

NOAA Integrated Ocean and Coastal Mapping (IOCM) Workshop
March 18-19, 2009
Silver Spring, MD

Summary Report



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I. Executive Summary

The NOAA Integrated Ocean and Coastal Mapping (IOCM) Workshop was held on March 18 and 19, 2009. The goals of the workshop were to: 1) create a better understanding of ocean and coastal mapping activities across NOAA, 2) gain support for a proposed vision and business framework, and 3) identify new actions required to fulfill this vision. While many important items were discussed throughout the workshop, a handful of immediate actions were identified and heavily emphasized.

Below is a summary of recommended actions that are foundational to moving NOAA IOCM forward. This section of the report focuses on those key immediate actions and how to accomplish them. A meeting agenda and comprehensive notes from the workshop breakout groups can be found in the appendix.

Establish NOAA IOCM Coordination Team and Related Work Groups

One of the most important immediate actions discussed at the workshop was the formalization of the NOAA IOCM Coordination Team and related workgroups. As of May 2009, this step has been addressed as a result of the establishment of the Integrated Ocean and Coastal Mapping Coordination Team of the NOAA Ocean Council (NOC). The team was established with the purpose of promoting “an integrated approach to NOAA ocean and coastal mapping, to facilitate communications and coordination within NOAA’s diverse ocean and coastal mapping community and to develop NOAA IOCM-related policies for review and endorsement by the NOC.” More information about the role and tasks of the Coordination Team can be found in Section III.B of this report. In addition, the first NOC IOCM Coordination Team Meeting has been held and a Terms of Reference document has been developed since the workshop took place (see appendix).

The creation of workgroups within the NOAA IOCM Coordination Team to address specific issues was emphasized including:

- A Communications and Coordination Workgroup to develop coordination mechanisms, gather information from different programs, ensure that relevant information is distributed to all audiences, and identify and prioritize NOAA IOCM requirements across NOAA,
- A Technical Workgroup to develop a strategy for technology improvements, and
- An IOCM Platform Workgroup to address issues related to data acquisition platforms.

In addition, the immediate need for additional full-time IOCM staff and funding resources was identified as a priority in order to successfully implement the NOAA IOCM initiative and to carry out the tasks of the NOAA IOCM Coordination Team and work groups.

Develop a NOAA IOCM Web Site

Another immediate action that came up repeatedly during the workshop was the need to develop a NOAA IOCM Web site, first to serve the NOAA mapping community, and later to be expanded to serve external NOAA partners and users of NOAA mapping information.

The following content was suggested to be incorporated on the Web site:

- General information about NOAA IOCM, including the one-pagers and diagrams developed for the workshop and included in the Appendix of this report.

- Summaries of all NOAA existing mapping programs, their capabilities, and points of contact for each.
- An inventory of existing standards and specifications documents for NOAA mapping programs.
- Links to any existing near-term data acquisition plans and longer-term programmatic mapping plans.

Implementation of the Ocean and Coastal Mapping Integration Act (OCMIA, H.R. 146)

One of the first tasks for the NOAA IOCM Coordination Team will be the implementation of OCMIA within NOAA and the development of the NOAA integrated ocean and coastal mapping initiative. OCMIA was signed into law on March 30, 2009, shortly after the workshop occurred. It is worth noting that many provisions of this law were also addressed at the NOAA IOCM Workshop. Two key provisions were discussed extensively: the demonstration of the value of an integrated approach to ocean and coastal mapping through the use of pilot projects, and the establishment of joint ocean and coastal mapping “centers of excellence.” These are discussed below. Additionally, the OCMIA calls for NOAA to establish mapping priorities, establish minimum data acquisition standards, encourage the development of innovative OCM technologies, and identify training and technology resource requirements.

Demonstration of the Value of the IOCM Approach and the Development of Performance Metrics

One of the primary tasks attributed to the NOAA IOCM Coordination Team should be the establishment of new pilot studies, as well as the continuation of existing pilot projects, to evaluate and quantify the benefits of the IOCM approach. Such projects should be designed to work out the methods for achieving a sufficient level of coordination, as well as create performance measures that can be used to measure success and be applied to future IOCM projects.

Establishment of NOAA Joint Ocean and Coastal Mapping Centers of Excellence

OCMIA authorizes the establishment of three joint ocean and coastal mapping centers, including a Joint Hydrographic Center. Workshop participants discussed the immediate need for expanding existing or creating new mapping centers (cooperative institutes) to ensure data quality and consistency, increase research and development, and provide additional training and education. The best initial approach would be to identify training, education, and research gaps to determine if the existing center could adequately address these needs. The University of New Hampshire Joint Hydrographic Center was discussed as a possible location to expand staff and capabilities for these purposes.

Gap Analyses for Technology Development, Training, Data Management and Coordination Processes

A recurring theme was the need to perform gap analyses in various areas to determine what new efforts are needed. The following gap analyses were suggested:

- **Technology** – First develop an inventory of current NOAA platform technology mapping systems and sensor capabilities. Then identify a strategy for required improvements, determine gaps and develop plans for the future.
- **Training** – First create an inventory of current training and then identify additional opportunities that would fill unmet needs. Also consider the creation of an online NOAA IOCM

Virtual Training Center that would provide links to all applicable on-line courses available through NOAA or NOAA mapping partners.

- **Data Management** – see section below on establishment of data standards.

Identify and Prioritize NOAA Ocean and Coastal Mapping Requirements

The importance of identifying and coordinating requirements across all NOAA mapping programs was emphasized. This should include the development of a requirements document by each program that could be shared through the NOAA IOCM Web site, and a tool for tracking and coordinating progress in all programs. This should be a primary task of the IOCM Coordination Team.

Identify and Establish Standards to Ensure the Greatest Level of Data Interoperability and Widest Use of Data

Standards need to be developed for data acquisition, data processing, databases and metadata. Participants suggested first developing a matrix of data standards categorized by survey/data type or theme, determining what is already in place, and identifying gaps. Metadata was discussed at length; it is clear the development of standards for metadata is a very high priority.

In summary, this was a very productive workshop with a high level of participation and interest for attendees. Participants came away with a better understanding of how IOCM can serve ocean and coastal mapping program interests across NOAA and provided extensive feedback on how this can be accomplished. There was enthusiastic support for IOCM as an approach, though the group recognized that this was no small task. The concept of integrated ocean and coastal mapping is very ambitious and will take much effort and coordination to implement effectively. More information about the workshop process and outcomes as well as details about all of the above priority actions can be found in Section III of this report. Full notes from the breakout groups and related workshop documents can be found in the Appendix.

II. Introduction & Background

Integrated Ocean and Coastal Mapping (IOCM) is the practice of acquiring, managing, integrating and disseminating ocean and coastal geospatial data in such a manner that permits these data and their derivative products to be easily accessed and used by and for the greatest range of users and purposes. IOCM requires intra- and inter-agency coordination with a focus on streamlining operations, reducing redundancies, improving efficiencies, facilitating collaboration, developing common standards, and stimulating innovation and technological development.

Approximately forty participants from a variety of NOAA mapping offices and programs attended the two-day NOAA IOCM Workshop held in Silver Spring, MD on March 18-19, 2009. The purpose of this meeting was to discuss mapping issues and coordination of NOAA's diverse mapping programs.

The 2009 NOAA IOCM workshop focused on a number of priority areas, including:

- Improving internal communications, coordination, planning and outreach,
- Understanding NOAA's diverse ocean and coastal mapping requirements,
- Improving NOAA's ocean and coastal mapping infrastructure which supports data acquisition, management, dissemination and product development, and
- Identifying processes for developing partnerships and collaborations.

The stated objectives of this workshop were to:

- Create a better understanding of ocean and coastal mapping activities across NOAA to enhance coordination of related NOAA programs.
- Gather input on and build support for a proposed vision and business framework for NOAA IOCM.
- Review recommended actions from the 2005 NOAA IOCM workshop, identify what has been accomplished in the ensuing four years, and identify new actions required to fulfill the IOCM vision and fully implement IOCM throughout NOAA within five years.

Expected workshop products included:

- Refined vision and business framework for NOAA IOCM.
- Refined list of completed, ongoing and future actions necessary to fulfill the NOAA IOCM vision within five years.
- Proposed process, including associated program/office commitments, for implementation of near-term actions required to support the NOAA IOCM vision.

Process

The workshop commenced with remarks from the Deputy Assistant Administrator of the National Ocean Service and three of the co-chairs of the Interagency Working Group on Ocean and Coastal Mapping. To create a better understanding of ocean and coastal mapping activities across NOAA and to improve coordination, there was a review of the IOCM progress to date, and updates regarding ongoing mapping success stories, partnerships, technology developments, inter-agency activities and pending IOCM legislation. There was a group discussion on the proposed NOAA IOCM Vision and Business Framework. In addition, the results and recommendations of a similar NOAA workshop held in 2005 were incorporated into the design of the agenda. Workshop attendees were assigned to breakout groups addressing a variety of topics to review recommended actions from the 2005 NOAA IOCM workshop, and to identify new actions required to fulfill the IOCM vision and fully implement IOCM at NOAA. There were also presentations and updates about NOAA Ships and Sensors, NOAA Aircraft and Sensors, remarks from the Commerce and Transportation and the Ecosystem Goal Teams, and an identification of next steps. The workshop agenda can be found in the Appendix.

This workshop report includes synthesized results from all discussions. Section III of this report represents the summarized input from the breakout sessions, and detailed notes from each individual breakout group are contained in the Appendix.

III. Summary of Participant Input

This section summarizes the input given by workshop participants in facilitated group sessions and breakout groups.

III. A. NOAA IOCM Vision and Business Framework

Participants were asked to comment on the following proposed NOAA IOCM Vision and Business Framework (see figures 1-3). The objective of this session was to gather input on and build support for a proposed vision and business framework for NOAA IOCM. Participants were generally

receptive to the proposed NOAA IOCM Vision and Business Framework. The following points were raised.

General Comments

- Consider forming an IOCM Subcommittee of the National Ocean Council (NOC) or the NOAA Ocean Observing Council (NOSC) so that there is an official venue for IOCM.
- A regional strategy is necessary, perhaps NOAA's regional governance can be used.
- Taxpayer-funded surveys should be available to the public immediately after the data leaves the ship, but accuracy needs to be addressed.
- Consolidated map requirements should have delineated criteria.
- Getting people to come to the table with requirements is easy, but identification of overlap and consolidation is difficult.
- Consider making NOAA IOCM a NOAA matrix program.
- One low-hanging fruit could be for the IOCM Coordination Team to provide assistance with outreach and product design since many scientists are too busy collecting data.
- An assessment of lessons learned from other programs would be helpful.
- No discussion of different mission areas for different agencies within the IWG-OCM has taken place to date, but a mechanism to pass funds between groups would be necessary to go down this path. Defining different missions is an option, but the technologies used by different groups will remain the same.

Funding-related Comments

- There is concern about requirements to use PPBES since FY 2012 is being planned for currently. It will be difficult to get work done right now while planning for FY 2012 through PPBES process.
 - In response to this comment, the NOAA IOCM Coordinator, Roger Parsons, stated efforts are underway but we can do a better job of tapping into them.
- Make the case to use the current budget now for things that are not too expensive. Not everything is very expensive and some things can be done with small amounts of money.

Comments on the Proposed NOAA IOCM Vision and Vision Diagram (see figures 1 and 2 below)

- The IOCM Vision focuses too much on data acquisition and management and not enough on integration. (i.e. how to create a product from disparate information using limited funds).
- The first sentence of the vision should read:
 - "NOAA is the national leader in providing *and disseminating* the ocean and coastal mapping products and services required..."

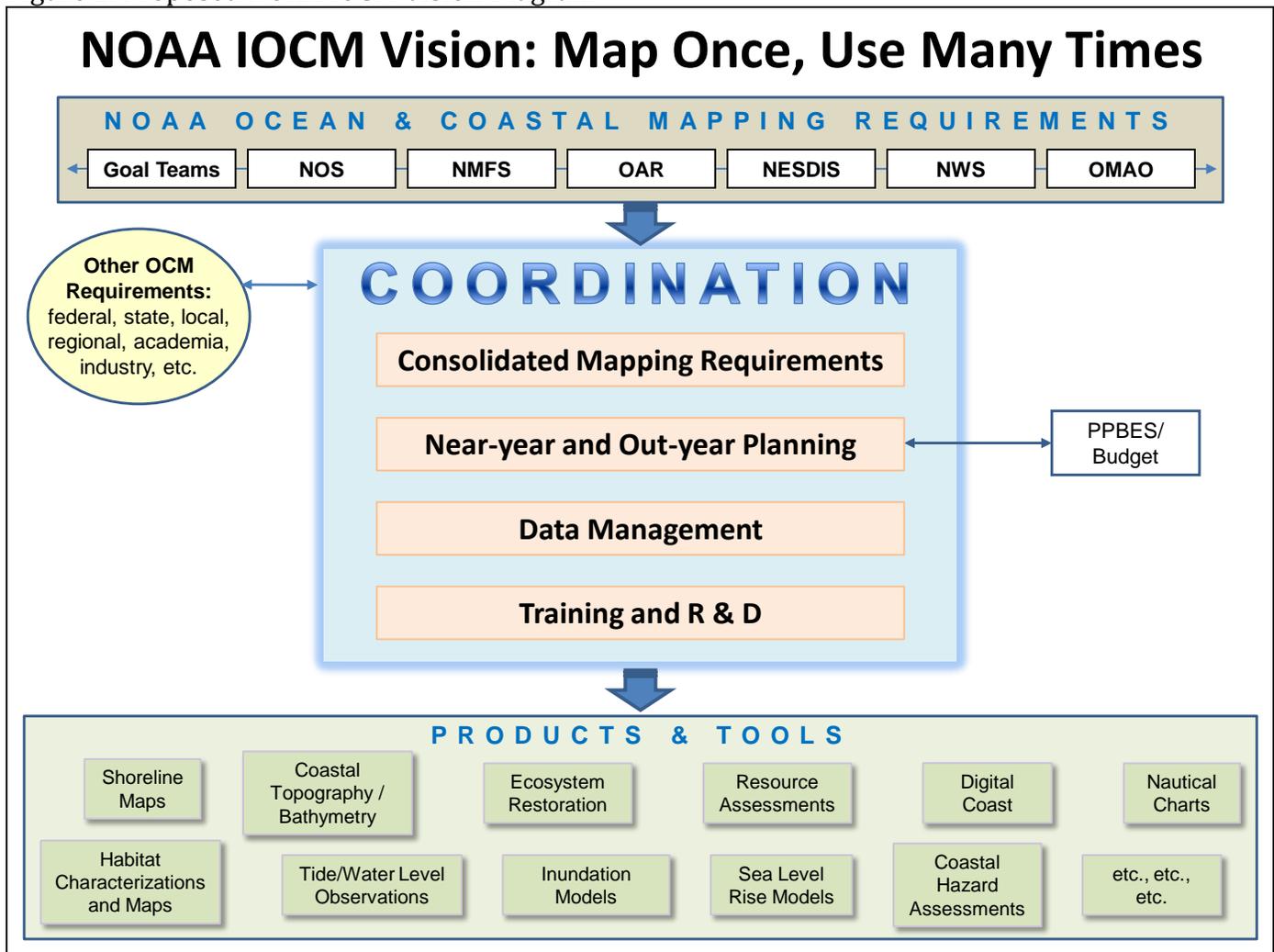
Figure 1. Proposed NOAA IOCM Vision Text

<p style="text-align: center;"><u>Proposed NOAA IOCM Vision</u></p> <p>NOAA is the national leader in providing the ocean and coastal mapping products and services required to understand and predict changes in the earth's coastal and oceanic environment and to manage ocean and coastal resources to meet the Nation's economic, social, security and environmental needs.</p> <p>Over the next five years, NOAA will establish a comprehensive NOAA IOCM program that supports</p>
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fully coordinated data acquisition and management efforts both within NOAA and with other agencies. This vision requires a commitment to:

- Acquiring quality data that meets the greatest range of user requirements;
- Coordinating mapping activities across NOAA and with Federal, State, regional, academic and private-sector mapping interests;
- Providing unrivaled data analysis, management, integration and access;
- Developing metadata that supports authoritative long-term archives;
- Developing products and tools required to support decision-makers;
- Forging new partnerships;
- Using cutting-edge technologies;
- Advancing mapping science and contributing to research and technology development;
- Fostering technology transfer;
- Preparing current and future members of the ocean and coastal mapping community; and,
- Energizing outreach efforts.

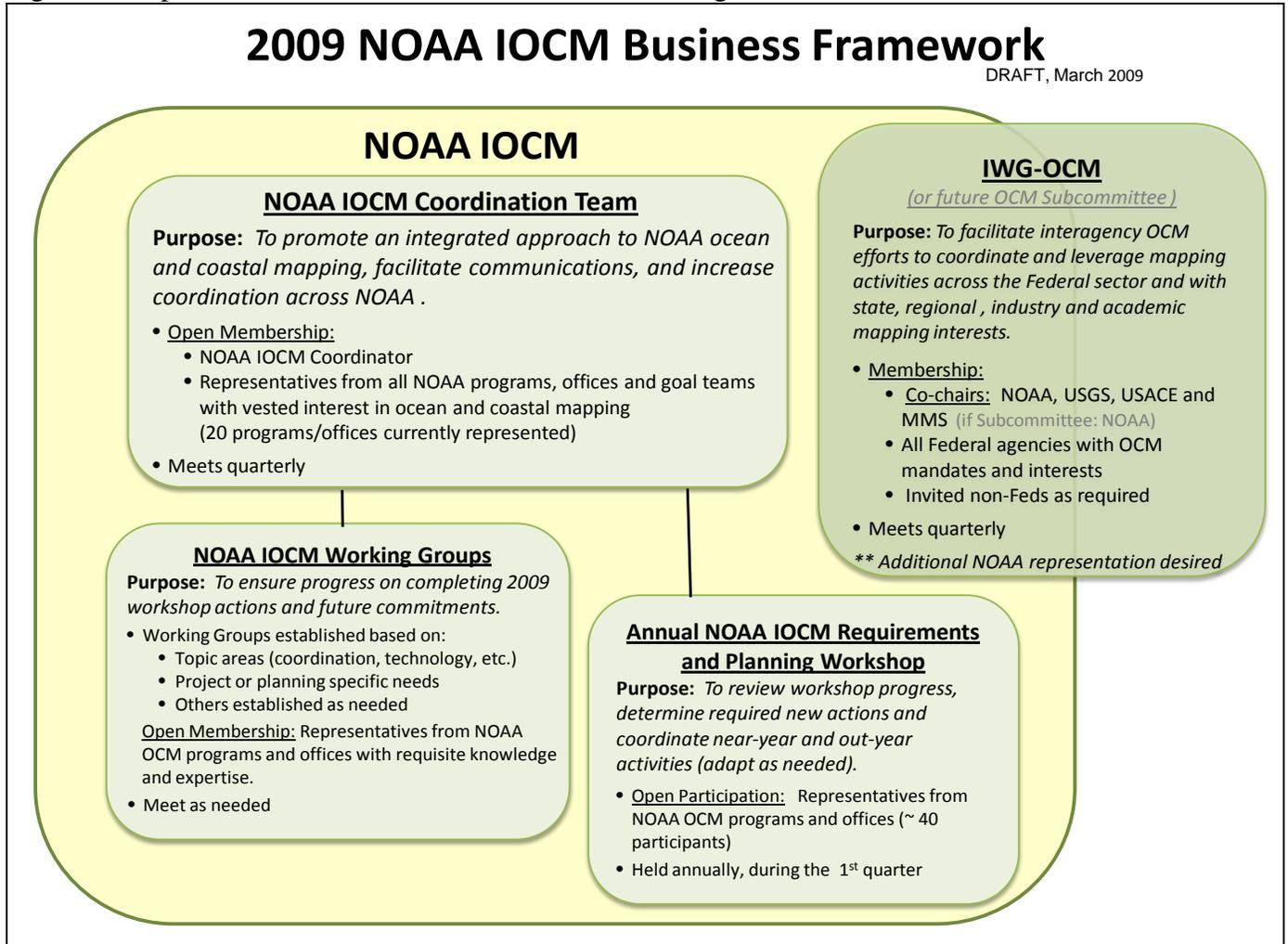
Figure 2. Proposed NOAA IOCM Vision Diagram



Comments on the Proposed NOAA IOCM Business Framework Diagram (see figure 3 below)

- The NOAA IOCM Business Framework should include an outreach component to Congress so that IOCM can get funding.
- Our return on investment needs to be represented on the IOCM Business Framework diagram. We need to show what is gained by better coordination.
- The precursor to outreach is establishing successful operations - the “meat” on the bones of the framework - and we need to discuss the barriers to successful operations.

Figure 3. Proposed NOAA IOCM Business Framework Diagram



III. B. The Way Forward for NOAA IOCM

All workshop attendees participated in small group discussions about actions needed to fulfill the NOAA IOCM vision and fully implement IOCM. Starting with actions recommended by participants at the 2005 NOAA IOCM workshop, the 2009 workshop participants were instructed to review the 2005 actions, add new actions required to achieve the proposed NOAA IOCM vision, and determine the priority level of each action. Priority categories included: **Immediate:** less than one year; **Short Term:** 1-2 YEARS; **Long Term:** 3-5 YEARS. Actions identified as immediate were then discussed in depth and participants provided suggestions on how to accomplish each action and who should be responsible for accomplishment of the tasks.

Breakout discussions were held on the following five categories (adapted from the 2005 workshop categories):

- Coordination
- Data Standards and Management
- Technology Development and Enhancement
- Outreach, Communication and Messaging
- Training and Education

III. B. i. IOCM Coordination Actions – Summary of Input from Breakout Groups

All workshop attendees participated in breakout groups focusing on coordination actions. The objective of this session was to review recommended actions from the 2005 NOAA IOCM workshop, identify new actions required to fulfill the IOCM vision and fully implement IOCM throughout NOAA within five years. Table 1 represents the summary of input from the three coordination breakout groups. Immediate, short- and long-term actions recommended by participants are included in the table below. (Comprehensive notes from each breakout group are in the Appendix).

There was agreement across all three breakout groups on coordination, **that establishing and formalizing the NOAA IOCM Coordination Team, including the creation of work groups**, was of upmost importance to achieving the proposed IOCM vision. All three groups recommended **the immediate establishment of an internal NOAA IOCM Web site** to begin the process of integrating ocean and coastal mapping plans and data throughout NOAA. **The importance of identifying and prioritizing ocean and coastal mapping requirements across NOAA**, including: prioritizing the remaining areas to be mapped, creation of a requirements document for each program, development of a tool to track all projects, and the development of a process for identifying which planned, non-navigation seafloor surveys might be of interest to NOAA nautical charting efforts and may require tide control support and also which seafloor surveys intended to support primarily navigation interests might be of interest to non-navigation programs .

Table 1 – IOCM Coordination Actions to Achieve Proposed NOAA IOCM Vision

Actions	How to Accomplish?
<p>IMMEDIATE: <i>The following actions were identified as immediate by at least 1 breakout group.</i></p>	
<p>1. Establish a NOAA IOCM Coordination Team</p>	<p>Formalize the team by doing the following:</p> <ul style="list-style-type: none"> • Validate roles, and ensure effective representation make-up; Ensure representatives are appropriate and agree to be involved and have time to be involved. • Develop dedicated IOCM capability – staff and resources. • Include NOAA line office teams and themes in NOAA IOCM working group structure. • Elevate IOCM to a sub-committee level in NOAA Observing Systems Council (NOSC) or NOAA Ocean Council (NOC). • Consider making IOCM a matrix program. • Create a Charter: establish goals and objectives; develop a plan and framework. • Publicize team and purpose – list names on new IOCM website. • Meet quarterly. • Form a variety of work groups (see below). • Establish progress/success metrics. • Identify pilot studies to show success/value of IOCM. • Engage Integration Ocean Observing Systems (IOOS), including the IOOS Data Management and Communication Committee, and define relationship between IOOS and NOAA IOCM. • Engage NOAA Data Management Committee, FGDC, etc. <p>The team should take on the following tasks:</p> <ul style="list-style-type: none"> • Determine what services IOCM can provide, then develop plans for these. For example: <ul style="list-style-type: none"> ○ Technical help and training ○ Data processing and equipment • Engage with IOOS and others to ensure coordination of requirements, data management efforts, communications and lessons learned. <ul style="list-style-type: none"> ○ IOOS should participate on IOCM Coordination team. ○ Clarify how IOOS relates to IOCM. ○ Align IOOS and IOCM missions where applicable. ○ IOCM could play a great role in establishing IOOS foundations. ○ Create IOCM subcommittee in each IOOS region. ○ Consider establishing a relationship with GEOSS and GOOS via a relationship with IOOS. • Start with a pilot project to develop a coordination plan based on a tangible challenge in order to work out the methods of how to achieve coordination, then scale up. • Define metrics of success for IOCM and identify other pilot studies to show success/value of IOCM.

<u>Actions</u>	<u>How to Accomplish?</u>
<p>1. Establish a NOAA IOCM Coordination Team <i>(continued)</i></p>	<ul style="list-style-type: none"> • Form the following work groups: <ul style="list-style-type: none"> ○ A TECHNICAL WORK GROUP to: <ul style="list-style-type: none"> – Develop strategy for technology improvements ○ An IOCM PLATFORM WORK GROUP ○ A COMMUNICATIONS & COORDINATION WORK GROUP to: <ul style="list-style-type: none"> – Identify best communication practices. – Consider impediments to communication/coordination. – Consider holding an annual meeting. – Consider regional engagement. – Develop coordination mechanisms (consider PPBES process). – Gather information on priorities, plans & requirements from programs. – Include NOAA Line Office IOCM working groups and diversify participants including those in regions.
<p>2. Identify and prioritize NOAA Ocean and Coastal Mapping requirements across NOAA and identify commonalities.</p>	<ul style="list-style-type: none"> • Prioritize areas remaining to be mapped including required mapping parameters, resolutions, etc. This includes seafloor, shoreline/coastal and other data, i.e. water column. • Each program should create a requirements document: <ul style="list-style-type: none"> – Define NOAA mapping requirements and communicate broadly. – Create and use a template to gather standard requirements from each NOAA office/program and post on new IOCM Web site. • Develop a process, tool or product to track and coordinate all projects, i.e. a Web tool to crosswalk needs with requirements: <ul style="list-style-type: none"> – Build for change and update annually. – Develop a common approach to plan NOAA data requirements better in the future. – Develop a matrix of mapping needs to look for linkages/coordination opportunities. – Need a communications mechanism to find out what other people are doing. • Develop a process for identifying which planned, non-navigation seafloor surveys might be of interest to NOAA’s nautical charting efforts and thus may require tide control support. • Establish which non-navigation seafloor programs can benefit from accounting for the effects of spatiotemporal sea surface fluctuations.
<p>3. Develop an IOCM Web site of completed, existing, and planned mapping activities, requirements, capabilities and cost estimates.</p>	<ul style="list-style-type: none"> • Phase I - Develop NOAA IOCM Web site. Phase II – Add Web-based GIS too and database to identify spatial overlap. • Develop database/mapping tools to support NOAA ships, aircraft, charter and contract survey coordination: <ul style="list-style-type: none"> ○ Develop ship coordination schedule (OMAO). ○ Re-invigorate the on-line NOAA Fleet Allocation Tool to request ship time. ○ Develop process for NOAA primary investigators to list projects that will occur in a fiscal year and make accessible to NOAA mapping community to help identify piggyback opportunities. ○ Provide ship schedule information to program offices earlier to improve planning. Fleet, platforms, and technology allocation.

<u>ACTIONS</u>	<u>How to Accomplish?</u>
3. Develop an IOCM Web site of completed, existing, and planned mapping activities, requirements, capabilities and cost estimates. <i>(continued)</i>	<ul style="list-style-type: none"> ○ Raise awareness about projects and include a point of contact, broadcast on Web site. ○ Determine if more NOAA-specific tools required beyond Geospatial One-Stop (GOS). ○ Market for use by other agencies. ● Should be two distinct Web offerings: <ul style="list-style-type: none"> ○ One public offering ○ One internal site for the NOAA IOCM Coordination Team and working group members.
4. Develop collaborations with other Federal/State/Regional mapping interests to address common needs.	<ul style="list-style-type: none"> ● Document current external NOAA mapping collaborations. ● Include Federal agencies outside of NOAA, USGS, ACOE. Extend to universities, NGOs, and other mapping interests.
5. Develop a plan and process to track metadata.	<ul style="list-style-type: none"> ● Consolidate the multiple paths that currently exist. Standardize the process and get everyone to do it. ● Have a defined path to reach NOAA Data Centers. ● Start metadata planning at initial planning stage and make sure it gets to the Archive.
SHORT TERM: <i>The following actions were identified as short-term by at least one breakout group. No group identified these actions as immediate.</i>	
6. Develop process for addressing Congressional reporting requirements for OCM Integration Act.	<ul style="list-style-type: none"> ● NOAA IOCM Coordination Team will participate on IWG Committee and meet quarterly on this topic. (check this, AH)
7. Schedule annual NOAA mapping coordination meetings.	<ul style="list-style-type: none"> ● Consider regional meetings as appropriate: <ul style="list-style-type: none"> – Consider utilizing existing regional meetings by having IOCM sessions at established meetings. – Could tap into 11 regional IOOS teams. – Update and engage NOAA Regional coordinators on all IOCM activities.
8. Schedule annual Federal mapping coordination meetings via IWG-OCM and include state and regional mapping interests.	
LONG TERM: <i>The following actions were identified as long-term by at least one breakout group. No group identified these actions as immediate or short-term.</i>	
9. Include atmospheric data in NOAA IOCM efforts.	

III. B. ii. IOCM Data Standards & Management Actions – Summary of Input from Breakout Groups

The objective of this session was to review recommended actions from the 2005 NOAA IOCM workshop, identify new actions required to fulfill the IOCM vision and fully implement IOCM throughout NOAA within five years. Table 2 represents the summary of input from the three data standard and management action breakout groups. Immediate, short- and long-term actions recommended by participants are included in the table below. (Comprehensive notes from each breakout group are in the Appendix).

Approximately three-fourths of workshop participants engaged in breakout group discussions of data standards and management actions needed to achieve the proposed IOCM vision. Much of the dialog centered **on the need to establish standards for a variety of data-related processes including data acquisition, data processing, and metadata.** Participants suggested a necessary first step would be to **develop a matrix of data standards categorized by survey type or theme.** The importance of metadata standards was discussed at length and it was suggested that the Interagency Working Group (IWG) metadata strawman be evaluated for use at NOAA. Participants also suggested the Federal Geographic Data Committee standards be reviewed and updated if necessary for use by NOAA. The **establishing an IOCM data processing center, possibly at the NOAA-UNH Joint Hydrographic Center,** was also given an immediate priority rating.

Table 2 – IOCM Data Standards and Management Actions to Achieve Proposed NOAA IOCM Vision

Actions	How to Accomplish?
IMMEDIATE	
<p>1. Identify and establish standards to ensure greatest level of data interoperability and widest use of data.</p> <p>a. Data acquisition Establish minimum seafloor, shoreline/coastal, and other data acquisition standards to ensure greatest level of data interoperability and widest use of data.</p> <p>b. Data processing</p> <p>c. Databases</p> <p>d. Metadata Establish minimum metadata standards, including content and lifecycle management process, as well as guidance for using these standards.</p>	<p>General</p> <ul style="list-style-type: none"> • Develop matrix of data standards categorized by survey type/theme (e.g. nautical charting, coastal mapping for environmental applications, coastal mapping for emergency response, etc.). <ul style="list-style-type: none"> ○ NGS has an example model. • Determine what is in place now and identify gaps. • Need to define “standards.” <p>a. Data Acquisition:</p> <ul style="list-style-type: none"> • Document current program-specific data needs and acquisition standards across all NOAA IOCM programs. • Identify current national or international standards and adapt as necessary. • Minimum bathymetric standards have been developed but need to be adopted. <p>d. Metadata:</p> <ul style="list-style-type: none"> • Evaluate IWG metadata strawman for NOAA.

<u>Actions</u>	<u>How to Accomplish?</u>
<p>1. Identify and establish standards to ensure greatest level of data interoperability and widest use of data.</p> <p>d. Metadata<i>(continued)</i></p> <p>e. Develop process for ensuring standards compliance.</p> <p>f. Revisit FGDC standards applicable to NOAA mapping requirements and determine whether any need updating and determine if other immediate FGDC (eventually ISO) standards are required.</p>	<p>d. Metadata <i>(continued)</i>:</p> <ul style="list-style-type: none"> • Review feasibility of developing a NOAA IOCM databank in collaboration with Geospatial One-stop (GOS). • Share process with others. • All NOAA metadata teams should be described and listed on the IOCM website. • Coordinate with IOOS and NOAA Program Offices. <p>e. Compliance</p> <ul style="list-style-type: none"> • Should be FGDC compliant and publicly available. • Training on this process is necessary. • Processing quality assurance process (OCS). <p>f. Federal Geographic Data Community (FGDC)</p> <ul style="list-style-type: none"> • Coordinate with other Federal Mapping agencies through the FGDC. • Revisit data acquisition standards and determine whether any need updating. • At a minimum, report how the data was collected and identify overlaps with other data standards.
<p>2. Create a NOAA Ocean & Coastal Mapping Data Center.</p>	<ul style="list-style-type: none"> • Identify what is available, what’s in use and the relationship among established centers.
<p>3. Establish and staff IOCM data processing centers to ensure data quality and consistency.</p>	<ul style="list-style-type: none"> • Define the mission for data processing centers. • Do outreach about the center and identify staffing needs. • Use creative ways to staff the UNH center until there is money available to hire permanent staff. <ul style="list-style-type: none"> ○ NOAA Program Offices and leadership can donate FTEs or support details. ○ NRAP assignments ○ LCDP ○ Hire summer interns to process data
IMMEDIATE	
<p>4. Determine the data stewardship responsibilities of the PIs, NMAO, NOAA Data Centers (NGDC, NODC, NCDC) and provide guidance to mapping programs to address requirements and processes for archiving mapping data to NOAA data centers.</p>	<ul style="list-style-type: none"> • Ensure that data acquired by NOAA becomes publically available in a timely fashion. • Relates to Web services and metadata. • Identify standard process for submitting data to the archive. • Identify who isn’t participating in current archiving process. • Clarification & education on data types and “why archive?” • Develop tracking mechanisms.

<u>Actions</u>	<u>How to Accomplish?</u>
4. Determine the data stewardship responsibilities of the PIs, NMAO, NOAA Data Centers (NGDC, NODC, NCDC) and provide guidance to mapping programs to address requirements and processes for archiving mapping data to NOAA data centers. (continued)	<ul style="list-style-type: none"> • Need a timeline for exclusive use by PI's before making information publicly available. • Need to enforce a NOAA policy on timeliness and suitability for release of data – consider NSF model.
5. Determine IOCM data boundary to understand what should be included and focus on ocean and coastal.	<ul style="list-style-type: none"> • Consider adapting the existing IWG-IOCM boundary.
SHORT TERM	
6. Establish platform-specific sensor CONOPS.	Include: <ul style="list-style-type: none"> • field procedures manual • standard operating procedure (SOP) • scope of work (SOW) • technical guides
7. Improve usability of data interfaces or centralize data (e.g. NGDC hydro data).	
LONG TERM	
8. Identify standard schemas for higher-level, nationwide classifications (substrate type, surficial geology, etc.).	<ul style="list-style-type: none"> • More efforts are needed in addition to the CSC's Coastal Marine Ecological Classification Standard (CMECS) • Coastal Marine Ecological Classification System (CMECS) needs NOAA review and revisions • This action is both long-term and ongoing
PRIORITY LEVEL NOT IDENTIFIED	
9. Identify existing, automated processes for data acquisition, data management and QA/QC that could be adapted for broader use.	

III. B. iii. IOCM Technology Development and Enhancement Actions – Summary of Input from Breakout Groups

The objective of this session was to review recommended actions from the 2005 NOAA IOCM workshop, identify new actions required to fulfill the IOCM vision and fully implement IOCM throughout NOAA within five years. Table 3 represents the summary of input from the three technology development and enhancement action breakout groups. Immediate, short- and long-term actions recommended by participants are included in the table below. (Comprehensive notes from each breakout group are in the Appendix).

Approximately three fourths of workshop attendees participated in discussions of technology development and enhancement actions. Recommended immediate actions included the **identification of required Web-based mapping tools, the development of an inventory of NOAA platform mapping technologies and capabilities, and development of a strategy to identify necessary technology improvements**. Putting together a workgroup to address these issues was seen as a key first step. A gap analysis should be done after the development of the inventory to determine future requirements. The formation of an Advanced Technology Working Group was suggested to perform these tasks and to develop strategies for identifying technology improvements.

Table 3 – IOCM Technology Development and Enhancement Actions to Achieve Proposed NOAA IOCM Vision

Actions	How to Accomplish?
IMMEDIATE: <i>The following actions were identified as immediate by at least 1 breakout group.</i>	
1. Identify required Web-based mapping tools (both a tool to make maps and to look at data).	<ul style="list-style-type: none"> • Use the list started at the IWG-OCM meeting in 9/08, focused on inventory and data portal, as a starting point. • Put a data call out to NOAA mapping contacts to find out the status of what Web tools already exist. • Compile list and ensure this is a dedicated effort that is updated annually. • Develop a plan and process for where things fit. • Evaluate if Geospatial One-stop (GOS) is the solution for NOAA. • Might need to develop a NOAA system that connects to an interagency system like GOS. • Investigate building on the capability that NOS Special Projects has developed to query GOS. • Use Virtual Earth as a model.
2a. Develop an inventory of NOAA platform technology mapping system /sensor capabilities, and a strategy for identifying required technology improvements.	<ul style="list-style-type: none"> • Identify team to develop strategy for technology improvements. • Develop a specific NOAA IOCM working group to focus on developing the strategy and to get tasks done, then group dissolves once task is complete. • Using a template, compile an inventory of what NOAA currently has and put on IOCM Web site.

<u>Actions</u>	<u>How to Accomplish?</u>
<p>2a. Develop an inventory of NOAA platform technology mapping system /sensor capabilities, and a strategy for identifying required technology improvements. (continued)</p>	<ul style="list-style-type: none"> • Also catalog non-platform based sensors with a link to non-NOAA systems or sensors. Look outside of NOAA for ideas. • Include true new technologies as well as existing technology in new ways. • Need one query-based system.
<p>2b. After developing inventory, determine what currently exists, gaps, and what is required for the future.</p>	<ul style="list-style-type: none"> • Need evaluation of sensor capabilities, how useful they are, and how they can be used to get our required data. • Identify required interferometric technology improvements (sensor development and associated software and instrumentation) consistent with needs and program requirements. • Determine how to get all required data from one pass/single operation of sonar. • Identify future requirements (including those for more efficient acquisition) for mapping sensors aboard NOAA ships and aircraft including autonomous sensors and AUV's. • Determine if all mapping instrumentation needs have been identified. • Do a better job learning from and sharing with other agencies (e.g. Navy, ACOE, NASA, etc.) for example AUV-Fest. • Continue to develop joint NOAA-Navy events (<i>on-going activity</i>) and communicate them on the new NOAA IOCM Web site.
<p>3. Determine immediate and long-term technology needs and develop strategies for identifying technology improvements.</p>	<ul style="list-style-type: none"> • Form IOCM Advanced Technology working group as sub team under NOAA IOCM Coordinating Team. • Workgroup also needs to think long term, for example: What do we need 10-20 years from now, and to also look outside of NOAA. • Someone from Advanced Science Technology Working Group (ASTWG) should be on this workgroup. • Need to determine how this workgroup relates to other technology work groups and what distinguishes it. • Share on the NOAA IOCM Web-based tool. • Include true new technologies as well as using existing technology in new ways. • Jack Dunnigan, NOS AA wants a 30 year mapping technology plan within the next year. • Establish a sensor and software development/ improvement process (including biosensors) that addresses evolving and future NOAA mapping requirements. • Establish a sensor development and improvement process that addresses evolving and future NOAA mapping requirements and a strategy for meeting future needs. • Develop a testing strategy for meeting future needs. • Ensure there is a process for this information to be shared.
<p>4. Determine gaps and strategies to fill gaps by "Centers of Excellence."</p>	<ul style="list-style-type: none"> • Establish and define relationship between NOAA and "Centers of Excellence" related to technology development. • Identify potential roles and priorities of "Centers." • Discover what is new, next (e.g. UNH Joint-Hydro Center). • Develop or enhance collaborative research with universities on new technologies.

Actions	How to Accomplish?
5. Develop optimal shipboard/ platform staffing model(s) to support NOAA's diverse mapping missions.	<ul style="list-style-type: none"> • Need to develop this on a NOAA-wide basis. • Marine Advanced Technology Education (MATE) Center is developing something that might be used as a model. • Put together an IOCM platform workgroup.
6. Continue developing pilot projects to demonstrate IOCM concepts.	<ul style="list-style-type: none"> • Identify opportunities to expand work, to operationalize and transition to production. • Find groups to do these demonstrations. • Consider a habitat mapping and hydro pilot project.
SHORT TERM: <i>The following actions were identified as short-term by at least one breakout group. No group identified these actions as immediate.</i>	
7. Track and provide input to NSV requirements process.	<ul style="list-style-type: none"> • Although a top level requirements document for the NOAA Survey Vessel has been developed by OMAO, might need to tie to other OCM requirements.
Actions	How to Accomplish?
LONG TERM: <i>The following actions were identified as long-term by at least one breakout group. No group identified these actions as immediate or short-term.</i>	
8. Ensure that NOAA has expertise to support next generation technologies.	<ul style="list-style-type: none"> • Hire in-house NOAA expertise (FTEs & contractors) e.g. Lidar expert. • Provide training and develop new skill sets.
PRIORITY LEVEL NOT IDENTIFIED: <i>The following actions were not prioritized by any breakout group.</i>	
9. Data Acquisition: Complete fly-away systems for ships of opportunity and, if useful, determine how to maintain.	
10. Data Integration: Tie sonar data to optical and sampling surveys or data.	
11. Improve algorithm to process and classify backscatter/LIDAR reflective data.	

III. B. iv. IOCM Training & Education Actions – Summary of Input from Breakout Groups

The objective of this session was to review recommended actions from the 2005 NOAA IOCM workshop, identify new actions required to fulfill the IOCM vision and fully implement IOCM throughout NOAA within five years. Table 4 represents the summary of input from the one training and education action breakout group. Immediate, short- and long-term actions recommended by participants are included in the table below. (Comprehensive notes from each breakout group are in the Appendix).

Approximately one fourth of workshop attendees participated in a breakout group discussion of proposed training and education actions. The most important, immediate actions proposed included **identification of gaps in IOCM-related training at NOAA**. This breakout group suggested gaps exist in the areas of data acquisition, standardized training on equipment operation, data and metadata management, and data processing/quality control. The creation of an on-line virtual training center to provide links to approved and applicable on-line courses was also suggested.

Table 4 – IOCM Technology Development and Enhancement Actions to Achieve Proposed NOAA IOCM Vision

IOCM Actions	How to Accomplish?
IMMEDIATE: <i>The following actions were identified as immediate the breakout group.</i>	
1. Determine training gaps within NOAA.	<ul style="list-style-type: none"> • Develop competency models to determine what we already do well (i.e. what does not require additional training) • Perform a needs assessment to determine what we need to learn to do (i.e. what requires more training) • Document existing training collaborations. <p>Areas of need for increased training:</p> <ul style="list-style-type: none"> • Data acquisition –Define all data acquisition methods <ul style="list-style-type: none"> ○ NERR collaborates with OCS, NRT, etc. to consolidate missions and develops some training from this – regional training for just a few people up to about 15-20 people, sometimes webinars up to 100people. Use this as a model. • Workforce: Train on multi-use techniques and standardize training on all equipment <ul style="list-style-type: none"> ○ OCS does this and is starting to open training to others • Data management/metadata <ul style="list-style-type: none"> ○ Mermaid metadata training is already offered by NCDDC and CSC. • Data processing and quality control. Should include: <ul style="list-style-type: none"> ○ How to work with different types of files ○ What can be extracted from the data ○ How to store the data • Development of mapping products and interpretation of products • Enhance understanding of strengths and limitations of various mapping technologies <ul style="list-style-type: none"> ○ This should encompass engineering training and development of new technologies.

<u>Actions</u>	<u>How to Accomplish?</u>
<p>2. Create a Virtual Training Center to increase mapping skills and knowledge within NOAA.</p>	<p>Define curriculum.</p> <p>Inventory current training.</p> <p>Provide links on IOCM Web site to all courses available through IOCM and partners.</p> <ul style="list-style-type: none"> • Start with Virtual Training portal with links to existing short courses like at CSC and JHC <ul style="list-style-type: none"> ○ Determine who has courses currently or content to be developed into a course ○ Start with JHC, CSC, NGS, COOPS, NMFS, OR&R, NERRS • See what other agencies offer for training. <ul style="list-style-type: none"> ○ Can link with other training networks that could offer to train us or to take our training. • Training should include: <ul style="list-style-type: none"> ○ Connections to formal courses ○ Cross program linkages ○ Cross mission understanding • Include a Wiki or Sharepoint site so each group can update training offerings and needs for training. • Develop more courses as needed. • Make sure all training reflects IOCM standards.
<p>SHORT-TERM: <i>The following action was identified as short-term by the breakout group.</i></p>	
<p>3. Improve skills of field technicians.</p>	<p>Provide field technicians more comprehensive training on all equipment and techniques</p> <ul style="list-style-type: none"> ○ could start with Virtual Train Center courses then expand
<p>LONG-TERM: <i>The following actions were identified as long-term by the breakout group.</i></p>	
<p>4. Provide Fellowships to train students in both surveying and habitat mapping.</p>	<p>Dependent on funding</p>
<p>5. Train personal at Service Centers to assist the IOCM community with data processing.</p>	<p>Implement a service model (e.g. data processing experts at Service Centers help with particular data types rather than each individual user learning everything.)</p>

III. B. v. IOCM Communications & Outreach Actions – Summary of Input from Breakout Groups

The objective of this session was to review recommended actions from the 2005 NOAA IOCM workshop, identify new actions required to fulfill the IOCM vision and fully implement IOCM throughout NOAA within five years. Table 5 represents the summary of input from the one communication & outreach action breakout group. Immediate, short- and long-term actions recommended by participants are included in the table below. (Comprehensive notes from each breakout group are in the Appendix).

Approximately one fourth of workshop attendees participated in a breakout group discussion of proposed communications and outreach actions. There was much overlap between the actions proposed in this breakout group and those proposed in the coordination breakout group discussions. The **establishment of an IOCM Web presence was of primary importance to enhancing communications regarding IOCM both internally and externally to NOAA.** They suggested an initial Web site be established to distribute information related to NOAA mapping programs and requirements internally, then the site should go external to communicate to NOAA mapping partners. The table below outlines suggested information and features to include on the Web site. The **importance of creating a communications plan** that details communications and outreach strategies for specific audiences was also emphasized. **Updating the “Profiles of NOAA Ocean Mapping Activities (May 2005 Draft)” document** created prior to the 2005 workshop would be instrumental to communicating broadly about NOAA mapping capabilities.

Table 5 – IOCM Communications and Outreach Actions to Achieve Proposed NOAA IOCM Vision

IOCM Actions	How to Accomplish?
IMMEDIATE: <i>The following actions were identified as immediate by the breakout group.</i>	
1. Establish an initial Web presence.	Document and distribute information related to NOAA's mapping programs and requirements <ul style="list-style-type: none"> • Include outreach, in-reach and training. • Start with a Web site that is internal, then go external once the site is more developed. • Must keep the site updated regularly. • Need to make sure people come to the site regularly – make it an invaluable resource! <ul style="list-style-type: none"> ○ Include ways to engage site users. Ideas are a 2-way portal, a SharePoint site, and RSS feeds. Include on Web site: <ul style="list-style-type: none"> • Workshop info for 2005 and 2009 meetings (participants, presentations, documents, summaries, etc.) • Templates (metadata, requests for mapping, other) • Links to programs and contacts • Input portal for programs to define mapping needs over the next year • Consolidate info and plans for all missions and programs • Have a map/matrix of programs and current interactions/existing collaborations • Provide links to documents on web sites of individual programs

<u>Actions</u>	<u>How to Accomplish?</u>
<p>1. Establish an initial Web presence. <i>(continued)</i></p>	<ul style="list-style-type: none"> • Include a matrix of main objectives and requirements, initial overview and highlights for each program. This should be a quick look at everything to help narrow down where a site user might start collaborations. • Have a mission query tool, maybe graphically • Could include a Forum/Networking type interface • Include other agencies (as part of Coordination effort) • See “Coordination” topic, Action #3 for more on Web site ideas.
<p>2. Establish a Communication Framework to communicate the IOCM Vision and the value of IOCM to NOAA and external mapping communities.</p>	<p>Develop a communication plan for specific audiences.</p> <ul style="list-style-type: none"> • Determine primary, secondary, tertiary audiences. <ul style="list-style-type: none"> ○ Primary: NOAA mapping and management community ○ Others: Federal community, State/regional levels, Legislature, General public (academia, K-12, NOG, etc.), and additional groups as appropriate <p>Define terms and standardize vocabulary.</p> <ul style="list-style-type: none"> • Coordinate vocabulary with other agencies and partners so all are ‘speaking the same language’. <p>Potential methods to communicate with...</p> <ul style="list-style-type: none"> • <u>Primary audience (NOAA)</u>: Web site • <u>Legislature</u>: one-pagers, newsletter • <u>All audiences</u>: Standard Power Point slides about IOCM that everyone involved with IOCM includes in any presentations they give. <p>Things to explore in plan development:</p> <ul style="list-style-type: none"> • Internal capacity building • Utilizing existing web-tool designs • Connections and intersections with IOOS (design a 1-pager) • Assess requirements of individual users to determine which templates, resources, etc. would be useful on the Web site. <p>Communicate the value of NOAA mapping capabilities (products and services) to untapped and evolving customers.</p> <ul style="list-style-type: none"> • Customers may include: offshore renewable energy interests, marine resource managers, communities impacted by climate change, etc.
<p>3. Highlight successes to strengthen the IOCM message.</p>	<p>Determine IOCM successes:</p> <ul style="list-style-type: none"> • Use performance assessments to identify strengths • Define efficiencies and cost savings • Highlight existing collaborations • Showcase expanded user groups

<u>Actions:</u>	<u>How to Accomplish?</u>
<p>3. Highlight successes to strengthen the IOCM message. <i>(continued)</i></p>	<p>Look for new projects that will accomplish NOAA Mission goals through collaboration with multiple NOAA groups.</p> <ul style="list-style-type: none"> • Demonstrate how IOCM can support these efforts in order to garnish more funding for IOCM. <p>Identify venues to advertise successes.</p> <ul style="list-style-type: none"> • Capitol Hill Ocean Week • present at established mapping-related meetings and conferences • Submit success stories through line office up through to leadership (e.g. OMB weekly blurbs) • Include IOCM story with all project reports
<p>4. Update “Profiles of NOAA Ocean Mapping Activities” (May 2005)</p>	<p>Share document broadly</p> <ul style="list-style-type: none"> • Via Web-links, presentations, etc.

IV. Next Steps

During the final session on “Next Steps” the workshop planning team and facilitators communicated their intent to review meeting notes and develop a summary report focused on actions. They also agreed to revise the NOAA IOCM 1-pager based on input received at the workshop and to continue meetings to begin implementing next steps.

The following recommended actions were identified:

- Synthesize workshop actions and comments into a report and submit for participant review.
- Ask pointed questions for workshop follow-up, such as:
 - Are these the correct people who should be a part of the IOCM? Should additional groups or individuals be added?
 - Are these the correct Immediate Actions?
 - What topics are you interested in being further involved with? Will you serve on the working group for this topic?
- Formalize NOAA IOCM Coordination Team including membership, team leads, purpose, etc., and investigate moving the team into the NOAA Council Framework (NOC or NOSC to improve its formal standing).
- Promote concept and show benefits of IOCM up the NOAA leadership chain.
- Determine what is the “low-hanging fruit” and other necessary actions, and work to accomplish them quickly.
- Assign additional full-time NOAA IOCM staff and work with the NOAA mapping experts to gather the required input for success.
- Continue to coordinate and work with other agencies externally.
- Develop an IOCM alternative for the FY12 PPBES Process.
- Get participant feedback as a meeting/seminar with WebEx access. Make meeting times at 2:00 PM or later so all can participate including those in Hawaii and Guam.
- Keep up momentum.

The actions identified by the workshop participants should not be considered an exhaustive list nor can we hope to accomplish many of these without a commitment from the NOAA mapping community. The degree of participation in this workshop by individuals from diverse NOAA programs and offices demonstrated a considerable level of interest in coordinating on and addressing mapping issues of common interest. The NOAA IOCM Coordinator is committed to addressing the many actions and issues identified at this workshop and through the involvement of the IOCM Coordination Team and others throughout NOAA, we will begin in earnest to prioritize these actions and build on their successes. Because of the growing need for geospatial data acquisition and management and derivative mapping products to support coastal zone management, coastal resiliency, climate change mitigation and adaptation, fisheries management, offshore renewable energy and marine spatial planning and other evolving national issues, Congress and the public are beginning to appreciate the importance of ocean and coastal mapping. It is through our efforts in demonstrating the value of an integrated approach to

mapping, the value of partnerships, and the value of innovative thinking that that our community will thrive.

V. Conclusion

In summary, the goals and objectives of this workshop were met although many next steps were identified to continue the momentum of implementing IOCM at NOAA. Participants came away with a better understanding of how NOAA IOCM could serve ocean and coastal mapping program interests across NOAA and provided extensive feedback on how this could be accomplished. The concept of integrated ocean and coastal mapping is very ambitious, and will take much support, effort and coordination to implement effectively. Full notes from the breakout groups and related workshop documents can be found in the Appendix.

VI. Appendices

Appendix A: Workshop Agenda

Appendix B: Workshop Participant List

Appendix C: IOCM Concept Handout

Appendix D: IOCM One-Pager Handout

Appendix E: Draft IOCM Coordination Team Terms of Reference

Appendix F: IOCM Vision Diagram

Appendix G: IOCM Business Framework Diagram

Appendix H: Comprehensive Discussion Notes from Coordination Breakout Groups

Appendix I: Comprehensive Discussion Notes from Data Standards & Management Breakout Groups

Appendix J: Comprehensive Discussion Notes from Technology Development & Enhancement Breakout Groups

Appendix K: Comprehensive Discussion Notes from Communications & Outreach Breakout Groups

Appendix L: Comprehensive Discussion Notes from Training & Education Breakout Groups

Appendix A: Workshop Agenda

NOAA IOCM Workshop Agenda

March 18-19, 2009

Silver Spring, MD

SSMC4/1W611 (First Floor Conference Center)

Objectives:

- Create a better understanding of ocean and coastal mapping activities across NOAA so that NOAA programs can better coordinate.
- Gather input on and build support for a proposed vision and business framework for NOAA IOCM.
- Review recommended actions from the 2005 NOAA IOCM workshop, identify new actions required to fulfill the IOCM vision and fully implement IOCM throughout NOAA within five years.

Expected Products:

- Refined vision and business framework for NOAA IOCM.
- Refined list of completed, ongoing and future actions necessary to fulfill the NOAA IOCM vision within five years.
- Proposed process, including associated program/office commitments, for implementation of near-term actions required to support the NOAA IOCM vision.

Day 1

8:30 – 10:10am	Welcome – Roger Parsons
	Agenda Review – Facilitators
	Opening Remarks – Bill Corso, Deputy Assistant Administrator, NOS
	IWG-OCM Co-Chair Remarks Jeff Lillycrop, U.S. Army Corps of Engineers John W. Haines, U.S. Geological Survey
	Review of IOCM Progress – Roger Parsons
10:10 – 10:25am	BREAK
10:25am – 12:00pm	NOAA IOCM Success Stories: The Digital Coast – Miki Schmidt, CSC NC Coastal Mapping Project and Hydropalooza – Chris Parrish, NGS <i>Objective: Create a better understanding of ocean and coastal mapping activities across NOAA so that NOAA programs can better coordinate.</i>
	NOAA IOCM Proposed Vision and Business Framework – Roger Parsons <i>Objective: Gather input on and build support for a proposed vision and business framework for NOAA IOCM.</i>
12:00 – 1:00pm	LUNCH (Pre-ordered box lunches)
1:00 – 3:00pm	The Way Forward for NOAA IOCM: Breakout Session 1 - COORDINATION <i>Objective: Review recommended actions from the 2005 NOAA IOCM workshop, identify new actions required to fulfill the IOCM vision and fully implement IOCM</i>

	<p><i>throughout NOAA within five years.</i></p> <p>*Please see the “Breakout Group Assignments” sheet in your participant folder for your assignment.</p>
3:00 – 3:45pm	Report Outs
3:45 – 4:00pm	BREAK
4:00 – 5:00pm	<p>NOAA Ship and Sensor Update – Captain Guy Noll, OMAO</p> <p>NOAA Aircraft and Sensor Update – Mike Aslaksen, NGS</p> <p><i>Objective: Create a better understanding of ocean and coastal mapping activities across NOAA so that NOAA programs can better coordinate.</i></p>
	Summary and Adjourn – Roger Parsons and Facilitators

Day 2

	Day 2 Agenda Review – Facilitators
8:30 – 9:30am	<p>Opening Remarks – Captain Steve Barnum, C&T Goal Team Lead</p> <p>– Kristen Koch, Deputy EGT Lead</p>
	<p>The Need to Account for the Effects of Spatiotemporal Sea Surface Fluctuations on Data Acquired by Hull-Mounted Sonar Systems</p> <p>– Steve Gill, CO-OPS</p> <p><i>Objective: Create better understanding of ocean and coastal mapping activities across NOAA so that NOAA programs can better coordinate.</i></p>
9:30 – 11:00am	<p>Breakout Session 2 – The Way Forward for NOAA IOCM</p> <p>DATA STANDARDS & DATA MANAGEMENT, or</p> <p>TRAINING & EDUCATION</p> <p><i>Objective: Review recommended actions from the 2005 NOAA IOCM workshop, identify new actions required to fulfill the IOCM vision and fully implement IOCM throughout NOAA within five years.</i></p> <p>*Please see the “Breakout Group Assignments” sheet in your participant folder for your assignment.</p>
11:00 – 11:15am	BREAK
11:15 – 12:00pm	Report Outs
12:00 – 1:00pm	LUNCH (Pre-ordered box lunches available)
1:00 – 2:30pm	<p>Breakout Session 3 – The Way Forward for NOAA IOCM:</p> <p>TECHNOLOGY DEVELOPMENT & ENHANCEMENT, or</p> <p>OUTREACH, COMMUNICATIONS & MESSAGING</p> <p><i>Objective: Review recommended actions from the 2005 NOAA IOCM workshop, identify new actions required to fulfill the IOCM vision and fully implement IOCM throughout NOAA within five years.</i></p> <p>*Please see the “Breakout Group Assignments” sheet in your participant folder for your assignment.</p>
	Report Outs
2:30 – 3:15pm	Report Outs
3:15 – 3:45pm	Where do we go from here? – Roger Parsons
3:45 – 4:00pm	Wrap Up & Adjourn – Facilitators

Appendix B: Workshop Participant List

NOAA IOCM Workshop

Participant List

March 18 – 19, 2009

Silver Spring, MD

<i>Participant</i>	<i>Office/Program</i>	<i>Contact Info</i>
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Curt Whitmire	<i>NMFS/NW Fisheries Science Center Fishery Resource Analysis & Monitoring Division</i>	Curt.Whitmire@noaa.gov
Robby Wilson	<i>NOS/Special Projects Integrated Planning & Technical Services Branch</i>	Robert.Wilson@noaa.gov
Mary Yoklavich	<i>NMFS/SW Fisheries Science Center Fisheries Ecology Division</i>	Mary.Yoklavich@noaa.gov

Guest Speakers

Bill Corso

Deputy Assistant Administrator, NOS

Steve Barnum

Commerce & Transportation Goal Team Lead

Kristen Koch

Ecosystem Goal Team Deputy Lead

Steve Gill

Center for Operational Oceanographic Products and Services

Jeff Lillycrop

Co-chair, IWG-OCM/U.S. Army Corps of Engineers

John Haines

Co-chair, IWG-OCM/U.S. Geological Survey

Facilitators – NOS Special Projects

Alison Hammer

Stephanie Kavanaugh

Tonya Kane

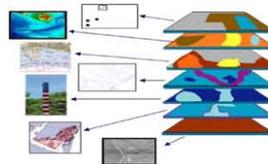
Chris David

Appendix C: 2009 IOCM Concept Handout

NOAA Integrated Ocean and Coastal Mapping (IOCM)

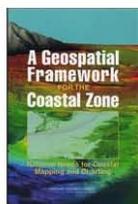
Map Once, Use Many Times

The National Oceanic and Atmospheric Administration (NOAA) conducts a variety of mapping, charting, and geospatial activities to support a wide range of diverse needs including safe navigation, ocean exploration, coastal and ocean living resource management, hazard preparedness, response and mitigation, and habitat assessment. NOAA programs also use mapping data to support tsunami modeling, storm surge planning, coastal erosion, habitat restoration, offshore renewable energy interests, climate change adaptation and storm surge modeling. Numerous Federal, state, and private-sector decision-makers rely on coastal, nearshore, and seafloor mapping data and products, and the uses and requirements for these data are growing exponentially.



As mapping requirements and applications have grown, we have become increasingly aware of the need to better coordinate mapping efforts to increase efficiency, maximize NOAA resources devoted to mapping, and take full advantage of new technologies. In addition, NOAA recognizes that it is important to coordinate mapping in the coastal and marine environment with other federal and non-federal entities. NOAA is one of the Federal agencies leading an initiative called Integrated Ocean and Coastal Mapping (IOCM). IOCM is the practice of acquiring, managing, integrating and disseminating ocean and coastal geospatial mapping data in such a manner that permits these data and their derivative products to be easily accessed and used by and for the greatest range of users and purposes. IOCM requires intra- and inter-agency coordination with a focus on streamlining operations, reducing redundancies, improving efficiencies, developing common standards, and stimulating innovation and technological development.

IOCM is an important objective for NOAA and includes all current and prospective NOAA program interests in mapping of coastal, ocean, benthic, and water-column attributes. The mapping of these attributes -- including but not limited to bathymetry, topography, biota, seafloor characterization, land cover, shoreline, geology and cadastre -- is required in the Great Lakes and coastal state waters, the territorial sea, the exclusive economic zone and the continental shelf and extends as far inland as necessary. Coordinating mapping efforts, leveraging resources, and facilitating the dissemination of mapping products aids NOAA in meeting its mission requirements and supports the public good with information critical for safe maritime transportation and for understanding and wisely managing marine resources.



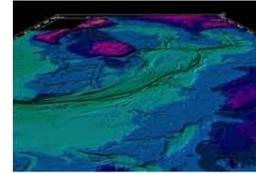
IOCM has been recommended by the National Academies of Science report, *A Geospatial Framework for the Coastal Zone – National Needs for Coastal Mapping and Charting*, the U.S. Commission on Ocean Policy, and NOAA's Federal Advisory Committee - the Hydrographic Services Review Panel. The *U.S. Ocean Action Plan* directed federal agencies to begin implementing IOCM.

IOCM success stories include—

The **California Seafloor Mapping Project** is an ideal example of a collaborative and integrated approach to seafloor mapping. Over the next two years the State of California, in partnership with the U.S. Geological Survey and NOAA's Ocean, Fisheries and Satellite Services, and in support of the West Coast Governors' Agreement on Ocean Health, will be acquiring high-resolution bathymetry, acoustic

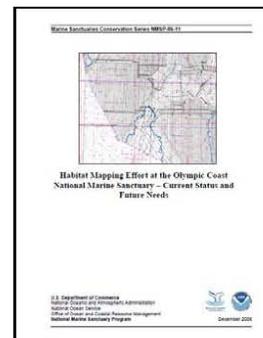
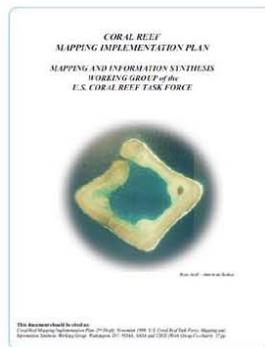
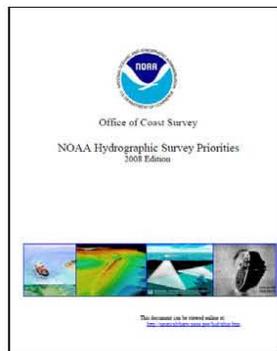
backscatter and biological and geological ground-truth data in coastal waters out to 3 nautical miles. These data, acquired to internationally-accepted standards using the most modern technologies, will be used to support the designation and monitoring of marine protected areas, manage marine fisheries, improve coastal circulation models, assess earthquake and tsunami hazards and update nautical charts.

The **Digital Coast** is envisioned as an information delivery system that will efficiently serve not only data, but also the training, tools, and examples needed to turn data into useful information. In this way, Digital Coast is designed to play a pivotal role in ensuring the wise use and management of coastal resources. NOAA's Coastal Services Center launched the site in 2008 and continues to lead the Digital Coast effort. While phase one focused on content provided by the NOAA Coastal Services Center, subsequent phases are adding content from other sources. These sources include NOAA, as well as other federal organizations, state and local governments, and the private and nonprofit sectors.



The **North Carolina Coastal Mapping Project**, a coordinated effort between NOAA's Ocean Service, U.S. Army Corps of Engineers, numerous NC State agencies, and university and private-sector partners, acquired more than 22,000 tide-coordinated color and near-infrared digital aerial images and airborne LIDAR data between Cape Henry, VA, and Ocracoke Island, NC. Geospatial data products generated as a result of this project include coastal orthophotos (aerial photos that have been geometrically corrected such that they have constant scale and can be used as planimetric maps) and LIDAR point cloud data in addition to National Geodetic Survey conventional shoreline products. All of these products have been disseminated by NOAA via a web portal which is accessible through an IOCM project website and the Geospatial One-Stop web portal.

Although NOAA is a leader in IOCM, it does not operate alone. The Joint Subcommittee on Ocean Science and Technology established the **Interagency Working Group on Ocean and Coastal Mapping (IWG-OCM)** in 2006 in response to findings of the U.S. Commission on Ocean Policy and the recommendations contained in the *US. Ocean Action Plan*. This federal interagency group seeks to avoid duplication of mapping efforts and facilitate the coordination and leveraging of mapping resources across the Federal sector and with State, industry, academic and non-governmental mapping interests.



Appendix D: IOCM One-Pager Handout

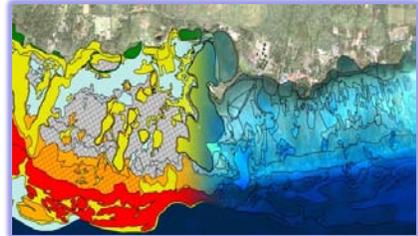
NOAA Integrated Ocean and Coastal Mapping

Map Once, Use Many Times

What is Integrated Ocean and Coastal Mapping (IOCM)?

IOCM is the practice of acquiring, managing, integrating and disseminating ocean and coastal geospatial mapping data in such a manner that permits these data and their derivative products to be easily accessed and used by and for the greatest range of users and purposes.

IOCM requires intra- and inter-agency coordination with a focus on streamlining operations, reducing redundancies, improving efficiencies, facilitating collaboration, developing common standards, and stimulating innovation and technological development.

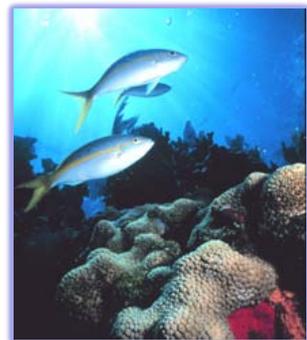
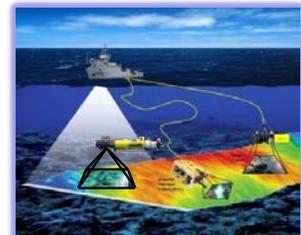


The NOAA IOCM Vision – Map Once, Use Many Times

NOAA is the national leader in providing the ocean and coastal mapping products and services required to understand and predict changes in the earth's coastal and oceanic environment and to manage ocean and coastal resources to meet the Nation's economic, social, security and environmental needs.

The Vision: Over the next five years, NOAA will establish a comprehensive NOAA IOCM program that supports fully coordinated data acquisition and management efforts both within NOAA and with other agencies. This vision requires a commitment to:

- acquiring quality data that meets the greatest range of user requirements;
- coordinating mapping activities across NOAA and with Federal, State; regional, academic and private-sector mapping interests;
- providing unrivaled data analysis, management, integration and access;
- developing metadata that supports authoritative long-term archives;
- developing products and tools required to support decision-makers;
- forging new partnerships;
- using cutting-edge technologies;
- advancing mapping science and contributing to research and technology development;
- fostering technology transfer;
- preparing current and future members of the ocean and coastal mapping community; and,
- energizing outreach efforts.



For more information, contact:

Roger Parsons
NOAA IOCM Coordinator
Roger.L.Parsons@noaa.gov



*Coordination
Consolidated Requirements
Multi-use Data
Product Development*

Appendix E: IOCM Coordination Team Terms of Reference Draft

NOAA Ocean Council
Integrated Ocean and Coastal Mapping Coordination Team
Terms of Reference
DRAFT

Purpose:

The NOAA Ocean Council (NOC) was established as the principal advisory body to the Administrator and focal point for the agency's ocean activities and interests, including open-ocean, near-shore, coastal, estuarine and Great Lakes activities. The NOC's purpose and Terms of Reference were approved and published on June 29, 2004. The body has met actively and regularly since that date.

Specific purposes of the Council are varied but include serving as a cross-line advisory committee on the management of ocean programs and activities within NOAA and with external partners. Accordingly, the NOC established an Integrated Ocean and Coastal Mapping Coordination Team (IOCMCT) to promote an integrated approach to NOAA ocean and coastal mapping, to facilitate communications and coordination within NOAA's diverse ocean and coastal mapping community and to develop NOAA IOCM-related policies for review and endorsement by the NOC.

Membership: Open to representatives from all NOC Principal organizations and representatives, and NOC Participating and Advisory bodies with a vested interest in Integrated Ocean and Coastal Mapping.

A Chair or Co-chairs of the IOCMCT will be selected by the NOC to convene and conduct the business of the coordination team.

Executive Secretariat:

The sponsoring organization of the Chair or Co-Chairs of the IOCMCT will be responsible for providing and appointing an Executive Secretariat.

Roles and Responsibilities:

The roles and responsibilities of the IOCMCT will include, but are not limited to:

- Developing IOCM-related policies for review by or as requested by the NOC.
- Providing a forum for keeping the NOAA mapping community abreast of planned and ongoing NOAA and other Federal, State and NGO ocean and coastal data acquisition activities.
- Identifying prospective opportunities to leverage mapping resources, capabilities and capacities and developing in-house and external collaborations.
- Providing a forum for educating NOAA's diverse mapping community on important aspects of ocean and coastal geospatial data acquisition and management, including minimum mapping standards/requirements, to ensure the widest use of these mapping data.

- Identifying needed investments in NOAA's ocean and coastal mapping infrastructure and working with NOAA's Goal Teams to ensure that these investments are addressed in the NOAA programming and budgeting process.
- Identifying existing and developing ocean and coastal mapping data management issues and developing solutions for resolving these issues.
- Providing updates on other NOAA and interagency teams, committees, working groups which are relevant to NOAA's ocean and coastal mapping efforts, including but not limited to:
 - JSOST Interagency Working Group on Ocean and Coastal Mapping
 - Line Office GIS Teams
 - NOS Remote Sensing Working Group
 - FGDC Subcommittees
- Identifying training and education opportunities relevant to the NOAA mapping community.
- Ensuring planning of mapping projects is conducted in a manner consistent with the objectives of ocean and coastal mapping coordination across NOAA.
- Communicating and coordinating NOAA's participation in meetings, conferences and symposia related to ocean and coastal mapping.

The Chair and/or Co-Chairs will:

- Convene and manage the business of the body in order to produce the work product desired by the NOC.
- Seek balanced participation and input from Principal member representatives, and the Participating and Advisory organizations as needed.
- Deliver work products to the NOC that are representative of the views of the IOCMCT members, seeking to develop a consensus view but reporting any and all minority opinions for consideration.

Decision Making Process:

Meetings will be held on an as needed basis.

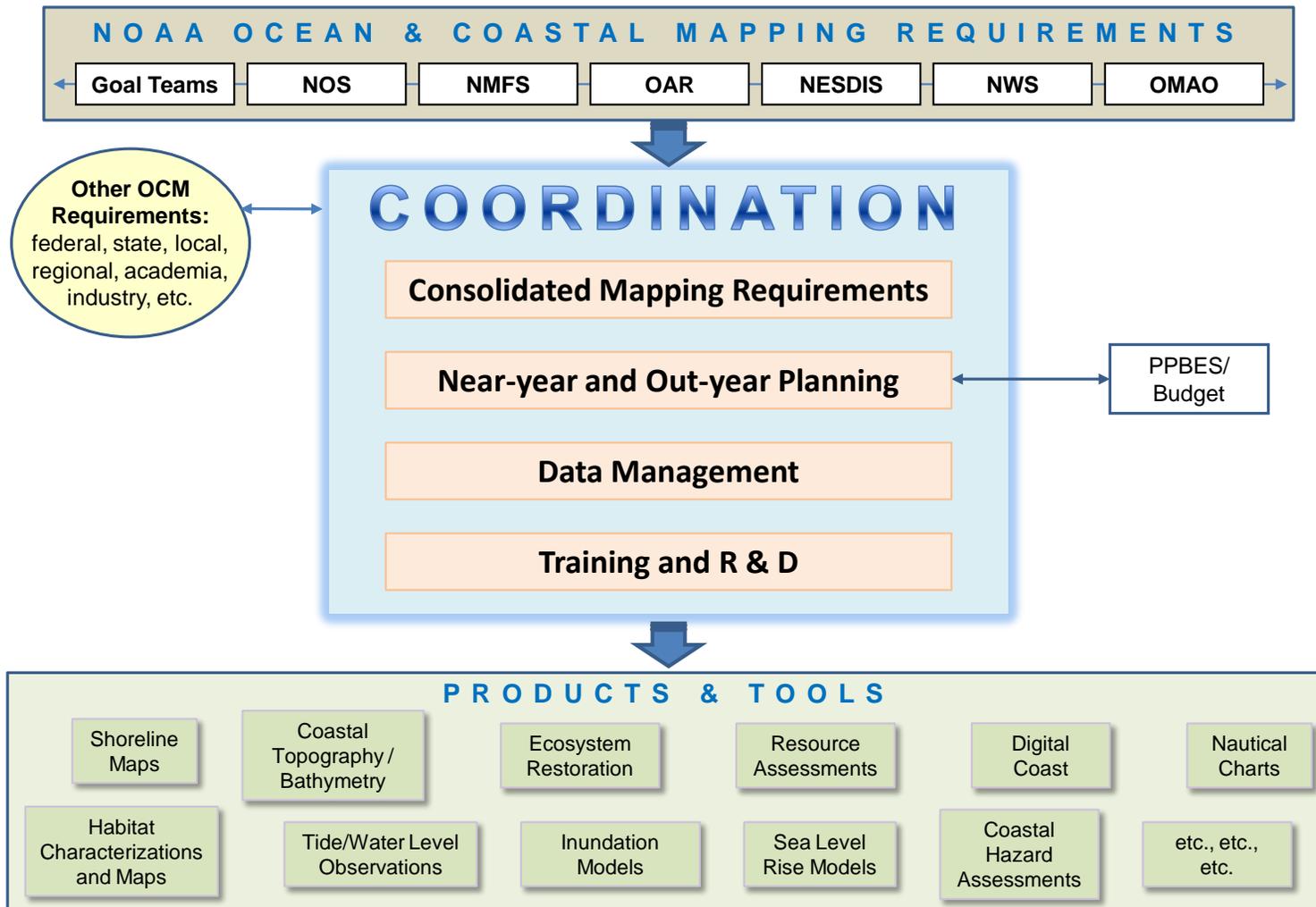
The body will develop and forward an agreed upon work product, including minority opinions when necessary. There is no authority for asserting a majority opinion (51%) of any element of the IOCMCT, recognizing the value of all opinions of NOC Principal organizations and representatives, and those of Participating and Advisory organizations and representatives as needed or appropriate.

***Integrated Ocean and coastal Mapping (IOCM) Coordination Team
Membership (4/1/09)***

- NOS - Office of Coast Survey – CDR Jim Crocker
- NOS - Center for Operational Oceanographic Products and Services – Peter Stone
- NOS - National Geodetic Survey – Chris Parrish
- NOS - Joint Hydrographic Center – Andy Armstrong
- NOS - National Centers for Coastal and Ocean Science – Tim Battista
- NOS - Office of National Marine Sanctuaries - Mitchell Tartt and Steve Rohmann
- NOS - Office of Ocean and Coastal Resource Management and Coral Reef Conservation Program – Nina Garfield and Mimi D'orio (Marie Bundy, alt.)
- NOS - Office of Response and Restoration and Marine Debris - George Graettinger
- NOS - IOOS Program Office - Gabrielle Canonico
- NOS - Coastal Services Center – Miki Schmidt (Tony Lavoie, alt.)
- NOS – Special Projects Office – Robby Wilson
- NMFS - Office of Science and Technology – Steve Brown
- NMFS - Office of Habitat Conservation – Dan Farrow
 - o Chesapeake Bay Office - Steve Giordano
- OAR - Office of Ocean Exploration and Research – John McDouough
- OAR - Climate Program Office – Sid Thurston
- NESDIS - National Geophysical Data Center and Tsunami Program – David Fischman
- NESDIS - National Coastal Data Development Center – Julie Bosch
- NMAO - Office of Marine and Aviation Operations – CAPT Guy Noll
- NOAA IOCM Coordinator and Team Chair – Roger Parsons

Appendix F: IOCM Vision Diagram

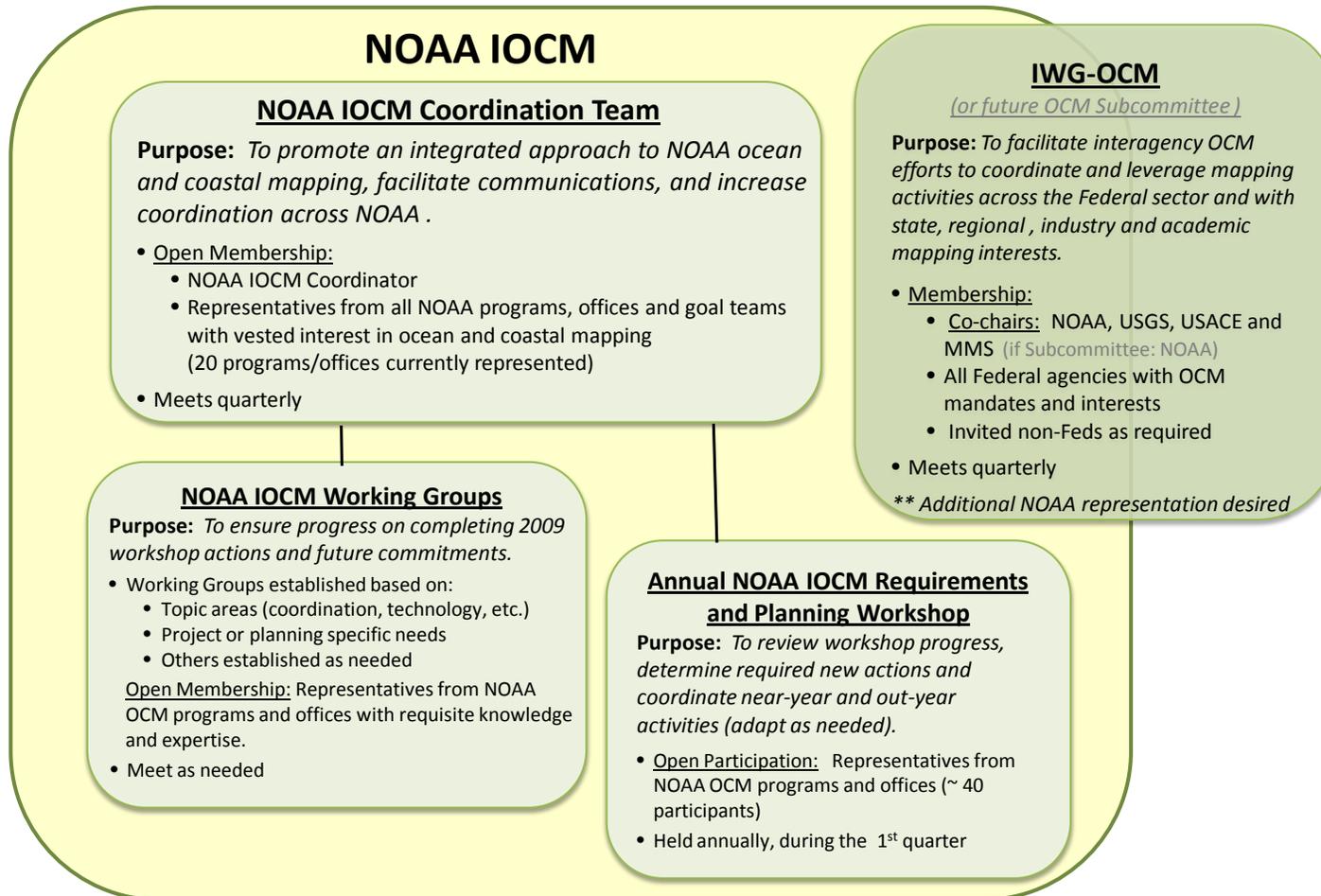
NOAA IOCM Vision: Map Once, Use Many Times



Appendix G: IOCM Business Framework Diagram

2009 NOAA IOCM Business Framework

DRAFT, March 2009



Appendix H: Comprehensive Discussion Notes from Coordination Breakout Groups

Worksheet A – COORDINATION ACTIONS

Breakout Group Facilitator: Alison Hammer

2005 Workshop Actions	Status	Priority
<p style="text-align: right;">I = Immediate = Less than 1 year ST = Short-term = 1-3 years LT = Long-term = 3-5 years</p>		
<p>1. Establish a NOAA IOCM Coordination Team – ensure effective representation and make-up. Publicize team and purpose.</p>	<ul style="list-style-type: none"> - Established but not yet tasked to address specific issues. - NOS remote sensing team has been created and is operational, meets 4x/year. Mike Aslasken, NGS is lead. Has concept of operations and a Web site that CSC hosts. Might be IOCM model. 	<p>I</p>
<p>2. Develop stronger collaborations with other Federal/State/Regional mapping interests to address common needs (on-going)</p>	<p>Efforts underway to coordinate with other Federal agencies through IWG-OCM . Need to document current external NOAA mapping collaborations.</p>	<p>I – Feds ST - others</p>
<p>3. Engage with IOOS efforts to ensure coordination of requirements</p>	<ul style="list-style-type: none"> - IOOS Program now exists (clarify how they relate to IOCM, subset?). - IOOS contact on IOCM coordination team. - GOS exists. 	<p>I</p>
<p>4. Identify what areas have been mapped, to what standards and resolutions and using which sensors (on-going, continuous effort). Prioritize areas remaining to be mapped including required mapping parameters, resolutions, etc. (Note: Sentence moved below as a separate action combined with 5a-d below)</p>	<p>NGDC on-line tools can identify availability of seafloor mapping data and other archived geophysical data. Standards, resolutions, etc. are metadata-dependent. Availability of other specific mapping data needs to be documented.</p>	<p>LT</p>

2005 Workshop Actions	Status	Priority
<p>5. Identify and prioritize OCM requirements. Build for change and update annually. Prioritize areas remaining to be mapped including required mapping parameters, resolutions, etc. <i>(Moved from action above and combined with 5a-d below).</i></p> <p>Identify and prioritize data requirements across NOAA and identify commonalities:</p> <ul style="list-style-type: none"> - Identify and prioritize seafloor mapping data requirements across NOAA. Determine what has been mapped and what is planned to be mapped. - Identify and prioritize shoreline/coastal mapping data requirements across NOAA and states. Identify temporal mapping requirements (e.g. how often). - Identify and prioritize other mapping data (e.g. water column) requirements and technical changes across NOAA. 		I
<p>Identify and prioritize data requirements across NOAA and identify commonalities:</p>		
<p>— Identify and prioritize seafloor mapping data requirements across NOAA</p>	<p>NMFS and OCS have established requirements. <i>Priorities have changed with climate change in the Bering Sea.</i></p>	
<p>— Identify and prioritize shoreline/coastal mapping data requirements across NOAA</p>	<p><i>NERRS will have a plan soon.</i></p>	
<p>— Identify and prioritize other mapping data (e.g. water column) requirements across NOAA</p>		
<p>6. Improve NOAA IOCM Communication and Coordination Tools. Develop database/mapping tools to support NOAA in-house Fleet, charter and contract survey coordination.</p>	<p>Ongoing IWG-OCM efforts to improve Geospatial One-Stop Marketplace features. Are more NOAA-specific tools required?</p>	I
<p>Suggested New Actions</p>		<p>Priority</p>
<p>7. Develop process for addressing Congressional bi-reporting requirements if OCM Integration Bill is enacted.</p>		ST
<p>8. Schedule annual NOAA mapping coordination meetings (when?). Regional meetings?</p>		ST
<p>9. Schedule annual Federal mapping coordination meetings via IWG-OCM and include state and regional mapping interests</p>		ST
<p><i>(Relates to above action 1):</i> Staff NOAA IOCM coordination team and list names on associated new IOCM Web site.</p> <ul style="list-style-type: none"> - In IOCM working groups, include NOAA Line Office IOCM working groups and diversify participants including those in regions. 		I
<p><i>(Relates to above action 2):</i> Communicate NOAA’s needs internally in NOAA. Establish a list of points of contact (automate if possible)</p>		I

Suggested New Actions	Priority
(Relates to above action 3): Nest IOCM subcommittee in each IOOS region and elevate IOCM to a committee level (use IOOS charter as a model).	I
(Relates to above action 5): Define NOAA mapping requirements and communicate broadly. Develop a common approach to plan NOAA data requirements better in the future. Post on new NOAA IOCM Web site. <ul style="list-style-type: none"> - Use a template for standard requirements. - Develop a matrix of mapping needs to look for linkages/coordination opportunities. Put on IOCM Web site. - Develop a Web tool to crosswalk needs with requirements and include emerging technology changes. 	I
(Relates to above actions 1 and 6): Develop NOAA IOCM Web sites (internal and external sites). Keep content up-to-date. <ul style="list-style-type: none"> - Create a template to gather NOAA requirements from each office/program. - Eventually put into a GIS to identify spatial overlap. (CSC or SP?) - Advertise new technologies in NOAA better. 	I
(Relates to above action 6): Develop Ship Coordination Schedule (OMAO) <ul style="list-style-type: none"> - Re-invigorate the on-line NOAA Fleet Allocation Tool to request ship time. - Develop process for NOAA primary investigators to list projects that will occur in a fiscal year and make accessible to NOAA mapping community to help identify piggyback opportunities. - Provide ship schedule information to program offices earlier to improve planning. - Raise awareness about projects and include a point of contact, broadcast on Web site. 	I
10. (Relates to above action 1.) Raise IOCM to Committee level in NOAA to improve visibility and accountability, maybe under the NOAA Observing Systems Council (NOSC).	ST

Worksheet Notes:

- 2005 Action 4 was broken into two; “prioritize areas remaining to be mapped...” was combined with action 5. Sub-components of action 5 (5a-5d) were lumped together under action 5.

Other Comments:

- Progress has been made since 2005. It takes time to integrate and build on a forward looking process.
- Eighty percent of the NOAA fleet allocation is fixed. Other vessels are also utilized to do mapping at NOAA including: contractors, states, universities, charter vessels (same time /each year) and small vessels.
- **Add to vision statement:** NOAA IOCM should be the place to go for geo-referenced information for one spot on earth from air to seafloor.

Worksheet B – IOCM COORDINATION ACTIONS

Breakout Group Facilitator: Alison Hammer

Immediate Actions	How to Accomplish?	Who is Responsible?
<p>1. Establish a NOAA IOCM Coordination Team – ensure effective representation and make-up. Publicize team and purpose.</p>	<ul style="list-style-type: none"> - Approve/validate framework. Use consensus. - Ensure representatives are appropriate and agree to be involved. Have time. - Engage IOOS. Define relationship. - Include NOAA line office teams and themes in NOAA IOCM working group structure. - Elevate IOCM to a sub-committee level in NOSC. 	<ul style="list-style-type: none"> - IOCM Coordinator (Roger Parsons). - Leads of the NOAA IOCM working groups. - NOAA leadership.
<p>6. Improve NOAA IOCM Communication and Coordination Tools. Develop database/mapping tools to support NOAA in-house Fleet, charter and contract survey coordination.</p>	<ul style="list-style-type: none"> - Develop NOAA IOCM Web sites (internal and external sites). Keep content up-to-date. - Eventually put into a GIS to identify spatial overlap. - Identify needs. - Develop Ship Coordination Schedule (OMAO). - Re-invigorate the on-line NOAA Fleet Allocation Tool to request ship time. - Develop process for NOAA primary investigators to list projects that will occur in a fiscal year and make accessible to NOAA mapping community to help identify piggyback opportunities. - Provide ship schedule information to program offices earlier to improve planning. Fleet, platforms, and technology allocation. - Raise awareness about projects and include a point of contact, broadcast on Web site. 	<ul style="list-style-type: none"> - OMAO for fleet information. - All NOAA IOCM reps. would be responsible to keep content up-to-date. - Dedicated Web master (NOS, CSC has potential).
<p>5. Identify and prioritize NOAA Ocean and Coastal Mapping (OCM) requirements. Prioritize areas remaining to be mapped including required mapping parameters, resolutions, etc.</p>	<ul style="list-style-type: none"> - Define NOAA mapping requirements and communicate broadly. - Build for change and update annually. - Create and use a template to gather NOAA requirements from each office/program. - Develop a common approach to plan NOAA data requirements better in the future. - Post on new NOAA IOCM Web site. - Develop a matrix of mapping needs to look for linkages/coordination opportunities. - Develop a Web tool to crosswalk needs with requirements and include emerging technology changes. 	<ul style="list-style-type: none"> - All NOAA IOCM reps. - Leads of working groups.

Worksheet A – COORDINATION ACTIONS

Breakout Group Facilitator: Stephanie Kavanaugh

2005 Workshop Actions	Status	Priority
<p>I = Immediate = Less than 1 year ST = Short-term = 1-3 years LT = Long-term = 3-5 years</p>		
<p>Establish a NOAA IOCM Coordination Team <i>that meets quarterly. Formalize IOCM Coordination Team (validate roles) and establish Communications & Coordination Subcommittee or Workgroup.</i></p> <ul style="list-style-type: none"> • Identify best communication practices • Consider impediments to communication/coordination • Consider annual meeting • Consider regional engagement • Develop coordination mechanisms (consider PPBES process) • Gather information on priorities, plans & requirements from programs 	<p>Established but not yet tasked to address specific issues.</p>	<p>I – 1st priority</p>
<p>Develop stronger collaborations with other Federal/State/Regional mapping interests to address common needs</p>	<p>Efforts underway to coordinate with other Federal agencies through IWG-OCM . Need to document current external NOAA mapping collaborations.</p>	<p>ongoing</p>
<p>Engage with IOOS <i>and others efforts</i> to ensure coordination of requirements, <i>data management efforts, communications and lessons learned. IOOS should participate on the IOCM Coordination team.</i></p>	<p><i>Currently minimal, but IOOS is eager to coordinate.</i></p>	<p>I</p>
<p>Identify what areas have been mapped, to what standards and resolutions and using which sensors. Prioritize areas remaining to be mapped including required mapping parameters, resolutions, etc.</p>	<p>NGDC on-line tools can identify availability of seafloor mapping data and other archived geophysical data. Standards, resolutions, etc. are metadata-dependent. Availability of other specific mapping data needs to be documented.</p>	<p>I</p>
<p><i>Programs should</i> Identify and prioritize data requirements across NOAA and identify commonalities: <i>Need a process, tool or product to coordinate – each program should create a requirements document.</i></p>	<p><i>A number of NOAA programs currently have mapping plans, but not requirements, including: NMSP, Coral (including deep), Hydrographic Surveys Priority Plans, NGS – hydro surveys, and OOE.</i></p>	<p>I</p>
<p>Identify and prioritize seafloor <i>and habitat (physical and biological)</i> mapping data requirements across NOAA</p>		<p>I</p>

2005 Workshop Actions	Status	Priority
Identify and prioritize shoreline/coastal mapping data requirements across NOAA, e.g. coastal watersheds to the extent that NOAA has requirements.		I
Identify and prioritize other mapping data (e.g. water column, including biological data) requirements across NOAA		I
Develop database/mapping tools to support NOAA in-house Fleet, charter and contract survey coordination	Ongoing IWG-OCM efforts to improve Geospatial One-Stop Marketplace features. Are more NOAA-specific tools required?	
Suggested New Actions		Priority
Establish a communications process for coordinating activities.		I – 2 nd priority
Schedule annual NOAA mapping coordination meetings (when?). Regional meetings? Explore a regional approach to mapping coordination. (Tap 11 regional IOOS teams?) NOAA Regional Coordinators need to be updated and engaged on all IOCM activities. Develop a mechanism/process for coordinating (in-house, via contracts) survey and acquisition planning across NOAA programs and externally. This includes engaging the fleet and aircraft allocation process.		ST – 3 rd priority
Develop process for addressing Congressional reporting requirements if OCM Integration Bill is enacted		ST/TBD
Schedule annual Federal mapping coordination meetings via IWG-OCM and include state and regional mapping interests		ST/LT
Include atmospheric data in this effort		LT
Identify impediments to coordination.		

This group did not complete **Worksheet B – IOCM COORDINATION ACTIONS**.

Worksheet A – COORDINATION ACTIONS

Breakout Group Facilitator: Tonya Kane

2005 Workshop Actions	Status	Priority
I = Immediate = Less than 1 year ST = Short-term = 1-2 years LT = Long-term = 3-5 years		
Establish a NOAA IOCM Coordination Team including technical working groups (who should be on this? What is their role? Should other non-NOAA groups be represented?)	Established but not yet tasked to address specific issues. Not yet functional – on paper only.	Immediate
Develop stronger collaborations with other Federal/State/Regional mapping interests to address common needs. Extend to other agencies and outside of NOAA, USGS, ACOE. Extend to Universities, NGOs and others who do coordination already – get buy-in to IOCM. Need a way to view projects in NOAA. Start early – lead time based on fleet plans?	Efforts underway to coordinate with other Federal agencies through IWG-OCM. Need to document current external NOAA mapping collaborations. Fleet management does this – quarterly check-ins and other meetings.	
Engage with IOOS efforts to ensure coordination of requirements Align IOOS and IOCM missions? IOCM could play greater role in establishing IOOS foundations.	IOOS: having data management conversations independent of IOCM - they have a real-time data focus. Regional IOOS Associations are established – might want more IOCM involvement (ex: Gulf of Maine projects)	
Identify what areas have been mapped, to what standards and resolutions and using which sensors. Need: <ul style="list-style-type: none"> • Better release of data (ex: proprietary data). • Faster speed for data to reach NGDC. 	NGDC on-line tools can identify availability of seafloor mapping data and other archived geophysical data. Standards, resolutions, etc. are metadata-dependent. Availability of other specific mapping data needs to be documented. NGDC is planning to consolidate web sites so resources are centralized.	
(We separated this from Action above.) Prioritize areas remaining to be mapped including required mapping parameters, resolutions, etc.	Should be up to the individual programs – not important for IOCM right now.	

2005 Workshop Actions	Status	Priority
<p>Identify and prioritize data requirements across NOAA and other agencies and identify commonalities: Some felt “identify” should be main focus and “prioritize” was less important for now. We talked about all three actions below (moved from separate rows) as a whole within this main heading.</p> <ul style="list-style-type: none"> • Identify and prioritize seafloor mapping data requirements across NOAA • Identify and prioritize shoreline/coastal mapping data requirements across NOAA • Identify and prioritize other mapping data (e.g. water column) requirements across NOAA <p>IOCM should be aware of ALL activities – need to know where individual groups’ priorities overlap and to help set overall priorities.</p>	<p>NMFS and OCS have established requirements. NMFS – a book and CD of info for 2-3yrs out (but was done a while ago; probably needs updating) OCS – hydrographic survey priorities document with long term plans</p>	<p>Immediate, especially to identify all requirements.</p>
<p>Develop database/mapping tools to support NOAA in-house Fleet, charter and contract survey coordination. Then get coordinated with other Federal agencies, but NOAA IOCM needs to get organized first → IOCM could develop tools and market for use to other agencies.</p>	<p>Ongoing IWG-OCM efforts to improve Geospatial One-Stop Marketplace features. Are more NOAA-specific tools required?</p>	

Suggested New Actions	Priority
<p>Develop process for addressing Congressional reporting requirements if OCM Integration Bill is enacted YES. And implement this process.</p>	
<p>Schedule annual NOAA mapping coordination meetings (when?). Should consider Budgets when planning meetings. 2 meetings (2nd and 4th quarters) and 1 big Annual Meeting (maybe one of the 2 meetings could be the annual mtg.) Regional meetings? Use existing regional meetings and have IOCM sessions at other established meetings (This needs an Outreach plan!)</p>	
<p>Schedule annual Federal mapping coordination meetings via IWG-OCM and include state and regional mapping interests. Yes – One per year. Will be very helpful to IWG</p>	

Suggested New Actions	Priority
<p>Determine IOCM Audience – who are we doing this for?</p> <ol style="list-style-type: none"> Ourselves (NOAA) USGS, Army Corps, etc. <p>What services can IOCM provide? Determine, then develop, plans for these.</p> <ul style="list-style-type: none"> Technical help and training Data processing and equipment 	Immediate
Establish relationships with GEOSS and GOOS via a relationship with IOOS?	
<p>Develop a plan and process to start metadata at the beginning and have a defined path to reach NOAA/NGDC. And to track all project info. Start metadata planning at initial planning stage and make sure it gets to the Archive.</p> <p>This exists, but there are too many paths and they are not all being followed. Need to consolidate the processes, make more consistent, and make sure everyone is informed of the process and follows through on it.</p>	Immediate
<p>Define metrics of success for IOCM.</p> <p>Identify other pilot studies to show success/value of IOCM.</p>	Immediate
Develop dedicated IOCM capability – staff and resources.	

Worksheet B – IOCM COORDINATION ACTIONS

Breakout Group Facilitator: Tonya Kane

Immediate Actions	How to Accomplish?	Who is Responsible?
Establish IOCM coordination team and workgroups	<ul style="list-style-type: none"> Establish goals and objectives, develop a plan and framework. Create a Charter. Define the audience. Establish progress metrics. Start with a pilot project (smaller scale coordination challenge that might be a current or ongoing project) to develop a coordination plan based on a tangible challenge in order to work out the methods of how to achieve coordination, then scale up. Consider making IOCM a Matrix program. 	<p>The whole IOCM team (people at this meeting).</p> <p>Need dedication – formal buy-in from the AAs. Jack is on-board, get commitment from all leadership.</p> <p>** IOCM should be done with or without funding.</p>

Immediate Actions	How to Accomplish?	Who is Responsible?
Identify data requirements and prioritize.	<p>Develop a tool to track ALL projects. (The technology to develop the tool is easy, but gathering all the info is hard.)</p> <p>Need a way to find out what other people are doing – Where are they? What are their projects? Who should I talk to?</p>	TBD
Develop a plan and process to track data.	Consolidate the multiple paths that currently exist. Standardize the process and get everyone to do it.	TBD

Other questions or comments that came up:

- How does historical data fit in?
- Should IOCM be tasked with data collection? – No
- Is there an IOCM Charter? – this should be an outcome of this meeting

Appendix I: Comprehensive Discussion Notes from Data Standards and Management Breakout Groups

Worksheet A – DATA STANDARDS & MANAGEMENT ACTIONS

Breakout Group Facilitator: Alison Hammer

2005 Workshop Actions	Status	Priority
I = Immediate = Less than 1 year ST = Short-term = 1-3 years LT = Long-term = 3-5 years		
1. Identify what standards are being used and establish minimum seafloor, shoreline/coastal, and other data acquisition and metadata standards to ensure greatest level of data interoperability and widest use of data.	<ul style="list-style-type: none"> - Limited efforts have taken place to develop seafloor and coastal Lidar mapping standards but there is much that remains to be done. - Adopt IHO standards except coverage requirements) – starting up. 	ST
2. Document current program-specific data needs. and data acquisition standards	Program Office specific actions have started.	ST
3. Develop process for ensuring standards compliance	<ul style="list-style-type: none"> - Program Office specific actions have occurred, but are very fragmented. - Federal processes are in place (GOS, IWG, etc.) 	ST
4. Provide guidance to mapping programs that addresses requirements and processes for archiving mapping data to NOAA data centers.	<ul style="list-style-type: none"> - Program office specific actions are occurring. NGDC has an archiving working group. - 1 year archiving requirement by OMB and NOAA exists, but is not enforced. 	I
1a. Establish and document data acquisition protocols and platform-specific sensor for in-situ operations specifically software and hardware CONOPS (e.g. field procedures manual, standard operating procedure (SOP), Scope of Work (SOW), and techy guidelines)		- (see 1)

2005 Workshop Actions	Status	Priority
<p>5. Establish minimum metadata standards and lifecycle management process (e.g. planning through archiving process).</p>	<ul style="list-style-type: none"> - Metadata issues being continuously addressed by numerous NOAA data committees and IWG-OCM Mapping Inventory Team, but much remains to be done. NOS metadata policy established. - Project specific actions have occurred (e.g. coral program has CoRIS). - IOOS program has a metadata working group (Julie B.) - IWG has IOCM minimum FGDC metadata guidelines sections 1, 6, 7) 	<p>I</p>
<p>1b. Engage NOAA data Management Committee, IOOS Data Management and Communication (DMAC), FGDC, etc.</p>	<p>More engagement required</p>	<p>- (see 1)</p>
<p>6. Establish standard schemas for higher-level, nationwide classifications (substrate type, surficial geology, etc.). Continuous process.</p>	<p>€€ NOAA (NMFS, NOS) has led effort to develop and promote the Coastal and Marine Ecological Classification Standard (CMECS) has been put forward to FGDC process, but still needs NOAA review and revisions. Are more efforts required?</p>	<p>LT</p>
<p>7. Establish centralized data processing centers (e.g. Boulder lab) to ensure data quality and consistency. Relates to legislation.</p>		<p>LT</p>

2005 Workshop Actions	Status	Priority
8. Staff an IOCM data processing center to take data from other places to create products, data fusion. Broader scope, not NOAA only. Create relationships with university.	<ul style="list-style-type: none"> - Addressed in PPBES but unfunded to date. - Facility built at JHC. Andy Armstrong, UNH Center building exists, needs staff. - Habitat mapping center in HI (NMFS Coral Program). Probably more out there. 	I

Worksheet Notes:

- Action 1, deleted metadata because it is already captured in action 6, establish minimum metadata standards.
- Action 5 became 1a.
- Action 7 became 1b.
- Other actions were renumbered accordingly.
- First new action has been combined with metadata (new action 5)
- Moved new actions 9 & 10 to coordination category and listed priority for both to be immediate

	Suggested New Actions	Priority
5.	Revisit FGDC standards applicable to NOAA mapping requirements and determine whether any need updating. Are other FGDC standards required? Coordinate with other Federal mapping agencies. (links to metadata, action 5 above) . Almost done, happening externally. OMB-FGDC document is coming out soon.	ST
9.	Develop a process for identifying which planned non-navigation seafloor surveys might be of interest to NOAA's nautical charting efforts and thus may require tide control support. Currently being done informally. Is really NOS-OCS' responsibility, not IOCM data standard. [Move to coordination category as an I]	-
10.	Establish which non-navigation seafloor mapping programs can benefit from accounting for the effects of spatiotemporal sea surface fluctuations. Linkages to tides. [Move to coordination category as an I]	-
11.	How do we Ensure that data acquired by NOAA becomes publicly available in a timely fashion. Developing tracking mechanisms. Determine What are the data stewardship responsibilities of the PIs, NMAO, NOAA Data Centers (NGDC, NODC, NCDC) and others. Relates to Web services and metadata.	ST
12.	Create an inventory of data centers (including biological data).	I
13.	Improve usability of data interfaces or centralize (e.g. NGDC hydro data).	ST

Suggested New Actions <i>(continued)</i>		Priority
14.	Determine IOCM data boundary (spatial-temporal definition) to understand what should be included and focus on ocean and coastal. Criteria has already been provided to Geospatial One-Stop (GOS).	I
15.	Revisit developing a NOAA fleet allocation system and tie it into NOAA IOCM (management action).	I

Worksheet B – IOCM DATA STANDARDS & MANAGEMENT ACTIONS

Breakout Group Facilitator: Alison Hammer

Immediate Actions	How to Accomplish?	Who is Responsible?
1. Identify what standards are being used and establish data acquisition standards to ensure greatest level of data interoperability and widest use of data.	<ul style="list-style-type: none"> - Develop matrix of data standards categorized by survey type/theme (e.g. nautical charting, coastal mapping for environmental applications, costal mapping for emergency response, etc.). Data acquisition, QA/QC. - Use model (Chris Parish, NGS) - Determine what is in place now and identify gaps. - Develop a strawman /template 	<ul style="list-style-type: none"> - NOAA IOCM data standards work group. - Chris Parish, NGS has an example model. - Tony LaVoi, CSC - OCS - Robby Wilson, NOS SP - NMFS
5. Establish minimum metadata standards and lifecycle management process (e.g. planning through archiving process).	<ul style="list-style-type: none"> - Evaluate IWG metadata strawman for NOAA. - Review feasibility of developing a NOAA IOCM databank in collaboration with Geospatial One-stop (GOS). - Share process with others. - Determine if there is a NOAA metadata team and coordinate with them. 	<ul style="list-style-type: none"> - NOAA reps to IWG metadata team will engage with NOAA Program Offices. - Establish a NOAA IOCM metadata working group. - Coordinate with IOOS and NOAA Program Offices.
12. and 8. Create an inventory of data centers and staff an IOCM data processing center.	<ul style="list-style-type: none"> - Use creative ways to staff the UNH center (details, NRAP assignments, LCDP, etc.) until there is money available to hire permanent staff. - Inventory existing and new data. - Outreach about the center and identify staffing needs. 	<ul style="list-style-type: none"> - NOAA Program Offices and leadership can donate FTEs or support details. - Hire summer interns to process data.

Worksheet A – DATA STANDARDS & MANAGEMENT ACTIONS

Breakout Group Facilitator: Stephanie Kavanaugh

2005 Workshop Actions	Status	Priority
<p style="text-align: right;">I = Immediate = Less than 1 year ST = Short-term = 1-3 years LT = Long-term = 3-5 years</p>		
<p>Establish minimum seafloor, shoreline/coastal, and other data acquisition and metadata standards to ensure greatest level of data interoperability and widest use of data. Identify current national or international standards and adapt if necessary.</p>	<p>Limited efforts have taken place to develop seafloor and coastal LIDAR mapping standards but there is much remains to be done. Minimum bathymetric standard developed, but needs to be adopted.</p>	I
<p>Document current program-specific data needs and data acquisition standards. Need backscatter (acquisition and processing) standards. Need ground truthing.</p>		
<p>Provide guidance to mapping programs that addresses requirements and processes for archiving mapping data to NOAA data centers. (Subset of above)</p>	<p>Ongoing discussion underway. Select programs are providing input to NGDC, NODC.</p>	
<p>Develop process for ensuring standards compliance</p>		
<p>Establish and document data acquisition protocols and platform-specific sensor CONOPS</p>	<p>Some protocols exist, for example: Hydrographic ships (not sure if for FSV's), aircraft? Need to develop "relaxed" standards that still meet minimum standards.</p>	
<p>Establish minimum metadata standards, content and guidance for using standards</p>	<p>Metadata issues being continuously addressed by numerous NOAA data committees and IWG-OCM Mapping Inventory Team, but much remains to be done. NOS metadata policy established. Ongoing efforts throughout NOAA.</p>	I
<p>Engage NOAA data Management Committee, IOOS Data Management and Communication (DMAC), FGDC, etc.</p>	<p>More engagement required</p>	

2005 Workshop Actions	Status	Priority
Establish standard schemas for higher-level, nationwide classifications (substrate type, surficial geology, etc.). Important to maintain access to original measurements. Identify what is available, what's in use and the relationship among them.	CSC has led effort to develop and promote the Coastal and Marine Ecological Classification Standard (CMECS). Are more efforts required? Yes.	
Establish centralized data processing centers to ensure data quality and consistency		
Staff an IOCM data processing center for acoustic seafloor data. Establish others for other data types?	Addressed in PPBES but unfunded to date. Facility built at JHC. No other centers identified yet.	
Suggested New Actions		Priority
Revisit FGDC standards applicable to NOAA mapping requirements and determine whether any need updating. Are other FGDC standards required? (Metadata is not) Coordinate with other Federal mapping agencies through the FGDC.		
Develop a process for identifying which planned non-navigation seafloor surveys might be of interest to NOAA's nautical charting efforts and thus may require tide control support. Issue best addressed through eventual IOCM Coordination Team process.		
Establish which non-navigation seafloor mapping programs can benefit from accounting for the effects of spatiotemporal sea surface fluctuations. Issue best addressed through eventual IOCM Coordination Team process.		
How do we ensure that data acquired by NOAA becomes publicly available in a timely fashion? Developing tracking mechanisms? What are the data stewardship responsibilities of the PIs, NMAO, NOAA Data Centers (NGDC, NODC, NCDC) and others? Need a timeline for exclusive use by PI's before making information publicly available. Need an enforced NOAA policy on timeliness and suitability for release of data – consider NSF model. Perhaps NRC addresses this?		
Identify existing, automated processes for data acquisition, data management and QA/QC, that could be adapted for broader use.		
Develop algorithm to process and classify backscatter/LIDAR reflective data.		

This group did not complete **Worksheet B – IOCM DATA STANDARDS & MANAGEMENT ACTIONS.**

Worksheet A – DATA STANDARDS & MANAGEMENT ACTIONS

Breakout Group Facilitator: Chris David

2005 Workshop Actions	Status	Priority
<p style="text-align: right;">I = Immediate = Less than 1 year ST = Short-term = 1-3 years LT = Long-term = 3-5 years</p>		
<p>1) Establish minimum seafloor, shoreline/coastal, and other a) data acquisition and b) metadata standards to ensure greatest level of data interoperability and widest use of data.</p>	<p>Limited efforts have taken place to develop seafloor and coastal Lidar mapping standards but there is much remains to be done - JALBTCX is working on Lidar standards - USGS has draft topographic lidar standards</p>	<p style="text-align: center;">ST</p>
<p>2) Document current program-specific data needs and data acquisition standards</p>	<p>- OCS hydro program provides standards now - NGS shoreline standards - Others are needed and must be communicated</p>	<p style="text-align: center;">I</p>
<p>3) Develop process for ensuring standards compliance</p>	<p>- Processing Quality assurance process (OCS) - Should be FGDC compliant and publicly available - training on the process is necessary</p>	<p style="text-align: center;">ST</p>
<p>4) Provide guidance to mapping programs that addresses requirements and processes for archiving mapping data to NOAA data centers.</p>	<p>NGDC has the capability to archive</p>	<p style="text-align: center;">I</p>
<p>5) Establish and document data acquisition protocols and platform-specific sensor CONOPS</p>	<p>- OMAO, OCS, and others have fairly specific protocol - OMAO and others need to serve protocol-specific sensor data online - the capability drives the protocol</p>	<p style="text-align: center;">ST</p>
<p>6) Establish minimum metadata standards (combine w/ metadata portion of action #1)</p>	<p>Metadata issues being continuously addressed by numerous NOAA data committees and IWG-OCM Mapping Inventory Team, but much remains to be done. NOS metadata policy established.</p>	<p style="text-align: center;">ST</p>
<p>7) Engage NOAA data Management Committee, IOOS Data Management and Communication (DMAC), FGDC, etc.</p>	<p>More engagement required</p>	<p style="text-align: center;">ST</p>
<p>8) Establish standard schemas for higher-level, nationwide classifications (substrate type, surficial geology, etc.).</p>	<p>CSC has led effort to develop and promote the Coastal and Marine Ecological Classification Standard (CMECS). Are more efforts required? -Yes, more efforts are required - Land cover classification standards w/ C-CAP & USGS</p>	<p style="text-align: center;">In Progress ST to LT</p>

2005 Workshop Actions	Status	Priority
9) Establish centralized data processing centers to ensure data quality and consistency. What is the model for data centers? Define a mission for these centers.	- The UNH center has been built, but there is no staff or mission yet	I
10) Staff an IOCM data processing center\ Combine w/ #9	Addressed in PPBES but unfunded to date. Facility built at JHC.	
Suggested New Actions		Priority
11) Revisit FGDC standards applicable to NOAA mapping requirements and determine whether any need updating. Are other immediate FGDC standards (or eventually ISO standards) required? Coordinate with other Federal mapping agencies. (This replaces #1b) Revisit data acquisition standards and determine whether any need updating. - At a minimum, report how the data was collected. And Identify overlaps w/ other data standards. - Migrate over to ISO		Follows #2 ST/LT
12) Develop a process for identifying which planned non-navigation seafloor surveys might be of interest to NOAA's nautical charting efforts and thus may require tide control support		I
13) Establish which non-navigation seafloor mapping programs can benefit from accounting for the effects of spatiotemporal sea surface fluctuations (Combine w/ #12)		
14) a) How do we ensure that data acquired by NOAA becomes publicly available in a timely fashion? b) Developing tracking mechanisms? What are the data stewardship responsibilities of the PIs, NMAO, NOAA Data Centers (NGDC, NODC, NCDC) and others?		I for a

Worksheet B – IOCM DATA STANDARDS & MANAGEMENT ACTIONS

Breakout Group Facilitator: Chris David

Immediate Actions	How to Accomplish?	Who is Responsible?
2) Data acquisition standards across all IOCM program	<ul style="list-style-type: none"> - ID and communicate parameters involved in the standards - Then programs ID a minimum standard (if they don't already have) - collect and coordinate standards - Establish a location that links to program standards (potentially the IOCM website) 	
4) Provide guidance to the programs that address guidance	<ul style="list-style-type: none"> - ID who isn't participating in archiving process - ID a standard process for submitting data to the archive - Clarification & education on data types and "why archive?" <p>Who is responsible?: Line Offices and NGDC / Archive Centers</p>	

Immediate Actions	How to Accomplish?	Who is Responsible?
11) Develop a process for identifying vertical datum requirements for non-navigation surveys	Important, and ties into 2) and 3)	
9) Define mission for data acquisition centers...		

Appendix J: Comprehensive Discussion Notes from Technology Development and Enhancement Breakout Groups

Worksheet A – TECHNOLOGY DEVELOPMENT & ENHANCEMENT ACTIONS

Breakout Group Facilitator: Alison Hammer

2005 Workshop Actions		Status	Priority
		I = Immediate = Less than 1 year ST = Short-term = 1-3 years LT = Long-term = 3-5 years	
1.	2. (2a is a Web site and 2b includes the GIS component of the site) Develop web-based GIS tool and data base of mapping activities, requirements, capabilities and cost estimates, a NOAA System of project information.	<ul style="list-style-type: none"> - Geospatial One-Stop system exists, and there are activities related to it underway. - NOS SP has some capability to query GOS. 	Phased approach: a) IOCM Web site with requirements = I b) GIS component = ST
2.	1c. Identify required technology improvements (sensor development and instrumentation) consistent with needs and program requirements	<ul style="list-style-type: none"> - Interagency group and NOS are trying to identify airborne sensor requirements. - Not much cross-cutting technology developments, more actions by NOAA Program Offices. - OCS is phase differing systems validated between habitat mapping and charting (e.g. AUV and NOAA working group UAS has some success stories crossing requirements through the NOAA working group). 	ST
3.	1b. Develop strategy for identifying required technology improvements (visionary).	<ul style="list-style-type: none"> - JSOST-IWG strategic plan - ME-70 sensor issue. 	I

2005 Workshop Actions		Status	Priority
4.	3. Identify required web-based mapping tools. On-going effort. Should be both a tool to make maps and to look at data.	<ul style="list-style-type: none"> - IWG-OCM meeting at CSC in 9/08 started a list, inventory and discussed data portal. Results are available as starting point. - GOS realm, Google map, Google Ocean have all been developed. - NOAA program office products: CSC has created digital coast; NGDC has on-line data portal, etc. 	I
5.	1e. Identify requirements for future multi-mission IOCM vessel platform (should be beyond just vessels and include all platforms).	Top Level Requirements document developed by OMAO. Done = NOAA Survey Vessel (NSV). Might need to tie to other OCM requirements.	ST
6.	1d. Establish a sensor development/improvement process that addresses evolving and future NOAA mapping requirements. Develop a strategy for meeting future needs.	NOS and NMFS have discussed with cooperative institutes, small businesses, and university grants.	ST
7.	1c. Identify future requirements for mapping sensors aboard NOAA ships and aircraft including autonomous sensors.	Ongoing efforts by OCS. Have all mapping instrumentation needs been identified?	ST
8.	4. Develop optimal shipboard platform staffing model(s) to support NOAA's diverse mapping missions	Some are in development (NOS, maybe NMFS) driven by NOAA Corp (FSV). H-CAP for survey. NMFS habitat mapping needs are project specific no overall habitat mapping program exists. Some ad hoc IOCM models exist. Pieces exist, but big challenge to identify. Should formalize Hydropalozoa as an IOCM project model.	LT
9.	1a. Develop a catalog of NOAA ship and aircraft platform technology mapping system/sensor capabilities. Inventory of what have.	Doesn't exist yet, OMAO?.	I

	Suggested New Actions	Priority
5.	Develop open and/or enhance collaborative research with universities.	ST
6.	Develop a pilot project focused on new technology uses of IOCM requirements (e.g. include habitat mapping with hydro)	I
7.	Codify Centers' role to NOAA and define "Centers of Excellence" to identify technology vision (e.g. Lidar, etc.). Discover what is new, next (e.g. UNH Joint-Hydro Center).	ST
8.	(Link to new action #2: Develop web-based GIS tool and data base of mapping activities, requirements, capabilities and cost estimates). Evaluate if GOS is the solution for NOAA. Might need to develop a NOAA system that connects to an interagency system like GOS.	I
9.	Do a better job learning from and sharing with other agencies (e.g. Navy, ACOE, NASA, etc.) for example AUV-Fest. Continue to develop joint NOAA-Navy events and communicate them on the new NOAA IOCM Web site. On-going activity.	IOCM sharing: I Events: ST
10.	Hire in-house NOAA expertise for next generation technologies.	LT

NOTES:

- Technology includes processing, not just hardware
- Group felt strongly about renumbering and lumping several actions under number 1 – technology development (steps 1a-e). Total number is now 4 actions. Also reworded some concepts below:
 - **Technology development (sensors, platforms and software): Adopt, adapt, develop.**
 - What can be improved?
 - Requirements (lump all). What have/available, what need, etc.
 - Consider research through operations (implementation through production)
 - Strategy for technology:
 - Identify technologies needed (cross-office requirements)?
 - What needs to be improved?
 - What is available?
 - What needs to be developed, how and what platform?

Worksheet B – IOCM TECHNOLOGY DEVELOPMENT & ENHANCEMENT ACTIONS

Breakout Group Facilitator: Alison Hammer

Immediate Actions	How to Accomplish?	Who is Responsible?
<p>2a. Develop web-based GIS tool and data base of mapping activities, requirements, capabilities and cost estimates (focuses just on the Web site component)</p>	<ul style="list-style-type: none"> - Develop a NOAA IOCM Web site. - Put requirements and plans on NOAA IOCM Web site. - Content needs to be kept up-to-date - Should be two distinct offerings: <ul style="list-style-type: none"> • one public offering • one internal site for the NOAA IOCM Coordination Team and working group members. 	<ul style="list-style-type: none"> - NOAA IOCM workshop participants and NOAA IOCM team members. - Content will be kept up-to-date by staff to Roger. - NOAA Program Office will host the site (e.g. CSC, SP?)
<p>3. Identify required Web-based mapping tools.</p> <p>AND</p> <p>8. Evaluate if GOS is the solution for NOAA. Might need to develop a NOAA system that connects to an interagency system like GOS.</p>	<ul style="list-style-type: none"> - Put a data call out to NOAA mapping contacts to find out the status of what Web tools exist - Compile a list and ensure this is a dedicated effort that is updated annually. - Develop a plan and process for where things fit. 	<ul style="list-style-type: none"> - All NOAA IOCM team - NOAA Line Office reps to coordination team compile information.
<p>1a. Develop a catalog of NOAA platform technology mapping system/sensor capabilities, an Inventory of what have.</p> <p>AND</p> <p>1b. Develop strategy for identifying required technology improvements</p>	<ul style="list-style-type: none"> - Identify team to develop strategy. - Use template to compile an inventory of what currently have. 	<p>Develop a specific NOAA IOCM working group to focus on the strategy and get tasks done, then group dissolves once complete.</p>

Worksheet A – TECHNOLOGY DEVELOPMENT & ENHANCEMENT ACTIONS

Breakout Group Facilitator: Stephanie Kavanaugh

2005 Workshop Actions	Status	Priority
<p style="text-align: right;">I = Immediate = Less than 1 year ST = Short-term = 1-3 years LT = Long-term = 3-5 years</p>		
<p>Develop an IOCM website, including a web-based GIS tool and data base of data acquisition/survey and mapping activities, requirements, capabilities and cost estimates (Related to coordination actions, but including cost estimates makes this unique from other discussions)</p>	<p>Some activities, etc. have been compiled, but are not available to the NOAA IOCM group.</p>	<p>I – in progress</p>
<p>**Identify required interferometric technology improvements (sensor development and associated software and instrumentation) consistent with needs and program requirements. Determine how to get all required data from one pass/single operation of sonar.</p>	<p>-ME-70 started -Use of AUV's underway</p>	<p>I/ST – Program-specific</p>
<p>##Develop strategy for identifying required technology improvements, including true new technologies as well as using existing technology in new ways. Exploit the web-based tool as a possible way to meet this requirement. Need a group responsible for this that looks outside of NOAA</p>	<p>Tech Refresh, Skunkworks, R&D, but more needed. Small & sporadic ASTING</p>	<p>ST – but iterative</p>
<p>Identify required web-based mapping tools</p>	<p>Virtual Earth, done.</p>	
<p>Identify requirements for future multi-mission IOCM vessel</p>	<p>Top Level Requirements document developed by NMAO NSV is underway. Ferdinand Hassler – coastal mapping vessel</p>	
<p>Establish a sensor and software development/improvement process (including biosensors) that addresses evolving and future NOAA mapping requirements. Develop a testing strategy for meeting future needs. IOCM Coord/Comm WG task Subset of ##</p>	<p>NGS work on airborne sensors. Free-fall cone penetrometer – ground truthing underway.</p>	<p>ST</p>
<p>Identify future requirements (including those for more efficient acquisition) for mapping sensors aboard NOAA ships and aircraft including autonomous sensors and AUV's. Subset of **</p>	<p>Ongoing efforts by OCS. Have all mapping instrumentation needs been identified? NOAA AUV workgroup is addressing – road map available Jun 2009</p>	<p>ST + ongoing forever</p>

2005 Workshop Actions	Status	Priority
Develop optimal shipboard staffing model(s) to support NOAA's diverse mapping missions See training and education results		
Develop a catalog of NOAA ship and aircraft mapping system/sensor capabilities, as well as a catalog of non-platform-based sensors, with link to non-NOAA systems or sensors. Feeds into GIS tool/IOCM website Need one query-based system		I for NOAA
Suggested New Actions		Priority
Form IOCM Coordinating Team Workgroup to focus on technology needs, both immediate and long-term. Workgroup also needs to think long term, for example: <ul style="list-style-type: none"> What do we need 10-20 years from now? Jack Dunnigan wants a 30 year technology plan within the next year.		
Determine our desired visualization mechanism and what technology is needed for this.		
Complete fly-away systems for ships of opportunity and, if useful, determine how to maintain.		

Worksheet B – IOCM TECHNOLOGY DEVELOPMENT & ENHANCEMENT ACTIONS

Breakout Group Facilitator: Stephanie Kavanaugh

Immediate Actions	How to Accomplish?Who is Responsible?
IOCM website with web-based GIS tool and database	-Possibly UNH data center – advantageous to having this at a university -Need a dedicated webmaster -Use what is already developed (adapt, adopt.....)
Form IOCM Advanced Technology Workgroup	How would this workgroup relate to other technology work groups? What distinguishes it? Someone from ASTWG should be on it.

Worksheet A – TECHNOLOGY DEVELOPMENT & ENHANCEMENT ACTIONS

Breakout Group Facilitator: Chris David

2005 Workshop Actions	Status	Priority
<p>I = Immediate = Less than 1 year ST = Short-term = 1-3 years LT = Long-term = 3-5 years</p>		
<p>1) Develop web-based GIS tool and data base of completed, existing, and planned mapping activities, requirements, capabilities and cost estimates</p>	<p>- Geospatial One Stop (GOS) has flaws, but is a discovery tool for metadata records - Seabed mapping data collection, but now on hold - GOS still needs refinement to be useful, up-to-date. - Need to define a template for entering data into GOS</p>	<p>I</p>
<p>2) Identify required technology improvements (sensor development and instrumentation) consistent with needs and program requirements</p>	<p>-ME70, multibeam - Need evaluation of sensor capabilities, how useful they are, and how they can be used to get our required data</p>	
<p>3) Develop strategy for identifying required technology improvements Combine w/ #2 The group feels this combined activity has evolved into a new action</p>		
<p>4) Identify required web-based mapping tools</p>	<p>(Need clarification of the meaning of this action. There are examples, but what focus?) - Inventory Map Application tools - PacOOS is serving west coast mapping data - Lamont GeoMap Application</p>	
<p>5) Identify requirements for future multi-mission IOCM vessel</p>	<p>Top Level Requirements document developed by NMAO - Action complete in general, but need for tracking and input by IOCM coordinating team</p>	
<p>6) Establish a sensor development/improvement process that addresses evolving and future NOAA mapping requirements. Develop a strategy for meeting future needs.</p>	<p>This is happening, but make sure there is a process for this info to be shared.</p>	
<p>7) Identify future requirements for mapping sensors aboard NOAA ships and aircraft including autonomous sensors.</p>	<p>Ongoing efforts by OCS. Have all mapping instrumentation needs been identified? - This is a NOS planned effort (see NOS all hands vision by J. Dunnigan)</p>	

2005 Workshop Actions	Status	Priority
8) Develop optimal shipboard staffing model(s) to support NOAA's diverse mapping missions	- Offices are looking at this (OCS) for their missions, but not NOAA wide. - MATE (Marine Advanced Technology Education) Center looking at this - Line offices should start this, but then developed across NOAA	I
Develop a catalog of NOAA ship and aircraft mapping system/sensor capabilities	OMAO has this info online	DONE
Suggested New Actions		Priority
9) Improve communication about technology development (for communications group) Suggestion to use an IOCM website for a clearinghouse of updates and projects		
10) Identify data analysis/processing/interpretation needs (the evolution of the second 2005 action)		I to ST
11) Continue to enhance the development of V-Datum		I
12) Tie sonar data to optical & sampling surveys or data		

Worksheet B – IOCM TECHNOLOGY DEVELOPMENT & ENHANCEMENT ACTIONS

Breakout Group Facilitator: Chris David

Immediate Actions	How to Accomplish?Who is Responsible?
10) Identify data analysis/processing/interpretation needs (the evolution of the second 2005 action)	-JHC works with user communities (including the NMFS science center, OCS< CSDL, RSD, CO-OPS) - IOCM collects the needs and coordinates and prioritizes actions
8) Develop optimal shipboard staffing model(s) to support NOAA's diverse mapping missions	Put together an IOCM workgroup. OMAO and offices need to buy into the IOCM process
11) Continue to enhance the development of V-Datum	

Appendix K: Comprehensive Discussion Notes from Outreach, Communications and Messaging Breakout Group

Worksheet A – OUTREACH, COMMUNICATIONS & MESSAGING ACTIONS

Breakout Group Facilitator: Tonya Kane

2005 Workshop Actions	Status	Priority
I = Immediate = Less than 1 year ST = Short-term = 1-3 years LT = Long-term = 3-5 years		
Participate in IWG-OCM (Should move this action to 'Coordination')	IWG-OCM is co-chaired by NOAA, USGS, USACE, and MMS Need more NOAA participants	
Document and distribute information related to NOAA's mapping programs and requirements Need: Web presence with outreach, in-reach and training Start internal then go external		Immediate
What types of mapping activities will be considered under NOAA IOCM (this should be addressed in other breakout groups) Take a staged approach → cover coastal watersheds to the deep sea		
Communicating throughout the NOAA mapping community: Inform all of NOAA about the "new" IOCM Vision, and what mapping types are included under IOCM		
How can we communicate the value of NOAA mapping and IOCM to NOAA leadership? Who? – Develop audience specific plans		Immediate
NOAA OCM Web site Could include a Forum/Networking type site		
Electronic news letter		
Others? Standard Power Point slides about IOCM that everyone includes in any presentations they give.		

Suggested New Actions	Priority
How can we communicate the value of NOAA mapping capabilities (products and services) to untapped and evolving customers (e.g. offshore renewable energy interests, marine resource managers, communities impacted by climate change, etc.)	
Update “Profiles of NOAA Ocean Mapping Activities” (May 2005) Yes – update this and share broadly (maybe through web links)	
Strengthen the IOCM message: Why is NOAA mapping important? Define efficiencies (\$\$\$). Highlight collaborations. Do performance assessment – what is success? Identify and advertise successes. Where to do this? - Hill Ocean Week - established mapping-related meetings/conferences	Immediate

Worksheet B – IOCM OUTREACH, COMMUNICATIONS & MESSAGING ACTIONS

Breakout Group Facilitator: Tonya Kane

Immediate Actions	How to Accomplish?	Who is Responsible?
<p>Establish initial web presence.</p>	<p>Find a host – CSC? NOS? Need to keep site updated regularly!</p> <p>Include initially:</p> <ul style="list-style-type: none"> • Workshop info for 2005 and 2009 meetings (participants, presentations, documents, summaries, etc.) • Templates for requests for mapping • Other templates • Links to programs and contact • Input portal: What are your mapping program needs in the next year? <p>Site should eventually:</p> <ul style="list-style-type: none"> • Consolidate info and plans for all missions and programs • Have a map/matrix of programs and current interactions/existing collaborations • Provide links to documents on sites of individual programs (instead of re-creating everything on IOCM site) • Include a matrix of main objectives and requirements, initial overview and highlights for each program – a quick look at everything to help narrow down where a site user might start a collaboration • Include other agencies (part of Coordination effort) • Have a Mission query tool, maybe graphically? • Be a source for Metadata templates and other tools <p>Other Ideas to engage site users: 2-way portal, SharePoint site, RSS feeds *need to make sure people come to site regularly – make it an invaluable resource.</p>	

Immediate Actions	How to Accomplish? Who is Responsible?
<p>Establish Communication Framework – Develop a communication plan for specific audiences.</p>	<p>Determine primary, secondary, tertiary audiences</p> <ul style="list-style-type: none"> • Primary: NOAA mapping and management community • Others: Federal community, State/regional levels, Legislature, General public (academia, K-12, NOG, etc.), Additional groups?? <p>Ideas of ways to communicate with...</p> <ul style="list-style-type: none"> • Primary audience (NOAA): Website (see ‘Immediate Action: Establish initial web presence’) • Legislature: one-pagers, newsletter <p>Need: Define terms and standardize vocabulary (FGDC as an example). Coordinate vocabulary with other agencies/partners so all are ‘speaking the same language’</p> <p>Things to explore in plan development:</p> <ul style="list-style-type: none"> • Internal capacity building • Utilizing existing web-tool designs • Connections/intersections with IOOS (design a 1-pager) • Assess requirements of individual users (which templates, resources, etc. would be useful on web site?) <p>Should be Standard Operating Procedure (SOP) that each group involved in IOCM has responsibility to demonstrate benefits from IOCM and communicate this at every opportunity.</p> <p>Get commitment and sign-up for working groups and meeting ASAP to begin this action. Develop timeline for this.</p>
<p>Highlight Successes</p>	<p>Include IOCM story with all project reports. Look for projects that will accomplish NOAA mission through collaboration with multiple NOAA groups. Demonstrate how IOCM supports these efforts in order to garnish more funding for IOCM. Submit success stories through line office up through to leadership (e.g. OMB weekly blurbs)</p>

Group recommendations for next steps for IOCM:

1. Synthesize workshop actions and comments and submit for participant review.
 - a. Ask pointed questions for workshop follow-up, such as:
 - i. Are these the correct people who should be a part of the IOCM? Additional groups or individuals?
 - ii. Are these the correct Immediate Actions?
 - iii. What topics are you interested in being further involved with? Will you serve on the working group for this topic?
2. Get participant feedback – do as a meeting/seminar with WebX access. Make meeting 2pm or later so all can participate.
3. Establish the IOCM main group members/IOCM team leads
4. Define working groups and the point people for these groups
5. Keep Motivation Up

Appendix L: Comprehensive Discussion Notes from Training and Education Breakout Group

Worksheet A – TRAINING & EDUCATION ACTIONS

Breakout Group Facilitator: Tonya Kane

2005 Workshop Actions	Status	Priority
<p style="text-align: right;">I = Immediate = Less than 1 year ST = Short-term = 1-3 years LT = Long-term = 3-5 years</p>		
<p>Increased training opportunities: <i>(We took this to mean increasing the training in the areas indented below)</i></p>	<p>Mapping training and IOCM Data Processing Center addressed in PPBES process but not funded to date</p>	
<p>Data acquisition – Need to define all data acquisition methods</p>	<p>NERR collaborates with OCS, NRT, etc. to consolidate missions and develops some training from this – regional training for just a few people up to about 15-20ppl, sometimes webinars up to 100ppl.</p>	
<p>Train on multi-use techniques and standardize training on all equipment</p>	<p>OCS does this → starting to open training to others</p>	
<p>Data management/metadata</p>	<p>Mermaid metadata training offered by NCDDC and CSC. Is this adequate?</p>	<p>Immediate</p>
<p>Data processing and quality control Should include:</p> <ul style="list-style-type: none"> • How to work with different types of files • What can be extracted from the data • How to store the data 		
<p>Development of mapping products and interpretation of products</p>		
<p>Enhance understanding of strengths and limitations of various mapping technologies This should encompass engineering training and development of new technologies.</p>		<p>Short term/ongoing</p>

2005 Workshop Actions	Status	Priority
Establish an IOCM training center Should include: <ul style="list-style-type: none"> • Connections to formal courses • Cross program linkages • Cross mission understanding Need: expertise and manpower available to provide support to programs Create Virtual Training Center with links to short courses like at CSC and JHC	Addressed in PPBES but unfunded to date CSC and JHC-NH already does some courses	Immediate
Suggested New Actions		Priority
Determine whether there is a need to establish additional OCM mapping centers of excellence (Cooperative Institutes) to address ocean and coastal mapping issues not addressed by JHC		Long term
Determine where gaps exist in skills and training – develop competency models		Immediate
Build workforce: Fellowships to support students to train in both surveying and habitat mapping (funding dependent)		Short/long term
Build workforce : Techs— more comprehensive training on all equipment and techniques (could start with Virtual Train Center courses then expand)		Immediate/short term
Awareness of what other groups are doing in regards to training		
Develop Service Centers/ Implement service model Ex: Staff experts to help with particular data types rather than each individual learning everything.		Short/long term

Worksheet B – IOCM TRAINING & EDUCATION ACTIONS

Breakout Group Facilitator: Tonya Kane

Immediate Actions	How to Accomplish?	Who is Responsible?
<p>Create a Virtual Training Center</p> <ul style="list-style-type: none"> • Define curriculum • Inventory of current training 	<p>Website housed at IOCM site – centralized location with links to all courses available through IOCM and partners. See what other agencies offer for training. Can link with other training networks that could offer to train or take our training. Could include a Wiki or a Sharepoint on the website so each group can update their offerings and/or share info/need requests with other groups.</p> <p>IOCM workgroup recruit and coordinate people with particular expertise Task someone to coordinate the website – maybe CSC or OED?</p> <p>Start with Virtual Training portal then could develop into more courses. Who has courses currently or content to be developed into a course? JHC, CSC, NGS, COOPS, NMFS, OR&R, NERRS</p> <p>NERRS has coastal training program at each reserve site and does needs assessments → NERRS CTP offered to help establish training program, especially knowledgeable regarding delivery to the field and regions</p>	
<p>Determine training gaps.</p> <ul style="list-style-type: none"> • Development of competency models (What can we already do?) • Need assessment (what do we need to learn to do?) 	<p>Each office must:</p> <ol style="list-style-type: none"> 1. Assess their own needs 2. Assess their need to use other groups’ training resources 3. Assess capabilities to provide training resources for other groups <p>Where are the intersections? Can different groups piggyback on opportunities for training?</p> <p>Areas of need for further training: workforce, decision makers, products, technologies, end use, data management and data processing</p> <p>Need: people that can determine/guide best practices to connect methods and end users “Adapt/Adopt/Develop”</p>	
<p>Document existing training collaborations.</p>		

Additional Comments:

IOCM should define protocols for products, data acquisition, and data management. Standardize so that all can be trained accordingly.