967
Fairweather	231	HS	Ketchikan, AK	1967
Oregon II	170	FR	Pascagoula, MS	1967
Hi'ialakai	224	OR, EA	Honolulu, HI	1984
Oscar Elton Sette	224	FR	Honolulu, HI	1987
Okeanos Explorer	224	OR, EA	Davisville, RI	1988
Gordon Gunter	224	FR	Pascagoula, MS	1989
Nancy Foster	187	OR, EA	Charleston, SC	1990
Thomas Jefferson	208	HS	Norfolk, VA	1991
Ronald H. Brown	274	OR, EA	Charleston, SC	1996
Oscar Dyson	209	FR	Kodiak, AK	2003
Henry B. Bigelow	209	FR	Newport, RI	2005
Pisces	209	FR	Pascagoula, MS	2007
Bell M. Shimada	209	FR	Newport, OR	2008
Ferdinand R. Hassler	123	HS	New Castle, NH	2009
Reuben Lasker	209	FR	San Diego, CA	2012

FIGURE 1

NOAA Ships and Homeports as of 2016

The fleet is listed with ship name, homeport location, primary mission, year built, and projected end of service life
NOAA's ships range in age from 3 to 48 years old.

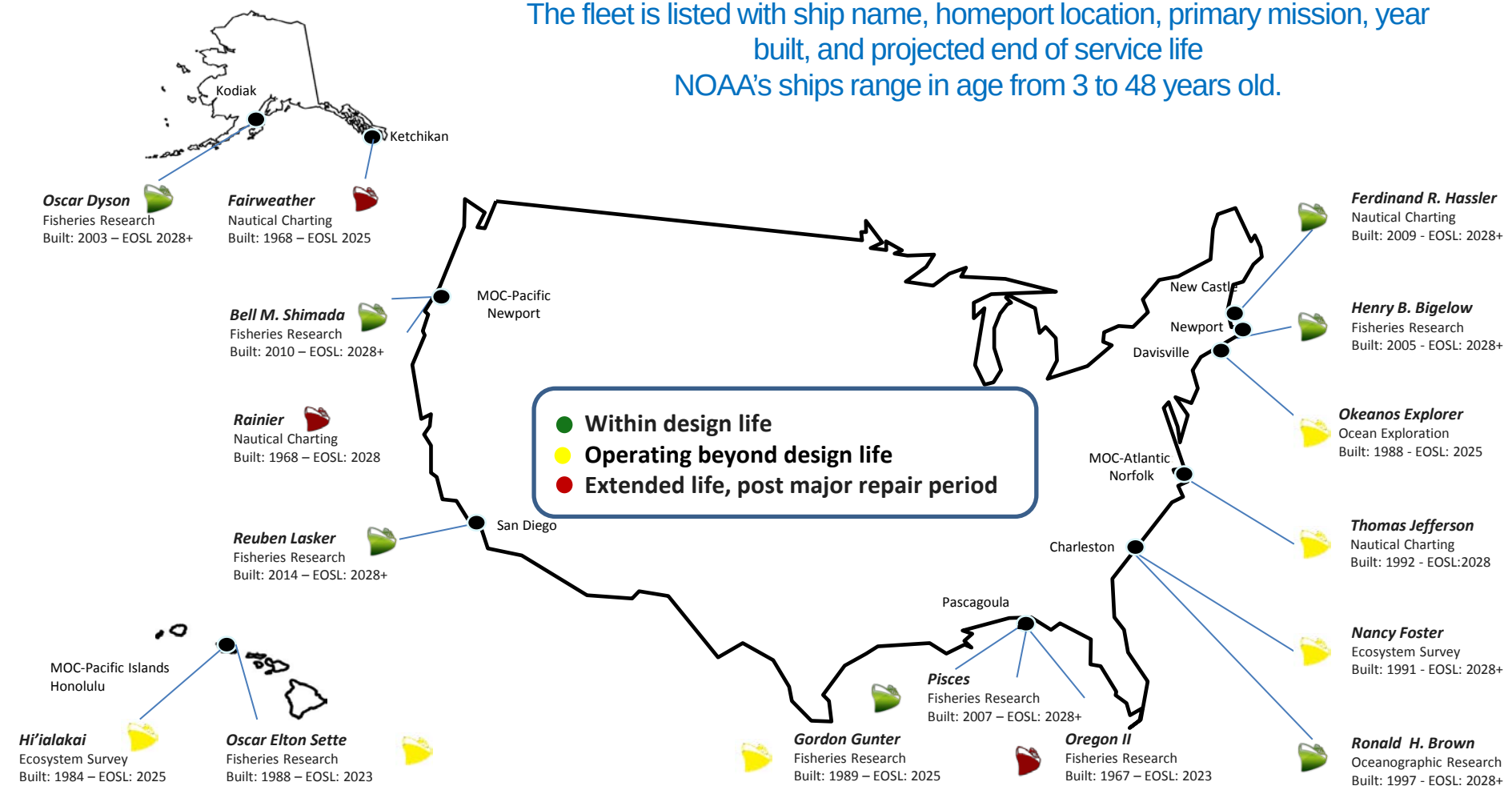
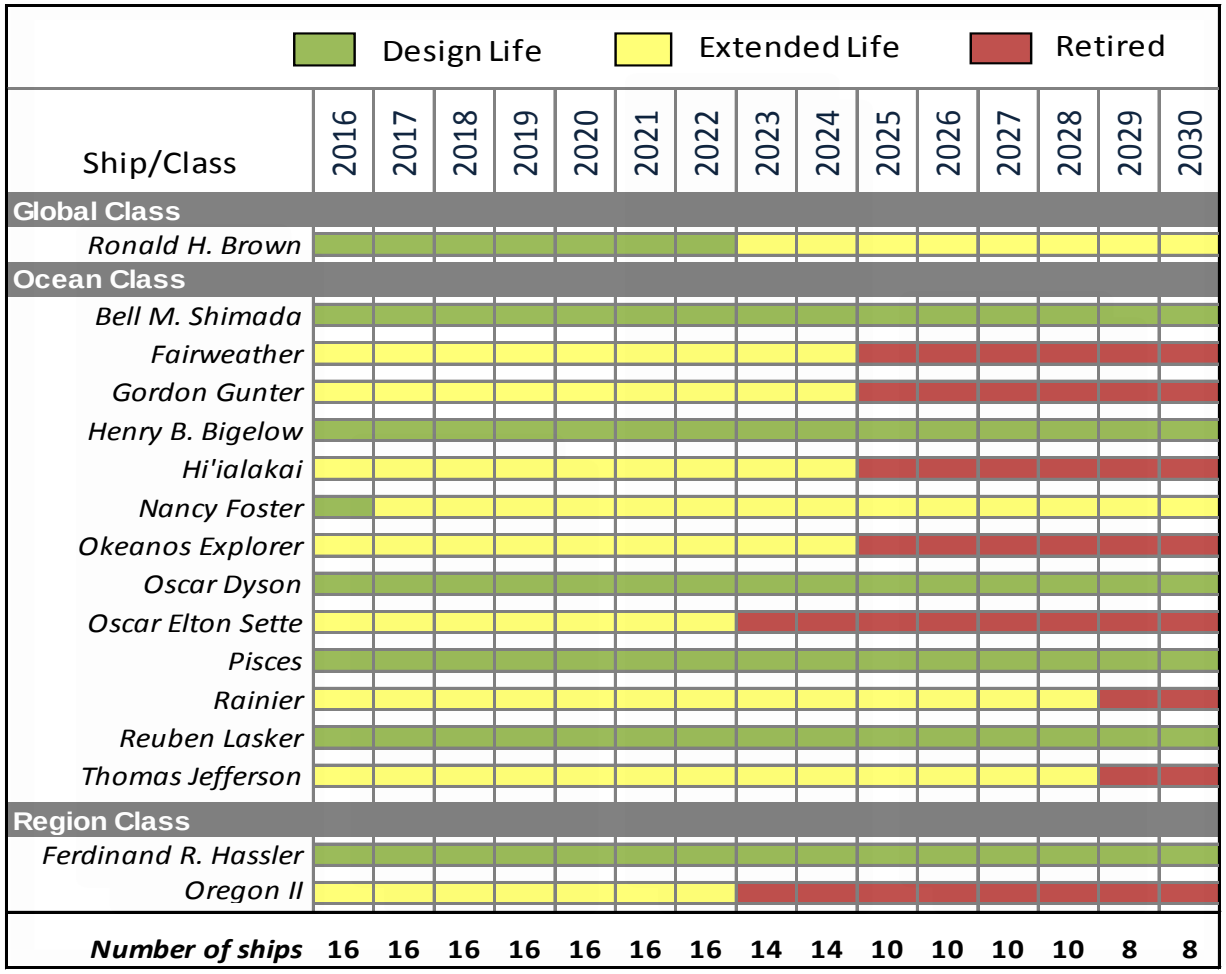


FIGURE 2

Estimated Remaining Years of Design Service Life



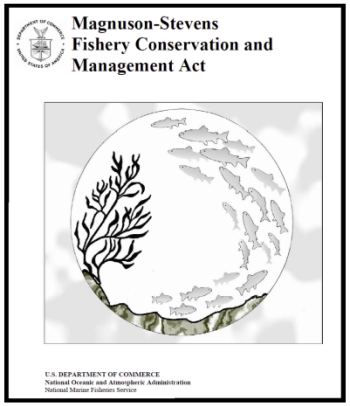
Ship/Class	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Global Class															
Ronald H. Brown															
Ocean Class															
Bell M. Shimada															
Fairweather															
Gordon Gunter															
Henry B. Bigelow															
Hi'ialakai															
Nancy Foster															
Okeanos Explorer															
Oscar Dyson															
Oscar Elton Sette															
Pisces															
Rainier															
Reuben Lasker															
Thomas Jefferson															
Region Class															
Ferdinand R. Hassler															
Oregon II															
Number of ships	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**14**	**14**	**10**	**10**	**10**	**10**	**8**	**8**

From draft NOAA Fleet Status Report – April 2016

FIGURE 3

Fleet Scheduling and Allocation Process

LEGISLATIVE MANDATES



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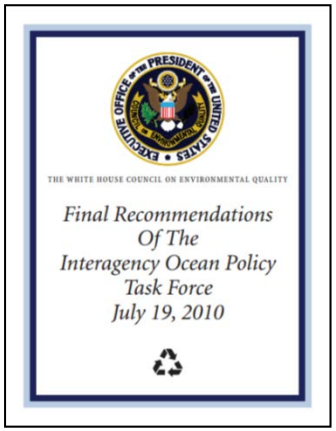
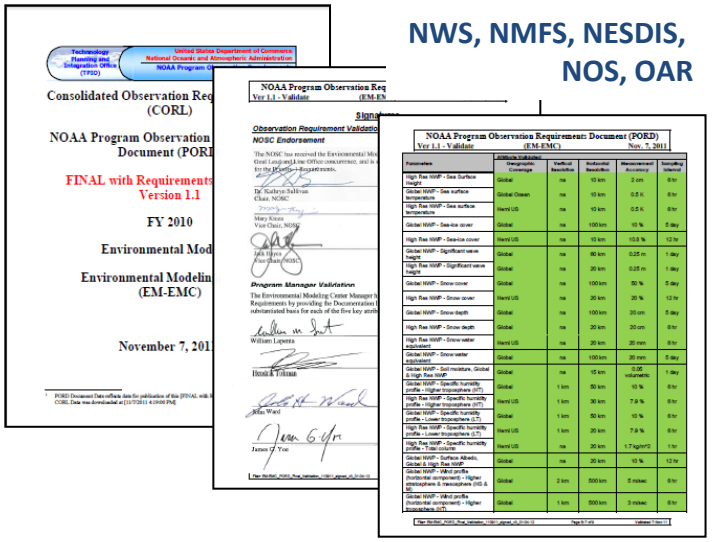
EXECUTIVE MANDATES



PRIORITIZED REQUIREMENTS



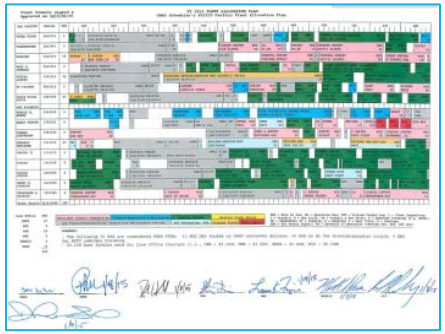
NWS, NMFS, NESDIS, NOS, OAR

HIGH LEVEL PRIORITIZATION

DETAILED PRIORITIZATION

NOAA FLEET COUNCIL

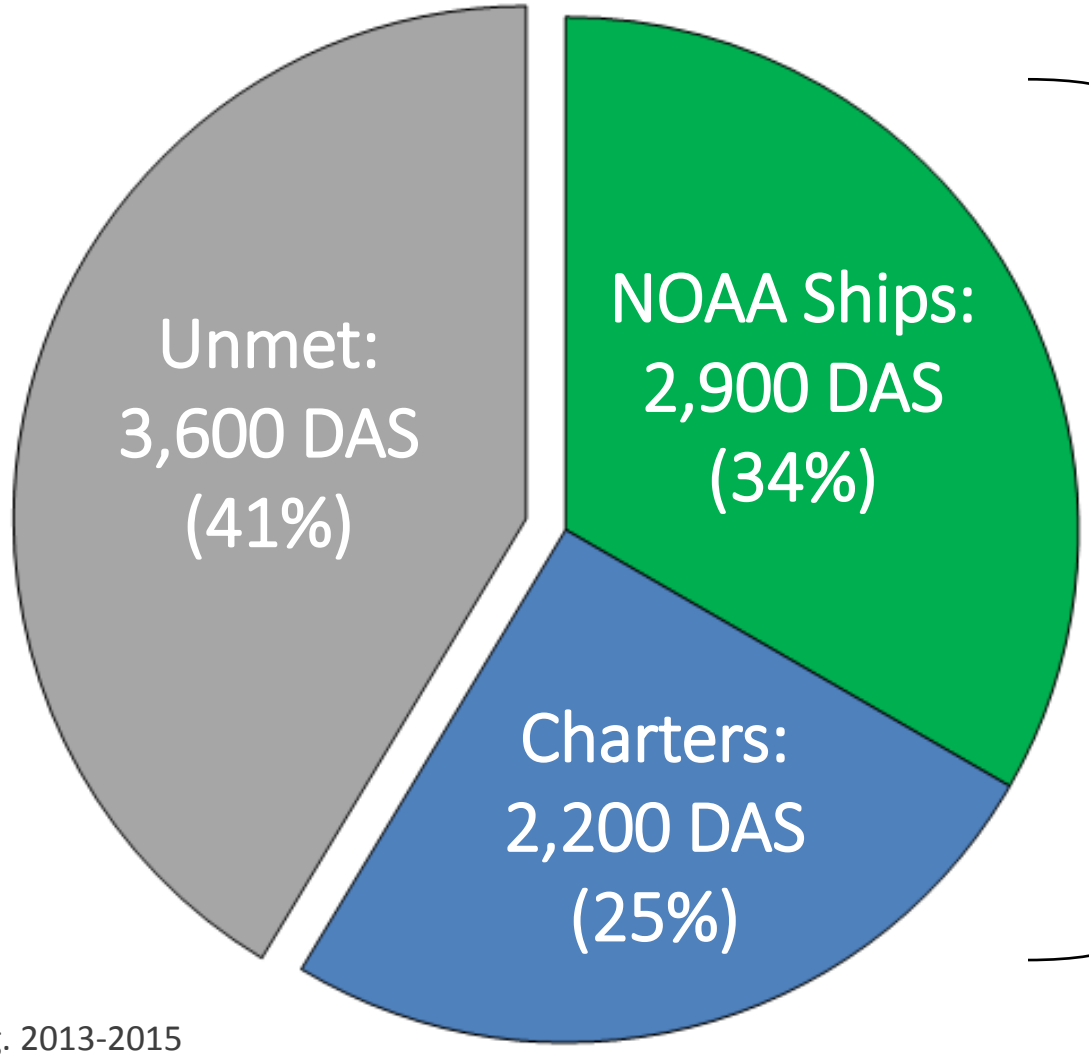
ALLOCATION/ SCHEDULING



FLEET ALLOCATION PLAN
(process includes UNOLS vessels)

FIGURE 4

Priority One Requirements: 8,700 Days At Sea Requested/Year *



5,100 DAS/Year allocated for NOAA missions (59% of days requested)

*avg. 2013-2015

pre-decisional/not for distribution

Task 2 Findings:
Long-Term Recapitalization Planning

- Single ship design or class will not meet all mission requirements
  - Acquisition strategies for each ship class are required to minimize cost
- NOAA lacks an approved fleet recapitalization/modernization plan and planning process that addresses core multi-mission capabilities to support diverse elements of NOAA mission
  - NOAA needs modern ships to meet at-sea missions across deep ocean, coastal, and polar waters
  - IRT has received and reviewed a draft recapitalization plan by the NOAA Tiger Team
- NOAA lacks analysis of fleet architecture, structure and capacity
  - Need methodology for converting priority one DAS requirements to mission capabilities
  - Need analysis of service life extension program (SLEP) to defer building new ships
- NOAA lacks an assessment of the utility of smaller, shallow draft (less than 40 meters) vessels for some missions

Task 2 Findings (continued):
Long-Term Recapitalization Planning

- Use of the terms ocean survey vessel (OSV) and regional survey vessel (RSV) to describe ship design is outdated and does not reflect mission capabilities such as such as hydrographic survey, fisheries, multi-purpose survey/research ships
- Accept NOAA assessment of NSF RCRV design as not suitable for a core mission ship
  - Preliminary NOAA assessment indicates not suitable for trawling
  - Design draft of 12’ 6” may not be suitable for coastal/near-shore work
- Navy has recently constructed and accepted two general purpose oceanographic research vessels, AGOR 27/28
  - NOAA study determined this hull would meet 90% of mission types (excluding fisheries); reduced to 61%, if fisheries requirements are considered
- Utilization of AGOR 27/28 specification is most expeditious means to initiate new ship recapitalization

Task 2 Findings (continued): Long-Term Recapitalization Planning

- Sequence of planned ship decommissioning must be clearly defined and in parallel with a ship acquisition plan
- Existing specification for AGOR 27/28 can be utilized to meet NOAA ocean multi-purpose vessel mission requirements
  - Ships accepted by Navy and operations underway
  - NOAA conducted assessment of AGOR capability to meet NOAA missions
- Ship specification is mature and program achieved milestone one in Department of Commerce (DOC) acquisition process
- NOAA use of specification can accelerate new ship delivery by at least two years with savings of up to $10M (as estimated by NOAA)
- Interagency agreement already established with Navy will capitalize on Navy team for acquisition support

Task 2 Findings (continued):
IRT Comments on September 2016 Draft Tiger Team Recapitalization Plan

- IRT appreciates NOAA leaderships' response to its preliminary recommendation to establish a "Tiger Team" to immediately draft a fleet recapitalization plan
- IRT provided guidance, reviewed and gave feedback on initial draft fleet recapitalization plan
- Tiger Team draft fleet recapitalization plan is an important step in addressing the IRT key finding and recommendation concerning the lack of a currently approved recapitalization plan
- Plan addresses the sequencing of a core multi-mission fleet that is appropriate in scale and scope to satisfy priority one ocean observation requirements
- Final fleet plan should meet NOAA's requirement for a comprehensive recapitalization strategy
- An approved plan must be supported by a funding profile for recapitalization, and operations and maintenance

Task 3 Findings:
Utilization of Alternatives to the NOAA Fleet

- About half of NOAA's at-sea data requirements are being met by charters, including University-National Oceanographic Laboratory System (UNOLS) ships and bathymetric survey data buys
- Current balance between in-house and charter capabilities helps mitigate risk, ensures in-house capability and allows scheduling flexibility
- Systemic chartering issues:
  - Five year limit on contracting limits feasibility of long term chartering of newly built special purpose ships in the private sector
  - Potential contractor defaults are a risk to NOAA at-sea plans
- No standard NOAA chartering policy
  - Line offices use program funds to charter independent of OMAO and without a requirement to verify availability of NOAA fleet
  - No centralized accounting for total DAS used by NOAA line offices to supplement the charters secured by OMAO

Task 4 Findings:
Current Operational Systems

- Ship scheduling system is effective
- NOAA's crewing model should be evaluated
  - Current crewing model leads to "crew rest days" which require the ships to be idle
  - NOAA has pursued funding to expand existing alternate crewing models to more ships and more departments
  - Currently used in engineering departments and on certain ships
- NOAA is unable to recruit and retain adequate, experienced ship crew and port engineers
- Exacerbated by recent home port relocation action on the west coast

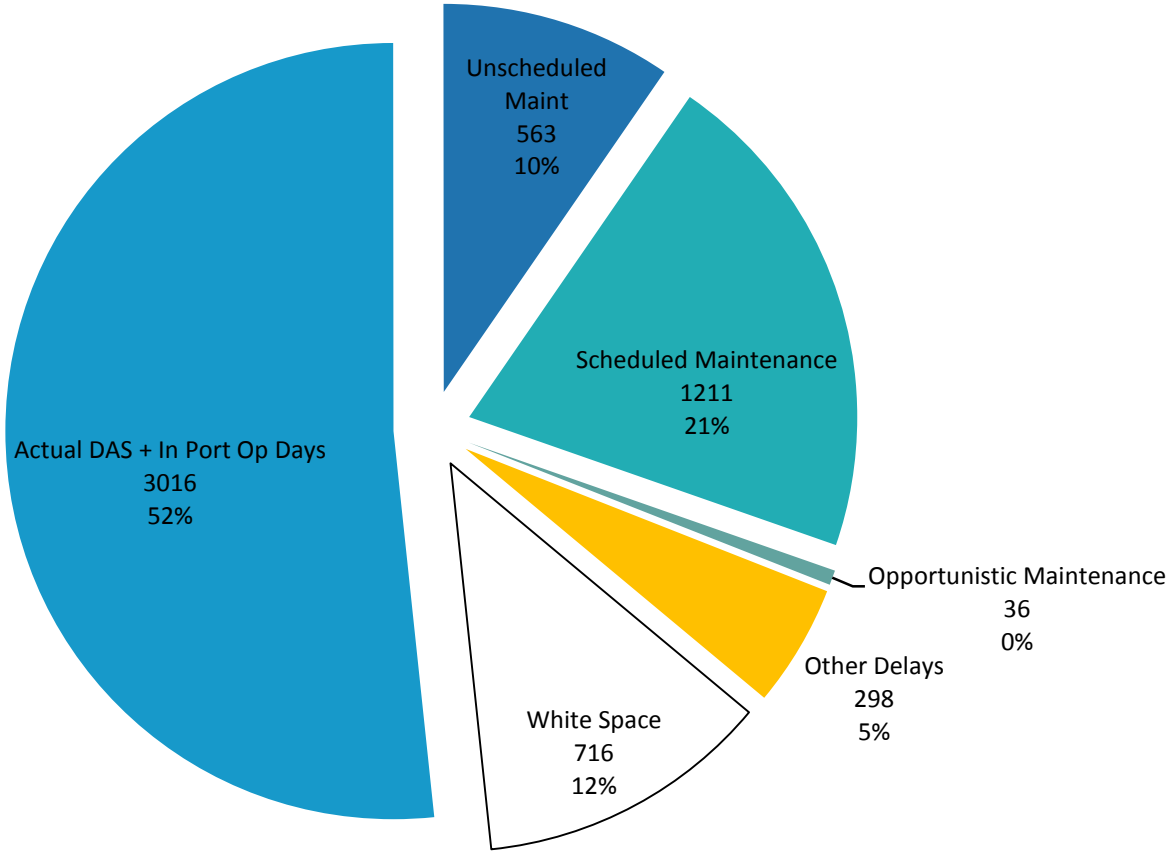
Task 5 Findings:
Current Maintenance Practices

- Lost time due to maintenance appears to be abnormally high, leading to a ratio of one day of maintenance to every two days actually spent at sea (Figure 6)
  - This appears out of line with industry practice (UNOLS ships are 1 day of maintenance for 5 to 7 days spent at sea, depending on age of ships)
- Past practices of deferring maintenance based on constrained budget have led to current high rate of lost time due to maintenance (planned and unplanned)
- Aging fleet with technical obsolescence suffers from a lack of available spare parts and the need to manufacture custom replacement parts
  - Lack of common ship design and/or equipment leads to higher spare parts inventory costs or delays in obtaining parts, higher training costs, and constraints on crew mobility
  - NOAA is unable to recruit and retain adequate, experienced port engineers
- Significant risk that some ships will not survive until planned first replacement ship is operational

Task 5 Findings (continued):
Current Maintenance Practices

- NOAA has increased funding for maintenance of its ships but funding remains insufficient to maintain a high state of readiness
  - NOAA is pursuing a new Progressive Maintenance Program to address deferred maintenance
- New ships will reduce unplanned maintenance and loss of service time, but will not necessarily result in lower routine maintenance costs
  - Complexity of new ship designs will not reduce the cost for maintaining replacement vessels, but could expand productivity of at-sea operations
- NOAA is currently doing a fleet-wide materiel condition assessment that should identify cost-effective candidates for service life extensions as appropriate
  - Ship conditions may preclude cost effective service life extensions for some vessels

FY15 Maintenance Days vs Total Days



In Port Op Days

- Project
- Staging/Destaging
- Crew rest
- Early project completion
- Fleet Inspection
- Launch work
- Outreach events
- Required crew training

Other Delays

- Medical/injury
- Acquisition issues
- Staffing issues
- Safety issues
- Weather
- Other

FIGURE 6

Task 6 Findings:
Technology Readiness and Infusions

- NOAA actively monitors, sponsors and implements research and development of new observing system technologies in cooperation with Navy, academia, industry, and other federal agencies
  - Examples of implemented technology include ARGO floats, laser bathymetry, sea gliders, fisheries optical and acoustic systems, high definition telepresence
- New unmanned and autonomous system technologies will mainly be “force multipliers,” offering enhanced capabilities rather than replacing the need for a core fleet of ships (Appendix D)
- For the foreseeable future in-situ ocean observatories systems, such as the Integrated Ocean Observing System (IOOS) and the Ocean Observing Initiative (OOI), and sea gliders will not diminish the need for a NOAA core fleet, but could result in a role change for ship capabilities

Task 6 Findings (continued):
Technology Readiness and Infusions

- Emerging technologies will influence ship design and fleet architecture with mission tailored platforms utilizing unmanned systems
  - Autonomous surface vehicles (ASV) and autonomous underwater vehicles (AUV) could result in changes in ship design and capabilities, launch and recovery, and data handling
  - Trawling surveys will continue for the foreseeable future, although use of advanced acoustic and optical systems will likely expand (Appendix E)
  - ASVs have the potential to replace hydrographic survey launches for charting mission
- Unmanned systems often require comparable at-sea workforce and hoteling needs as the current manned systems require
- Often difficult to predict when new technologies are sufficiently ready to go from development to operation

Task 7 Findings:
Risk Identification, Mitigation and Management Planning

- OMAO has identified the risk of near term fleet failure, but NOAA/OMAO has not provided mitigation strategies to manage the risk
- OMAO is no longer staffed with the in-house capability required to manage a major ship procurement program
- Funding limitations prevent full utilization of the fleet
- Deferred maintenance results in higher unplanned emergency maintenance and reduced available DAS
- Impacts of not fully funding priority one requirements and the reduction in capability due to reduced size of fleet are not documented
- Acquisition strategy of block buys of a common design is more fiscally efficient
  - Lead ship with options for one or two additional ships

Recommendations

- Immediately develop and implement a recapitalization plan using a “Tiger Team” for a right-sized multi-mission fleet to meet well-defined priority one requirements
- Plan should:
  - Assess capabilities for a mix of multi-purpose, single purpose, shallow draft, smaller (40 meters or less) and charter vessels to meet priority one requirements
  - Present a clear plan for a sequence of ship replacements
  - The recapitalization plan needs to be a living document, with a process to reevaluate every two years

Note: The IRT reviewed the resulting September 2016 Tiger Team draft recapitalization plan and utilized it in the preparation of this final report

Recommendations (continued)

- Final approved fleet recapitalization plan must be supported by funding for ship construction and utilization, building on the FY16 NOAA budget which contained ship construction funds
- NOAA leadership needs to develop and strongly advocate a multi-year capital acquisition plan which enables multi-year, multi-ship acquisition contracting
- NOAA leadership needs to routinely review metrics associated with implementation of the recapitalization plan similar to other major acquisition programs

Recommendations (continued)

- Initiate actions to procure general purpose oceanographic research vessels as the first step in a fleet recapitalization plan based on the AGOR 27/28 specification
- Concurrently start mission and concept ship design(s) to meet requirements that are not met with the AGOR specification
  - Consider alternate technologies, or smaller vessels
  - Assess domestic and international design for ships constructed in the past five years
  - Minimize the number of ship classes to achieve economies of scale
  - Ship design must be flexible to incorporate potential for unmanned surface, underwater and aerial systems (ASV/AUV/UAS) in future ships
  - Include life cycle considerations
  - Optimize acquisition strategy and minimize cost by procuring at least two ships of common design from the classes of ships identified in the draft Tiger Team recapitalization plan (i.e., classes A, B and C)
  - Conduct lessons learned and assessment of recent acquisitions

Recommendations (continued)

- Establish comprehensive benchmarking study of fleet maintenance and crewing against other federal ships and assess best commercial practices, include independent expertise
- Ensure ship and shore side fleet readiness responsibilities are better aligned and funded to utilize standard/best practices to manage maintenance requirements and infrastructure to ensure a high state of readiness
- Establish a NOAA-wide policy for chartering to address vetting with OMAO for availability of ships, potential for long-term charters, and legal constraints

Concluding Comments

- The Nation is highly dependent on information gathered by the NOAA fleet to inform a variety of critical mission responsibilities in the oceans
- IRT has identified pressing actions that are necessary to ensure success of the NOAA mission
- Implementation of the fleet recapitalization plan requires significant and immediate attention in order to avoid loss of service gaps
- With appropriate action all identified findings and recommendations are resolvable

Appendices:

Appendix A: IRT Terms of Reference

Appendix B: Meetings and Briefings

Appendix C: FY2016 Fleet Allocation Plan – Mobilization and Demobilization Included

Appendix D: Nautical Charting Technology

Appendix E: Incorporation of Advanced Fishery Sampling

Appendix A
IRT Terms of Reference

A. TASK OBJECTIVE: NOAA senior management requests a senior-level independent review team to assess the health of the NOAA Fleet of research vessels, requirements for recapitalization, and analysis of operational, maintenance practices and technology infusion. The IRT will consider the compelling data-collection requirements that need access to the oceans; the applicable technologies and how they change the requirements; the appropriate fleet size and composition to meet needs; and best approaches to meet this need. Towards this objective, the IRT will assess the NOAA Fleet for:
   i. Current Fleet composition and capabilities;
   ii. Long-term recapitalization planning based on NOAA's at sea data-collection requirements;
   iii. Utilization of alternatives to the NOAA Fleet (commercial contracting, Academic Research Fleet, other public-funded vessels) to meet requirements.
   iv. Analysis of current operational systems (crewing, scheduling);
   v. Analysis of current maintenance practices;
   vi. Technology readiness and infusion (instrumentation and mechanical);
   vii. Risk identification, mitigation and management planning.

B. PROCEDURES and ASSUMPTIONS: The following ground rules and assumptions are to be aligned with the in-process review:
   i. The independent review teams will not have the authorities of a FACA advisory panel. The IRT will conduct its business independent of NOAA, but consistent with the tasks outlined in the Terms of Reference.
   ii. The OMAO AA will assign a NOAA/OMAO employee as the Executive Secretariat for the IRT.
   iii. NOAA shall facilitate IRT performance by providing timely access to necessary data, other government personnel as appropriate, and other applicable information as requested by the IRT. NOAA shall also provide necessary meeting and workspace, and visitor access to NOAA and DOC facilities. Cost estimating resources are not required to support the in-process review.
   iv. There will be co-chairs of the IRT. The co-chairs will have the authority to suggest augmenting the permanent IRT with subject matter experts who may be needed to evaluate unique aspects of a project.
   v. Travel to key prime or subcontractor facilities is not required to support the in-process review.
   vi. The IRT in-process review will be unclassified.

C. GENERAL TASKS:
   i. The co-chairs shall assemble an IRT consisting of a core group of individuals, SMEs and final reviewers, as needed. This core group should be augmented with specific technical, cost and/or programmatic expertise as required. To the extent possible, continuity of review panel membership will be maintained throughout the duration of the NOAA Fleet review. The core group shall be comprised of individuals with extensive experience in the following areas:
      1. Knowledge of research oceanographic ships, and underlying operational requirements.
      2. Knowledge of at-sea data requirement types, and ship-based data collection operational requirements.
      3. Knowledge of NOAA at-sea scientific priorities programs and missions.
      4. Participation in similar high-level U.S. Government ship acquisition panels or studies.
      5. Knowledge of and experience with large-scale acquisition, specifically shipbuilding and refurbishment.
      6. Knowledge of recent ship acquisitions, both from refurbishments and new builds.
      7. Knowledge of current and potential ship-based technological advancements, including instrumentation, engineering, unmanned aircraft and autonomous underwater vehicles.
   ii. All IRT member selections are the responsibility of the co-chairs. However, to ensure proper breadth and depth of experience and expertise, the co-chairs shall review panel member qualifications with NOAA to ensure that the IRT objectives are met. Annex A is a list of the IRT members.
   iii. The co-chairs may propose that additional subject matter experts (SMEs) augment a specific IRT if specific knowledge is required. With NOAA approval, the SMEs will augment the permanent IRT members until the review is complete.
   iv. OMAO will provide a contractor to provide administrative and logistics support to the IRT and assist with technical and report preparation as desired. NOAA and the contractor shall provide all executive secretariat and administrative support resources for the IRT including the collection of data, the arrangements for meetings and the production of all IRT products. The contractor will obtain NOAA approval for any proposed IRT member official travel in support of a review.
   v. The co-chairs will develop a detailed task statement providing detail to the generic tasks in this paragraph. NOAA will approve the task statement.
   vi. The co-chairs, with the support of NOAA OMAO staff and the contractor, shall develop meeting agendas, conduct the reviews and conduct follow-up meetings as needed.
   vii. If tasked by NOAA, the IRT co-chairs and designated team members will support the briefing of results to NOAA leadership or external stakeholders as NOAA or Department of Commerce (DOC) leadership may direct.

D. DELIVERABLES: The IRT will provide a final report by the end of September, 2016 that addresses the task objectives. The IRT shall prepare an in-process review assessment report(s) to NOAA senior leadership as appropriate or requested. If tasked by NOAA, the IRT shall evaluate all action item responses for adequacy and recommend disposition. Follow up efforts following completion of the final report will be determined by NOAA senior leadership.

IRT Members
Annex A to IRT Terms of Reference

Dick West, RADM, United States Navy (ret)

Robert Winokur, Senior Advisor, Michigan Tech Research Institute, NOAA National Environmental Satellite, Data, Information Service (NESDIS)

Fred Byus, RDML, United States Navy (ret), Vice President and General Manger, Battelle Mission and Defense Technologies

Dr. John Hughes-Clark, Professor, University of New Hampshire

John Crowley, RADM, United States Coast Guard (ret), National Association of Waterfront Employers

Bauke (Bob) Houtman, Head, Integrative Programs Section, National Science Foundation

Dr. Steve Murawski, Professor, University of South Florida

Blake Powell, President, JMS Naval Architects

Dr. Nancy Rabalais, Professor, Louisiana State University, Louisiana Universities Marine Consortium

Robert (Tim) Schnoor, Ocean Research Facilities Manager, Office of Naval Research

Dr. Steve Ramberg, Distinguished Research Fellow, National Defense University, Penn State University

Dick Vortmann, President and CEO (ret), National Steel and Shipbuilding Company (NASSCO)

NOAA Liaisons:
CAPT Nancy Hann, Chief of Staff, Office of Marine and Aviation Operations (OMAO)
LT Richard Park, Flag Aide to Director NOAA Corps and OMAO
LT Zachary Cress, Flag Secretary, OMAO

Appendix B
Meetings and Briefings

- January 20-22, 2016
  History of Fleet Plans; OMAO 101, NOAA Legislative Affairs Update; Interagency Working Group on Facilities and Infrastructure; Research Requirements; Budget Environment; NMFS; NOS; NESDIS; OAR; NWS; Fleet Projections

- February 16, 2016 (teleconference)
  Inter-Agency Plan (Bob Houtman, NSF); Navy Acquisition of AGOR 27-28 (Tim Schnoor, ONR); NOAA's 10-12 year Acquisition Plan (Jeff Peter, ECS OMAO)

- March 10-11, 2016
  TPIO Requirements (Pam Taylor); 2012 Fleet Plan (Stu Williams and CAPT Bridgeman, NOAA); Fleet Allocation Council (CDR Martin, NOAA); NOSC (RADM Score, NOAA); UAS (CAPT Hall, NOAA); Unmanned Marine Systems (Wayne Perryman, NMFS); OCS Technology LCDR Greenaway and RADM DeBow (ret), NOAA); Fleet Maintenance (Troy Frost, OMAO); New Autonomous Technology (RDML Gallaudet, USN); Offshore Telepresence (Dr. Dwight Coleman, URI); NOAA Small Boat Program (Dennis Donohue, LT Guberski, NOAA)

- April 13, 2016 (teleconference)
  FY16 NOAA Fleet Plan Update (RADM Score, NOAA); discussion on days at sea; draft status report to NOAA administrator and senior leadership

Appendix B (continued)
Meetings and Briefings

- May 10-11, 2016
  "White Space" (Bill O'Clock, OMAO); Charters (Bill O'Clock, OMAO); Ship Comparisons, Acquisition Strategy, and Ownership of Ship Plans (Joe Hubbard, OMAO); Hydrography (Dr. John Hughes-Clarke, UNH); Fishery Technology impacting Fleet Recapitalization (Dr. Steve Murawski, USF); Maintenance, State of Fleet in 8 years (Troy Frost and CDR Hann, NOAA); IOOS (Carl Gouldman, OAR); NOAA Fleet Status Report Update; OOI (Bob Houtman, NSF)

- June 14, 2016 (teleconference)
  Review core need for ships; need for coastal ship; establishment of Tiger Team to develop a recapitalization plan; draft IRT status report

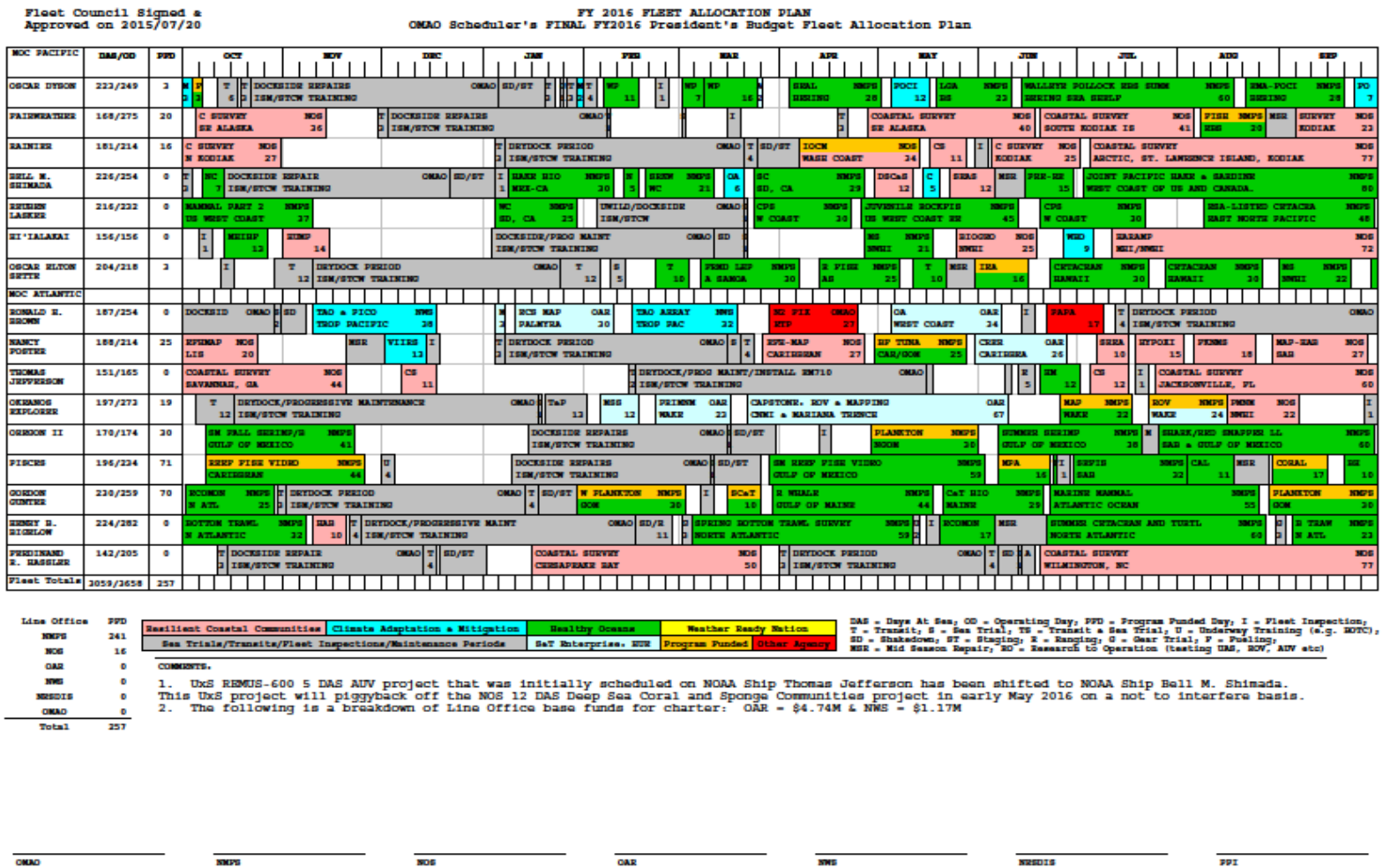
- July 13-14, 2016
  Discussion of ship issues; brief on FSV; discussion of Navy AGOR; Tiger Team update; chartering; impact of lost DAS on requirements; discussion of IRT report

- August 23, 2016 (teleconference)
  Update on briefings to NOAA leadership, OMD and hill staff; Fy17 fleet allocation plan; fleet architecture study; discussion on maintenance issues; Tiger Team update; review IRT draft report

- September 14-15, 2016
  Review draft Tiger Team draft recapitalization plan; complete IRT report

Appendix C

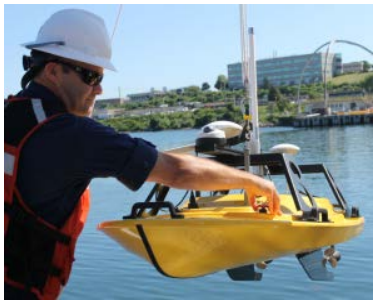
FY2016 Fleet Allocation Plan Mobilization and Demobilization Included



Appendix D

Nautical Charting Technology

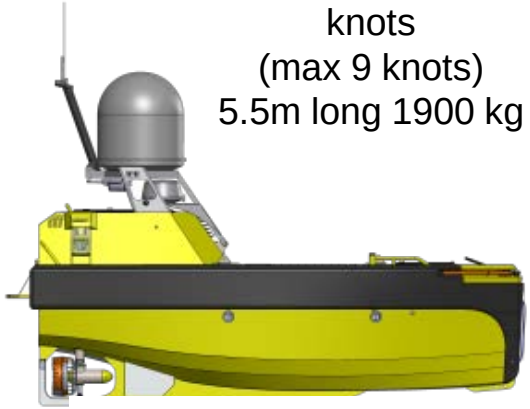
Manned Launch:
0.5 day endurance (personnel limited)
Typically ~ 8 knots.
9m long – 5000+kg(?)



~2 hours endurance
at ~4 knots
(max 9 knots)
1.8m long <100 kg

1-2days endurance at ~4
knots
(max 9 knots)
4.0m long 680 kg

Up to 5 days endurance at 7
knots
(max 9 knots)
5.5m long 1900 kg



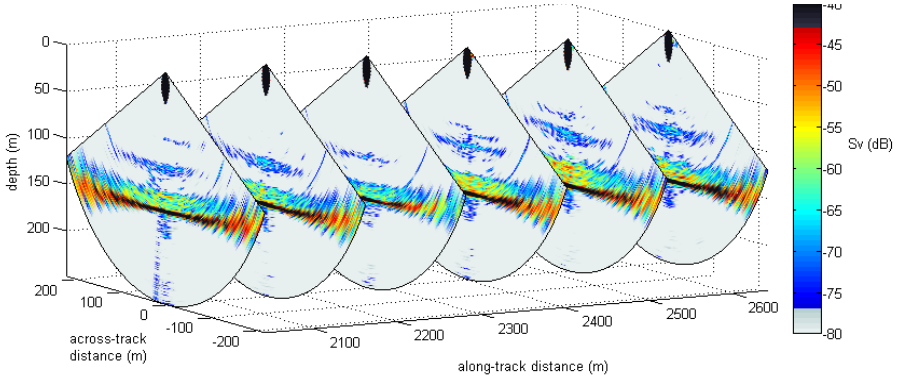
30 day endurance at 4
knots
(max 6.5 knots)
5.8m – 3500 kg

The potential benefits of ASVs:

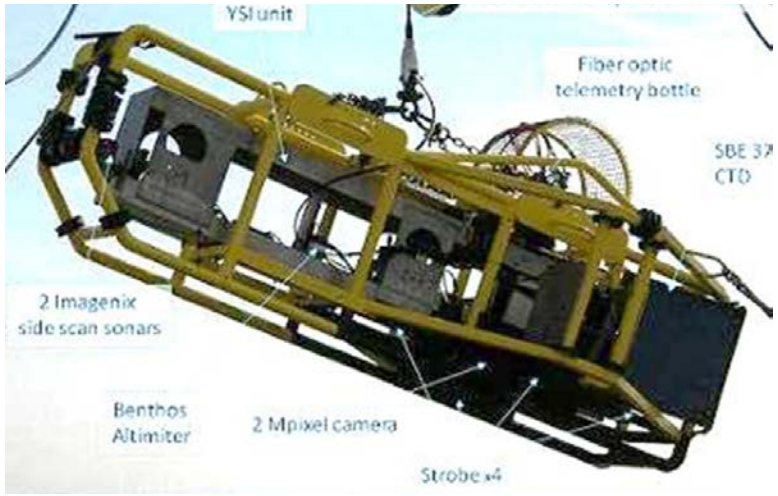
- Can carry identical payload (same positioning)
- Less human exposure to hazards
- Longer endurance (same sea states)

Appendix E

Incorporation of Advanced Fishery Sampling Technologies



Tomographic image of walleye pollock shoal and seafloor from FSV *OSCAR DYSON using the ME-70 multibeam sonar* (Tom Weber, UNH)



HABCAM – NE scallop stock assessment

Camera-Based Assessment Survey System (C-BASS) Reef Fish & Habitat Assessment