Program Observation Requirements Document (PORD)

for

Ocean In situ Observation Requirements

Oceanic and Atmospheric Research (OAR)

National Oceanic and Atmospheric Administration
November 14, 2012

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NOAA Observing Systems Council (NOSC) Endorsement

The NOSC has received Oceanic and Atmospheric Research Requirements for Ocean In Situ Observations, with Line Office concurrence, and is satisfied with the level of validation provided for the Priority-1 Requirements.

12/7/12

Dr. Kathryn Sullivan
Chair, NOSC

Date

12/13/12

Mary E. Kicza
Vice Chair, NOSC

Date

12/4/12

Laura K. Furgione
Vice Chair, NOSC

Date

11/29/12

RADM Michael S. Devany
Vice Chair, NOSC

Date

Line Office Concurrence

The Office of Oceanic and Atmospheric Research concurs with the observation requirements and is satisfied with the Level-of-Validation provided by the Priority-1 Days at Sea Requirements.

	11/19/12	✓
Robert Detrick Assistant Administrator, OAR	Date	Validated
	11/16/12	✓
Alexander MacDonald Deputy Assistant Administrator, OAR	Date	Validated
	11/19/12	✓
Richard Hester Research Platform Manager, OAR	Date	Validated

1. Document Overview

NOAA's Ocean *In Situ* requirements validation process creates a baseline of objectively verifiable requirements based on:

- Documentation via mandates, scientific studies, or ongoing research, and/or
- Consensus among Program Members, Program Managers, Goal Leads, and Line Office AAs

With these, NOAA can better set priorities based on mission needs and stakeholder input. The validated requirements can then be the basis for justification and gap analysis of NOAA observing systems satisfying those requirements, positioning NOAA to operate the right mix of assets and options to meet at-sea sampling requirements now and in the future.

The Office of Oceanic and Atmospheric Research (OAR) worked closely with the Office of Technology, Planning, and Integration for Observations (TPIO), Office of Marine and Aviation Operations (OMAO), and Subject Matter Experts (SMEs) to document their list of Ocean *In Situ* requirements.

TPIO, on behalf of the NOAA Observing Systems Council (NOSC), follows a standard process when documenting observation, system-independent, requirements with NOAA Line Offices. This template includes the priority of each requirement based on its importance to the group mission:

Mission Critical (Priority-1)
Mission Optimal (Priority-2)
Mission Enhancing (Priority-3)

Specific attributes for each Priority-1 requirement are then documented and validated. In support of generation of the NOAA Fleet Plan in late 2012, the NOSC's Observation Requirements process was modified for application to more system specific Ocean *In Situ* requirements. The validation process for each Line Office's Ocean *In Situ* requirements has been applied to the 1) observational need; 2) geographic coverage and 3) sampling frequency. In addition, the number of Days At Sea (DAS) associated with each requirement are also provided to assist with the NOAA Fleet Plan. The requirements list and attributes are verified by the Line Office representatives and SMEs who then provide validation documentation to support each Priority-1 requirement and its specified attributes values. Validation is important as it provides independent confirmation of the needs of the program either through the results of scientific studies, operational use, or subject matter experts. Both the Line Office representatives and TPIO assess the applicability of the documents and prepare a summary of the validation of Priority-1 requirements. The NOAA Line Office obtains their leadership concurrence and presents the requirements summary to the NOSC for their endorsement of the validation process.

2. Observation Requirements Summary

NOAA Oceanic and Atmospheric Research (OAR) has a total of 70 Priority 1 "Mission Critical" ocean in-situ observing requirements that must be met in order to accomplish its mission. These ocean-specific requirements originate from 7 OAR lab and program organizations. This section summarizes requirements from each contributing lab and program. It provides a lab or program description, a table outlining the requirements, and a table listing the documentation that validates them.

2.1 Atlantic Oceanographic and Meteorological Laboratory (AOML)

2.1.1 Laboratory Summary

AOML, a federal research laboratory, is located in Miami, Florida. AOML's research spans hurricanes, coastal ecosystems, oceans and human health, climate studies, global carbon systems, and ocean observations. Research programs are augmented by the Cooperative Institute for Marine and Atmospheric Studies (CIMAS), a joint enterprise with the University of Miami's Rosenstiel School of Marine and Atmospheric Science.

The Laboratory is a member of a unique community of marine research and educational institutions located on Virginia Key in Miami, Florida, including the University of Miami's Rosenstiel School of Marine and Atmospheric Science, NOAA's Southeast Fisheries Science Center, the Miami Seaquarium, the Maritime and Science Technology (MAST) Academy.

2.1.2 Validation Assessment for Priority-1 Requirements

OAR and TPIO representatives worked jointly to review the submitted documentation, and identify the "level of validation" for the Priority-1 Observation Requirement.

Table 1: Validation Assessment for AOML Priority-1 Requirements

#	Validation Assessment	Observation Requirement	Geo Coverage	Frequency of campaigns	DAS / campaign	Validation Docs
OAR.AO.001	Validated	Ecosystem Charecterization, Coastal and Great Lake - AOML South Florida Program (AOML SFP)	REGION 2 - SOUTHEAST & CARRIBBEAN (NC, SC, GA, FL)	Once / 2 months	8	1, 2, 3
OAR.AO.002	Validated	Ecosystem Charecterization, Coastal and Great Lakes - Coral Reef Ecosystem Research	REGION 2 - SOUTHEAST & CARRIBBEAN (NC, SC, GA, FL)	Once / year	44	4, 5

#	Validation Assessment	Observation Requirement	Geo Coverage	Frequency of campaigns	DAS / campaign	Validation Docs
OAR.AO. 003	Validated	Maintain Observing Systems and Produce Key Data Sets (Brazil -- Argo deployment and Western Boundary Current monitoring)	REGION 9 - GLOBAL, ANTARCTICA	Once / year	12	6, 7, 12 (SME), 24
OAR.AO. 004	Validated	Maintain Observing Systems and Produce Key Data Sets (France (30) and Brazil (45) – PIRATA)	REGION 9 - GLOBAL, ANTARCTICA	Once / year	75	8
OAR.AO. 005	Validated	Maintain Observing Systems and Produce Key Data Sets (PIRATA)	REGION 9 - GLOBAL, ANTARCTICA	Once / year	35	8
OAR.AO. 006	Validated	Maintain Observing Systems and Produce Key Data Sets - Southwest Atlantic MOC monitoring system	REGION 9 - GLOBAL, ANTARCTICA	Once / year	16	6, 7, 12 (SME), 24
OAR.AO. 007	Validated	Maintain Observing Systems and Produce Key Data Sets - Western Boundary Time Series	REGION 2 - SOUTHEAST & CARRIBBEAN (NC, SC, GA, FL)	Once / year	60	6, 7, 12 (SME), 24
OAR.AO. 008	Validated	Maintain Observing Systems and Produce Key Data Sets - Research & Development, AOML Data Pod System (ABIISS)	REGION 2 - SOUTHEAST & CARRIBBEAN (NC, SC, GA, FL)	Once / year	5	6, 7, 12 (SME)
OAR.AO. 009	Validated	Ocean Carbon - Moored Ocean-Atm CO2 Fluxes on TAO and other moorings	REGION 9 - GLOBAL, ANTARCTICA	N/A	VOP	13
OAR.AO. 010	Validated	Ocean Carbon Inventory, Global Inventories - CLIVAR-Atlantic (Measurements of physical ocean data, ocean carbon, and chemical tracers)	REGION 9 - GLOBAL, ANTARCTICA	Once / 2 years	70	16, 20

NOTE: VOP means Vessel of Opportunity

Legend: Level of Validation

- Validated
- Validated with SME Statement
- Not Validated (insufficient documentation)

2.1.3 Validation Documents Submitted

OAR and TPIO representatives worked jointly to identify references to validate the need for each observation requirement and its specific location and frequency. For occurrences where validation documents could not be identified Subject Matter Expert (SME) statements were provided. These validation documents support one or more of the above Priority-1 requirements. The validation documents are listed in the table below.

Table 2: Validation Documents provided to support AOML Priority-1 requirements

Doc #	Document Title
1	Public Law 104-303-Oct. 12, 1996, Water Resources Development Act of 1996
2	2009 Revised CERP Monitoring and Assessment Plan, Dec 2009: Sec. 3.4 Southern Coastal Systems Module
3	CERP Monitoring and Assessment Plan, Part 1, January 15, 2004: Sec 3.2 Southern Estuaries Module
4	SEDAR SP3-07, Consolidated Carribean SEDAR Research Recommendations
5	NOAA Technical Memorandum CRCP 9, November 2009, NOAA Coral Reef Ecosystem Integrated System (CREIOS) Workshops Report
6	Charting the Course for Ocean Science in the United States for the Next Decade: An Ocean Research Priorities Plan and Implementation Strategy; January 26, 2007
7	U.S. CLIVAR Report No. 2007-2, October 2007: Implementation Strategy for a JSOST Near-teram Priority, Assessing Meridional Overturning Circulation Variability: Implications for Rapid Climate Change
8	PIRATA - Pilot Research Moored Array in the Tropical Atlantic, Science and Implementation Plan for an Observing System to support Tropical Atlantic Climate Studies 1997-2000, Final Version October 1996
9	PIRATA-8 Meeting Report - Paris, France, 29-31 August, 2001
10	THE PIRATA PROGRAM - History, Accomplishments, and Future Directions
11	Fleet Plan Data Call Project Validation Document Information, June 2012
12	SME Statement - Fleet Plan Data Call Project Validation Document Information, June 2012
13	A Large-Scale CO2 Observing Plan: In Situ Oceans and Atmosphere (LSCOP)
14	The Second Report on the Adequacy of the Global Observing Systems for Climate in Support of the UNFCCC - Executive Summary, April 2003, GCOS-82 (ES) (WMO/TD No. 1143)
15	Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC, Executive Summary, October 2004, GCOS – 92 (ES) (WMO/TD No. 1244)
16	Subtitle D--Federal Ocean Acidification Research and Monitoring Act of 2009
17	15 USC CHAPTER 56A - GLOBAL CHANGE RESEARCH, 01/03/2012 (National Climate Program Act)
18	NATIONAL CLIMATE PROGRAM ACT (As enacted by Public Law 95–367 (Sept. 17, 1978) [As Amended Through P.L. 106–580, Dec. 29, 2000]
19	The U.S. Climate Change Science Program - Vision for the Program and Highlights of the Scientific Strategic Plan

Doc #	Document Title
20	IMPLEMENTATION PLAN FOR THE GLOBAL OBSERVING SYSTEM FOR CLIMATE IN SUPPORT OF THE UNFCCC (2010 UPDATE)
21	U.S. Ocean Action Plan - The Bush Administration's Response to the U.S. Commission on Ocean Policy
22	CLIVAR in the Atlantic Sector: a Joint Effort Towards a Better Understanding of Climate Variability and Predictability
23	U.S CLIVAR Implementation Plan, CLIVAR Atlantic Sector Implementation Panel, 2000
24	The Tropical Ocean-Global Atmosphere observing system: A decade of progress
25	OAR_CPO_Global Change Research Act_1990_15C56A.doc
26	Draft National Ocean Policy Implementation Plan - National Ocean Council
27	NOAA's Arctic Vision & Strategy
28	A Science Plan for Regional Arctic System Modeling - a report by the arctic research community for the national science foundation office of polar programs

2.2 Pacific Marine Environmental Laboratory (PMEL)

2.2.1 Laboratory Summary

The Pacific Marine Environmental Laboratory (PMEL) carries out interdisciplinary scientific investigations in oceanography and atmospheric science. Current PMEL programs focus on open ocean observations in support of long-term monitoring and prediction of the ocean environment on time scales from hours to decades. Studies are conducted to improve our understanding of the complex physical, geochemical and biological processes operating in the world oceans, to define the forcing functions and processes driving ocean circulation and the global climate system, and to improve environmental forecasting capabilities and other supporting services for marine commerce and fisheries. Research programs are augmented by the Joint Institute for the Study of the Atmosphere and Ocean (JISAO), a Cooperative Institute with the University of Washington.

2.2.2 Validation Assessment for Priority-1 Requirements

OAR and TPIO representatives worked jointly to review the submitted documentation and identify the level of validation for PMEL Priority-1 observation requirements. Requirements and validation levels are summarized below.

Table 1: Validation Assessment for PMEL Priority-1 Requirements

#	Validation Assessment	Observation Requirement	Geo Coverage	Frequency of Cruises	DAS / Cruise	Validation Docs
OAR.PM.001	Validated	Air Quality/Climate Studies - Biennial Regional Study, West Coast (e.g. CalNex)	REGION 5 - WESTERN (CA, OR, WA, NV, NM)	Once / 8 years	30	1, 2, 4
OAR.PM.002	Validated	Air Quality/Climate Studies - Biennial Regional Study, East Coast (e.g. WACS)	REGION 1 - NORTH ATLANTIC (ME, VT, NH, MA, CT, RI, NY, NJ, PA, DE, MD)	Once / 8 years	30	1, 2, 4
OAR.PM.003	Validated	Air Quality/Climate Studies - Biennial Regional Study (Gulf of Mexico)	REGION 3 - GULF OF MEXICO (AL, MS, LA, TX)	Once / 8 years	30	1, 2, 4
OAR.PM.004	Validated	Air Quality/Climate Studies - Biennial Regional Study (International)	REGION 9 - GLOBAL, ANTARCTICA	Once / 8 years	30	1, 2, 4
OAR.PM.005	Validated	Arctic Characterization - Ocean & Atmos sampling in/near the marginal ice zone (NPCREP/Eco-FOCI Spring ice edge habitat and mechanisms) (charter)	REGION 6 - ALASKA (BC, AK)	Once / year	17	2, 4, 7, 10
OAR.PM.006	Validated	Arctic Characterization - Ocean & Atmos sampling in open water (NPCREP/Eco-FOCI Fall mechanism cruise) (charter)	REGION 6 - ALASKA (BC, AK)	Once / year	15	2, 4, 7, 10
OAR.PM.007	Validated	Arctic Characterization - Ocean & Atmos sampling in open water (Bering Sea Climate and Ecosystems) (charter)	REGION 6 - ALASKA (BC, AK)	Once / year	23	2, 4, 7, 10
OAR.PM.008	Validated	Arctic Characterization - Ecosystem Observations and Research (NPCREP/Eco-FOCI Spring and Winter climate-mediated fish recruitment)	REGION 6 - ALASKA (BC, AK)	Once / year	16	2, 4, 7, 10
OAR.PM.009	Validated	Arctic Characterization - Ecosystem Observations and Research (Ecosystem data from buoys and ships to characterize the Chukchi Sea)	REGION 7 - ARCTIC	Once / year	29	5, 7, 11

#	Validation Assessment	Observation Requirement	Geo Coverage	Frequency of Cruises	DAS / Cruise	Validation Docs
OAR.PM.010	Validated	Ecosystem Characterization, Ocean - New Millennium Observatory (Deep Ocean Ecosystems on Active Submarine Volcano)	REGION 5 - WESTERN (CA, OR, WA, NV, NM)	Once / year	10	5, 7, 11
OAR.PM.011	Validated	Ecosystem Charecterization - Ocean (Equatorial Atlantic Hydrophone Array)	REGION - Equatorial Atlantic Ocean	Once / 2 years	3	11, 12 13, 14
OAR.PM.012	Validated	Ecosystem Charecterization - Ocean (VENTS - Extreme Ecosystems of Intraoceanic Arcs)	REGION 8 - HI, PACIFIC ISLANDS	Once / 2 years	30	1, 2, 3, 7
OAR.PM.013	Validated	Maintain Observing Systems and Produce Key Data Sets - Research & Development (PICO, Pralwer, DART-ETD (near-field))	REGION 9 - GLOBAL, ANTARCTICA	2 to 3 cruises / year	3-5	1, 3, 4, 7, 15 (SME)
OAR.PM.014	Validated	Maintain Observing Systems and Produce Key Data Sets - Research & Development (Autonomous System Development)	Regions 5, 6, 7, 8	4 to 20 cruises / year	1-5	2, 4, 7, 15 (SME)
OAR.PM.015	Validated	Maintain Observing Systems and Produce Key Data Sets - Ocean Reference Stations (Ocean Station PAPA)	REGION 6 - ALASKA (BC, AK)	Once / year	12	1, 2, 3, 4, 7
OAR.PM.016	Validated	Maintain Observing Systems and Produce Key Data Sets - Research & Development (PICO)	REGION 5 - WESTERN (CA, OR, WA, NV, NM)	Once / year	5	1, 2, 3, 4, 5, 6, 7, 15 (SME)
OAR.PM.017	Validated	Maintain Observing Systems and Produce Key Data Sets and measure ecosystem processes - NPCREP/EcoFOCI process studies	REGION 6 - ALASKA (BC, AK)	Once / year	30	12, 13, 15
OAR.PM.018	Validated	Maintain Observing Systems and Produce Key Data Sets , Ocean Reference Stations - KEO/ Kuroshio Extension Observatory	REGION 9 - GLOBAL, ANTARCTICA	Once / year	5	13, 15

#	Validation Assessment	Observation Requirement	Geo Coverage	Frequency of Cruises	DAS / Cruise	Validation Docs
OAR.PM.019	Validated	Ocean Carbon/Ocean Acidification, Global inventories - CLIVAR-Pacific (Measurements of physical ocean data, ocean carbon, and chemical tracers)	REGION 9 - GLOBAL, ANTARCTICA	Once / 2 years	70	13, 15

Legend: Level of Validation

- Validated
- Validated with SME Statement
- Not Validated (insufficient documentation)

2.2.3 Validation Documents Submitted

OAR and TPIO representatives worked jointly to identify references to validate the need for an observation and its specific location and frequency. For occurrences where validation documents could not be identified Subject Matter Experts (SME) statements were provided. The validation documents support one or more of the Priority-1 Requirements shown above. The validation documents are listed in the table below.

Table 2: Validation Documents provided to support PMEL Priority-1 requirements

Doc #	Document Title
1	NATIONAL CLIMATE PROGRAM ACT (As enacted by Public Law 95–367 (Sept. 17, 1978) [As Amended Through P.L. 106–580, Dec. 29, 2000]
2	U.S. Global Change Research Act of 1990 - Public Law 101-606(11/16/90) 104 Stat. 3096-3104
3	Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC, Executive Summary, October 2004, GCOS – 92 (ES) (WMO/TD No. 1244)
4	The U.S. Climate Change Science Program - Vision for the Program and Highlights of the Scientific Strategic Plan
5	The Marine Mammal Protection Act of 1972, As Amended (as amended 2007)
6	ENDANGERED SPECIES ACT OF 1973 - As Amended through the 108th Congress
7	Subtitle D--Federal Ocean Acidification Research and Monitoring Act of 2009
8	Magnuson-Stevens Fishery Conservation and Management Act - As Amended Through January 12, 2007
9	Organic Act, 15 USC 313 - Sec. 313, Duties of Secretary of Commerce
10	A Science Plan for Regional Arctic System Modeling - a report by the arctic research community for the national science foundation office of polar programs
11	National Materials and Minerals Policy Research and Development Act sec 1601
12	National Materials and Minerals Policy Research and Development Act sec 1602
13	National Materials and Minerals Policy Research and Development Act sec 1603

Doc #	Document Title
14	PUBLIC LAW 111–11—MAR. 30, 2009 (H.R. 146)
15	The U.S. Climate Change Science Program - Vision for the Program and Highlights of the Scientific Strategic Plan

2.3 Climate Program Office (CPO)

2.3.1 Program Summary

The Climate Program Office (CPO) manages a competitive research program in which NOAA funds high-priority climate science to advance understanding of Earth's climate system and its atmospheric, oceanic, land, and snow and ice components. This research contributes to knowledge of how climate variability and change affect our health, economy, and well-being. CPO supports research that is conducted in regions across the United States, at national and international scales, and globally.

Activities are now organized within four Programs:

1. Climate Observations and Monitoring
2. Earth System Science
3. Modeling, Analysis, Predictions and Projections
4. Climate and Societal Interactions

CPO also provides strategic guidance for the agency's climate science and information service activities and supports NOAA's contributions to the U.S. Global Change Research Program (USGCRP) and the interagency Climate Change Adaptation Task Force. It also plays an active role in numerous international climate activities, including the Intergovernmental Panel on Climate Change (IPCC) and the Global Framework for Climate Services initiative launched by the 2009 Third World Climate Conference.

2.3.2 Validation Assessment for Priority-1 Requirements

OAR and TPIO representatives worked jointly to review the submitted documentation, and identify the level of validation for CPO Priority-1 observation requirements. Note that NOAA contributions to CLIVAR and GO-SHIP global ocean scale repeat hydrography transects have been identified in separate above sections as observing requirement “OAR.AO.010” and “OAR.PM.019”. Significant additional U.S. contributions are handled by other agencies, and a large majority of the requirement is met by international partners. A rough order of magnitude estimate for the overall total repeat hydrography observing requirement is 2,000 DAS over a 10 year period. Though these are essential to the NOAA/OAR/CPO mission, the international and other non-NOAA U.S. contributions have not been submitted for validation during the current process.

Table 1: Validation Assessment for CPO Priority-1 Requirements

#	Validation Assessment	Observation Requirement	Geo Coverage	Frequency of Campaign	DAS / Campaign	Validation Docs
OAR.CP. 001	Validated	Arctic Characterization - Ocean & Atmos sampling in/near the marginal ice zone (Climate impacts on Ecosystem)	REGION 7 - ARCTIC	Once / year	12	16, 52, 53
OAR.CP. 002	Validated	Arctic Characterization, Seafloor Methane release observations - Thawing of Seafloor Permafrost	Region 7- Arctic	Once / year	40	15, 25, 26, 27, 28
OAR.CP. 003	Validated	Maintain Observing Systems and Produce Key Data Sets - Ocean Reference Stations (NTAS/MOVE)	REGION 9 - GLOBAL, ANTARCTICA	Once / year	20	12, 13, 16, 42, 43, 44
OAR.CP. 004	Validated	Maintain Observing Systems and Produce Key Data Sets - Ocean Reference Stations (WHOTS)	REGION 8 - HI, PACIFIC ISLANDS	Once / year	10	12, 13, 16, 46, 47
OAR.CP. 005	Validated	Maintain Observing Systems and Produce Key Data Sets - Ocean Reference Stations (Southern Ocean/Weddell Sea Mooring)	REGION 9 - GLOBAL, ANTARCTICA	Once / 2 years	10	2, 6, 15, 16, 55, 62 (SME)
OAR.CP. 006	Validated	Maintain Observing Systems and Produce Key Data Sets - Ocean Reference Stations (STRATUS)	REGION 9 - GLOBAL, ANTARCTICA	Once / year	33	12, 13, 16, 40, 41
OAR.CP. 007	Validated	Maintain Observing Systems and Produce Key Data Sets - Maintain Drifting Arrays (Argo deployment)	REGION 9 - GLOBAL, ANTARCTICA	Once / year	65	12, 13, 16, 54, 64 (SME)

#	Validation Assessment	Observation Requirement	Geo Coverage	Frequency of Campaign	DAS / Campaign	Validation Docs
OAR.CP. 009	Validated	Maintain Observing Systems and Produce Key Data Sets - Technology Development (Deep Argo). Initial deployments will be in basins 6,000 meters deep where the deep ocean warming signal is greatest and least variable: (1) SW Pacific; (2) Argentine Basin, (3) NW Atlantic.	REGION 9 - GLOBAL, ANTARCTICA	Once / year	8	12, 13, 16, 54, 64 (SME)
OAR.CP. 010	Validated	Ocean - Coastal Fluxes (CCE)	REGION 5 - WESTERN (CA, OR, WA, NV, NM)	Once / year	8	8, 9, 12, 16, 20
OAR.CP. 011	Validated	Ocean Climate - California Current mooring/glider work, Consortium on the Ocean's Role in Climate (CORC)	REGION 5 - WESTERN (CA, OR, WA, NV, NM)	Once / 2 years	5	8, 9, 12, 16, 20
OAR.CP. 012	Validated	Maintain Observing Systems and Produce Key Data Sets - Research & Development (TAO/TRITON Flux Moorings)	REGION 9 - GLOBAL, ANTARCTICA	N/A*	VOP	6, 16, 37
OAR.CP. 013	Validated	Maintain Observing Systems and Produce Key Data Sets - Maintain Fixed Arrays (India -- RAMA)	REGION 9 - GLOBAL, ANTARCTICA	Once / year	75	9, 31, 48, 49, 50
OAR.CP. 014	Validated	Maintain Observing Systems and Produce Key Data Sets - Maintain Fixed Arrays (Indonesia -- RAMA)	REGION 9 - GLOBAL, ANTARCTICA	Once / year	50	9, 31, 48, 49, 50
OAR.CP. 015	Validated	Maintain Observing Systems and Produce Key Data Sets - Maintain Fixed Arrays, ASCLME (Africa – RAMA)	REGION 9 - GLOBAL, ANTARCTICA	Once / year	40	9, 31, 48, 49, 50

#	Validation Assessment	Observation Requirement	Geo Coverage	Frequency of Campaign	DAS / Campaign	Validation Docs
OAR.CP. 016	Validated	Maintain Observing Systems and Produce Key Data Sets - Ocean Reference Stations (Indonesia – Indonesian Through Flow Ocean Reference Station)	REGION 9 - GLOBAL, ANTARCTICA	Once / year	8	16, 18, 31, 49, 62 (SME)
OAR.CP. 017	Validated	Ocean-atmosphere climate studies - Climate process and observational campaign, Regional process study/campaign	REGION 9 - GLOBAL, ANTARCTICA	Once / 2 years	35	12, 15, 25, 51
OAR.CP. 018	Validated	Climate Research - DYNAMO	REGION 9 - GLOBAL, ANTARCTICA	Once / 3 years	90	60, 61, 66 (SME)
OAR.CP. 020	Validated	Arctic Characterization, Ocean & Atmos sampling in the ice - atmospheric boundary layer and heat budget processes (Arctic Change)	REGION 7 - ARCTIC	Once / 2 years	28	16, 52, 53, 67 (SME)

*NOTE: VOP means Vessel of Opportunity, and requirements related to the core functions of the TAO/TRITON buoy array in the equatorial Pacific are captured as Priority 1 requirements in the National Weather Service Program Observation Requirements Document.

Legend: Level of Validation

- Validated
- Validated with SME Statement
- Not Validated (insufficient documentation)

2.3.3 Validation Documents Submitted

OAR and TPIO representatives worked jointly to identify references to validate the need for an observation and its specific location and frequency. For occurrences where validation documents could not be identified Subject Matter Experts (SME) statements were provided. The validation documents support one or more of the above Priority-1 requirements. The validation documents are listed below.

Table 2: Validation Documents provided to support CPO Priority-1 requirements

Doc #	Document Title
1	CPO Requirements Documents for NOAA Fleet Plan, TPIO Information
2	SOUTHERN OCEAN OBSERVING SYSTEM (SOOS): RATIONALE AND STRATEGY FOR SUSTAINED OBSERVATIONS OF THE SOUTHERN OCEAN
3	A GLOBAL BOUNDARY CURRENT CIRCULATION OBSERVING NETWORK
4	PROGRESSING TOWARDS GLOBAL SUSTAINED DEEP OCEAN OBSERVATIONS
5	AN INTERNATIONAL OBSERVATIONAL NETWORK FOR OCEAN ACIDIFICATION
6	TOWARDS AN INTEGRATED GLOBAL OBSERVING SYSTEM: IN-SITU OBSERVATIONS
7	A Framework for Ocean Observing - Prepared for the Task Team for an Integrated Framework for Sustained Ocean Observing (IFSOO)
8	Observation of Ocean Biology on a Global Scale : Is New Technology Required for Bio-GOOS?
9	In situ Sustained Eulerian Observatories
10	PUBLIC LAW 111–11—MAR. 30, 2009 (H.R. 146)
11	The U.S. Climate Change Science Program - Vision for the Program and Highlights of the Scientific Strategic Plan
12	15 USC CHAPTER 56A - GLOBAL CHANGE RESEARCH, 01/03/2012 (National Climate Program Act)
13	Subtitle D--Federal Ocean Acidification Research and Monitoring Act of 2009
14	Generated from WMO Requirements Database 08-16-2012
15	Strategic Plan for the U.S. Climate Change Science Program
16	IMPLEMENTATION PLAN FOR THE GLOBAL OBSERVING SYSTEM FOR CLIMATE IN SUPPORT OF THE UNFCCC (2010 UPDATE)
17	The Compilation and Analysis of Data Relevant to a U.S. Claim Under United Nations Law of the Sea Article 76: A Preliminary Report
18	INTEROCEAN EXCHANGE OF THERMOCLINE WATER: INDONESIAN THROUGHFLOW; "TASSIE" LEAKAGE; AGULHAS LEAKAGE
19	A seasonal cycle in the export of bottom water from the Weddell Sea
20	Group on Earth Observations - GEO 2009-2011 WORK PLAN, Revision 2
21	THE ACTION PLAN FOR GOOS/GCOS AND SUSTAINED OBSERVATIONS FOR CLIVAR
22	On the freshening of the northwesternWeddell Sea continental shelf
23	OceanObs '09 Public Comments - Overview of Community White Papers
24	Global Observing Systems Information Center (GOSIC) - GCOS Essential Climate Variable (ECV) Data & Information Access Matrix
25	NATIONAL CLIMATE PROGRAM ACT (As enacted by Public Law 95–367 (Sept. 17, 1978) [As Amended Through P.L. 106–580, Dec. 29, 2000]
26	Throughflow within Makassar Strait
27	Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC, Executive Summary, October 2004, GCOS – 92 (ES) (WMO/TD No. 1244)

Doc #	Document Title
28	The Second Report on the Adequacy of the Global Observing Systems for Climate in Support of the UNFCCC - Executive Summary, April 2003, GCOS-82 (ES) (WMO/TD No. 1143)
29	WMO Observing Requirements Database Variable List
30	TAO publications/reports – justification
31	"The Global Tropical Moored Buoy Array" - McPhaden, M.J., et al, In: Proceedings of the "OceanObs'09:Sustained Ocean Observations and Information for Society" Conference (Vol. 2), Venice, Italy, 21-25 September 2009, Hall, J., D.E. Harrison, and D.Stammer, Eds., ESA Publication WPP-306.
32	"A TOGA Retrospective" - McPhaden, M.J., et al, Oceanography, 23, 86-103 (2010)
33	"Evolution of the 2002-03 El Niño" - McPhaden, M.J., Bull. Am. Meteorol. Soc., 85, 677-695 (2004)
34	"El Niño and La Niña: Causes and Global Consequences" (and corrigendum) - McPhaden, M.J., In: Encyclopedia of Global Environmental Change, Vol 1, John Wiley and Sons, LTD., Chichester, UK, 353-370 (2002)
35	"The El Niño/Southern Oscillation (ENSO) Observing System" - McPhaden, M.J., et al. In: Observing the Ocean in the 21st Century. Australian Bureau of Meteorology, Melbourne, Australia, 231-246 (2001)
36	"Genesis and Evolution of the 1997-98 El Niño" - McPhaden, M.J. Science, 283, 950-954 (1999)
37	"The Tropical Ocean-Global Atmosphere observing system: A decade of progress" - McPhaden, M.J. et al. Journal of Geophysical Research, 103, 14,169-14,240 (1998)
38	"TOGA-TAO and the 1991-93 El Niño Southern Oscillation Event" - McPhaden, M.J. Oceanography, 6(2), 36-44 (1993)
39	Justification for Stratus, NTAS and WHOTS Ocean Reference Stations
40	EPIC Science Plan, EPIC Science Steering Committee, 1999. See: IMET mooring, Pg. 59-65. Figure 3.6, Figure 3.8. http://www.atmos.washington.edu/gcg/EPIC/EPIC_rev.pdf)
41	U.S. CLIVAR Pan American Research, Science Prospectus and Implementation Plan, 2002. See: Air-sea interaction buoy, Pg. 39 (note typo, 8 W should be 85 W), Pg. 41, Figure 43. (www.jisao.washington.edu/pacs/plan2001/PanAm_Plan_v4.1.doc)
42	U.S CLIVAR Implementation Plan, CLIVAR Atlantic Sector Implementation Panel, 2000. See: surface flux reference sites in the Atlantic, Pg. 16 (NTAS is slightly east of the recommended "Atlantic Warm Pool" site), sustained measurements, Pg. 16-17 (refers to the surface flux reference sites in Sec. 3.1.1), Appendix, Pg. 31 (Surface Flux Moorings in tropics) (http://www.jamstec.go.jp/wcrp/project/clivar/handbook.pdf)
43	CLIVAR in the Atlantic Sector: a Joint Effort Towards a Better Understanding of Climate Variability and Predictability, Roberta Boscolo, 2004. See: Pg. 17-Fig. 3 (Atlantic Sector Observing Network, Flux Moorings) (http://digital.csic.es/handle/10261/6578)
44	Hurrell, et al., Journal of Climate, Vol. 19, 2006. See: Fig. 5 (Key elements of the observing system, Air-Sea Flux buoys)
45	Overview-Towards a Science Plan for GOFS: Program Elements, Priorities and Planning, 1987. (http://www1.whoi.edu/publications/reports.html)Karl and Lukas, "The Hawaii Ocean Time-series (HOT) Program: Background, Rationale and Field Implementation", Deep-Sea Research, 1996. See: Pg. 12-17, Fig. 5 and 6, Tables 2 and 3. (http://hahana.soest.hawaii.edu/hot/abstracts/ds_2.html)

Doc #	Document Title
46	U.S. JGOFS Mid-Program Strategy, 1995. See: Chapter 4, Time Series, Sec. 4.3.2 Hawaii Ocean Timeseries (HOT).RAMA Cruise Schedule
47	Karl and Lukas, “The Hawaii Ocean Time-series (HOT) Program: Background, Rationale and Field Implementation”, Deep-Sea Research, 1996. See: Pg. 12-17, Fig. 5 and 6, Tables 2 and 3. (http://hahana.soest.hawaii.edu/hot/abstracts/ds_2.html)OceanSITES - INDIAN OCEAN SITE DESCRIPTIONS
48	RAMA CruisesOceanSITES Station Data – Full List
49	OceanSITES - INDIAN OCEAN SITE DESCRIPTIONSU.S. Global Change Research Act of 1990 - Public Law 101-606(11/16/90) 104 Stat. 3096-3104
50	OceanSITES Station Data – Full ListDraft National Ocean Policy Implementation Plan - National Ocean Council
51	U.S. Global Change Research Act of 1990 - Public Law 101-606(11/16/90) 104 Stat. 3096-3104A Science Plan for Regional Arctic System Modeling - a report by the arctic research community for the national science foundation office of polar programs
52	Draft National Ocean Policy Implementation Plan - National Ocean CouncilWarming of Global Abyssal and Deep Southern Ocean Waters between the 1990s and 2000s: Contributions to Global Heat and Sea Level Rise Budgets
53	A Science Plan for Regional Arctic System Modeling - a report by the arctic research community for the national science foundation office of polar programsThe Southern Ocean Observing System: Initial Science and Implementation Strategy (Draft for review and community comment)
54	Warming of Global Abyssal and Deep Southern Ocean Waters between the 1990s and 2000s: Contributions to Global Heat and Sea Level Rise Budgets
55	The Southern Ocean Observing System: Initial Science and Implementation Strategy (Draft for review and community comment)
56	Observations to Quantify Air-Sea Fluxes and Their Role in Climate Variability and Predictability
57	Oceansites and moored time series
58	BIOLOGICAL RESPONSE TO REDUCED SEA ICE IN THE PACIFIC ARCTIC REGION
59	NOAA’s Arctic Vision & Strategy
60	Critical Infrastructure for Ocean Research and Societal Needs in 2030
61	Science at Sea: Meeting Future Oceanographic Goals with a Robust Academic Research Fleet
62	SME Statement, Weddell Sea, Indonesian Throughflow Projects
63	Subject Matter Expert validation of ship time DAS requirements for Stratus, NTAS and WHOTS Ocean Reference Stations
64	Subject Matter Expert validation of ship time DAS requirements for Argo, Deep Argo
65	Subject Matter Expert validation of ship time DAS requirements for RUSALCA Siberian Shelf Studies
66	Subject Matter Expert validation of Ocean-Atmosphere Climate Studies projects

2.4 Ocean Exploration and Research Program (OER)

2.4.1 Program Summary

The OER mission is to support national and NOAA requirements by exploring the Earth's largely unknown ocean in all its dimensions for the purpose of discovery and the advancement of knowledge, using state-of-the-art technologies in evolutionary and revolutionary ways. The potential of ocean exploration has only begun to be met. OER is investing in new technologies, in state-of-the-art platforms, undersea vehicles and infrastructure, in data and information management, in transmission networks, in research programs, and in efforts to inform and educate society on the importance of ocean exploration and research.

OER provides and manages systematic telepresence-enabled mission exploration capability. Results of these expeditions are consistent and standardized data and products, similar in their standardization to the data sets produced by hydrographic survey vessels. Data and products developed from OER missions support NOAA Oceans, Climate, and Resilient Coastal Communities goals, NOAA's Habitat Blueprint, and serve the research, management, technology and education communities. Meeting the legislative mandate of systematically exploring the unknown ocean requires full year operations in the Atlantic and Pacific as described in the table below.

OER is the NOAA lead for the interagency Extended Continental Shelf (ECS) mapping initiative. Meeting the needs of the ECS initiative requires multiple ships to conduct offshore mapping surveys which meet IHO standards, and to acquire sub-bottom profiling data and geologic analysis of bottom core samples.

OER's focused exploration in deep water habitats also require ships to support the systematic approach OER developed jointly with BOEM and USGS. Data and products from these missions inform decisions on potential energy development and are incorporated into the NOAA Habitat Blueprint.

Finally, OER funds NOAA and external scientists to conduct peer-reviewed exploration expeditions for a range of targeted objectives, from investigations of tectonically active areas, to new and unique biological habitats, to significant submerged cultural resources.

2.4.2 Validation Assessment for Priority-1 Requirements

OAR and TPIO representatives worked jointly to review the submitted documentation, and identify the level of validation for OER Priority-1 observation requirements.

Table 1: Validation Assessment for OER Priority-1 Requirements

#	Validation Assessment	Observation Requirement	Geo Coverage	Frequency of Campaign	DAS / Campaign	Validation Docs
OAR.OE.001	Validated	Ecosystem Characterization, Ocean - EXPLORER Program, Systematic telepresence enabled exploration in support of Ecosystem Approaches to Management	REGION 8 - HI, PACIFIC ISLANDS	Once / year	36*	1, 3, 4, 5, 6
OAR.OE.002	Validated	Ecosystem Characterization, Ocean - EXPLORER Program, Systematic telepresence enabled investigations of Pacific Island Areas (Biogeography, Benthic Habitat Mapping, Sample Collection, Ecological Transects)	REGION 8 - HI, PACIFIC ISLANDS	Once / year	36*	1, 3, 4, 5, 6
OAR.OE.003	Validated	Systematic telepresence enabled investigations of Mid-Atlantic Deepwater (Hard Bottom Habitats and Shipwrecks with Emphasis on Canyons and Coral Communities); Systematic approach with DOI BOEM and USGS for locating and characterizing deep water habitats to inform decisions on energy development, and NOAA Habitat Blueprint	REGIONS 1, 2, 3 – East Coast and Gulf of Mexico; or REGION 7 - ARCTIC	Once / year	66*	1, 3, 4, 5, 6
OAR.OE.004	Validated	Systematic telepresence enabled investigations of Gulf of Mexico/Caribbean deep corals (GT 1000m Deep Ocean Ecosystems on Methane Hydrates and related Ocean Acoustics); peer-reviewed exploration expeditions of tectonically active areas, new and unique biological habitats, significant submerged cultural resources.	REGIONS 1, 2, 3 – East Coast and Gulf of Mexico; or REGIONS 5, 8 – West Coast, HI and Pacific Islands	Once / year	66*	1, 3, 4, 5, 6

#	Validation Assessment	Observation Requirement	Geo Coverage	Frequency of Campaign	DAS / Campaign	Validation Docs
OAR.OE.005	Validated	Ecosystem Characterization, Ocean - EXPLORER Program, Systematic telepresence enabled investigations in support of Deep Sea Mapping (Exploration and Research along the North Atlantic and Gulf Continental Shelf Margin using Advanced Technologies)	REGION 2 – East Coast south of Cape Hatteras; and REGION 3 - Gulf of Mexico	Once / year	36*	1, 3, 4, 5, 6
OAR.OE.006	Validated	Ecosystem Characterization, Ocean - EXPLORER Program, Systematic telepresence enabled investigations in support of National Maritime Heritage	REGION 1 – East Coast north of Cape Hatteras; and REGION 3 - Gulf of Mexico	Once / year	30*	1, 3, 4, 5, 6
OAR.OE.008	Validated	Ecosystem Characterization, Ocean - EXPLORER Program, Systematic telepresence enabled investigations in support of Habitat mapping	REGIONS 1, 2, 3, 5, 8 – East Coast and Gulf of Mexico, West Coast, HI and Pacific Islands	Once / year	35*	1, 3, 4, 5, 6
OAR.OE.009	Validated	Ecosystem Characterization, Ocean - EXPLORER Program, Systematic telepresence enabled investigations in support of Deep Water Ecosystems using Advanced Technologies	REGIONS 1, 2, 3, 5, 8 – East Coast and Gulf of Mexico, West Coast, HI and Pacific Islands	Once / year	35*	4
OAR.OE.010	Validated	Ecosystem Characterization, Ocean - Exploration and Research of Hard Bottom Communities (Alaska and the Arctic)	REGION 6 - ALASKA (BC, AK)	Once / year	20	4, 10, 5 (SME), 6 (SME)

#	Validation Assessment	Observation Requirement	Geo Coverage	Frequency of Campaign	DAS / Campaign	Validation Docs
OAR.OE.011	Validated	Ecosystem Characterization, Ocean - Exploration and Research of Mid-Atlantic Deepwater Hard Bottom Habitats and Shipwrecks (Emphasis on Canyons and Coral Communities)	REGION 1 - NORTH ATLANTIC (ME, VT, NH, MA, CT, RI, NY, NJ, PA, DE, MD)	Once / year	20	1, 2, 4
OAR.OE.012	Validated	Mapping surveys in support of the Extended Continental Shelf (ECS) mapping initiative, meeting IHO standards; also acquisition of sub-bottom profiling data and geologic analysis of dredge samples.	REGION 7 – ARCTIC; REGIONS 1, 2, 3 – East Coast and Gulf of Mexico; or REGIONS 5, 8 – West Coast, HI and Pacific Islands	Once / year	40	1, 3, 4, 5, 6

Legend: Level of Validation

- Validated
- Validated with SME Statement
- Not Validated (insufficient documentation)

* Note: more than 200 total additional DAS per year have been categorized under Priority 2 and Priority 3 observing requirements for these missions.

2.4.3 Validation Documents Submitted

OAR and TPIO representatives worked jointly to identify references to validate the need for an observation and its specific location and frequency. For occurrences where validation documents could not be identified Subject Matter Experts (SME) statements were provided. The validation documents support one or more of the above Priority-1 requirements. The validation documents are listed below.

Table 2: Validation Documents provided to support OER Priority-1 Requirements

Doc #	Document Title
1	NOAA Workshop on Systematic Telepresence-Enabled Exploration in the Atlantic Basin, May 10-11, 2011, Coastal Institute Building, University of Rhode Island, Narragansett, Rhode Island - Workshop Summary (October 1, 2011)
2	NOAA Ocean Exploration Program: 10 Year Review - Appendix 2, NOAA Ship Okeanos Explorer, Target Identification and Scheduling Process
3	DISCOVERING EARTH'S FINAL FRONTIER: A U.S. STRATEGY FOR OCEAN EXPLORATION
4	PUBLIC LAW 111–11—MAR. 30, 2009 (H.R. 146)
5	EX FY13 150 DAS Schedule Prospectus (July 25, 2012)
6	Okeanos Explorer FY 13 Proposed Schedule
7	NATIONAL CLIMATE PROGRAM ACT (As enacted by Public Law 95–367 (Sept. 17, 1978) [As Amended Through P.L. 106–580, Dec. 29, 2000]
8	U.S. Global Change Research Act of 1990 - Public Law 101-606(11/16/90) 104 Stat. 3096-3104
9	The U.S. Climate Change Science Program - Vision for the Program and Highlights of the Scientific Strategic Plan
10	Exploration and Research of Mid-Atlantic Deepwater Hard Bottom Habitats and Shipwrecks with Emphasis on Canyons and Coral Communities (NSL at 10-03)

2.5 National Sea Grant College Program (SG)

2.5.1 Program Summary

Environmental stewardship, long-term economic development and responsible use of America's coastal, ocean and Great Lakes resources are at the heart of Sea Grant's mission. Sea Grant is a nationwide network, administered through NOAA, of 33 university-based programs that work with coastal communities. The National Sea Grant College Program engages this network of the nation's top universities in conducting scientific research, education, training, and extension projects designed to foster science-based decisions about the use and conservation of our aquatic resources.

Sea Grant is NOAA's primary university-based program in support of coastal resource use and conservation. Its research and outreach programs promote better understanding, conservation and use of America's coastal resources. In short, Sea Grant is "science serving America's coasts."

2.5.2 Validation Assessment for Priority-1 Requirements

OAR and TPIO representatives worked jointly to review the submitted documentation, and identify the level of validation for Sea Grant Priority-1 observation requirements.

Table 1: Validation Assessment for Sea Grant Priority-1 Requirements

#	Validation Assessment	Observation Requirement	Geo Coverage	Frequency	Annual DAS	Validation Docs
OAR.SG.001	Validated	Ecosystem Characterization, REGION 1 - NORTH ATLANTIC - Sea Grant Research to Characterize Coastal, Ocean, and Great Lakes Ecosystem to support ecosystem management	REGION 1 - NORTH ATLANTIC (ME, VT, NH, MA, CT, RI, NY, NJ, PA, DE, MD)	Many trips / year*	77	1, 2, 4 (SME), 5,6
OAR.SG.002	Validated	Ecosystem Characterization, REGION 3 - GULF OF MEXICO - Sea Grant Research to Characterize Coastal, Ocean, and Great Lakes Ecosystem to support ecosystem management	REGION 3 - GULF OF MEXICO (AL, MS, LA, TX)	Several trips / year*	40	1, 2, 4 (SME), 5,6
OAR.SG.003	Validated	Ecosystem Characterization, REGION 4 - GREAT LAKES - Sea Grant Research to Characterize Coastal, Ocean, and Great Lakes Ecosystem to support ecosystem management	REGION 4 - GREAT LAKES	Many trips / year*	77	1, 2, 4 (SME), 5,6
OAR.SG.004	Validated	Ecosystem Characterization, REGION 5 - WESTERN - Sea Grant Research to Characterize Coastal, Ocean, and Great Lakes Ecosystem to support ecosystem management	REGION 5 - WESTERN (CA, OR, WA, NV, NM)	Many trips / year*	35	1, 2, 4 (SME), 5,6
OAR.SG.005	Validated	Forecasting and Modeling Ecosystem Events - Sea Grant Research to Develop Forecasts of Coastal, Great Lakes, and Ocean ecosystems	REGION 5 - WESTERN (CA, OR, WA, NV, NM)	Many trips / year*	33	1, 2, 4 (SME), 5,6
OAR.SG.006	Validated	Outreach and Education, Sea Grant Research & Education - Diverse Coastal and Ocean Processes Research, Technology Development, & Educational Opportunities for Students and Teachers	REGION 1 - NORTH ATLANTIC (ME, VT, NH, MA, CT, RI, NY, NJ, PA, DE, MD)	Several trips / year*	16	1, 2, 4 (SME), 5,6

Legend: Level of Validation

- Validated
- Validated with SME Statement
- Not Validated (insufficient documentation)

* Note "many trips" indicates that much of the requirement is met by small boats or small research vessels

2.5.3 Validation Documents Submitted

OAR and TPIO representatives worked jointly to identify references to validate the need for an observation and its specific location and frequency. For occurrences where validation documents could not be identified Subject Matter Experts (SME) statements were provided. The validation documents support one or more of the above Priority-1 requirements. The validation documents are listed below.

Table 2: Validation Documents provided to support Sea Grant Priority-1 Requirements

Doc #	Document Title
1	National Sea Grant College Program - Strategic Plan 2009-2013
2	SG Sea Days Requirements Validation Document
3	NOAA Form 57-11-01, Ship Time Request Form (Sea Grant Coastal and Estuarine Education, Outreach, and Research Projects)
4	Subject Matter Expert statement on at-sea requirements for NOAA's National Sea Grant College Program
5	Sea Grant – A National Network
6	Sea Grant Colleges Text List: Sea Grant: National Oceanic and Atmospheric Administration

2.6 Great Lakes Environmental Research Laboratory (GLERL)

2.6.1 Laboratory Summary

The Great Lakes face many challenges today ranging from the impacts of invasive species on fisheries, to a decrease in ice cover, the resurgence of harmful algal blooms, and varying water levels in response to our changing climate. Since its founding in 1974, GLERL has provided Great Lakes decision-makers and resource managers with the information needed to anticipate and respond to ecosystem changes. Today GLERL is adapting as an organization to advance ecosystem forecasting capabilities in a time of environmental uncertainty.

GLERL and its partners conduct innovative research on the dynamic environments and ecosystems of the Great Lakes to inform resource use and management decisions that lead to safe and sustainable ecosystems, ecosystem services, and resilient coastal communities. Our vision is for reliable predictions of changes in

interconnected natural and human systems contributing to the improved management of large lakes of the world and associated coastal ecosystems.

2.6.2 Validation Assessment for Priority-1 Requirements

OAR and TPIO representatives worked jointly to review the submitted documentation, and identify the level of validation for GLERL Priority-1 observation requirements.

Table 1: Validation Assessment for GLERL Priority-1 Requirements

#	Validation Assessment	Observation Requirement	Geo Coverage	Frequency	Annual DAS	Validation Docs
OAR.GL.005	Validated	Ecosystem Charecterization, Coastal and Great Lakes - Integrative Regional Assessments (Coastal Ecosystem, Great Lakes Waters Condition, NMSs)	REGION 4 - GREAT LAKES	Many trips / year	117	1, 7
OAR.GL.006	Validated	Forecasting and Modeling Ecosystem Events, Forecasting and Modeling Ecosystem Events - Cumulative Impacts of Multiple Stressors	REGION 4 - GREAT LAKES	Several trips / year	35	1, 7
OAR.GL.007	Validated	Forecasting and Modeling Ecosystem Events - Ecological Forecasting	REGION 4 - GREAT LAKES	Several trips / year	39	1, 7, 14
OAR.GL.008	Validated	Forecasting and Modeling Ecosystem Events - Ecology and Oceanography of Harmful Algal Blooms	REGION 4 - GREAT LAKES	Several trips / year	39	1, 7, 14

Legend: Level of Validation

- Validated
- Validated with SME Statement
- Not Validated (insufficient documentation)

2.6.3 Validation Documents Submitted

OAR and TPIO representatives worked jointly to identify references to validate the need for an observation and its specific location and frequency. For occurrences where validation documents could not be identified Subject Matter Expert (SME) statements were provided. The validation documents support one or more of the above Priority-1 requirements. The validation documents are listed below.

Table 2: Validation Documents provided to support GLERL Priority-1 Requirements

Doc #	Document Title
1	GLERL FY2011 Boat Schedule
2	FY12 INTERNAL PROPOSAL BUDGET SUMMARY - Eco Dyn (Lake Huron)
3	Ecological Modeling and Forecasting (EMF) - GLERL Project Description for FY12
4	Point Paper - Vessel Support Request for MARAD/NAVSEA/NMFS acoustic noise profiling
5	Laurentian vessel request for U of M oceanography
6	FY12 INTERNAL PROPOSAL BUDGET SUMMARY - EcoDyn (LTER - Lake MI)
7	Ecosystem Dynamics Base-Funded Theme Project/Program CY12, Project Title: GLERL Long-Term Ecological Research (GLERL-LTER)—Lake Michigan
8	Grand Valley State University Letter, GVSU-MAREC/U-M Offshore Wind Assessment Project
9	GLERL 2012 Research Map
10	Mid-Year Vessel Request: Point Paper, NOAA Mussel Watch Program
11	FY12 vessel schedule - rev7 SRS
12	FY12 INTERNAL PROPOSAL BUDGET SUMMARY - OSAT
13	Mid-Year Vessel Request: Point Paper, Thunder Bay Island Survey
14	FY12 Observing Systems and Advanced Technology (OSAT): Project Description
15	FY12 INTERNAL PROPOSAL BUDGET SUMMARY - EMF

2.7 Ocean Acidification Program (OAP)

2.7.1 Program Summary

The overarching goal of the NOAA Ocean and Great Lakes Acidification Research Plan is to predict how ecosystems will respond to acidification and to provide information that resource managers can use to address acidification issues. The research effort will be executed at the regional level with strong national coordination. The monitoring of temporal and spatial trends will be done through ship-based and moored observations of key physical, chemical, and biological parameters. Ecosystem responses will be studied with the same platforms but will also require laboratory experiments to study physiological responses to acidified waters. Modeling studies will delineate large-scale changes in water chemistry and ecosystem response and will be used to develop adaptation strategies in response to ocean and lake acidification.

The primary goals of this research are to:

- Theme 1: Develop the monitoring capacity to quantify and track ocean acidification and its impacts in open-ocean, coastal, and Great Lakes systems
- Theme 2: Assess the response of organisms to ocean and lake acidification
- Theme 3: Forecast biogeochemical and ecological responses to acidification

- Theme 4: Develop management strategies for responding and adapting to the consequences of ocean acidification from a human dimensions perspective
- Theme 5: Provide a synthesis of ocean and Great Lakes acidification data and information; and,
- Theme 6: Provide an engagement strategy for educational and public outreach.

These themes will be executed taking full advantage of the observational, experimental, and modeling capacities within NOAA and relying on external research partners to complement and augment NOAA's internal expertise in coastal and ocean sciences. Progress will be gauged from ongoing synthesis and assessment efforts.

2.7.2 Validation Assessment for Priority-1 Requirements

OAR and TPIO representatives worked jointly to review the submitted documentation, and identify the level of validation for the OAP Priority-1 observation requirements.

Table 1: Validation Assessment for OAP Priority-1 Requirements

#	Validation Assessment	Observation Requirement	Geo Coverage	Frequency of Cruises	DAS / Cruise	Validation Docs
OAR.OAP.001	Validated	Ocean Carbon/Ocean Acidification, Coastal Fluxes - CO2 coastal fluxes and acidification East and Gulf Coasts	Regions 1,2, 3	Once / 2 years	40	1, 2
OAR.OAP.002	Validated	Ocean Carbon/Ocean Acidification, Coastal Fluxes - CO2 coastal fluxes and acidification West Coast	REGION 5 - WESTERN (CA, OR, WA, NV, NM)	Once / 2 years	38	1, 2

Legend: Level of Validation

- Validated
- Validated with SME Statement
- Not Validated (insufficient documentation)

2.7.3 Validation Documents Submitted

OAR and TPIO representatives worked jointly to identify references to validate the need for an observation and its specific location and frequency. For occurrences where validation documents could not be identified Subject Matter Experts (SME)

statements were provided. The validation documents support one or more of the above Priority-1 requirements. The validation documents are listed below.

Table 2: Validation Documents provided to support OAP Priority-1 Requirements

Doc #	Document Title
1	The Second Report on the Adequacy of the Global Observing Systems for Climate in Support of the UNFCC, Executive Summary, April 2003
2	WORLD CLIMATE RESEARCH PROGRAMME - The CLIVAR Handbook, July 2007
3	Subtitle D--Federal Ocean Acidification Research and Monitoring Act of 2009
4	AN INTERNATIONAL OBSERVATIONAL NETWORK FOR OCEAN ACIDIFICATION
5	NOAA Ocean and Great Lakes Acidification Research Plan, April 2012