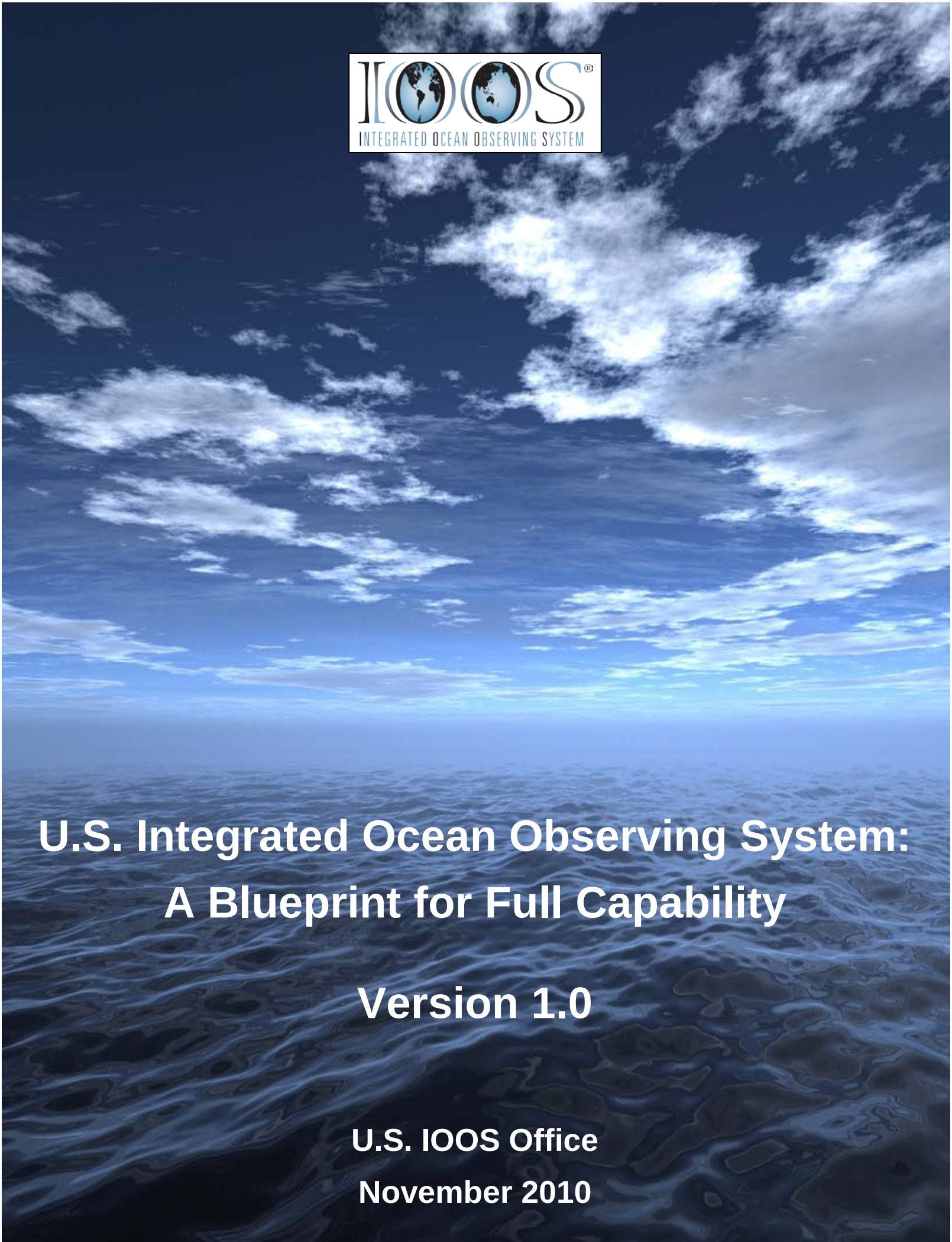

U.S. Integrated Ocean Observing System: A Blueprint for Full Capability

Version 1.0

U.S. IOOS Office

November 2010

Executive Summary

The U.S. Integrated Ocean Observing System (IOOS®) represents a national consortium of governmental and nongovernmental stakeholders with specific interest in marine environmental phenomena occurring in the open ocean, U.S. coastal waters, and the Great Lakes. The core mission of U.S. IOOS is the systematic provision of ready access to this marine environmental data and data products in an interoperable, reliable, timely, and user-specified manner to end users/customers in order to serve seven critical and expanding societal needs:

- Improve predictions of climate change and weather, and their effects on coastal communities and the nation
- Improve the safety and efficiency of maritime operations
- More effectively mitigate the effects of natural hazards
- Improve national and homeland security
- Reduce public health risks
- More effectively protect and restore healthy coastal ecosystems
- Enable the sustained use of ocean and coastal resources.[1]

The U.S. IOOS Blueprint is guided by the Integrated Coastal and Ocean Observation System (ICOOS) Act of 2009, which addresses the need for centralized coordination and stewardship of U.S. IOOS development and sustainment that enables distributed national and regional U.S. IOOS implementation. U.S. IOOS broadly consists of both Federal and non-Federal assets and capabilities that contribute to the U.S. IOOS in the areas of governance/management ; observing systems; data management and communication; and modeling and analysis systems; education and training; and

[1] National Office for Integrated and Sustained Ocean Observations, *The First U.S. Integrated Ocean Observing System (IOOS) Development Plan*, Ocean.US Publication, January 2006, p. viii.

research and development. Version 1.0 of the U.S. IOOS Blueprint identifies common roles and vocabulary for all of these subsystems, with the greatest detail focused on the data management and communication component which supports integration and many central functions of IOOS. Subsequent versions of the U.S. IOOS Blueprint will expand the information on the other subsystems. Implementing Version 1 of the U.S. IOOS Blueprint is intended to support the IOOS partners in self-identifying their roles and thereby inform Version 2 of the U.S. IOOS Blueprint, which will expand from a list of roles and functions to include specific programs, adopted responsibilities, and identified gaps.

The U.S. IOOS Blueprint is intended to inform the specific efforts of all identified U.S. IOOS partners and the U.S. IOOS Program Office to develop and sustain a fully capable U.S. IOOS. It builds upon the strategic framework provided by previous high-level U.S. IOOS conceptual, organizational, planning, and developmental efforts to provide specific execution recommendations to U.S. IOOS partners/participants for achieving full system capability (FC). It identifies, describes, and organizes the specific functional activities to be developed and executed by U.S. IOOS partners, centrally coordinated by a U.S. IOOS Program Office, in accordance with the provisions of the ICOOS Act. As such, the Blueprint is directed to an audience that is conversant in IOOS concepts and principles and that will actively participate in the achievement of FC.

To enhance the efficiency and effectiveness of U.S. IOOS development, the Blueprint leverages prior and ongoing ocean observation data interoperability efforts, including IOOS conceptual designs and IOOS Data Integration Framework project accomplishments. It also leverages, to the maximum extent possible, existing and planned capabilities of U.S. IOOS participants.

The Blueprint employs an architectural framework to rationally structure and describe the core functionality of U.S. IOOS at a level of detail sufficient to support initial systems analysis and systems engineering, as well as preliminary project and project management planning activities.

The U.S. IOOS Blueprint architectural framework divides U.S. IOOS into six distinct subsystems. Three functional subsystems—observations, data management and communications, and modeling and analysis—provide the technical capability to readily access marine environment data and data products. Three cross-cutting subsystems—governance and management, research and development, and training and education—enable sustainment of, and improvement to, U.S. IOOS and its usage.

The U.S. IOOS Blueprint focuses on required U.S. IOOS functional capability. It addresses organizational functions/activities, technology requirements, business processes, resourcing of tasks/activities, logical nodal infrastructure capability requirements, and relationships and partnerships to achieve FC. However, it does not address specific U.S. IOOS Program Office organizational or management structure, specific technology solutions, detailed business process steps, funding

mechanisms, or infrastructure material solutions. The Blueprint identifies the need for follow-on systems analysis and systems engineering activities, along with detailed project and project management planning at the subsystem level, to address these issues. Detailed follow-on planning will elaborate on subsystem development, deployment, and sustainment activities, including (1) requirements determination, (2) assessment of current capabilities and partnership capabilities, (3) system gap analysis and associated planning to close gaps for specific subsystems, and (4) U.S. IOOS Program Office oversight and coordination to support system integration requirements.

The U.S. IOOS Blueprint includes detailed appendixes providing U.S. IOOS architectural views that amplify the systems functional structure and associated capabilities; a structured hierarchy of, and associated definitions for, 350 discrete activities that when fully established, describe the specific actions to be performed by U.S. IOOS at FC; linkages of these activities to other key U.S. IOOS documentation to show alignment with strategic and statutory guidance; a multiphase plan for identifying the sequence in which these activities should be functioning, and a list of related tasks necessary to accomplish that plan; and a database of U.S. IOOS partners, categorized by key partnership roles and contributions to U.S. IOOS.

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Preface

The purpose of the U.S. Integrated Ocean Observing System (IOOS®) is to advance the utility of marine observations by creating a system that rapidly and systematically acquires and disseminates ocean, coastal, and Great Lakes data and data products to meet seven critical societal needs/goals:

- Improve predictions of climate change and weather, and their effects on coastal communities and the nation
- Improve the safety and efficiency of maritime operations
- More effectively mitigate the effects of natural hazards
- Improve national and homeland security
- Reduce public health risks
- More effectively protect and restore healthy coastal ecosystems
- Enable the sustained use of ocean and coastal resources.[1]

Since its inception in the 1990s, U.S. IOOS development efforts have largely been accomplished through a loose confederation of willing and dedicated participants working collaboratively to enable the realization of a U.S. IOOS capability. Within U.S. IOOS, there are 17 Federal partners, 11 Regional Associations (RAs) and Regional Coastal Ocean Observing Systems (RCOOSs), and one consortium for testing and evaluating sensor technologies who are all working together to advance U.S. IOOS development. However, early in U.S. IOOS development, it was recognized that "the greatest challenge to enhancing marine data integration is one of coordination and cooperation among members of IOOS and its user communities."[2] To date, the confederation's progress has been substantial, but it is uniformly recognized to be slower than desired. Recent events, such as enactment of the Integrated Coastal and Ocean Observation System (ICOOS) Act of 2009, recognize the need for centralized coordination and stewardship of U.S. IOOS development and sustainment that enables distributed national and regional U.S. IOOS implementation. The U.S. IOOS Blueprint is written to address that requirement. It identifies, describes, and organizes the specific functional activities to be developed and executed by U.S. IOOS partners, centrally

[1] National Office for Integrated and Sustained Ocean Observations, *The First U.S. Integrated Ocean Observing System (IOOS) Development Plan*, Ocean.US Publication 9, January 2006, p. viii.

[2] National Office for Integrated and Sustained Ocean Observations, *Data Management and Communications Plan for Research and Operational Integrated Ocean Observing Systems*, Ocean.US Publication No. 6, March 2005, p. 3.

coordinated by a U.S. IOOS Program Office, in accordance with the provisions of the ICOOS Act of 2009 and previous U.S. IOOS developmental guidance. The Blueprint also describes specific activities and tasks that the U.S. IOOS Program Office must coordinate with U.S. IOOS partners to develop, deploy, and sustain those functional activities that make up a fully capable U.S. IOOS.

This high-level guidance provides a framework to facilitate the initiation of formal systems analysis and systems engineering, as well as preliminary project and project management activities by U.S. IOOS partners, to be supported by the U.S. IOOS Program Office. In this context, this document acts as a blueprint to inform those activities for building and sustaining a fully capable U.S. IOOS.

Chapter 1
Introduction

The U.S. IOOS® Blueprint is guided by the Integrated Coastal and Ocean Observation System (ICOOS) Act of 2009, which addresses the need for centralized coordination and stewardship of U.S. IOOS development and sustainment that enables distributed national and regional U.S. IOOS implementation. U.S. IOOS broadly consists of both Federal and non-Federal assets and capabilities that contribute to the U.S. IOOS in the areas of governance/management; observing systems; data management and communication; and modeling and analysis systems; education and training; and research and development. Version 1.0 of the U.S. IOOS Blueprint identifies common roles and vocabulary for all of these subsystems, with the greatest detail focused on the data management and communication component which supports integration and many central functions of IOOS. Subsequent versions of the U.S. IOOS Blueprint will expand the information on the other subsystems. Implementing Version 1 of the U.S. IOOS Blueprint is intended to support the IOOS partners in self-identifying their roles and thereby inform Version 2 of the U.S. IOOS Blueprint, which will expand from a list of roles and functions to include specific programs, adopted responsibilities, and identified gaps.

The U.S. IOOS Blueprint is a structured framework for informing the U.S. IOOS development and execution activities of U.S. IOOS partners, including the U.S. IOOS Program Office, to achieve system full capability (FC). The Blueprint builds on the organizational and functional constructs provided by preceding IOOS guidance—such as the May 2002 design and implementation plan,[1] the January 2006 development plan,[2] and the June 2008 Interagency Working Group on Ocean Observations (IWGOO) strategic plan[3]—to describe a time-phased architectural framework for fielding (developing, deploying, and sustaining) the core U.S. IOOS capability. [The IWGOO is the predecessor interagency body to the current Interagency Ocean Observation Committee (IOOC).] The Blueprint also accounts for recent legislation directing U.S. IOOS activities[4] and ongoing developmental efforts of U.S. IOOS partners. The IOOC will approve changes to the content of the Blueprint and direct the creation of follow-on versions of the document.

[1] National Office for Integrated and Sustained Ocean Observations, *An Integrated and Sustained Ocean Observing System (IOOS) for the United States: Design and Implementation*, Ocean.US Publication, May 2002.

[2] National Office for Integrated and Sustained Ocean Observations, *The First U.S. Integrated Ocean Observing System (IOOS) Development Plan*, Ocean.US Publication 9, January 2006.

[3] Interagency Working Group on Ocean Observations, *Integrated Ocean Observing System Strategic Plan*, June 2008.

[4] Integrated Coastal and Ocean Observation System Act of 2009, part of the Omnibus Public Land Management Act of 2009 (H.R. 146), pp. 437–446.

The product of the U.S. IOOS Blueprint is a detailed path to achieving U.S. IOOS FC. FC is the point at which

- all designated U.S. IOOS data providers are integrated and making accessible all appropriate, non-classified ocean observing core variables in a U.S. IOOS-compliant manner to end users/customers,
- all U.S. IOOS services are available and functioning at the desired level determined by the IOOC, and
- a fully capable U.S. IOOS Program Office is providing system oversight and coordination.

Significantly, FC is not the end of all development. It is simply the objective state defined for the initial establishment of a fully functional U.S. IOOS consistent with the requirements that have been levied to date. U.S. IOOS is envisioned as an adaptive system that will continue to implement new solutions, adopt new technologies, and improve system processes to ensure that the U.S. IOOS remains capable of meeting evolving end-user/customer needs.

Specifically, the Blueprint does the following:

- Defines U.S. IOOS components, scope, and structured priorities
- Provides an architectural framework for articulating U.S. IOOS full capability that can be applied to U.S. IOOS partners
- Identifies partner roles and other support required to accomplish U.S. IOOS implementation
- Describes an approach to engaging partners
- Defines U.S. IOOS implementation steps, milestones, and associated tasks.

Appendix A contains a glossary of terms used in this document.

U.S. IOOS BACKGROUND

Overview of U.S. IOOS

The U.S. IOOS is

> a coordinated national and international network of observations and data transmission, data management and communications (DMAC), and data analyses and modeling that systematically and efficiently acquires and disseminates data and information on past, present and future states of the oceans and U.S. coastal waters to the head of tide. "Coastal" includes the U.S. Exclusive Economic Zone (EEZ) and territorial sea, Great Lakes, and semi-enclosed bodies of water and tidal wetlands connected to the coastal ocean.[5]

The following descriptions provide additional context for the U.S. IOOS Blueprint:

- As a functional capability, U.S. IOOS provides for the common, interoperable exchange of, and access to, ocean observing data among U.S. IOOS data collectors, data providers, data managers, and data users.

- As a system, U.S. IOOS is an adaptive, federated network of ocean observation, data management and communications, and modeling and analysis capabilities.

- As a process, U.S. IOOS is a social network of organizations and people supporting and using the U.S. IOOS.

At the national level, U.S. IOOS represents a national partnership of 17 Federal partners, 11 Regional Associations and Regional Coastal Ocean Observing Systems, and a validation and verification testing capability with a shared responsibility for the design, operation, and improvement of both the national and regional network of observations linking marine data in a compatible and easy-to-use manner by the wide variety of U.S. IOOS customers.[6] Further, the ICOOS Act within the Omnibus Public Land Management Act of 2009 calls for an Integrated Ocean Observing Program Office to oversee daily operations and coordination of the system (referred to as the *U.S. IOOS Program Office* in the Blueprint).[7] Within this framework, the U.S. IOOS will generate and disseminate continuous data, information, models, products, and services concerning the open oceans, coastal waters, and Great Lakes. In addition, U.S. IOOS is part of the U.S.

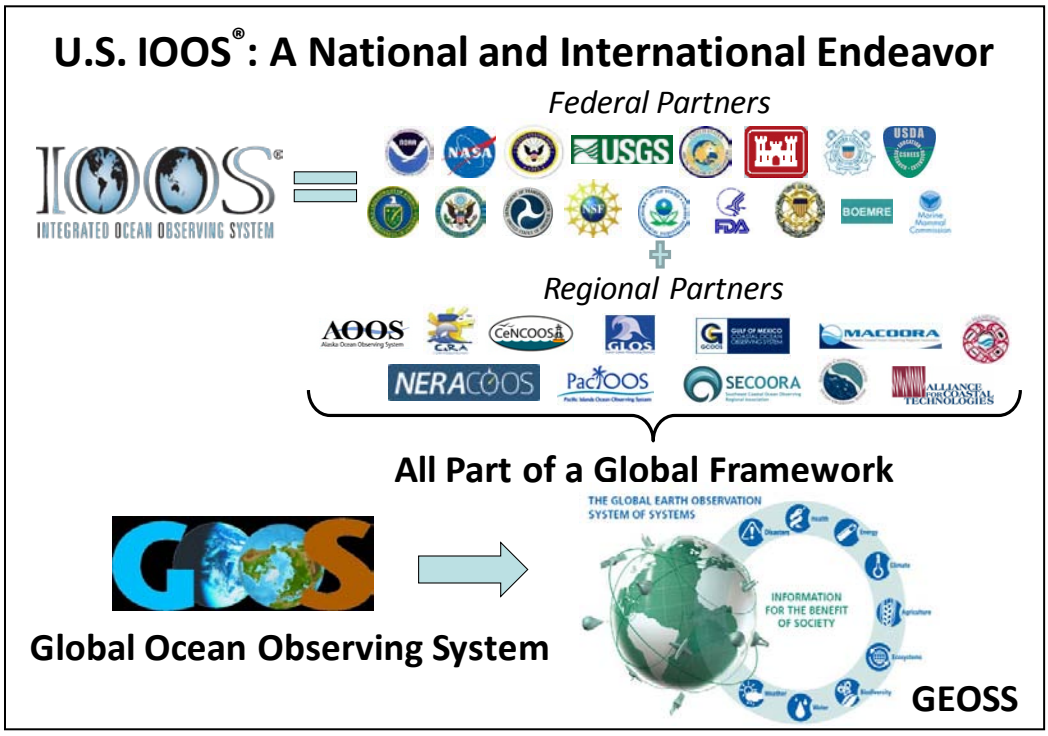
[5] See Note 2, p. i.

[6] National Oceanic and Atmospheric Administration, "IOOS 101" (briefing by John H. Dunnigan, Chair of the Interagency Working Group on Ocean Observations and Assistant Administrator for Ocean Services and Coastal Zone Management, January 15, 2009).

[7] Integrated Coastal and Ocean Observation System Act of 2009, part of the Omnibus Public Land Management Act of 2009 (H.R. 146), p. 1181.

Integrated Earth Observation System and serves as the U.S. contribution to the Global Ocean Observing System (GOOS) and to the Global Earth Observation System of Systems (GEOSS). As such, the U.S. IOOS marine environmental data enterprise is designed as an integral part of the overall U.S. and global environmental data enterprises. The composite of these activities and associations form the basis for both the global and coastal components of U.S. IOOS. Figure 1-1 depicts the relationships.

Figure 1-1. U.S. IOOS National and International Relationships



Ocean Observation Requirements

The Ocean.US Workshop conducted at Airlie House in Warrenton, VA, in March 2002 identified 20 ocean observing core variables "required to detect and/or predict changes in a maximum number of phenomena of interest to user groups."[8] Core variables represent the key properties and processes that the U.S. IOOS community of practice determined at the Airlie House conference should be measured on a national scale.[9] Subsequent efforts identified six additional core

[8] See Note 2, p. 20, for a table of the 20 initial core variables.

[9] National Office for Integrated and Sustained Ocean Observations, *Building Consensus: Toward An Integrated and Sustained Ocean Observing System*, Ocean.US Workshop Proceedings, March 10–15, 2002, p. 6.

variables.[10] The 26 U.S. IOOS core variables are as follows (asterisks denote the six core variables added after the Airlie House conference):

- Acidity (pH)*
- Bathymetry
- Bottom character
- Colored dissolved organic matter*
- Contaminants
- Dissolved nutrients
- Dissolved oxygen
- Fish abundance
- Fish species
- Heat flux
- Ice distribution
- Ocean color
- Optical properties
- Partial pressure of carbon dioxide (pCO_2)*
- Pathogens
- Phytoplankton species
- Salinity
- Sea level
- Stream flow*
- Surface currents
- Surface waves
- Temperature
- Total suspended matter*
- Wind speed and direction*
- Zooplankton abundance
- Zooplankton species

These core variables represent the high-level ocean observation requirements for U.S. IOOS and form the basis for U.S. IOOS ocean observation needs that the Blueprint addresses. The continued establishment of national core variables will be provided through formal interagency coordination, and partnership engagement, by the IOOC in accordance with the provisions of ICOOS Act of 2009. The Blueprint views U.S. IOOS Program Office participation in core variable management to occur in the governance and management subsystem of U.S. IOOS, one of the six subsystems of U.S. IOOS. Significantly, the governance and management subsystem includes high-level councils to address stakeholder/user-group needs and issues and high-level planning processes to implement solutions.

U.S. IOOS Subsystems

U.S. IOOS is composed of six subsystems: three functional and three cross-cutting. All subsystems are so designated because they represent "a collection of components organized to accomplish a specific function or set of functions."[11] The six subsystems will be described in greater detail in subsequent chapters and

[10] Adapted from Integrated Global Observing Strategy, *Coastal Theme Report*, January 2006, and from Intergovernmental Oceanographic Commission, *An Implementation Strategy for the Coastal Module of the Global Ocean Observing System*, 2005.

[11] Institute of Electrical and Electronics Engineers, *IEEE Standard Glossary of Software Engineering Terminology*, September 1990, p. 73.

associated appendixes; however, general descriptions for the six subsystems are provided below.

FUNCTIONAL SUBSYSTEMS

U.S. IOOS functional subsystems provide the technical capability to readily access marine environment data and data products within a fully capable U.S. IOOS. Each consists of a set of functions, hardware, software, and/or infrastructures managed by a variety of programs and entities.[12] The functional subsystems and their definitions are as follows:

- *Observing subsystem.* This subsystem comprises the collection of sensor and non-sensor marine environment measurements and their transmission from regional and national platforms. Accordingly, the observing subsystem is responsible for data quality assurance/quality control (QA/QC) and for initial metadata generation for the measurements being made and transmitted. U.S. IOOS observing subsystem data collectors transmit their data from the sensor (hardware or human) to data providers such as ocean data assembly centers (DACs) and ocean data archive centers.

- *DMAC subsystem.* This subsystem comprises the information technology (IT) infrastructure that enables the interoperable transmission of marine environment data from a data provider (U.S. IOOS observing subsystem) to a data/services customer (U.S. IOOS modeling and analysis subsystem). Similarly, this subsystem makes available DMAC-compliant data products (products derived from data such as model outputs) to end users, including U.S. IOOS customers and data product repositories. It also maintains catalogs of data and registries of observation systems that facilitate customer discovery of desired observation data. The U.S. IOOS Program Office will be responsible for coordinating the availability of the material/equipment solution, both hardware and software, for DMAC subsystem fielding and operations. This will entail leveraging existing capabilities when possible and developing, deploying, and supporting DMAC capabilities when necessary.

- *Modeling and analysis subsystem.* This subsystem comprises the U.S. IOOS-provided data, data products (products derived from IOOS data), and services used by U.S. IOOS users/customers. These users are Federal and non-Federal organizations and agencies, industry, academia, the research community, nongovernmental organizations (NGOs), tribal entities, professional organizations, and the general public. Intermediate users/customers synthesize and evaluate those data, products, and services to forecast the state of the marine environment and provide the results via reports, alerts, model outputs, or tailored analytical products to various

[12] National Office for Integrated and Sustained Ocean Observations, *IOOS Data Management and Communications Concept of Operations*, Version 1.5, January 2009, p. 1-1.

end users/customers. This subsystem also provides the mechanism by which intermediate and end users make their requirements for IOOS data and data products known.

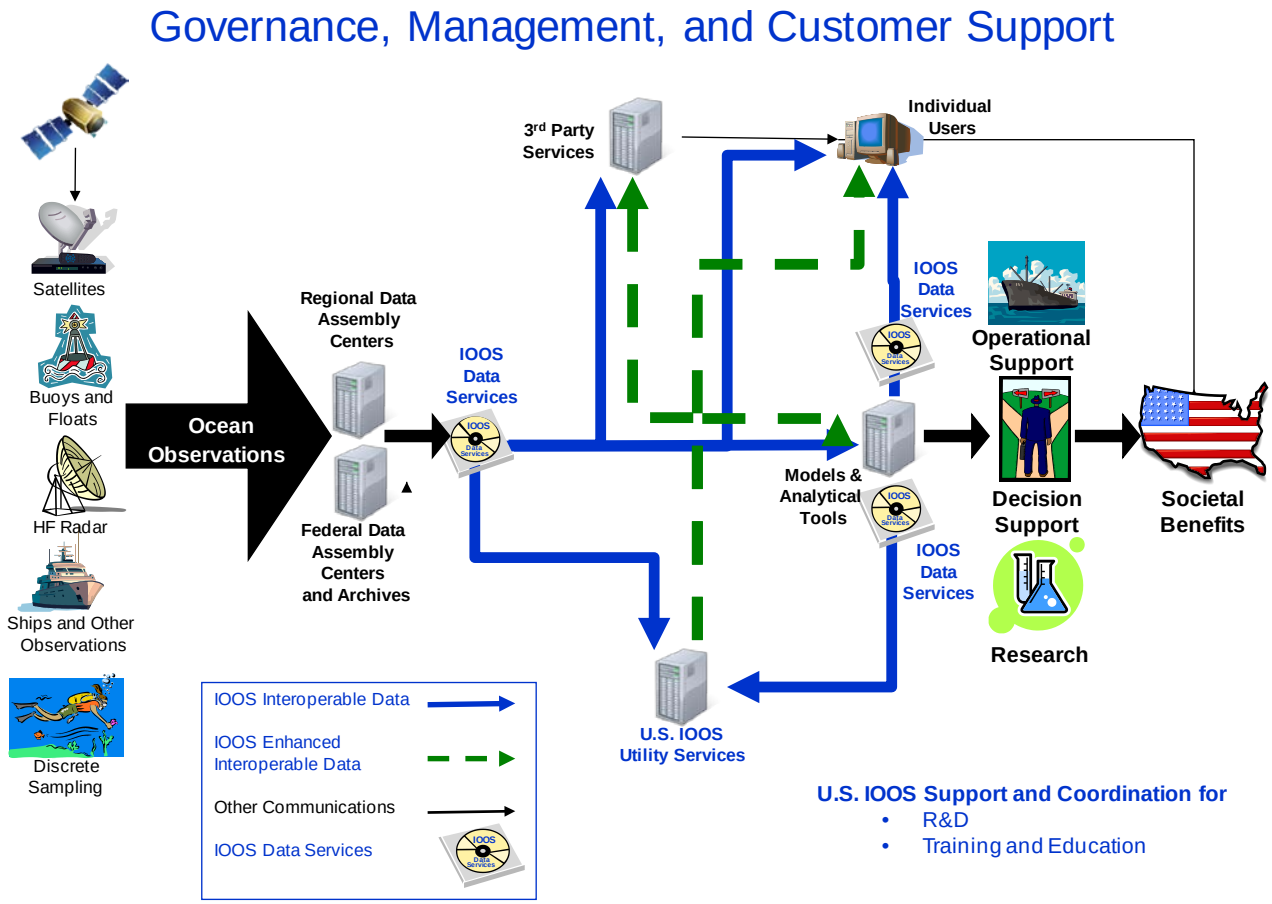
U.S. IOOS is a user-driven system linking user needs to required measurements. User needs determine the variables to be measured; the approach to managing, sharing, and analyzing data; and the speed and quality with which data, data products, and services are to be made available to users. This calls for a two-way flow of data and information among the three functional subsystems.[13]

The Blueprint envisions using existing capabilities to the greatest extent possible. Observing capabilities and modeling and analysis capabilities are relatively robust, but integrated data management and communications capabilities are limited. The Blueprint delves more extensively into DMAC, because this capability must be developed.

Figure 1-2 is a high-level view of the flow of data, in response to end-user/customer requirements, from the U.S. IOOS observing subsystem through the U.S. IOOS DMAC subsystem to the U.S. IOOS modeling and analysis subsystem. End-user/customer needs form the basis for ocean observation requirements generation. As the figure illustrates, the DMAC subsystem facilitates knowledge of, and access to, marine data for diverse data and data product customers. To do this, the DMAC subsystem provides key functionality in the areas of utility services (services, highlighted in green, that manipulate data to provide a value-added service such as product generation, metadata generation, or QA/QC) and data services (standardized data access methods, highlighted in blue, that have been adopted by U.S. IOOS in collaboration with data providers and customers to enable delivery of DMAC-compliant ocean observing data such as discovery, access, transport, visualization). Because of this, DMAC build-out will serve as the integrating mechanism for the three related functional subsystems. (Appendix B contains detailed descriptions of the utility and data services provided by DMAC, and Appendix C provides additional detail on subsystem breakout and data flow descriptions.) Models and analytical tools provide U.S. IOOS interoperable and enhanced data or data products in a manner required by end users.

[13] See Note 1, p. 4.

Figure 1-2. High-Level View of Data Flow through U.S. IOOS Functional Subsystems in Response to End-User Needs/Requirements



CROSS-CUTTING SUBSYSTEMS

In general, U.S. IOOS cross-cutting subsystems enhance the utility of U.S. IOOS functional subsystem capabilities. The U.S. IOOS cross-cutting subsystems include entities, processes, and tools that provide products and services to ensure sustainment of, and improvements to, the overall system and its usage. The cross-cutting subsystems and their definitions are as follows:

- *Governance and management subsystem.* This subsystem comprises the collection of functions and activities that support U.S. IOOS in terms of policy, plans, guidance, resources, processes, tools, and infrastructure.

- *Research and development (R&D) subsystem.* This subsystem comprises the functions and activities required to gather requirements for research and development, analyze and prioritize those requirements, and facilitate cooperation among partners with R&D capabilities to satisfy identified requirements. It also includes processes to manage R&D pilot projects, conduct technology assessments, field technology enhancements, and

transition technology solutions from the laboratory to the field. U.S. IOOS is not anticipated to directly run R&D laboratories or facilities, but can engage such institutions to act as agents of U.S. IOOS to perform designated R&D activities.

- *Training and education subsystem.* This subsystem comprises the entities, processes, and tools required to (1) develop and sustain a broad spectrum of educators and trainers who use U.S. IOOS information to achieve their education and training objectives and (2) create the workforce needed to develop and sustain the U.S. IOOS and produce U.S. IOOS information products, services, and tools.[14] Educators, trainers, and students represent a significant customer base of U.S. IOOS.

U.S. IOOS Development

U.S. IOOS is being developed using a distributed implementation approach that engages a broad range of stakeholders. This development effort must be responsive to end-user/customer needs. Implementation is distributed in that the U.S. IOOS Program Office is responsible for identifying and supporting U.S. IOOS developmental efforts among participating partners. Federal and non-Federal U.S. IOOS partners, including the RAs, are responsible for developing and operating models, decision-support tools, data management components, and most observation systems, making it easier to take advantage of existing technical capabilities and capacity. (In the case of Federal agencies, participation in IOOS does not supersede individual agencies' budget and requirements processes. U.S. IOOS will not interfere with Federal agency mission-directed activities. Each partner agency is responsible for developing programs that may contribute to IOOS in a manner consistent with agency priorities, but coordinated with IOOS as appropriate.) This distributed implementation approach requires considerable and recurring interaction among U.S. IOOS partner organizations.[15] Accordingly, the U.S. IOOS Blueprint recognizes that planning associated with the development and fielding/deployment of U.S. IOOS capabilities must incorporate the following three related objectives:

- Establish an integrated system by incorporating currently operating assets
- Enhance the system by incorporating planned and programmed capabilities as they are resourced and become available
- Improve and expand IOOS capabilities by incorporating new assets developed through research and pilot projects.[16]

[14] See Note 2, p. 68.

[15] LMI, *Business Model for Developing Regional IOOS Capability*, April 2008, p. 1-1.

[16] See Note 2, p. 11.

U.S. IOOS BLUEPRINT APPROACH

The U.S. IOOS Blueprint employs an architectural framework for describing U.S. IOOS FC, partnership roles and and implementation requirements. An architectural framework was chosen to provide a structured approach for organizing and describing discrete activities and components of U.S. IOOS that can be uniformly and repeatedly applied to all U.S. IOOS-related capabilities and participants. The architectural framework defines the domain of U.S. IOOS in terms of its component parts, how those parts function, and how those parts relate to each other and to the environment they operate in.[17]The architectural guidance and documentation in the Blueprint and associated appendices are used to do the following:

- Establish initial priorities
- Describe what needs to be accomplished, who executes it, and in what order
- Provide functional descriptions, including working relationships among U.S. IOOS components.

Significantly, the Blueprint's architectural framework does not prescribe specific system or technical solutions, infrastructure/facility material solutions, detailed business process steps, funding mechanisms, or an organizational/management structure for the U.S. IOOS Program Office. Instead, the U.S. IOOS Blueprint's focus is on identifying the requirements for developing, operating, and maintaining a fully capable integrated ocean observation system. Those requirements include the following:

- Requisite U.S. IOOS organizational functions and activities
- Technology requirements
- Required business processes
- Funding of tasks and activities
- Infrastructure node capability requirements and relationships.

[17] Department of Defense, *DoD Architecture Framework,* Version 1.5, April 23, 2007, p. 1-6.

Further, U.S. IOOS Blueprint guidance and attendant architectural views are intended to provide sufficient specificity to enable detailed, follow-on planning by U.S. IOOS partners. U.S. IOOS partners should apply the architectural views to their respective planning and execution efforts to

- form a logical basis for decision making regarding U.S. IOOS concepts and engineering detailed U.S. IOOS solutions and
- serve as a structured foundation for developing, managing, and coordinating U.S. IOOS activities.

U.S. IOOS BLUEPRINT ASSUMPTIONS

The following represent U.S. IOOS Blueprint assumptions for the effective development and execution of a fully functional U.S. IOOS:

- The U.S. IOOS Program Office, at FC, will be structured to function independent of whatever Federal agency houses it; in other words, agency functions will be independent of U.S. IOOS functions.
- All of the U.S. IOOS missions and functions cited in legislation, the IWGOO strategic plan, and the U.S. IOOS Blueprint will be resourced.
- The U.S. IOOS Program Office will provide policy oversight and coordination and will administer the terms for participation in U.S. IOOS in accordance with the provisions of the ICOOS Act of 2009.
- U.S. IOOS governance does not entail “rule making” or “regulatory” authority beyond setting the terms of participation within the system.
- The U.S. IOOS Program Office, under the auspices of the IOOC, will be the central manager of U.S. IOOS funding for contracts, grants, and cooperative agreements within U.S. IOOS.
- The U.S. IOOS Program Office will coordinate and/or inform the development of technology for, and deployment of, sensors and platforms.
- U.S. IOOS data will be interoperable in terms of discovery, access, transport/exchange, and use between two or more systems or components.
- U.S. IOOS will be developed as a system of systems linking distributed systems through standardized services.
    - U.S. IOOS will align, locate, and link disparate architectures and architecture information via information exchange standards to deliver a seamless outward appearance to users.

- Ocean observing systems, data, models, and analytic tools will contribute to U.S. IOOS but will not normally be owned by the U.S. IOOS Program Office.

- Most U.S. IOOS participating data providers (DACs, archives, sponsored models) and service providers will join U.S. IOOS largely as they are. The U.S. IOOS Program Office will certify each data provider to ensure compliance with IOOS data standards. Part of that certification process will include characterizing the QC measures applied by the data provider and the metadata it makes available. These characterizations will be made available to potential data customers so that they understand what metadata are available and what QC measures were applied to the data they access from a data provider.

- Over time, and consistent with funding, the U.S. IOOS Program Office may recommend, or coordinate the resourcing of, improvements in data provider sources to improve quality, metadata, or other aspects useful to U.S. IOOS customers.

- U.S. IOOS formally recognizes Federal and non-Federal partnerships; and recognizes that 11 RAs, the national consortium for verification and validation of ocean sensors and other non-Federal entities will provide specific functions.

ORGANIZATION OF THIS REPORT

The remainder of the document is organized as follows:

- Chapter 2 describes U.S. IOOS FC, including U.S. IOOS core functional activities.

- Chapter 3 outlines a U.S. IOOS implementation plan. It specifies the key principles guiding the implementation of U.S. IOOS and identifies the critical path to FC.

- Chapter 4 addresses U.S. IOOS partners, including their roles. It also describes an approach to engaging partners to increase their involvement in achieving U.S. IOOS FC.

- Chapter 5 describes the method for tracking and reporting progress on the development of U.S. IOOS capabilities and services.

The appendixes contain additional detail.

Chapter 2
U.S. IOOS® Full Capability

This chapter describes the desired U.S. IOOS® functionality when it is fully capable and forms the anchor to which following chapters are tied. The scope of this FC description is limited to the functions U.S. IOOS will perform. It does not address organizational structure, assignment of responsibilities within or between organizations, or resource levels, but should be used as foundational guidance for follow-on U.S. IOOS organizational design activities and resource planning/cost estimation. This description assumes funding for all functions. The pace and completeness of U.S. IOOS functionality will be affected by actual funding levels at the time of execution. Priorities for development, deployment, and operation of U.S. IOOS will be decided in accordance with responsibilities as defined in the ICOOS Act of 2009 and will be informed by user councils and approved planning documents.

Approach to Developing the FC Description

Development of the U.S. IOOS FC description began with a thorough review of U.S. IOOS documentation, which provided a high-level conceptual view of the desired functionality of U.S. IOOS at full capability. (Appendix D lists the key documents.) The Blueprint employed a structured systems approach to these largely text-based descriptions for developing the U.S. IOOS architectural framework, functional designs, activity diagrams, and working definitions.

In-depth analysis was performed on the functional U.S. IOOS subsystems (observing, DMAC, and modeling and analysis) and on the cross-cutting subsystems (research and development, training and education, and governance and management). Each of these subsystems was decomposed to answer the following questions:

- What is included in this subsystem?
- What functions does the subsystem perform?
- How does this subsystem relate to and interchange with the other subsystems?
- What is the role of the U.S. IOOS Program within each subsystem?

The resulting description of FC provides a high-level vision for U.S. IOOS. Development of the FC description should be followed by formal system analysis, engineering and design, and detailed U.S. IOOS subsystem project and project

management planning, include the following (definitions of these terms are provided in Appendix A):

- Detailed business process definition
- Use-case modeling
- Organizational design
- Systems and technical solution development
- Resource planning
- Cost estimates.

ARCHITECTURAL APPROACH

The Blueprint employs an architectural approach that depicts the complex relationships and functionality of U.S. IOOS. This architectural approach forms the basis for follow-on system analysis, requirements definition, engineering, and development. The architectural diagrams identify which entities perform what functions and to describe when, where, and why required information exchanges occur. These diagrams also serve to define the working relationships among U.S. IOOS participants and between U.S. IOOS functional components.

The U.S. IOOS Architecture provides the following:

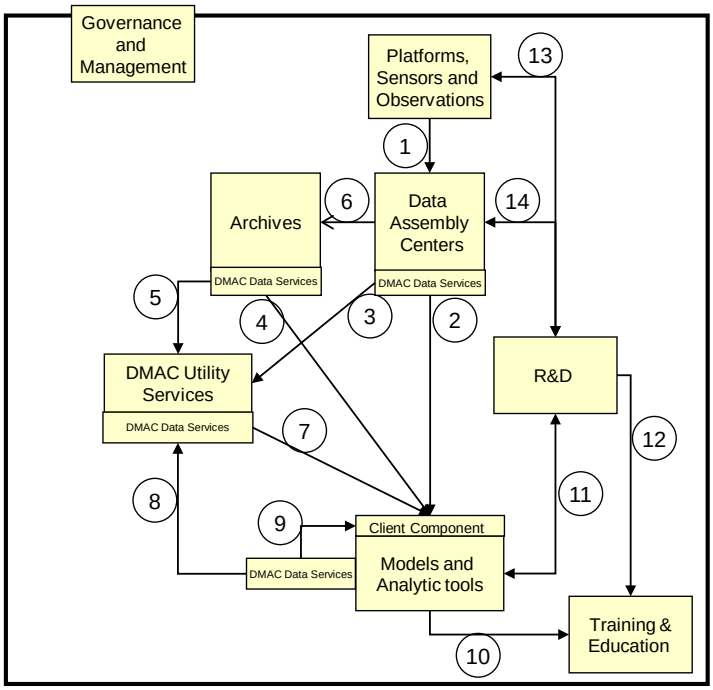
- Operational structure for U.S. IOOS components and activities
- Semantic agreement and common understanding of terms and functions
- Logical basis for decision making regarding U.S. IOOS concepts and detailed U.S. IOOS solutions
- Structured foundation for developing, managing, and coordinating U.S. IOOS activities
- Mechanism for leveraging existing systems and working relationships
- Foundation for compliance with the Federal Enterprise Architecture.

The high-level logical components of U.S. IOOS are called nodes. Nodes produce, consume, and/or process data/information.[1] Nodes may be organizations, classes of users, categories of people, software packages, collections of hardware, or combinations of these elements. Figure 2-1 depicts the high-level view of U.S. IOOS in terms of the connectivity between U.S. IOOS nodes. The figure shows

[1] Department of Defense, *DoD Architecture Framework*, Version 1.5, April 23, 2007, p. B-4.

the nodes linked by "need arrows." The need arrows describe, at a very high level, the essential information and service exchanges that must occur between the nodes for U.S. IOOS to operate effectively. The direction of the arrows shows the primary flow of data or information. Single-headed arrows show a one-directional flow of data or information, while dual-headed arrows show an exchange of data or information. For example, the single-headed arrow from "Platforms, Sensors, and Observations" to "Data Assembly Centers" shows the flow of ocean observing data. The double-headed arrow between "R&D" and "Models and Analytic Tools" shows that the products of modeling analysis inform R&D efforts and that R&D helps improve modeling and analysis. Together, the nodes and need arrows describe the functional relationships between U.S. IOOS elements and identify the major information exchanges. Following the diagram is a more detailed description of each node.

Figure 2-1. Node Connectivity Diagram with Need-Arrow Definitions



1. Raw Core Variable Data to Data Provider DAC
2. DMAC compliant data for direct model/analysis application
3. DMAC compliant data to support DMAC Utility Services
4. DMAC compliant archived data for direct model/analysis application
5. DMAC compliant archived data to support Utility Services
6. Selected data sent to archives
7. DMAC utility services value added data for intermediate/end-users
8. DMAC compliant products of models/analysis to support DMAC services
9. DMAC compliant model outputs directly to other models/analysis
10. Information from modeling and analysis efforts to inform education products
11. Model and analysis requirements for R&D and Technology solutions returning from R&D efforts
12. Information from R&D efforts to inform educational products
13. Observations System requirements for R&D and Technology solutions returning from R&D efforts
14. DAC requirements for R&D and technology solutions returning from R&D efforts

U.S. IOOS nodes are defined as follows:

- *Platforms, sensors, and observations.* This logical node encompasses all observing systems (in situ and remote), platforms, sensors, human observations, and others that collect observing data from and about the oceans and report their data to a U.S. IOOS DMAC-compliant DAC. These data are transmitted by various means to the DACs. Platforms, sensors, and observations that are not reported to a U.S. IOOS DMAC-compliant DAC are not considered to be "in U.S. IOOS." Those that are not in U.S. IOOS can become part of U.S. IOOS by reporting their data to a DMAC-compliant DAC or by having their servicing DAC reach an agreement to have a compliant DAC receive their data and offer that data in U.S. IOOS.

  Although most platforms, sensors, or observations will be owned and operated by entities other than the U.S. IOOS Program Office, it is possible that the Program Office may own, fund, or otherwise direct some platforms or sensor observation efforts.

  U.S. IOOS platforms, sensors, and sampling methods will be informed by R&D coordinated by the U.S. IOOS Program Office. For example, R&D could result in better sensors, improvements to platform designs, or changes to models that would affect sampling.

- *Data assembly centers.* This logical node includes Federal and non-Federal entities that have ocean observation data in accessible databases and that have adopted U.S. IOOS DMAC standards and passed U.S. IOOS certification (a process to be developed in accordance with the ICOOS Act of 2009). DACs (both existing and newly formed) will be registered in the U.S. IOOS registry. The heart of a DAC is the database that contains the observation data generated in the platforms, sensors, and observations node. DACs collect data from one or more sources and compile them locally so that metadata about the observations are captured and QC/QA processes can be applied. DACs may also collect data from other DACs to provide centralized access or to provide additional QC/QA measures or services. Data from DACs may be archived onsite or by another entity.

  DAC holdings may include other data beyond that targeted by U.S. IOOS at FC. Because those data can be delivered through the data access services used by U.S. IOOS DMAC, they may also be accessed through U.S. IOOS.

  DACs may also benefit from U.S. IOOS-coordinated R&D efforts such as enhancements to capabilities through the introduction of newly developed technologies.

- *Archives.* This logical node contains archives of ocean observations that were initially recorded at DACs, are DMAC compliant, and are in the U.S. IOOS registry. (Appendix B provides more information on the IOOS registry.) The U.S. IOOS Program Office manages the ability to access the archives using standardized services, methods, and tools, but it is not the arbiter of what data are archived. The decision about the data to be archived is determined by the needs of entities with an interest in the data and by the archive owners. The U.S. IOOS Program Office can inform that process and may assist with linking archives, DACs, and data users to optimize data holdings.

  Archive data holdings may include other data beyond those targeted for U.S. IOOS at FC. Data that can be delivered through the data access services used by U.S. IOOS DMAC subsystem is accessible through U.S. IOOS.

  Archives may also benefit from U.S. IOOS-coordinated R&D efforts such as enhancements to capabilities through the introduction of newly developed technologies.

- *DMAC data services.* Both DACs and archives store data in formats and structures that are conducive to the data's originally intended uses. This node organizes and packages the data to enable users/customers to easily find, access, and use data from various sources. This node also makes the underlying ocean data interoperable by applying a set of software packages to existing web-based communications servers, which will result in the DAC or archive being a participant in U.S. IOOS. (Appendix B contains a list of DMAC data services and their definitions.) The data services include the following capabilities:

  - Standardized data access regardless of the underlying data structure or format

  - Standardized IT security procedures for transmitting and receiving data

  - Standardized metadata profiles to simplify customers' decisions about which data to use and how best to use them

  - Standardized procedures to describe the QC/QA level of the data being transmitted.

  Due to the speed with which new technologies become available, U.S. IOOS will require efficient procedures to evaluate new technologies, assess economic viability, and manage change.

- *DMAC utility services.* This logical node contains the hardware and software to deliver value-added services that use U.S. IOOS data obtained

from DACs, archives, or model/analysis outputs. Utility services entail registry, catalog for data discovery, mapping and visualization, system monitoring, format conversion, subscriptions and alerts, and data integration. (Appendix B lists and describes DMAC utility services.) Due to the speed with which new technologies become available, U.S. IOOS will require efficient procedures to evaluate new technologies, assess economic viability, and manage change.

- *Client component.* This logical node contains client-owned, DMAC-compatible software that is uniquely configured to the user's system to access U.S. IOOS data, utility services, or model/analysis outputs. This software will accept the data feed from U.S. IOOS and render that data in a manner required by the U.S. IOOS customers' models and analytical tools to meet their data needs.

- *Models and analytic tools.* This logical node represents the users of U.S. IOOS data and utility services. It includes all the models, analytic tools, or other destinations for U.S. IOOS data, utility services, or model/analysis outputs. Included in this node are users who do not have tools or models but access refined products for immediate use through the U.S. IOOS.

  Some users will be the final recipients of the outputs from this node. Others will be intermediate customers who will produce model or analytic outputs that will support other customers' needs for information about the marine environment. How clients request or access products is a topic for business process development, which should occur later in the detailed subsystem planning phase.

  Some of these models or analytic outputs will be of such significance to the IOOS community that the U.S. IOOS Program Office will make them available as a data product. In these cases, the U.S. IOOS Program Office will enter into an agreement with the model owner to provide the outputs of their model/analytic tool in a format that complies with DMAC data standards. Models or tools covered by these agreements are termed "sponsored models," and U.S. IOOS customers may access their outputs as they do other ocean observing data from DACs or archives. Sponsored model outputs may also feed DMAC utility services, allowing them to provide improved services for U.S. IOOS customers.

  "Sponsorship" in this context does not imply funding. Although U.S. IOOS may fund modeling efforts, for various reasons, those model outputs may or may not be made available to customers in U.S. IOOS. For example, R&D of a model could be funded by U.S. IOOS, but until the outputs of that model are made available in U.S. IOOS, it is not "sponsored."

Archiving of model outputs is normally the result of agreements between model/tool owners and archiving entities. U.S. IOOS can make the data accessible as it does for ocean observing data. The U.S. IOOS Program Office can help broker archiving agreements and will help determine demand for access to such products.

This node also produces information that can feed R&D efforts and support training and education efforts.

- *R&D.* U.S. IOOS uses its robust communications with data providers (DACs, archives, and sponsored models) and data customers to identify R&D requirements; it then coordinates with R&D-capable entities to pursue research to meet those needs. The U.S. IOOS Program Office is the aggregator of demand (requirements) for ocean data and services, and is uniquely positioned to help bring synergy to research efforts. The products of these research efforts can improve the functionality of observations, the DACs, and modeling and analytic tools. In addition, R&D discoveries can and should help feed the training and education subsystem.

- *Training and education.* Although the U.S. IOOS Program Office will not own classrooms or schools, it will be a key provider of educational and training materials. These materials can be geared to teaching specific skills (training) or can support development of knowledge about the marine environment (education). The U.S. IOOS Program Office will work with training and education providers to understand their requirements and to develop products and services to meet those needs. As identified in the IWGOO strategic plan, the Program Office will engage professional societies to assist with training and development of professional certifications.

- *Governance and management.* This node has all the administrative and management functions that allow for a coordinated U.S. IOOS. Among these functions are plans and operations, budgeting and finance, acquisition and grants, and human resources. Also within this node are the user councils that provide feedback to the U.S. IOOS Program Office on the functioning of the system, unmet requirements, and opportunities for integration with other programs. The cross-cutting functions of governance and management are overarching operations for the system and apply to all nodes within U.S. IOOS.

Appendix C contains a full-sized version of Figure 2-1 as well as a version of the same diagram overlaid with DMAC services, components, and standards. Also in Appendix C is a diagram showing U.S. IOOS subsystem boundaries and major U.S. IOOS functions associated with each subsystem.

CORE FUNCTIONAL ACTIVITIES

The Blueprint decomposes the six U.S. IOOS subsystems into 37 distinct core functional activities. The activities, listed in Table 2-1, are the minimum capabilities required for an effective U.S. IOOS and represent, at a high level, the contribution required of U.S. IOOS to produce a cohesive suite of data, information, products, and services related to our coastal waters, Great Lakes, and oceans. Each core functional activity has subordinate activities, which are identified and organized in the activity hierarchy in Appendix E. Appendix F contains a full definition of each activity.

Table 2-1. U.S. IOOS Core Functional Activities

U.S. IOOS subsystem	Core functional activities
Governance and management	User councils Financial management Policy Plans and operations Human resources Acquisition and grants Marketing, outreach, and engagement IT support
Observing systems	Observing subsystem management Surveys Optimization studies Asset management
DMAC	Register data providers Manage data providers Deregister data providers Standards management Utility services management Utility services development Data services and component development Data services and component management Configuration control
Modeling and analysis	Customer needs Sponsored models MOU management Publication of standards
Research and development	R&D requirements determination Coordination of R&D programs R&D pilot projects Technical assessments Technology enhancements Technology transition

Table 2-1. U.S. IOOS Core Functional Activities

U.S. IOOS subsystem	Core functional activities
Training and education	Training and education strategy and plans development Training and curriculum development Training and education pilot projects Training and education assessments Collaboration with education delivery managers Professional certifications

Note: MOU = memorandum of understanding.

ALIGNMENT WITH RECENT GUIDANCE

The ICOOS Act of 2009 stipulates 35 actions to be performed by the National Ocean Research Leadership Council, the Interagency Committee, or the National Oceanic and Atmospheric Administration (NOAA). Appendix G lists those actions and shows their alignment with the objectives from the IWGOO strategic plan and with the related U.S. IOOS activities. Every action required by the ICOOS Act, and every objective from the IWGOO strategic plan aligns with an identified U.S. IOOS activity.

Chapter 3
Implementation Plan

The Blueprint implementation plan is a high-level guide to the development and integration of U.S. IOOS® to achieve full capability (FC). FC is the point at which

- all designated U.S. IOOS data providers are integrated and making accessible all appropriate ocean observing core variables in a U.S. IOOS compliant manner to end users/customers,
- all U.S. IOOS services are available and functioning at the desired level, and
- a fully capable U.S. IOOS Program Office is providing system oversight and coordination.

Significantly, FC is not the end of all development. It is simply the objective state defined for the initial establishment of a fully functional U.S. IOOS consistent with the requirements that have been levied to date. U.S. IOOS is envisioned as an adaptive system that will continue to implement new solutions, adopt new technologies and improve system processes to ensure that the U.S. IOOS remains capable of meeting evolving end-user/customer needs.

The implementation plan

- specifies the key principles guiding the implementation of U.S. IOOS,
- describes the high-level approach to attaining U.S. IOOS FC encompassing the six functional and cross-cutting U.S. IOOS subsystems, and
- identifies next steps required to implement the Blueprint.

The implementation plan sets the stage for systems analysis and engineering and for detailed subsystem planning by identifying U.S. IOOS activities that must be established and functioning within each subsystem, sequencing the development of those activities, and describing expected outcomes. Detailed plans can then be developed; those plans, combined with partnership agreements and funding profiles, must identify and coordinate agency/organizational responsibilities with U.S. IOOS implementation and associated milestone dates.

PRINCIPLES

Implementation of U.S. IOOS will be guided by the following key principles:

- U.S. IOOS will provide value to its partners by helping them succeed at their self-directed efforts that help meet U.S. IOOS societal goals.
- U.S. IOOS will be a federated architecture.
- U.S. IOOS will use a distributed implementation approach.
- Implementation of U.S. IOOS will focus on achieving three related objectives:
  - Establish an integrated system by incorporating existing operational and R&D assets;
  - Enhance the system by incorporating planned and programmed operational and R&D capabilities as they are resourced and become available; and
  - Improve and expand IOOS capabilities by incorporating new assets developed through research and pilot projects.[1]
- The U.S. IOOS Program Office will work with other entities—for example, RAs; U.S. Federal agencies; international groups such as the World Meteorological Organization (WMO), the Intergovernmental Oceanographic Commission, and the International Oceanographic Data and Information Exchange; and standards-developing organizations such as Open Geospatial Consortium—to adopt, adapt, profile, or develop standards and best practices for data management. U.S. IOOS will also comply with U.S. policies regarding data and metadata.
- The DMAC subsystem will be the integrating mechanism.
- U.S. IOOS is a partnership among government, academia, non-governmental organizations, and industry and is firmly rooted in a strong Federal and non-Federal partnership.
- Participation in U.S. IOOS will be voluntary.

These principles are addressed in the following subsections.

[1] National Office for Integrated and Sustained Ocean Observations, *The First U.S. Integrated Ocean Observing System (IOOS) Development Plan*, Ocean.US Publication 9, January 2006, p. 11.

Value to U.S. IOOS Partners—Achieving Societal Goals

U.S. IOOS will provide value to its partners by helping them succeed at their self-directed efforts that help meet U.S. IOOS societal goals. While there is a common need for readily accessible ocean observation data and data products, each partner in U.S. IOOS operates under its own direction in pursuit of its individual organizational goals and objectives. U.S. IOOS provides the structure in which data and data products can be seamlessly shared by partners and other data customers as needed. U.S. IOOS will set criteria and standards for accessibility, transportability, and integrity of all U.S. IOOS relevant data and data products integrated into the System. The intent is that each partner should be able to get what it needs from U.S. IOOS while delivering their data or services contribution with little or no change to their underlying business processes. All this occurs within the context of achieving the seven U.S. IOOS societal goals.

Federated Architecture

A federated architecture transparently integrates the data, services and products from multiple autonomous contributing systems and presents them as a larger integrated system. The federated architecture defines the objectives of the larger system; the technologies necessary to integrate data, services, and products; and the role of each autonomous contributing system without changing the underlying structure or functionality of those systems. It provides a framework for enterprise architecture development, maintenance, and use that links disparate system architectures and architecture information. This linkage is achieved through data exchange standards to deliver a seamless outward appearance to users while leaving the underlying systems undisturbed. This allows participating organizations' architectures to remain unique and autonomous while enabling users everywhere to benefit from their content.

A federated architecture does not imply a strict hierarchy of contributors in which U.S. IOOS lies at the top of the hierarchy. There will not be a unidirectional flow of technical benefits from other networks into U.S. IOOS. Rather, there will often be a mutual interdependence between integration components that bear the "IOOS®" brand and integration components that bear other brands, such as WMO, National Aeronautics and Space Administration (NASA), and Environmental Protection Agency.

Distributed Implementation Approach

Rather than a centrally created and managed system, U.S. IOOS will be implemented using a distributed approach. This approach uses existing components, procedures, and resources to create the core of the system and then adds only those elements that are necessary to supplement what is already available. Distributed implementation engages a broad range of stakeholders and helps to ensure that U.S. IOOS responds to end-user needs. The U.S. IOOS

Program Office is responsible for identifying, managing, and coordinating U.S. IOOS development efforts. Other Federal and non-Federal U.S. IOOS partners, including the RAs, are responsible for model development and operations, decision-support tools, data management components, and observing systems, consistent with their organizational missions. The benefits of this approach have been described as follows:

> This approach makes it possible to take advantage of existing technical capabilities and capacity, rather than duplicate them, and to view U.S. IOOS more objectively, without being constrained by programmatic ties to existing structures, systems, or approaches. The distributed implementation approach requires considerable interaction between the [U.S.] IOOS Program [Office] and its partner organizations.[2]

Although these benefits can be achieved in other ways, using existing assets and capabilities is a rapid and cost-effective way to create a large-scale, robust system.

Implementation Objectives

U.S. IOOS implementation has three related objectives:

- Establish an integrated system by incorporating existing operational and R&D assets
- Enhance the system by incorporating planned and programmed operational and R&D capabilities as they are resourced and become available
- Improve and expand IOOS capabilities by incorporating new assets developed through research and pilot projects.[3]

Guided by these three objectives, with their focus on integrating current developmental capabilities, the U.S. IOOS Program Office will establish, enhance, and improve U.S. IOOS. The cost and time required to link these existing efforts are projected to be substantially lower than they would be if all required capabilities were created using new development efforts.

An example of establishing the system by integrating existing assets is the inclusion of Federal data providers such as the National Data Buoy Center. Enhancing the system by incorporating additional operating assets could include regional observing assets not currently reported through a Federal data source. An example of improving capabilities through the incorporation of R&D pilot projects is the distributed cyber infrastructure being built by the National Science

[2] LMI, *Business Model for Developing Regional IOOS Capability*, April 2008, p. 1-1.
[3] See Note 1.

Foundation's Ocean Observatories Initiative for efficient storage and transport of vast amounts of data.[4]

U.S. IOOS Program Office Coordination with Other Entities

The U.S. IOOS Program Office will work with other entities—for example, U.S. Federal agencies; RAs; international groups such as the WMO, the Intergovernmental Oceanographic Commission, and the International Oceanographic Data and Information Exchange; and standards-developing organizations such as Open Geospatial Consortium—to adopt, adapt, profile, or develop standards and best practices for data management. U.S. IOOS will also comply with U.S. policies regarding data and metadata. The U.S IOOS Program Office will maintain open lines of communication with partners as well as with national and international organizations pursuing similar goals in data management and communications.

In an effort to use the best available standards and practices and to avoid undue cost and make U.S. IOOS data available to the widest possible audience, the Program Office will apply the following approach. The U.S. IOOS Program Office will seek to meet any documented requirement by adopting existing, widely accepted standards and practices. In this way, the Program Office will experience lower development cost and attain standards that are already tested and accepted by the larger community. If there are no existing standards that meet the requirement, the U.S. IOOS Program Office will seek to adapt an existing standard to fulfill the need. If this is not possible, the U.S. IOOS Program Office will use the closest standard it can find as a guide and profile a new standard based on the existing standard. Finally, if all other methods to meet the requirement fail, the U.S. IOOS Program Office will develop a new standard and then seek community acceptance. All standards and practices will adhere to U.S. policies regarding data and metadata.

DMAC Subsystem as the Integrating Mechanism

The DMAC subsystem is the primary mechanism for data integration required for the U.S. IOOS to function effectively. DMAC will be developed with the intent of integrating all projected data sources and with flexibility to integrate future data sources. Which data sources are integrated will be determined consistent with user requirements, policy, and standards. The DMAC subsystem represents the primary direct equipment/material responsibility of the U.S. IOOS Program Office for development, deployment, and sustainment.

[4] National Office for Integrated and Sustained Ocean Observations, *The Integrated Ocean Observing System (IOOS) Modeling and Analysis Workshop Report*, Ocean.US Publication, July 2008, p. 8.

Voluntary Participation

Participation in U.S. IOOS will be voluntary. Federal assets are included in accordance with the ICOOS Act of 2009. Non-Federal assets are encouraged to participate, but their participation is purely voluntary. Data providers and data/services customers must decide to participate in U.S. IOOS in order for it to be successful. This reality has four ramifications:

- The U.S. IOOS Program Office must have a means to gather requirements from participants and process those requirements to provide solutions.
- The cost of participation, particularly for data providers, must be reasonable in terms of level of effort/resource commitment (time, money, personnel) and required changes to their current processes.
- U.S. IOOS must provide value to its data providers.
- U.S. IOOS must provide value to its data/services customers.
- The U.S. IOOS Program Office must have mechanisms to stay in touch with participants' perceptions about their experience with U.S. IOOS.

Without willing participation, U.S. IOOS will remain a niche system serving only a few users. With robust participation, it will become the primary source of ocean data and analysis in the United States.

IMPLEMENTATION APPROACH

The U.S. IOOS implementation approach has three key steps:

- Map activities to time frames
- Map activity-derived tasks to time frames
- Build out the DMAC subsystem.

Mapping of Activities to Time Frames

The U.S. IOOS Blueprint looks at U.S. IOOS development in terms of three sequential time frames:

- Current activities—the status or capability to perform U.S. IOOS activities or functionality of U.S. IOOS equipment/material (hardware/software) at the time of Blueprint issuance.
- Initial capability (IC)—the point at which U.S. IOOS provides access to a large enough set of data, from a large enough set of data providers, with

enough utility services to present a meaningful and useful source of data to most users. The key features of IC are described below. The final decision on what constitutes IC is the purview of the IOOC as described in the ICOOS Act of 2009.

- Full capability (FC)—the point at which all designated data providers are integrated and providing all the targeted ocean observing core variables via U.S. IOOS data services, and all U.S. IOOS utility services are available and functioning at the desired level. FC is not the end of all development. It is simply the objective state defined for the initial establishment of a fully functional IOOS consistent with the requirements described to date. The functions and activities described in the appendixes provide for ongoing collection of requirements, implementation of new solutions, adoption of new technologies, and processes to ensure that IOOS remains a viable system meeting customer needs into the future.

These time frames are described in event-based terms, because the actual timing of these events is contingent on U.S. IOOS resourcing, the creation of detailed subsystem development plans, preliminary systems analysis and engineering requirements, and the establishment of partnership agreements with attendant partnership development plans.

The definition of IC will depend on detailed planning for each subsystem and well-defined expectations for partnership participation. To support this detailed planning, a list of IC features has been developed that will drive development of key U.S. IOOS functions, activities, and processes. Attaining this level of capability will ensure that the system has the minimum essential processes up and running. Achieving these minimum essential processes can occur in a progressively systematic manner. For example, having seven core variables available in DMAC-compliant form guarantees that the process to create data services is functioning. Likewise, having four data providers certified and participating demonstrates that the processes to certify and integrate various data providers are functional. Achieving the listed capabilities will demonstrate that IOOS is broadly prepared to be operational and only needs to expand using the process in place.

The following features of IC constitute the minimum acceptable level of capability:

- Seven core variables are available in DMAC-compliant form.
- A certification process for data providers is in place (as defined by the IOOC in compliance with the ICOOS Act of 2009).
- At least four data providers are certified and participating:
  - At least one must be part of NOAA as lead Federal agency.

- At least one must be part of another Federal agency.
- At least one must be regional.

- At least one sponsored model is available for use.
- DMAC standards are generally available for adoption by others.
- Standardized metadata are available from the participating data providers.
- Data customers have the ability to know the quality of data they are accessing.
- At least two societal benefit areas are served by the core variables, data structures, data providers, and DMAC services offered by U.S. IOOS.
- There is a functioning U.S. IOOS registry with network catalogs to enhance usability and data discovery.
- A generic viewer client—a program that allows any potential U.S. IOOS user to access the U.S. IOOS registry and catalogs to find the data and services he or she needs—is available.
- U.S. IOOS data are available through the Global Telecommunications System (GTS). (At FC, many methods of data dissemination are anticipated.)

To achieve the minimum level of capability, the U.S. IOOS Program Office will have to develop many of the functions and activities described in Chapter 2, as well as develop DMAC data access and utility services and partnership agreements. The list of minimum capabilities drives the required development across the full gamut of U.S. IOOS.

Once IC is achieved, the U.S. IOOS Program Office will work to reach FC. At FC, all core variables are served in DMAC-compliant form, from all targeted (as determined by the detailed U.S. IOOS implementation plan) data providers, and all DMAC services function as designed for the benefit of U.S. IOOS data customers/users.

Appendix E identifies all of the functional activities and subordinate activities to be developed for each U.S. IOOS subsystem. Figure 3-1 shows a portion of the activity hierarchy, specifically, the U.S. IOOS governance and management subsystem, decomposed to its eight core functional activities.

Figure 3-1. Portion of the U.S. IOOS Activity Hierarchy

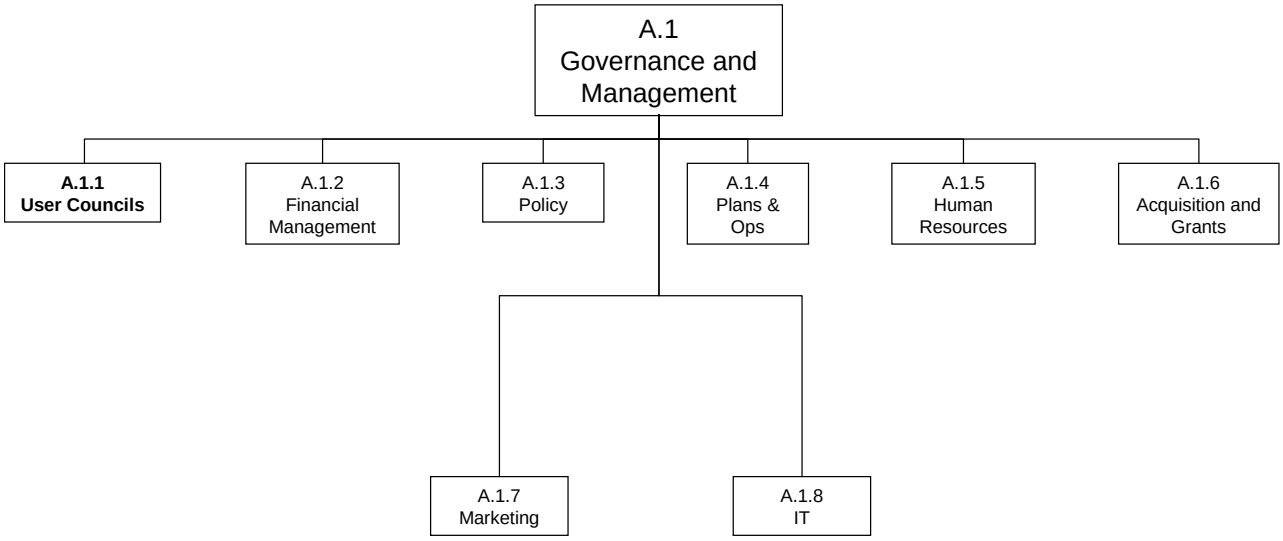


Table 3-1 shows a portion of the U.S. IOOS implementation plan organized by time frame. Specifically, it depicts U.S. IOOS governance and management core functional activities with their subordinate activities arrayed against the three sequential Blueprint time frames, indicating when they are expected to be available. Activities identified in the current activities and IC time frames must be developed to a minimum functional level. This means they must achieve sufficient capability to provide meaningful and useful benefit to meet their stated purpose for U.S. IOOS participants/partners. All activities must achieve full functionality by FC. There is nothing prohibiting achieving full functionality prior to FC. (A blank box in the FC column indicates that FC for that particular function is achieved at IC.)

Table 3-1. Portion of Time Frame for U.S. IOOS Implementation, by Subsystem

Function	Current activities	IC	FC
Governance and management subsystem			
User councils	Multiple advisory bodies with differing policies, procedures, and feedback mechanisms (NFRA, workgroups, DIF project workgroups/IPTs)	(A.1.1.2–A.1.1.6 and A.1.1.8) Create user council: ◆ Create user council policy and procedures ◆ Develop resource plan ◆ Create member lists ◆ Develop procedures to address user requirements ◆ Convene user councils (A.1.1.1 and A.1.1.7) Identify target standards bodies and international councils	(A.1.1.1 and A.1.1.7) Convene standards bodies and international councils (A.1.1.9 and A.1.1.10) Convene combined forums (A.1.1.11) Convene R&D asset owners

Table 3-1. Portion of Time Frame for U.S. IOOS Implementation, by Subsystem

Function	Current activities	IC	FC
Financial management	(A.1.2.1–A.1.2.4) Planning, budgeting, execution, analysis (NOAA-centric and regional-centric resourcing)	(A.1.2.5) Interagency coordination	
Policy	(A.1.3.1) Intramural policy (A.1.3.3) Congressional liaison	(A.1.3.2) Extramural: technical and administration	
Plans and operations	(A.1.4.1.2) IOOS internal (plans) (A.1.4.2.6) Program office internal (operations) (A.1.4.2.4) Regional assessments (A.1.4.2.5) Regional project management	(A.1.4.1.1) National coordination (plans) (A.1.4.2.1) Interagency (operations) (A.1.4.2.2) National (operations)	(A.1.4.1.3) International coordination (plans) (A.1.4.2.3) International (operations)
Human resources		(A.1.5) Human resources	
Acquisition and grants	(A.1.6.1 - A.1.6.3) Acquisition and grants (purchasing, contracting, and grants and cooperative agreements)	(A.1.6.4) Independent cost estimates	

Notes: DIF = Data Integration Framework, IPT = integrated project team, and NFRA = National Federation of Regional Associations for Coastal and Ocean Observing.

Appendix H contains the complete list of U.S. IOOS activities and subactivities and their respective time frames for implementation (current, IC, and FC).

Mapping of Activity-Derived Tasks to Time Frames

Establishing the core functional and subordinate activities requires accomplishing numerous specific tasks. Appendix I lists the U.S. IOOS implementation tasks that must be completed to attain IC and FC. The tasks are sequenced to support the three time frames for establishing the activities. In other words, Appendix I is a composite list of all the tasks required to develop U.S. IOOS associated with the time frame in which they must be completed. Tasks do not have a one-to-one alignment with activities in the activity hierarchy (Appendix E). In some cases, an activity in the activity hierarchy may require completion of multiple tasks; in other cases, a single task may support development of multiple activities.

Table 3-2 shows a portion of the task list associated with the first core functional activity (user councils) of the U.S. IOOS governance and management subsystem. (Where there are no tasks listed as “Prior to FC,” all tasks have been completed “Prior to IC” for that particular core functional activity.)

Table 3-2. Portion of U.S. IOOS Implementation Plan Task List

No.	Core functional activity	Prior to IC		Prior to FC	
		Task no.	Task	Task no.	Task
Governance and management subsystem					
1	User councils	T-1.1	Get budget authority for user council activities	T-1.13	Begin conducting standards bodies, international, combined forums, and R&D asset owners user councils
		T-1.2	Gather human resources to manage user councils		
		T-1.3	Secure facilities and required equipment for managing user councils		
		T-1.4	Develop policies required to manage the user councils		
		T-1.5	Develop meeting procedures for user councils		
		T-1.6	Develop process for adjudicating user council recommendations and translating requirements into actions		

The task list provides the basis for detailed subsystem planning, which includes assigning responsibilities, coordinating requirements, and determining which tasks can occur simultaneously and which must be sequential. Much of this detailed planning will depend on funding levels and numbers of personnel assigned.

Building out the DMAC Subsystem

The DMAC subsystem is the central integrating component of U.S. IOOS and, as such, deserves particular attention. It is also the least developed of the IOOS subsystems. The material/equipment solution—hardware and software for developing, fielding, and operating the DMAC subsystem and its associated services—is a primary responsibility of the U.S. IOOS Program Office.

Build-out of DMAC services has four main elements:

- *Variables.* A total of 26 core ocean observing variables (identified in Chapter 1) are required to detect and predict changes in a maximum number of marine phenomena of interest to U.S. IOOS participants. These core variables represent the high-level ocean observation requirements for U.S. IOOS.

- *Data providers.* Data providers are the U.S. IOOS sources for core variable data.

- *Data structures.* From a technical standpoint, each core variable is expressed by one or more data structures. The DMAC data services must be able to convey these structures and transport that information to U.S. IOOS data customers/users. The data structures are as follows:

  - Regular grid (some models, satellite level 3)
  - Point time-series
  - Profile time-series
  - Collection of points or profiles
  - Trajectory (2D or 3D)
  - Collection of trajectories
  - Unstructured grid (some models)
  - Curvilinear grid (e.g., HFR radials)
  - Swath (satellite level 2)
  - Polygon (ancillary data).

- *Societal benefit areas.* U.S. IOOS supports seven societal benefit areas:[5]

  - Weather and climate
  - Marine operations
  - Natural hazards
  - National/homeland security
  - Public health
  - Healthy ecosystems
  - Sustained resources.

Considering these four elements, and the guidance from previous U.S. IOOS planning documents, the requirement for developing the U.S. IOOS DMAC subsystem may be summarized as follows: provide data and utility services to

[5] National Office for Integrated and Sustained Ocean Observations, *The First U.S. Integrated Ocean Observing System (IOOS) Development Plan*, Ocean.US Publication, January 2006, p. viii.

transport 26 ocean observing variables, in as many as 10 data structures, from a list of identified U.S. IOOS data providers to U.S. IOOS data/services customers in support of the seven societal benefit areas. This description is accurate based on the existing high-level IOOS documentation; however, it may be modified over time due to changing needs. Any modifications must be approved by the IOOC in accordance with the ICOOS Act of 2009.

Overview of Recognized Approaches to DMAC Build-out

To date, three approaches to building out the DMAC subsystem have been identified. All three have problems, and none has been deemed adequate when considered alone. The three individual approaches and a summary of the problems with each follow:

- *Core-variable centric.* This approach would systematically expand DMAC capability by pursuing one core variable at a time until all 26 variables are complete. On a technical level, this cannot be accomplished without determining the best ways to access and transport the various data structures in which the core variables are conveyed. To pursue one variable to completion would require solving all the data structure that could be used. This is inefficient because not every data structure is needed for every variable and because once a data structure is solved, it can quickly be reused on other variables that have similar structures. It is very inefficient to delay implementing other core variables—that could be ready with some adjustments—until the data structures of one variable are fully completed. Another problem is determining the sequence of core variables and which data providers should have priority for integration.

- *Data-structure centric.* This approach would systematically expand DMAC capability by successively delivering data structure capability. From a technical standpoint, it makes sense to pursue data structures, because each structure helps deliver parts of core variables. Here, the difficulties begin with determining the sequence of data structures to deliver. Other than the known difficulty of developing standards for data access and transport, based on existing industry standards, there is no commonly understood way to prioritize which structures to work on first. Further, this fragmented approach would result in parts of variables becoming available as each structure is finished, and there is no way to tell how valuable those results would be. In addition, although completing a data structure provides the ability to address all the variables that use that structure, some individual adjustments will likely be necessary to accommodate some variables. That means that taking a data-structure centric approach will still, to a limited extent, leave unresolved the question of optimal core variable and data provider sequencing.

- *Data-provider centric.* In this approach, the desired U.S. IOOS data providers would be taken in sequence; all their core variables would be

accommodated before moving to the next data provider. If the first few data providers have large holdings, the universe of data structures and variables would be accommodated within the first few data providers. However, this approach could result in the first few data providers taking multiple years to complete, denying the modeling and analysis subsystem/data user community access to significant holdings for an extended period of time in a resource-constrained environment.

Analysis of these three approaches and their deficiencies led to the development of the focus-area centric approach to DMAC build-out.

PROPOSED FOCUS-AREA CENTRIC APPROACH

In this approach, DMAC development focuses successively on selected societal benefit areas. The selection and sequencing of societal benefit areas is based on a combination of societal urgency for the U.S. IOOS data and the ability to logically, effectively, and efficiently incorporate core variables, data structures, and data providers. This results in "capability packages" being delivered that include core variables, their associated data structures, and key data providers to meet the selected societal need of the modeling and analysis subsystem/data user community. In other words, each capability package delivers the specific needs of a selected societal benefit focus area. Although it may not deliver all the data structures of a given variable, it delivers the data structures that are most needed. Likewise, it may not include all the data providers that hold a certain core variable, but it delivers the most important ones. Because core variables typically have value to more than one societal benefit area, selectively sequencing the incorporation of societal benefit areas affords satisfaction of all core variables, with their attendant data structures and servicing data providers, over the course of four iterations of focus-area centric execution (see the example provided below). Thus, by selecting the focus areas judiciously, the U.S. IOOS Program Office can ensure that it is rationally sequencing the delivery of interoperable data that are important to the U.S. IOOS community in a manner consistent with its needs.

Steps in Focus-Area Centric Approach

The focus-area centric approach uses the following steps.

- *Step 1. Identify the sequence of targeted societal benefit areas and select a single focus area.* This step is accomplished once and is based on a strategic assessment of the seven ocean observing societal goals.

- *Step 2. Identify the core variables related to each focus area.* Twenty core variables have already been aligned with societal benefit areas.[6] Table 3-3 shows the alignment. The table also shows a draft alignment for three of

[6] See Note 1, p. 20.

the six new core variables; all six of the new variables must be aligned and approved by the IOOC in accordance with the ICOOS Act of 2009.

Table 3-3. Relationship of Core Variables to Societal Benefit Areas

Core variable	Weather and climate	Marine operations	Natural hazards	National security	Public health	Healthy ecosystems	Sustained resources
Salinity	X	X	X	X	X	X	X
Temperature	X	X		X	X	X	X
Bathymetry	X	X	X	X	X	X	X
Sea level	X	X	X	X		X	X
Surface waves	X	X	X	X	X	X	X
Surface currents	X	X	X	X	X	X	X
Ice distribution	X	X	X	X			
Contaminants				X	X	X	X
Dissolved nutrients					X	X	X
Fish species						X	X
Fish abundance						X	X
Zooplankton species					X	X	X
Optical properties				X	X	X	X
Heat flux	X					X	X
Ocean color	X	X			X	X	X
Bottom character	X	X				X	X
Pathogens				X	X	X	X
Dissolved oxygen						X	X
Phytoplankton species	X	X		X	X	X	X
Zooplankton abundance						X	X
Wind speed and direction (new)							
Stream flow (new)	X		X			X	X
Total suspended matter (new)							
Colored dissolved organic matter (new)							
Partial pressure of carbon dioxide (pCO_2) (new)					X	X	X
Acidity (pH) (new)					X	X	X

Note: Highlighted cells indicate priority variables.

- *Step 3. Convene a work group of experts for the first focus area.* These experts advise on which variables are the most important to their work and

which key data sets and data providers they need to have included. Experts should include users of data services such as policy managers as well as technical data experts.

- *Step 4. Assess the data providers named by the work group to identify the data structures they use to convey the data the work group needs.* If some data providers are not participating in U.S. IOOS, undertake procedures to incorporate them into the system.

- *Step 5. If an observation gap is found to exist (i.e., the needed data are not collected), assess the requirement and cost to fill the gap.*

- *Step 6. Analyze effort versus benefits to determine the right sequence for developing data structures, the right sequence for core variables, and the right sequence for data providers.* These determinations will be based on providing the most benefit with the least cost in terms of funding and schedule. This will deliver the most important data to the user community as quickly as possible. It is probable that not all data structures, core variables, or data providers can be accommodated in a reasonable time frame. Some may be too costly in terms of resources (time, money, manpower) when considered in terms of the value they present to the user community.

- *Step 7. Plan and execute development of the DMAC focus area capability package.*

- *Step 8. Upon completion of the focus area capability package, repeat steps 2–7 for the next focus area.*

Example of Focus-Area Centric Approach

With careful selection of the societal benefit areas by the IOOC, four iterations could address all the core variables, data structures, and important data providers, depending on the IOOC-approved mapping of the six additional core variables to societal needs. For example, if the first societal benefit area chosen is weather and climate, with a focus on climate change, the following core and additional variables may be included: salinity, temperature, sea level, ice distribution, heat flux, ocean color, phytoplankton species, and stream flow. These variables will be linked to the important data providers, and analysis of their data holdings will dictate which data structures are required. When the first capability package is completed, all the important variables, data structures, and data providers needed to support climate change will be part of U.S. IOOS.

The variables (and corresponding data structures and data providers) under weather and climate that were not included in the first capability package—bathymetry, surface waves, surface currents, and bottom character—can be addressed in the next capability package if marine operations is selected as the second focus area.

This focus-area centric approach adds a reasonable number of new core variables to accommodate the needs of the successively addressed focus areas, while expanding on prior variables as necessary. Continuing with this approach, the selection of public health and healthy ecosystems as the third and fourth societal benefit areas will have the following results:

- A reasonable number of new variables will be added in each capability package.
- All variables will have been addressed.
- All variables that are important to more than one societal benefit area will have been addressed and reassessed multiple times. In effect, the more important a variable is across societal benefit areas, the more attention it gets in development.
- All the data structures that are important will be addressed in the sequence that was most important to providing the data needed by modeling and analysis subsystem/data users.
- All the U.S. IOOS data providers that are important to the modeling and analysis subsystem/data users will be included.
- Each capability package will support real needs and provide required U.S. IOOS data based on priority of importance to the modeling and analysis subsystem/data users.

Although it is possible that the first four cycles will not develop every data structure for every variable or will not include every data provider, every one of these that is important in practical terms will have been accommodated. At the completion of four cycles of development, the remaining three societal benefit areas will be assessed to see if any work remains to meet their unique needs.

U.S. IOOS NEXT STEPS

The next step in implementing the requirements of the U.S. IOOS Blueprint is to develop the detailed plans necessary to assign and execute responsibilities, resources, and timelines. This detailed planning will require decisions on funding levels and organization responsibilities and falls into two realms:

- Detailed planning for subsystem development.
- Detailed planning for partnership development.

Detailed Planning for Subsystem Development

The U.S. IOOS Program Office is responsible for coordinating and overseeing the development and integration of the capabilities of the remaining five IOOS subsystems: ocean observations, modeling and analysis, governance and management, research and development, and training and education. Development of detailed subsystem plans requires the following steps:

- Disseminate policy decisions on agency responsibilities for each subsystem and validate the associated functions, activities, and responsibilities
- Establish functions within the U.S. IOOS Program Office to coordinate and oversee development efforts, consistent with IOOC-established plans, across agencies/organizations
- Determine detailed requirements for each subsystem
- Assess current capabilities and partnership capabilities
- Develop plans to close gaps with system integration coordinated by the U.S. IOOS Program Office
- Develop cost estimates and funding allocations to support subsystem development
- Conduct detailed planning to accomplish the tasks (identified in Appendix I), including assigning responsibilities, budgets, and schedules
- Identify the focus areas for DMAC subsystem development, determine the desired sequence, and identify the focus-area experts
- Develop change management plan and control mechanisms.

Detailed Planning for Partnership Development

Detailed partnership planning must take place in conjunction with the detailed subsystem planning:

- Identify partnership requirements to execute the detailed plans for subsystems, including DMAC development, employing the three related U.S. IOOS development objectives initially cited in Chapter 1
- Create requisite partnerships based on unresolved needs, define roles and responsibilities, and identify expected outcomes
- Monitor execution of agreements and modify partnerships as U.S. IOOS develops and as partner needs evolve

- "Market" the U.S. IOOS development effort and system capabilities to convince data providers, data/services customers, and model owners to participate in U.S. IOOS.

Partner roles and engagement are described in greater detail in Chapter 4.

Chapter 4
U.S. IOOS® Partnership Roles and Engagement

U.S. IOOS® partners are distributed across Federal agencies, Regional Associations and other organizations around the country, presenting significant programmatic integration challenges. The U.S. IOOS Program Office is responsible for coordinating these distributed capabilities to maximize partner involvement with U.S. IOOS. The objective is to take advantage of existing capabilities among U.S. IOOS partners and to objectively identify opportunities for incorporation and collaboration.

To ensure an effective partner contribution to U.S. IOOS, as well as other national and global observation systems, the U.S. IOOS Program Office will maintain strong connections to, and understanding of, U.S. IOOS partners. This chapter defines the different types of partners contributing to U.S. IOOS and identifies partner roles and responsibilities. It then defines a strategy and implementation approach for engaging—building, managing, and accessing—U.S. IOOS partnerships. It is intended to guide future relationships among U.S. IOOS internal and external partners. The goal of this engagement is to move U.S. IOOS to an optimum partnership environment; one in which all designated U.S. IOOS goals and objectives have committed and capable partners contributing in a coordinated and productive manner.

DEFINITION OF A PARTNER

In this Blueprint, a U.S. IOOS partner is defined as any entity that assists the U.S. IOOS Program with carrying out its mission and that meets one or more of the following conditions:

- Receives or contributes U.S. IOOS resources (either funding or in-kind support), excluding the legislative branch
- Is identified as a partner or potential partner in planning, programming, or budgeting documentation
- Supports the development or implementation of U.S. IOOS by providing capabilities—products, services, data, expertise, or infrastructure—to U.S. IOOS.

Once an organization has been identified as meeting one or more of the conditions, it will be designated a partner and will be entered into a partnership

database that catalogs the entire spectrum of U.S. IOOS partners. (Appendix J contains the partnership database as of July 2010.) The partnership database details what partners directly participate in U.S. IOOS; the partner roles they fulfill in a fully functioning U.S. IOOS; and the context, manner, and extent to which they currently participate. It is a dynamic database that will be continually managed and updated by the U.S. IOOS Program Office as the number of dedicated U.S. IOOS partners grows and their respective roles and capabilities evolve.

For each partner, the database captures pertinent partner data elements such as partner type, partner role, point of contact (POC), description and purpose of partner activities, and structural agreements. The partnership database thus identifies and describes in detail the current, composite U.S. IOOS partnership environment. This partnership database also provides a baseline for identifying and establishing future partnerships. New partners will be added to the database regularly, as the U.S. IOOS operating and partnership environments evolve.

PARTNER ROLES

To facilitate U.S. IOOS Program Office coordination of, and understanding among, U.S. IOOS participants of their relative contributions to U.S. IOOS, partner roles have been developed to characterize and categorize partner participation in U.S. IOOS. A U.S. IOOS partner may fulfill one or more partner roles. These roles demonstrate the wide-ranging ways in which the development of U.S. IOOS is advanced by its active engagement with partners.

U.S. IOOS partners fall into one or more of the following categories:

- *Data collector.* A data collector is an entity that operates an in situ or remote ocean observing sensor that routinely, reliably, and repeatedly feeds core variable-based data desired by a U.S. IOOS customer/end user to an IOOS-compliant DAC or archive.

- *Data provider.* A data provider is an entity that operates a DAC or data archive that is certified as U.S. IOOS DMAC compliant and that monitors the environment and supplies the data required by user groups for operational, applied, or research purposes. This includes both research and operational communities from academia, private enterprise, government agencies, and NGOs.[1]

- *Services provider.* A services provider is an entity that provides data access or utility services to U.S. IOOS.

[1] National Office for Integrated and Sustained Ocean Observations, *The First U.S. Integrated Ocean Observing System (IOOS) Development Plan*, Ocean.US Publication 9, January 2006, p. 75.

- *Data/services customer.* A data/services customer is an entity that accesses data and/or data products through U.S. IOOS or uses U.S. IOOS services (e.g., DMAC services or education and training services). Although most data/services customers will be anonymous to the system, they can be categorized according to their key characteristics or attributes. For example, they could be categorized by type of user (intermediate users such as modelers versus end users such as the general public) or by type of entity (government agency, NGO, private company, education/training institution, R&D activity, or the public at large). Data/services customers that use, benefit from, manage, or study ocean and coastal systems specify requirements for data and data products and evaluate the U.S. IOOS performance.[2]

- *Sponsored model owner.* A sponsored model owner is an entity that owns a model or analytic tool that generates outputs used by DMAC services or is made available to data/services customers in DMAC-compliant form.

- *Grantee.* A grantee is an entity that competes for or receives a U.S. IOOS grant or cooperative agreement.

- *User council member.* A user council member is an entity that has membership in one or more U.S. IOOS user councils for the purpose of supporting management and governance of U.S. IOOS. (See definition of *User Council* in Appendix F.)

- *Governance body.* A governance body is an entity that provides the U.S. IOOS with direction, funding, or policy guidance or approves U.S. IOOS plans and activities.

- *U.S. IOOS Program Office.* This office, called for in the ICOOS Act of 2009, oversees daily operations and coordinates the National Integrated Coastal and Ocean Observing System.

All partner roles for currently identified partners are listed in Appendix J.

PARTNER RESPONSIBILITIES

To provide clarity regarding the responsibilities assigned to each partner role , the U.S. IOOS Blueprint mapped each partner role to those activities listed in the U.S. IOOS Activity Hierarchy (Appendix E) and defined in the Working Definitions of U.S. IOOS Activities (Appendix F) for which it is responsible. This shows each partner, by virtue of the all the partner roles it undertakes, the specific U.S. IOOS activities it is expected to conduct, participate in, or contribute to. This information will help identify partners that can best support the development needs of U.S. IOOS as it matures from its current state to FC. It also provides a

[2] See Note 1.

framework for tracking the development of IOOS partners' capabilities as they mature to U.S. IOOS FC. Table 4-1 is an example of the mapping of roles to the activities related to the U.S. IOOS governance and management subsystem. For example, the highlighted cell indicates that one of the activities of a U.S. IOOS data provider is to participate in and contribute to the Data Provider Council. Appendix K contains the complete list of U.S. IOOS activities mapped to the nine partner roles. Partners can use the mapping to identify all the activities that they are responsible for conducting, participating in, and/or contributing to based on their partner roles.

Table 4-1. Example Mapping of U.S. IOOS Activities to U.S. IOOS Partner Roles

Number	Activity	Data collector	Data provider	Services provider	Data/services customer	Sponsored model owner	Grantee	User council member	Governance body	U.S. IOOS Program Ofc
A.1	Governance and Management									X
A.1.1	User Councils							X		X
A.1.1.1	Standards Bodies							X		X
A.1.1.2	Data Provider Council	X	X	X		X	X	X		X
A.1.1.3	Customer Council				X	X		X		X
A.1.1.4	Federal Partners		X		X			X		X
A.1.1.5	Regional Associations		X	X	X	X	X	X		X
A.1.1.6	NGOs				X			X	X	X
A.1.1.7	International							X		X
A.1.1.7.1	GEOSS							X	X	X
A.1.1.7.2	GOOS		X		X			X	X	X
A.1.1.8	IEOS							X	X	X
A.1.1.9	Combined Forums by Geographic Area	X	X	X	X	X	X	X	X	X
A.1.1.10	Combined Forums by Functional Area	X	X	X	X	X	X	X	X	X
A.1.1.11	R&D Asset Owners							X		X

PARTNERSHIP DISCOVERY AND ENGAGEMENT

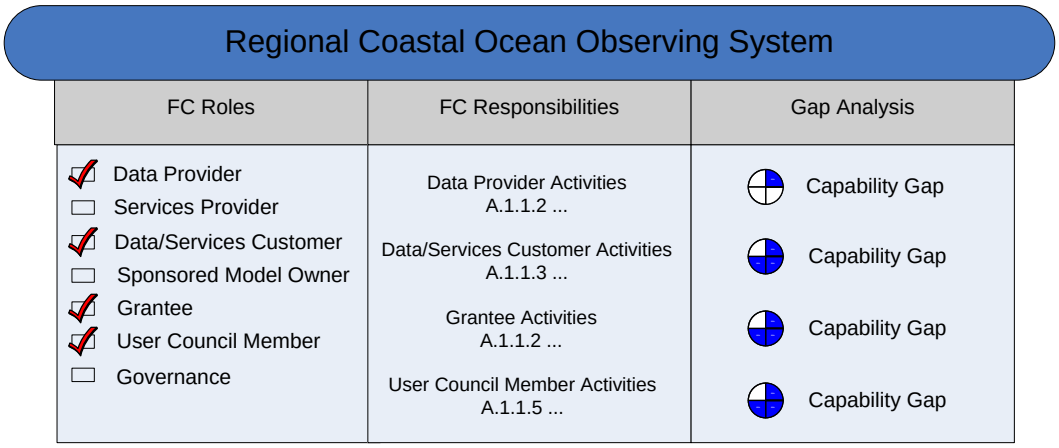
The U.S. IOOS Program Office will actively facilitate the discovery of, and engagement with, potential partners and will manage the processes for convincing potential partners, such as data providers, services providers, and model owners, to participate in U.S. IOOS. This area of responsibility includes "communications," outreach, and other aspects of managing the public face of U.S. IOOS, but also has a strong central focus on causing a targeted audience to join and actively participate in the U.S. IOOS effort. Accordingly, this effort must actively market U.S. IOOS capabilities and utility. In this capacity, the U.S. IOOS

Program Office must actively engage potential partners with targeted information designed to engender participation in U.S. IOOS. This is fundamentally distinct from "training and education," whose intent is to provide the target audience with a U.S. IOOS-related skill or to impart U.S. IOOS-related knowledge.

The U.S. IOOS partnership database will serve as an essential tool for tracking, managing, and facilitating U.S. IOOS partner development and sustainment. It will be a living database maintained by the U.S. IOOS Program Office (Appendix J provides a reference version) to describe all the dimensions by which partners can and should participate in U.S. IOOS. Toward that end, the information captured in the partnership database provides the foundation for conducting a U.S. IOOS partner gap analysis to identify where further partner engagement is needed to advance U.S. IOOS development toward FC. Specifically, the database identifies, for each partner, both its prescribed roles for participation in U.S. IOOS and the current manner and extent of participation. This identification of as-is and to-be states for each identified U.S. IOOS partner provides the basis for more detailed gap analysis.

To assist the gap analysis, the U.S. IOOS Program Office will employ a partner organizational assessment tool for assessing and documenting the capabilities of each partner to accomplish its U.S. IOOS responsibilities. This tool is expressed as a template; Figure 4-1 shows the template with an example of the assessment of one partner.

Figure 4-1. Template for U.S. IOOS Partner Gap Analysis



In this example, which is purely notional, a regional partner has been identified to play four roles in support of U.S. IOOS: data provider, data/services customer, grantee, and user council member. These roles are identified in the first column of the template. For each of the four roles, specific activities, or responsibilities, are assigned. The responsibilities are recorded in the second column. (The entire list of activities assigned to specific roles can be found in Appendix K. Descriptions/ definitions of what each of the activities entail are listed in Appendix F.) The gap analysis, appearing in the third column, shows the U.S. IOOS Program Office's

determination of the current ability of the notional partner to perform each of its assigned roles. More specifically, the gap analysis will look at how well the partner is performing specific activities associated with each designated role. When conducting the gap analysis, the U.S. IOOS Program Office will coordinate closely with the partner being assessed. The gap analysis will enable the U.S. IOOS Program Office to identify areas requiring further partnership engagement to develop courses of action to close the gaps, and thus ensure that the partnership meets its full potential in advancing U.S. IOOS toward FC.

Figure 4-2 defines the symbols used to indicate a partner's ability to accomplish its assigned roles. As the definitions suggest, partner roles in the developmental stage or with less than full functionality will be identified as gaps. The gap evaluation for each partner role will be based on a cumulative assessment of the partner's ability to perform the activities associated with each assigned role as identified in Appendix K.

Figure 4-2. Partnership Gap Evaluation Criteria

	**Pre-Developmental.** New partner is recognized as a member of U.S. IOOS and has established preliminary partnership development plans, to include assigning resources and tools.
	**Developmental.** Partner has begun development process leading to Initial Capability (IC) for assigned roles.
	**Minimum Essential Functionality.** Partner has achieved IC—accomplished minimum critical functions associated with IC for assigned role(s).
	**Significant Functionality.** Partner as begun development process leading to Full Capability (FC) for assigned role(s).
	**Full Functionality.** Partner has achieved FC—accomplished critical functions associated with FC for assigned role(s).

The results of the gap analysis will reflect the combined and mutually supportive assessment of both the U.S. IOOS Program Office and the individual partner. The U.S. IOOS Program Office will work collaboratively with individual partners to work strategies to address evaluation results. Further, "minimum essential functionality," which represents a U.S. IOOS partner's individual IC, will be specific to that individual partner. It will reflect a level of desired partner capability that is mutually understood and accepted between the partner and the U.S. IOOS Program Office.

Partnership engagement is critical to the success of U.S. IOOS. As U.S. IOOS develops over the next several years, it must evolve into a system that is designed, operated, improved, and used by a broad diversity of public- and private-sector stakeholders, including state and Federal agencies, tribes, industry, NGOs, academia, and the general public. Therefore, two convergent and interrelated approaches are recommended:

- A national approach to begin serving data and information that attracts the interest of potential users and stimulates product development
- A regional approach that engages, from the beginning, users from both the private and public sectors in the design and implementation of regional coastal ocean observing systems.[3]

The partnership database allows the U.S. IOOS Program Office to track its many partnerships based on a variety of different criteria. It identifies the benefits or potential benefits of each partnership, as well as the partnership's current status. This database works in conjunction with the partnership gap analysis tool to identify those partners for which accelerated engagement between the U.S. IOOS Program Office and the partner is needed. Once specific gaps are identified, targeted strategies can be developed.

[3] See Note 1, p. xiii.

Chapter 5
Tracking and Reporting

This chapter describes an approach to track and report progress on the development of required U.S. IOOS® capabilities and services. The approach relies on a set of symbols with accompanying definitions that allow anyone to visualize the overall status of U.S. IOOS readiness. These symbols may apply to multiple levels within the development effort, such as at activity development level, U.S. IOOS functions development level, or node level. The use of consistent symbols across various levels and domains of the development effort simplifies communications and reporting. This chapter identifies and defines those symbols and then describes the concept for using them to depict U.S. IOOS readiness.

It is of the utmost importance that a clear set of definitions and metrics are defined prior to implementing this reporting system. Although the proposed method allows for generalizations that can be quickly understood by managers and stakeholders, there must be a common and accepted understanding by affected stakeholders and the U.S. IOOS Program Office of how success for each category is defined and measured for a given activity. With this understanding in place, the proposed tools can communicate program status efficiently and effectively and can tailor that communication to the specific activities being assessed.

SYMBOLS

The symbols used to track and report progress fall into two categories: U.S. IOOS capability readiness symbols, and DMAC services performance symbols.

U.S. IOOS Capability Readiness Symbols

The U.S. IOOS capability readiness symbols represent an assessment of the ability of U.S. IOOS to perform required activities at a given point in time. Appendix F lists the activities required to establish a fully functioning U.S. IOOS. These symbols provide a means to categorize the readiness of the U.S. IOOS program to conduct a specific required activity by assessing the readiness of the people, processes, and tools to perform that required activity. A higher level of readiness assessment can be conducted at the core functional level by amalgamation of the individual readiness assessments of required activities within that core function.

These symbols do not convey any information about the effectiveness or efficiency with which the activity is conducted. These symbols, unlike those in

the next section, are focused on the readiness to perform an activity, not the characterization of the actual execution of that activity. As an example, one can divide creating a manufacturing plant into two phases: establishing the manufacturing line, and producing products. Capability readiness symbols would aid in tracking the establishment of the manufacturing line by rating such aspects as the availability of proper tools and trained workers and the existence of agreements with suppliers.

Figure 5-1 depicts and defines the symbols for tracking and reporting U.S. IOOS readiness to perform functions.

Figure 5-1. Definitions of U.S. IOOS Capability Readiness Symbols

	**Pre-Developmental.** Includes all stages from concept development to actually assigning people and tools.
	**Developmental.** Some people, processes, and tools are available, but there are insufficient repeatable processes to accomplish critical functions.
	**Minimum Essential Functionality.** Enough people, processes, and tools are available to accomplish minimum critical functions or all functions on a very small scale.
	**Significant Functionality.** Most people, processes, and tools are available to accomplish most functions on a large scale. A few non-critical functions cannot be available, or there may be difficulty meeting surge requirements.
	**Full Functionality.** All people, processes, and tools are available and are properly organized to accomplish the intended function.

The symbols provide an easy-to-understand summary of the state of readiness to perform a given activity. The details—the combination of facilities, tools, personnel, training, business processes, and procedures that must be in place at each readiness level—will differ from activity to activity. The criteria for the first two levels, “pre developmental” and “developmental,” apply to most development efforts, but the specifics of the next three levels are normally unique to the specific activity being assessed. Significantly, each subsystem development effort must declare the thresholds for “minimal essential,” significant,” and “full” functionality, with respect to the specific activities that fall within their domain, as part of follow-on detailed subsystem development planning.

DMAC Services Performance Symbols

In addition to developing the capability to execute activities, U.S. IOOS must produce and field functioning DMAC services, to enable the interoperable exchange of data (DMAC data services) and to provide value-added data (DMAC utility services) to U.S. IOOS customers. The performance of these services merit special tracking, because these services are the linchpin that allows U.S. IOOS data exchanges to be interoperable. In addition, these services are distinctive

within U.S. IOOS, because they require software development and provisioning of hardware, while the remaining subsystems consist principally of people and business processes.

Figure 5-2 depicts and defines the symbols for tracking the actual performance of DMAC services from pre-development efforts through IC and on to FC. These symbols apply specifically to the discrete capabilities (software and hardware) provided by the DMAC subsystem. Whereas the previous symbols (Figure 5-1) categorized the capability to perform an activity, these symbols represent the observed performance of implemented services.

Figure 5-2. Definitions of DMAC Services Performance Symbols

	**Pre-Developmental.** No DMAC services in use.
	**Developmental.** Small number of DMAC services available and performing with limited capability.
	**Significant Performance.** Most DMAC services performing at significant levels, but short of full capability.
	**Full Performance.** All DMAC services performing at full capability.

The specific criteria that separate the categories (e.g., the definition of "small number of DMAC services") must be developed during follow-on detailed planning for DMAC subsystem development. Precise agreement on how to label DMAC services in light of these categories is imperative to ensure clear communications.

CONCEPT FOR USING THE SYMBOLS TO TRACK U.S. IOOS DEVELOPMENT

U.S. IOOS's attainment of increasing levels of developmental maturity (progress toward IC and FC) hinges on the development of both the ability to perform U.S. IOOS activities (do assigned work) and the actual delivery of U.S. IOOS products and services (provide assigned output). Figure 5-3 shows a notional assessment of the readiness of U.S. IOOS nodes based on an assessment of their ability to perform relevant work and provide expected output employing the previously described readiness and performance symbols.

Figure 5-3. Notional Assessment of U.S. IOOS Maturity of Capability and Products, by U.S. IOOS Node

Functions Associated with Node	Current State	Initial Capability	Full Capability
Observations			
Data Assembly Center			
Archives			
DMAC Data Services			
DMAC Utility Services			
Client Component			
Models and Analytic Tools			
Model/Analysis Output			
R&D			
Training & Education			

This same system of symbols and definitions can be applied to show the status of U.S. IOOS core functional activities and associated subordinate activities. Figure 5-4 shows a notional example of the symbols applied to the U.S. IOOS governance and management subsystem's core functional activities. Reaching these assessment values entails detailed assessment of subordinate activities as listed in the activity hierarchy diagram (Appendix E) and amalgamating the subordinate activity level values at their respective core functional activity levels.

Figure 5-4. Notional Assessment of U.S. IOOS Maturity of Capability and Products for the Governance and Management Subsystem, by Maturity Level and Function

Functions Associated with Node	Current State	Initial Capability	Full Capability
Marketing, Outreach, and Engagement			
Human Resources			
Plans & Ops			
Policy			
Financial Management			
User Councils			
Procurement			
IT			

The symbols and definitions described above, underpinned by follow-on detailed U.S. IOOS subsystem planning, provide a simple and consistent way to communicate objective readiness levels and progress toward IC and FC.

Appendix A
Glossary of Terms

architecture	A framework, structure or design that identifies what needs to be accomplished, who does it, and what dependencies exist (e.g. what information exchanges are required in U.S. IOOS), and that provides a logical basis for decision making regarding system concepts and detailed engineering system solutions.
archive	An entity that permanently stores measurements from observing subsystem elements; forecasts, nowcasts, and hindcasts from numerical models; and other environmental information products and that makes them available to the DMAC infrastructure for use/reuse. An archive is one type of data assembly center.
cost estimate	An estimate of cost to achieve or sustain defined objectives.
data assembly center	An entity that processes raw measurements from observing subsystem elements, collects the output from numeric models, or produces routine analysis products and that makes them available to the DMAC infrastructure.
data integration	The process of combining data residing at different sources and providing users with unified access to the data. It involves the extraction, consolidation, and management of data from disparate systems to achieve broader capability by (functionally or technically) relating two or more data streams for the purposes of manipulation, analysis, and distribution.
data management and communications	The software, hardware, policies, procedures, services, and standards that allow interoperable exchange of ocean data and ocean-related modeling and analysis outputs.
data provider	An entity that operates a DAC or data archive that is certified as U.S. IOOS® DMAC compliant and that monitors the environment and supplies the data required by user groups for operational, applied, or research purposes.

data/services customer	An entity that accesses data through U.S. IOOS and/or uses U.S. IOOS DMAC services. Data/services customers can be categorized into meaningful groupings according to key customer characteristics/attributes, for example, by type of user (modelers vs. end user) or type of entity (government agency, NGO, private company, academic institution, or the public at large). A customer may be either a human user or another software component.
detailed business process definition	A description of a series of actions directed to achieve a desired business outcome (e.g., a product or service).
federated architecture	A framework for developing, maintaining, and using an enterprise architecture. The framework aligns, locates, and links disparate architectures via information exchange standards to deliver a seamless outward appearance to users. A federated architecture approach recognizes the uniqueness and specific purpose of disparate architectures and allows for their autonomy and local governance while enabling the enterprise to benefit from their content.[1]
functional design	A process of defining the working relationships among the components of a system.
governance	Mechanisms that provide the U.S. IOOS Program direction, funding, or policy guidance or approve U.S. IOOS plans and activities.
grantee	An entity that receives an U.S. IOOS grant or cooperative agreement.
integrated system	A system that (1) efficiently links environmental observations, data management and communications, data analyses, and models; (2) provides rapid access to multidisciplinary data from many sources; (3) serves data and information required to achieve multiple goals that historically have been the domain of separate agencies, offices, or programs; and (4) involves cross-cutting partnerships among Federal and state agencies, the private sector, and academic institutions.
interoperable	The ability of two or more systems to exchange and mutually use data, metadata, information, or system parameters using established protocols or standards.

[1] *Department of Defense Architectural Framework: Definitions and Guidelines*, Volume I, April 2007, p. 1-6.

maturity model	A method to categorize, for easy reference, the capabilities of a U.S. IOOS entity. For example, factors such as metadata availability, data quality, and quality assurance and quality control procedures are summarized as a maturity level, which informs use of the entity's data by prospective data customers and also shows the specific areas of improvement required to move up to the next maturity level.
modeling and analysis	Evaluation and forecasting of the state of the marine environment based on assimilated measurements to support decision making. "Analysis" may range from simple display for visual assessment to actual scientific analysis of data values. "Modeling" may include forecasting, nowcasting, and hindcasting.
need line	A line identifying the requirement for information exchange between nodes. The need line does not indicate how that information is exchanged.
node	An element of a system or architecture that produces, consumes, or processes information. Nodes may be organizations, classes of users, categories of people, software packages, collections of hardware, or combinations of these elements.
observation	A collection of nonsensor (e.g., human observations) and sensor measurements and their transmission from a measurement platform or site to a data provider.
operational activity	An activity in which the provision of data streams and data products of known quality is routine, guaranteed, and sustained (in perpetuity or until no longer needed) at rates and in forms specified by user groups regardless of its intended use (operational support or R&D).
organizational design	The structure of an organization in support of its business functions.
owner	An entity having full life-cycle management responsibility over an asset (hardware, software, or intellectual property) or the authority to delegate partial responsibility for life-cycle elements to others.
reference implementation	Software and documentation that allows someone to implement U.S. IOOS data or utility services. The software and documentation are based on previous successful installations on similarly configured systems and serves as a "reference" for the next user.

resource planning	Planning for budgets, personnel, and facilities to accomplish stated objectives.
service-oriented architecture	An approach to organizing and using distributed data resources operated by independent organizations. The architecture establishes standard procedures for interactions (services) among these resources. Resources offer services that wait in a state of readiness. Other resources may invoke those services by a request that complies with the U.S. IOOS procedure.
services provider	An entity that provides data access or utility services to U.S. IOOS.
sponsored model	A model or other analytical tool that takes raw or refined ocean observation data and provides value-added output that is of such significance to the U.S. IOOS community that the output is served through U.S. IOOS. This is a distinct subset of models and analytic tools. All models and analytic tools are customers of U.S. IOOS data. Sponsored models are distinctive in that they also function as data providers.
sponsored model owner	An entity that owns a model or analytic tool that provides outputs used by DMAC services or is made available to data/services customers in DMAC-compliant form.
stakeholders	Government agencies (local, state, and Federal), private enterprise, public and nongovernment organizations, and science and education communities that use, benefit from, manage, or study ocean and coastal systems.
standard	A document approved by a recognized body that provides for common and repeated use, rules, guidelines, or characteristics for products, processes, or services.
system	A collection of components organized to accomplish a specific function or set of functions (adapted from Institute of Electrical and Electronics Engineers *Glossary of Software Engineering Terminology*, p. 73).
systems and technical solution development	The development of technologies to achieve system capabilities in line with requirements.
third-party service	An entity that is not a U.S. IOOS partner but accesses IOOS data or data products. A third-party service may manipulate the data or data products to create a new product or service and may make that product or service available for use by its customers.

U.S. Integrated Ocean Observing System	A coordinated national and international network of observations and data transmission, data management and communications, and data analyses and modeling that systematically and efficiently acquires and disseminates data and information on past, present, and future states of the oceans and U.S. coastal waters to the head of tide.
U.S. IOOS data	Data that are served in U.S. IOOS DMAC-compliant means by services that are listed in the U.S. IOOS Service Registry.
U.S. IOOS partner	Any entity that assists U.S. IOOS with carrying out its mission and that meets one of more of the following conditions: ◆ Receives or contributes U.S. IOOS resources (either funding or in-kind support), excluding the legislative branch ◆ Is a partner or potential partner in planning, programming, or budgeting documentation ◆ Supports the development or implementation of U.S. IOOS by providing capabilities—products, data, expertise, or infrastructure—to U.S. IOOS.
use-case modeling	Technique used to describe a system's behavior as it responds to a request that originates from a user outside of that system in order to achieve a desired result.
user council member	An entity that has membership in one or more U.S. IOOS user councils.

Appendix B
DMAC Services, Components, and Standards

This appendix contains detailed descriptions of services, components, and standards provided by the DMAC subsystem.

DMAC DATA SERVICES

data access services	These services allow customers to "pull" data on request from data assembly centers. Different data types may require different services, and a variety of services may be offered to satisfy different customers, but all data access services are expected to enable the customer to (1) make an explicit request at the moment of need and (2) specify the desired subset of the data based on the location of interest, the time of interest, or other criteria.
data subscription and alert services	Subscription services allow data customers to arrange for all data of particular types to be streamed to the customer without further intervention or explicit request. Alert services are similar, with the added notion that data values are sent only when a customer-defined threshold is exceeded or a defined set of circumstances occur; for example, fishermen in a particular area may want an alert when wind speed and wave height exceed certain levels.

DMAC UTILITY SERVICES

service registry	This service provides the master list of all U.S. IOOS® data providers as well as the master list of DMAC-offered services. The registry is the official record of what is included in and excluded from U.S. IOOS. The registry may be accessed by data customers directly, but data customers will more likely use catalogs derived from the registry to discover sources for their needs. The GEOSS component and service registry (CSR) and U.S. Geospatial One-Stop will also be able to query the IOOS registry.

data catalog service	This service draws on the data in the Service Registry and provides a user-friendly way to search for specific data sets and browse the data holdings of US IOOS data providers. Data discovery may be accomplished by manual or automated means. U.S. IOOS will provide catalogs that allow a data customer to search for data in a variety of ways. For example, a data customer can search for water temperature and can narrow that search by location of the sensor, time and date of the observation, level of quality control, and metadata offered. Catalog searches allow customers to identify a source for the data they need. IOOS will also produce web-accessible folders of service metadata and data set metadata that can be harvested by commercial search engines.
mapping and visualization service	This service allows a data customer to see data portrayed as a graphical representation rather than as numerical data, for example, a time-series graph or a color-coded map that uses different colors to show variations in salinity in the ocean. The visualization service allows large volumes of data to be quickly communicated to data users.
format conversion service	This service changes data formats from the format used by the data provider to a format requested by the data customer. Given the number of popular public data formats, this service helps data customers to easily assimilate data for their needs. An example of this service is the conversion of water temperature data that are in DMAC-compliant format (for data access and transmission) into the format required by Google Ocean for publishing on the Internet.
coordinate transformation services	These services provide the ability to convert between different geographic coordinate systems (e.g., from latitude/longitude to Mercator), between different vertical datums (e.g., from a tidal datum to a geodetic datum), between different measurement axes (e.g., from northward and eastward components of wind to wind speed and direction), or between different units of measure (e.g., from Celsius to Fahrenheit).
product generation services	These services provide the ability to produce derived products such as statistical analyses and feature extractions from data.

data integration service	This service automatically combines similar data from multiple data providers and provides a single data product to the data customer. For example, water temperature may be measured in a geographical area by a mix of Federal and non-Federal observations. With U.S. IOOS, a data customer no longer has to query each data provider separately and integrate the results. Instead, the data integration service gathers and integrates data in response to a single request from the data customer. Not all possible combinations or volumes of data can necessarily be integrated. In practice, the U.S. IOOS Program Office will work with customers to determine which integration capabilities will be offered.
workflows	These services enable customers to chain together multiple processing steps to produce the desired output. For example, the steps may include getting data from the source, converting the data to another format, computing polygonal boundary of observed phenomenon, and then producing an image of the result.

DMAC COMPONENTS

system viewer	This component provides a web-based user interface to the data catalog and the service registry. It allows humans to issue searches for data using map-based or form-based query interface, it displays results of searches in either map or tabular form, and it provides links to the actual data and metadata corresponding to the search results.
system monitor	This component enables monitoring of the status of DMAC services. Monitoring allows U.S. IOOS to identify problems and take action to resolve issues. Monitoring may also include gathering usage statistics if data searches and requests are made via an U.S. IOOS catalog or viewer. However, because data requests may go directly to the data providers, this monitoring service will not provide a complete view of system usage.

DMAC STANDARDS

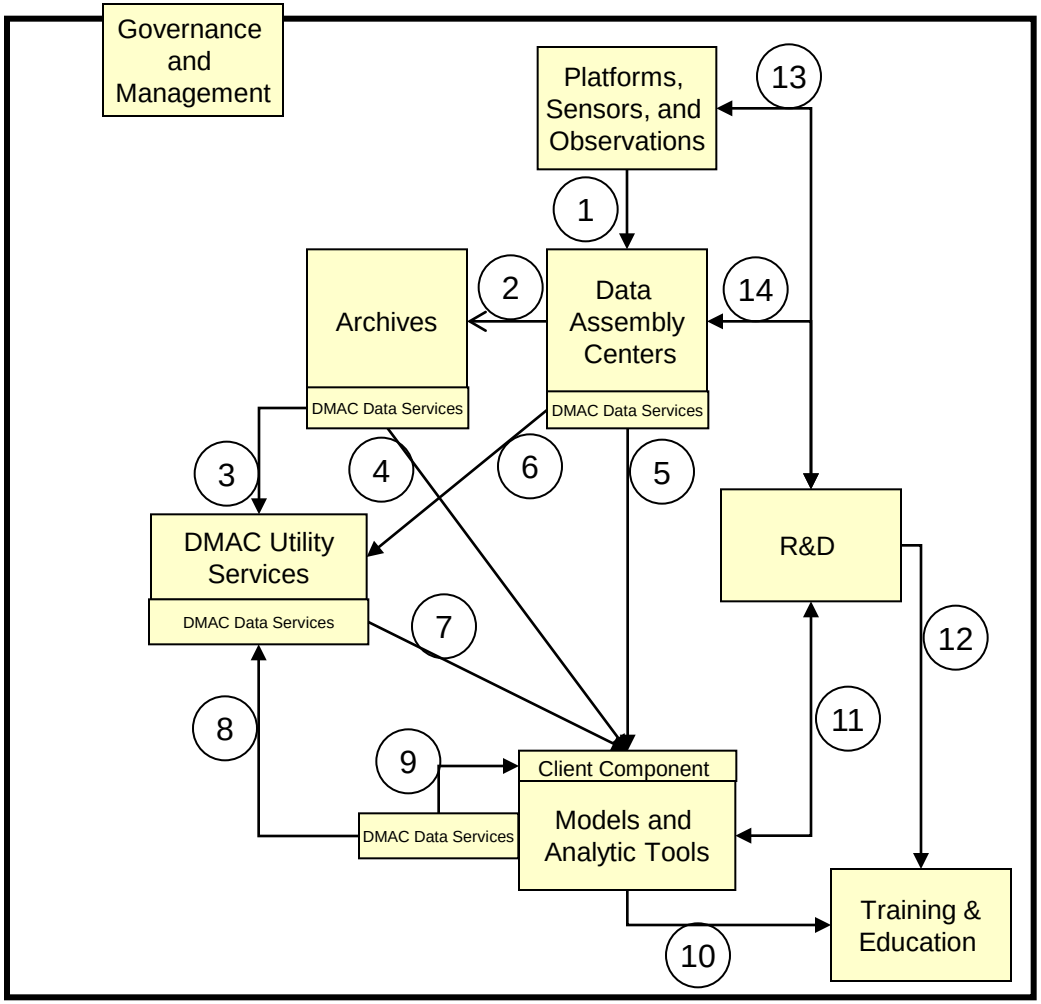
metadata standards	Metadata describes the organization and structure of the ocean observation data and provides information about how and when the data were gathered. Metadata standards include both general-purpose standards for representing metadata (e.g., FGDC CSDGM ISO 19115/19139 or OGC Sensor Model Language) as well as U.S. IOOS-specific conventions and best practices that provide greater specificity for those general standards. For example, U.S. IOOS conventions may make some metadata fields mandatory even though they are optional in the base standard.
quality assurance and quality control standards	These standards ensure that data are as consistent, accurate, and reliable as possible, both in structure (format) and content (values). U.S. IOOS will provide a minimum acceptable quality standard for data to be included in U.S. IOOS, information about best practices for quality assurance/quality control, as well as a maturity model that will allow data customers to understand the levels of quality assurance/quality control used at each data provider site. Data providers will apply automated or manual quality reviews as appropriate.
information technology security standards	These standards describe the hardware, software, and processes to ensure the protection of systems and data both in transit and in storage. Security includes protection against deliberate attacks, human or system failures, and events of nature.
controlled vocabularies	These standards define how to select or define names and machine-readable identifiers for phenomena, units of measure, coordinate systems, sensor IDs, thematic keywords, named oceanographic areas, etc. U.S. IOOS will adopt existing vocabularies to the greatest extent possible and will provide semantic mapping between equivalent terms in relevant vocabularies.

Appendix C
Node Connectivity Diagrams

This appendix contains three diagrams:

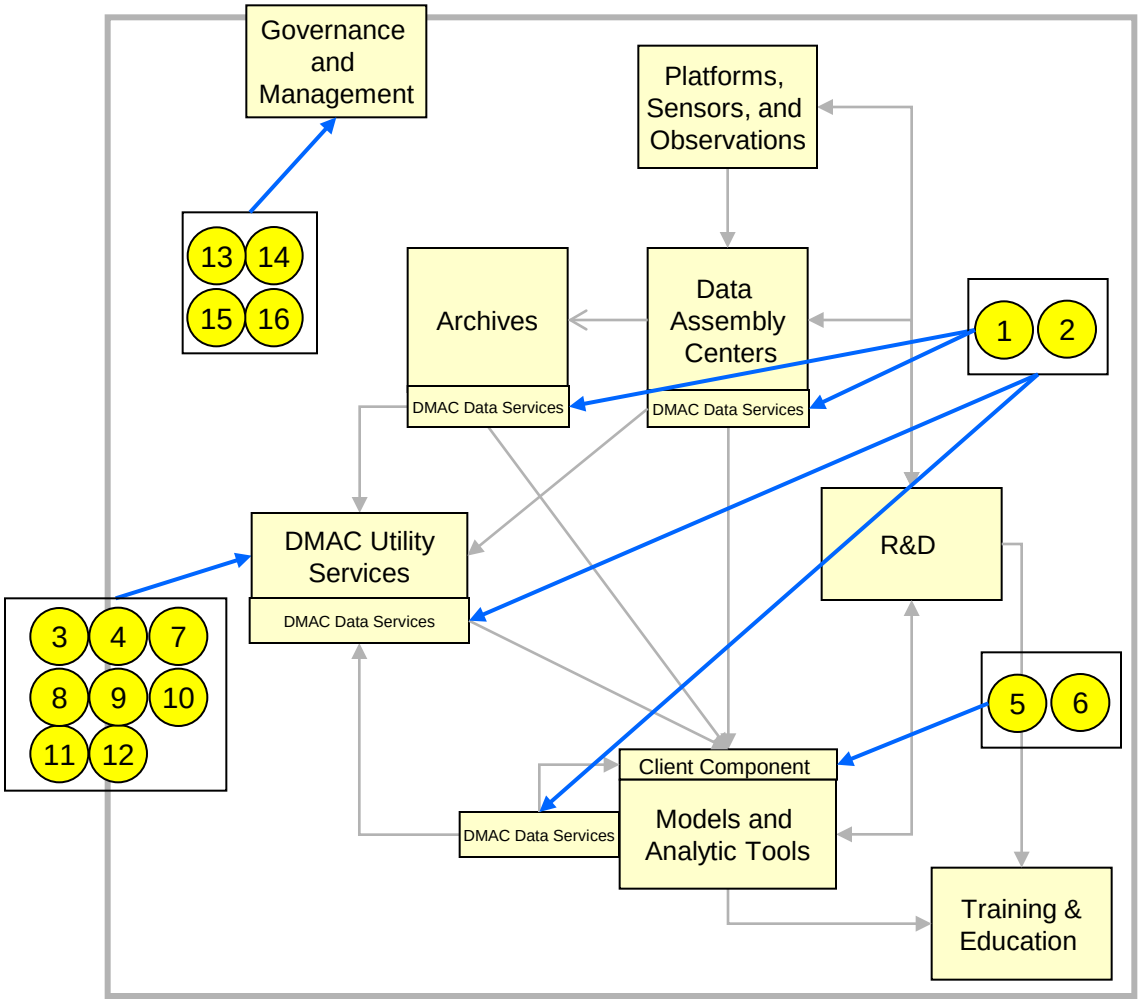
- The first contains a node connectivity diagram of U.S. IOOS® at FC. It also includes definitions of the need arrows.
- The second shows the location of the major DMAC services (data and utility services), components, and standards aligned to the node connectivity diagram.
- The third shows the U.S. IOOS subsystems overlaid on the node connectivity diagram.

U.S. IOOS®
Nodes and Need Arrows



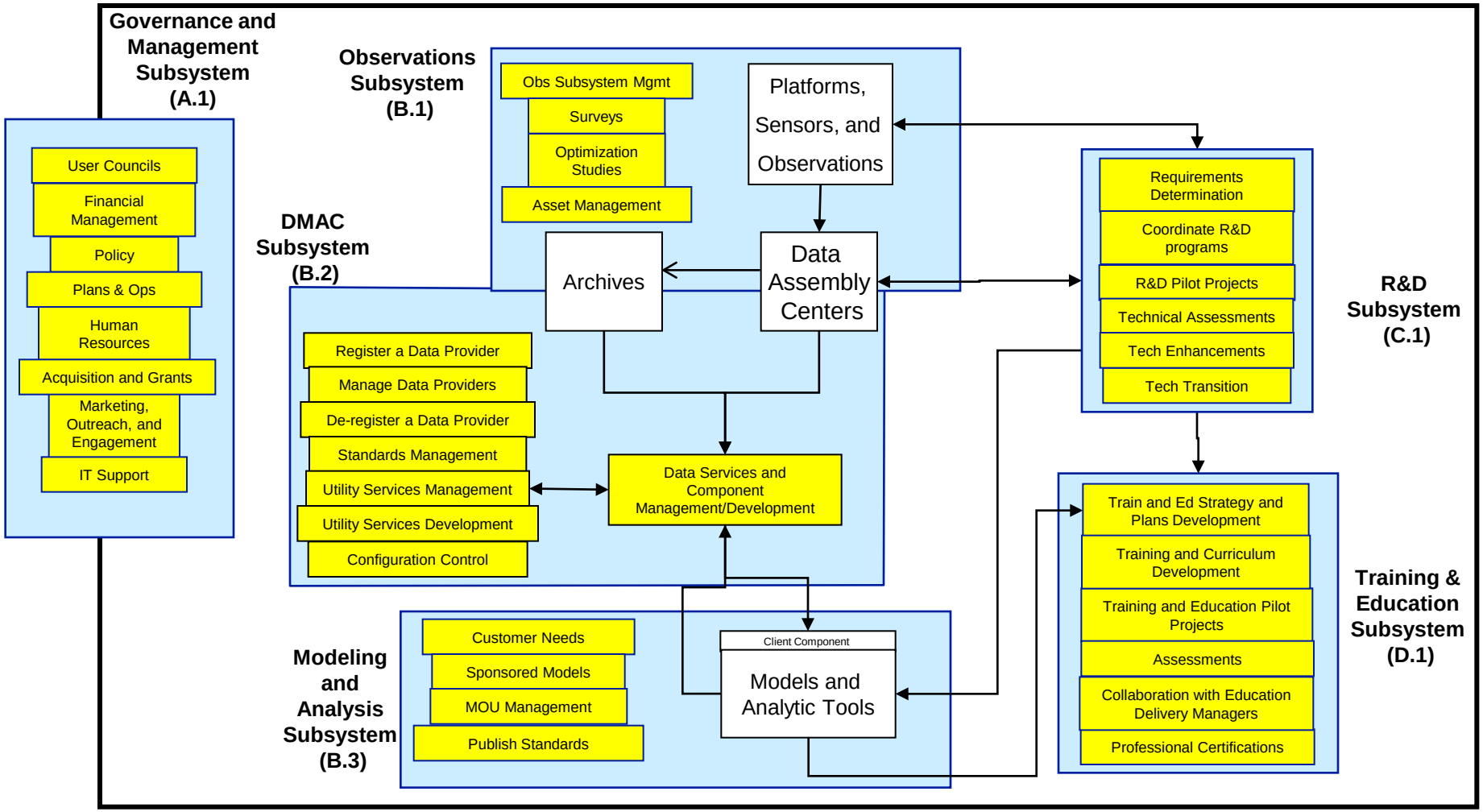
1. Raw Core Variable Data to Data Provider DAC
2. Selected data sent to archives
3. DMAC-compliant archived data to support Utility Services
4. DMAC-compliant archived data for direct model/analysis application
5. DMAC-compliant data for direct model/analysis application
6. DMAC-compliant data to support Utility Services
7. DMAC utility services value added data for intermediate/end users
8. DMAC-compliant products of models/analysis to support DMAC services
9. DMAC-compliant model outputs directly to other models/analysis
10. Information from modeling and analysis efforts to inform education products
11. Model and analysis requirements for R&D and Technology solutions returning from R&D efforts
12. Information from R&D efforts to inform educational products
13. Observations System requirements for R&D and Technology solutions returning from R&D efforts
14. DAC requirements for R&D and technology solutions returning from R&D efforts

DMAC Services, Components, and Standards Aligned with Nodes



1. Data Access Services
2. Data Subscription and Alert Services
3. Service Registry Service
4. Data Catalog Service
5. Viewer Component
6. System Monitor Component
7. Mapping and Visualization Services
8. Format Conversion Services
9. Coordinate Transformation Services
10. Product Generation Services
11. Data Integration Services
12. Workflow Services
13. Info Technology Security Standards
14. Controlled Vocabulary Standards
15. Metadata Standards
16. Quality Assurance and Quality Control Standards

U.S. IOOS® Subsystem Boundaries and Major Functions



Existing systems, members of which may join U.S. IOOS

U.S. IOOS Subsystem boundaries

U.S. IOOS Major Functions

Appendix D
Key U.S. IOOS® Documents

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Appendix E
U.S. IOOS® Activity Hierarchy

This appendix contains the complete U.S. IOOS® activity hierarchy, which identifies 350 distinct U.S. IOOS activities.

U.S. IOOS® Activity Hierarchy

November 2010

Introduction

- Activity Hierarchy and Flow Diagrams

  – This introduction to activity hierarchy and flow diagrams is intended for readers who are unfamiliar with these depictions. Experienced users can skip this introduction.

  – The activity hierarchy and activity flow diagrams depict U.S. IOOS activities at full capability (FC). **For the purposes of the U.S. IOOS Blueprint, these diagrams are specifically focused on answering the question, "What activities does the U.S. IOOS Program perform in each of the U.S. IOOS subsystems?" For this reason, there will be activities associated with ocean observing that are not depicted in this document** since they are not directly affected by the creation of IOOS. Likewise, there will be activities listed that require participation by others that are outside the U.S. IOOS Program. By limiting the focus to the specific activities that U.S. IOOS performs, these diagrams help define what the U.S. IOOS Program should be at FC, its capabilities, and the required relationships of the U.S. IOOS Program to U.S. IOOS participants/partners.

Introduction (continued)

- Activity Hierarchy Diagram

  – An activity hierarchy represents a structured decomposition of activities and associated sub activities organized by subject or theme. The U.S. IOOS Blueprint activity hierarchy starts with the six U.S. IOOS subsystems and decomposes each to identify the specific activities that the U.S. IOOS Program performs within that subsystem. Because this analysis is U.S. IOOS Program-centric, activities may be nested under subsystems that would not seem intuitive if one were to approach the diagrams from a data provider or data/services customer-centric viewpoint. Proper nesting of activities from an overarching U.S. IOOS Program perspective is necessary to properly ground future efforts, such as business process design or organizational structure development.

  – The activity hierarchy depicts the organization of the requisite functions and activities of the U.S. IOOS when it is at FC. In other words, it represents a detailed, working-level decomposition of the core activities of a properly functioning U.S. IOOS. These activities are thematically organized and decomposed to a level that is low enough to guide detailed business process development and execution. Figure E-1 depicts a notional major activity broken down into its constituent steps. The shaded boxes in the figure indicate activities that are decomposed to the lowest reasonable level. A sequenced, alphanumeric designation is assigned to each U.S. IOOS activity and associated sub activities, such that their location within the hierarchy can be readily identified.

Introduction (continued)

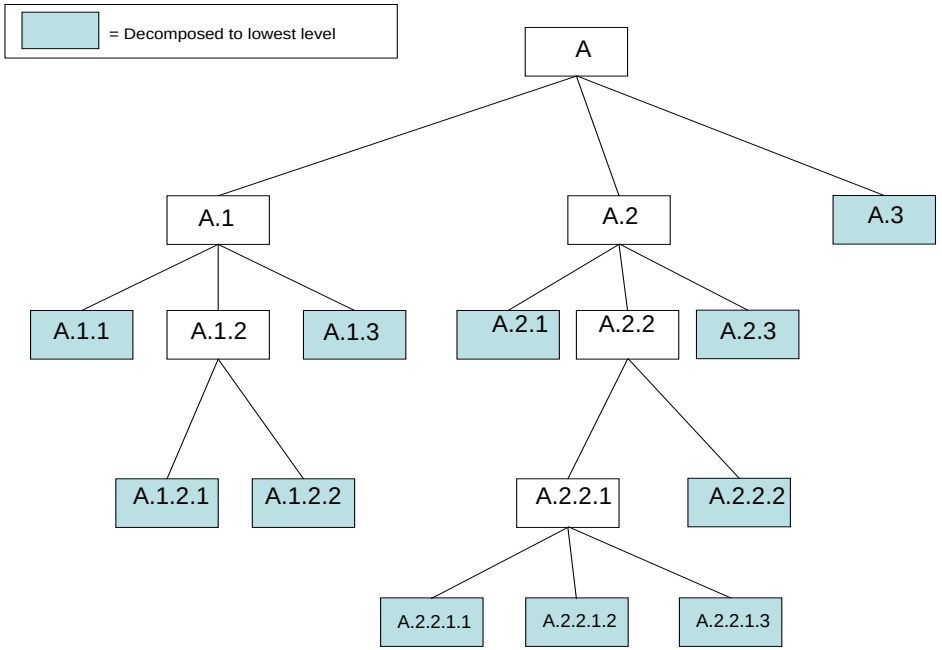


Figure E-1. Notional Activity Hierarchy Diagram

– The complete U.S. IOOS activity hierarchy, presented in this Appendix, identifies more than 350 distinct U.S. IOOS activities. Appendix F provides a short working definition for each discrete U.S. IOOS activity and sub activity. Functionally, all U.S. IOOS activities and sub activities serve as U.S. IOOS building blocks. As a result, one can use the activity alphanumeric designations, and associated diagrams and working definitions, to map U.S. IOOS activities to the host of U.S. IOOS guidance, planning, and coordination requirements.

Introduction (continued)

- Activity Flow Diagram
  - The activity flow diagram takes activities from the hierarchy and displays them in a sequence to show how activities are linked to accomplish a mission. Figure E-2 is a notional activity flow diagram, which is based on the hierarchy diagram but shows where tasks are linked in sequence to perform a mission.

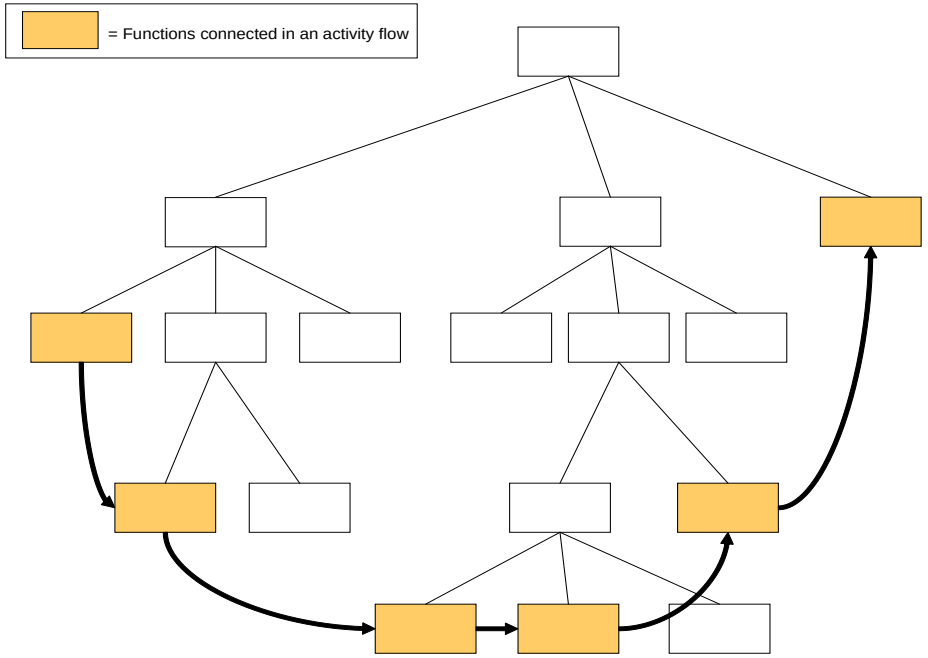
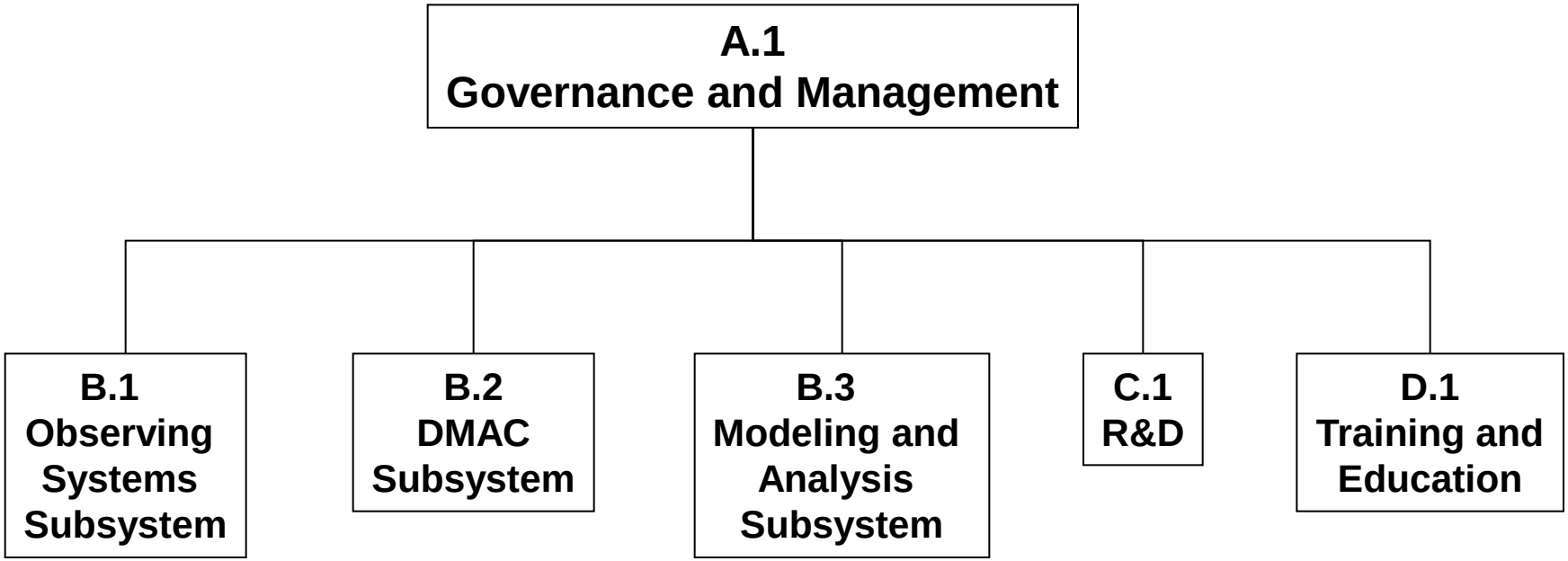


Figure E-2. Notional Activity Flow Diagram

Introduction (continued)

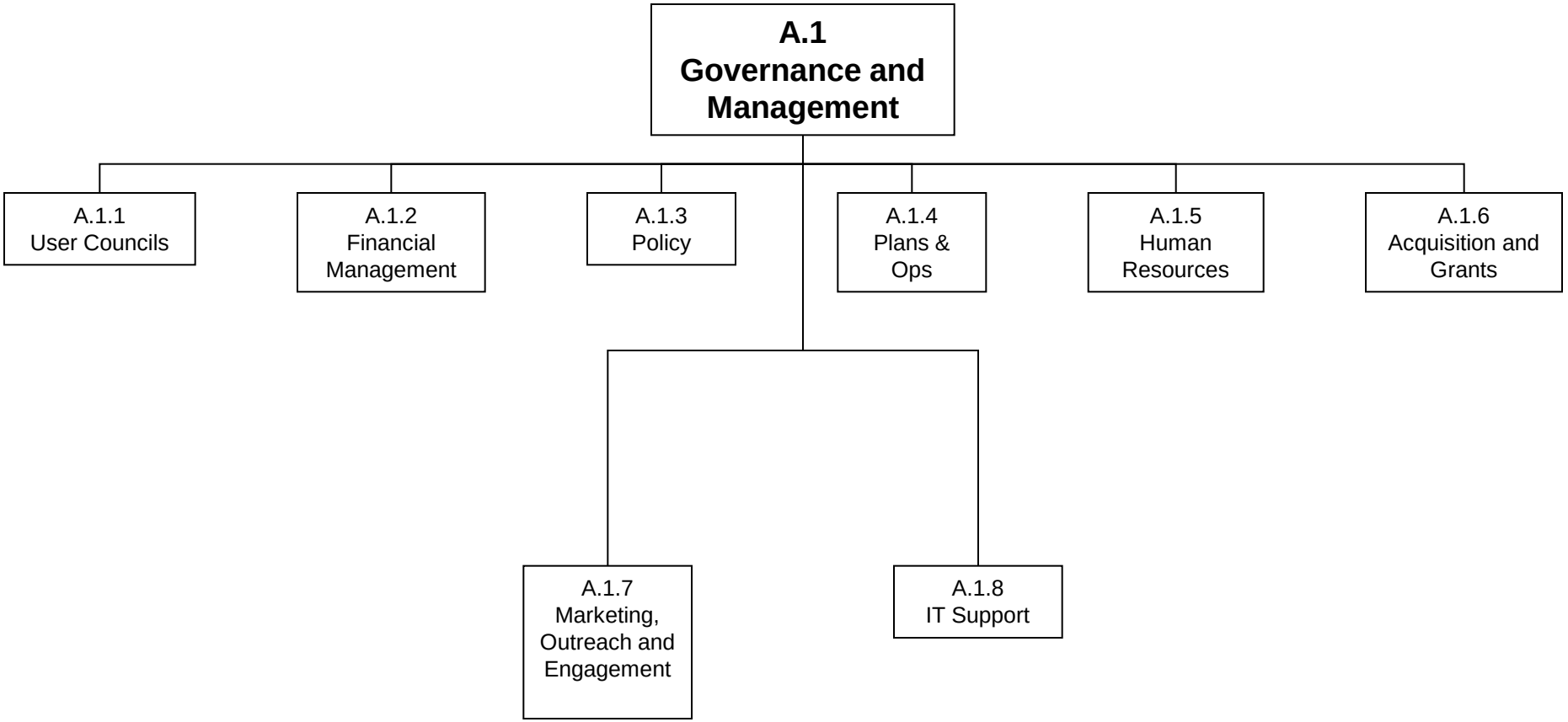
- Activity flow diagramming is a large task that results in every mission, function, or procedure being diagramed. These diagrams will be essential for detailed subsystem planning. During development of this Blueprint, key activity flows were analyzed to do the following:
  - Demonstrate how, at a high level, all the major functions are properly related to each other.
  - Demonstrate that requirements for key U.S. IOOS mission areas are well supported by the developed hierarchy of activities. This served as one of the checks to ensure the hierarchy's completeness.
  - As a component of follow-on detailed U.S. IOOS planning, activity flow diagrams should be developed for each U.S. IOOS subsystem to graphically articulate key subsystem processes.
  - The flows that were used for analysis are not included in this document. While adequate to demonstrate that key functions were accounted for, they are too small a sampling to add significantly to the description of functions and activities.

U.S. IOOS

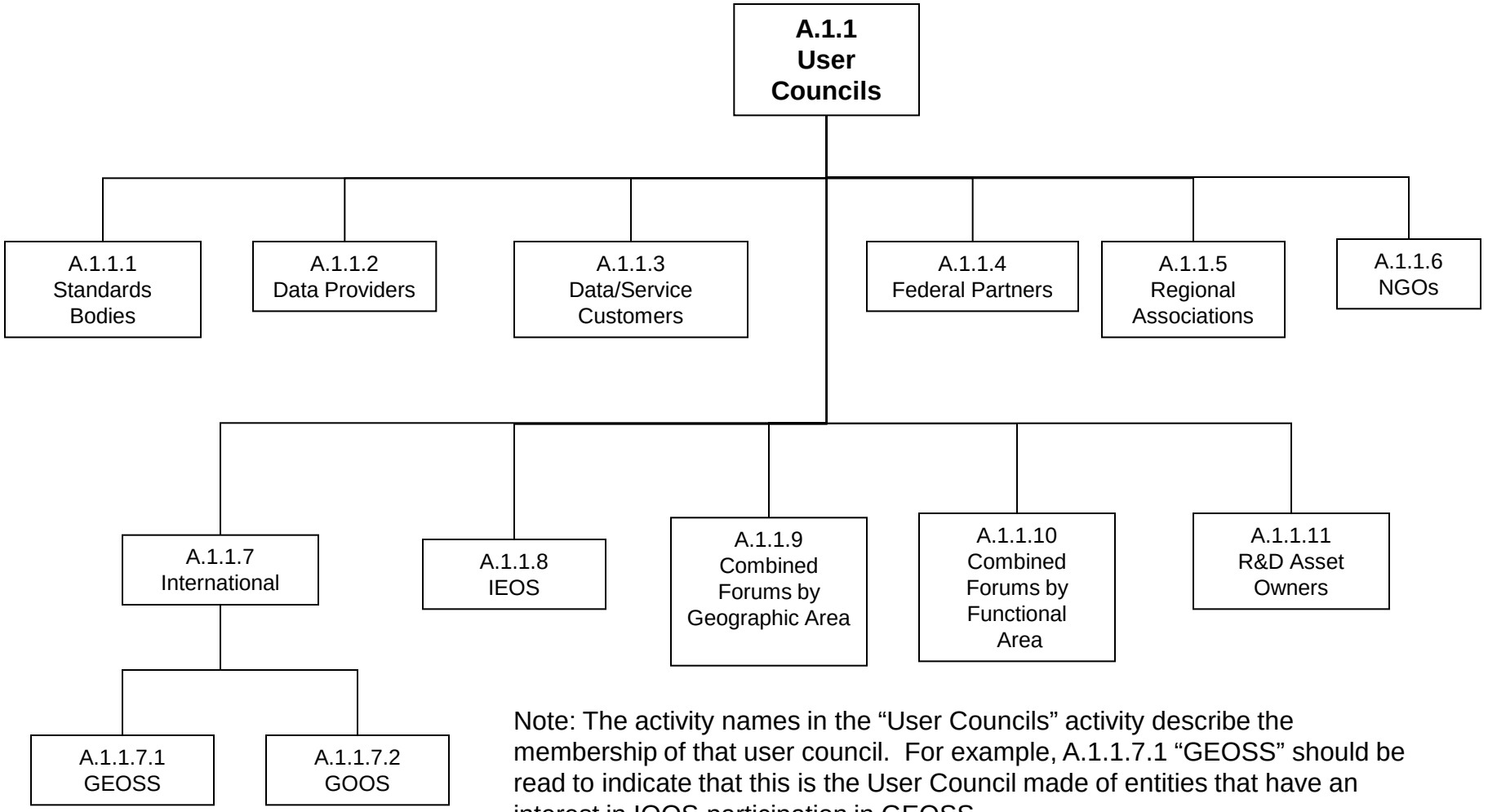

A.1
Governance and Management
B.1
Observing
Systems
Subsystem
B.2
DMAC
Subsystem
B.3
Modeling and
Analysis
Subsystem
C.1
R&D
D.1
Training and
Education

A.1
Governance and Management

Governance and Management

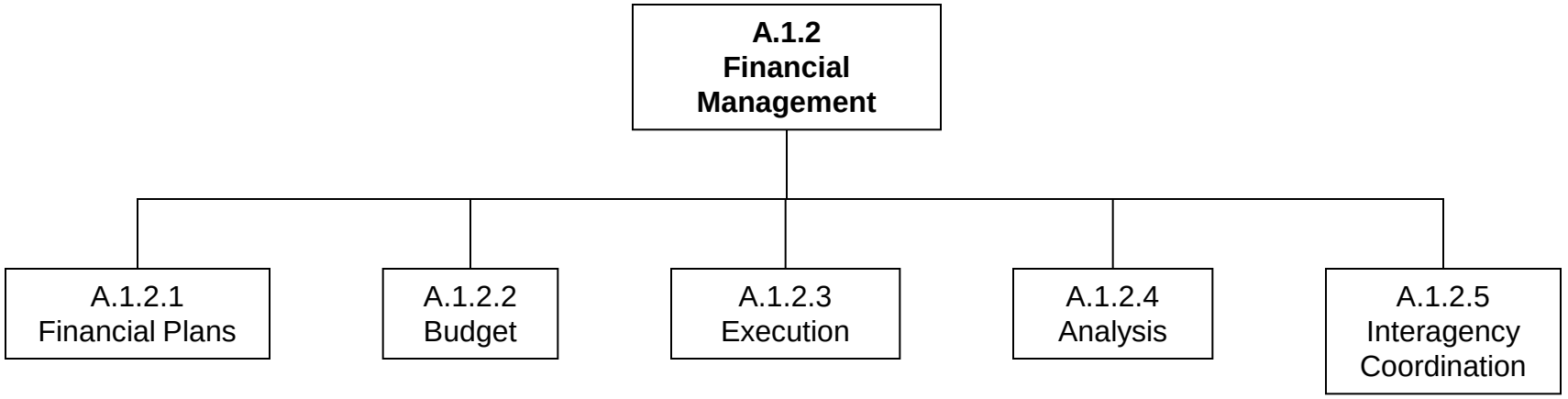


Governance and Management

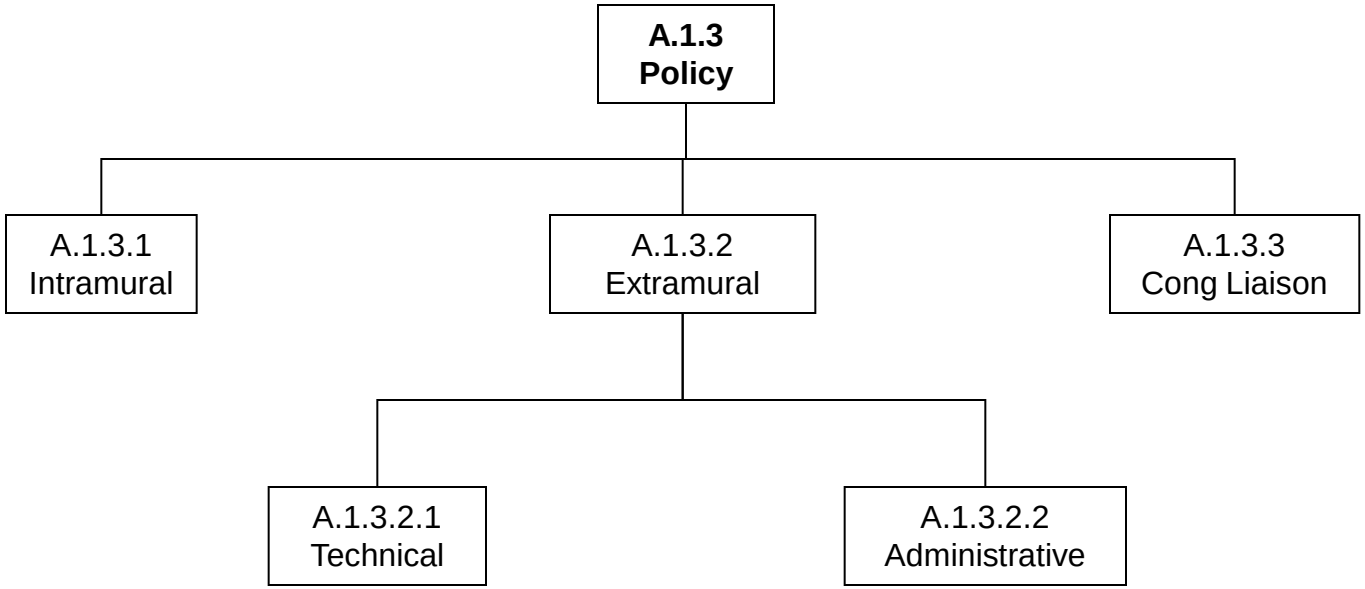


Note: The activity names in the "User Councils" activity describe the membership of that user council. For example, A.1.1.7.1 "GEOSS" should be read to indicate that this is the User Council made of entities that have an interest in IOOS participation in GEOSS.

Governance and Management



Governance and Management



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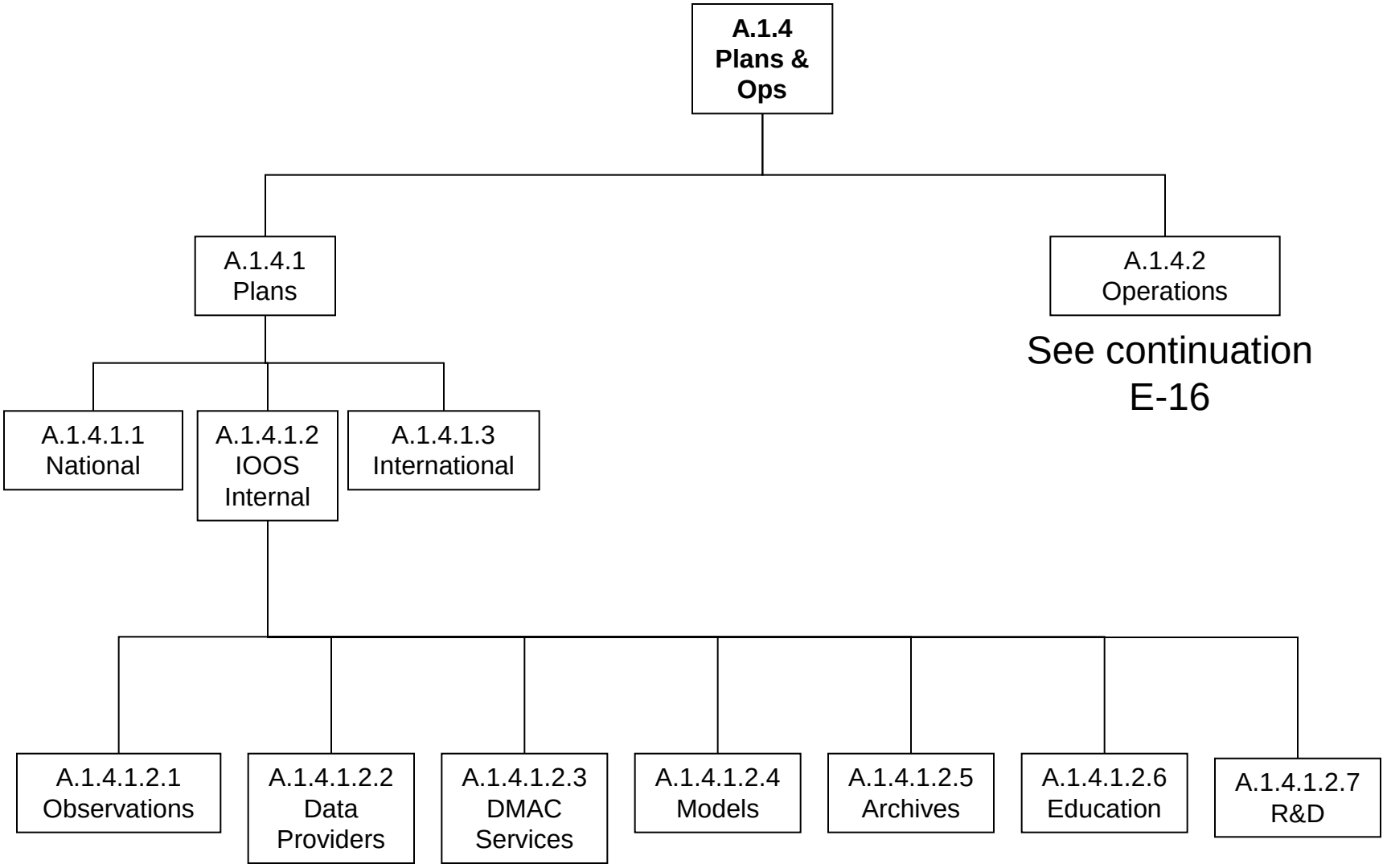

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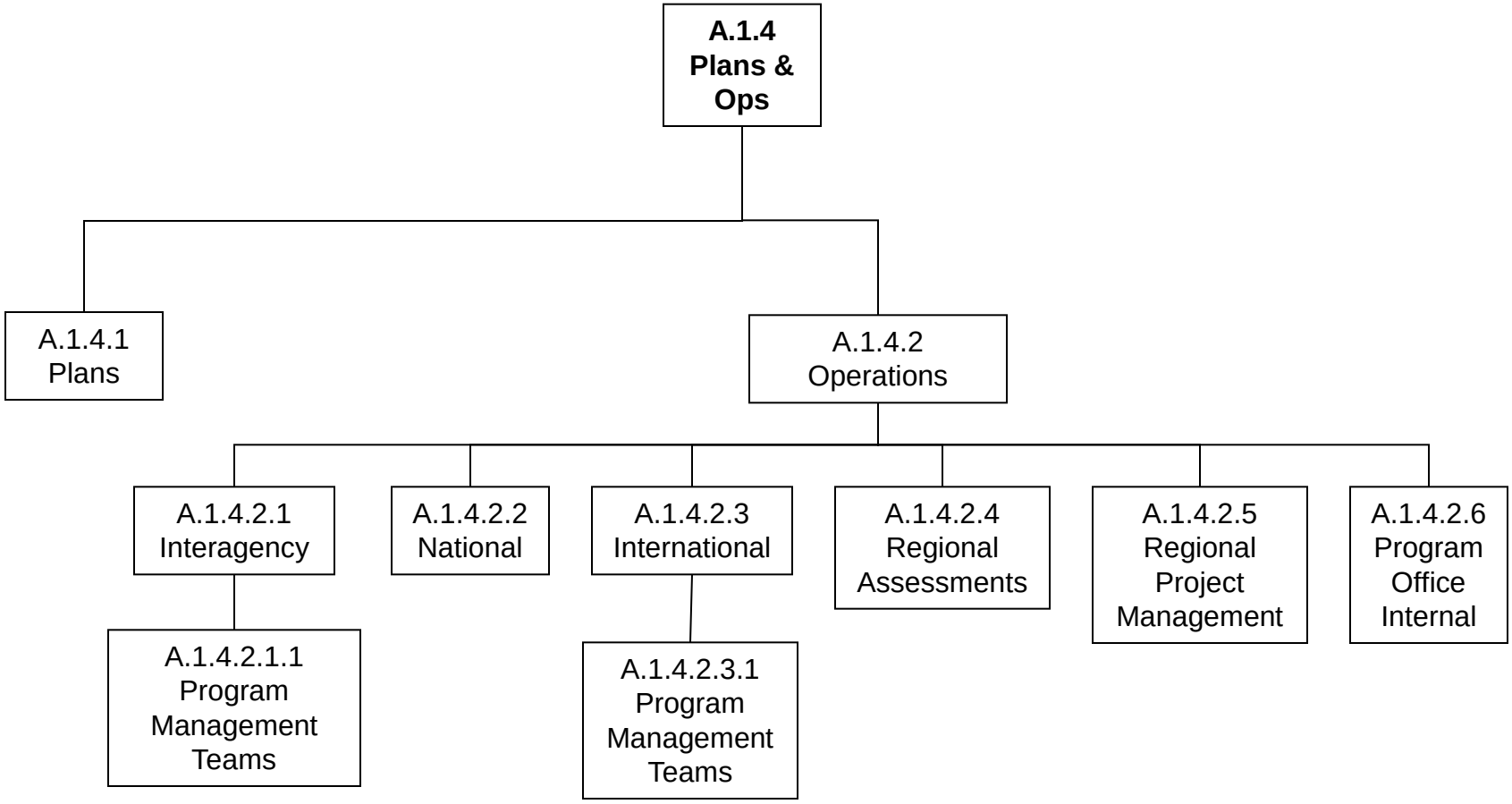
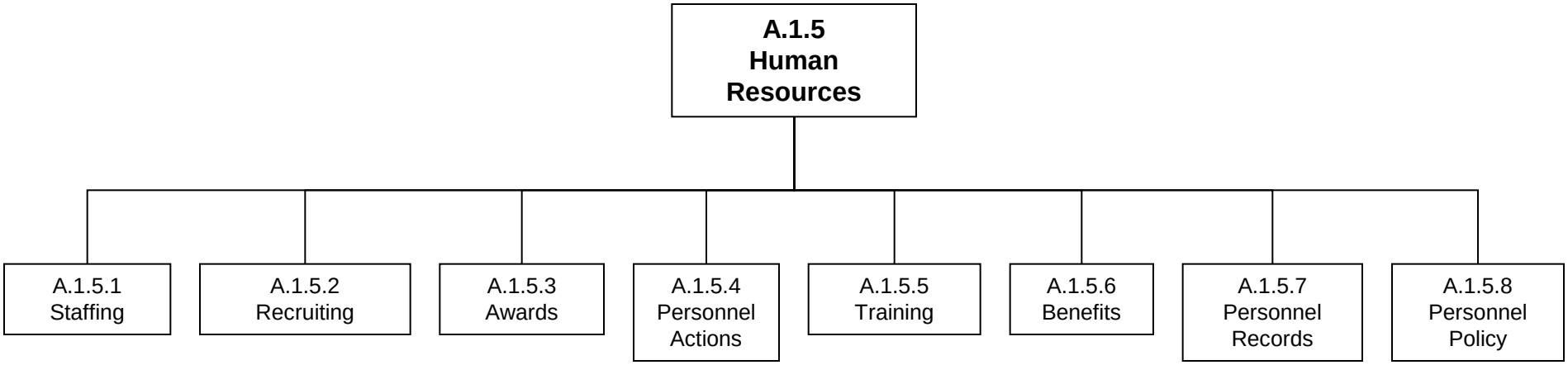


Governance and Management



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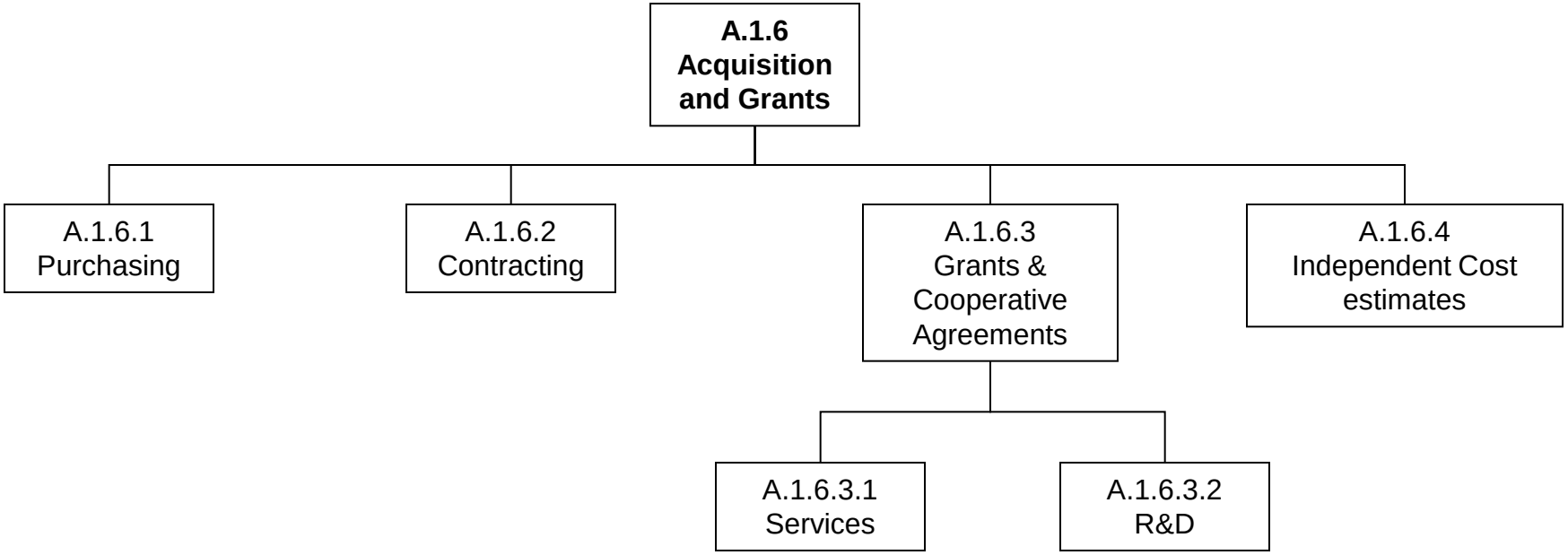

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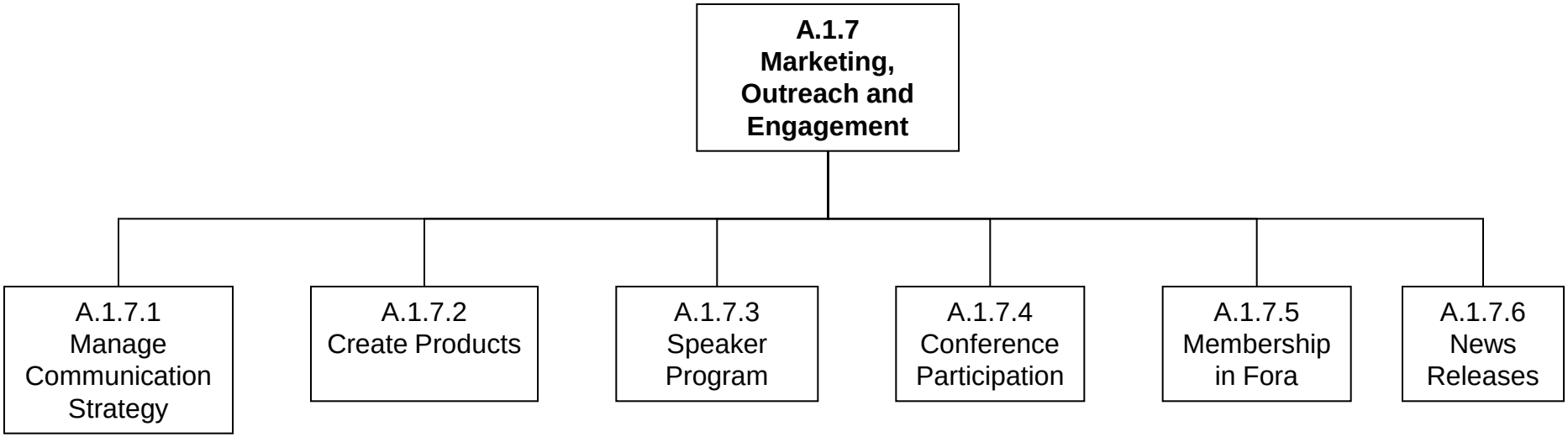
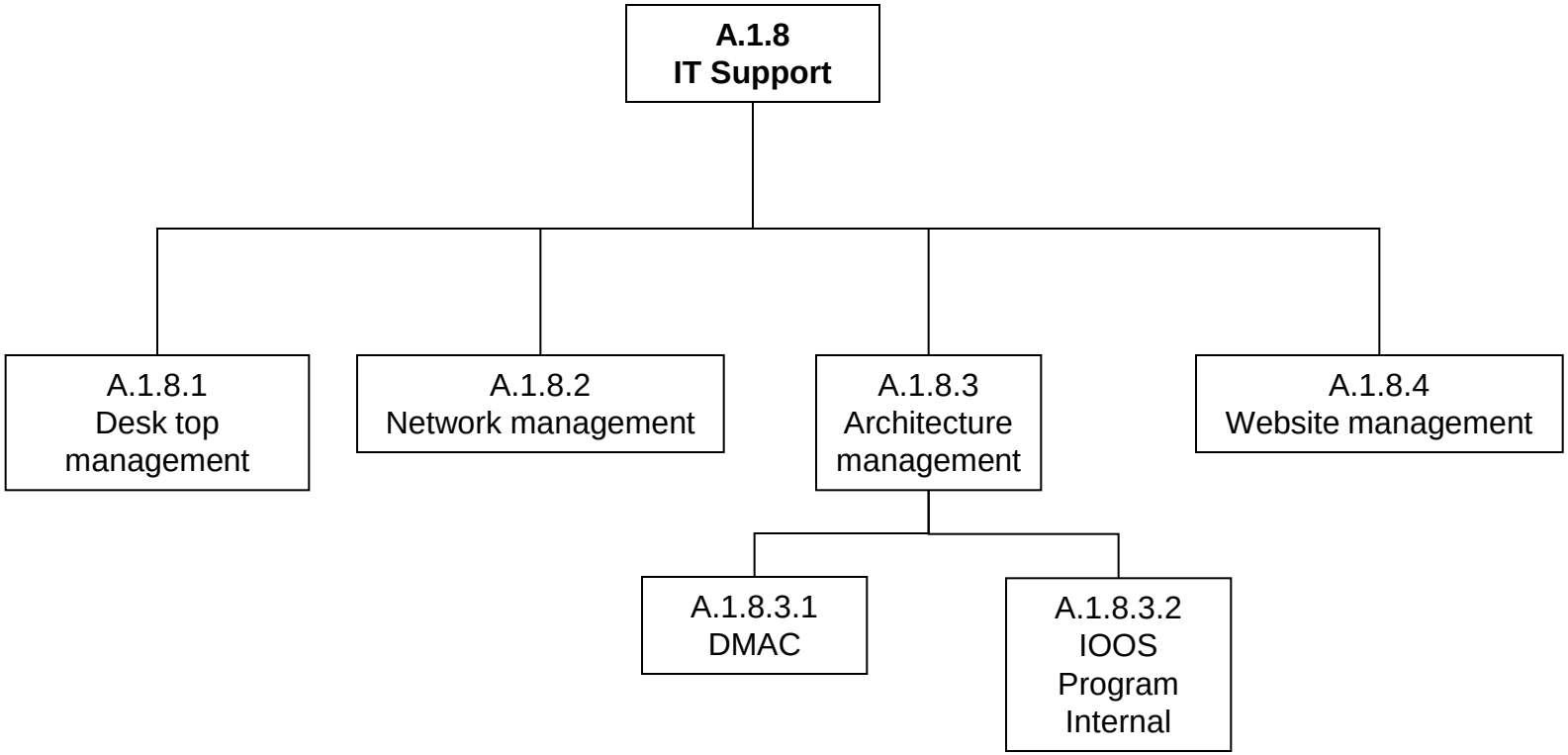
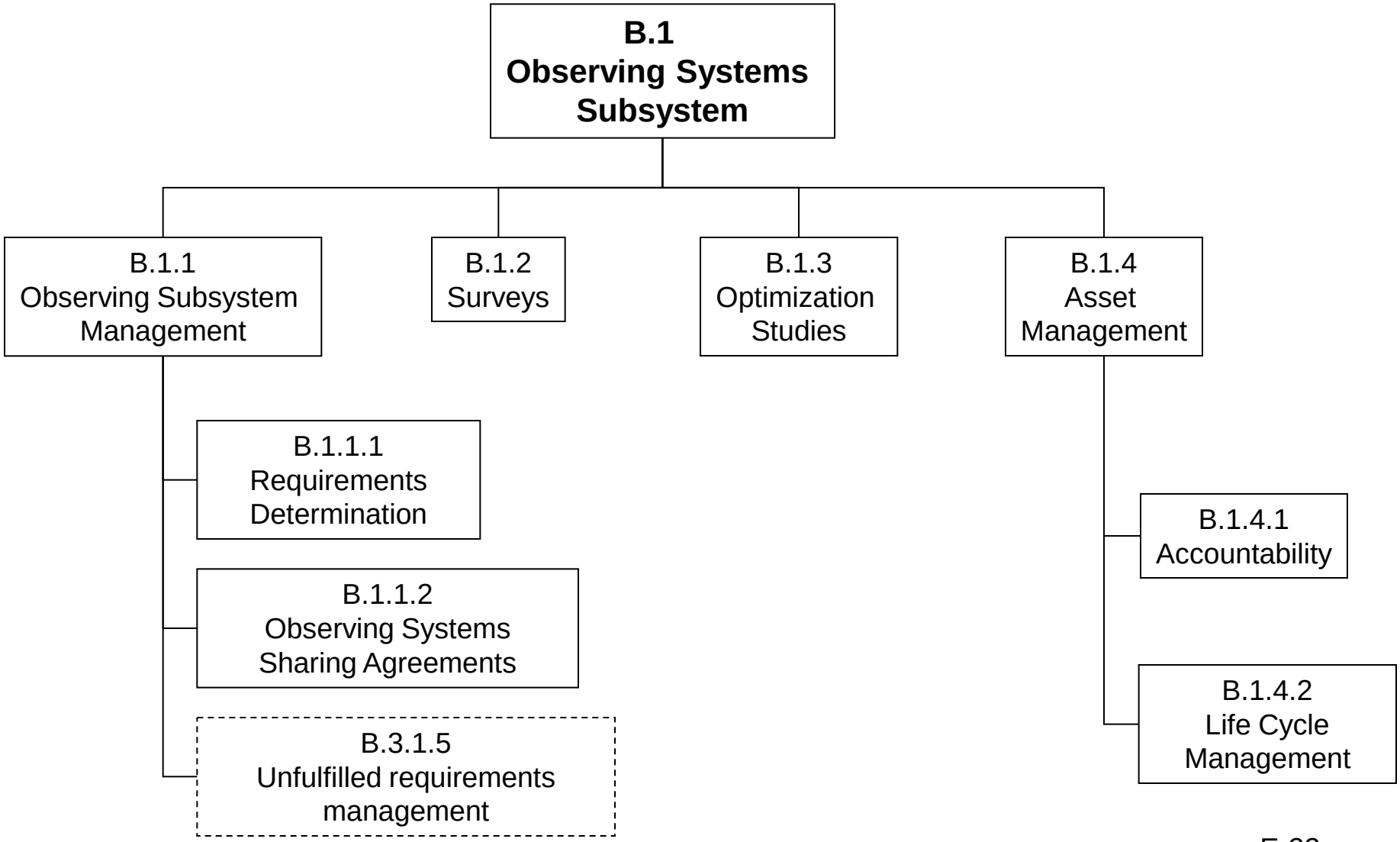


Governance and Management



B.1
Observing Systems Subsystem

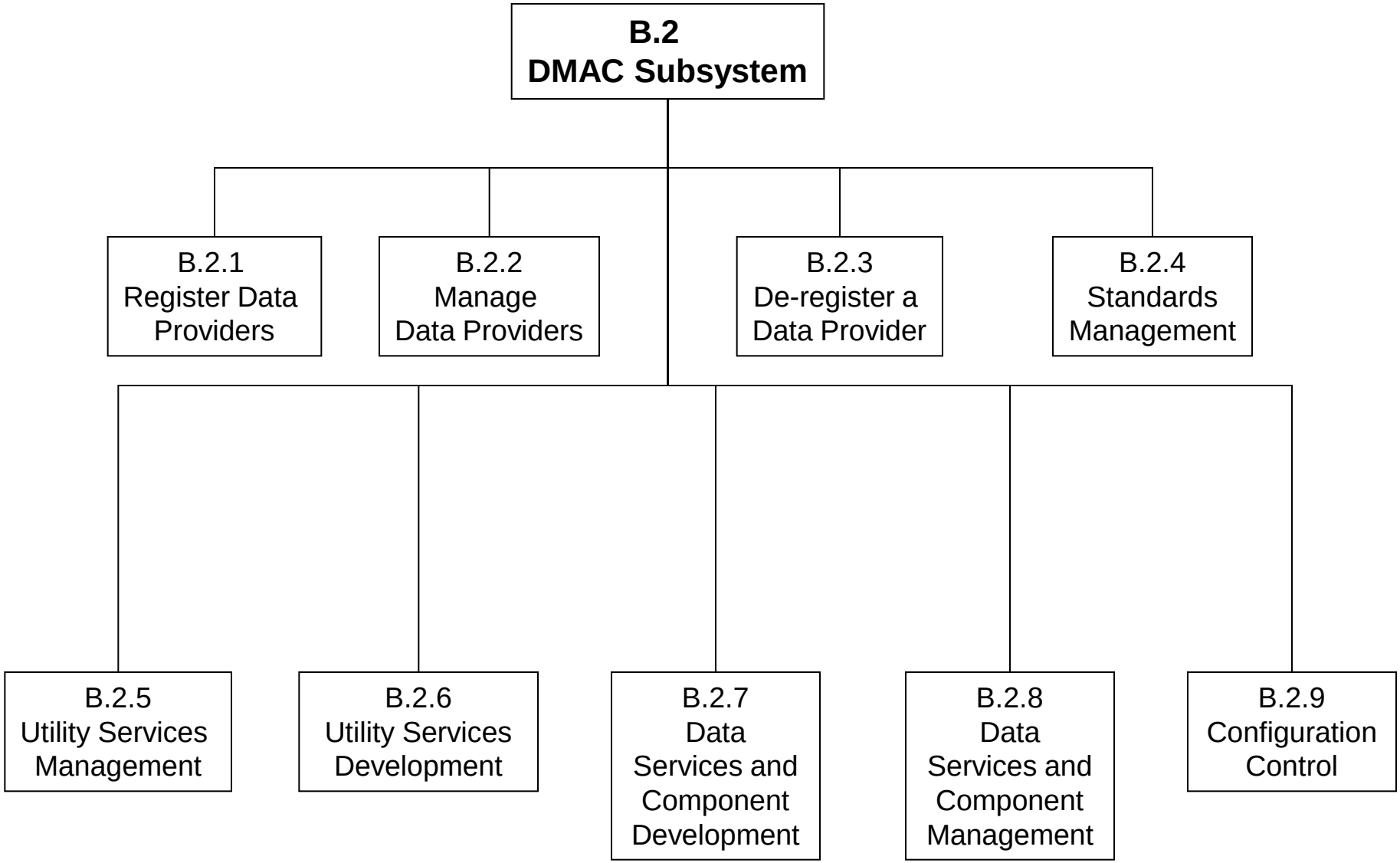
Observing Systems Subsystem



Note: Dotted boxes indicate a function or activity depicted elsewhere in the hierarchy that is also used as part of this subsystem.

B.2
DMAC Subsystem

DMAC Subsystem



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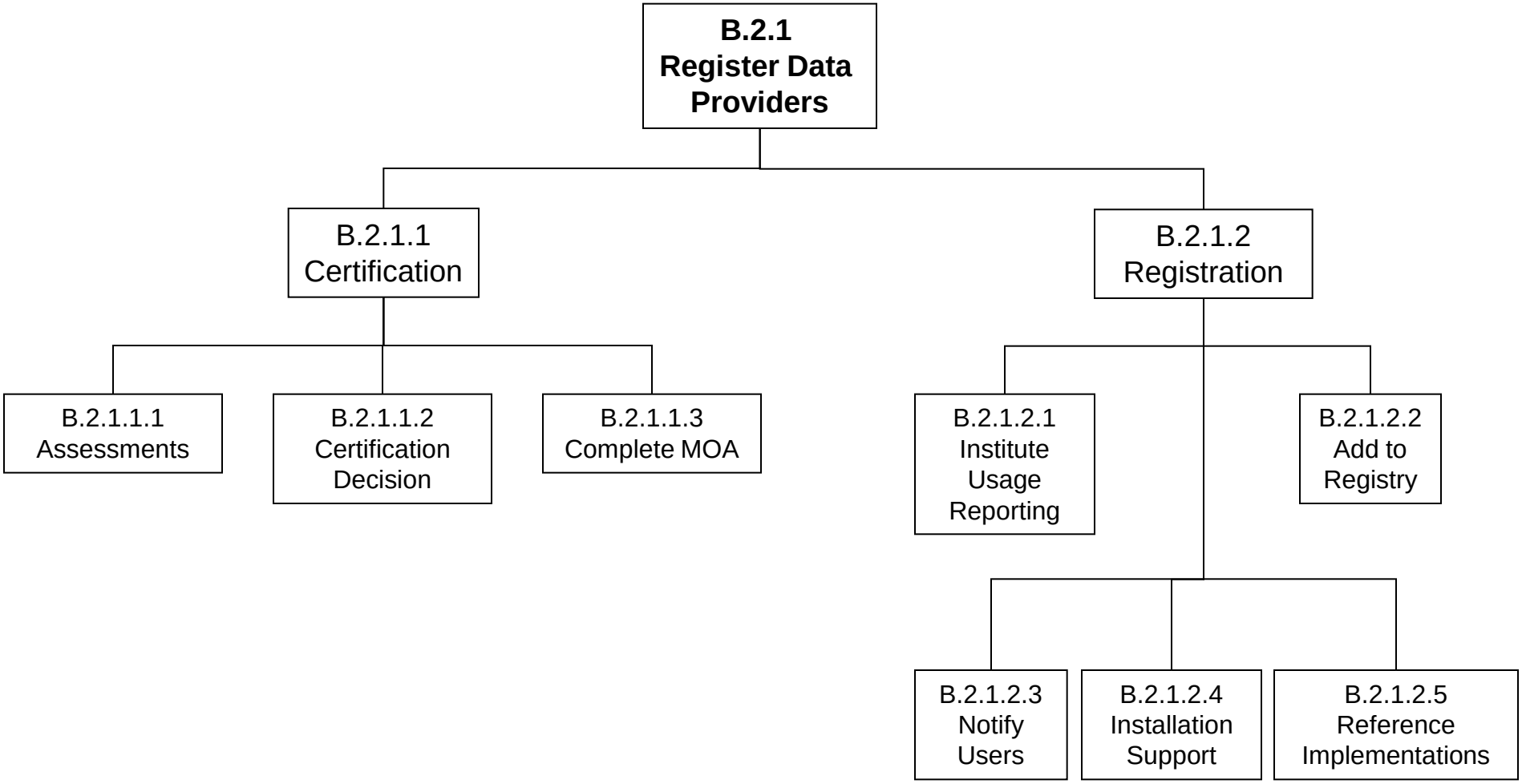

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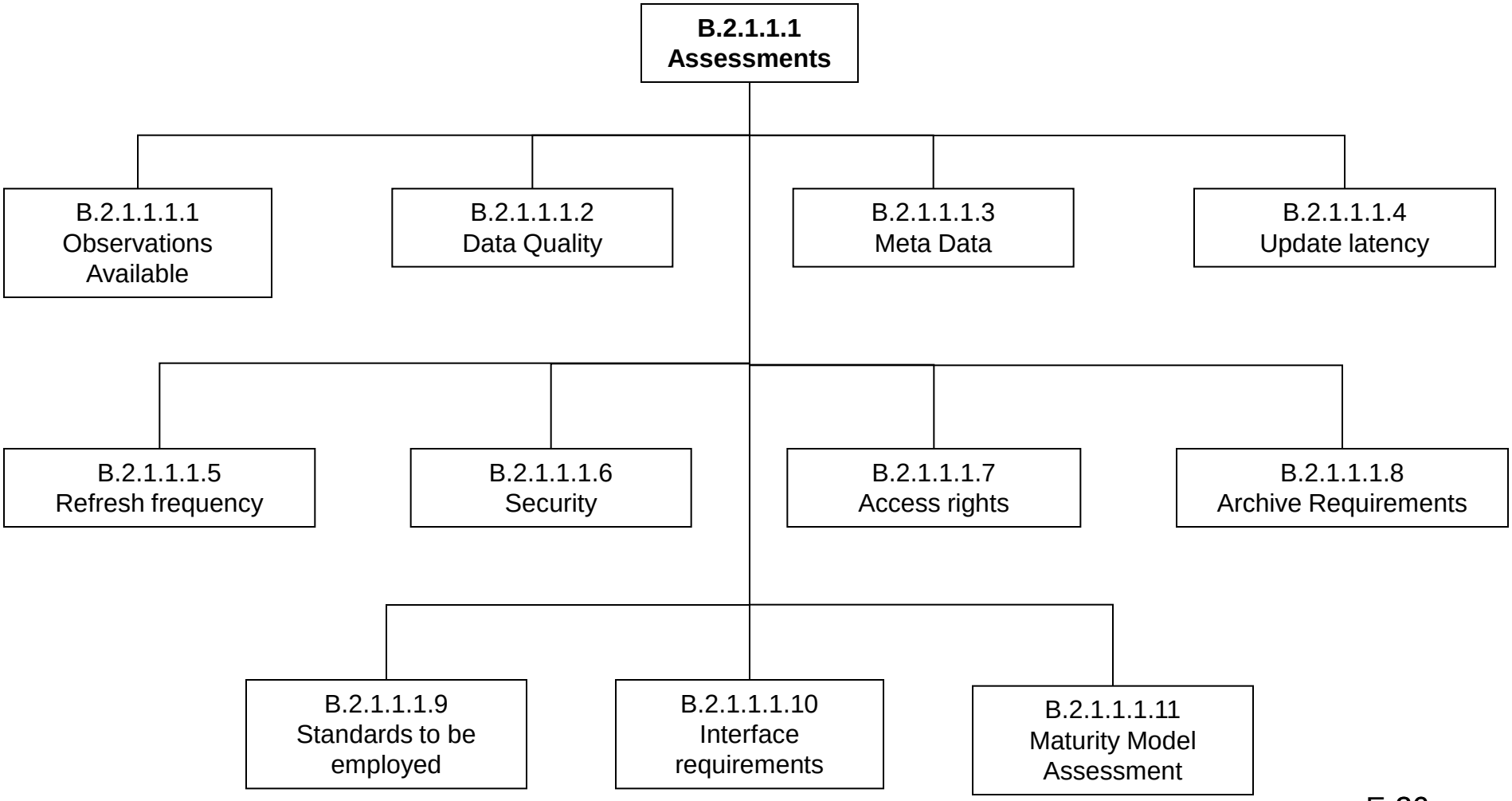

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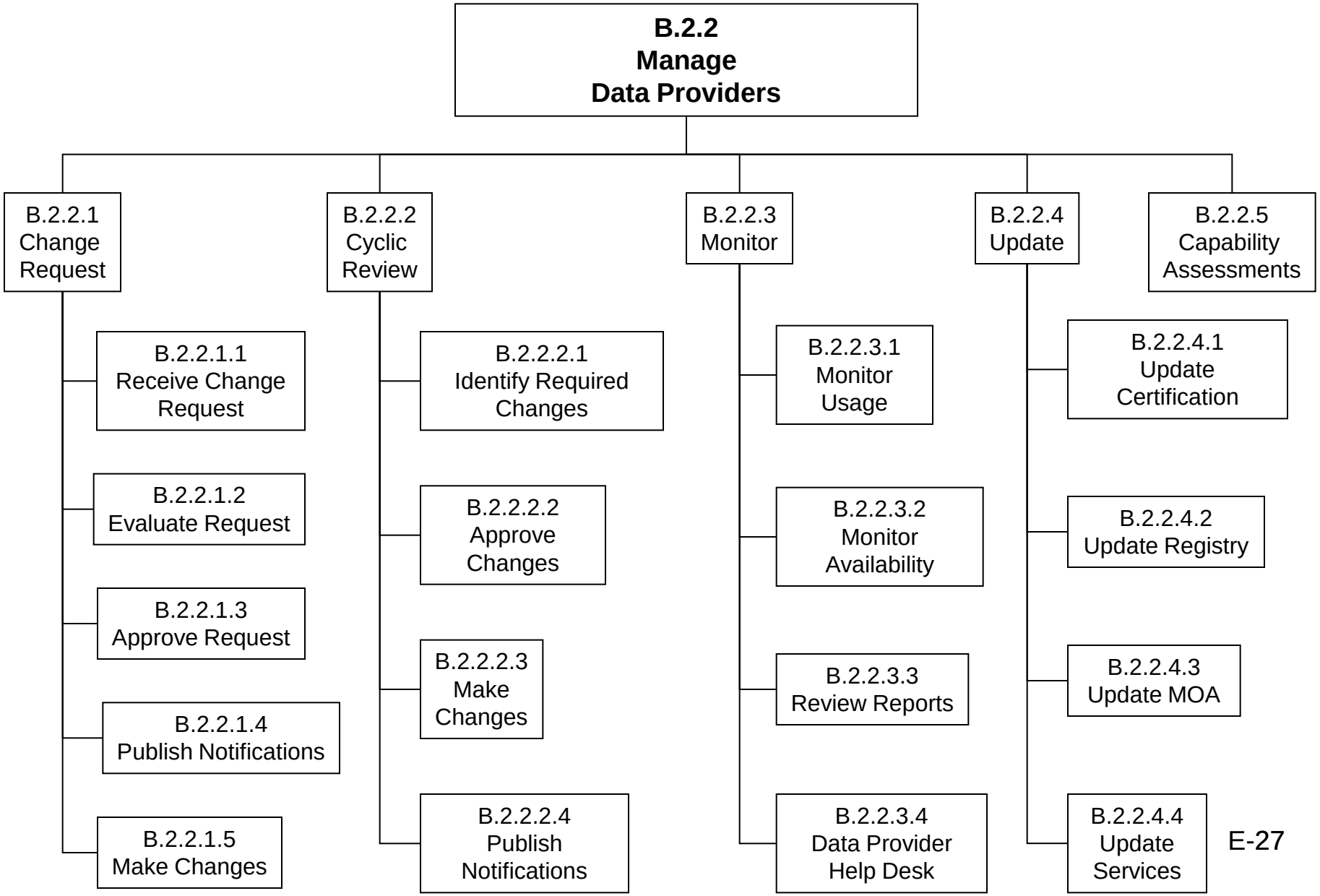

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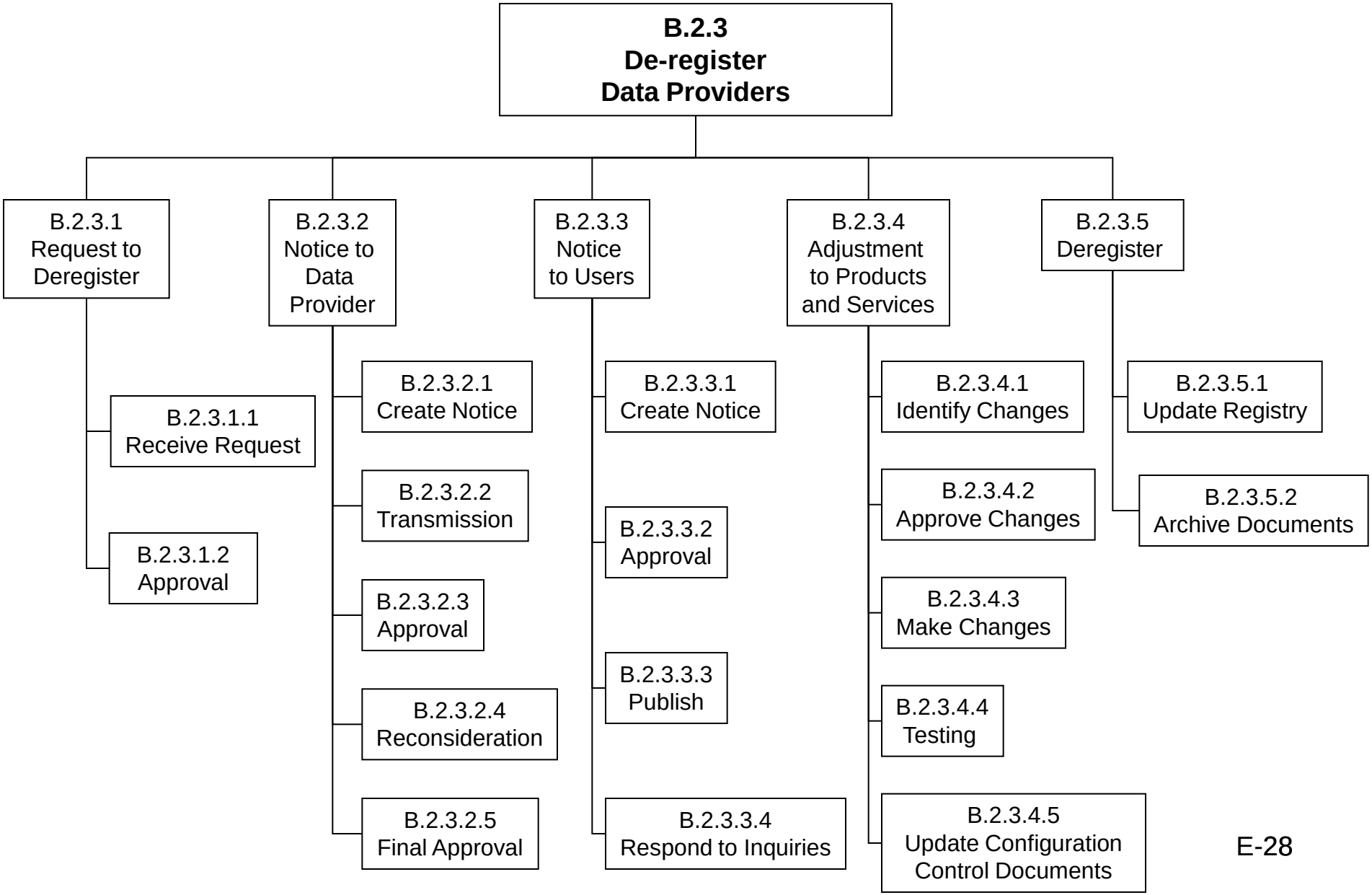

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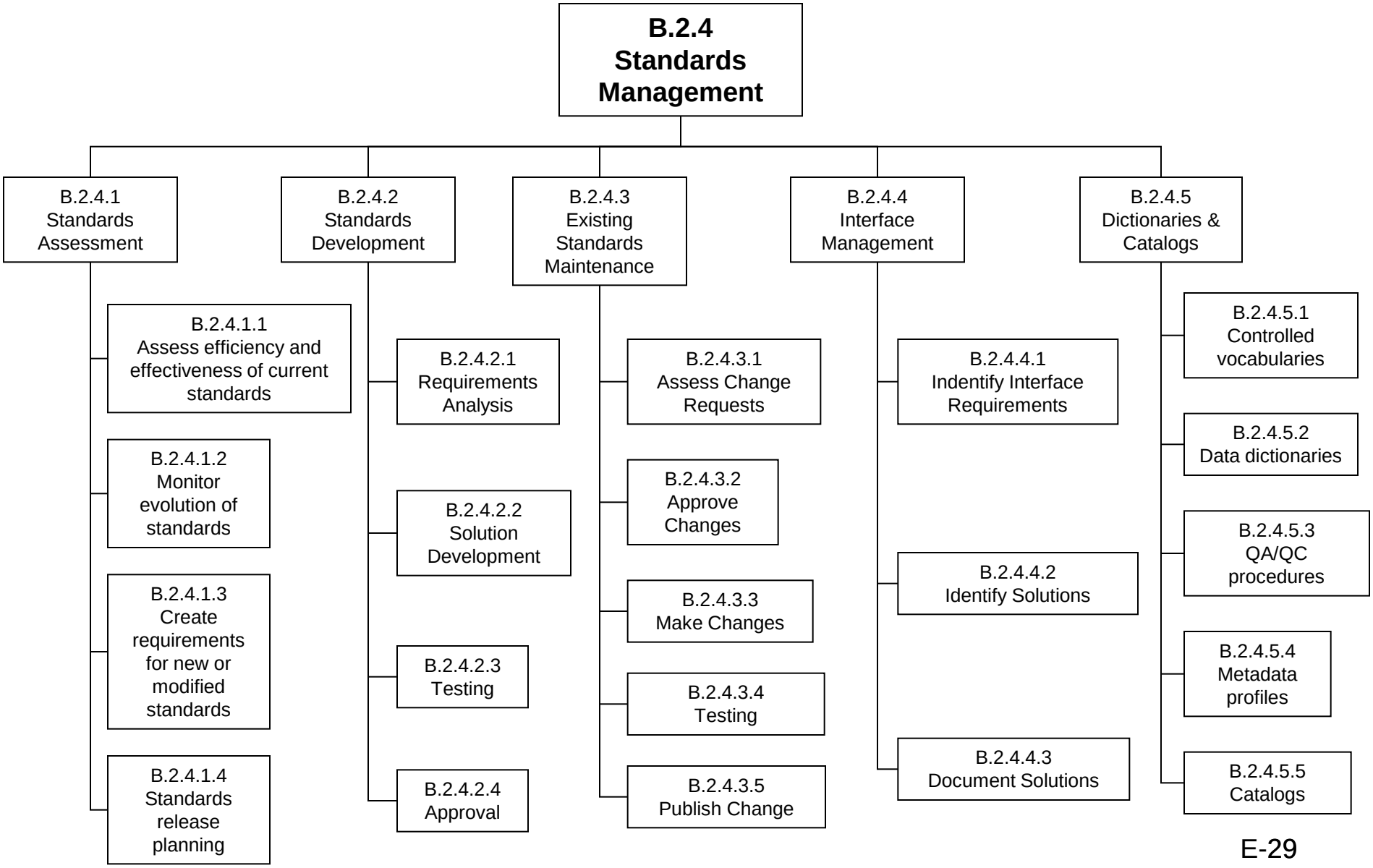

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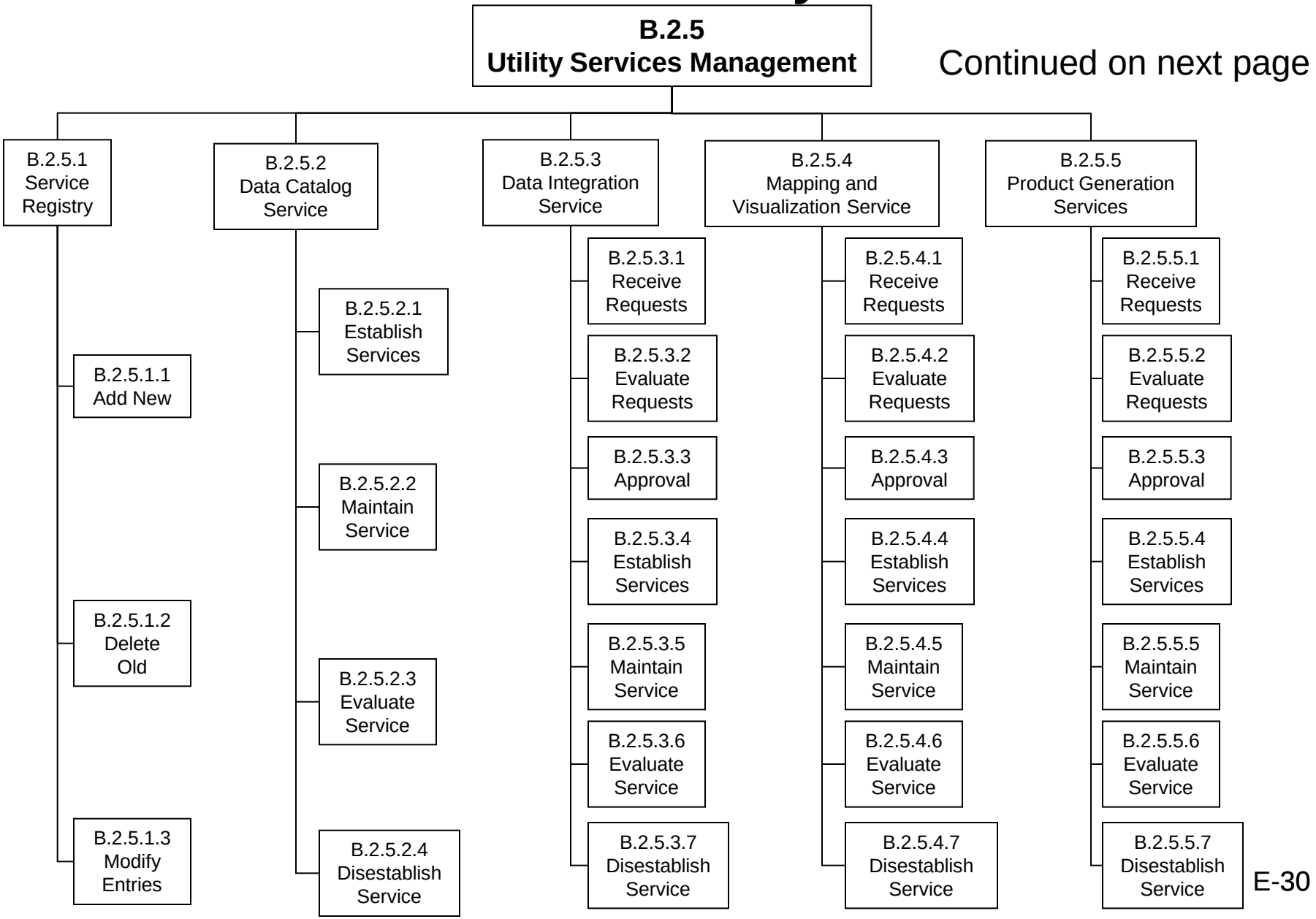

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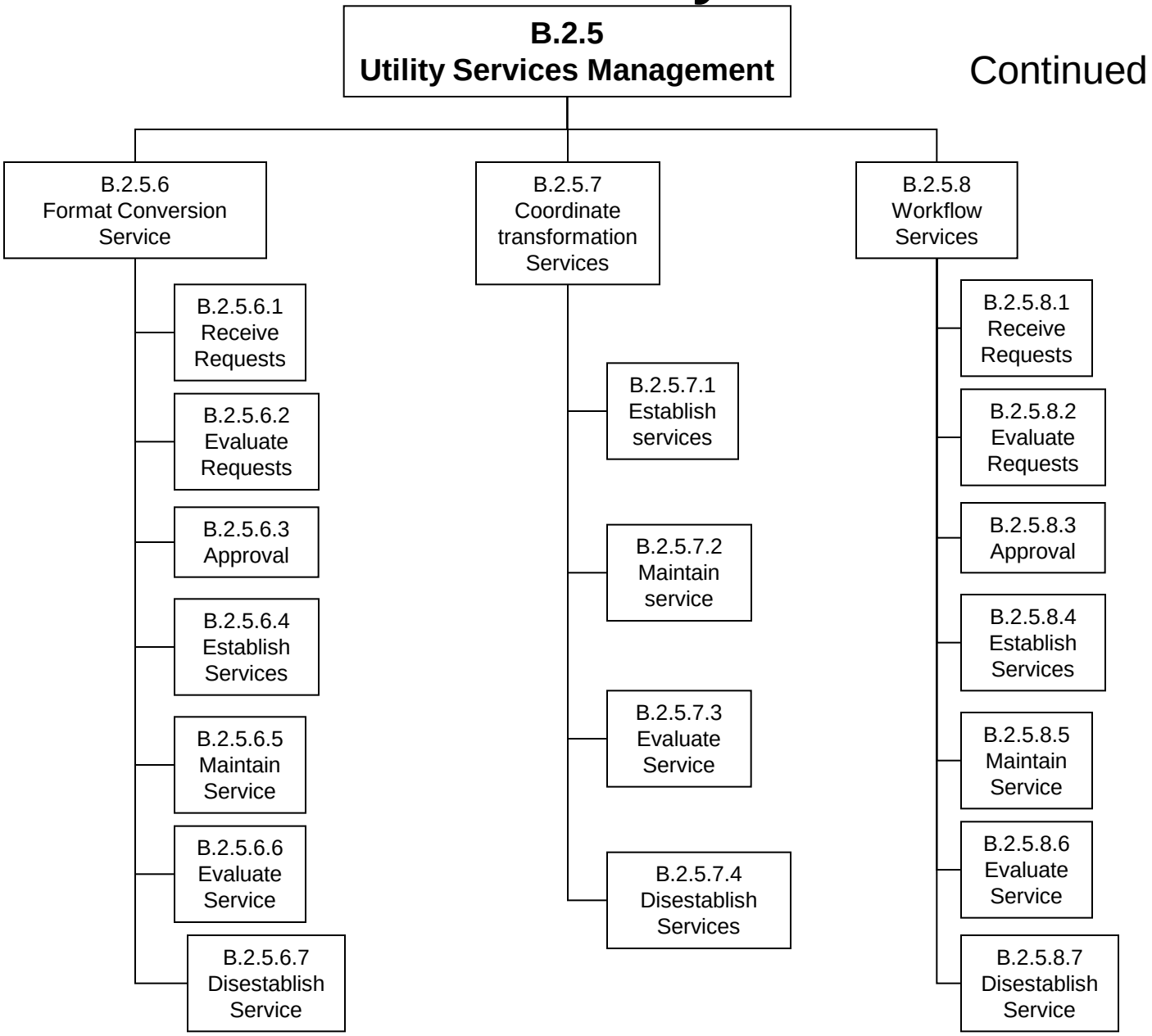

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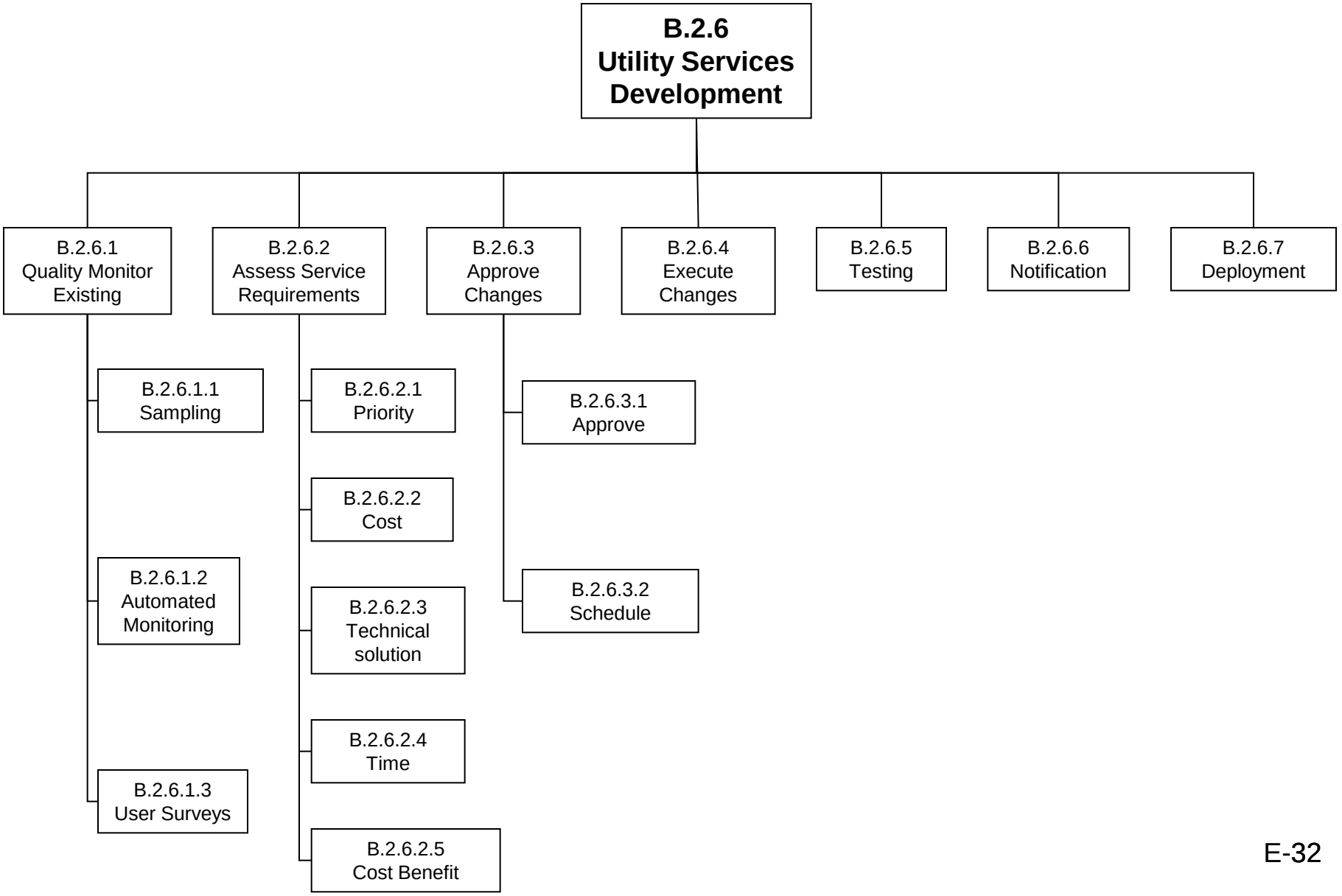

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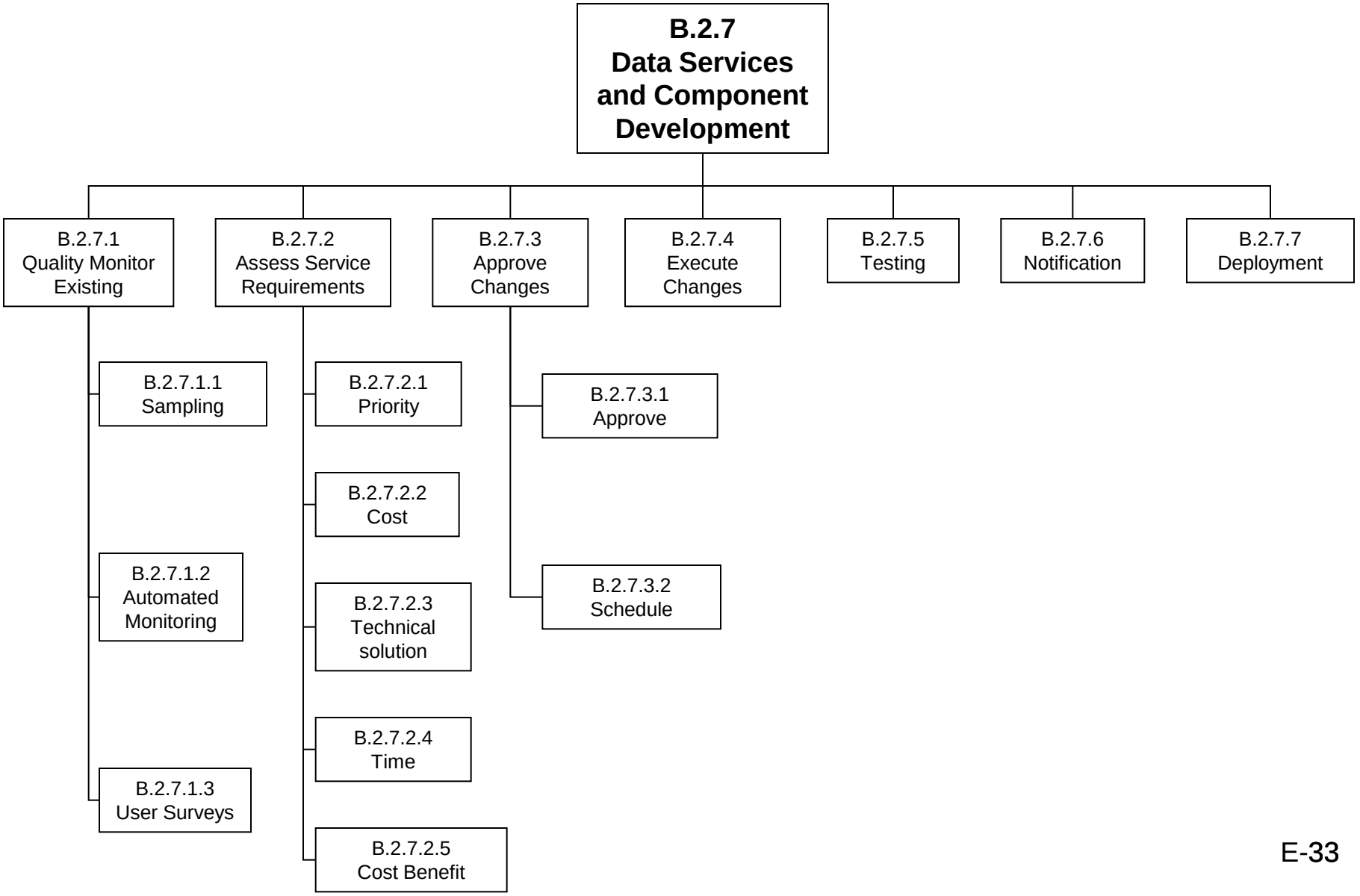

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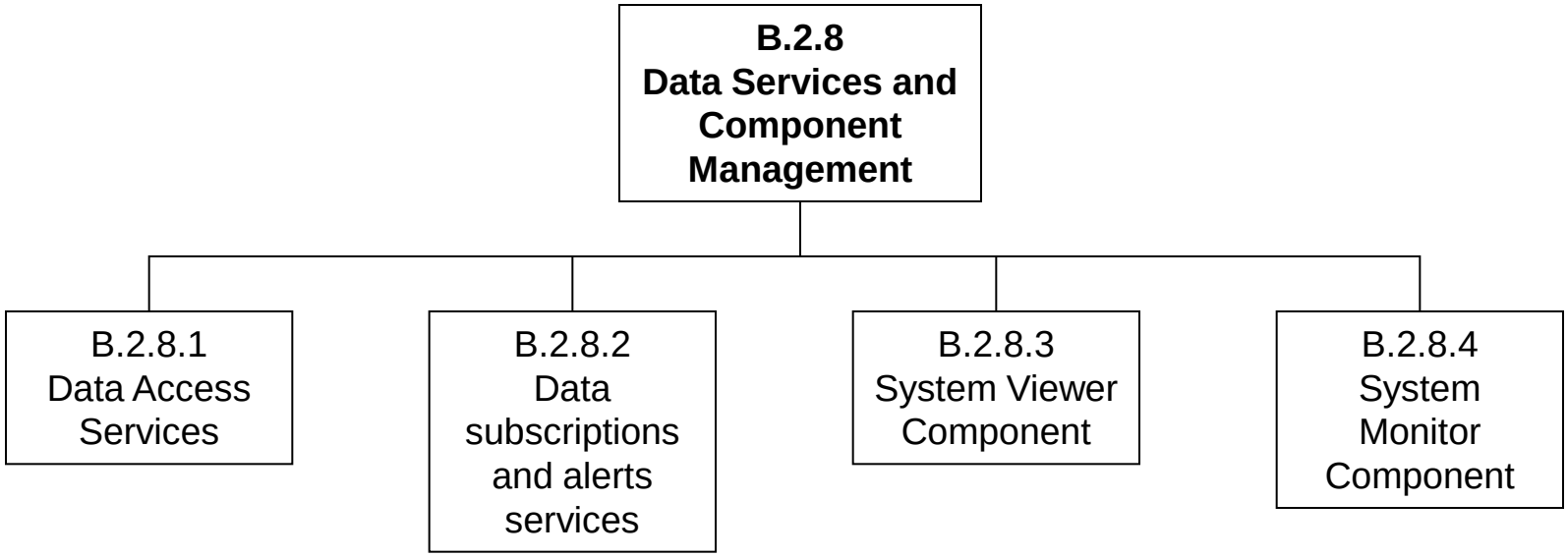

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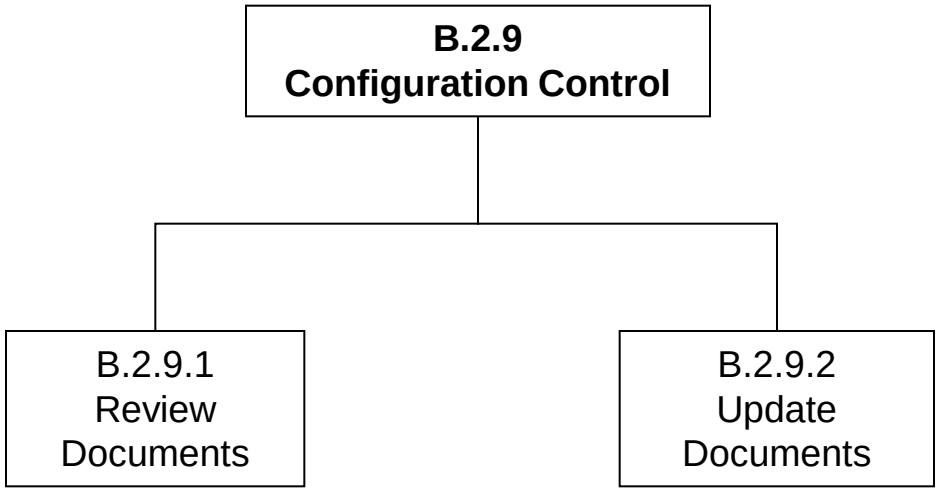
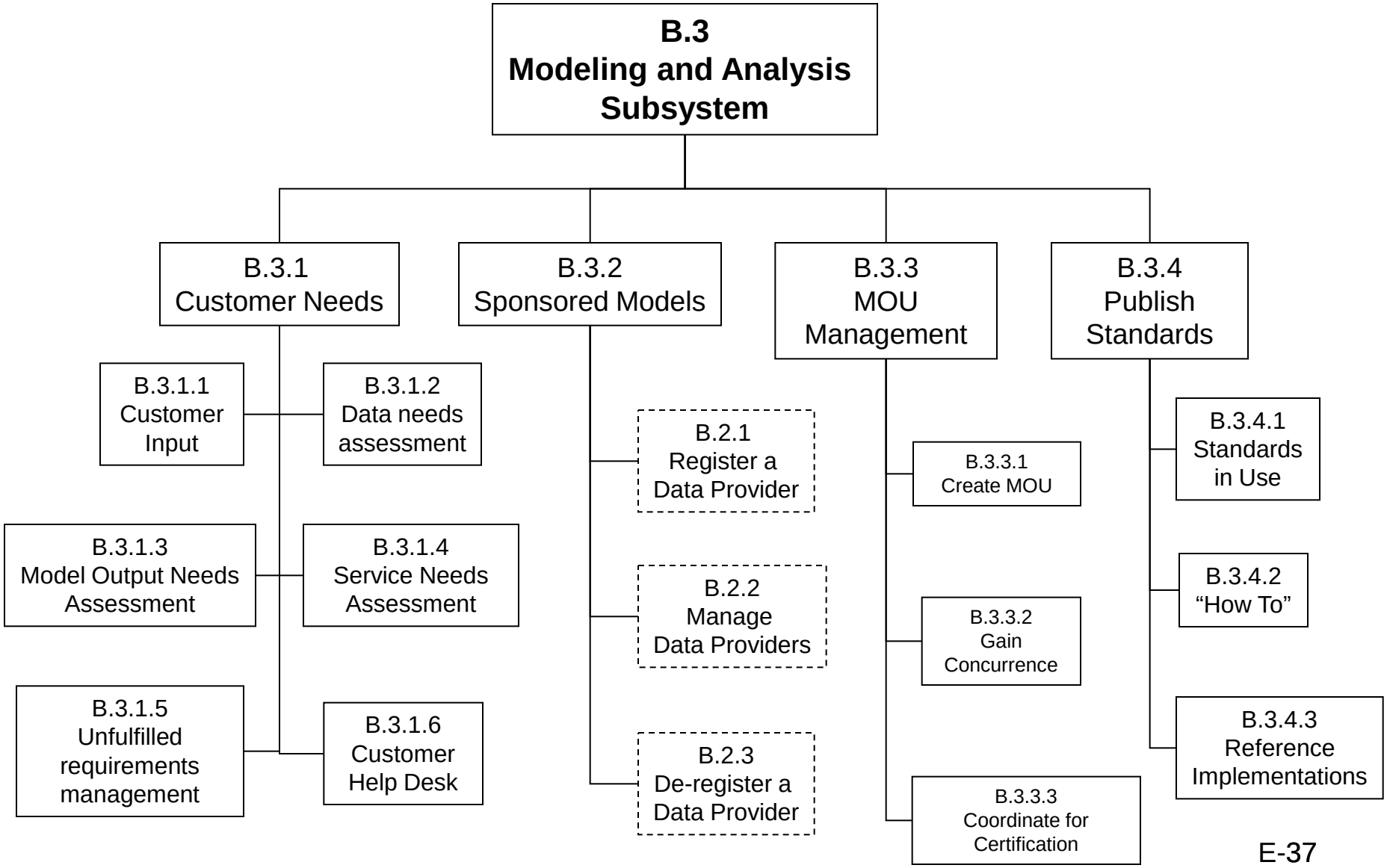


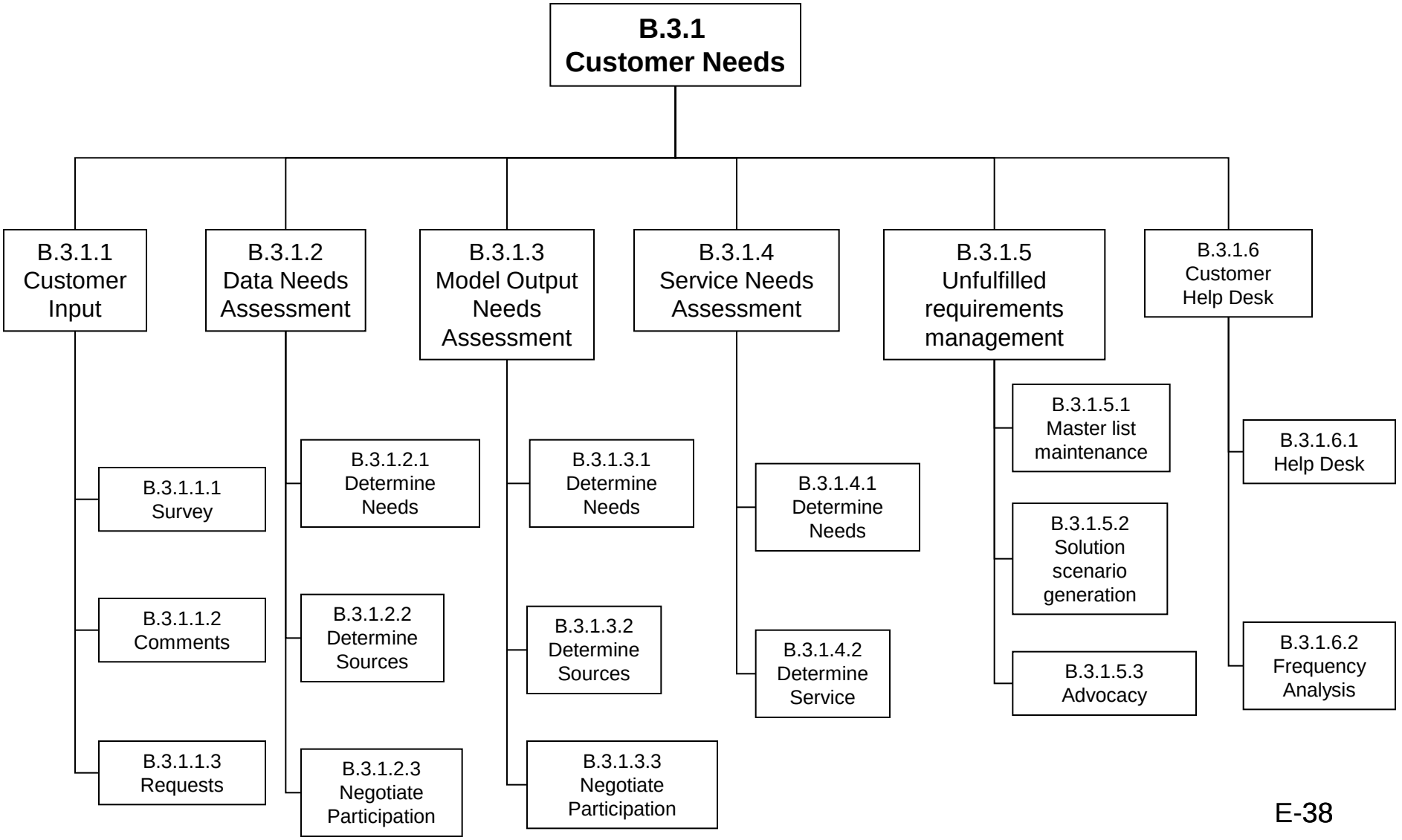
B.3
Modeling and Analysis Subsystem

Modeling and Analysis Subsystem

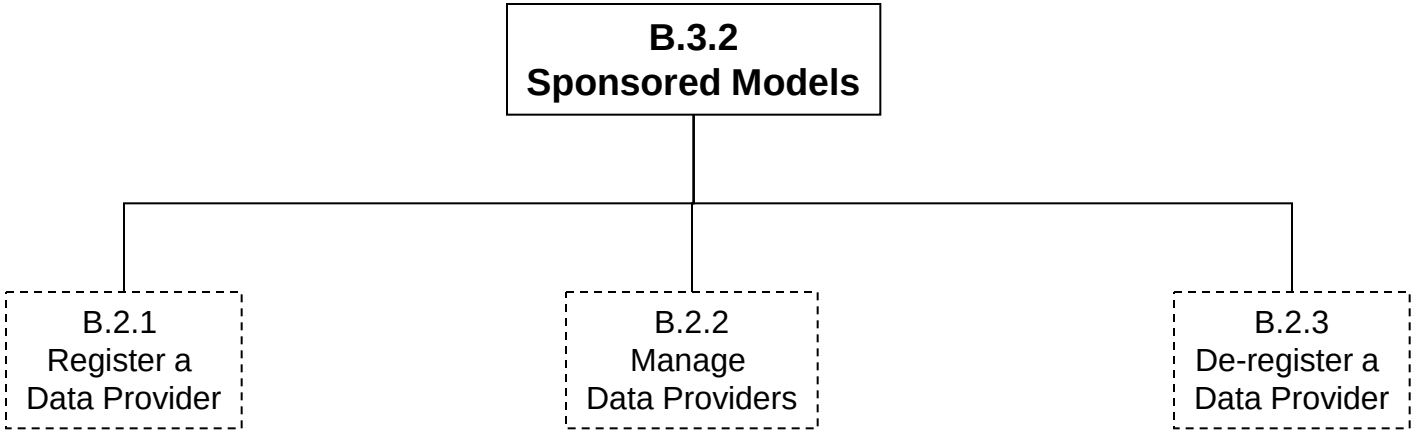


Note: Dotted boxes indicate a function or activity depicted elsewhere in the hierarchy that is also used as part of this subsystem.

Modeling and Analysis Subsystem



Modeling and Analysis Subsystem



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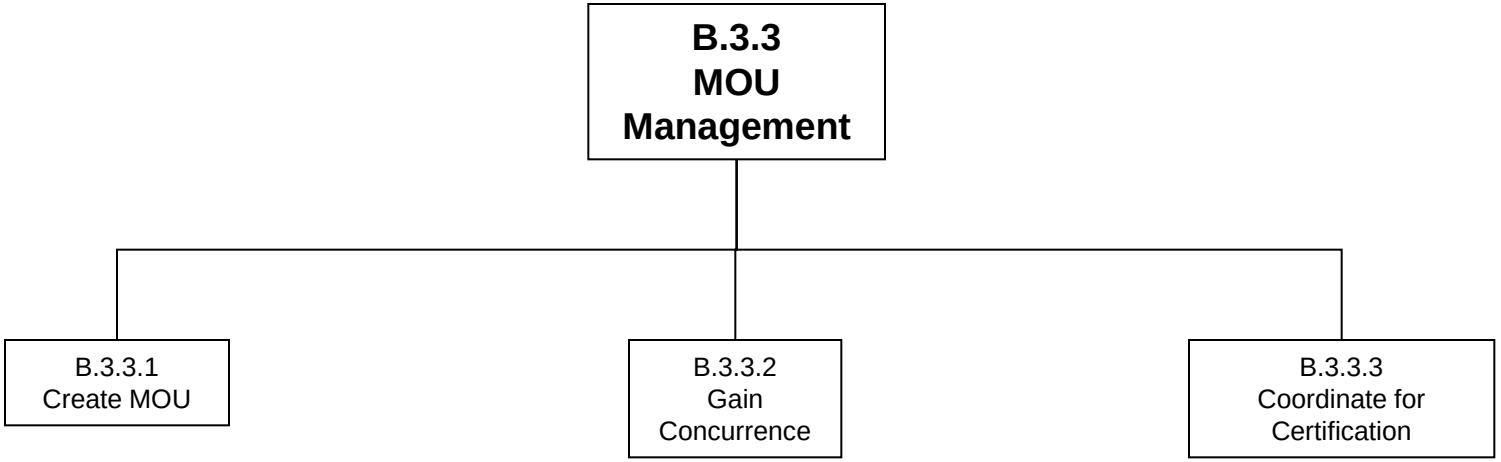

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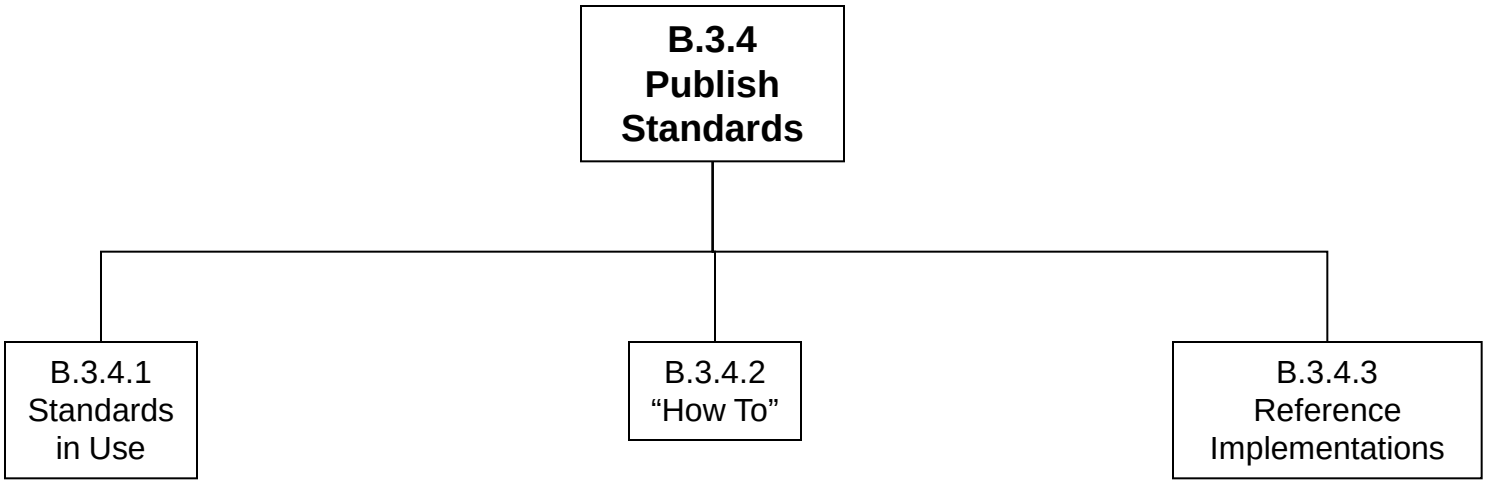
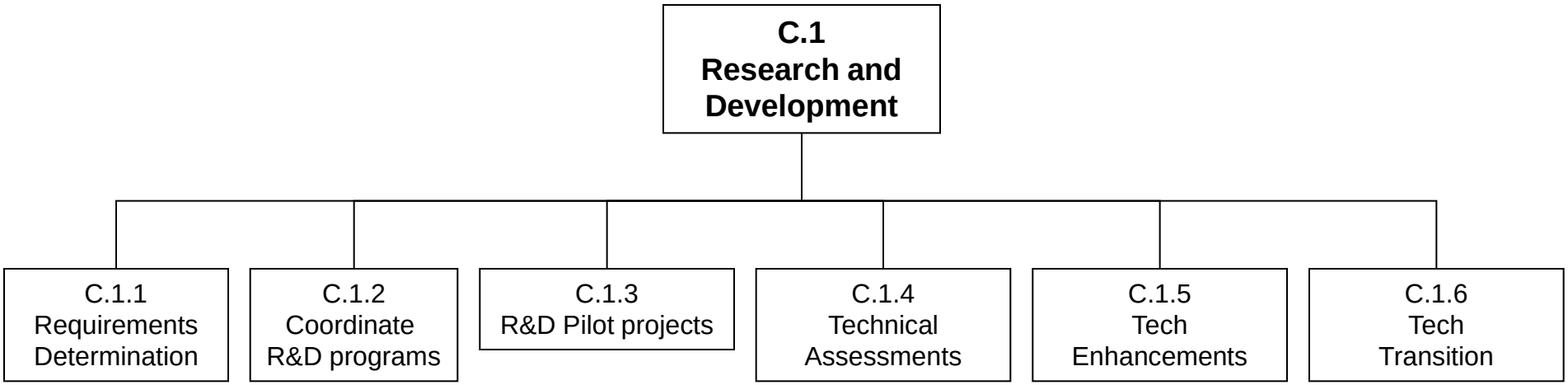
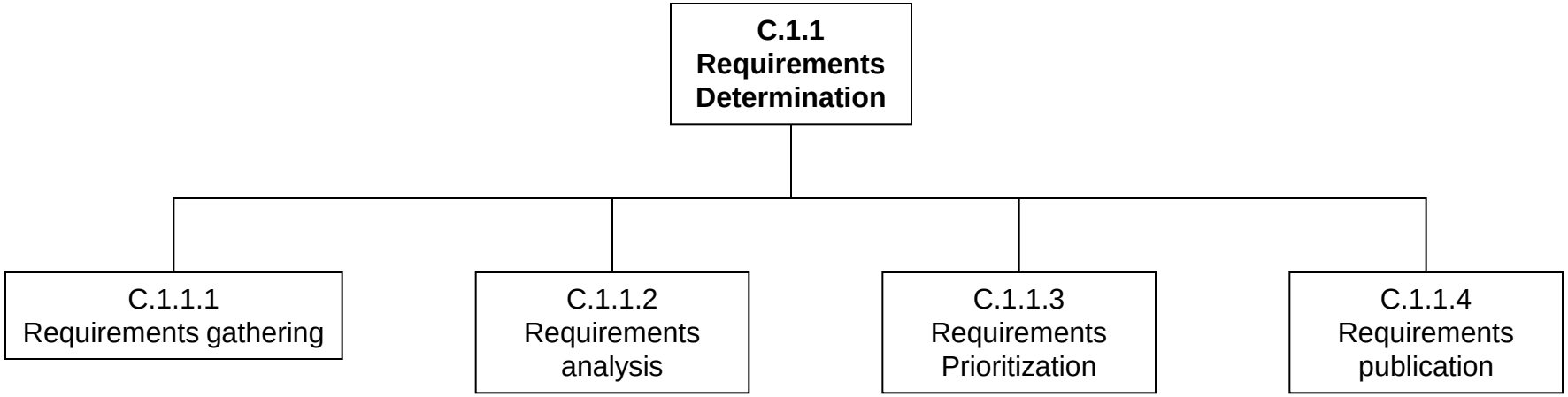


C.1
Research and Development

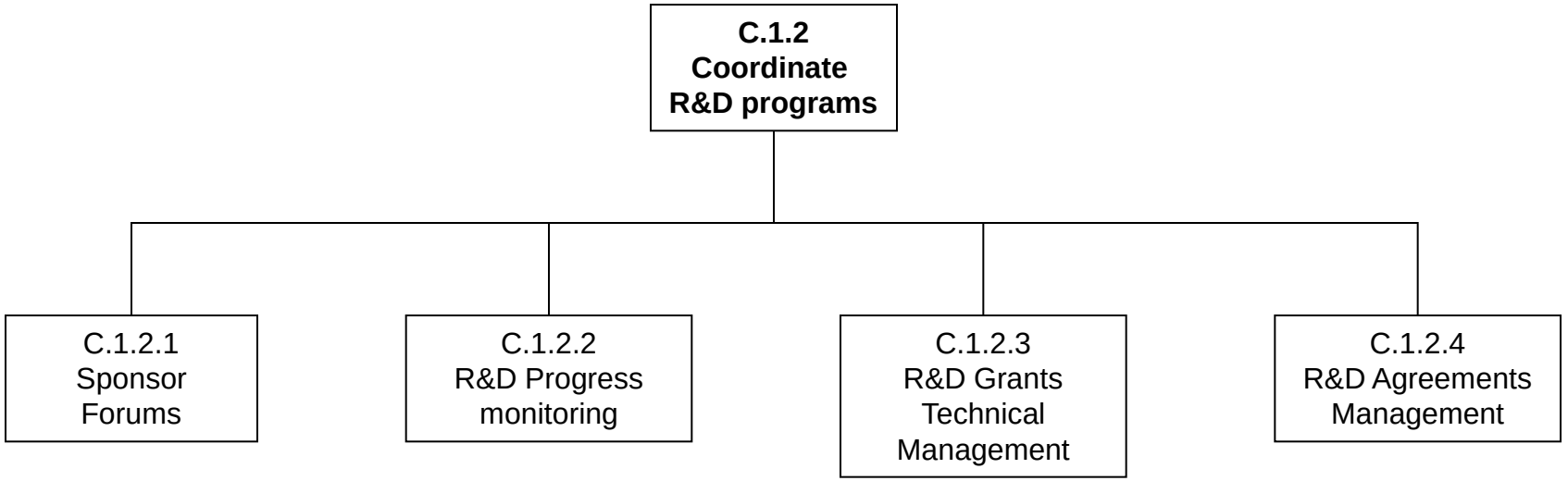
Research and Development



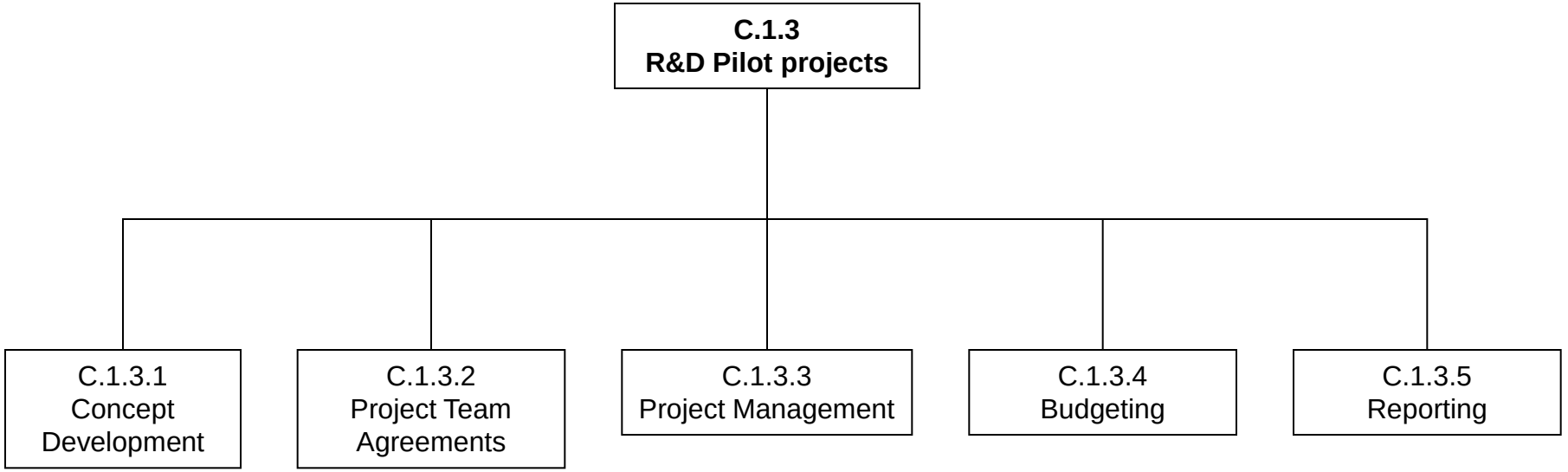
Research and Development



Research and Development



Research and Development



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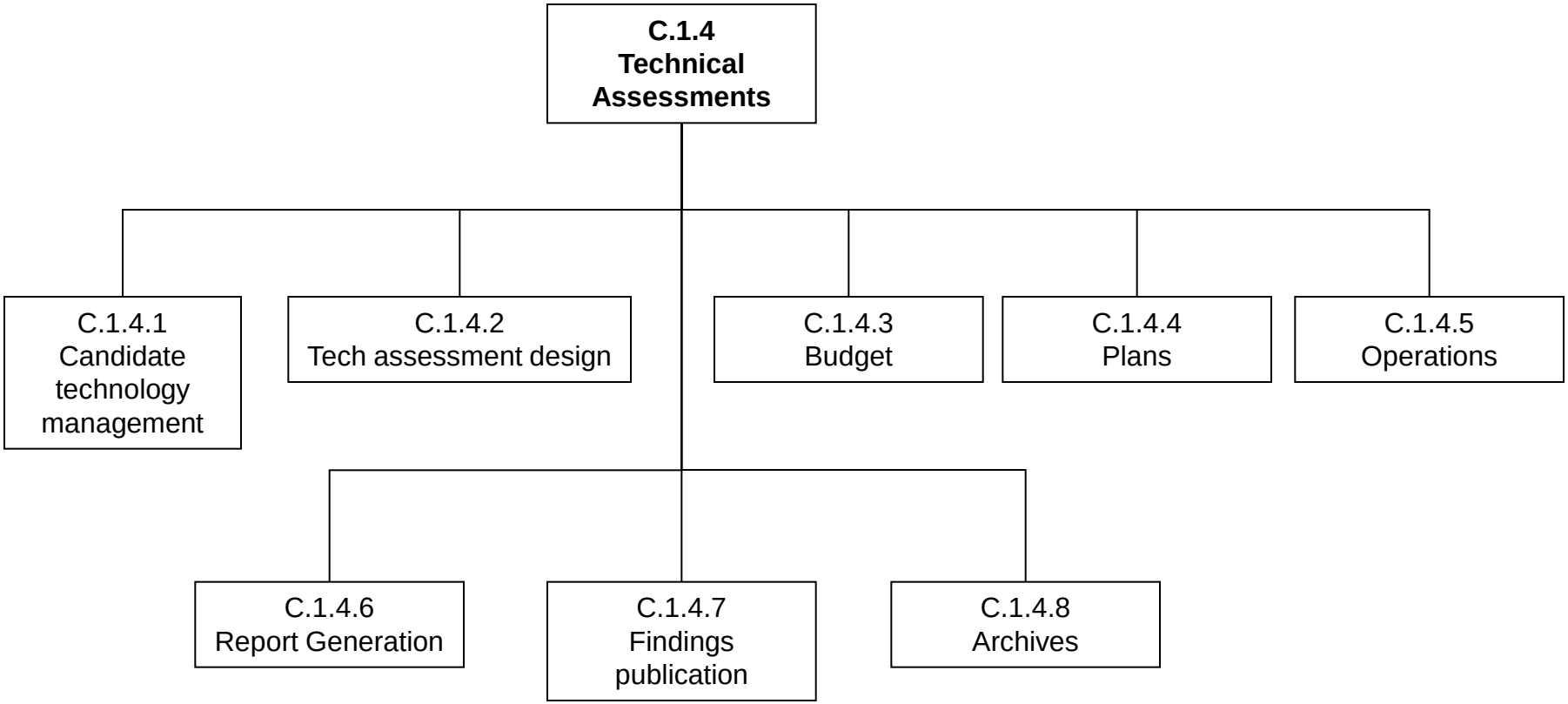
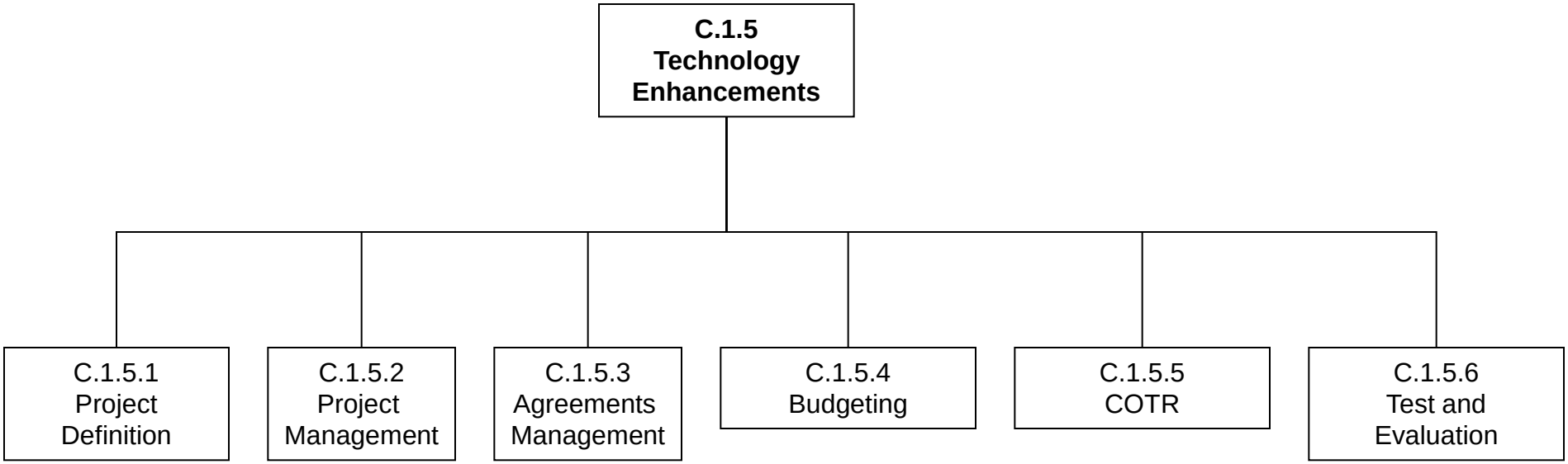


Research and Development



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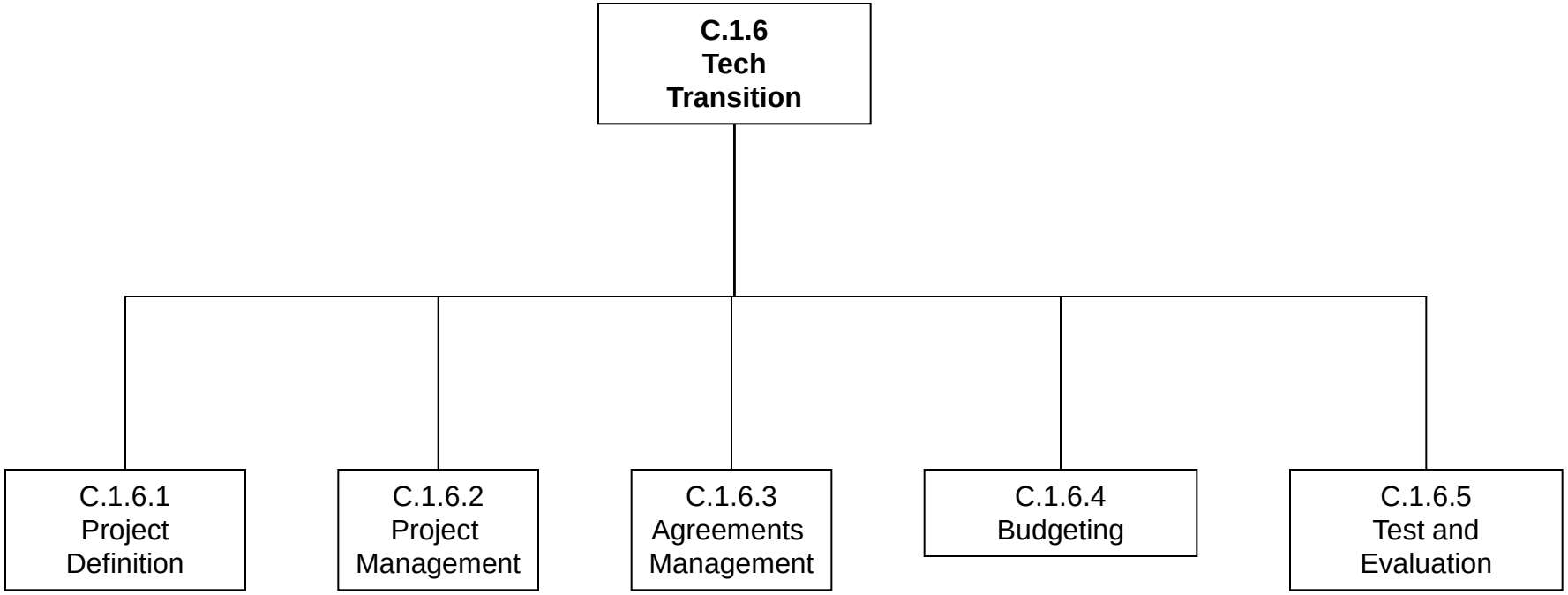
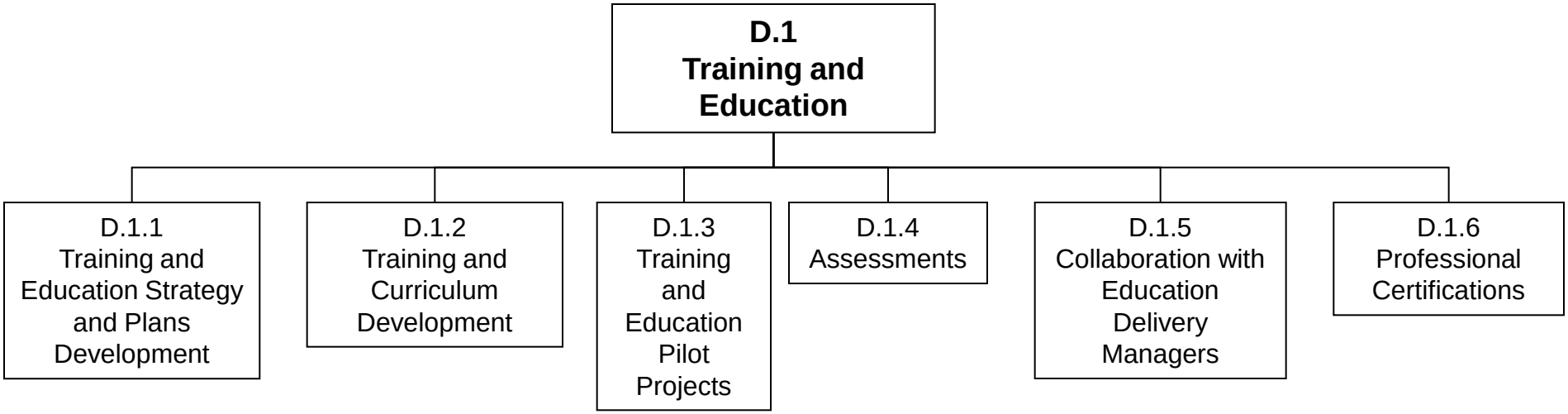
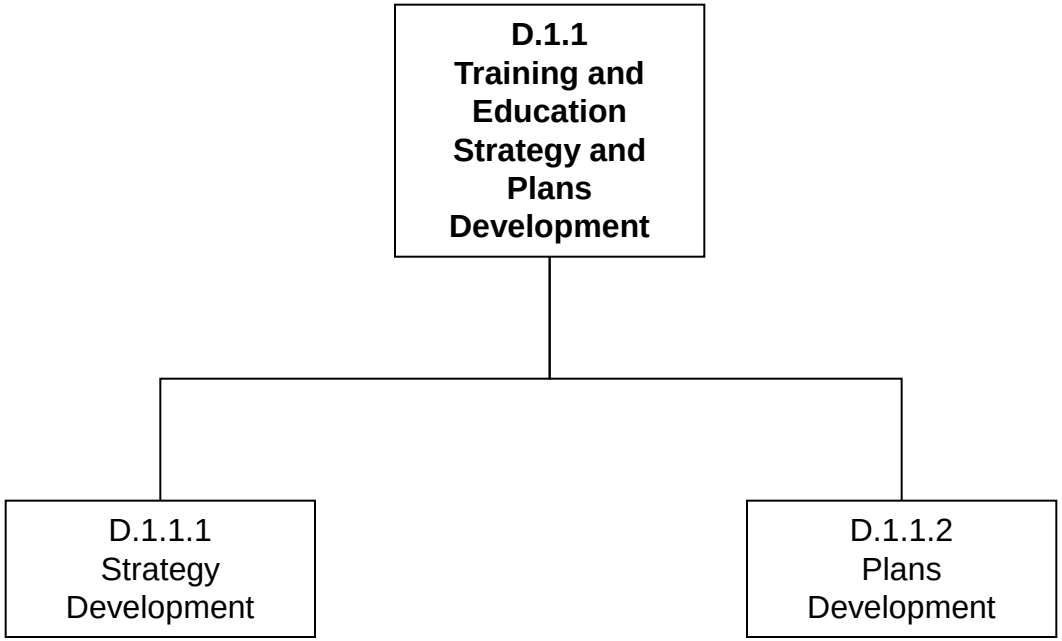


D.1
Training and Education

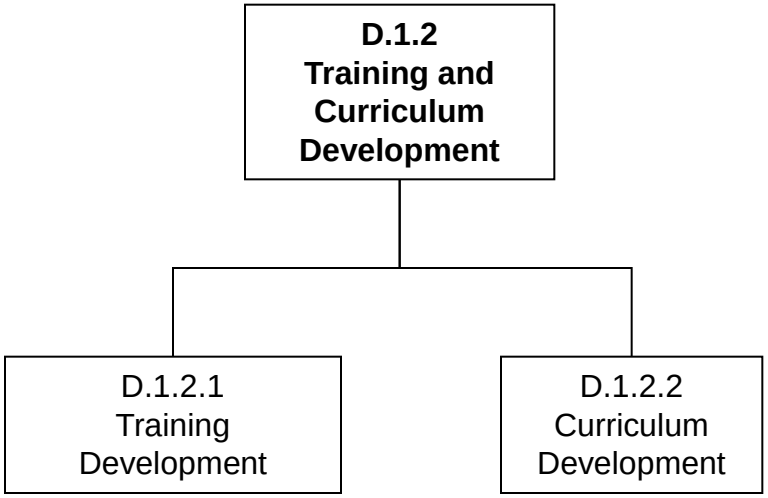
Training and Education



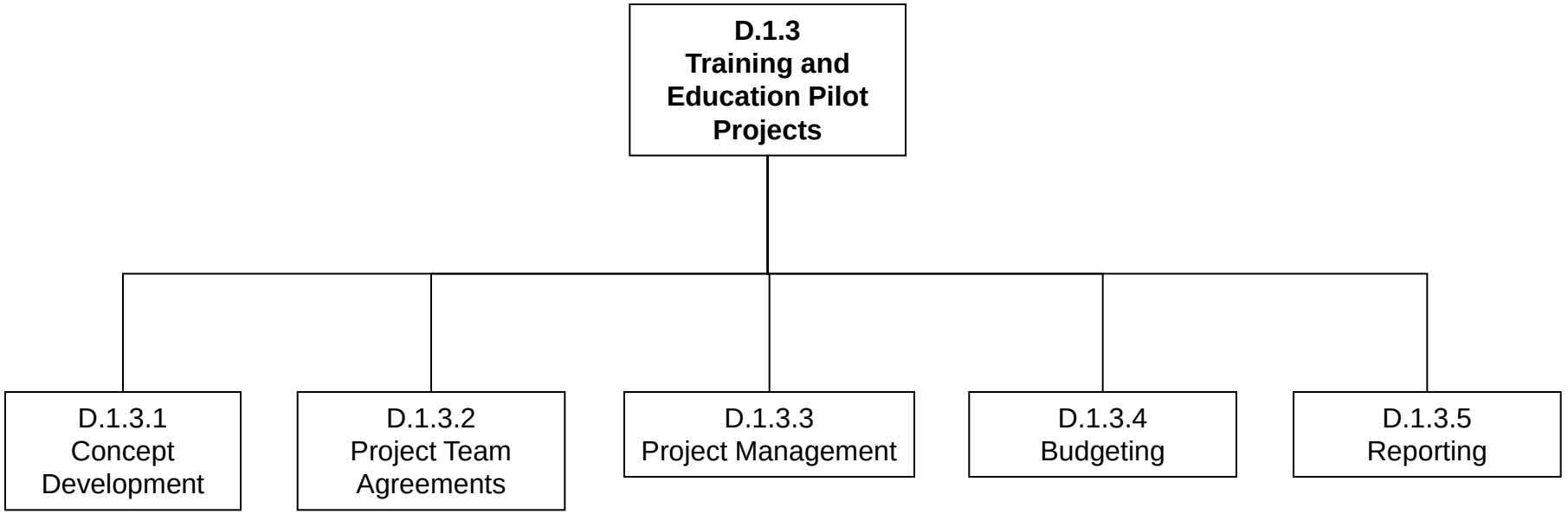
Training and Education



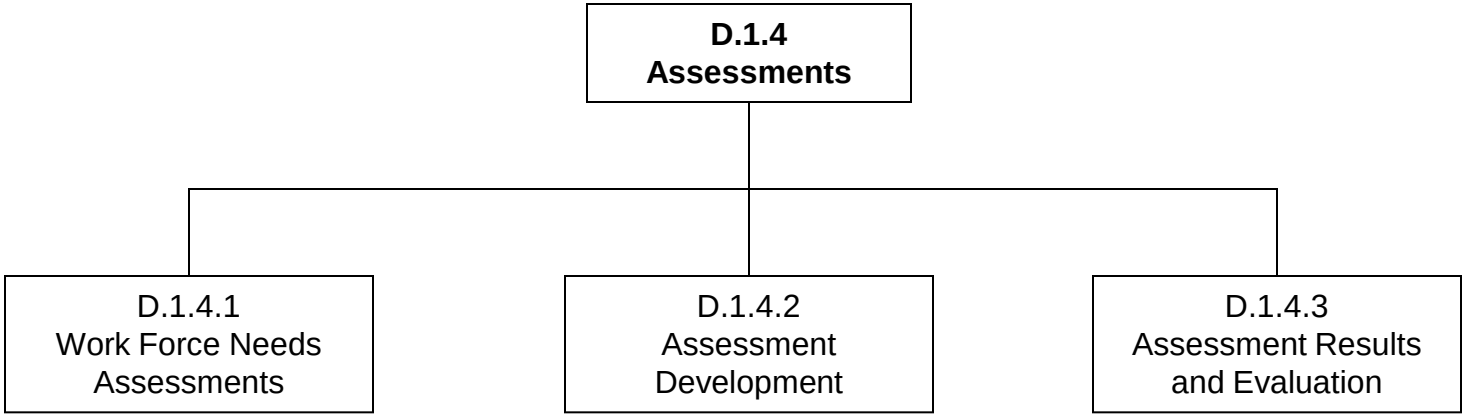
Training and Education



Training and Education



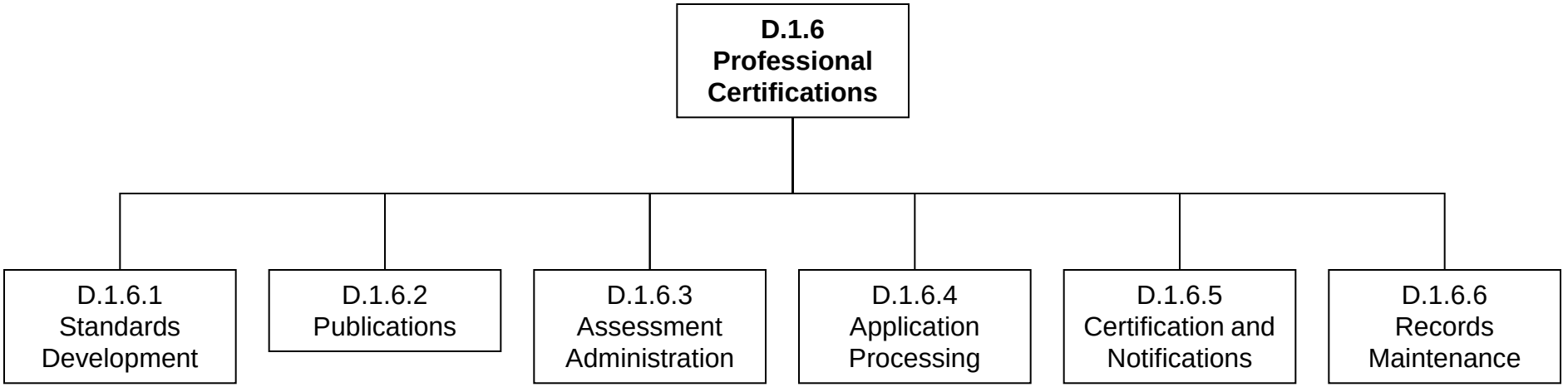
Training and Education



Training and Education

D.1.5 Collaboration with Education Delivery Managers

Training and Education



Appendix F
Working Definitions of U.S. IOOS® Activities

Table F-1 lists all of the U.S. IOOS® activities by number and name and, for each, provides a short working definition.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
A.1	Governance and Management	Support U.S. IOOS in terms of guidance, resources, process, tools, and infrastructure.
A.1.1	User Councils	Provide input/feedback on plans for and execution of U.S. IOOS, and provide a forum for discussion of U.S. IOOS user needs keyed to specific areas of interest and to influence future U.S. IOOS plans. Also provide a forum through which collaboration and agreements for future development can be made. They are a primary means for U.S. IOOS to stay engaged with myriad System stakeholders. They are advisory in nature, but also provide the forum in which agreements between partners can be initiated and IOOS plans can be vetted.
A.1.1.1	Standards Bodies	Represent the interests of the various standards organizations that govern nationally and international recognized standards used by U.S. IOOS (OGC, ISO, etc.).
A.1.1.2	Data Provider Council	Represent data providers who are current or anticipated U.S. IOOS-compliant data providers. These data providers include DAC owners, owners of U.S. IOOS sponsored models, and archives.
A.1.1.3	Customer Council	Represent the various U.S. IOOS customer communities. These include customers that access data directly from the source, (DACs, archives, or sponsored models) and those that use U.S. IOOS-compliant data or utility services. There may be subgroups within this user council to represent the various types of customers such as high-volume institutional users or low-volume users such as citizens. Third-party service providers are included in this user group.
A.1.1.4	Federal Partners	Represent the interests of Federal agencies that have a role or interest in ocean observing data.
A.1.1.5	Regional Associations	Represent the interests of the regional associations participating in, or anticipated to participate in, U.S. IOOS.
A.1.1.6	NGOs	Represent the interests of nongovernmental entities not represented in other user councils (i.e., they are not Federal entities and they are not part of the U.S. IOOS regional structure). The Consortium on Ocean Leadership is an example of an NGO.
A.1.1.7	International	Represent the interests of integrating U.S. IOOS with international ocean observations.
A.1.1.7.1	GEOSS	Represent the interests of integrating U.S. IOOS into GEOSS.
A.1.1.7.2	GOOS	Represent the interests of integrating U.S. IOOS into GOOS.
A.1.1.8	IEOS	Represent the interests of integrating U.S. IOOS into IEOS.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
A.1.1.9	Combined Forums by Geographic Area	Represent all U.S. IOOS users with a role or interest in a stated large geographic area (e.g., the Atlantic Ocean). Council members may include data collectors that collect ocean observing data in that area, data providers that assemble observations and make them available in DMAC-compliant form for that area, Federal agencies, regional associations, international members, data/services customers, and others.
A.1.1.10	Combined Forums by Functional Area	Represent all U.S. IOOS users with a role or interest in a stated functional area of interest (e.g., ocean acidification). Council members may include data collectors that collect relevant ocean observing data, data providers that compile relevant observations, Federal agencies, regional associations, international members, data/services customers, and others.
A.1.1.11	R&D Asset Owners	Represent the interests of U.S. IOOS participating organizations that conduct R&D. This forum allows for an exchange of ideas about approaches to solving ocean observation problems, coordination across R&D programs, transition from R&D to operations, and joint R&D ventures and budgeting.
A.1.2	Financial Management	Manage planning, programming, budgeting, and execution of funds. This includes management of internal U.S. IOOS Program funds, funding for U.S. IOOS projects, and coordination of financial plans and budgets with other U.S. IOOS participating organizations.
A.1.2.1	Financial Plans	Create U.S. IOOS financial plans, including prescribed planning, programming, and budget documents.
A.1.2.2	Budget	Create U.S. IOOS-required planning, programming, and budget documentation and to develop final budget plans.
A.1.2.3	Execution	Manage execution of the annual budget.
A.1.2.4	Analysis	Conduct program/budget analysis, economic analysis, and cost benefit studies.
A.1.2.5	Interagency Coordination	Create financial plans and monitor execution of funds in cooperation with other Federal and non-Federal U.S. IOOS organizations.
A.1.3	Policy	Create and manage policy both internal to the U.S. IOOS Program and external. Policies may be administrative, such as the steps required to become a data provider, or technical, such as data quality standards that must be in place. Congressional liaison activities fall within this area.
A.1.3.1	Intramural	Create and manage policy within the U.S. IOOS Office.
A.1.3.2	Extramural	Create and manage policies that affect external partners.
A.1.3.2.1	Technical	Create and manage technical policy.
A.1.3.2.2	Administrative	Create and manage administrative policy.
A.1.3.3	Congressional Liaison	Provide information requested by congressional members and analyze congressional language to assess policy ramifications.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
A.1.4	Plans and Ops	Manage plans and operations supporting the full range of U.S. IOOS activities. These include coordination of IOOS subsystem development efforts, plans and operations relating to modeling and analysis, DMAC observing subsystem, R&D, training and education, and change management. In addition to routine functions of planning and controlling U.S. IOOS functions, plans and operations can include activities agreed upon by user council, national, or international plans agreed to by U.S. IOOS.
A.1.4.1	Plans	Create and manage near-term, long-term, and contingency plans across all U.S. IOOS activity areas.
A.1.4.1.1	National Coordination	Create and manage plans that coordinate activities at a national level that may include members of some or all user councils or other entities with interest. (Examples are the National Waves Plan and the National Surface Current Mapping Plan.)
A.1.4.1.2	IOOS Internal	Create and manage plans that do not include participation by non-U.S. IOOS partners.
A.1.4.1.2.1	Observations	Create and manage plans, including regional U.S. IOOS plans, relating to development, management, and improvement of ocean observing capability.
A.1.4.1.2.2	Data Providers	Create and manage plans relating to management of U.S. IOOS data providers, include Federal and non-Federal data assembly centers, sponsored models, and archives.
A.1.4.1.2.3	DMAC Services	Create and manage plans that affect DMAC services development, management, evolution, and delivery.
A.1.4.1.2.4	Models	Create and manage plans that affect data delivery to models and efforts to assimilate and manage U.S. IOOS-sponsored models.
A.1.4.1.2.5	Archives	Create and manage plans that affect U.S. IOOS-compliant archives, including data storage, retrieval, and backup.
A.1.4.1.2.6	Education	Create and manage plans related to assessing U.S. IOOS-related training and education requirements, content development, and delivery.
A.1.4.1.2.7	R&D	Create and manage plans related to R&D efforts in support of U.S. IOOS or user council member needs.
A.1.4.1.3	International Coordination	Create and manage plans that coordinate activities at an international level that may include members of some or all user councils or other entities with an interest (e.g., U.S. participation in an international ocean observing plan).
A.1.4.2	Operations	Control, monitor and report on operations covering the full range of U.S. IOOS activities. These include operations relating to modeling and analysis, DMAC, observing subsystem, R&D, and training and education. Operations can include activities agreed upon by user councils, national or international plans agreed to by U.S. IOOS.
A.1.4.2.1	Interagency	Control, monitor, and report on operations conducted with or by interagency partners.
A.1.4.2.1.1	Program Management Teams	Manage interagency programs and projects where U.S. IOOS is the lead agency.
A.1.4.2.2	National	Control, monitor, and report on operations conducted with or by domestic partners.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
A.1.4.2.3	International	Control, monitor, and report on operations conducted with or by international partners.
A.1.4.2.3.1	Program Management Teams	Manage international programs and projects where U.S. IOOS represents the United States as the lead country.
A.1.4.2.4	Regional Assessments	Conduct capability maturity assessments of the U.S. IOOS regions.
A.1.4.2.5	Regional Project Management	Manage regional projects funded by U.S. IOOS.
A.1.4.2.6	Program Office Internal	Control, monitor, and report on U.S. IOOS Program Office internal operations.
A.1.5	Human Resources	Manage/coordinate U.S. IOOS Program Office human resources, including job descriptions, hiring, employee benefits, personnel actions, and other routine personnel administration tasks.
A.1.5.1	Staffing	Manage people to positions.
A.1.5.2	Recruiting	Recruit new employees.
A.1.5.3	Awards	Receive recommendations and approve awards.
A.1.5.4	Personnel Actions	Perform personnel actions.
A.1.5.5	Training	Manage training for employees.
A.1.5.6	Benefits	Manage employee benefit programs.
A.1.5.7	Personnel Records	Maintain and update employee personnel files.
A.1.5.8	Personnel Policy	Develop and implement personnel policies.
A.1.6	Acquisition and Grants	Acquire required items and services, award grants and cooperative agreements, and do independent cost estimates.
A.1.6.1	Purchasing	Make purchases (including government credit card).
A.1.6.2	Contracting	Manage contracts from identification of requirements through closeout.
A.1.6.3	Grants and Cooperative Agreements	Create FFO, conduct competitions, award grants and cooperative agreements, and manage postaward administration.
A.1.6.3.1	Services	Create and manage services grants and cooperative agreements.
A.1.6.3.2	R&D	Create and manage R&D grants and cooperative agreements.
A.1.6.4	Independent Cost Estimates	Conduct independent cost estimates in anticipation of a contracting action.
A.1.7	Marketing, Outreach, and Engagement	Convince data providers, data/services customers, and model owners to participate in U.S. IOOS. This function includes “communications,” outreach, and other aspects of managing the public face of U.S. IOOS, but has a strong central focus on causing the target audience to join and actively participate in the U.S. IOOS effort. Although some activities are similar to traditional “outreach,” the purpose of outreach is to inform, while this effort is unsuccessful if only information is transmitted. This is targeted information designed to engender action. It is also fundamentally different from “training and education,” where the intent is to give the target audience a skill or knowledge.
A.1.7.1	Manage Communication Strategy	Create and manage the communication strategy, including identification of target audiences, desired outcomes, communications messages, channels, vehicles, schedules, and results assessments.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
A.1.7.2	Create Products	Manage creation of marketing, outreach, and engagement products, including brochures, web pages, articles, position papers, briefings, and congressional correspondence support documents.
A.1.7.3	Speaker Program	Manage providing U.S. IOOS knowledgeable speakers at influential conferences and other venues according to the communications strategy.
A.1.7.4	Conference Participation	Ensure knowledgeable and proactive participation at U.S. IOOS-related conferences.
A.1.7.5	Membership in Fora	Ensure that U.S. IOOS is properly represented in councils and forums of importance to U.S. IOOS.
A.1.7.6	News Releases	Manage media engagement and information releases to press/media outlets and third-party communications managers and publishers.
A.1.8	IT Support	Manage information technology related to delivery of DMAC services and all realms of services for internal U.S. IOOS Program Office users.
A.1.8.1	Desktop Management	Manage office IT services, including hardware, software, and help desk support. These services include desktop computers, printers, laptops, backups, COOP, hand-held devices, and other computer resources that interface with individuals.
A.1.8.2	Network Management	Manage the U.S. IOOS-owned network, including cabling, servers, routers, bridges, gateways, etc. Due to the nature of computer networks, there is no differentiation between the network to support internal U.S. IOOS office needs and the network that provides DMAC services. The network will likely be a composite of owned, leased, and partner-provided assets.
A.1.8.3	Architecture Management	Manage the IT architecture, including internal, network, and DMAC, to ensure effectiveness, efficiency, and compliance with Federal and other standards.
A.1.8.3.1	DMAC	Manage IT services, including hardware, software, and help desk support related to the delivery of IOOS DMAC-compliant data and utility services.
A.1.8.3.2	IOOS Program Internal	Manage IT services, including hardware, software, and help desk support related to U.S. IOOS Program Office user needs.
A.1.8.4	Website Management	Manage the U.S. IOOS website, including technical management and content management.
B.1	Observing Systems Subsystem	Serve as the source of U.S. IOOS-provided data. U.S. IOOS accesses the data from databases such as data assembly centers (which collect ocean observation data, make metadata available, and control data quality), archives (where ocean observation data previously available from a DAC are maintained for long-term access), and sponsored models (models and other analytical tools that take raw or refined ocean observation data and provide a value-added output that is of such significance to the U.S. IOOS community that the output is specifically served through U.S. IOOS).
B.1.1	Observing Subsystem Management	Oversee and manage the observing functional subsystem of U.S. IOOS.
B.1.1.1	Requirements Determination	Gather observing system requirements, perform analysis, and recommend plans to address the requirements.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
B.1.1.2	Observing System Sharing Agreements	Broker agreements to share observing platforms and/or sensor outputs.
(B.3.1.5)	Unfulfilled Requirements Management	Manage data/services customer and observing subsystem requirements that could not be satisfied by existing data providers (U.S. IOOS or non-U.S. IOOS), existing model outputs (U.S. IOOS and non-U.S. IOOS), or DMAC services (existing, modified, or planned).
B.1.2	Surveys	Conduct surveys of ocean observing capability and assets across the ocean observing subsystem, including U.S. IOOS partners and non-U.S. IOOS assets.
B.1.3	Optimization Studies	Utilize survey data and conduct optimization studies to identify actions that will improve ocean observations to meet current requirements or future plans.
B.1.4	Asset Management	Manage U.S. IOOS-owned observing system assets. These processes relate to items that are part of the U.S. IOOS property book or for which U.S. IOOS bears life-cycle management responsibilities.
B.1.4.1	Accountability	Add and manage assets in the U.S. IOOS property book.
B.1.4.2	Life Cycle Management	Manage the full life cycle of assets from development and procurement through retirement.
B.2	DMAC Subsystem	Manage data provider and sponsored model participation and to create, manage, and deliver IOOS DMAC-compliant data and utility services. Collective activities form the framework for the integration of both heterogeneous and independent DMAC systems (adapted from the *DMAC Plan for Research and Operational Integrated Ocean Observing Systems*, Ocean.US Publication 6, March 2005).
B.2.1	Register Data Providers	Bring data providers, archives, or sponsored models into U.S. IOOS and facilitate proper categorization of their holdings to inform potential data/services customers of data availability, data quality, and metadata available. This activity includes certifying and adding data providers, archives, and sponsored models to the U.S. IOOS registry.
B.2.1.1	Certification	Certify a data provider's DAC, archive, or sponsored model as DMAC compliant and gather the information needed to properly categorize their holdings for publication in the U.S. IOOS registry.
B.2.1.1.1	Assessments	Collect assessment information required to certify a new U.S. IOOS data provider, archive, or sponsored model.
B.2.1.1.1.1	Observations Available	Assess which core variables are available and in which data structures and formats they are offered.
B.2.1.1.1.2	Data Quality	Assess and categorize the data quality procedures used by the data provider, archive, or sponsored model.
B.2.1.1.1.3	Metadata	Assess metadata available and the degree to which it conforms to U.S. IOOS minimum standards.
B.2.1.1.1.4	Update Latency	Assess the latency between observations and the time they are available for transmission in U.S. IOOS.
B.2.1.1.1.5	Refresh Frequency	Assess how frequently data are refreshed.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
B.2.1.1.1.6	Security	Assess current security measures and identify additional security measures required.
B.2.1.1.1.7	Access Rights	Assess if there any limitations on who should be allowed to access any data.
B.2.1.1.1.8	Archive Requirements	Assess which data are archived, where they are archived, and for how long they will be accessible.
B.2.1.1.1.9	Standards to Be Employed	Identify which IOOS DMAC-compliant data standards will be employed.
B.2.1.1.1.10	Interface Requirements	Assess how data users will access the data and whether the data provider needs to make changes to hardware or software.
B.2.1.1.1.11	Maturity Model Assessment	Assess the “maturity” of the data provider, archive, or sponsored model in terms of the U.S. IOOS maturity model.
B.2.1.1.2	Certification Decision	Make determinations to grant or deny certification pending specified actions being completed.
B.2.1.1.3	Complete MOA	Create memoranda of agreement or service level agreements (SLAs) that detail the commitments made by the data provider, archive, sponsored model, and U.S. IOOS.
B.2.1.2	Registration	Add the data provider’s DAC, archive, or sponsored model to the U.S. IOOS registry.
B.2.1.2.1	Institute Usage Reporting	Establish routine reporting of data provider, archive, and sponsored model’s data usage on a predetermined schedule.
B.2.1.2.2	Add to Registry	Update the U.S. IOOS registry to include new data providers, archives, and sponsored models; core variables served; data structures available; data quality; and metadata available.
B.2.1.2.3	Notify Users	Provide broad notification to U.S. IOOS partners, data/services customers, and internal U.S. IOOS offices that new data providers, archives, or sponsored models are available. The notification includes a recap of the registry information.
B.2.1.2.4	Installation Support	Provide technical assistance to the data provider, archive, or sponsored model owner in setting up IOOS DMAC-compliant data services. This could include reference implementations, “how to” guides, and help desk support.
B.2.1.2.5	Reference Implementations	Maintain a library of reference implementations for use by new data providers, archives, or sponsored models.
B.2.2	Manage Data Providers	Manage DACs, archives, and sponsored models that are already U.S. IOOS providers.
B.2.2.1	Change Request	Change registry, interface, or any other aspect of the relationship between the data provider, archive, or sponsored model owner and U.S. IOOS.
B.2.2.1.1	Receive Change Request	Accept, log, and process change requests initiated by a data provider, archive, or sponsored model owner.
B.2.2.1.2	Evaluate Request	Evaluate change requests to see if they are reasonable, supportable, and determine any impacts on the system.
B.2.2.1.3	Approve Request	Approve change requests.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
B.2.2.1.4	Publish Notifications	Publish notification of an impending change and effective date to the requesting data provider, archive, or sponsored model owner and to U.S. IOOS internal and data/services customers.
B.2.2.1.5	Make Changes	Implement change requests as scheduled.
B.2.2.2	Cyclic Review	Review participating DACs, archives, and sponsored models on a recurring basis. The time between reviews may be different depending on the unique aspects of each data provider's participation.
B.2.2.2.1	Identify Required Changes	Change the registry or make other changes identified in the cyclic review and negotiated with a data provider, archive, or sponsored model owner.
B.2.2.2.2	Approve Changes	Evaluate changes to determine if they are reasonable and supportable as well as to determine their impacts.
B.2.2.2.3	Make Changes	Implement changes that result from cyclic reviews.
B.2.2.2.4	Publish Notifications	Publish notification of an impending change and effective date to the requesting data provider, archive, sponsored model owner and to U.S. IOOS internal and data/services customers.
B.2.2.3	Monitor	Monitor the U.S. IOOS network to ensure functionality and identify problems.
B.2.2.3.1	Monitor Usage	Monitor customer interest in data by monitoring registry and catalog requests.
B.2.2.3.2	Monitor Availability	Check on the availability of data provider (DACs, archives, and sponsored models) offerings in U.S. IOOS.
B.2.2.3.3	Review Reports	Review data provider (DACs, archives, and sponsored models) utilization reports.
B.2.2.3.4	Data Provider Help Desk	Provide technical assistance to data providers (DACs, archives, and sponsored models) in isolating and resolving issues.
B.2.2.4	Update	Periodically update data provider (DACs, archives, sponsored models) certification and registration information.
B.2.2.4.1	Update Certification	Update existing certifications and assessments.
B.2.2.4.2	Update Registry	Update registry information.
B.2.2.4.3	Update MOA	Update existing MOAs/SLAs for reissue.
B.2.2.4.4	Update Services	Create change requests for existing IOOS DMAC-compliant data and utility services.
B.2.2.5	Capability Assessments	Assess the composite capability of the U.S. IOOS participating data providers' DACs, archives, and sponsored models in light of existing requirements and future plans.
B.2.3	Deregister Data Providers	Remove a data provider (DAC, archive, sponsored model) from U.S. IOOS if/when circumstances dictate.
B.2.3.1	Request to Deregister	Allow data providers (DAC, archive, sponsored model owners) to request removal from U.S. IOOS. The request may also be generated as a result of U.S. IOOS monitoring and quality control efforts.
B.2.3.1.1	Receive Request	Receive, log, and process requests to deregister a data provider.
B.2.3.1.2	Approval	Approve deregistration requests.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
B.2.3.2	Notice to Data Provider	Notify the affected data provider (DAC, archive, or sponsored model owner) of the intent to remove their data from U.S. IOOS.
B.2.3.2.1	Create Notice	Create the notice to the data provider (DAC, archive, or sponsored model owner) citing the reasons for removal and the effective date.
B.2.3.2.2	Transmission	Transmit removal notice to the data provider.
B.2.3.2.3	Approval	Adjudicate and approve the decision to remove a data provider (DAC, archive, or sponsored model owner) from U.S. IOOS.
B.2.3.2.4	Reconsideration	Allow a data provider (DAC, archive, or sponsored model owner) to request reconsideration of a deregistration action.
B.2.3.2.5	Final Approval	Provide final approval or disapproval of removal decisions after review of requests for reconsideration.
B.2.3.3	Notice to Users	Provide notice to data/services customers and internal U.S. IOOS offices of the impending deregistration action.
B.2.3.3.1	Create Notice	Create notification materials.
B.2.3.3.2	Approval	Approve notices for publication.
B.2.3.3.3	Publish	Publish notice of deregistration of a data provider (DAC, archive, or sponsored model) to data/services customers and internal U.S. IOOS offices.
B.2.3.3.4	Respond to Inquiries	Respond to inquiries from affected data/services customers based on deregistration of a data provider.
B.2.3.4	Adjustment to Products and Services	Make changes to DMAC utility services and sponsored models that are affected by the decision to deregister a data provider DAC, archive, or sponsored model.
B.2.3.4.1	Identify Changes	Identify all changes to DMAC utility services and sponsored models that are required by a deregistration action.
B.2.3.4.2	Approve Changes	Approve the changes to DMAC utility services and sponsored models that are required by a deregistration action.
B.2.3.4.3	Make Changes	Implement the changes to DMAC utility services and sponsored models that are required by a deregistration action.
B.2.3.4.4	Testing	Test DMAC utility services and sponsored models to ensure changes required by a deregistration action were properly applied and the services and models are functioning correctly.
B.2.3.4.5	Update Configuration Control Documents	Ensure configuration control documentation is updated after a deregistration action.
B.2.3.5	Deregister	Remove a data provider (DAC, archive, or sponsored model owner) information/data from the U.S. IOOS registry.
B.2.3.5.1	Update Registry	Ensure that the U.S. IOOS registry reflects the registration and all other changes made as a result of a deregistration.
B.2.3.5.2	Archive Documents	Archive all documentation associated with a deregistration action.
B.2.4	Standards Management	Manage U.S. IOOS standards, including IOOS DMAC-compliant data services.
B.2.4.1	Standards Assessment	Evaluate U.S. IOOS standards and to develop standards requirements.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
B.2.4.1.1	Assess Efficiency and Effectiveness of Current Standards	Assess efficiency and effectiveness of U.S. IOOS standards.
B.2.4.1.2	Monitor Evolution of Standards	Keep track of proposed changes in open standards proposed by standards bodies.
B.2.4.1.3	Create Requirements for New or Modified Standards	Define requirements for U.S. IOOS standards.
B.2.4.1.4	Standards Release Planning	Determine the optimum time for the release of new or improved U.S. IOOS standards to ensure synchronized application.
B.2.4.2	Standards Development	Adopt, adapt, or develop new U.S. IOOS standards.
B.2.4.2.1	Requirements Analysis	Analyze requirements for new U.S. IOOS standards.
B.2.4.2.2	Solution Development	Adopt, adapt, or create new U.S. IOOS standards as required.
B.2.4.2.3	Testing	Test the proposed new U.S. IOOS standards to ensure that they work as intended and meet U.S. IOOS requirements.
B.2.4.2.4	Approval	Approve implementation of new U.S. IOOS standards as part of U.S. IOOS DMAC.
B.2.4.3	Existing Standards Maintenance	Maintain DMAC standards in use.
B.2.4.3.1	Assess Change Requests	Receive, record, and evaluate requests for changes to published DMAC standards.
B.2.4.3.2	Approve Changes	Approve requests to change existing DMAC standards, including timing of releases, to help manage impacts of the changes.
B.2.4.3.3	Make Changes	Implement the approved changes to DMAC standards.
B.2.4.3.4	Testing	Test changes to ensure that they were properly applied and the results meet expectations.
B.2.4.3.5	Publish Changes	Publish changes to data providers, archives, and sponsored model owners (IOOS DMAC-compliant data services) and to other interested parties.
B.2.4.4	Interface Management	Manage creation and publishing of solutions to meet specific or unique data/services customers' data interface requirements to allow their interfaces to communicate with IOOS DMAC-compliant data and utility services.
B.2.4.4.1	Identify Interface Requirements	Collect interface requirements from data/services customers.
B.2.4.4.2	Identify Solutions	Identify and publish solution software, documentation, and procedures to meet data/services customer interface requirements.
B.2.4.4.3	Document Solutions	Catalog and retain solution documentation for reference and reuse by other data/services customers.
B.2.4.5	Dictionaries and Catalogs	Control development and maintenance of U.S. IOOS dictionaries and catalogs to facilitate easy discovery of U.S. IOOS data and model outputs and to provide a standards set of references to ensure uniform application of terminology and metrics across U.S. IOOS.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
B.2.4.5.1	Controlled Vocabularies	Create and maintain controlled vocabularies that provide a uniform meaning for terminology across U.S. IOOS, both in terms of ocean science and in terms of IT supporting documentation that underlies DMAC subsystem functionality.
B.2.4.5.2	Data Dictionaries	Create and maintain data dictionaries (technical documentation of data elements) used by U.S. IOOS.
B.2.4.5.3	QA/QC Procedures	Create, maintain, and modify quality assurance and quality control procedures that will be employed by U.S. IOOS participants.
B.2.4.5.4	Metadata Profiles	Create and maintain metadata profiles that will be used by U.S. IOOS participants.
B.2.4.5.5	Catalogs	Create standards for development and maintenance of catalogs.
B.2.5	Utility Services Management	Manage and maintain the development and delivery of U.S. IOOS DMAC utility services (services that manipulate data to provide a value-added service as distinct from “data services,” which function to enable delivery of DMAC-compliant ocean observing data and model outputs).
B.2.5.1	Service Registry	Create and maintain the central records that allow data discovery and inform users of the core variables, data structures, metadata, and quality of U.S. IOOS data providers as well as how to access and use them.
B.2.5.1.1	Add New	Add new records to the registry.
B.2.5.1.2	Delete Old	Delete antiquated records from the registry.
B.2.5.1.3	Modify Entries	Modify existing registry entries.
B.2.5.2	Data Catalog Service	Create catalogs that are derivative of the registry and other documentation. Catalogs provide simplified and enhanced means for U.S. IOOS data/services customers to find the kinds of data or services that they need.
B.2.5.2.1	Establish Service	Create and publish new catalogs.
B.2.5.2.2	Maintain Service	Maintain accuracy and availability of catalogs.
B.2.5.2.3	Evaluate Service	Evaluate the usefulness of existing catalogs and to determine the need for new catalogs.
B.2.5.2.4	Disestablish Service	Remove unneeded catalogs from use.
B.2.5.3	Data Integration Service	Develop and maintain data integration services. (Some data will require aggregation from multiple data sources in support of customer needs, or as an intermediate product in support of other U.S. IOOS services.) If required, data translation may be part of this service.
B.2.5.3.1	Receive Requests	Receive and record requests from data/utility services customers for data integration service.
B.2.5.3.2	Evaluate Requests	Evaluate data integration related requests for current sources or to determine if development is needed.
B.2.5.3.3	Approval	Approve or disapprove access to existing data integration services or to approve request to develop new data integration services.
B.2.5.3.4	Establish Services	Implement access to existing data integration services.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
B.2.5.3.5	Maintain Service	Perform routine maintenance of data integration service software and hardware.
B.2.5.3.6	Evaluate Service	Evaluate data integration service usage, reliability, cost and performance.
B.2.5.3.7	Disestablish Service	Shut down unneeded data integration services.
B.2.5.4	Mapping and Visualization Service	Provide data as a visual and/or mapping display that supports data/utility services customer needs. For example, data from multiple data providers may be combined and displayed in the form of a color-coded map to support customer needs.
B.2.5.4.1	Receive Requests	Receive and record requests from data/utility services customers to access Mapping and Visualization services.
B.2.5.4.2	Evaluate Requests	Evaluate requests for Mapping and Visualization services to determine existing sources or the need to develop new Mapping and Visualization services.
B.2.5.4.3	Approval	Approve or disapprove access to existing Mapping and Visualization services or to approve request to develop new Mapping and Visualization services.
B.2.5.4.4	Establish Services	Implement the Mapping and Visualization displays and make appropriate changes to the registry and catalogs, and inform the requesting data/utility services customer.
B.2.5.4.5	Maintain Service	Maintain existing mapping and visualization services.
B.2.5.4.6	Evaluate Service	Evaluate usage and quality of Mapping and Visualization services.
B.2.5.4.7	Disestablish Service	Delete mapping and visualization display products, including notification to users and changes to the registry and catalogs.
B.2.5.5	Product Generation Services	Support provision of services that provide derived products such as statistical analyses and feature extractions from data.
B.2.5.5.1	Receive Requests	Receive Product Generation requests from data/utility services customers.
B.2.5.5.2	Evaluate Requests	Ensure that Product Generation requests can be accommodated in terms of data availability and that the requested information will properly support the intent of the requestor.
B.2.5.5.3	Approval	Approve Product Generation requests from data/utility services customers.
B.2.5.5.4	Establish Services	Deliver Product Generation services for data/utility services customers.
B.2.5.5.5	Maintain Service	Maintain Product Generation services.
B.2.5.5.6	Evaluate Service	Ensure quality control and evaluate usage of Product Generation services.
B.2.5.5.7	Disestablish Service	Remove data/utility services customers from Product Generation services or to shut down a particular service.
B.2.5.6	Format Conversion Service	Support provision of a utility service that allows translation of data from one format to another. Unlike data access services that allow users to access data regardless of the source, this service fundamentally changes the data format into a format more convenient for the data/utility services customer. Examples of Format Conversions include XML to NetCDF or GML to KML.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
B.2.5.6.1	Receive Requests	Receive requests for Format Conversion utility services.
B.2.5.6.2	Evaluate Requests	Determine if existing Format Conversion services are adequate or if modified or new services are required.
B.2.5.6.3	Approval	Approve requests to access existing Format Conversion services, or to modify or develop new services.
B.2.5.6.4	Establish Services	Set up data/utility services customer access to a Format Conversion service.
B.2.5.6.5	Maintain Service	Maintain Format Conversion services.
B.2.5.6.6	Evaluate Service	Evaluate the quality of Format Conversion services and evaluate usage.
B.2.5.6.7	Disestablish Service	Remove data/utility services customers from access to a Format Conversion service or to shut down a service.
B.2.5.7	Coordinate Transformation Services	Support provision of services that convert between different geographic coordinate systems (e.g., from latitude/longitude to Mercator), between different measurement axes (e.g., from northward and eastward components of wind to wind speed and direction), or between different units of measure (e.g., from Celsius to Fahrenheit).
B.2.5.7.1	Establish Services	Set up Coordinate transformation services.
B.2.5.7.2	Maintain Service	Maintain and modify Coordinate transformation services.
B.2.5.7.3	Evaluate Service	Monitor quality and usage of Coordinate transformation services.
B.2.5.7.4	Disestablish Service	Shut down unneeded Coordinate transformation services.
B.2.5.8	Workflow Services	Support provision of services that enable customers to chain together multiple processing steps to produce the desired output. For example, get data from the source, convert to another format, compute polygonal boundary of observed phenomenon, then produce an image of the result.
B.2.5.8.1	Receive Requests	Receive requests for workflow services.
B.2.5.8.2	Evaluate Requests	Determine if existing workflow services are adequate, or if modified or new workflow services are required.
B.2.5.8.3	Approval	Approve requests to access existing workflow services, or modify or develop workflow services.
B.2.5.8.4	Establish Services	Set up customer access to workflow services.
B.2.5.8.5	Maintain Service	Maintain workflow services.
B.2.5.8.6	Evaluate Service	Evaluate the quality of workflow services and evaluate usage.
B.2.5.8.7	Disestablish Service	Remove customers from access to workflow services or to shut down a workflow service.
B.2.6	Utility Services Development	Develop new utility service offerings, or improve existing DMAC utility services.
B.2.6.1	Quality Monitor Existing	Monitor the quality of the existing set of DMAC utility services to inform improvement decisions.
B.2.6.1.1	Sampling	Provide human sampling of existing utility services.
B.2.6.1.2	Automated Monitoring	Automatedly monitor existing services.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
B.2.6.1.3	User Surveys	Conduct surveys of utility service customers to identify needed improvements.
B.2.6.2	Assess Service Requirements	Assess requirements for new utility services derived from the monitoring efforts.
B.2.6.2.1	Priority	Prioritize utility service requirements in terms of importance.
B.2.6.2.2	Cost	Determine cost of proposed utility service changes.
B.2.6.2.3	Technical Solution	Develop a technical solution to satisfy utility service requirements.
B.2.6.2.4	Time	Determine time required to implement utility service changes.
B.2.6.2.5	Cost Benefit	Determine cost-benefit of proposed utility service changes.
B.2.6.3	Approve Changes	Approve utility service development efforts and integrate work into existing schedules.
B.2.6.3.1	Approve	Approve utility service changes.
B.2.6.3.2	Schedule	Integrate work into existing utility service plans.
B.2.6.4	Execute Changes	Make utility service changes to test servers.
B.2.6.5	Testing	Test new utility services.
B.2.6.6	Notification	Notify data/utility services customers and internal U.S. IOOS offices of pending release of new utility services.
B.2.6.7	Deployment	Roll out new utility services for U.S. IOOS DMAC.
B.2.7	Data Services and Component Development	Adopt, modify, or develop IOOS DMAC-compliant data services and components.
B.2.7.1	Quality Monitor Existing	Monitor the quality of the existing IOOS DMAC-compliant data services and components to inform improvement decisions.
B.2.7.1.1	Sampling	Provide human sampling of existing IOOS DMAC-compliant data services and components.
B.2.7.1.2	Automated Monitoring	Automatedly monitor existing IOOS DMAC-compliant data services and components.
B.2.7.1.3	User Surveys	Conduct surveys of IOOS DMAC-compliant data service and component customers to identify needed improvements.
B.2.7.2	Assess Service Requirements	Assess requirements for new IOOS DMAC-compliant data services and components derived from the monitoring efforts.
B.2.7.2.1	Priority	Prioritize IOOS DMAC-compliant data service and component requirements in terms of importance.
B.2.7.2.2	Cost	Determine cost of proposed IOOS DMAC-compliant data service and component changes.
B.2.7.2.3	Technical Solution	Develop a technical solution to satisfy IOOS DMAC-compliant data service and component requirements.
B.2.7.2.4	Time	Determine time required to implement IOOS DMAC-compliant data service and component changes.
B.2.7.2.5	Cost Benefit	Determine cost-benefit of proposed IOOS DMAC-compliant data service and component changes.
B.2.7.3	Approve Changes	Approve IOOS DMAC-compliant data service and component development efforts and integrate work into existing schedules.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
B.2.7.3.1	Approve	Approve IOOS DMAC-compliant data service and component changes.
B.2.7.3.2	Schedule	Integrate work into existing IOOS DMAC-compliant data service and component plans.
B.2.7.4	Execute Changes	Make IOOS DMAC-compliant data service and component changes to test servers.
B.2.7.5	Testing	Test new IOOS DMAC-compliant data services and components.
B.2.7.6	Notification	Notify customers and internal U.S. IOOS offices of pending release of new IOOS DMAC-compliant data services and components.
B.2.7.7	Deployment	Roll out new IOOS DMAC-compliant data services and components for U.S. IOOS DMAC.
B.2.8	Data Services and Component Management	Manage and maintain existing IOOS DMAC-compliant data services and perform component management.
B.2.8.1	Data Access Services	Manage services that allow customers to “pull” data on request from data assembly centers. Different data types may require different services, and a variety of services may be offered to satisfy different customers, but all Data Access Services are expected to enable the customer to (a) make an explicit request at the moment of need and (b) specify the desired subset of the data based on the location of interest, the time of interest, and possibly other subset criteria.
B.2.8.2	Data Subscriptions and Alerts Services	Manage services that inform customers of various types about changes in U.S. IOOS, model outputs, data provider offerings, quality or metadata, etc. The customers are grouped into lists that receive notifications when news of interest to that category of customer occurs. The notifications may be administrative, such as changes in a data provider’s data offerings, or data-related, such as the temperature in a specific location has peaked above a specified level. This utility service will have two functions: 1) a subscription service which allows a user to access information on a particular topic area, and 2) an alert service that allows users to define data of interest and thresholds. When the data, or combined data exceeds these threshold, the users will receive notification automatically.
B.2.8.3	System Viewer Component	Support provision of the component that provides a web-based user interface to the Data Catalog and the Service Registry. It allows humans to issue searches for data using map-based or form-based query interface, it displays results of searches in either map or tabular form, and it provides links to the actual data and metadata corresponding to the search results.
B.2.8.4	System Monitor Component	Support management of the component that enables monitoring of the status of DMAC services. Monitoring allows U.S. IOOS to identify problems and take action to resolve issues. Monitoring *may* also include gathering of usage statistics if data searches and request are made via an U.S. IOOS Catalog or Viewer. However, because data requests may go directly to the data providers, this monitoring service will not provide a complete view of system usage.
B.2.9	Configuration Control	Ensure that all aspects of U.S. IOOS software development and IT life-cycle management have proper configuration control and documentation.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
B.2.9.1	Review Documentation	Review U.S. IOOS IT configuration control documentation to ensure that it is current.
B.2.9.2	Update Documentation	Update IT configuration control documentation when changes are required.
B.3	Modeling and Analysis Subsystem	Include all data/services customers of U.S. IOOS to include Federal, regional, national, international, NGO, corporate, institutional, and private citizen users. All users of U.S. IOOS receive their data/utility services through the processes defined in the Modeling and Analysis subsystem and use these processes to make their requirements known. The Customer Needs process defined in this subsystem combined with the User Councils (Governance and Management) and U.S. IOOS monitoring and assessments processes (all subsystems) are the three methods by which U.S. IOOS defines its requirements and establishes its goals.
B.3.1	Customer Needs	Capture customer needs, translate those needs into requirements, and assess the requirements to determine possible sources to resolve customer data needs. Includes processes to record and manage unmet requirements, seek possible solutions, and advocate with user council members to implement solutions.
B.3.1.1	Customer Input	Receive customer input and determine requirements for DMAC services or feedback on U.S. IOOS procedures and policies.
B.3.1.1.1	Survey	Obtain customer input through periodic surveys of data/services customers.
B.3.1.1.2	Comments	Receive and adjudicate data/services customer comments received through an IOOS DMAC-compliant data/utility service or help desk calls.
B.3.1.1.3	Requests	Receive and adjudicate specific data/services customer requests.
B.3.1.2	Data Needs Assessment	Assess whether data/services customer needs can be met with existing data sources.
B.3.1.2.1	Determine Needs	Interpret data/services customer requirements in terms of data/services required.
B.3.1.2.2	Determine Sources	Align data requirements with existing U.S. IOOS and non-U.S. IOOS data/services sources.
B.3.1.2.3	Negotiate Participation	Negotiate with non-U.S. IOOS data/services providers to participate in U.S. IOOS and make available the required data/service.
B.3.1.3	Model Output Needs Assessment	Assess whether data/services customer needs can be met with existing model outputs.
B.3.1.3.1	Determine Needs	Interpret data/services customer requirements in terms of model output products.
B.3.1.3.2	Determine Sources	Align requirements with existing U.S. IOOS and non-U.S. IOOS model output sources.
B.3.1.3.3	Negotiate Participation	Negotiate with non-U.S. IOOS model output sources to participate in U.S. IOOS and make available the required data.
B.3.1.4	Service Needs Assessment	Assess whether data/services customer needs can be met with existing, new, or modified DMAC services.
B.3.1.4.1	Determine Needs	Interpret data/services customer requirements in terms of DMAC services.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
B.3.1.4.2	Determine Service	Align data/services customer requirements with existing DMAC services or to recommend new or modified services for development.
B.3.1.5	Unfulfilled Requirements Management	Manage data/services customer requirements that could not be satisfied by existing data providers (U.S. IOOS or non-U.S. IOOS), existing model outputs (U.S. IOOS and non-U.S. IOOS) or DMAC services (existing, modified, or planned).
B.3.1.5.1	Master List Maintenance	Maintain a prioritized record of all unsatisfied data/services customer requirements.
B.3.1.5.2	Solution Scenario Generation	Craft solution sets that meet multiple unfulfilled requirements with an emphasis on cost effectiveness, asset optimization, and efficiency.
B.3.1.5.3	Advocacy	Shop solution scenarios to potential providers in and out of the User Groups to garner consensus to make the investments necessary to implement solutions.
B.3.1.6	Customer Help Desk	Provide customers with help resolving questions and issues.
B.3.1.6.1	Help Desk	Provide electronic and phone-based help to assist data/services customers in meeting their U.S. IOOS needs.
B.3.1.6.2	Frequency Analysis	Track help requests to inform future U.S. IOOS design and funding decisions.
B.3.2	Sponsored Models	Assess models and make their outputs available through U.S. IOOS. Once the decision is made to provide a models output through U.S. IOOS, the processes used are identical to those used to bring a new data providers into U.S. IOOS.
(B.2.1)	Register a Data Provider	Bring data providers, archives, or sponsored models into U.S. IOOS and facilitate proper categorization of their holdings to inform potential data/services customers of data availability, data quality, and metadata available. This activity includes certification and adding data providers, archives, and sponsored models to the U.S. IOOS registry.
(B.2.2)	Manage Data Providers	Manage DACs, archives, and sponsored models that are already U.S. IOOS providers.
(B.2.3)	Deregister a Data Provider	Remove a data provider (DAC/archive/sponsored model) from U.S. IOOS if/when circumstances dictate.
B.3.3	MOU Management	Govern the management of memorandums of understanding between U.S. IOOS and potential data providers/sponsored models owners. These MOUs articulate the required steps to become certified and registered as a U.S. IOOS provider, expected functionality consistent with U.S. IOOS participatory role, and define the expected schedule for those actions.
B.3.3.1	Create MOU	Create MOUs.
B.3.3.2	Gain Concurrence	Approve MOUs.
B.3.3.3	Coordinate for Certification	Transition a potential data/service provider DAC/sponsored model output from MOU status to certification as a U.S. IOOS data provider.
B.3.4	Publish Standards	Make U.S. IOOS standards accessible to data/services customers.
B.3.4.1	Standards in Use	Disseminate existing standards information.
B.3.4.2	“How To”	Make available simple “how to” instructions for using U.S. IOOS data and services.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
B.3.4.3	Reference Implementations	Develop, maintain, and make available reference implementations for typical customer needs.
C.1	Research and Development	Coordinate R&D efforts across U.S. IOOS participating entities. Also processes to manage R&D pilot projects, conduct technical assessments, field technology enhancements, and transition technology solutions from the laboratory to the field.
C.1.1	Requirements Determination	Gather R&D requirements, analyze and prioritize those requirements, and publish the requirements to inform R&D efforts.
C.1.1.1	Requirements Gathering	Gather and record R&D requirements from all U.S. IOOS participating entities.
C.1.1.2	Requirements Analysis	Analyze raw requirements and restate them in terms meaningful to the R&D community.
C.1.1.3	Requirements Prioritization	Prioritize refined R&D requirements based on criticality and size of population that is experiencing the need.
C.1.1.4	Requirements Publication	Publish the prioritized R&D requirements to all R&D performing entities in order to spark interest and coordinate efforts.
C.1.2	Coordinate R&D Programs	Coordinate research and development activities among participating U.S. IOOS R&D organizations.
C.1.2.1	Sponsor Forums	Sponsor forums where R&D capable organizations can meet to discuss approaches to solving R&D requirements.
C.1.2.2	R&D Progress Monitoring	Monitor and report progress in addressing R&D requirements based on R&D activities in participating organizations.
C.1.2.3	R&D Grants Technical Management	Assess and manage R&D efforts that accrue from R&D grants made by or through U.S. IOOS.
C.1.2.4	R&D Agreements Management	Create and manage cross-organizational R&D agreements to pursue solutions to prioritized R&D requirements.
C.1.3	R&D Pilot Projects	Create and manage R&D pilot projects that demonstrate R&D solutions to assess effectiveness and limit risk.
C.1.3.1	Concept Development	Control development of R&D pilot project concepts to include concept approval.
C.1.3.2	Project Team Agreements	Create multi-organizational R&D project teams to implement R&D pilot projects.
C.1.3.3	Project Management	Manage the R&D pilot project execution.
C.1.3.4	Budgeting	Plan, budget, and execute financial aspects of the R&D pilot projects.
C.1.3.5	Reporting	Assess technical merits of the R&D pilot project and report results.
C.1.4	Technical Assessments	Conduct assessments of existing technology that is either in use or available for implementations from a government or commercial source. These assessments will generally be to assess the fidelity of observations and or durability and reliability of the sensor or platform.
C.1.4.1	Candidate Technology Management	Keep visibility of technology that is available and aspects of that technology that require assessment.
C.1.4.2	Technology Assessment Design	Design technology assessments that are scientifically sound and that can be practically conducted within budget.
C.1.4.3	Budget	Manage the financial planning and execution of technology assessments.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
C.1.4.4	Plans	Plan and coordinate the technology assessments.
C.1.4.5	Operations	Conduct technology assessments.
C.1.4.6	Report Generation	Assess the findings of the technology assessment and create comprehensive reports on findings.
C.1.4.7	Findings Publication	Publish the findings of technology assessments to concerned parties and to make the findings generally available to all concerned U.S. IOOS participants.
C.1.4.8	Archives	Keep permanent archives of assessment to ensure their availability for future use.
C.1.5	Technology Enhancements	Manage implementation of technology enhancements or upgrades to existing technology to include sensors and platforms.
C.1.5.1	Project Definition	Define succinct projects that field specific upgrade packages to specific sets of hardware or software on a specific timeline.
C.1.5.2	Project Management	Manage the execution of planned technology enhancements.
C.1.5.3	Agreements Management	Create and manage cross-agency/organization agreements to allow execution of the planned technology enhancements.
C.1.5.4	Budgeting	Manage the planning and execution of funds associated with fielding technology enhancements.
C.1.5.5	COTR	Manage contractors, if needed, that execute fielding of technology enhancements.
C.1.5.6	Test and Evaluation	Test and evaluate that the enhancements are properly applied and the resulting improved technology performs to expected standards.
C.1.6	Technology Transition	Assist with transitioning new R&D products from the labs to use in the field. In some cases, the R&D product will be an enhancement to an existing technology that will be executed using the processes defined for “technology enhancements.” The processes described here in “Technology Transition” will normally apply to fielding new technology solutions that may include new hardware, software, procedures, maintenance procedures, etc.
C.1.6.1	Project Definition	Establish comprehensive projects to field new technology to specific customers on a specific timeline to include training.
C.1.6.2	Project Management	Manage the execution of planned technology transitions.
C.1.6.3	Agreements Management	Create and manage cross agency/organization agreements to allow execution of the planned technology transition.
C.1.6.4	Budgeting	Manage the planning and execution of funds associated with technology transition.
C.1.6.5	Test and Evaluation	Test and evaluate that the technology transition are properly implemented and the resulting technology performs to expected standards.
D.1	Training and Education	Manage development of U.S. IOOS specific training and educational materials to support the needs of training and education providers. These processes include development of training and education strategy, plans, and curriculum. Other processes include development and execution of training and education pilot projects, assessments and professional certifications.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
D.1.1	Training and Education Strategy and Plans Development	Develop U.S. IOOS training and education strategies and plans to achieve training and education strategic goals.
D.1.1.1	Strategy Development	Manage development of U.S. IOOS training and education strategy.
D.1.1.2	Plans Development	Manage development of U.S. IOOS training and education plans.
D.1.2	Training and Curriculum Development	Manage development of U.S. IOOS training programs and curriculum.
D.1.2.1	Training Development	Develop training programs to meet the needs of U.S. IOOS members (organizations and individuals).
D.1.2.2	Curriculum Development	Develop curriculum to meet the educational needs of U.S. IOOS members (organizations and individuals).
D.1.3	Training and Education Pilot Projects	Develop and execute U.S. IOOS specific training and education pilot projects.
D.1.3.1	Concept Development	Manage the development of training and education pilot project concepts.
D.1.3.2	Project Team Agreements	Secure agreements with participating organizations to conduct the training and education pilot project.
D.1.3.3	Project Management	Manage the conduct of training and education pilot projects.
D.1.3.4	Budgeting	Manage the financial planning and execution of training and education pilot projects.
D.1.3.5	Reporting	Manage reporting results from training and education pilot projects.
D.1.4	Assessments	Create, execute, and assess the results of U.S. IOOS training and education programs. These assessments may take the form of standard tests that accompany training packages and curriculum, or they may be assessments of effectiveness of training programs and curriculum. Assessments include the creation, executing, and evaluation of certification testing for U.S. IOOS professional certifications.
D.1.4.1	Work Force Needs Assessments	Create, execute and assess the training and education needs of U.S. IOOS workforce. This includes U.S. IOOS Program Office personnel as well as data providers, archives, sponsored model owners, and data/services customers.
D.1.4.2	Assessment Development	Develop assessments tools to support training programs and curriculum products to include professional certifications.
D.1.4.3	Assessment Results and Evaluation	Evaluate the results of administered assessments and determine effectiveness of training and education efforts and to provide feedback to improve future training and education products.
D.1.5	Collaboration with Education Delivery Managers	Manage relationships with entities that deliver educational services and deliver U.S. IOOS-related training or education. U.S. IOOS will not own classrooms or instructors, but will provide training programs and curriculum for others to use. This requires robust collaboration to ensure that training and education requirements are well understood and to ensure that training and education products are properly used.

Table F-1. U.S. IOOS Activity Definitions

Number	Name	Definition
D.1.6	Professional Certifications	Create and manage U.S. IOOS professional certifications, as required. These certifications may be related to any of the U.S. IOOS subsystems. Examples may include IT certifications at the data provider/archive level related to proper integration of U.S. IOOS data services or certifications to manage U.S. IOOS test and evaluation projects.
D.1.6.1	Standards Development	Develop the standards for certifications.
D.1.6.2	Publications	Publish and maintain the certification standards.
D.1.6.3	Assessment Administration	Perform assessments of an individual's ability to meet certification standards.
D.1.6.4	Application Processing	Receive and adjudicate request for certification packets.
D.1.6.5	Certification and Notifications	Award certification and make notifications.
D.1.6.6	Records Maintenance	Maintain records of certifications so that concerned parties can easily access them.

Appendix G
Alignment with Recent Guidance

The Integrated Coastal and Ocean Observation System Act of 2009 stipulates 35 actions to be performed by the National Ocean Research Leadership Council, the Interagency Committee, or NOAA. Table G-1 lists those actions, along with the point of contact (POC) for each. It also shows the alignment of those actions with the objectives from the IWGOO strategic plan and with the related U.S. IOOS® activities. (The IWGOO is the predecessor interagency body to the current Interagency Ocean Observation Committee.) As the table shows, every action required by the ICOOS Act and every objective from the IWGOO strategic plan aligns with an identified U.S. IOOS activity from the U.S. IOOS activity hierarchy (see Appendixes E and F). Each of the six subsystems has a linkage to the ICOOS Act. The governance and management subsystem has 41 percent of the links, the DMAC and modeling and analysis subsystems each account for 19 percent of the links, the research and development subsystem has 11 percent of the links, and the observing systems subsystem and the training and education subsystem each have 5 percent of the links.

Table G-1. Alignment of U.S. IOOS Activity with Recent Guidance

ICOOS Act of 2009 action	IWGOO strategic plan objectives	U.S. IOOS activity
The President, acting through the Council, shall establish a National Integrated Coastal and Ocean Observation System to fulfill the purposes set forth in section 12302 of this subtitle and the System Plan and to fulfill the Nation's international obligations to contribute to the Global Earth Observation System of Systems and the Global Ocean Observing System. Section 12304 (a) POC: Council	Objective 1.1: Establish a national partnership of Federal agencies to integrate the coastal and ocean observing assets of agencies by developing improved capacity to unify IOOS.	A.1.1.4 Federal Partners
	Objective 2.1: The IWGOO and JSOST … will coordinate IOOS with current and future terrestrial, aquatic, and atmospheric observing systems to establish and maintain a GEOSS. Objective 2.2: The JSOST will work with international partners to ensure IOOS is compatible with and contributes to the GOOS.	A.1.1.7.1 GEOSS A.1.1.7.2 GOOS

Table G-1. Alignment of U.S. IOOS Activity with Recent Guidance

ICOOS Act of 2009 action	IWGOO strategic plan objectives	U.S. IOOS activity
The head of each Federal agency that has administrative jurisdiction over a Federal asset shall support the purposes of this subtitle and may take appropriate actions to enhance internal agency administration and management to better support, integrate, finance, and utilize observation data, products, and services developed under this section to further its own agency mission and responsibilities. Section 12304 (b) (2) POC: Federal Agencies	Objective 1.1: Establish a national partnership of Federal agencies to integrate the coastal and ocean observing assets of agencies by developing improved capacity to unify IOOS.	A.1.1.4 Federal Partners
The head of each Federal agency that has administrative jurisdiction over a Federal asset shall make available data that are produced by that asset and that are not otherwise restricted for integration, management, and dissemination by the System. Section: 12304 (b) (3) POC: Federal Agencies	Objective 1.1: Establish a national partnership of Federal agencies to integrate the coastal and ocean observing assets of agencies by developing improved capacity to unify IOOS.	A.1.1.4 Federal Partners
The Council shall serve as the policy and coordination oversight for all aspects of the System. Section 12304 (c)(1) POC: Council		A.1.1 User Councils A.1.3 Policy
Approve and adopt comprehensive System budgets developed and maintained by the Interagency Committee. Section 12304 (c)(1)(A) POC: Council	Objective 1.2: Establish effective mechanisms for the budget planning and timely transfer of appropriated resources to IOOS partners. Objective 1.4: Focus IOOS partners and resources to demonstrate effective development of improved delivery of information and services.	A.1.2 Financial Management
Ensure coordination of the System with other domestic and international earth observing activities including GOOS and GEOS, and provide, as appropriate, support for and representation on U.S. delegations to international meetings on coastal and ocean observing programs. Section 12304 (c)(1)(B) POC: Council	Objective 2.1: The IWGOO and JSOST … will coordinate IOOS with current and future terrestrial, aquatic, and atmospheric observing systems to establish and maintain a GEOSS.	A.1.1 User Councils

Table G-1. Alignment of U.S. IOOS Activity with Recent Guidance

ICOOS Act of 2009 action	IWGOO strategic plan objectives	U.S. IOOS activity
	Objective 2.2: The JSOST will work with international partners to ensure IOOS is compatible with and contributes to the GOOS.	A.1.1.7.2 GOOS
	Objective 3.1: Provide an integrated and extensible IOOS system of systems design to facilitate use of the IOOS ocean component within the U.S. Integrated Earth Observation System (IEOS). The design shall be flexible and consistent with GEOSS plans and hence a fully functioning component of GEOSS.	A.1.1.7.1 GEOSS A.1.1.8 IEOS
The Council shall establish or designate an Interagency Ocean Observing Committee. Section 12304 (c)(2)(c) POC: Council	Objective 1.1: Establish a national partnership of Federal agencies to integrate the coastal and ocean observing assets of agencies by developing improved capacity to unify IOOS.	A.1.1 User Councils
Prepare annual and long-term plans for consideration and approval by the Council for the integrated design, operation, maintenance, enhancement, and expansion of the System to meet the objectives of this subtitle and the System Plan. Section 12304 (c)(2)(A) POC: Interagency Committee		A.1.4.1 Plans
		A.1.4.1 Plans
Develop and transmit to Congress at the time of submission of the President's annual budget request an annual coordinated, comprehensive budget to operate all elements of the System identified in subsection (b), and to ensure continuity of data streams from Federal and non-Federal assets. Section 12304 (c)(2)(B) POC: Interagency Committee	Objective 1.2: Establish effective mechanisms for the budget planning and timely transfer of appropriated resources to IOOS partners.	A.1.2 Financial Management
	Objective 7.1: Establish an environment where current and outyear budget information is shared across agencies for coordinated interagency IOOS planning and programming purposes.	A.1.4.1 Plans

Table G-1. Alignment of U.S. IOOS Activity with Recent Guidance

ICOOS Act of 2009 action	IWGOO strategic plan objectives	U.S. IOOS activity
	Objective 7.2: Establish mechanisms, common business best practices, and planning processes for sharing costs and outlining roles and responsibilities among agencies to enhance interagency planning for advancing common IOOS priorities, including joint projects that require shared funding.	A.1.2.5 Interagency Coordination
Establish required observation data variables to be gathered by both Federal and non-Federal assets and identify, in consultation with regional information coordination entities, priorities for System observations. Section 12304 (c)(2)(c) POC: Interagency Committee	Objective 1.4: Focus IOOS partners and resources to demonstrate effective development of improved delivery of information and services.	A.1.4.1 Plans B.3.1.1 Customer Input B.3.1.2 Data Needs Assessment B.3.1.4 Service Needs Assessment B.3.1.3 Model Output Needs Assessment B.3.1.5 Unfulfilled Requirements Management
Establish protocols and standards for System data processing, management, and communication. Section 12304 (c)(2)(D) POC: Interagency Committee		B.2.4 Standards Management B.2.4.3 Existing Standards Maintenance
Develop contract certification standards and compliance procedures for all non-Federal assets, including RICEs, to establish eligibility for integration into the System and to ensure compliance with applicable standards and protocols as established by the Council; and ensure that regional obs are integrated into the System on a sustained basis. Section 12304 (c)(2)(E) POC: Interagency Committee		B.2.1.1 Certification A.1.6.3 Grants and Cooperative Agreements
Identify gaps in observation coverage or needs for capital improvements of both Federal and non-Federal assets. Section 12304 (c)(2)(F) POC: Interagency Committee		B.3.1.5 Unfulfilled Requirements Management

Table G-1. Alignment of U.S. IOOS Activity with Recent Guidance

ICOOS Act of 2009 action	IWGOO strategic plan objectives	U.S. IOOS activity
Subject to the availability of appropriations, establish through one or more participating Federal agencies, in consultation with the System advisory committee established under subsection (d), a competitive matching grant or other programs - (i) to promote intramural and extramural research and development of new, innovative, and emerging observation technologies including testing and field trials; and (ii) to facilitate the migration of new, innovative, and emerging scientific and technological advances from research and development to operational deployment. Section 12304 (c) (2) (G) POC: Interagency Committee	Objective 1.2: Establish effective mechanisms for the budget planning and timely transfer of appropriated resources to IOOS partners.	A.1.6.3 Grants and Cooperative Agreements
	Objective 5.2: Modify and enhance IOOS with new technologies as they are proven.	C.1.2 Coordinate R&D Programs C.1.3 R&D Pilot Projects C.1.4 Technical Assessments
	Objective 5.3: Apply the outcomes of basic research as it benefits the operational system.	C.1.6 Tech Transfer

Table G-1. Alignment of U.S. IOOS Activity with Recent Guidance

ICOOS Act of 2009 action	IWGOO strategic plan objectives	U.S. IOOS activity
Within 1 year after the date of enactment of this Act, the Interagency Ocean Observation Committee, through the Administrator and the Director of the National Science Foundation, shall obtain an independent cost estimate for operations and maintenance of existing Federal assets of the System, and planned or anticipated acquisition, operation, and maintenance of new Federal assets for the System, including operation facilities, observation equipment, modeling and software, data management and communication, and other essential components. The independent cost estimate shall be transmitted unabridged and without revision by the Administrator to Congress. Section 12309 POC: Interagency Committee through NOAA administrator and NSF director		A.1.6.4 Independent Cost Estimates
The National Oceanic and Atmospheric Administration shall function as the lead Federal agency for the implementation and administration of the System, in consultation with the Council, the Interagency Ocean Observation Committee, other Federal agencies that maintain portions of the System, and the regional information coordination entities. Section 12304 (c) (3) POC: NOAA	Objective 1.1: Establish a national partnership of Federal agencies to integrate the coastal and ocean observing assets of agencies by developing improved capacity to unify IOOS.	A.1 Governance and Management
Establish an Integrated Ocean Observing Program Office within the National Oceanic and Atmospheric Administration utilizing to the extent necessary, personnel from member agencies participating on the Interagency Ocean Observation Committee, to oversee daily operations and coordination of the System. Section 12304 (c)(3)(A) POC: NOAA		A.1 Governance and Management B.1 Observing Systems Subsystem B.2 DMAC Subsystem B.3 Modeling and Analysis Subsystem C.1 R&D D.1.Training and Education

Table G-1. Alignment of U.S. IOOS Activity with Recent Guidance

ICOOS Act of 2009 action	IWGOO strategic plan objectives	U.S. IOOS activity
Implement policies, protocols, and standards approved by the Council and delegated by the Interagency Ocean Observing Committee. Section 12304 (c)(3)(B) POC: NOAA		A.1.4 Plans and Operations B.1 Observing Systems Subsystem B.2 DMAC Subsystem B.3 Modeling and Analysis Subsystem C.1 R&D D.1 Training and Education
Promulgate program guidelines to certify and integrate non-Federal assets, including regional information coordination entities, into the System to provide regional coastal and ocean observation data that meet the needs of user groups from the respective regions. Section 12304 (c)(3)(c) POC: NOAA	Objective 5.1: Integrate successful operational and pre-operational programs into IOOS, and continue critical existing operational programs of IOOS.	A.1.3 Policy B.2.4 Standards Management B.1 Observing Systems Subsystem B.2 DMAC Subsystem B.3 Modeling and Analysis Subsystem
Implement a merit-based, competitive funding process to support non-Federal assets, including the development and maintenance of a network of regional information coordination entities, and develop and implement a process for the periodic review and evaluation of all non-Federal assets, including regional information coordination entities. Section 12304 (c)(3)(E) POC: NOAA	Objective 1.3: Ensure the effective implementation of appropriate regional components of IOOS.	A.1.6.3 Grants and Cooperative Agreements B.2.2.2 Cyclic Review B.2.2.3 Monitor
Provide opportunities for competitive contracts and grants for demonstration projects to design, develop, integrate, deploy, and support components of the System. Section 12304 (c)(3)(F) POC: NOAA		A.1.6.3 Grants and Cooperative Agreements

Table G-1. Alignment of U.S. IOOS Activity with Recent Guidance

ICOOS Act of 2009 action	IWGOO strategic plan objectives	U.S. IOOS activity
Establish efficient and effective administrative procedures for allocation of funds among contractors, grantees, and non-Federal assets, including regional information coordination entities in a timely manner, and contingent on appropriations according to the budget adopted by the Council. Section 12304 (c)(3)(G) POC: NOAA	Objective 7.1: Establish an environment where current and out-year budget information is shared across agencies for coordinated interagency IOOS planning and programming purposes.	A.1.4.1 Plans
	Objective 7.2: Establish mechanisms, common business best practices, and planning processes for sharing costs and outlining roles and responsibilities among agencies to enhance interagency planning for advancing common IOOS priorities, including joint projects that require shared funding.	A.1.2 Financial Management
Develop and implement a process for periodic review and evaluation of RICEs. Section 12304 (c)(3)(H) POC: NOAA		B.2.2.2 Cyclic Review B.2.2.3 Monitor
Formulate an annual process by which gaps in observation coverage or needs for capital improvements of Federal assets and non-Federal assets of the System are identified by the regional information coordination entities, the Administrator, or other members of the System and transmitted to the Interagency Ocean Observing Committee. Section 12304 (c)(3)(I) POC: NOAA	Objective 4.2: Develop and distribute applications for meeting targeted regional uses through a distributed, coordinated, interactive process involving both governmental and nongovernmental organizations.	B.3.1.5 Unfulfilled Requirements Management
	Objective 4.3: Provide users with the information and products needed to address key priorities in planning and decision making at national to regional scales.	B.3.1 Customer Needs

Table G-1. Alignment of U.S. IOOS Activity with Recent Guidance

ICOOS Act of 2009 action	IWGOO strategic plan objectives	U.S. IOOS activity
Develop and be responsible for a data management and communication system, in accordance with standards and protocols established by the Council, by which all data collected by the System regarding ocean and coastal waters of the United States including the Great Lakes, are processed, stored, integrated, and made available to all end-user communities. Section 12304 (c)(3)(J) POC: NOAA	Objective 3.2: Provide integrated data for an initial set of core ocean variables that address priority coastal issues within two years and a second set of variables within five years.	B.2 DMAC Subsystem
Implement a public education and outreach program to improve awareness of global climate change and effects on the ocean, coastal, and Great Lakes environment. Section 12304 (c)(3)(K) POC: NOAA	Objective 6.1: Build and maintain a community of formal and informal educators that use IOOS information to achieve education objectives.	A.1.7 Marketing, Outreach and Engagement D.1 Training and Education
Report annually to the Interagency Ocean Observing Committee on the accomplishments, operational needs, and performance of the System to contribute to the annual and long-term plans developed pursuant to subsection. Section 12304 (c)(3)(L) POC: NOAA		A.1 Governance and Management B.1 Observing Systems Subsystem B.2 DMAC Subsystem B.3 Modeling and Analysis Subsystem C.1 R&D D.1 Training and Education
Develop a plan to efficiently integrate into the System new, innovative, or emerging technologies that have been demonstrated useful to the System and which will fulfill the purposes of the Act and the System Plan. Section 12304 (c)(3)(M) POC: NOAA	Objective 5.1: Integrate successful operational and pre-operational programs into IOOS, and continue critical existing operational programs of IOOS.	A.1.4.1 Plans
	Objective 5.2: Modify and enhance IOOS with new technologies as they are proven.	B.2 DMAC Subsystem C.1.6 Tech Transition
	Objective 5.3: Apply the outcomes of basic research as it benefits the operational system.	C.1.2 Coordinate R&D programs C.1.6 Tech Transition

Table G-1. Alignment of U.S. IOOS Activity with Recent Guidance

ICOOS Act of 2009 action	IWGOO strategic plan objectives	U.S. IOOS activity
	Objective 4.1: Develop and improve national and regional models that provide outputs used to develop products that address the critical regional and national needs in one or more of the priority coastal issues (e.g., coastal flooding, navigation, ecosystem assessment).	B.3.2 Sponsored Models
Demonstrate an organizational structure capable of gathering required System observation data, supporting and integrating all aspects of coastal and ocean observing and information programs within a region and that reflects the needs of State and local governments, commercial interests, and other users and beneficiaries of the System and other requirements specified under this subtitle and the System Plan. Section 12304 (c)(4)(a)(i) POC: RICEs	Objective 1.3: Ensure the effective implementation of appropriate regional components of IOOS.	B.1.1 Observing Subsystem Management A.1.1.5 Regional Associations A.1.4.2.4 Regional Assessments A.1.4.2.5 Regional Project Management
Identify gaps in observation coverage needs for capital improvements of Federal assets and non-Federal assets of the System, or other recommendations to assist in the development of the annual and long-term plans created pursuant to subsection (c)(2)(A)(i) and transmit such information to the Interagency Ocean Observing Committee via the Program Office. Section 12304 (c)(4)(a)(ii) POC: RICEs	Objective 5.1: Integrate successful operational and pre-operational programs into IOOS, and continue critical existing operational programs of IOOS.	B.1.1 Observing Subsystem Management B.1.3 Optimization Studies
Develop and operate under a strategic operational plan that will ensure the efficient and effective administration of programs and assets to support daily data observations for integration into the System, pursuant to the standards approved by the Council. Section 12304 (c)(4)(a)(iii) POC: RICEs	Objective 1.1: Establish a national partnership of Federal agencies to integrate the coastal and ocean observing assets of agencies by developing improved capacity to unify IOOS.	A.1.4.1 Plans

Table G-1. Alignment of U.S. IOOS Activity with Recent Guidance

ICOOS Act of 2009 action	IWGOO strategic plan objectives	U.S. IOOS activity
The Administrator shall establish or designate a System advisory committee, which shall provide advice as may be requested by the Administrator or the Interagency Ocean Observing Committee. Section 12304 (d)(1) POC: NOAA Administrator		A.1. Governance and Management
Provide administrative support to the advisory committee. Section 12304 (d)(4)(B) POC: NOAA Administrator		A.1. Governance and Management
Not later than 2 years after the date of the enactment of this Act and every 2 years thereafter, the Administrator shall prepare and the President acting through the Council shall approve and transmit to the Congress a report on progress made in implementing this subtitle. Section 12307 (a) POC: NOAA Administrator (and Council)		A.1 Governance and Management
	Objective 6.2: Train the workforce to have the technical and scientific skills necessary to (a) deploy, maintain, and improve ocean observing systems needed to develop and sustain IOOS; and (b) produce the allied information products, services, and tools.	D.1 Training and Education

Table G-1. Alignment of U.S. IOOS Activity with Recent Guidance

ICOOS Act of 2009 action	IWGOO strategic plan objectives	U.S. IOOS activity
The Council shall develop a policy within 6 months after the date of the enactment of this Act that defines processes for making decisions about the roles of the Federal Government, the States, regional information coordination entities, the academic community, and the private sector in providing to end-user communities environmental information, products, technologies, and services related to the System. The Council shall publish the policy in the Federal Register for public comment for a period not less than 60 days. Nothing in this section shall be construed to require changes in policy in effect on the date of enactment of this Act. Section 12308 POC: Council		A.1.3 Policy

Appendix H
U.S. IOOS® Implementation Plan by Time Frame

Table H-1 is a complete sequencing of U.S. IOOS® activities, identified in Appendixes E and F, for U.S. IOOS implementation. Organized by U.S. IOOS subsystem, the table identifies current activities as well as activities to be completed by initial capability (IC) and full capability (FC). (A blank box in the FC column indicates that FC for that particular function is achieved at IC.)

Table H-1. Time Frame for U.S. IOOS Implementation, by Subsystem

Function	Current activities	IC	FC
Governance and management subsystem			
User councils	Multiple advisory bodies with differing policies, procedures, and feedback mechanisms (NFRA, workgroups, DIF project workgroups/IPTs)	(A.1.1.2–A.1.1.6 and A.1.1.8) Create user councils: ◆ Create user council policy and procedures ◆ Develop resource plan ◆ Create member lists ◆ Develop procedures to address user requirements ◆ Convene user councils (A.1.1.1 and A.1.1.7) Identify target standards bodies and international councils	(A.1.1.1 and A.1.1.7) Convene standards bodies and international councils (A.1.1.9 and A.1.1.10) Convene combined forums (A.1.1.11) Convene R&D asset owners
Financial management	(A.1.2.1–A.1.2.4) Planning, budgeting, execution, analysis (NOAA-centric and regional-centric resourcing)	(A.1.2.5) Interagency coordination	
Policy	(A.1.3.1) Intramural policy (A.1.3.3) Congressional liaison	(A.1.3.2) Extramural: technical and administration	
Plans and operations	(A.1.4.1.2) IOOS internal (plans) (A.1.4.2.6) Program Office internal (operations) (A.1.4.2.4) Regional assessments (A.1.4.2.5) Regional project management	(A.1.4.1.1) National coordination (plans) (A.1.4.2.1) Interagency (operations) (A.1.4.2.2) National (operations)	(A.1.4.1.3) International coordination (plans) (A.1.4.2.3) International (operations)
Human resources		(A.1.5) Human resources	

Table H-1. Time Frame for U.S. IOOS Implementation, by Subsystem

Function	Current activities	IC	FC
Acquisition and grants	(A.1.6.1 - A.1.6.3) Acquisition and grants (purchasing, contracting, and grants and cooperative agreements)	(A.1.6.4) Independent cost estimates	
Marketing, outreach, and engagement		(A.1.7) Marketing, outreach, and engagement	
IT support	(A.1.8.1) Desktop management (A.1.8.4) Website management	(A.1.8.2) Network management (A.1.8.3) Architecture management (A.1.8.4) DMAC IOOS Program (internal)	
Observing subsystem			
Observing subsystem management		(B.1.1.1) Requirements Determination (B.3.1.5) Unfulfilled requirements management	(B.1.1.2) Observing system sharing agreements
Surveys		(B.1.2) Surveys	
Optimization studies			(B.1.3) Optimization studies
Asset management		(B.1.4.1) Accountability	(B.1.4.2) Life-cycle management
DMAC subsystem			
Register data providers		(B.2.1.1) Certification (B.2.1.2) Registration	
Manage data providers		(B.2.2.1) Change request (B.2.2.3) Monitor (B.2.2.4) Update	(B.2.2.2) Cyclic review (B.2.2.5) Capability assessments
Deregistration of data providers			(B.2.3.1) Request to deregister (B.2.3.2) Notice to data provider (B.2.3.3) Notice to users (B.2.3.4) Adjustment to products and services (B.2.3.5) Deregister
Standards management	(B.2.4.2) Standards development (B.2.4.3) Existing standards maintenance	(B.2.4.1) Standards assessment (B.2.4.4) Interface management (B.2.4.5) Dictionaries and catalogs	

Table H-1. Time Frame for U.S. IOOS Implementation, by Subsystem

Function	Current activities	IC	FC
Utility services management		(B.2.5.1) Service registry (B.2.5.2) Data catalog service	(B2.5.3) Data integration service (B.2.5.4) Mapping and visualization service (B.2.5.5) Product generation service (B.2.5.6) Format conversion (B.2.5.7) Coordinate transformation services (B.2.5.8) Workflows
Utility services development		(B.2.6.1) Quality monitor existing (B.2.6.2) Assess service requirements (B.2.6.3) Approve changes (B.2.6.4) Execute changes (B.2.6.5) Testing (B.2.6.6) Notification (B.2.6.7) Deployment	
Data services and component development		(B.2.7.1) Quality monitor existing (B.2.7.2) Assess service requirements (B.2.7.3) Approve changes (B.2.7.4) Execute changes (B.2.7.5) Testing (B.2.7.6) Notification (B.2.7.7) Deployment	
Data services and component management	(B.2.8.1) Data access services	(B.2.8.3) System viewer component (B.2.8.4) System monitor component	(B.2.8.2) Data subscriptions and alerts services
Configuration control		(B.2.9.1) Review documentation (B.2.9.2) Update documentation	
Modeling and analysis subsystem			
Customer needs		(B.3.1.1) Customer input (B.3.1.2) Data needs assessment (B.3.1.3) Model output needs assessment (B.3.1.4) Service needs assessment (B.3.1.5) Unfulfilled requirements management (B.3.1.6) Customer help desk	

Table H-1. Time Frame for U.S. IOOS Implementation, by Subsystem

Function	Current activities	IC	FC
Sponsored models		(B.2.1) Register data providers (B.2.2) Manage data providers	(B.2.3) Deregister data providers
MOU management	(B.3.3.1) Create MOU (B.3.3.2) Gain concurrence	(B.3.3.3) Coordinate for certification	
Publication of standards	(B.3.4.1) Standards in use	(B.3.4.2) "How to" (B.3.4.3) Reference implementations	
R&D subsystem			
Requirements determination		(C.1.1.1) Requirements gathering (C.1.1.2) Requirements analysis (C.1.1.3) Requirements prioritization (C.1.1.4) Requirements publication	
Coordination of R&D programs		(C.1.2.1) Sponsor forums (C.1.2.2) R&D progress monitoring (C.1.2.3) R&D grants technical management (C.1.2.4) R&D agreements management	
R&D pilot projects			(C.1.3.1) Concept development (C.1.3.2) Project team agreements (C.1.1.3) Project management (C.1.3.4) Budgeting (C.1.3.5) Reporting
Technical assessments			(C.1.4.1) Candidate technology management (C.1.4.2) Tech assessment design (C.1.4.3) Budget (C.1.4.4) Plans (C.1.4.5) Operations (C.1.4.6) Report generation (C.1.4.7) Findings publication (C.1.4.8) Archive

Table H-1. Time Frame for U.S. IOOS Implementation, by Subsystem

Function	Current activities	IC	FC
Technology enhancements			(C.1.5.1) Project definition (C.1.5.2) Project management (C.1.5.3) Agreements management (C.1.5.4) Budgeting (C.1.5.5) COTR (C.1.5.6) Test and evaluation
Technology transition			(C.1.6.1) Project definition (C.1.6.2) Project management (C.1.6.3) Agreements management (C.1.6.4) Budgeting (C.1.6.5) Test and evaluation
Training and education subsystem			
Training and Education Strategy and plans development		(D.1.1.1) Strategy development	(D.1.1.2) Plans development
Training and curriculum development			(D.1.2.1) Training development (D.1.2.2) Curriculum development
Training and education pilot projects			(D.1.3.1) Concept development (D.1.3.2) Project team agreements (D.1.3.3) Project management (D.1.3.4) Budgeting (D.1.3.5) Reporting
Training and Education Assessments			(D.1.4.1) Workforce needs assessment (D.1.4.2) Assessment development (D.1.4.3) Assessment results and evaluation
Collaboration with education delivery managers		(D.1.5) Collaboration with education delivery managers	

Table H-1. Time Frame for U.S. IOOS Implementation, by Subsystem

Function	Current activities	IC	FC
Professional certifications			(D.1.6.1) Standards development (D.1.6.2) Publications (D.1.6.3) Assessment administration (D.1.6.4) Application processing (D.1.6.5) Certification and notifications (D.1.6.6) Records maintenance

Appendix I
U.S. IOOS® Implementation Plan Tasks

Table I-1 lists all of the U.S. IOOS® implementation tasks that must be completed by initial capability (IC) and by full capability (FC). (Where there are no tasks listed as "Prior to FC," all tasks have been completed at Prior to IC for that particular core functional activity.)

Table I-1. U.S. IOOS Implementation Plan Task List

No.	Core functional activity	Prior to IC		Prior to FC	
		Task no.	Task	Task no.	Task
Governance and management subsystem					
1	User councils	T-1.1	Get budget authority for user council activities	T-1.13	Begin conducting standards bodies, international, combined forums, and R&D asset owners user councils
		T-1.2	Gather human resources to manage user councils		
		T-1.3	Secure facilities and required equipment for managing user councils		
		T-1.4	Develop policies required to manage the user councils		
		T-1.5	Develop meeting procedures for user councils		
		T-1.6	Develop process for adjudicating user council recommendations and translating requirements into actions		
		T-1.7	Create invitee lists for user councils		
		T-1.8	Develop user council meeting schedules		
		T-1.9	Develop user council meeting agendas		
		T-1.10	Develop user council meeting logistics plans		
		T-1.11	Create user council charters		
		T-1.12	Begin conducting user council meeting (all except standards bodies, international, combined forums, and R&D asset owners)		

Table I-1. U.S. IOOS Implementation Plan Task List

No.	Core functional activity	Prior to IC		Prior to FC	
		Task no.	Task	Task no.	Task
2	Financial management	T-2.1	Create O&M funding policy		
		T-2.2	Create interagency budget coordination policy		
		T-2.3	Implement interagency budget coordination process		
		T-2.4	Create policy on funding international projects		
		T-2.5	Implement process to fund international projects		
		T-2.6	Create funds management policy		
		T-2.7	Implement funds management process		
3	Policy	T-3.1	Implement policy management procedures (internal and external)	T-3.4	Develop external management policies
		T-3.2	Develop internal management policies		
		T-3.3	Implement congressional liaison functions		
4	Plans	T-4.1	Implement process for managing internal planning	T-4.6	Create policy on participating in international plans
		T-4.2	Create policy on interagency and national planning	T-4.7	Implement process for managing international planning
		T-4.3	Implement process for interagency planning		
		T-4.4	Implement process for managing national planning		
		T-4.5	Develop plans for facilities and equipment		
5	Operations	T-5.1	Implement operational reporting process	T-5.9	Implement international plans
		T-5.2	Implement operations management process		
		T-5.3	Implement communications process		
		T-5.4	Implement decision-making and management process		
		T-5.5	Create capability assessment policy		
		T-5.6	Develop capability assessment standards		
		T-5.7	Implement capability assessment process		
		T-5.8	Implement internal, regional, interagency, and national plans		

Table I-1. U.S. IOOS Implementation Plan Task List

No.	Core functional activity	Prior to IC		Prior to FC	
		Task no.	Task	Task no.	Task
6	Human resources	T-6.1	Create policy on management of interagency personnel		
		T-6.2	Define and implement organizational structure and staffing plans		
7	Acquisition and grants	T-7.1	Create policies for purchasing, contracting, grants, and cooperative agreements		
		T-7.2	Implement processes for purchasing, contracting, grants, and cooperative agreements		
		T-7.3	Develop independent cost estimates policy		
		T-7.4	Implement independent cost estimate process		
8	Marketing, outreach, and engagement	T-8.1	Create marketing, outreach, engagement, and communications policy		
		T-8.2	Implement process to identify marketing, outreach, and engagement opportunities and create marketing, outreach, and engagement plans		
		T-8.3	Implement process to assess effectiveness of marketing, outreach, and engagement efforts		
		T-8.4	Conduct marketing, outreach, and engagement operations		
9	IT support	T-9.1	Create IT infrastructure plan for internal support		
		T-9.2	Create IT infrastructure plan for DMAC operations		
		T-9.3	Implement U.S. IOOS network management plan (internal and DMAC)		
		T-9.4	Create U.S. IOOS IT architecture management plan		
		T-9.5	Implement U.S. IOOS IT operations		
		T-9.6	Establish help desk		
Observing subsystem					
10	Observing subsystem management	T-10.1	Create observing system management policy	T-10.5	Implement observing system optimization process
		T-10.2	Implement observing system management process		

Table I-1. U.S. IOOS Implementation Plan Task List

No.	Core functional activity	Prior to IC		Prior to FC	
		Task no.	Task	Task no.	Task
		T-10.3	Implement observing system requirements survey process		
		T-10.4	Implement U.S. IOOS asset management process		
11	Surveys	T-11.1	Establish survey procedures		
		T-11.2	Create policies to standardize how assets are counted		
		T-11.3	Establish a database of record for survey data		
		T-11.4	Establish reporting standards for post-survey information dissemination		
12	Optimization studies			T-12.1	Establish method to define and update requirements
				T-12.2	Establish policies and procedures to assess the ability of an existing or projected asset to meet requirements
				T-12.3	Establish policy and procedures to conduct analysis of asset arrays and their combined ability to meet requirements
				T-12.4	Develop procedures for conducting and publishing optimization studies
13	Asset management	T-13.1	Create policy to define what assets to manage and how they are managed throughout their life cycle	T-13.2	Create procedures to manage assets
				T-13.3	Induct assets into the management system
DMAC subsystem					
14	Register data providers	T-14.1	Create policy on certification of data providers		
		T-14.2	Define data provider certification standards		
		T-14.3	Implement data provider certification process		
		T-14.4	Define data provider maturity standards		
		T-14.5	Create data provider registration and management policy		
		T-14.6	Define data provider registration standards		
		T-14.7	Implement data provider registration process		

Table I-1. U.S. IOOS Implementation Plan Task List

No.	Core functional activity	Prior to IC		Prior to FC	
		Task no.	Task	Task no.	Task
15	Manage data providers	T-15.1	Implement data provider management process	T-15.2	Implement cyclic review process
				T-15.3	Implement capability assessments
16	Deregister data providers			T-16.1	Create data provider deregistration policy
				T-16.2	Implement data provider deregistration process
17	Standards management	T-17.1	Develop quality standards	T-17.18	Create archive data policy
		T-17.2	Define standards for dictionaries and catalogs	T-17.19	Implement process to monitor archiving
		T-17.3	Develop metadata standards	T-17.20	Implement interface management process
		T-17.4	Implement process to assess and categorize metadata		
		T-17.5	Implement metadata profiles		
		T-17.6	Create DMAC IT security policy		
		T-17.7	Develop DMAC IT security standards		
		T-17.8	Implement process to assess and manage DMAC IT security		
		T-17.9	Create quality control and quality assurance policy		
		T-17.10	Develop quality control and quality assurance standards		
		T-17.11	Implement process to assess and monitor application of quality control and quality assurance standards		
		T-17.12	Implement QA/QC protocols		
		T-17.13	Create system monitoring policy		
		T-17.14	Implement system monitoring process		
		T-17.15	Create archive data policy		
		T-17.16	Implement process to monitor archiving		
		T-17.17	Create policy on development, publication, and management of U.S. IOOS data standards		
18	Utility services development	T-18.1	Create policy on developing and hosting utility services	T-18.5	Create data integration policy
		T-18.2	Implement process to develop and manage utility services	T-18.6	Define data integration standards

Table I-1. U.S. IOOS Implementation Plan Task List

No.	Core functional activity	Prior to IC		Prior to FC	
		Task no.	Task	Task no.	Task
		T-18.3	Develop and implement U.S. IOOS registry	T-18.7	Implement data integration service
		T-18.4	Develop and implement U.S. IOOS catalogs	T-18.8	Develop mapping and visualization standards
				T-18.9	Implement mapping and visualization service
				T-18.10	Develop standards for format conversion
				T-18.11	Implement format conversion service
				T-18.12	Develop standards for coordinate transformation services
				T-18.13	Implement coordinate transformation services
				T-18.14	Develop policy for product generation services
				T-18.15	Develop standards and tools for production generation services
				T-18.16	Implement product generation services
				T-18.17	Develop policy for workflow services
				T-18.18	Develop standards and tools for workflow services
				T-18.19	Implement workflow services
19	Utility services management	T-19.1	Implement utility services requirements management process		
		T-19.2	Implement utility services change process		
		T-19.3	Implement process to manage configuration control		
20	Data services and component development	T-20.1	Create data services policy	T-20.23	Identify focus area subject matter experts for DMAC build-out cycle 3
		T-20.2	Create and implement data services requirements process	T-20.24	Identify required variables for DMAC build-out cycle 3
		T-20.3	Create and implement data services development process	T-20.25	Identify required data providers for DMAC build-out cycle 3
		T-20.4	Create and implement data services change process	T-20.26	Identify required data structures for DMAC build-out cycle 3
		T-20.5	Identify and prioritize focus areas for DMAC data standards development and deployment	T-20.27	Convene experts to review findings and inform the plan for DMAC build-out cycle 3
		T-20.6	Create process for implementing repeatable DMAC build-out cycles	T-20.28	Conduct optimization planning for DMAC build-out cycle 3

Table I-1. U.S. IOOS Implementation Plan Task List

No.	Core functional activity	Prior to IC		Prior to FC	
		Task no.	Task	Task no.	Task
		T-20.7	Develop policy and procedures for U.S. IOOS Viewer	T-20.29	Execute DMAC build-out for cycle 3
		T-20.8	Develop and deploy U.S. IOOS Viewer	T-20.30	Identify focus area subject matter experts for DMAC build-out cycle 4
		T-20.9	Identify focus area subject matter experts for DMAC build-out cycle 1	T-20.31	Identify required variables for DMAC build-out cycle 4
		T-20.10	Identify required variables for DMAC build-out cycle 1	T-20.32	Identify required data providers for DMAC build-out cycle 4
		T-20.11	Identify required data providers for DMAC build-out cycle 1	T-20.33	Identify required data structures for DMAC build-out cycle 4
		T-20.12	Identify required data structures for DMAC build-out cycle 1	T-20.34	Convene experts to review findings and inform the plan for DMAC build-out cycle 4
		T-20.13	Convene experts to review findings and inform the plan for DMAC build-out cycle 1	T-20.35	Conduct optimization planning for DMAC build-out cycle 4
		T-20.14	Conduct optimization planning for DMAC build-out cycle 1	T-20.36	Execute DMAC build-out cycle 4
		T-20.15	Execute DMAC build-out cycle 1	T-20.37	Assess requirements for further DMAC build-out cycles
		T-20.16	Identify focus area subject matter experts for DMAC build-out cycle 2	T-20.38	Create subscriptions and alerts policy
		T-20.17	Identify required variables for DMAC build-out cycle 2	T-20.39	Develop standards for subscriptions and alerts
		T-20.18	Identify required data providers for DMAC build-out cycle 2	T-20.40	Implement subscriptions and alert service
		T-20.19	Identify required data structures for DMAC build-out cycle 2		
		T-20.20	Convene experts to review findings and inform the plan for DMAC build-out cycle 2		
		T-20.21	Conduct optimization planning for DMAC build-out cycle 2		
		T-20.22	Execute DMAC build-out cycle 2		
21	Data services and component management	T-21.1	Create policy on managing data services		
		T-21.2	Implement data standards management process		
		T-21.3	Develop and implement data services quality monitoring processes		
		T-21.4	Implement process to manage configuration control		

Table I-1. U.S. IOOS Implementation Plan Task List

No.	Core functional activity	Prior to IC		Prior to FC	
		Task no.	Task	Task no.	Task
		T-21.5	Develop system monitoring policy		
		T-21.6	Implement quality monitoring process		
22	Configuration control	T-22.1	Create configuration control policy		
		T-22.2	Implement configuration control process		
Modeling and analysis subsystem					
23	Customer needs	T-23.1	Implement process to collect, categorize, and prioritize customer needs		
		T-23.2	Implement process and procedures for a customer help desk		
		T-23.3	Publicize customer help desk		
		T-23.4	Implement customer help desk operations		
		T-23.5	Implement process to assess customer data needs and identify data sources		
		T-23.6	Create policy for adopting sponsored models		
		T-23.7	Define standards required for sponsored models		
		T-23.8	Implement process to assess customer needs for model outputs and identify sources		
		T-23.9	Implement process to assess customer needs for utility services and identify sources		
		T-23.10	Implement process to assess customer needs for data services and identify sources		
		T-23.11	Implement process to create and manage MOUs with data providers and sponsored model owners		
		T-23.12	Implement process to record, prioritize, and report on unfulfilled requirements		
		T-23.13	Implement process to generate solution scenarios for unfulfilled requirements		
		T-23.14	Implement process to advocate and garner support for solution scenarios		

Table I-1. U.S. IOOS Implementation Plan Task List

No.	Core functional activity	Prior to IC		Prior to FC	
		Task no.	Task	Task no.	Task
24	Sponsored models	T-24.1	Create policy on certification of data providers	T-15.2	Implement cyclic review process
		T-24.2	Define data provider certification standards	T-15.3	Implement capability assessments
		T-24.3	Implement data provider certification process	T-16.1	Create data provider deregistration policy
		T-24.4	Define data provider maturity standards	T-16.2	Implement data provider deregistration process
		T-24.5	Create data provider registration and management policy		
		T-24.6	Define data provider registration standards		
		T-24.7	Implement data provider registration process		
		T-15.1	Implement data provider management process		
25	MOU management	T-25.1	Create MOU policy		
		T-25.2	Implement MOU management		
		T-25.3	Implement coordination for certification process		
26	Publish standards	T-26.1	Create standards publication policy		
		T-26.2	Implement standards publication process		
		T-26.3	Implement process to manage “how to” documentation		
		T-26.4	Implement process to manage reference implementations		
R&D subsystem					
27	R&D requirements determination	T-27.1	Implement R&D requirements determination and prioritization process		
28	Coordination of R&D programs	T-28.1	Create policy on coordinated R&D between Federal and non-Federal agencies		
		T-28.2	Implement process to coordinate R&D programs		
29	R&D pilot projects			T-29.1	Create policy on R&D pilot projects
				T-29.2	Define standards for R&D pilot projects
				T-29.3	Implement process to manage R&D pilot projects

Table I-1. U.S. IOOS Implementation Plan Task List

No.	Core functional activity	Prior to IC		Prior to FC	
		Task no.	Task	Task no.	Task
30	Technical assessments			T-30.1	Create technical assessment policy
				T-30.2	Create process to manage technical assessments
31	Technology enhancements			T-31.1	Create policy on technology enhancements
				T-31.2	Create process to manage technology enhancements
32	Technology transition			T-32.1	Create technology transition policy
				T-32.2	Define technology transition standards
				T-32.3	Implement process to transition technology from the lab into service
Training and education subsystem					
33	Training and education strategy and plans development	T-33.1	Create training and education policy		
		T-33.2	Develop strategy for training and education		
				T-33.3	Develop plans for training and education
34	Training and curriculum development			T-34.1	Implement process to create training programs and curriculums
35	Training and education pilot projects			T-35.1	Create policy on training and educational pilot projects
				T-35.2	Implement process to manage pilot projects
36	Assessments			T-36.1	Define standards for training and education assessments (student assessments and program quality assessments)
				T-36.2	Implement process for developing, conducting, and evaluating the results of assessments
37	Collaboration with education delivery managers	T-37.1	Create policy on collaborations with education delivery managers		
		T-37.2	Implement process to collaborate with education delivery managers		

Table I-1. U.S. IOOS Implementation Plan Task List

No.	Core functional activity	Prior to IC		Prior to FC	
		Task no.	Task	Task no.	Task
		T-37.3	Implement education managers meetings		
38	Professional certifications			T-38.1	Create professional certifications policy
				T-38.2	Define professional certification standards
				T-38.3	Implement process to award and record professional certifications

Appendix J
U.S. IOOS® Partnership Database

Data on partner organizations are maintained in a partnership database. Table J-1 catalogs the entire spectrum of U.S. IOOS® partners. The database has the following elements:

- *Partner organization.* This is the name of the partner organization.
- *Partner type.* This classifies the partner organization by its status as a Federal entity, non-governmental organization, regional entity, private-sector firm, interagency body or other.
- *Partner role.* This assigns one or more roles to the partner organization.
- *Partner POC.* This is the name of the point of contact at the partner organization.
- *Name of project.* This captures the name of the joint project, venture, or effort.
- *Description and purpose.* This captures a description of partner activities, including the frequency of contact, the duration of the partnership, the purpose of the partnership, the anticipated result of the partnership, and any other relevant partnership attributes.
- *Lead organization.* This captures the lead organization for the project, where applicable. Many times, projects do not have a single lead entity.
- *U.S. IOOS Office POC.* This captures the U.S. IOOS Program Office point of contact for the project, where applicable.
- *Subject area.* This attempts to map partners to U.S. IOOS subsystems and other U.S. IOOS Program functional areas, including models, products, and applications; observations; DMAC; coordination/communications; research; and education.
- *Codification.* This indicates any structural agreements among or between partners, including grants and cooperative agreements, memorandums of understanding, or letters of authorization.

The database is current as of November 2010.

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE)	Federal Agency/ BOEM	User Council Member	Walter Johnson, Physical oceano-grapher/ coordinator, oil spill modeling program	IOOC	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communica-tions	
BOEMRE	Federal Agency/ BOEM	User Council Member	Walter Johnson	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Department of Agriculture Cooperative State Research, Education and Exten-sion Service	Federal Agency/ Dept of Agricul-ture	User Council Member	Luis M. Tupas, National program leader for global change and climate	Interagency Ocean Observation Committee (IOOC)	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communica-tions	
Department of Energy	Federal Agency/ Dept of Energy	User Council Member	Wanda Ferrell, U.S. Department of Energy Climate and Envi-ronmental Sciences Division	IOOC	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communica-tions	
Department of State	Federal Agency/ Dept of State	User Council Member	Gustavo Bisbal, Office of Ocean Affairs	IOOC	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communica-tions	

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
Department of Transportation	Federal Agency/ Dept of Transportation	User Council Member	Todd Ripley, Maritime Administration	IOOC	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communications	
Environmental Protection Agency (EPA)	Federal Agency/ EPA	User Council Member	Brian Melzian, Oceanographer/ Project Officer National Health and Environmental Effects	IOOC	Support interagency program coordinating office for ocean data integration. Coordinating on National Water Quality Monitoring Network. DIF/DMAC linkages.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communications	
EPA	Federal Agency/ EPA	Data Provider, Data/Services Customer	Chuck Spooner	National Water Quality Monitoring Network	Provide information about the health of our oceans and coastal ecosystems and inland influences on coastal waters for improved resource management.	USGS and EPA	Rob Ragsdale	DMAC	
EPA	Federal Agency/ EPA	User Council Member	Vacant	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
EPA	Federal Agency/ EPA	Sponsored Model Owner, Data/Services Customer	Richard Healy	Beaches Environmental Assessment, Closure, and Health (BEACH) Program	The BEACH Program focuses on the following five areas to meet the goals of improving public health and environmental protection for beach goers and providing the public with information about the quality of their beach water: (1) strengthening beach standards and testing; (2) providing faster laboratory test methods; (3) predicting pollution; (4) investing in health and methods research; and (5) informing the public.	EPA	Charly Alexander	Models, Products, and Applications	

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
EPA	Federal Agency/ EPA	Sponsored Model Owner, Data/Services Customer	Peter Silva	National Estuary Program (NEP)	The NEP was established by Congress in 1987 to improve the quality of estuaries of national importance. In addition to water quality improvements, habitat restoration and protection is one of the major focuses of the NEP.	EPA	Charly Alexander	Models, Products, and Applications	
EPA	Federal Agency/ EPA	Sponsored Model Owner, Data/Services Customer	Mike McDonald	National Coastal Assessment (NCA)	The NCA surveys the condition of the nation's coastal resources by creating an integrated, comprehensive monitoring program among the coastal states.	EPA	Charly Alexander	Models, Products, and Applications	
Department of Health and Human Services, Food and Drug Administration	Federal Agency/ FDA	User Council Member	Stacey Etheridge, Biologist	IOOC	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communications	
Joint Chiefs of Staff (JCS)	Federal Agency/ JCS	User Council Member	Robert Winokur, Joint Chiefs of Staff	IOOC	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communications	
Marine Mammal Commission	Federal Agency/ MMC	User Council Member	Samantha Simmons, Assistant Scientific Program Director	IOOC	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communications	
National Aeronautics and Space Administration (NASA)	Federal Agency/ NASA	User Council Member	Lucia Tsaoussi, Vice-Chair Deputy Associate Director for Research	IOOC	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communications	

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
NASA	Federal Agency/ NASA	User Council Member	Jorge Vazquez	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
NOAA Hydrographic Services Review Panel	Federal Agency/ NOAA	Governance	Kathy Watson	N/A	In October 2003, Secretary of Commerce Don Evans established the Hydrographic Services Review Panel as directed by the Hydrographic Services Improvement Act of 2002, Public Law 107-372. The Panel is composed of a diverse field of experts in hydrographic surveying, vessel pilotage, port administration, tides and currents, coastal zone management, geodesy, recreational boating, marine transportation, and academia. Advice from this panel will assist in addressing NOAA's strategic plan to improve the nation's marine transportation system and NOAA's plans to support commerce with world-class products and services that will help ensure safe, efficient and environmentally sound marine transportation.	N/A	N/A	Coordination/ Communications	
Habitat Program	Federal Agency/ NOAA/ NESDIS	Data/Services Customer	Roger Griffis	Coastal Resiliency (Hazard Resiliency of Coastal Communities)	NOAA-wide initiative to reduce the risk to coastal communities from weather- and climate-related natural hazards.	NOAA - CEO	Carl Gouldman	All	N/A
NESDIS STAR	Federal Agency/ NOAA/ NESDIS	Sponsored Model Owner, Data/Services Customer	Erik Baylor	Coastal and Ocean Prediction Enterprise	Produce integrated environmental modeling assessments and predictions, data assimilation, and data distribution.	NOAA - EMP	Carl Gouldman	Models, Products, and Applications	

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
Technical Require-ments, Planning, and Integration Program (TRP)	Federal Agency/ NOAA/ NESDIS	Governance	Pamela Taylor	Observing System Evaluations/ Observing System Simulation Experiments (OSE/OSSE)	Develop a robust OSE/OSSE capability for NOAA in order to establish NOAA's capability and capacity for observing system analysis and design.	NOAA - EMP	Carl Gouldman	Observations	
National Oceano-graphic Data Center (NODC)	Federal Agency/ NOAA/ NESDIS	Data/Services Customer, Data Provider	Terry Tielking	Ocean Data Stewardship	Develop an archive of ocean observation data that provides NOAA with long-term datasets, on which it can base synthesized products.	NOAA - NODC	Carl Gouldman	Observations	
WW - WWS (Science, Technology, and Infusion)	Federal Agency/ NOAA/ NESDIS	Data Provider, Data Collector	Paul DiGiacomo	CoastWatch/ OceanWatch	Support sea surface salinity efforts, provid-ing NOAA with salinity products and data for assimilation into models from remote sensing capabilities. Also supports ocean color efforts through SeaWIFS/MODIS satellites.	NOAA - CoastWatch	Charly Alexander	Observations	
National Coastal Data Development Center (NCDDC)	Federal Agency/ NOAA/ NESDIS	Data Provider	Russ Beard	Integrated Ecosystem Assessment Development	Provide integrated data on a variety of ecosystem characteristics in support of IEA development in eight regions.	NOAA - ERP	Charly Alexander	DMAC	
NCDDC	Federal Agency/ NOAA/ NESDIS	User Council Member	Julie Bosch	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Office of Systems Development	Federal Agency/ NOAA/ NESDIS	User Council Member	Kenneth McDonald	DIF Integrated Products Team (IPT)	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
NODC	Federal Agency/ NOAA/ NESDIS	User Council Member	Kenneth Casey	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
Oceanic Research and Applications Division	Federal Agency/ NOAA/ NESDIS	User Council Member	Kent Hughes	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Oceanic Research and Applications Division	Federal Agency/ NOAA/ NESDIS	User Council Member	Paul DiGiacomo	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
National Geophysical Data Center	Federal Agency/ NOAA/ NESDIS	User Council Member	Ted Habermann	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Information Technology Management Office	Federal Agency/ NOAA/ NESDIS	User Council Member	Jennifer Frye	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
TRP	Federal Agency/ NOAA/ NESDIS	User Council Member	Lewis McCulloch	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Center for Satellite Applications and Research, CoastWatch	Federal Agency/ NOAA/ NESDIS	User Council Member	Phillip Keegstra	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
NODC	Federal Agency/ NOAA/ NESDIS	User Council Member	Tess Brandon	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
CoastWatch	Federal Agency/ NOAA/ NESDIS	Data Provider		Hurricane Forecasting (Intensity) Improvement	Project evaluates the benefits of integration of ocean data in DIF standards into an air-sea numerical model, to aid the scientific and operational community to improve Atlantic hurricane intensity forecasts.	Mutual Arrangement	Charly Alexander	Models, Products, and Applications	SOW in Place

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
NCDDC	Federal Agency/ NOAA/ NESDIS	Sponsored Model Owner, Data/Services Customer		Integrated Ecosystem Assessment Development	Modify Environmental Research Division's Data Access Program (ERDDAP) software to provide enhanced integration with selected IOOS DIF data services and, to prototype the implementation of these services into the IEA model for the Gulf of Mexico and California Current regions.	Mutual Arrangement	Charly Alexander	Models, Products, and Applications	SOW in Place
Polar Operational Environmental Satellite	Federal Agency/ NOAA/ NESDIS	Data Provider	Kathleen Kelly Director, Office of Satellite Operations, NOAA	Polar Operational Environmental Satellite	The POES satellite system offers the advantage of daily global coverage, by making nearly polar orbits roughly 14.1 times daily. Since the number of orbits per day is not an integer the sub orbital tracks do not repeat on a daily basis, although the local solar time of each satellite's passage is essentially unchanged for any latitude. Currently in orbit we have a morning and afternoon satellite, which provide global coverage four times daily. The POES system includes the Advanced Very High Resolution Radiometer (AVHRR) and the Tiros Operational Vertical Sounder (TOVS).	NOAA	Zdenka Willis	Coordination/ Communications	
Environmental Research Division (ERD) of the Southwest Fisheries Science Center (SWFSC)	Federal Agency/ NOAA/ NMFS	Data Provider	Frank Schwing	Integrated Ecosystem Assessment Development	Provide integrated data on a variety of ecosystem characteristics in support of IEA development in eight regions.	NOAA - ERP	Charly Alexander	DMAC	
ERD/SWFSC	Federal Agency/ NOAA/ NMFS	User Council Member	Roy Mendelssohn	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
ERD/SWFSC	Federal Agency/ NOAA/ NMFS	User Council Member	Roy Mendelssohn	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
Office of Science and Technology (OST)	Federal Agency/ NOAA/ NMFS	User Council Member	Jim Sargent	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
OST	Federal Agency/ NOAA/ NMFS	User Council Member	Becky Shuford	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
ERD/SWFSC	Federal Agency/ NOAA/ NMFS	User Council Member	Dave Foley	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
ERD/SWFSC	Federal Agency/ NOAA/ NMFS	Sponsored Model Owner, Data/Services Customer		Integrated Ecosystem Assessment Development	Modify Environmental Research Division's Data Access Program (ERDDAP) software to provide enhanced integration with selected IOOS DIF data services and, to prototype the implementation of these services into the IEA model for the Gulf of Mexico and California Current regions.	Mutual Arrangement	Charly Alexander	Models, Products, and Applications	SOW in Place
Ecosystem Research Program (ERP)	Federal Agency/ NOAA/ NOS	Data/Services Customer	Libby Jewitt	Integrated Ocean Acidification	NOAA-wide initiative to provide OA monitoring and forecasting.	NOAA - ERP	Carl Gouldman	All	Omnibus Public Land Management Act of 2009
Coral Reef Conservation Program	Federal Agency/ NOAA/ NOS	Data/Services Customer	TBD	Integrated Ocean Acidification	NOAA-wide initiative to provide OA monitoring and forecasting.	NOAA - ERP	Carl Gouldman	All	Omnibus Public Land Management Act of 2009
Geodesy Program	Federal Agency/ NOAA/ NOS	Data/Services Customer		Coastal Resiliency (Hazard Resiliency of Coastal Communities)	NOAA-wide initiative to reduce the risk to coastal communities from weather- and climate-related natural hazards.	NOAA - CEO	Carl Gouldman	All	N/A

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
Coastal and Marine Resources Program	Federal Agency/ NOAA/ NOS	Data/Services Customer	Tim Goodspeed	Coastal Resiliency (Hazard Resiliency of Coastal Communities)	NOAA-wide initiative to reduce the risk to coastal communities from weather- and climate-related natural hazards.	NOAA - CEO	Carl Gouldman	All	N/A
Coasts, Estuaries, and Oceans Program (CEO)	Federal Agency/ NOAA/ NOS	Data/Services Customer	Keelin Kuipers, Audra Luscher	Coastal Resiliency (Hazard Resiliency of Coastal Communities)	NOAA-wide initiative to reduce the risk to coastal communities from weather- and climate-related natural hazards.	NOAA - CEO	Carl Gouldman	All	N/A
Marine Transportation System Program (MTS) Center for Operational Oceanographic Products and Services (CO-OPS)	Federal Agency/ NOAA/ NOS	Data Provider, Data Collector	Rich Edwing	Physical Oceanographic Real-Time System (PORTS)	MTS decision-support tool that improves the safety and efficiency of maritime commerce and coastal resource management through the integration of real-time environmental observations, forecasts and other geospatial information.	NOAA - MTS CO-OPS	Charly Alexander	Observations	PPBES
MTS CO-OPS	Federal Agency/ NOAA/ NOS	Data Provider, Data Collector	Rich Edwing	National Water Level Program (NWLP)	Water-level datum reference service for the nation, providing water-level stations throughout the nation.	NOAA - MTS CO-OPS	Charly Alexander	DMAC	PPBES
MTS CO-OPS	Federal Agency/ NOAA/ NOS	Data Provider	Rich Edwing	IOOS Water-Level Data Assembly Center at CO-OPS	IOOS water-level DAC at CO-OPS to ingest water-level data, conduct QC, present data in standardized format (per DMAC standards), disseminate it to end users, and archive the data. (Received FY09 ARRA funds to begin this work. May want to link with IOOS in FY13-17.)	NOAA - MTS CO-OPS	Carl Gouldman	Observations	
EMP Coast Survey Development Lab (CSDL)	Federal Agency/ NOAA/ NOS	Sponsored Model Owner, Data/Services Customer	Mary Erickson	Coastal and Ocean Prediction Enterprise	Produce integrated environmental modeling assessments and predictions, data assimilation, and data distribution.	NOAA - EMP	Carl Gouldman	Models, Products, and Applications	

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
NOAA IOOS	Federal Agency/ NOAA/ NOS	User Council Member	Zdenka Willis	IOOC	Support interagency program coordinating office for ocean data integration. This partnership indicates the U.S. IOOS Program's role as a member of the IOOC.	NOAA	Zdenka Willis	Coordination/ Communications	
MTS CO-OPS	Federal Agency/ NOAA/ NOS	Data Provder	Andrea Hardy	Data Convention Implementation	Implement DIF conventions for data content, encoding, and web services for IOOS variables available from CO-OPS.	NOAA - MTS CO-OPS	Charly Alexander	DMAC	
Observing System Monitoring Center (OSMC)	Federal Agency/ NOAA/ NOS	Data/Services Customer	Steve Hankin	Ocean Data Preservation	Funds ocean data management efforts to develop the capacity for end users to be able to request IOOS observations from the OSMC viewer.	NOAA - U.S. IOOS Office	Jeff de La Beaujardiere	DMAC	
National Data Buoy Center (NDBC)	Federal Agency/ NOAA/ NOS	Data Provider	Bill Burnett	Operational NDBC Data Assembly Center (DAC)	Enhance the IOOS DAC at NDBC, at which data undergo primary assembly, quality control, and packaging for release to end users.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	SOW in Place (for data provider enhancements)
Coastal Services Center (CSC)	Federal Agency/ NOAA/ NOS	User Council Member	Anne Ball	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
CSC	Federal Agency/ NOAA/ NOS	User Council Member	John Ulmer	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
CSC	Federal Agency/ NOAA/ NOS	User Council Member	Daniel Martin	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
National Centers for Coastal Ocean Science (NCCOS)	Federal Agency/ NOAA/ NOS	User Council Member	Michelle Tomlinson	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
Estuarine Reserves Division (OOCRM)	Federal Agency/ NOAA/ NOS	User Council Member	Whitley Saumwe-ber	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
CSC	Federal Agency/ NOAA/ NOS	User Council Member	Rebecca Love	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Information Systems Division (COOP)	Federal Agency/ NOAA/ NOS	User Council Member	Andrea Hardy	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
CSDL	Federal Agency/ NOAA/ NOS	User Council Member	Rich Patchen	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Information Systems Division (COOP)	Federal Agency/ NOAA/ NOS	User Council Member	Kathleen Fisher	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
MBO - Information Management Division of NOS Management and Budget Office	Federal Agency/ NOAA/ NOS	User Council Member	Hugh Johnson	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
CSC	Federal Agency/ NOAA/ NOS	User Council Member	John Ulmer	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
MBO - Information Management Division of NOS Management and Budget Office	Federal Agency/ NOAA/ NOS	User Council Member	John D Parker	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
MBO - Information Management Division of NOS Management and Budget Office	Federal Agency/ NOAA/ NOS	User Council Member	John Dandy	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
MTS CO-OPS	Federal Agency/ NOAA/ NOS	Data Provider		SLOSH Display Enhancement	Project showcases the benefits of the IOOS DIF by providing enhancements to how SLOSH forecasts hurricanes and by allowing uses of SLOSH to utilize DIF real-time observations, tidal predictions, and other water-level products in operational forecasts and other decision-making.	Mutual Ar-rangement	Charly Alexander	Models, Products, and Applications	SOW in Place
IOOS - National Surface Current Monitoring Capability	Federal Agency/ NOAA/ NOS	Data Collector		Search & Rescue and Toxic Spill Response	Provides surface current data via network of regionally situated high-frequency radars (HFRs), accessible from the IOOS Regions and from NDBC.	NOAA - U.S. IOOS Office	Jack Harlan	Models, Products, and Applications	
CSDL	Federal Agency/ NOAA/ NOS	Sponsored Model Owner, Data/Services Customer		Harmful Algal Bloom (HAB) Forecasting	Quantify potential improvements to NOAA's operational HAB forecasting system by ingesting IOOS DIF-compliant streams, including (but not limited to) forecast surface currents (HFR) and forecast winds.	Mutual Arrangement	Charly Alexander	Models, Products, and Applications	SOW in Place

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
NCCOS National Center for Coastal Monitoring and Assessment	Federal Agency/ NOAA/ NOS	Sponsored Model Owner, Data/Services Customer		Harmful Algal Bloom (HAB) Forecasting	Quantify potential improvements to NOAA's operational HAB forecasting system by ingesting IOOS DIF-compliant streams, including (but not limited to) forecast surface currents (HFR) and forecast winds.	Mutual Arrangement	Charly Alexander	Models, Products, and Applications	SOW in Place
National Estuarine Research Reserve System (NERRS)	Federal Agency/ NOAA/ NOS	Data Provider	Laurie McGilvray	NERRS - The National Estuarine Research Reserve System	The National Estuarine Research Reserve System is a network of protected areas established for long-term research, education, and stewardship. This partnership program between NOAA and the coastal states protects more than one million acres of estuarine land and water, which provides essential habitat for wildlife; offers educational opportunities for students, teachers, and the public; and serves as living laboratories for scientists.	NOAA	Zdenka Willis	Coordination/ Communications	
GEOSS - NOAA	Federal Agency/ NOAA/ NOS	Governance	Ken McDonald	GEOSS	The purpose of GEOSS is to achieve comprehensive, coordinated and sustained observations of the Earth system, in order to improve monitoring of the state of the Earth, increase understanding of Earth processes, and enhance prediction of the behavior of the Earth system. GEOSS will meet the need for timely, quality long-term global information as a basis for sound decision-making, and will enhance delivery of benefits to society.	NOAA	Zdenka Willis	Coordination/ Communications	
EMP	Federal Agency/ NOAA/ NWS	Sponsored Model Owner, Data/Services Customer	Sreela Nandi	Coastal and Ocean Prediction Enterprise	Produce integrated environmental modeling assessments and predictions, data assimilation, and data distribution.	NOAA - EMP	Carl Gouldman	Models, Products, and Applications	
NDBC	Federal Agency/ NOAA/ NWS	User Council Member	Landry Bernard	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
Engineering Branch (OOS)	Federal Agency/ NOAA/ NWS	User Council Member	Bill Burnett	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Operations Support and Performance Monitoring	Federal Agency/ NOAA/ NWS	User Council Member	Walter Smith	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Marine Modeling and Analysis Branch	Federal Agency/ NOAA/ NWS	User Council Member	Hendrik Tolman	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Marine Modeling and Analysis Branch	Federal Agency/ NOAA/ NWS	User Council Member	Avichal Mehra	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Engineering Branch (OOS)	Federal Agency/ NOAA/ NWS	User Council Member	Christopher Taylor	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Meteorological Development Lab	Federal Agency/ NOAA/ NWS	Sponsored Model Owner, Data/Services Customer		SLOSH Display Enhancement	Project showcases the benefits of the IOOS DIF by providing enhancements to how SLOSH forecasts hurricanes and by allowing uses of SLOSH to utilize DIF real-time observations, tidal predictions, and other water-level products in operational forecasts and other decision-making.	Mutual Arrangement	Charly Alexander	Models, Products, and Applications	SOW in Place
Tropical Prediction Center	Federal Agency/ NOAA/ NWS	Sponsored Model Owner, Data/Services Customer		SLOSH Display Enhancement	Project showcases the benefits of the IOOS DIF by providing enhancements to how SLOSH forecasts hurricanes and by allowing uses of SLOSH to utilize DIF real-time observations, tidal predictions, and other water-level products in operational forecasts and other decision-making.	Mutual Arrangement	Charly Alexander	Models, Products, and Applications	SOW in Place

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
NDBC	Federal Agency/ NOAA/ NWS	Data Provider, Data Collector		SLOSH Display Enhancement	Project showcases the benefits of the IOOS DIF by providing enhancements to how SLOSH forecasts hurricanes and by allowing uses of SLOSH to utilize DIF real-time observations, tidal predictions, and other water-level products in operational forecasts and other decision-making.	Mutual Arrangement	Charly Alexander	Models, Products, and Applications	SOW in Place
Weather Forecast Offices (WFOs) (Wakefield and Slidell)	Federal Agency/ NOAA/ NWS	Data/Services Customer		SLOSH Display Enhancement	Project showcases the benefits of the IOOS DIF by providing enhancements to how SLOSH forecasts hurricanes and by allowing uses of SLOSH to utilize DIF real-time observations, tidal predictions, and other water-level products in operational forecasts and other decision-making.	Mutual Arrangement	Charly Alexander	Models, Products, and Applications	SOW in Place
National Centers for Environmen-tal Prediction	Federal Agency/ NOAA/ NWS	Sponsored Model Owner, Data/Services Customer		Hurricane Forecasting (Intensity) Improvement	Project evaluates the benefits of integration of ocean data in DIF standards into an air-sea numerical model, to aid the scientific and operational community to improve Atlantic hurricane intensity forecasts.	Mutual Arrangement	Charly Alexander	Models, Products, and Applications	SOW in Place
OST	Federal Agency/ NOAA/ NWS	Data Provider, Data/Services Customer	Jason P. Tuell	Advanced Weather Interactive Processing System (AWIPS)	AWIPS integrates meteorological and hydrological data, from supercomputer generated NWS weather models, satellites, and radar. It serves the NWS providing real-time data for forecasting. AWIPS 1 has been around conceptually since 1995 and was deployed in 1999. It has gone through many cycles of hardware refreshes.	Mutual Arrangement	Charly Alexander	Observations	SOW in Place
ERP	Federal Agency/ NOAA/ OAR	Data/Services Customer		Coastal Resi-liency (Hazard Resiliency of Coastal Communities)	NOAA-wide initiative to reduce the risk to coastal communities from weather- and climate-related natural hazards.	NOAA - CEO	Carl Gouldman	All	N/A
WWS - Science, Technology, & Infusion Program	Federal Agency/ NOAA/ OAR	Data/Services Customer	John Gaynor	Coastal Resi-liency (Hazard Resiliency of Coastal Communities)	NOAA-wide initiative to reduce the risk to coastal communities from weather- and climate-related natural hazards.	NOAA - CEO	Carl Gouldman	All	N/A

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
EMP	Federal Agency/ NOAA/ OAR	Sponsored Model Owner, Data/Services Customer	Alan Leonardi	Coastal and Ocean Prediction Enterprise	Produce integrated environmental modeling assessments and predictions, data assimilation, and data distribution.	NOAA - EMP	Carl Gouldman	Models, Products, and Applications	
EMP	Federal Agency/ NOAA/ OAR	Governance	Alan Leonardi	Observing System Evaluations/ Observing System Simulation Experiments (OSE/OSSE)	Develop a robust OSE/OSSE capability for NOAA in order to establish NOAA's capability and capacity for observing system analysis and design.	NOAA - EMP	Carl Gouldman	Observations	
Pacific Marine Environmental Laboratory (PMEL)	Federal Agency/ NOAA/ OAR	User Council Member	Steve Hankin	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
PMEL	Federal Agency/ NOAA/ OAR	User Council Member	Steve Hankin	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
CPO	Federal Agency/ NOAA/ OAR	User Council Member	David Goodrich	DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Atlantic Oceanographic and Meteorological Laboratory (AOML)	Federal Agency/ NOAA/ OAR	User Council Member		DIF IPT	NOAA body to provide DIF guidance and coordination.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
AOML	Federal Agency/ NOAA/ OAR	Sponsored Model Owner, Data/Services Customer		Hurricane Forecasting (Intensity) Improvement	Project evaluates the benefits of integration of ocean data in DIF standards into an air-sea numerical model, to aid the scientific and operational community to improve Atlantic hurricane intensity forecasts.	Mutual Arrangement	Charly Alexander	Models, Products, and Applications	SOW in Place

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
U.S. National Park Service (NPS)	Federal Agency/ NPS	Grantee	Sam Walker, Debra Hernandez	Everglades Marine Monitoring Sites	Marine Weather Portal and SECOORA partners at the University of South Florida have worked with the National Park Service (NPS) to put the Everglades Marine Monitoring Sites data online. Approximately 25 in-situ sites are now online on the NDBC site. Currently water temperature and tide data are getting pushed to NDBC. This is an important milestone as to getting the NPS data on the NDBC map.	NOAA - U.S. IOOS Office	Gabrielle Canonico	Models, Products, and Applications	Cooperative agreement
National Science Foundation (NSF)	Federal Agency/ NSF	User Council Member	Alexandra Isern, Vice-Chair Ocean Technology and Interdisciplinary Coordination	IOOC	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communications	
Office of Naval Research, U.S. Navy	Federal Agency/ ONR	User Council Member	Steve Ackleson, Vice-Chair Ocean, Atmosphere & Space Division	IOOC	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communications	
Subcommittee on Integrated Management of Ocean Resources (SIMOR)	Federal Agency/ SIMOR	User Council Member	Paul Scholz	IOOC	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communications	

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
Smithsonian Institution	Federal Agency/ Smithso-nian	User Council Member	Dr. Len Hirsch, Office of Internation-al Relations	IOOC	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communica-tions	
U.S. Navy, GEOSS and IEOS liaison	Federal Agency/ U.S. Navy	User Council Member	John Lever	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Integrated buoy program, U.S. Navy	Federal Agency/ U.S. Navy	Data Provider		Integrated Buoy Program – U.S. Navy	A prime objective of Naval Oceanography is to get data, “From the sea…,” and quickly into the hands of the Fleet operators whose safety, sensors, and systems are influenced by it. Changing world politics and econom-ics will undoubtedly reduce the number of maritime observations in the future with increasing reliance being made on automated reporting systems. The Oceanographer/Navigator of the Navy has been investigating methods to reduce reliance on single profile expendables and ship observations by development of a series of satellite reporting expendable drifting buoys. These buoys will be capable of measuring air temperature, sea surface temperature, barometric pressure, subsur-face ocean temperature with depth, ambient noise, wind speed, wind direction, and directional wave spectra. These develop-mental buoys have been designated by the Navy as the AN/WSQ-6 (series) drifting buoys. This paper updates some of the Navy’s recent testing of these buoys and provides insight into the engineering challenges ahead for additional sensor development.	U.S. Navy	Zdenka Willis	Coordination/ Communica-tions	

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Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
U.S. Army Corps of Engineers (USACE)	Federal Agency/ USACE	User Council Member	William Birkemeier Research Coastal Engineer	IOOC	Support interagency program coordinating office for ocean data integration. National Waves Plan. Will be providing 1 FTE detailee to IOOS Office in FY09 or FY10.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communica-tions	
USACE	Federal Agency/ USACE	User Council Member	Jeff Lillycrop	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
U.S. Arctic Research Commission (USARC)	Federal Agency/ USARC	User Council Member	John Farrell Executive Director	IOOC	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communica-tions	
U.S. Coast Guard (USCG)	Federal Agency/ USCG	Not captured by current definitions	LT Scott Talbot	USCG Ship Support	Ship support from USCG for deploying and servicing data buoys.	USCG	Charly Alexander	Observations	
USCG	Federal Agency/ USCG	User Council Member	Jonathon Berkson, Marine Science Program Manager	IOOC	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communica-tions	
USGS, U.S. Geological Survey (USGS)	Federal Agency/ USGS	User Council Member	John Haines, Coordinator for Coastal and Marine Geology Program	IOOC	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communica-tions	
USGS	Federal Agency/ USGS	Data Provider, Data/Services Customer	John Scott	National Water Quality Monitoring Network	Provide information about the health of our oceans and coastal ecosystems and inland influences on coastal waters for improved resource management.	USGS and EPA	Rob Ragsdale	DMAC	
USGS	Federal Agency/ USGS	User Council Member	Dave Briar	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A

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Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
Census of Marine Life, Ocean Biogeographic Information System, USGS National Biological Information Infrastructure	Federal Agency/ USGS	User Council Member	Mark Fornwall	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
USGS	Federal Agency/ USGS	User Council Member	Robert Mason	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
National Oceanographic Partnership Program (NOPP)	Interagency Body	Sponsored Model Owner, Data/Services Customer	Ben Chicoski, Program Manager	Coastal and Ocean Prediction Enterprise	Produce integrated environmental modeling assessments and predictions, data assimilation, and data distribution.	NOAA - EMP	Carl Gouldman	Models, Products, and Applications	
Ocean Research and Resources Advisory Panel	Interagency Body	User Council Member	Linwood Vincent, Designated Federal Official	IOOC	Support interagency program coordinating office for ocean data integration.	NOAA	Zdenka Willis and Jessica Geubtner	Coordination/ Communications	

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
National Ocean Research Leadership Council (NORLC)	Intera-gency Body	Governance		Ocean Research Advisory Panel (ORAP)	The NORLC consisted of the heads of 15 Federal agencies involved in conducting or funding ocean research or developing ocean research policy. The NORLC had the responsibility to establish National Oceano-graphic Partnership Program (NOPP) poli-cies and implement procedures, including selection of projects, allocation of funds, and establishment of a Program Office, an Advisory Panel, and a Federal Oceano-graphic Facilities Committee. The NORLC reported the activities of the Program annually to Congress.	Interagency	Zdenka Willis	Coordination/ Communica-tions	
National Science and Technology Council (NSTC) Joint Subcommit-tee on Ocean Science and Technol-ogy (JSOST)	Intera-gency Body	Governance		N/A	NSTC established a Joint Subcommittee on Oceans in 2003. At the direction of the Ocean Action Plan, this group was expanded in 2005 to include Science and Technology. The JSOST reports to the Committee on Environment and Natural Resources in addition to the Interagency Committee on Ocean Science and Re-source Management Integration. JSOST adheres to the rules and regulations of the NSTC. The group consists of Deputy Assistant Secretaries or appropriate representatives from the Executive branch agencies and departments of the Committee on Ocean Policy.	Interagency	Zdenka Willis	Coordination/ Communica-tions	

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Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
Joint Intergovernmental Oceanographic Commission/ World Meteorological Technical Commission for Oceanography and Marine Meteorology (JCOMM)	Interagency Body	Governance		N/A	The WMO partnership with the Intergovernmental Oceanographic Commission of UNESCO (IOC) for JCOMM officially started in 1999, when the Technical Commission was established. Prior to 1999, marine meteorological and oceanographic observations, data management and service provision programs were international coordinated through the WMO Commission for Marine Meteorology (CMM) on one hand and through the joint WMO-IOC Committee for the Integrated Global Ocean Services System (IGOSS) on the other hand. While enhancing safety at sea remained the primary objective of marine forecast and warning programs, requirements for data and services steadily expanded in volume and breadth during the preceding decades.	Interagency	Zdenka Willis	Coordination/ Communications	
U.S. Global Ocean Observing System Steering Committee	Interagency Body	Governance		USGSC	The U.S. GOOS Steering Committee was formed at the request of Dr. D. James Baker, Jr., NOAA Administrator and Under Secretary for Oceans and Atmosphere, on behalf of interested Federal agencies. The group was requested to help in the development of information concerning options on how to match the needs of user groups with the observations and products required to meet those needs, addressing what is working well, what is not working well, the impediments we face at present, and the opportunities we face for the future.	Interagency	Zdenka Willis	Coordination/ Communications	

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Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
Marine Protected Areas	Intera-gency Body	Governance		N/A	Marine Protected Areas (MPAs) are valua-ble tools for conserving the nation's natural and cultural marine resources as part of an ecosystem approach to management. The United States has many types of MPAs for many purposes, including conservation of natural heritage, cultural heritage and sustainable production. Learn more about the national effort to build an effective na-tional system of marine protected areas.	N/A	N/A	Coordination/ Communica-tions	
Alliance for Coastal Technologies (ACT)	NGO	Governance, Grantee	Dr. Mario Tamburri (tamburri@ cbl.umces. edu)	Alliance for Coastal Technologies	Fund ACT, a partnership of research institu-tions, resource managers, and private-sector companies dedicated to fostering the development and adoption of effective and reliable sensors and platforms.	NOAA - U.S. IOOS Office	Gabrielle Canonico	Models, Products, and Applications	
Open-source Project for a Network Data Access Protocol (OPeNDAP)	NGO	Governance, Grantee		OPeNDAP Gateway Construction	Build OPeNDAP gateways to two Open Geospatial Consortium data protocols: Web Coverage Service and Web Feature Ser-vice.	NOAA - U.S. IOOS Office	Gabrielle Canonico	DMAC	
Monterey Bay Sanctuary Foundation	NGO	Governance, Grantee		IOOS Registry Enhancement	Enhance the IOOS observation registry infrastructure to better serve RCOOSs.	NOAA - U.S. IOOS Office	Gabrielle Canonico	Observations	
Woods Hole Oceano-graphic Institution	NGO	Governance, Grantee		QA/QC Requirements Standards Integration	Define requirements in QA/QC for oceano-graphic observing systems.	NOAA - U.S. IOOS Office	Gabrielle Canonico	Observations	
SCCOOS - Joint Institute for Marine Observations	NGO	Data Provider, Grantee	Eric Terrill	Surface Current Monitoring Data Server	Support and enhance national high-frequency radar servers. QA/QC algorithm development.	NOAA - U.S. IOOS Office	Jack Harlan	Observations	

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Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
Seakeepers Society	NGO	Data/Services Customer	John Englander, englander @seakeepers.org	Seakeepers Society	SeaKeepers actively participates in monitoring the world's oceans by simultaneously measuring a suite of near-surface meteorological and oceanographic parameters of scientific interest using their SeaKeeper 1000 system. The SeaKeeper 1000 is an integrated modular sensor suite that is adaptable to a broad set of platforms of opportunity.	N/A	Suzanne Skelley	DMAC	LOA between OAR and Seakeepers
Gulf of Maine Ocean Data Partnership, Southern Universities Research Association	NGO	User Council Member	Philip Bogden	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
University of Rhode Island Graduate School of Oceanography	NGO	User Council Member	Peter Cornillon	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Texas A&M University	NGO	User Council Member	Matthew Howard	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Rutgers	NGO	User Council Member	Josh Kohut	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
University of California at San Diego, Scripps Institution of Oceanography	NGO	User Council Member	John Orcutt	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
University of California at San Diego, Scripps Institution of Oceanography	NGO	User Council Member	Matthew Arrott	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
NOPP	NGO	Governance		Grants Management	NOPP will provide grants management support to the U.S. IOOS Program in FY11. NOPP is funded mostly by the U.S. Navy, with some NOAA support, but no funding comes directly from the IOOS budget. Its website is http://www.nopp.org/.	N/A	Gabrielle Canonico	Coordination/ Communications	N/A
Consortium of Ocean Leadership	NGO	Governance		Interagency	COL advocates for ocean priorities and staffs the IOOC. Its website is http://www.oceanleadership.org/.	Interagency	Suzanne Skelley	Coordination/ Communications	N/A
National Federation of Regional Associations for Ocean Observing (NFRA)	NGO	Governance	NFRA Chair Molly McCammon and NFRA Executive Director Josie Quintrell	Regional Coordination	NFRA oversees the 11 Regional Associations. Its website is http://www.usnfra.org/index.html.	N/A	Gabrielle Canonico	Coordination/ Communications	Cooperative agreement
Univ of Miami Cooperative Institute for Marine and Atmospheric Studies	NGO	Sponsored Model Owner, Data/Services Customer		Hurricane Forecasting (Intensity) Improvement	Project evaluates the benefits of integration of ocean data in DIF standards into an air-sea numerical model, to aid the scientific and operational community to improve Atlantic hurricane intensity forecasts.	Mutual Arrangement	Charly Alexander	Models, Products, and Applications	SOW in Place
Coastal States Organization	NGO	Governance		N/A	Since 1970, the Coastal States Organization (CSO) has represented the Governors of coastal states.	N/A	N/A	Coordination/ Communications	

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
National Marine Sanctuary Foundation	NGO	Governance		N/A	The National Marine Sanctuary Foundation, a private, non-profit, 501(c)(3) tax-exempt organization, was created to assist the Federally managed National Marine Sanctuary Program with education and outreach programs designed to preserve, protect and promote meaningful opportunities for public interaction with the nation's marine sanctuaries.	N/A	N/A	Coordination/ Communications	
Center for Satellite Applications and Research, National Coastal Data Development Center	Other	Governance	Paul DiGiacomo	Ocean Color Data Improvements	Develop data server to provide remote sensing ocean color data, and develop data content standards for this variable.	NOAA - CoastWatch	Charly Alexander	DMAC	SOW in Place
Canada: Fisheries and Oceans	Other	User Council Member	Bob Keeley	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Global Climate Observing System (GCOS) Steering Committee	Other	Governance		GCOS	The GCOS Steering Committee (SC) consists of up sixteen scientific and technical experts selected on the basis of their personal expertise. The chairs of standing GCOS panels are members ex officio. The SC is appointed jointly by the executive heads of the GCOS sponsoring organizations by mutual consent. Membership of the SC includes a balanced geographical representation of major operational and research observing programs contributing to GCOS, as well as an appropriate mix of disciplines in atmospheric, oceanic, hydrological, cryospheric, and biospheric sciences.	Interagency	Zdenka Willis	Coordination/ Communications	

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC)	Other	Governance		OOPC	The Ocean Observations Panel for Climate (OOPC) is a scientific expert advisory group charged with making recommendations for a sustained global ocean observing system for climate in support of the goals of its sponsors. This includes recommendations for phased implementation. The Panel also aids in the development of strategies for evaluation and evolution of the system and of its recommendations, and supports global ocean observing activities by interested parties through liaison and advocacy for the agreed observing plans.	Interagency	Zdenka Willis	Coordination/ Communications	
Integrated Marine Observing System (IMOS)	Other	Services Provider		IMOS	IOOS has shared with Australia's IMOS a summary spreadsheet of ocean data management standards in use or planned to be in use, in order to ascertain and maximize overlap with IMOS.	NOAA	Jeff de La Beaujardiere	Coordination/ Communications	
MyOcean	Other	Services Provider		MyOcean	IOOS has shared with the European Commission's MyOcean a summary spreadsheet of ocean data management standards in use or planned to be in use, in order to ascertain and maximize overlap with MyOcean.	NOAA	Jeff de La Beaujardiere	Coordination/ Communications	
Unidata	Private Sector	User Council Member	Ben Domenico	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A
Raytheon	Private Sector	User Council Member	Carroll Hood	DMAC Steering Team	Interagency guiding and coordination body for DMAC activities.	NOAA - U.S. IOOS Office	Charly Alexander	DMAC	N/A

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
CaRA - Caribbean Region	Regional IOOS	Data Provider, Data/Services Customer, Grantee, User Council Member	Prof. Julio M. Morell (jmorell@uprm.edu)	Implementation of the Caribbean Regional Integrated Coastal Ocean Observing System	This project will implement the initial stages of a Caribbean Integrated Coastal Ocean Observing System (CarICOOS) consistent with national IOOS development plans. Investigators will address stakeholder needs through 1) enhancement of existing and installation of essential in situ observational assets; 2) operational implementation of modeling tools, validated with the above observations; and 3) partnering with NOAA for the production of regionally focused remote sensing products. Achieving DMAC-compliant data processing and archiving, and appropriate data and data product dissemination to agencies and stakeholders will assure initial implementation of a user-responsive, operational CarICOOS.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	Cooperative agreement
CeNCOOS - Central and Northern California Region	Regional IOOS	Data Provider, Data/Services Customer, Grantee, User Council Member, Data Collector	Monterey Bay Aquarium Research Institute/ Steven R. Ramp (sramp@mbari.org)	CeNCOOS: Long-term monitoring of environmental conditions in support of protected marine area management in central and northern California	The project will develop the Central and Northern Coastal Ocean Observing System (CeNCOOS) in open and semi-enclosed bays in the region including San Francisco Bay, Monterey Bay, Bodega Bay, Humboldt Bay, and Morro Bay. The focus will be on water temperature and salinity and relating these changing conditions to ecosystem and human health. This effort will link with state-sponsored high-frequency radar mapping of surface currents and numerical modeling of San Francisco and Monterey bays and also the Gulf of Farallones. The temperature and salinity data will be the basis of specific decision-support indices directed toward harmful algal blooms, contamination, and integrated ecosystem assessment.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	Cooperative agreement

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
GLOS - Great Lakes Region	Regional IOOS	Data Provider, Data/Services Customer, Grantee, User Council Member, Data Collector	Jen Read (jread@glos.us)	Implementation of the Great Lakes Observing System	The Great Lakes Observing System (GLOS) will focus in the first year on four tasks that support regional observation priorities: 1) implementation of prototype nearshore buoys on lakes Superior, Michigan, Erie, and Ontario to collect meteorological, wave information, and vertical lake temperature observations; 2) development of public domain 3D hydrodynamic modeling for the lakes Huron-to-Erie Corridor (HEC), including Lake St. Clair; 3) expansion of the development, user assessments and market analysis of customized integrated harbor specific products (Great Lakes HarborView); and 4) implementation of the Great Lakes Modeling and Assessment Center (GLMAC). More extensive observations, providing system-wide coverage, and related user-defined products will occur in years two and three.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	Cooperative agreement

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
AOOS - Alaska Region	Regional IOOS	Data Provider, Data/Services Customer, Grantee, User Council Member, Data Collector	Molly McCammon (mccammon@aoos.org)	Alaska Regional Coastal and Ocean Observing Systems	The Alaska Ocean Observing System (AOOS) is focused on four key issues: climate change and its impacts, sustainability of fisheries and marine ecosystems, mitigation of natural hazards, especially coastal erosion, and safety of marine operations and health of coastal communities. Priorities in FY07 include continuing the development of the Prince William Sound (PWS) Ocean Observing System pilot project that collects observations for use by stakeholders and develops and tests forecast models as a demonstration of an end-to-end observing system in Alaska. The project will complete development of the three primary models for Alaska: ocean circulation (Regional Ocean Model System (ROMS)), waves (Simulating WAves Nearshore (SWAN)), and Nutrient-Phytoplankton-Zooplankton (NPZ). The high-resolution wind, wave, and ocean current forecast products provide expanded and improved marine safety for recreational and commercial vessel operators and enhance the security to oil tanker traffic in PWS.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	Cooperative agreement

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
NANOOS - Pacific Northwest Region	Regional IOOS	Data Provider, Data/Services Customer, Grantee, User Council Member, Data Collector	Dr. David Martin (dmartin @apl.washington.edu)	Enhancing the Pacific Northwest Regional Coastal Ocean Observing System of the Northwest Association of Networked Ocean Observing Systems (NANOOS)	This project to develop the Northwest region will be executed in four subcomponents: observing systems, modeling and products, data management and communications (DMAC), and education and outreach. The work will be applied in four observational domains: coastal ocean shelf, coastal ocean surface currents, estuaries, and shorelines. The primary goals of the project are to: 1) maintain existing surface current mapping capabilities and expand with new HF radar sites by extending the current radar array with additional operation, maintenance, and products; 2) expand coverage and range of observations on the coastal ocean shelf in coordination with emerging national programs with fixed buoys and gliders that will provide information on hypoxia/anoxia and harmful algal blooms (HABs); 3) maintain and expand observations in estuaries through improved maintenance and staff support, including partnerships at local, state, and Federal levels; and 4) maintain and expand core elements of existing beach and shoreline observing programs in Oregon and Washington.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	Cooperative agreement

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
SCCOOS - Southern California Region	Regional IOOS	Data Provider, Data/Services Customer, Grantee, User Council Member, Data Collector	Julie Thomas (jot@cdip.ucsd.edu)	Implementation of Regional Integrated Ocean Observing System: Southern California Regional Coastal Ocean Observing System (SCCOOS)	This project will continue to expand activities that have been identified as priorities by the SCCOOS stakeholder community. These include supporting the southern California beach water quality management community including issues related to harmful algal blooms (HABs), maintaining area-wide ocean assessment to identify secular trends in the environment and their relationship to ecosystem variability, supporting operational users such as search and rescue, oil spill, and marine safety, and managing and distributing ocean information of public interest. In year one, this project will focus on establishing a HAB surveillance program, maintaining forecasts and nowcasts of ocean and atmospheric conditions, continued acquisition of nearshore larval and fish counts to complement the California Department of Fish and game's management of fisheries, and the generation of a coastal climatology to aid management decisions as they relate to climate change and ecosystem variability.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	Cooperative agreement

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
PacIOOS - Pacific Islands Regions	Regional IOOS	Data Provider, Data/Services Customer, Grantee, User Council Member, Data Collector	Dr. Brian Taylor (taylorb@hawaii.edu)	Developing the Hawaii-Pacific Ocean Observing and Information System	The objective of this project is to integrate and expand ocean observing and forecasting first in the Hawaiian Islands, and later among the Pacific Islands as part of a larger Pacific Integrated Ocean Observing System (PacIOOS). Investigators will begin with four integrated "catalyst" projects focused initially on waters along the southern shore of Oahu, Hawaii's most populous island. These catalyst projects support one another to enhance community capabilities and respond to the needs of a diverse constituency of stakeholders are (1) coastal ocean-state and forecast; (2) coastal resiliency; (3) automated water quality sensing; and (4) marine ecosystem stewardship. Resultant products will contribute to nearshore and offshore safety, shipping and marine commerce, water quality assessments, marine ecosystem indicators, and marine inundation forecasts.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	Cooperative agreement

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
SECOORA - Southeast Atlantic Region	Regional IOOS	Data Provider, Data/Services Customer, Grantee, User Council Member	S.C. Sea Grant Consortium, Dr. Rick DeVoe (Rick.Devoe@scseagrant.org)	Implementation of Regional Integrated Ocean Observing Systems: Support of RCOOS Development in SECOORA	This project will consolidate Coastal Ocean Observing System (COOS) assets and products in the Carolinas with those in Georgia and Florida to establish a user-driven observing system that spans the entire SECOORA footprint. The foundation of the SECOORA RCOOS will build initially upon six primary elements included in this proposal: 1) Maintenance and development of existing observing assets and consolidation of existing sub-regional observing systems, 2) Construction of an integrated and embedded modeling system, 3) Development of ecosystems models targeted at predicting the characteristics of regionally important fish stocks, 4) Establishment of a data management system designed to disseminate rapid, high quality products, 5) Establishment of a systems engineering based structure to the observing system architecture that enables the seamless interoperability, and 6) Integration of an end-user community into the fabric of SECOORA to ensure responsiveness to regional needs.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	Cooperative agreement

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
SECOORA - Southeast Atlantic Region	Regional IOOS	Data Provider, Data/Services Customer, Grantee, User Council Member	University of North Carolina Wilmington/ Dr. Lynn Leonard (lynnl@ uncw.edu)	Integration of Coastal Observations and Assets in the Carolinas in Support of Regional Coastal Ocean Observation System Development in the Southeast Atlantic	This project will focus on the integration of existing assets and observations specific to the development of wave, water quality, and public health safety products in the Carolinas Coastal region. Investigators will support and use a subset of existing platforms currently operated by academic and Federal entities and eventually will install two new wind, wave, and current monitoring stations in the North Carolina Pamlico and Albemarle sounds and two additional coastal wave stations off the Outer Banks.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	Cooperative agreement
SECOORA - Southeast Atlantic Region	Regional IOOS	Sponsored Model Owner, Grantee, User Council Member	University of Florida/ Dr. Peter Sheng (pete@coastal.ufl.edu)	A Regional Storm Surge and Inundation Model Test Bed for the Southeast Coastal Ocean Observing System Regional Association	Using a community-based approach and working with NWS, Federal Emergency Management Agency, and state and county departments of emergency management, this project will conduct a comprehensive validation and comparative study of four leading storm surge and inundation models developed by the academic community. The goals of this project are to enhance the storm surge and inundation modeling capabilities, to establish common standards for storm surge and inundation modeling, and to bridge the gap between the leading academic storm surge modelers.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	Cooperative agreement

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
SECOORA - Southeast Atlantic Region	Regional IOOS	Sponsored Model Owner, Grantee, User Council Member	University of North Carolina at Chapel Hill/Dr. Rick Luettich (rick_luettich@unc.edu)	A Prototype Operational Modeling System for Waves, Coastal Currents, Inundation and Hydrologic Flooding for Eastern North Carolina	This project will develop a modular, integrated modeling system that provides 24/7/365 forecasts of waves, storm surge, inundation, coastal circulation, and hydrologic runoff for eastern North Carolina, a region highly susceptible to catastrophic impacts of severe coastal weather. Resultant data and products will be developed using ensemble-based procedures and routinely evaluated against extensive existing in-situ observations. The overall goal is to demonstrate the relevance to regional stakeholders of an operational watershed-to-coastal ocean modeling system that provides information on offshore and nearshore wave conditions, information to assess rip current threats, regional wave and current conditions in high-traffic areas such as tidal inlets, nearshore currents for search and rescue operations, and inundation data associated with coastal storm surge and hydrologic runoff. Information will be transmitted in compatible formats to three regional National Weather Service Forecast Offices to the U.S. Coast Guard (USCG) to be applied during moderate conditions and severe storms for use in marine forecasts, search and rescue operations, decision-making by emergency managers, and the U.S. Army Corps of Engineers for evaluating near shore sediment transport budgets.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	Cooperative agreement

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Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
SECOORA - Southeast Atlantic Region	Regional IOOS	Sponsored Model Owner, Data/Services Customer, Grantee, User Council Member	University of North Carolina at Wilmington/ Jennifer Dorton (dortonj@ uncw.edu)	Expansion of the Carolinas Coast Marine Weather Template within the SECOORA Region	Investigators will work with NWS' Southern Region Headquarters and Weather Forecast Offices (WFOs) to expand the NWS' experimental Carolinas Coast marine portal (www.weather.gov/carolinascoast) into Florida, thereby creating a standardized Southeast Marine Weather Portal that covers the entire Southeast Coastal Ocean Observing Regional Association (SECOORA) domain. The goals of this proposal are to provide 24/7 access to critical marine information for the commercial and recreational marine communities within the SECOORA region; and, to support the transfer of the developed information technology product to WFOs with marine forecasting responsibilities.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	Cooperative agreement
MACOORA - Mid-Atlantic Region	Regional IOOS	Data Provider, Data/Services Customer, Grantee, User Council Member	Rutgers/Dr. Scott Glen (glenn@marine.rutgers.edu)	Phased Deployment and Operations of the Mid-Atlantic Regional Coastal Ocean Observing System (MARCOOS)	This project will have a region-wide focus and be conducted by leveraging extensive existing regional observation assets. The primary themes are maritime safety and ecological decision support though coastal inundation and water quality are also important areas of emphasis. Investigators will coordinate, sustain, and expand ongoing ocean observing and forecasting activities to generate regional-scale data and other products in real time across the full Mid-Atlantic region and extending in the bays and sounds. HFR server redundancy.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	Cooperative agreement

Table J-1. U.S. IOOS® Partnership Database

Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
NERACOOS - Northeast Atlantic Region	Regional IOOS	Data Provider, Data/Services Customer, Grantee, User Council Member, Data Collector	Dr. John Trowbridge (jtrowbridge@whoi.edu)	Development of the Northeast Regional Coastal Ocean Observing System	This project will develop the Northeastern Regional Coastal Ocean Observing System. Regional user requirements identified inundation, harmful algal blooms, water quality, and living marine resources as specific concerns in the Northeastern Region. There are three objectives of this proposal: (1) operate a core of observing elements; (2) establish new observing capabilities for inundation, water quality, and harmful algal bloom; and (3) develop the design for the user-driven core observing system.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	Cooperative agreement
GCOOS - Gulf of Mexico Region	Regional IOOS	Data/Services Customer, Grantee, User Council Member, Data Collectors	Dr. Ann Jochens (ajochens@tamu.edu)	Maintenance and Enhancement of the GCOOS Data Portal: Building Toward a Regional Operations Center	The overarching goal of this project is to develop an integrated data framework for data streams, quality assurance procedures, and data delivery. This will be achieved through four objectives to: maintain and enhance the data portal beyond 2008, develop and refine a comprehensive data management system, build a pre-operational Regional Operations Center (ROC), and develop educational resources for significant IOOS outreach efforts. This project builds upon current efforts to design and build a centralized data portal for the Gulf of Mexico Coastal Ocean Observing System Regional Association (GCOOS-RA).	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	

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Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
GCOOS - Gulf of Mexico Region	Regional IOOS	Data Provider, Data/Services Customer, Grantee, User Council Member, Data Collector	Dr. Ann Jochens (ajochens@tamu.edu)	Standardization of Local Data Network Nodes in the Gulf of Mexico Coastal Ocean Observing System Regional Association (GCOOS-RA)	This project will standardize elements of the near real-time marine data delivery systems of 10 major non-Federal data providers of the Gulf of Mexico Coastal Ocean Observing System Regional Association (GCOOS-RA). Uniform data delivery systems will be developed that maximize interoperability within the region, between regions, and with the Federal backbone to facilitate the production of operational data and model products in support of the regional and national needs. The three specific objectives are to: 1) establish a single common vocabulary for variables served; 2) serve point and vector data via an Open Geospatial Consortium (OGC) compliant Sensor Web Enablement (SWE) framework comprised of Sensor Observation Service and Observation and Measurement standards; and 3) serve satellite data via a OCG Web Coverage Service (WCS) service interface.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	

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Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
MACOORA - Mid-Atlantic Region	Regional IOOS	Sponsored Model Owner, Grantee, User Council Member	Chesapeake Bay Research Consortium/Kevin Sellner (sellnerk@si.edu) and Chesapeake Bay Observing System (CBOS)/ Elizabeth Smith (exsmith@odu.edu)	Chesapeake Inundation Prediction System (CIPS): Flood Forecast Prototype for Coastal-Bay-Estuary Resiliency to Storm Surge	The Chesapeake Inundation Prediction System (CIPS) will be developed to improve the accuracy, reliability, and capability of flood forecasts for tropical cyclones and non-tropical wind systems such as nor'easters. Investigators from government, industry and academia will construct, evaluate, and deliver a prototype inundation forecasting system to facilitate emergency management and decision-making in the challenging case of intricate coastlines, semi-enclosed coastal bays, and estuaries.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	
SCCOOS - Southern California Region	Regional IOOS	Data/Services Customer, Grantee, Sponsored Model Owner, Data Collector	University of California at San Diego, Scripps Institution of Oceanography/ Julianna Thomas (jot@splash.ucsd.edu)	Long Beach/Los Angeles Harbor IOOS Demonstration Project	This project will integrate regional assets by leveraging existing observations, models, and data management to develop products that contribute to the safety and efficiency of maritime transportation. The proposed customized website for Long Beach/Los Angeles Harbor entrance is designed to provide critical marine conditions necessary for the safe passage inbound and outbound from Long Beach/Los Angeles Harbor.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	

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Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
SCCOOS - Southern California Region	Regional IOOS	Sponsored Model Owner, Data Provider, Grantee, Data Collector	University of California at San Diego, Scripps Institution of Oceanography/Dr. Arthur J. Miller (ajmiller@ucsd.edu)	Using Ocean Data Assimilation to Incorporate Environmental Variability into Sardine and Squid Assessments	This project will study the influence of physical oceanography on the populations of sardine and squid by selecting key El Niño and La Niña time periods (which represent environmental extremes) for intensive analysis, comparison, and contrast to typical conditions.	NOAA - U.S. IOOS Office	Gabrielle Canonico	All	
NERACOOS - Northeast Atlantic Region	Regional IOOS	Governance, Grantee	Woods Hole/Dr. Hauke L. Kite-Powell (hauke@whoi.edu)	Maximizing the Economic Return form NERACOOS: Prioritized End User Needs and Tools for Tracking Use and Value of Observing System Information	The purpose of this project is to: 1) work with prospective end users of ocean observing system products in the Gulf of Maine/New England area to ensure that information generated by Northeast Regional Association of Coastal Ocean Observing Systems (NERACOOS) effectively addresses end-user needs; and (2) develop and implement a system to track the use of regional observing system information by end users and document the economic value generated by this information. This will involve three main activities: 1) identify user priorities and information products to address inundation, harmful algal blooms, water quality, and living marine resources management, 2) develop usage tracking and economic assessment tools, and 3) adapt the tools to be used by other regional ocean observing systems.	NOAA - U.S. IOOS Office	Gabrielle Canonico	Observations	

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Partner organization	Partner type	Partner role	Partner POC	Name of project	Description and purpose	Lead organization	U.S. IOOS Office POC	Subject area	Codification
NERACOOS - Northeast Atlantic Region	Regional IOOS	Sponsored Model Owner, Data/Services Customer, Grantee, User Council Member, Data Collector	Woods Hole Oceanographic Institution/ Dr. Scott Gallager (sgallager@whoi.edu)	A Northeast Benthic Observatory (NEBO) to Support Multi-Species Fisheries and Ecosystem Management	This project will collect and analyze spatially comprehensive high-resolution seafloor imagery to quantify key taxa, benthic community structure, species diversity, seafloor habitat characteristics, and coincident water column properties with repeated measurements on time scales of weeks to years. Data collection will be at locations with high fishery and conservation value, such as the western Gulf of Maine.	NOAA - U.S. IOOS Office	Gabrielle Canonico	Observations	

Appendix K
Mapping of Activities to Partner Roles

Table K-1 lists all U.S. IOOS® activities and maps them to the nine partner roles.

Table K-1. Mapping of U.S. IOOS Activities to U.S. IOOS Partner Roles

Number	Activity	Data collector	Data provider	Services provider	Data/services customer	Sponsored model owner	Grantee	User council member	Governance body	U.S. IOOS Program Ofc
A.1	Governance and Management									X
A.1.1	User Councils							X		X
A.1.1.1	Standards Bodies							X		X
A.1.1.2	Data Provider Council	X	X	X		X	X	X		X
A.1.1.3	Customer Council				X	X		X		X
A.1.1.4	Federal Partners		X		X			X		X
A.1.1.5	Regional Associations	-	X	X	X	X	X	X		X
A.1.1.6	NGOs				X			X	X	X
A.1.1.7	International							X		X
A.1.1.7.1	GEOSS							X	X	X
A.1.1.7.2	GOOS		X		X			X	X	X
A.1.1.8	IEOS							X	X	X
A.1.1.9	Combined Forums by Geographic Area	X	X	X	X	X	X	X	X	X
A.1.1.10	Combined Forums by Functional Area	X	X	X	X	X	X	X	X	X
A.1.1.11	R&D Asset Owners							X		X
A.1.2	Financial Management									X
A.1.2.1	Financial Plans							X	X	X
A.1.2.2	Budget							X	X	X
A.1.2.3	Execution							X	X	X
A.1.2.4	Analysis									X
A.1.2.5	Interagency Coordination							X	X	X
A.1.3	Policy									X
A.1.3.1	Intramural									X
A.1.3.2	Extramural		X	X	X	X	X		X	X
A.1.3.2.1	Technical		X	X	X	X	X			X
A.1.3.2.2	Administrative		X	X	X	X	X		X	X
A.1.3.3	Congressional Liaison								X	X

Table K-1. Mapping of U.S. IOOS Activities to U.S. IOOS Partner Roles

Number	Activity	Data collector	Data provider	Services provider	Data/services customer	Sponsored model owner	Grantee	User council member	Governance body	U.S. IOOS Program Ofc
A.1.4	Plans and Operations									X
A.1.4.1	Plans									X
A.1.4.1.1	National Coordination							X	X	X
A.1.4.1.2	IOOS Internal								X	X
A.1.4.1.2.1	Observations	X	X							X
A.1.4.1.2.2	Data Providers		X			X				X
A.1.4.1.2.3	DMAC Services		X	X	X	X				X
A.1.4.1.2.4	Models				X	X				X
A.1.4.1.2.5	Archives		X							X
A.1.4.1.2.6	Education							X		X
A.1.4.1.2.7	R&D							X		X
A.1.4.1.3	International Coordination							X	X	X
A.1.4.2	Operations									X
A.1.4.2.1	Interagency							X	X	X
A.1.4.2.1.1	Program Management Teams									X
A.1.4.2.2	National							X	X	X
A.1.4.2.3	International							X	X	X
A.1.4.2.3.1	Program Management Teams									X
A.1.4.2.4	Regional Assessments		X	X		X		X		X
A.1.4.2.5	Regional Project Management	X	X	X		X		X		X
A.1.4.2.6	Program Office Internal									X
A.1.5	Human Resources								X	X
A.1.5.1	Staffing								X	X
A.1.5.2	Recruiting								X	X
A.1.5.3	Awards								X	X
A.1.5.4	Personnel Actions								X	X
A.1.5.5	Training								X	X
A.1.5.6	Benefits								X	X
A.1.5.7	Personnel Records								X	X
A.1.5.8	Personnel Policy								X	X
A.1.6	Acquisition and Grants								X	X
A.1.6.1	Purchasing								X	X
A.1.6.2	Contracting								X	X
A.1.6.3	Grants and Cooperative Agreements						X		X	X
A.1.6.3.1	Services						X		X	X

Table K-1. Mapping of U.S. IOOS Activities to U.S. IOOS Partner Roles

Number	Activity	Data collector	Data provider	Services provider	Data/services customer	Sponsored model owner	Grantee	User council member	Governance body	U.S. IOOS Program Ofc
A.1.6.3.2	R&D						X		X	X
A.1.6.4	Independent Cost Estimates								X	X
A.1.7	Marketing									X
A.1.7.1	Manage Communication Strategy									X
A.1.7.2	Create Products									X
A.1.7.3	Speaker Program									X
A.1.7.4	Conference Participation									X
A.1.7.5	Membership in Fora									X
A.1.7.6	News Releases									X
A.1.8	IT Support									X
A.1.8.1	Desktop Management									X
A.1.8.2	Network Management									X
A.1.8.3	Architecture Management									X
A.1.8.3.1	DMAC									X
A.1.8.3.2	IOOS Program Internal									X
A.1.8.4	Website Management									X
B.1	Observing Systems Subsystem									X
B.1.1	Observing Subsystem Management	X								X
B.1.1.1	Requirements Determination	X	X	X	X	X	X	X	X	X
B.1.1.2	Observing System Sharing Agreements	X	X							X
(B.3.1.5)	Unfulfilled Requirements Management	X			X			X		X
B.1.2	Surveys	X	X					X	X	X
B.1.3	Optimization Studies	X	X					X	X	X
B.1.4	Asset Management		X					X	X	X
B.1.4.1	Accountability		X				X			X
B.1.4.2	Life-Cycle Management		X				X			X
B.2	DMAC Subsystem									X
B.2.1	Register Data Providers		X	X		X				X
B.2.1.1	Certification		X	X		X				X
B.2.1.1.1	Assessments		X	X		X				X
B.2.1.1.1.1	Observations Available		X	X		X				X
B.2.1.1.1.2	Data Quality		X	X		X				X
B.2.1.1.1.3	Metadata		X	X		X				X
B.2.1.1.1.4	Update Latency		X	X		X				X
B.2.1.1.1.5	Refresh Frequency		X	X		X				X

Table K-1. Mapping of U.S. IOOS Activities to U.S. IOOS Partner Roles

Number	Activity	Data collector	Data provider	Services provider	Data/services customer	Sponsored model owner	Grantee	User council member	Governance body	U.S. IOOS Program Ofc
B.2.1.1.1.6	Security		X	X		X				X
B.2.1.1.1.7	Access Rights		X	X		X				X
B.2.1.1.1.8	Archive Requirements		X	X		X				X
B.2.1.1.1.9	Standards to Be Employed		X	X		X				X
B.2.1.1.1.10	Interface Requirements		X	X		X				X
B.2.1.1.1.11	Maturity Model Assessment		X	X		X				X
B.2.1.1.2	Certification Decision									X
B.2.1.1.3	Complete MOA		X	X		X				X
B.2.1.2	Registration		X	X		X				X
B.2.1.2.1	Institute Usage Reporting		X	X		X				X
B.2.1.2.2	Add to Registry		X	X		X				X
B.2.1.2.3	Notify Users									X
B.2.1.2.4	Installation Support		X	X		X				X
B.2.1.2.5	Reference Implementations		X	X		X				X
B.2.2	Manage Data Providers									X
B.2.2.1	Change Request									X
B.2.2.1.1	Receive Change Request		X	X		X				X
B.2.2.1.2	Evaluate Request									X
B.2.2.1.3	Approve Request									X
B.2.2.1.4	Publish Notifications				X					X
B.2.2.1.5	Make Changes		X							X
B.2.2.2	Cyclic Review									X
B.2.2.2.1	Identify Required Changes		X	X		X				X
B.2.2.2.2	Approve Changes									X
B.2.2.2.3	Make Changes									X
B.2.2.2.4	Publish Notifications				X					X
B.2.2.3	Monitor									X
B.2.2.3.1	Monitor Usage		X	X		X				X
B.2.2.3.2	Monitor Availability		X	X		X				X
B.2.2.3.3	Review Reports									X
B.2.2.3.4	Data Provider Help Desk									X
B.2.2.4	Update									X
B.2.2.4.1	Update Certification									X
B.2.2.4.2	Update Registry									X
B.2.2.4.3	Update MOA		X	X		X				X
B.2.2.4.4	Update Services			X						X

Table K-1. Mapping of U.S. IOOS Activities to U.S. IOOS Partner Roles

Number	Activity	Data collector	Data provider	Services provider	Data/services customer	Sponsored model owner	Grantee	User council member	Governance body	U.S. IOOS Program Ofc
B.2.2.5	Capability Assessments									X
B.2.3	De-register Data Providers									X
B.2.3.1	Request to Deregister		X	X		X				X
B.2.3.1.1	Receive Request									X
B.2.3.1.2	Approval									X
B.2.3.2	Notice to Data Provider		X	X		X				X
B.2.3.2.1	Create Notice									X
B.2.3.2.2	Transmission		X	X		X				X
B.2.3.2.3	Approval									X
B.2.3.2.4	Reconsideration		X	X		X				X
B.2.3.2.5	Final Approval									X
B.2.3.3	Notice to Users									X
B.2.3.3.1	Create Notice									X
B.2.3.3.2	Approval									X
B.2.3.3.3	Publish				X					X
B.2.3.3.4	Respond to Inquiries				X					X
B.2.3.4	Adjustment to Products and Services									X
B.2.3.4.1	Identify Changes									X
B.2.3.4.2	Approve Changes									X
B.2.3.4.3	Make Changes									X
B.2.3.4.4	Testing									X
B.2.3.4.5	Update Configuration Control Documents									X
B.2.3.5	Deregister									X
B.2.3.5.1	Update Registry									X
B.2.3.5.2	Archive Documents									X
B.2.4	Standards Management									X
B.2.4.1	Standards Assessment									X
B.2.4.1.1	Assess Efficiency and Effectiveness of Current Standards									X
B.2.4.1.2	Monitor evolution of standards									X
B.2.4.1.3	Create Requirements for New or Modified Standards									X
B.2.4.1.4	Standards Release Planning									X
B.2.4.2	Standards Development									X
B.2.4.2.1	Requirements Analysis		X	X	X	X		X		X
B.2.4.2.2	Solution Development									X

Table K-1. Mapping of U.S. IOOS Activities to U.S. IOOS Partner Roles

Number	Activity	Data collector	Data provider	Services provider	Data/services customer	Sponsored model owner	Grantee	User council member	Governance body	U.S. IOOS Program Ofc
B.2.4.2.3	Testing									X
B.2.4.2.4	Approval								X	X
B.2.4.3	Existing Standards Maintenance									X
B.2.4.3.1	Assess Change Requests		X	X	X	X		X		X
B.2.4.3.2	Approve Changes								X	X
B.2.4.3.3	Make Changes									X
B.2.4.3.4	Testing									X
B.2.4.3.5	Publish Change		X	X	X	X		X		X
B.2.4.4	Interface Management									X
B.2.4.4.1	Indentify Interface Require-ments				X	X				X
B.2.4.4.2	Identify Solutions									X
B.2.4.4.3	Document Solutions									X
B.2.4.5	Dictionaries and Catalogs									X
B.2.4.5.1	Controlled Vocabularies		X	X	X	X				X
B.2.4.5.2	Data Dictionaries		X	X	X	X				X
B.2.4.5.3	QA/QC Procedures		X	X	X	X				X
B.2.4.5.4	Metadata Profiles		X	X	X	X				X
B.2.4.5.5	Catalogs		X	X	X	X				X
B.2.5	Utility Services Management									X
B.2.5.1	Service Registry		X	X	X	X				X
B.2.5.1.1	Add New									X
B.2.5.1.2	Delete Old									X
B.2.5.1.3	Modify Entries									X
B.2.5.2	Data Catalog Service		X	X	X	X				X
B.2.5.2.1	Establish Services		X	X	X	X				X
B.2.5.2.2	Maintain Service									X
B.2.5.2.3	Evaluate Service									X
B.2.5.2.4	Disestablish Service		X	X	X	X				X
B.2.5.3	Data Integration Service		X	X	X	X				X
B.2.5.3.1	Receive Requests				X					X
B.2.5.3.2	Evaluate Requests									X
B.2.5.3.3	Approval									X
B.2.5.3.4	Establish Services		X	X	X	X				X
B.2.5.3.5	Maintain Service									X
B.2.5.3.6	Evaluate Service									X

Table K-1. Mapping of U.S. IOOS Activities to U.S. IOOS Partner Roles

Number	Activity	Data collector	Data provider	Services provider	Data/services customer	Sponsored model owner	Grantee	User council member	Governance body	U.S. IOOS Program Ofc
B.2.5.3.7	Disestablish Service		X	X	X	X				X
B.2.5.4	Mapping and Visualization Service		X	X	X	X				X
B.2.5.4.1	Receive Requests									X
B.2.5.4.2	Evaluate Requests									X
B.2.5.4.3	Approval									X
B.2.5.4.4	Establish Services		X	X	X	X				X
B.2.5.4.5	Maintain Service									X
B.2.5.4.6	Evaluate Service									X
B.2.5.4.7	Disestablish Service		X	X	X	X				X
B.2.5.5	Product Generation Services		X	X	X	X				X
B.2.5.5.1	Receive Requests				X					X
B.2.5.5.2	Evaluate Requests									X
B.2.5.5.3	Approval									X
B.2.5.5.4	Establish Services		X	X	X	X				X
B.2.5.5.5	Maintain Service									X
B.2.5.5.6	Evaluate Service									X
B.2.5.5.7	Disestablish Service		X	X	X	X				X
B.2.5.6	Format Conversion Service		X	X	X	X				X
B.2.5.6.1	Receive Requests				X					X
B.2.5.6.2	Evaluate Requests									X
B.2.5.6.3	Approval									X
B.2.5.6.4	Establish Services		X	X	X	X				X
B.2.5.6.5	Maintain Service									X
B.2.5.6.6	Evaluate Service									X
B.2.5.6.7	Disestablish Service		X	X	X	X				X
B.2.5.7	Coordinate Transformation Services		X	X	X	X				X
B.2.5.7.1	Establish Services		X	X	X	X				X
B.2.5.7.2	Maintain Service									X
B.2.5.7.3	Evaluate Service									X
B.2.5.7.4	Disestablish Service		X	X	X	X				X
B.2.5.8	Workflow Services		X	X	X	X	X			X
B.2.5.8.1	Receive Requests		X	X	X	X	X			X
B.2.5.8.2	Evaluate Requests									X
B.2.5.8.3	Approval									X

Table K-1. Mapping of U.S. IOOS Activities to U.S. IOOS Partner Roles

Number	Activity	Data collector	Data provider	Services provider	Data/services customer	Sponsored model owner	Grantee	User council member	Governance body	U.S. IOOS Program Ofc
B.2.5.8.4	Establish Services									X
B.2.5.8.5	Maintain Service									X
B.2.5.8.6	Evaluate Service		X	X	X	X	X			X
B.2.5.8.7	Disestablish Service									X
B.2.6	Utility Services Development									X
B.2.6.1	Quality Monitor Existing									X
B.2.6.1.1	Sampling			X						X
B.2.6.1.2	Automated Monitoring									X
B.2.6.1.3	User Surveys				X					X
B.2.6.2	Assess Service Requirements									X
B.2.6.2.1	Priority									X
B.2.6.2.2	Cost									X
B.2.6.2.3	Technical Solution									X
B.2.6.2.4	Time									X
B.2.6.2.5	Cost Benefit									X
B.2.6.3	Approve Changes								X	X
B.2.6.3.1	Approve								X	X
B.2.6.3.2	Schedule								X	X
B.2.6.4	Execute Changes									X
B.2.6.5	Testing									X
B.2.6.6	Notification		X	X	X	X		X		X
B.2.6.7	Deployment									X
B.2.7	Data Services and Component Development									X
B.2.7.1	Quality Monitor Existing									X
B.2.7.1.1	Sampling									X
B.2.7.1.2	Automated Monitoring									X
B.2.7.1.3	User Surveys		X	X	X	X				X
B.2.7.2	Assess Service Requirements									X
B.2.7.2.1	Priority									X
B.2.7.2.2	Cost									X
B.2.7.2.3	Technical solution									X
B.2.7.2.4	Time									X
B.2.7.2.5	Cost Benefit									X
B.2.7.3	Approve Changes									X

Table K-1. Mapping of U.S. IOOS Activities to U.S. IOOS Partner Roles

Number	Activity	Data collector	Data provider	Services provider	Data/services customer	Sponsored model owner	Grantee	User council member	Governance body	U.S. IOOS Program Ofc
B.2.7.3.1	Approve									X
B.2.7.3.2	Schedule									X
B.2.7.4	Execute Changes									X
B.2.7.5	Testing									X
B.2.7.6	Notification									X
B.2.7.7	Deployment									X
B.2.8	Data Services and Component Management									X
B.2.8.1	Data Access Services									X
B.2.8.2	Data Subscriptions and Alerts Services									X
B.2.8.3	System Viewer Component									X
B.2.8.4	System Monitor Component									X
B.2.9	Configuration Control									X
B.2.9.1	Review Documentation									X
B.2.9.2	Update Documentation									X
B.3	Modeling and Analysis Subsystem									X
B.3.1	Customer Needs									X
B.3.1.1	Customer Input				X					X
B.3.1.1.1	Survey				X					X
B.3.1.1.2	Comments				X					X
B.3.1.1.3	Requests				X					X
B.3.1.2	Data Needs Assessment									X
B.3.1.2.1	Determine Needs				X					X
B.3.1.2.2	Determine Sources		X							X
B.3.1.2.3	Negotiate Participation									X
B.3.1.3	Model Output Needs Assess-ment									X
B.3.1.3.1	Determine Needs				X					X
B.3.1.3.2	Determine Sources					X				X
B.3.1.3.3	Negotiate Participation									X
B.3.1.4	Service Needs Assessment									X
B.3.1.4.1	Determine Needs				X					X
B.3.1.4.2	Determine Service			X						X
B.3.1.5	Unfulfilled Requirements Man-agement				X			X		X
B.3.1.5.1	Master List Maintenance									X
B.3.1.5.2	Solution Scenario Generation									X

Table K-1. Mapping of U.S. IOOS Activities to U.S. IOOS Partner Roles

Number	Activity	Data collector	Data provider	Services provider	Data/services customer	Sponsored model owner	Grantee	User council member	Governance body	U.S. IOOS Program Ofc
B.3.1.5.3	Advocacy							X	X	X
B.3.1.6	Customer Help Desk				X					X
B.3.1.6.1	Help Desk				X					X
B.3.1.6.2	Frequency Analysis				X					X
B.3.2	Sponsored Models									X
(B.2.1)	Register a Data Provider					X				X
(B.2.2)	Manage Data Providers					X				X
(B.2.3)	Deregister a Data Provider					X				X
B.3.3	MOU Management									X
B.3.3.1	Create MOU		X	X		X				X
B.3.3.2	Gain Concurrence									X
B.3.3.3	Coordinate for Certification									X
B.3.4	Publish Standards		X	X	X	X		X	X	X
B.3.4.1	Standards in Use		X	X	X	X				X
B.3.4.2	"How To"		X	X	X	X				X
B.3.4.3	Reference Implementations		X	X	X	X				X
C.1	Research and Development									X
C.1.1	Requirements Determination							X		X
C.1.1.1	Requirements Gathering							X		X
C.1.1.2	Requirements Analysis									X
C.1.1.3	Requirements Prioritization									X
C.1.1.4	Requirements Publication									X
C.1.2	Coordinate R&D Programs									X
C.1.2.1	Sponsor Forums							X		X
C.1.2.2	R&D Progress Monitoring							X		X
C.1.2.3	R&D Grants Technical Management						X			X
C.1.2.4	R&D Agreements Management							X		X
C.1.3	R&D Pilot Projects									X
C.1.3.1	Concept Development									X
C.1.3.2	Project Team Agreements							X		X
C.1.3.3	Project Management									X
C.1.3.4	Budgeting									X
C.1.3.5	Reporting									X
C.1.4	Technical Assessments									X
C.1.4.1	Candidate Technology Management		X					X		X

Table K-1. Mapping of U.S. IOOS Activities to U.S. IOOS Partner Roles

Number	Activity	Data collector	Data provider	Services provider	Data/services customer	Sponsored model owner	Grantee	User council member	Governance body	U.S. IOOS Program Ofc
C.1.4.2	Tech Assessment Design									X
C.1.4.3	Budget								X	X
C.1.4.4	Plans									X
C.1.4.5	Operations									X
C.1.4.6	Report Generation									X
C.1.4.7	Findings Publication							X		X
C.1.4.8	Archives									X
C.1.5	Tech Enhancements									X
C.1.5.1	Project Definition							X	X	X
C.1.5.2	Project Management									X
C.1.5.3	Agreements Management									X
C.1.5.4	Budgeting									X
C.1.5.5	COTR									X
C.1.5.6	Test and Evaluation									X
C.1.6	Tech Transition									X
C.1.6.1	Project Definition							X	X	X
C.1.6.2	Project Management									X
C.1.6.3	Agreements Management									X
C.1.6.4	Budgeting									X
C.1.6.5	Test and Evaluation									X
D.1	Training and Education									X
D.1.1	Training and Education Strategy and Plans Development									X
D.1.1.1	Strategy Development							X	X	X
D.1.1.2	Plans Development									X
D.1.2	Training and Curriculum Develop-ment									X
D.1.2.1	Training Development									X
D.1.2.2	Curriculum Development									X
D.1.3	Training and Education Pilot Projects									X
D.1.3.1	Concept Development							X	X	X
D.1.3.2	Project Team Agreements							X		X
D.1.3.3	Project Management									
D.1.3.4	Budgeting									X
D.1.3.5	Reporting									X
D.1.4	Assessments									X
D.1.4.1	Work Force Needs Assessments							X		X

Table K-1. Mapping of U.S. IOOS Activities to U.S. IOOS Partner Roles

Number	Activity	Data collector	Data provider	Services provider	Data/services customer	Sponsored model owner	Grantee	User council member	Governance body	U.S. IOOS Program Ofc
D.1.4.2	Assessment Development									**X**
D.1.4.3	Assessment Results and Evaluation							**X**		**X**
D.1.5	Collaboration with Education Delivery Managers									**X**
D.1.6	Professional Certifications									**X**
D.1.6.1	Standards Development							**X**	**X**	**X**
D.1.6.2	Publications									**X**
D.1.6.3	Assessment Administration									**X**
D.1.6.4	Application Processing									**X**
D.1.6.5	Certification and Notifications									**X**
D.1.6.6	Records Maintenance									**X**

Appendix L
Abbreviations

DAC	data assembly center
DIF	data integration framework
DMAC	data management and communications
FC	full capability
GEOSS	Global Earth Observation System of Systems
GOOS	Global Ocean Observing System
GTS	Global Telecommunications System
ICOOS	Integrated Coastal and Ocean Observation System
IC	initial capability
IOOC	Interagency Ocean Observation Committee
IOOS®	Integrated Ocean Observing System
IT	information technology
IWGOO	Interagency Working Group on Ocean Observations
MOU	memorandum of understanding
NASA	National Aeronautics and Space Administration
NGO	nongovernmental organization
NOAA	National Oceanic and Atmospheric Administration
POC	point of contact
QA	quality assurance
QC	quality control
R&D	research and development
RA	Regional Association
RCOOS	Regional Coastal Ocean Observing System
WMO	World Meteorological Organization