Program Observation Requirements Document (PORD)

For

Ocean *In situ* Observation Requirements

National Environmental Satellite, Data, and Information Service (NESDIS)

October 31, 2012

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NOSC Endorsement

The NOSC has received the National Environmental Satellite, Data, and Information Service's Observation Requirements with Goal Lead and Line Office concurrence, and is satisfied with the Level-of-Validation provided for the Priority-1 Ocean *In Situ* Requirements.

Dr. Kathryn Sullivan Chair, NOSC	12/7/12 Date	✓ Endorsed
Mary Kicza Vice Chair, NOSC	12/5/12 Date	✓ Endorsed
Laura K. Furgione Vice Chair, NOSC	12/4/12 Date	✓ Endorsed
RDML Mike Devany Vice Chair, NOSC	11/29/12 Date	✓ Endorsed

Goal and Line Office Concurrence

The National Environmental Satellite, Data, and Information Service's Line Office and Coastal Goal's Lead concur with the Observation Requirements and are satisfied with the Level-of-Validation provided by the Priority-1 Ocean *In Situ* Requirements.

Mary Kicza AA	11/15/12 Date	✓ Validated
Suzanne Hilding Science & Technology Objective Observations Lead	11/15/12 Date	✓ Validated

Program Membership Concurrence

Al Powell Director, STAR	10/31/2012 Date	✓ Concurred
Paul Digiacomo Division Chief, STAR/SOCD	10/31/12 Date	✓ Concurred
Menghua Wang Science Team Lead, STAR	10/31/12 Date	✓ Concurred
Kent Hughes CoastWatch / OceanWatch Lead, STAR	10/31/2012 Date	✓ Concurred
Michael Ondrusek Oceanographer, STAR	10/31/2012 Date	✓ Concurred

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 National Weather Service (NWS) worked closely with the Technology, Planning, and Integration for Observations (TPIO) Office, Office of Marine and Aviation Operation (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 Offices 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

NESDIS of NOAA's Science & Technology Enterprise (S&T) Goal has a total of 5 Priority 1 Ocean *In Situ* Requirements to address its mission. This document provides the list of requirements for the following NESDIS programs:

2.1 Center for Satellite Applications and Research (STAR)

2.1.1 Program Summary

The National Environmental Satellite, Data, and Information Service (NESDIS) is dedicated to providing timely access to global environmental data from satellites and other sources to promote, protect, and enhance the Nation's economy, security, environment, and quality of life. To fulfill its responsibilities, NESDIS does the following:

- acquires and manages the Nation's operational environmental satellites,
- operates the NOAA National Data Centers,
- provides data and information services including Earth system monitoring,
- performs official assessments of the environment, and
- conducts related research.

NESDIS requires DAS to maintain and operate the Marine Optical BuoY (MOBY) system (Clark *et al.,* 1997) that provide the data for vicarious calibration and validation of Ocean Color Satellite Sensors. Radiometric measurements from ocean color satellite sensors are calibrated by comparison with *in situ* measurements of normalized water-leaving radiances. This vicarious calibration procedure is necessary because the radiance from the ocean is about 10% of the total radiance measured from space, which includes the atmospheric and ocean surface components. Laboratory, pre-flight radiometric calibration uncertainty values are about an order of magnitude too large to support the ~5% uncertainty requirements for normalized water-leaving radiances.

The MOBY (Clark *et al.,* 1997) has evolved into the primary calibration site for satellite ocean color sensors based on independent *in situ* measurements. Since late 1996, the suite of radiometric and environmental sensors attached to MOBY has provided a continuous time series of measurements. The radiometric calibration reference values of the MOBY are traceable to NIST absolute radiometric standards. MOBY has been functioning as the world's primary ocean color vicarious calibration and validation site, serving US and foreign ocean color missions.

NESDIS also requires days at sea (DAS) to collect data for ocean color calibration and validation for the Visible Infrared Imager Radiometer Suite (VIIRS) onboard the Suomi National Polar-orbiting Partnership (NPP) satellite. This requested shiptime will be utilized by the JPSS Ocean Color Cal/Val working group for dedicated cruises to validate, characterize and evaluate Suomi NPP VIIRS ocean color products, as well as for monitoring of sensor performance. This activity is an important requirement in the VIIRS Ocean EDR Calibration and Validation Operations Concept

(OPSCON) Document. Shipboard measurements provide near real-time monitoring of satellite sensor performance, assessment of processing changes, and required ocean color product validation. Shipboard measurements of radiometrically calibrated data will provide the necessary validation to make the VIIRS operational ocean color product usable. This request is for an annual cruise aboard a NOAA or chartered ship dedicated to the Cal/Val working group validation efforts. This cruise will take place off the continental US in a region that a variety of bio-optical provinces can be accessed to provide validation in many representative conditions. Currently, the VIIRS ocean color team is leveraging on-going validation activities with individual investigators following NASA Cal/Val protocols. An annual dedicated cruise is required to provide intercomparison and standardization of measurements, closure of the optical signature, increased *in situ*/satellite matchups, and feedback and verification on the performance of the VIIRS ocean color products.

2.1.2 Validation Assessment for Priority-1 Requirements

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

Table 1: STAR Validation Assessment for Priority-1 Requirements

#	Validation Assessment	Observation Requirement	Geo Coverage	Samp-ling	Mean DAS	Validation Docs
NES.STR.001	Validated	Operation and maintenance of MOBY Buoy_Cleaning & Calibration	Pacific Islands	1 mo	2	1
NES.STR.002	Validated	Operation and maintenance of MOBY Buoy_Swap out	Pacific Islands	4 mo	3	1
NES.STR.003	Validated	Operation and maintenance of Moored buoy Swap Out	Pacific Islands	2 yr	5	1
NES.STR.004	Validated	Operation and maintenance of MOBY Buoy Tech Refresh	Pacific Islands	5 yr	15	1
NES.STR.005	Validated	VIIRS Ocean Calibration/Validation	Coastal US	1 yr	20	2

Note: DAS numbers were not validated but were submitted by programs to indicated needed days at sea for each survey.

Legend: Level of Validation

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

2.1.3 Validation Documents Submitted

Program and TPIO representatives worked jointly to identify references to validate both the need for an observation requirement and its specific measurement attributes. These validation documents support one or more of the Priority-1 Requirements as shown in Table 1 above. For occurrences where validation documents could not be identified, Program SMEs justifications are provided.

The following Validation Documents have been submitted in support of the NESDIS Program's Priority 1 Observation Requirements.

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

Doc #	Document Title
1	Assessing Requirements for Sustained Ocean Color Research and Operations
2	VIIRS OCEAN EDR Calibration and Validation Operations Concept (OPSCON) Document