

# National Physical Oceanographic Real-Time Systems (PORTS™) Management Report

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**noaa** National Oceanic and Atmospheric Administration

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U.S. DEPARTMENT OF COMMERCE  
National Ocean Service  
Center for Operational Oceanographic Products and Services

**Center for Operational Oceanographic Products and Services  
National Ocean Service  
National Oceanic and Atmospheric Administration  
U.S. Department of Commerce**

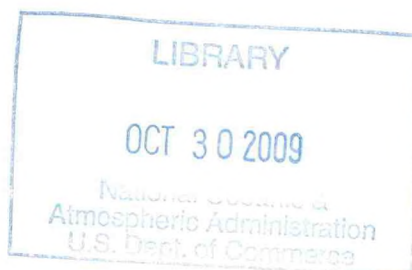
The National Ocean Service (NOS) Center for Operational Oceanographic Products and Services (CO-OPS) collects and distributes observations and predictions of water levels and currents to ensure safe, efficient and environmentally sound maritime commerce. The Center provides the set of water level and coastal current products required to support NOS' Strategic Plan mission requirements, and to assist in providing operational oceanographic data/products required by NOAA's other Strategic Plan themes. The Center manages the National Water Level Observation Network (NWLON), and a national network of Physical Oceanographic Real-Time Systems (PORTS) in major U.S. harbors. The Center: establishes standards for the collection and processing of water level and current data; collects and documents user requirements which serve as the foundation for all resulting program activities; designs new and/or improved oceanographic observing systems; designs software to improve CO-OPS' data processing capabilities; maintains and operates oceanographic observing systems; performs operational data analysis/quality control; and produces/disseminates oceanographic products.



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U.S. DEPARTMENT OF COMMERCE  
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# **National Physical Oceanographic Real-Time Systems (PORTS™) Management Report**

## **I. INTRODUCTION**

The National Ocean Service, (NOS) is responsible for providing real-time data and other navigation products to promote safe and efficient navigation within U.S. waters. The need for these products is great and rapidly increasing. Maritime commerce has tripled in the last 50 years and is expected to continue growing. Ships are getting larger, drawing more water, and pushing the channel depth limits to derive benefit from the last inch of cargo draft. Ninety-eight percent by weight of the Nation's international trade moves through U.S. ports and harbors, with 50 percent of these goods being hazardous materials.

Therefore, a major challenge facing the Nation is to improve the economic efficiency and competitiveness of U. S. maritime commerce, while reducing the risks to life, property, and the coastal environment. With increased marine commerce come increased risks to the coastal environment making marine navigation safety a serious national concern. For example, from 1980 to 1988, tankers in the United States were involved in 468 groundings, 371 collisions, 97 rammings, 55 fires and explosions, and 95 deaths.

Although the situation described above is complex and has serious national implications, our need to remain economically competitive must not be at variance with our desire to protect the coastal marine environment. Consequently, it is the mission of NOS to exercise national leadership to advance the sustainable use of our coastal systems in order to provide for the Nation's economic prosperity and environmental well being. The Center for Operational Products and Services (CO-OPS) of NOS contributes to this mission by providing timely and accurate tide and current information. These data are produced by the National Water Level Observation Network (NWLON) and through CO-OPS' operation of several Physical Oceanographic Real-Time Systems (PORTS™). This document defines and describes the development, operation and management of NOS' National PORTS Program. PORTS management and CO-OPS organization structure are presented in Appendix 1.

## **II. PORTS™**

PORTS is a decision support tool, which improves the safety and efficiency of maritime commerce and coastal resource management through the integration of real-time environmental observations, forecasts and other geospatial information. PORTS measures and disseminates observations and predictions for water levels and currents and other parameters, such as, winds, atmospheric pressure, visibility, and salinity needed by the mariner to navigate safely. PORTS was built upon CO-OPS' real-time water level capabilities (i.e., NWLON) by adding incremental improvements to field systems, sensor capabilities, communications, information systems and operational procedures to ensure that the full value of NOS's capabilities was realized by the marine transportation community and other users requiring operational oceanographic information.

Prior to 1991, CO-OPS' efforts were centered around the operation of NWLON and circulation surveys, which provides data to establish and maintain the vertical water level reference frame required to: support nautical chart production, establish state and federal boundaries, establish setbacks from the high water line, and to support U.S. Army Corps of Engineers dredging projects. All activities were performed in a non real-time environment.

PORTS began in 1991 as a demonstration project to prove the value of real-time information to the marine navigation community. PORTS systems come in a variety of sizes and configurations, each specifically designed to meet local user requirements. The largest of NOS' existing PORTS installations is comprised of more than 26 separate instruments. The smallest consist of a single water level gauge and associated meteorological instruments (i.e., winds, barometric pressure, etc.).

Full systems are presently installed in Tampa Bay, New York/New Jersey Harbor, San Francisco Bay, Houston/Galveston Ship Channel, and Narragansett Bay. Smaller PORTS are presently installed at Anchorage and Nikiski, Alaska; Seattle and Tacoma, Washington; Chesapeake Bay; New Haven, Connecticut; Soo Locks, Michigan. Regardless of its size, each PORTS installation provides information that allows shippers and port operators to maximize port throughput while maintaining an adequate margin of safety for the increasingly large vessels visiting U.S. ports.

As part of the Department of Transportation's (DOT) FY 1997 Appropriation, Congress directed the USCG to develop, in cooperation with the marine transportation community, a set of user validated requirements for a Vessel Traffic System (VTS). The USCG convened a National Dialog Group to document the information required by the mariner to navigate safely. Included among these requirements is the need for real-time tide, current, bridge clearance, and other environmental information. NOS PORTS was specifically identified by the National Dialog Group as a critical component of VTS to help ensure maritime safety in estuaries with complex and unpredictable oceanographic conditions. In addition, access to real-time water level information, such as that provided by NOAA, is required in order for the USCG to effectively implement its proposed underkeel clearance policies.

### **III. PROGRAM OBJECTIVES**

The objectives of the PORTS program are to: promote navigation safety, improve the efficiency of U.S. ports and harbors, and ensure the protection of coastal marine resources.

**Navigation Safety:** The real-time tide and current data provided through PORTS represent one component of NOS' integrated program to promote safe navigation. PORTS data, when combined with up-to-date nautical charts and precise positioning information, provide the mariner with a clearer picture of the potential dangers that can threaten navigation safety. NOS fulfills its navigation safety mission in close concert with other Federal agencies, such as the U.S. Coast Guard (USCG).

**Improved Economic Efficiency:** Our Nations's waterfronts, ports and harbors have historically been centers of rapid industrial and urban growth, and have advanced critical national objectives by promoting



energy exploration, fishery production, commerce, and recreation. In 1991 alone, the commercial shipping industry supported 1.5 million jobs, provided \$52 billion in personal income, and generated approximately \$20 billion in Federal, state and local taxes.

Increasingly, shipping companies seeking to improve their profit margin, are implementing new navigation systems aboard ships to maximize cargo load while reducing uncertainties in underkeel clearances. These new systems require the availability of real-time tide/current and other information. One foot of draft accounts for between \$36,000 and \$288,000 of increased profit per transit for vessels in Tampa Bay according to the Greater Tampa Bay Marine Advisory Committee. Consequently, the cargo transport throughput of U.S. ports and harbors depends on many factors including marine environmental conditions. Knowledge of the currents, water levels, winds, waves, visibility, and density of the water can increase the amount of cargo moved through a port and harbor by safely utilizing every inch of dredged channel depth.

***Coastal Resource Protection:*** Most ports are at the mouth of major estuaries which provide critical habitat for many important biological resources. For example, coastal waters provide nurseries and spawning grounds for 70 percent of the U.S. commercial and recreational fisheries. Commercial fishing employs more than 350,000 people in vessel and shore-related fisheries work. An additional seventeen million people participate in recreational saltwater fishing, spending \$7.2 billion annually. Activities within ports can greatly affect these critical resources. Dredging is but one such activity.

The increasing demands of maritime commerce will require expanded port facilities, both in efficiency and in size. Currently there are about 190 seaports offering more than 3,000 berths for commercial carriers. An estimated 60% of the Nation's coastal waterways require operational and maintenance dredging. Within coastal waters, some 200-250 million cubic yards of sediments are dredged each year. The shortage of available sites for the disposal of dredged material often prevents port expansion and threatens the continued use of waterways for shipping. There will be increasing demands to sacrifice wetlands to expand port infrastructure so the ports can be more competitive. PORTS provides information on the physical processes that support wise decision making in our coastal zone. The availability of PORTS data will help ensure that resource management decisions are based on the best science and information available.

In addition, prevention of maritime accidents is the most cost effective measure that can be taken to protect fragile coastal ecosystems. In 1996 alone, NOS' Hazardous Materials Response and Assessment Division responded to 69 spills including the release of 1.9 million gallons of caustic soda in Florida and a spill of 825,000 gallons of diesel fuel in Rhode Island. One major oil spill (e.g., EXXON VALDEZ) can cost billions of dollars and destroy sensitive marine habitats critical to supporting coastal marine ecosystems. PORTS provides information to make navigation safer, thus reducing the likelihood of a maritime accident, and also provides the information necessary to mitigate the damages from a spill, should one occur.

#### **IV. NATIONAL PORTS™ POLICY**

PORTS is a partnership program based on extensive collaboration between NOS and the local maritime community to identify local needs. The enhancements that PORTS bring to both navigation safety and efficiency can result in significant local economic benefits. Consequently, it is the policy of NOS to require that all costs to operate existing PORTS be provided by the local user community. In addition, absent special Congressional appropriation or clearly defined Federal Government needs, all future PORTS installations will be paid for in their entirety (both installation and local operation) by the local user community. The requirement for local sponsorship of PORTS operations and maintenance underscores the importance of user commitment to the partnership.

The PORTS partnership is founded on the principle that there are both local and National responsibilities. The local sponsor's responsibilities include, but are not limited to, the following:

- Design/installation costs, including the purchase of all equipment and contractor support.
- Local operating/maintenance costs to include repair/preventive maintenance for all locally resident instrumentation and computer equipment.
- Telephone lines/communications equipment costs for local distribution of PORTS information.
- Spare parts/supplies, and the amortized costs to replace all equipment at the end of their expected life.
- Operational/maintenance costs to include costs of operating an appropriate nowcast/forecast model that supplements the real-time observations.

National PORTS Program responsibilities include, but are not limited to, the following:

- Development of PORTS National Standards - Standardized data formats and baseline accuracy requirements will enable the maritime community's ability to utilize PORTS data with confidence and anticipate seamless transitions when transiting between ports. Standardization also enables manufacturers of digital charts, vessel traffic information systems, and other related private sector products to hold down equipment costs by not having to address variable, or proprietary, data formats.
- Development of User Agreements - NOS will develop and maintain cooperative agreements between NOS and the local organization responsible for the operation of a PORTS. These agreements will contain details regarding O&M requirements and the responsibilities for each organization.
- Installation of PORTS - Utilizing funds provided by the local user community, NOS will design and implement new PORTS systems. Installations will be accomplished through the use of, or in partnership with, private sector contractors.
- Data Quality - NOS is responsible for the accuracy of the information products and services that it provides to ensure safe navigation. Operating a centralized data quality assurance system on a national scale is an appropriate role for the federal government, as well as an equitable contribution for NOS' participation in the PORTS partnership.

The issue of liability (e.g., if a maritime accident should occur as a result of reliance on erroneous real-time PORTS data) has been a central concern for local sponsors due to the potentially enormous costs of a marine accident. Existing PORTS local sponsors will not continue to provide local operations and maintenance funding without NOS retaining responsibility for the accuracy of PORTS real-time data.

NOS will continue to provide the necessary quality control through the establishment of the Continuous Operational Real-time Monitoring System (CORMS). CORMS is a 24 hour, 7 days a week, centralized quality control and decision support system that: ingests real-time data (every six minutes) from all sensors for each PORTS system; determines data quality and evaluates each PORTS system's performance; identifies and communicates the presence of invalid or suspect PORTS data to real-time users who rely on PORTS data to ensure navigation safety; and provides decision making information needed by maintenance crews to affect repairs to PORTS systems.

CORMS is currently a minimal prototype system capable of supporting the existing PORTS. Therefore, to respond to the maritime communities request for additional PORTS, CO-OPS produced a System Development Plan for CORMS II. CORMS II is designed to (1) monitor more sites/systems without compromising quality; (2) to make better decisions based on information that has been summarized and mapped against existing rules and directives; and (3) to ensure more consistent actions and/or non-actions are taken by the CORMS watch personnel. CORMS II will enable the maritime community to receive the most accurate real-time PORTS data possible. The implementation and operation of CORMS II is critical for NOS to continue its expansion of PORTS.

In addition, NOS will oversee the operation and maintenance (O&M) of each PORTS to assure that the systems are maintained in accordance with PORTS National Standards. The conscientious operation, maintenance and timely repair of the PORTS components is critical to assure that reliable and accurate information is available for users. The Field Operations Division of CO-OPS will assign the necessary resources to monitor the performance of the local operators of each PORTS, review all related O&M documentation, and verify compliance with the terms contained within the cooperative agreement prepared by the Requirements and Development Division.

- Research and Development - CO-OPS will develop and implement the Ocean Systems Test and Evaluation Program (OSTEP) to conduct the research and development necessary to continuously improve the accuracy, reliability, and applicability of PORTS information. OSTEP will develop new sensor technology and apply oceanographic measurement quality assurance (QA) processes to ensure that the instruments used to support PORTS are providing safe and accurate data. New sensor technology will be evaluated by OSTEP before operational use in CO-OPS PORTS, NWLON, or National Current Observation programs.
- Development of operational nowcast/forecast models desired by the user community in the PORTS development process.

## **V. PORTS™ PROGRAM MANAGEMENT**

The PORTS Program consists of seven major elements: (1) Daily Operations and Quality Control; (2) Program Outreach; (3) Requirements and Development; (4) Scientific Oversight; (5) Computer-based Product Development and Data Management; (6) Research and Development and (7) Policy Making and Strategic Planning. These seven elements map to specific Divisions, Programs and/or individuals within CO-OPS. To effectively administer NOS' National PORTS responsibilities, eight PORTS management positions and Teams have been established: PORTS Strategic Oversight Team, PORTS Program



Manager, Navigation & PORTS Liaison Officer, PORTS Development Team, PORTS Information Technology Team, PORTS Implementation Team, PORTS Operations Team, and OSTEP Manager. These positions have been filled from within CO-OPS and represent collateral duty assignments. A synopsis of their respective responsibilities follows:

***PORTS™ Strategic Oversight Team (PSOT):*** the PSOT consists of all four Division Chiefs, the CO-OPS Science Oversight Manager, the Navigation and PORTS Liaison Officer, the PORTS Operations Team Leader, the PORTS IT Team Leader, the OSTEP Manager, the PORTS Program Manager and the Director and Deputy Director of CO-OPS. The purpose of this team is to (1) employ strategies for positioning CO-OPS to be responsive to changes in the maritime community, political landscape and National Ocean Service management; (2) oversee all of the PORTS Program elements; (3) target and plan for new PORTS opportunities that enable PORTS to grow and expand; and (4) provide a vehicle for resolving PORTS issues that have been elevated by any of the PORTS Teams/Individuals defined in this document.

***PORTS™ Program Manager (PPM):*** The PPM resides on the Directors Staff within CO-OPS. In general, the PORTS Program Manager is responsible for the monitoring, coordination and oversight of all activities associated with any of the seven PORTS Program Elements. This position is required to provide dedicated and full time management of all of the various elements of the PORTS Program using a systemic approach with a National perspective. The PORTS Program Manager does not replace any of the resources required to carry out the functions associated with any of the seven PORTS Program elements. The PORTS Program Manager does create an environment within which these resources can work productively.

Specifically, the PPM will:

- In consultation with the PORTS Strategic Oversight Team (PSOT), set policy for the PORTS Program.
- Conduct regularly scheduled PSOT meetings
- Establish, promote, encourage and enable communications between CO-OPS and local PORTS representatives and among PSOT members.
- Coordinate and monitor PORTS Program activities to maximize resource allocation, remove obstacles to success and to insure timely accomplishment of PORTS Program goals and objectives.
- Provide a single point of contact for PORTS programmatic issues.
- Serve as a diplomat in generally promoting the PORTS Program as a national asset to the maritime community and to other constituent groups. Service in this area simply augments the outreach functions.

To accomplish these tasks, the PPM works with six CO-OPS Teams/individuals on a regular basis. These are: PORTS Strategic Oversight Team, PORTS IT Team Leader, PORTS Operations Team, PORTS Implementation Team, PORTS Development Team, OSTEP Manager, and the PORTS & Navigation Liaison Officer. The membership and responsibilities of these teams are as follows:

**PORTS™ Development Team (PDT):** The PORTS Development Team Leader (PDTL) is a member of the Requirements and Development Division of CO-OPS. The PDTL is responsible for the solicitation, documenting and finalizing of all PORTS requirements. These requirements can be for new PORTS development or for PORTS enhancements. The PDTL uses the resources available within CO-OPS, including the Measurement System Configuration Board and working with the PSOT members and the OSTEP manager, establishes a PORTS Development Team(s). The PDT(s) develop the requirements to a point that the Implementation Team can install the designed systems or enhancements.

The PORTS Development Team does not have a standing membership. Each development is somewhat unique, consequently, the PDTL will select a new team with a skill mix appropriate to the development task at hand. A representative from the user community and the PORTS Operations and Implementation Team Leaders will be members of this Team.

The PORTS Development Team undertakes all development tasks associated with the PORTS Program. This includes, but is not limited to the following:

- Requirements identification/documentation.
- Science-based assessment of the number and locations of instruments necessary to provide the required information.
- Model development and implementation.
- Design/development of new PORTS installations.
- Design/development of new sensor, communication, and dissemination technology.

**PORTS™ Implementation Team (PIT):** The PORTS Implementation Team Leader (PITL) is a member of the Field Operations Division of CO-OPS. The leader uses the resources available within CO-OPS and working with the respective CO-OPS Division Chiefs, establishes a PORTS Implementation Team(s) to install and configure the system(s) defined by the requirements. This Team is responsible for all aspects of implementation including test and acceptance and implements both new and enhanced PORTS designs. This Team works closely with the Development Team to insure a smooth transition from conception to implementation. Upon completion of the design and development of a new PORTS, the Implementation Team will manage the physical installation of the PORTS. In order to assure success, the Implementation Team will closely coordinate the various aspects of the new system installation with the PORTS Development Team and the local PORTS representatives

**PORTS™ Operations Team (POT):** The PORTS Operations Team Leader (POTL) is the CORMS manager and is a member of the Products and Services Division. The POTL manages CORMS watch standing personnel as well as performs a triage function for all quality control issues for existing PORTS. The POTL works with a team consisting of the CORMS watch standing personnel, one Computer Specialist from the Information Systems Division and one Engineer from the Field Operations Division. All operational problems, concerns and issues must pass through the PORTS Operations Manager for initial and appropriate assignment to either or both of the Division technical representatives. Depending on the complexity of the identified problem(s), these representatives can call upon other resources within CO-OPS for assistance. It is the PORTS Operations Team Leader's responsibility, however, to monitor the



progress of the diagnostic and problem solving process and report any unresolved problems to the PORTS Program Manager. These types of problems could be timeliness in repair(s), recurring failures, resource allocation, or prioritization. The PORTS Program Manager provides direct technical direction to the POTL

The PORTS Operations Team is responsible for responding to PORTS operations and maintenance (O&M) requirements. Each of the four Divisions within the CO-OPS will provide members for the POT. The team is headed by the PORTS Operations Manager. The team provides input to the PORTS Operations Manager concerning operational budgets, equipment inventories and maintenance, resource allocation, travel schedules, and provides a link between NOS' National PORTS Operations and local PORTS operations.

The team, in concert with the local partners, ensures that PORTS is monitored and maintained properly to assure both reliability and quality of data. POT reviews all O&M agreements with local organizations and all PORTS related contract services prior to approval by the PORTS Program Manager.

POT coordinates all operational PORTS field activities supported by CO-OPS. This activity involves preparing personnel resource estimates and schedules for the various PORTS projects. Working with the Division Chief, determines available resources which can be committed to the projects, identify Branch personnel to be assigned to the various PORTS Teams, and determines the project's priority within the Division.

**NOS PORTS Field Point of Contact:** The NOS PFPC is a member of the Field Operations Division and coordinates field operations with the PSOT and support personnel which may be accomplished by serving as a Contracting Officers Technical Representative (COTR). A PFPC is assigned to existing PORTS .

**PORTS™ Information Technology Team (PITT) Leader:** The PITT leader position resides in the Information Systems Division and is responsible for all computer-based components of PORTS. This includes PORTS system components in the field and at headquarters. The list of responsibilities includes but is not limited to hardware and software associated with (1) data acquisition subsystems; (2) national WAN data communications; (3) all CORMS (Continuous Operational Real Time Monitoring System) components; (4) the PORTS InfoHub; (5) Tides Online; and (6) the PORTS voice response system. The PITT Leader participates on development and implementation teams as required. The PITT is the primary IT contact for the CORMS operators and provides resources for a 24 x 7 standby operation to respond to requests for support for all PORTS IT related quality control issue.

**OSTEP Manager:** The OSTEP Manager resides on the staff of CO-OPS and provides oversight, coordination and planning of the test and evaluation activities for CO-OPS. OSTEP and its facility insure that all candidate PORTS system components are tested, and accepted using established procedures, standards and methods prior to becoming part of the operational PORTS. OSTEP is the foundation for quality assurance for PORTS. OSTEP is also responsible for defining the appropriate quality control procedures for use by CORMS. The OSTEP Manager provides technical direction to a team comprised

of representatives from all Divisions supporting OSTEP activities. The team may be augmented with contractor personnel or other resources CO-OPS. Working the Division Chiefs, the OSTEP Manager draws on available resources to: (1) participate in OSTEP experiments; (2) provide input to Statements of Work; (3) review test and evaluation data, and (4) perform special analysis. All of the Center's test and evaluation requirements for telecommunications, engineering, and oceanography are the responsibility of OSTEP.

***Navigation and PORTS™ Liaison Officer (N&PLO):*** The N&PLO resides on the CO-OPS staff and provides a direct link to the Office of Coast Survey Regional Navigation Managers. The N&PLO maintains a line of communication to these representatives by:

- furnishing Navigation Managers with updated information about current and planned PORTS activities;
- developing and providing public relations and marketing information for internal use and use by the regional representatives;
- traveling to existing PORTS sites or potential PORTS sites with the Navigation Managers within the various regions to promote PORTS and respond to inquiries; and
- assist the PSOT in providing a political and strategic perspective to its discussions and decisions.

## **PORTS™ MANAGEMENT PROCESS**

The goal of the PORTS management process, is to utilize the technical resources of CO-OPS to best meet PORTS Program requirements, without jeopardizing other CO-OPS requirements. The process uses CO-OPS's formal Center structure to keep the lines of communication clear and open, and to eliminate intra-organizational conflict resulting from competition for the limited resources needed to meet all of CO-OPS program commitments.

The CO-OPS Director, Deputy Director and Division Chiefs exercise their traditional "line management" roles as in any operational organization. Specifically, they are responsible for the management of the personnel and financial resources which are required for the National PORTS Program. The CO-OPS Director is responsible and accountable for allocation of all funds, people, equipment, and facilities to the PORTS Management, Development, and Operations Processes. The Division Chiefs develop personnel and facility allocation plans to accomplish tasks identified by the PORTS Program Manager and approved by the CO-OPS Director.

***PORTS™ Advisory Panels:*** A key component of the PORTS management philosophy is the need for outside review and consultation. The Advisory Panel consist of independent experts from outside NOS to review the management, development, and operations of PORTS. They are responsible to the PORTS Program Manager, but are empowered to independently review management performance, technical performance, budgets, and schedules.



## **VI. PORTS™ OPERATIONS PROCESS**

The goal of the PORTS Operations Process is to ensure that all PORTS systems remain in good operating order and produce accurate information. The process requires the close coordination of all CO-OPS components. Real-time, 24 hour/day quality control (QC) is provided through CORMS, however, other CO-OPS personnel will retrospectively analyze PORTS data to detect sources of error not readily apparent to the real-time QC checks. These analyses could form the basis for revised real-time checks and procedures.

The risk to safe navigation from erroneous PORTS data is great, consequently, the PORTS Operations Process is designed to error on the side of caution. Similar to the auto assembly line where each worker can halt the line if they believe that a quality defect exists, each CO-OPS employee responsible for PORTS data quality can temporarily stop the dissemination of data from any instrument that they believe is producing erroneous data. Strict adherence to "chain of command" management models sometimes creates bureaucratic inertia which does not allow an organization to react quickly enough to potential emergency situations. By empowering employees to act on their own authority, CO-OPS will ensure that the PORTS Operations Process is flexible enough to meet the challenge of real-time data QC.

Once a possible data quality defect has been detected, the PORTS Operations Team is automatically tasked to determine if the data are, in fact, erroneous, and to take the required steps to correct the malfunctioning instrument. The corrective steps could be as simple as contacting the local PORTS operators and requesting that they replace a malfunctioning sensor, or as complex as the relocation or redesign of an instrument. In the latter case, the PORTS Development Team would take the lead in developing the required solution. In either case, the PORTS Operations Team provides the diagnosis. A more complete description of the PORTS Operations Protocol is contained in the CO-OPS Standard Operating Procedures (SOPs).

## **VII. The PORTS™ DEVELOPMENT PROCESS**

Development is one of the management components of any successful and forward-looking program, and thus is a component of the National PORTS™ Program. A PORTS™ Development Team (PDT) will be established to develop new PORTS™ installations and to implement changes to a basic design component in an existing PORTS™. Major design changes include: significant location changes, the addition or deletion of instruments, addition of new sensor or system technology, and the addition of requirements.

NOS has adopted a defined development process which will be employed in the establishment of all new PORTS™ installations and when making major system design changes to existing PORTS™. This development process consists of five basic steps which serve to move from concept to implementation. One of the primary goals of this process is to provide a framework for the local user community to interact with NOS in order to produce a system which is of maximum benefit to all interested parties. NOS recognizes that local input at all phases of the project is crucial to its ultimate success.

The steps of the development process are:

- Outreach and Preliminary Assessment of User Requirements

- Initial User Requirements Meeting
- Formation of a Development Team
- Local Review of Requirements Assessment and Budget Estimates
- Drafting of an Implementation Plan and MOA

The above listed steps are described in more detail in the remaining sections, as well as the documents expected from each of these steps. The flow of information between steps is depicted in Figure 1, and a list of the documents resulting from of the development process is given in Table 1.

**Step 1 - Outreach and Preliminary Assessment of User Requirements:** The Navigation and PORTS Liaison Officer (NPLO) will work with the Office of Coast Survey Regional Navigation Managers to conduct briefings for the local navigational community which demonstrate the benefits, basic components, and requirement for local support of PORTS™. The NPLO will gather feedback from these interactions to derive a preliminary understanding of the navigational and coastal resource issues of the area. As a result of these meetings the NPLO will prepare the first draft of a requirements assessment (RA) which includes:

- a problem statement describing the scientific/navigational/environmental issues
- background information (political scope, major port business, NOS history in port)
- geographic scope of project
- the operational scenario (i.e., intended use of PORTS information)
- local expectation of time frame
- key local players and organizations

The NPLO will request that the local community send a letter to the Assistant Administrator (AA) of NOS and a copy to the PORTS Program Manager (PPM) requesting that a PDT be formed and that the PORTS Development Team Leader (PDTL) travel to the site to give a more detailed PORTS briefing. The PORTS Program Manager will prepare a response for the AA's signature to the local community apprizing them of CO-OPS' commitment to the project. The PSOT, PDT, and POL will receive copies of the local letter of interest and the response letter.

**Step 2 - Initial User Requirements Meeting:** The NPLO will be responsible for setting up a meeting with the PDTL and principle potential local users of PORTS information. The PDTL and NPLO will travel to the local site, meet the principle users, refine the problem statement and operational scenario, and perform a preliminary site review. At this meeting a local representative will be identified for PDT membership. This visit should be well coordinated to ensure that all the key interests are represented and that all necessary information is exchanged. The PDTL will produce a final RA as a result of this meeting and will circulate as described in Table 1.

**Step 3 - Formation of a Development Team:** The PDTL will assemble a PDT to address major development questions. Each development is somewhat unique, consequently, the PDTL will select a team with a skill mix appropriate to the task at hand. A representative(s) from the user community, and the PORTS Operations and Implementation Team Leaders will always be members of this team.

The team will be provided with the RA and any available user community feedback prior to the team's first meeting. The NPLO will provide a debriefing resulting from Steps 1 and 2 at the first PDT meeting. The



PDT will then decide whether additional user input is necessary, and if so, the NPLO will be tasked with gathering the information.

**Step 4 - Local Review of the Requirements Assessment and Budget Estimates:** The PDT will produce preliminary budget estimates and site maps based on the information contained in the RA. These documents will be reviewed by the PORTS Strategic Oversight Team (PSOT) prior to being sent to the local partners. The PDTL will then provide the RA, which is a written articulation of the problems and operational scenario which NOS has gleaned from interactions, to a group of the key local potential PORTS users. Preliminary budget estimates and station locations will be included in this package. This step serves as a "reality check," to ensure that the PORTS will be designed to meet the needs of a particular area.

The local partners will be asked to communicate their continued interest in the development of a PORTS in writing to the AA with a copy to the PPM.

**Step 5 - Drafting of an Implementation Plan and MOA:** Following local statement of a desire to proceed with development, the PPM will convene a PORTS Implementation Team (PIT), specific to each site. The local community will be represented on the implementation team. This team will be tasked with developing a detailed implementation plan. The PDT will work with the PIT to ensure a smooth transition between the development and implementation processes.

The PORTS Implementation Team will adhere to the CO-OPS standard outline for a PORTS™ Implementation Plan (PIP). If in the drafting of this plan the PIT discovers a need for additional reconnaissance, CO-OPS employees or local support will be dispatched to obtain the necessary information.

Concurrent with the drafting of the PIP, the NPLO, with assistance from the Requirements and Development Division, will draft a Memorandum of Agreement (MOA) between NOS and the local partner. The NPLO will work with the partner to insure that specifics such as funding, invoicing, and equipment ownership are described to the mutual satisfaction of all parties.

#### **Implementation and Post Implementation Acceptance**

The PPM will administer review of the Implementation Plan and the MOA by the PSOT and local partners. The PORTS Implementation Team Leader will be responsible for assimilating the reviewers' comments and preparing a final draft of the PIP. The NPLO will be responsible for assimilating the reviewers' comments and preparing a final draft of the MOA. The PIP and MOA will be subject to final approval from both the PPM and a locally designated partner.

After implementation and prior to a PORTS being accepted as operational, the Development and Implementation Teams will review the installation and insure that the PORTS meets the requirements documented in the RA and PIP. The NPLO will arrange for a user feedback meeting to be held at the local site to respond to questions and requests for training.

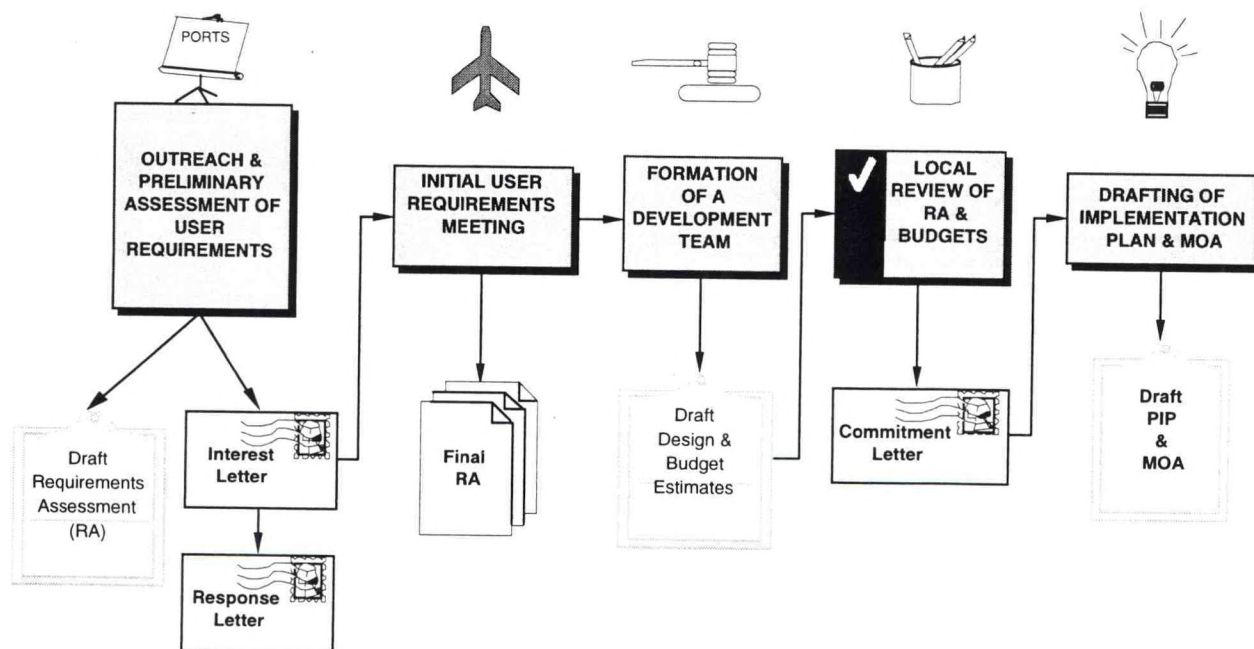
**Table 1. Documents Resulting from the PORTS™ Development Process**

Step #	Document	Lead Author	Distribution
1	draft requirements analysis (RA)	NPLO	2,3,8,8,9,10
1	interest letter	local partners	1, cc 2,3,8,9
1	response to local partners	PPM	2,3,8,9,10
2	users meeting agenda & goals	PDTL	2,3,8,10,11
2	revised RA	NPLO	2,3,8,9,10,11
3	preliminary budget and station map	PDTL	2-10
4	commitment letter from locals	local partners	cc 2,3,8,9
5	draft PIP	PITL	2-10
5	draft MOA	NPLO	2-10
	final PIP	PIT	2-10
	final MOA	NPLO	2-10
	acceptance memo	PDTL and PITL	2-11

*distribution codes*

- 1 - National Ocean Service AA
- 2 - PORTS™ Program Manager (PPM)
- 3 - Navigation and PORTS™ Liaison Officer(NPLO)
- 4 - PORTS™ Operations Team Leader (POTL)
- 5 - PORTS™ Development Team Leader (PDTL)
- 6 - PORTS™ Implementation Team Leader (PITL)
- 7 - PORTS™ Operations Team (POT)
- 8 - PORTS™ Development Team (PDT)
- 9 - PORTS™ Strategic Oversight Team (PSOT)
- 10 - Local representatives
- 11 - Wide local distribution

# PORTS™ DEVELOPMENT PROCESS



## VIII. MODEL-BASED NOWCAST/FORECAST DEVELOPMENT

Modeling, specifically forecasting, is considered to be cutting-edge oceanography. The application of modeling in PORTS provides users with even a broader potential suite of products and services that observations cannot provide. As such, CO-OPS is in the process of developing an operational Modeling Program that will support PORTS and provide for expansion of modeling into other NOS mission portfolios such as Sustain Healthy Coast (SHC). From an oceanographic perspective, modeling can serve to supplement observational schemes such that information on water levels and currents can be made available where observations are not practical. Models can provide predictive capabilities, such as the total water level forecasts that CBOFS provides, that traditional tide predictions fail to provide. Models also can provide a level of quality control for the observations themselves.

There are two major components of a modeling program: the research and development activities and operation and maintenance activities. The functional pipeline for the program can be described by:

- Requirements Functions
- Design/Development Functions
- Transition From Development to Operations Functions
- Operation and Maintenance Functions
- Enhancement Functions



A set of defined steps is followed in the development and implementation of numerical prediction models and other forecast techniques. CO-OPS and the Coast Survey Development Laboratory (CSDL) documented this process in *NOS Procedures for Developing and Implementing Operational Nowcast and Forecast Systems for PORTS*, NOAA Technical Report NOS CO-OPS 0020. The first step in this process will be the establishment of a NOS Scientific Steering Committee (SSC) which will be comprised of members from appropriate components of NOS. The SSC will oversee the development, evaluation, and implementation process. It will convene internal and external review panels, approve candidate solutions, set standards, establish testing procedures, and approve operational implementation. A summary of the steps in this process is as follows:

1. Requirements Analysis - A user requirements document will be prepared by the PDT. User needs must be clearly documented and alternative approaches addressed. Modeling should be included as part of the PORTS suite of products and services promoted in the Outreach phases. (See step 1, Section VII).
2. Candidate Solution - A candidate solution will be proposed by the PORTS Development Team and approved by the SSC. The Developer will take the lead in cooperation with the PORTS Development Team in drafting a Systems Development Plan (SDP). The SDP would include a description of proposed approach and operational requirements and would address computer, initialization/input and dissemination considerations.
3. Model Evaluation - Throughout development and testing, the model and its output will undergo evaluation. At least twice a year the Developer will provide progress reports on the development. A part of this evaluation is the development of methods to objectively assess skill/model performance. The chosen assessment scores must be acceptable to the scientific community as well as the user. Another key component of the evaluation step is documentation of the model which must include a discussion of how the model works, the equations, ocean boundary conditions, how winds are introduced, and skill assessment.
4. Internal Review - Following preliminary model acceptance by SSC, SSC will select and convene an Internal Review Panel. The Internal Review Panel would review the final evaluation on the candidate model and the statistics as outlined in the evaluation section of the model documentation. Also included is a Model Test and Evaluation (MT&E) Plan which details how NOS and the local users will know if the candidate model is meeting the documented user requirements. Based on its evaluation the Internal Review Panel would make recommendations to SSC as to whether the model should be accepted or reevaluated with or without modification.
5. Operational Evaluation (OP-EVAL) - The model will now be implemented in a test mode to allow an evaluation of its performance in an operational setting. A subset of users will be selected to participate in the OP-EVAL. These users will rely on the MT&E Plan to guide their evaluation. Results will be provided to an independent External Review Panel which must include members of the user community.

6. External Review - An External Review Panel would review the findings of the Internal Review Panel and the results from the Operational Evaluation. Based on this review, the External Review Panel would make a recommendation to the SSC as to whether the model should be accepted and implemented, or reevaluated with or without modification. The SSC and the user community will jointly make the final recommendation regarding acceptance and implementation.
7. User Acceptance - Based on the results of the OP-EVAL and recommendation of the External Review Panel, the user community will make the final decision regarding acceptance of the forecast product.
8. Implementation - Once the forecast product has been approved for implementation, but *prior to* implementation, the Developer, in cooperation with the PDT, would produce an Operations and Maintenance Manual (O&MM), and a User Documentation Manual (UDM). The O&MM defines input and output data streams, time requirements for data streams and model runs, required computer resources, and establishes back-up procedures. The UDM documents the strengths and weaknesses of the forecast product and highlights results of the OP-EVAL and External Review.

The forecast product is then implemented and run in an operational environment (i.e., 24 hours/day, 7 days/week). A continuing component of the implementation step is the requirement for CO-OPS to monitor the input data streams and output forecast products through CORMS and/or through cooperative relationships with NWS. Responsibility for the ultimate accuracy of the forecast products resides with CO-OPS.

## **IX. PORTS™ USE OF CONTRACT SERVICES and COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENT (CRADA)**

NOS does not have adequate personnel resources to meet the anticipated increase in personnel requirements to implement and operate the PORTS Program. NOS plans to address this challenge by using contract services. The use of contract services will be focused on, but not limited to, the field implementation, operation, and maintenance of local PORTS sites. Contract services will also be used to operate the 7x24 Continuous Operational Monitoring Systems (CORMS).

NOS plan to utilize Cooperative Research and Development Agreement's (CRADA) to conduct the research and development required to continue growth in a National PORTS Program. A CRADA is an instrument through which the U.S. Government seeks to: promote technology transfer and in particular commercial development of Federally developed technology; and to improve access to science and technology through collaboration with other party(s). The scope of the PORTS CRADA is to expand and improve existing PORTS sensor, communications, and data acquisition subsystems; develop interfaces between PORTS and marine traffic management systems; and insure the development of a quality assurance processes.

## **X. SUMMARY**

The challenges facing NOS as it endeavors to provide national leadership to advance the sustainable use of the coastal marine environment are complex and hold potentially significant consequences for the Nation if solutions are not found. No one component of NOAA or the Federal Government can address these problems alone. Balancing the two national priorities of economic prosperity and environmental well being requires the integration of federal, state, and local government agencies, the academic community, public interests groups, and the strong support and participation by the private sector to ensure the health, safety and sustainable use of our country's coastal areas.

This document has defined and described the development, operation and management of NOS' National PORTS Program. PORTS is but one component of NOS' integrated Navigation Services Program within NOS' Coastal Stewardship mission. In this time of diminishing federal resources, partnerships with other federal, state, and local organizations, in conjunction with the private sector, represent the only viable solution to address these National needs. The partnerships created through the PORTS Program activities described above serve as a model for the proper role of the Federal Government, acting in concert with the user community, to meet National needs.



## APPENDIX 1. PORTS Management and CO-OPS Organizational structure.

