

Integrated Ocean Observing System (IOOS)

Cost Estimate

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Change History

Change Contact	Date	Summary of Change
	August 31, 2006	Initial Release
	September 8, 2006	Lockheed Martin Proprietary Information notice removed from document. Copyright information added to title page.

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1. PURPOSE AND SCOPE

The purpose of this cost estimate document is to provide the life cycle costs of Lockheed Martin Team's conceptual design for IOOS. This document is a companion document to Lockheed Martin Team's Conceptual Design document.

The document describes the assumptions and methodology used in estimating the life cycle costs of the IOOS conceptual design.

1.1 Cost Estimation Objective

The objective of Lockheed Martin Team's cost estimation process was to determine a one time development or implementation cost of IOOS, and the costs of its on-going operations and maintenance. Further, it was the objective to be able to present the cost numbers by the three IOOS subsystems – namely, DMAC, Observing and Modeling/Analysis, as well as by participating Agencies and Regional Associations.

1.2 Document Structure

This document is composed in the following manner:

- Assumptions
- Implementation Timeline
- Estimating Methodology
 - Management & Oversight Functions
 - Governance
 - Development
 - IOOS Infrastructure
 - IOOS Integration
 - Operations and Maintenance
- Work Breakdown Structure
- Costs
- Referenced Programs

2. ASSUMPTIONS

The following key assumptions were made in estimating the life cycle costs of the IOOS conceptual design:

- IOOS will be managed as a Program with an oversight body responsible for coordinating its implementation
- IOOS will be implemented to support a federated system-of-systems environment, fully leveraging existing assets within participating stakeholders

- IOOS will require some new infrastructure that will provide the framework for integrating existing assets
- IOOS will be implemented over a period of five (5) years followed by an operations and maintenance period of fifteen (15) years for a total life cycle of twenty (20) years
- IOOS will leverage all existing stakeholder physical facilities with the exception of three (3) facilities that will be established specifically for IOOS, including an IOOS service center with 24X7 operations.
- On-going operations and maintenance as well as planned enhancement costs of existing systems/programs, even after their integration into IOOS, are not part of IOOS life cycle costs
- On-going operations and maintenance cost of the *integration layer* of existing systems/programs are part of IOOS life cycle costs
- NOAA-provided and other publicly available budget information on Federal agency Oceans and Coastal programs represent and include operations and maintenance costs of all existing systems/programs, as well as costs for planned enhancements to those systems and programs
- Overhead costs such as costs associated with Program Management, Governance, etc. are the same across all participating stakeholders
- Facility costs for Governance and Education/Outreach functions will be borne by participating stakeholders and are not part of IOOS life cycle costs
- An IOOS ‘system’ or ‘program’ is viewed as:
 - A database with IOOS-related information (e.g., observations, models, analyzed data) that is periodically updated through a number of mechanisms including manual updates, that is then made available for use by the IOOS user, or
 - A physical entity made up of dedicated hardware and software, or a network of such physical entities, that provide observations, models and products into IOOS either in real-time or via a local storage, either autonomously or on-demand from the user

In either case, there will be people, processes, tools and facilities associated with these systems and programs.

- There are two types of systems/programs in all participating stakeholders – simple and complex. The distinction between a simple and complex system/program is in the number of service components that they contribute to the target IOOS service oriented architecture, as noted below:
 - A simple system is assumed to contribute three (3) service components to IOOS
 - A complex system is assumed to contribute eight (8) service components to IOOS
- Eight (8) Federal Agencies and eleven (11) Regional Associations are assumed to participate in and contribute service components to IOOS. Each of these agencies and regional associations are assumed to have a mix of simple and complex existing or new systems as shown in the following table:

Table 1.2-1 Number of Systems/Programs in Stakeholders

Agency/Regional Association	Number of Systems/Programs	Number of Simple Systems/Programs	Number of Complex Systems/Programs
NOAA	97	17	80
EPA	3	1	1
NSF	8	0	8
NASA	0	3	0
NAVY	2	2	0
MMS	17	1	11
USGS	28	17	11
USACE	3	1	2
All Other Agencies	28	17	11
Each Regional Association	3	2	1

- IOOS costs by the three subsystems are determined by a simple allocation of total IOOS integration costs at each Agency and Regional Association as follows:
 - DMAC – 60%
 - Modeling and Analysis – 20%
 - Observing – 20%
- Agency and Regional Association infrastructure costs to support their contributions to IOOS are part of IOOS life cycle costs
- Marketing activities, including the preparation and production of non-electronic media (e.g., pamphlets) are not part of the IOOS Education and Outreach costs.
- Major technology refresh occurs every 3 years during the 15 year operations and maintenance period
- Travel costs incurred in IOOS development and deployment activities are part of IOOS life cycle costs
- Active, dedicated Program Management, Governance, and System Engineering functional entities with people, processes and tools will be maintained right through the life cycle of IOOS
- Cost estimate is of a high level conceptual design – and not of a system design and is therefore subject to variances as IOOS moves from concepts to detailed design and implementation

3. IOOS IMPLEMENTATION TIMELINE

Figure 3.2-1 below illustrates the assumed implementation timeline for IOOS that was used as the basis for cost estimation.

3.1 Implementation Phase

As shown in the figure, years 1 through 5 form the implementation phase of IOOS. Years 1 and 2 of this implementation phase will focus on establishing and executing the Program Management and Governance functions, System Engineering functions, development of the IOOS infrastructure services and integrating a limited number of existing Federal Agency and Regional Association assets into IOOS. This will culminate at the end of year 2 in achieving the Initial Operational Capability (IOC) of IOOS.

Following the successful verification of the IOOS IOC, years 3 through 5 will focus on expanding the IOOS infrastructure services to accommodate the integration of all identified Federal and Regional Association assets including the National Backbone. This will culminate at the end of year 5 in achieving the Full Operational Capability of IOOS. Years 3 through 5 will also include the operations and maintenance of all assets that were part of IOOS IOC.

3.2 Operations and Maintenance Phase

Operations and Maintenance phase spans years 6 through 20 of the IOOS Program. This phase is dedicated to the following activities:

- Maintenance of IOOS infrastructure services
- Maintenance of service upgrades based on technology refresh activities
- On-going development and management of software and hardware
- Management and resolution of software and hardware defects
- Routine system maintenance such as backup of logs and configuration files in accordance with automated backup procedures
- Maintenance and management of software and hardware configuration
- Maintenance of Agency and Regional Association interfaces with IOOS including subsystem-specific services and IOOS infrastructure services
- Maintenance and management of IOOS facilities

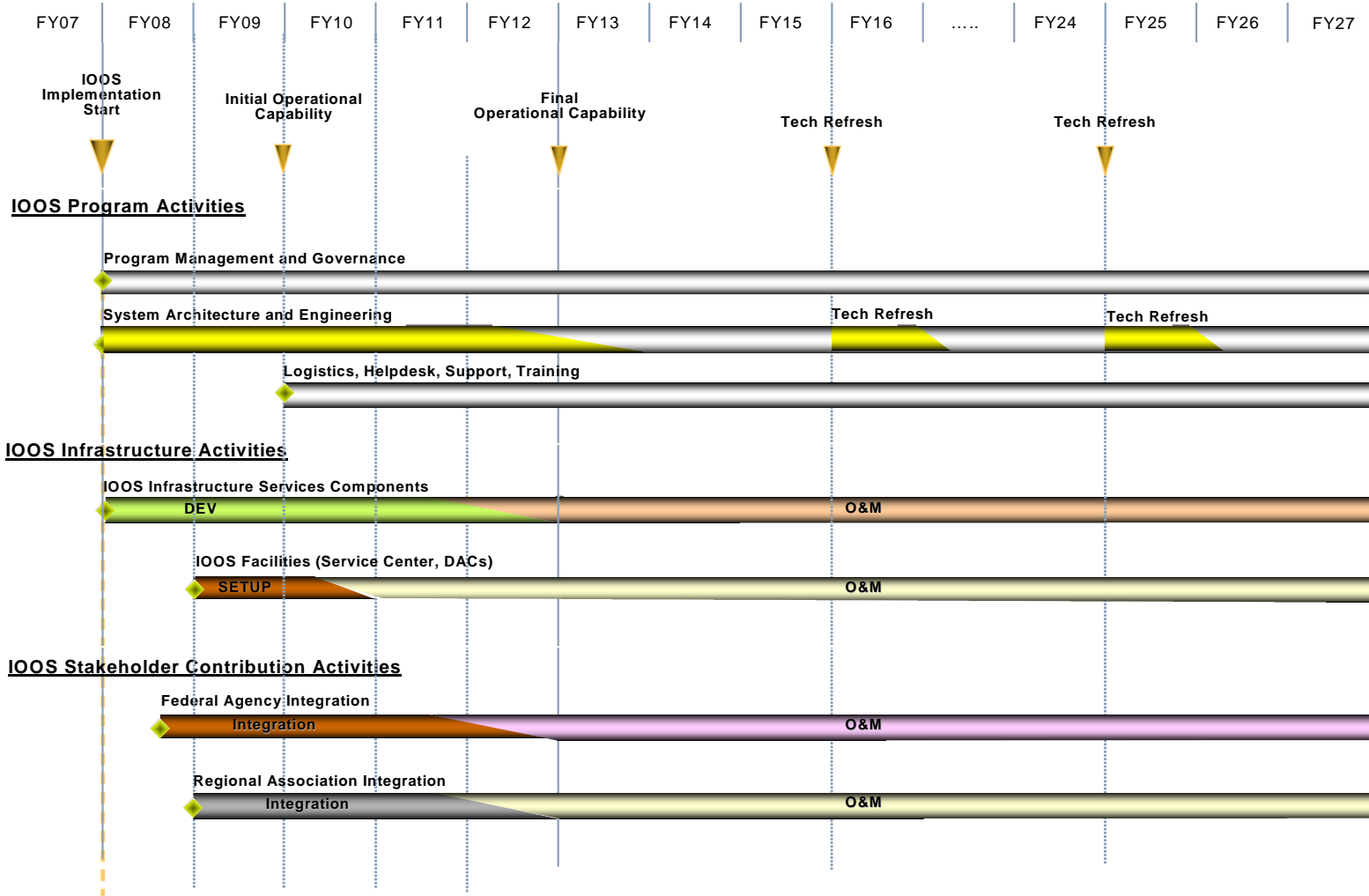


Figure 3.2-1 IOOS Implementation Timeline

4. COST ESTIMATION METHODOLOGY

The Lockheed Martin Team adopted a customized life cycle cost estimation methodology and Lockheed Martin proprietary tools for estimating the cost of the IOOS conceptual design. The methodology used principles and approaches from industry-standard methodologies such as COCOMO/COCOMO II, COCOTS, RADC, COQUALMO, COSYSMO, etc. The customized methodology is rational given the following:

- The high-level nature of the proposed conceptual design.
- The inheritance and incorporation of third party work done on estimating the costs of observing and modeling systems.
- The *federated* ‘system of systems’ nature of IOOS. Methodologies such as COCOMO are more suited for N-Tier system cost estimation and are therefore not applicable without some level of modification and adaptation.

The seed for estimating life cycle costs of implementing and maintaining the IOOS conceptual design is the life cycle cost of developing and maintaining an IOOS service component. An IOOS service component is a software-hardware entity that may be new or may be a modification to an existing software-hardware asset. The life cycle cost of developing and maintaining a service component includes labor, material and overhead such as management and governance.

The life cycle cost of implementing and maintaining the IOOS conceptual design is then computed as an aggregate total of the life cycle costs of developing and maintaining **all** service components that make up IOOS.

A participating stakeholder’s ‘system’ or ‘program’ is considered to contribute a certain number of service components to IOOS.

4.1 Cost Estimation Process

The cost estimation process consisted of the following:

- Defining the life cycle cost elements
- Defining a work breakdown structure for implementing the conceptual design
- Estimating the one time development cost of new assets of the IOOS conceptual design
- Estimating the one time development cost for integrating existing assets into the target IOOS conceptual design
- Estimating an on-going operations and maintenance cost of the integrated IOOS conceptual design
- Leveraging cost information from NOAA-provided and publicly available budget information to determine on-going operations and maintenance costs of *existing* assets in Federal Agencies and Regional Associations

- Leveraging NOAA provided Federal Agency program and budget information to determine the complexity of an existing system/program
- Leveraging experiential data from Lockheed's large base of implemented projects that had program, project and design elements comparable in scope, scale and size to IOOS

4.2 Cost Elements:

Cost elements of the cost estimate are adapted from proven life cycle cost determination methodologies and include all functional aspects of a typical design implementation as follows:

- Program Management and Control
 - Scheduling
 - Risk Management
 - Logistics
- System Engineering
 - Requirements Definition
 - Requirements Analysis
 - System Design
 - Detailed Design and Development
 - Testing and Verification
- Deployment (using existing assets as a dominant component)
- Acceptance Testing
- On-going Operations
- On-going Maintenance (including periodic Technology Refresh)
- Quality Assurance
- Education and Outreach.

5. WORK BREAKDOWN STRUCTURE

The IOOS Work Breakdown Structure (WBS) documents the tasks that have to be performed for the implementation of IOOS. Its hierarchical arrangement allows for easy identification of the activities to be accomplished within the program and serves as the basis for much of the project planning. The WBS was worked to a level required to estimate costs. The levels are consistent with the IOOS design being at the conceptual level. It is expected that this WBS will be broken down into lower levels during the System Engineering phase of IOOS.

In developing the WBS for the IOOS program special attention was given to ensure costs could be allocated and managed from both an overall program perspective as well as from each stakeholder's perspective.

Table 4.2-1 IOOS Work Breakdown Structure

WBS	WBS Title
1.1	IOOS Management and Oversight
1.1.2	Program Management
1.1.3	System Engineering
1.2	IOOS Governance
1.2.1	IOOS Policies and Standards
1.2.2	Education and Outreach
1.3	IOOS Infrastructure Services
1.3.1	Security Services
1.3.2	Enterprise Services
1.3.3	Interoperability Services
1.3.4	Portal Services
1.3.5	Data Services
1.3.6	Data Collection Services
1.3.7	Data Storage Services
1.3.8	IOOS Facilities
1.4	DMAC Subsystem
1.5	Observing Subsystem
1.6	Modeling and Analysis Subsystem

Costs associated with WBS line items pertaining to design and development were estimated based on a combination of bottoms-up ‘level of effort’ estimation, and extensive experiential data from previous large-scale programs managed and executed by Lockheed Martin that had project and design elements comparable to IOOS in scope, scale and size.

Costs associated with WBS line items pertaining to non-design and development - such as Program Management - were then assigned a percentage of the total design and development costs, based on the extensive experiential data at Lockheed Martin.

5.1 Management and Oversight Functions

5.1.1 Program Management

Activities included in this WBS line item include all program and support organization functions as follows:

- Program Management
- Program/Project Controls
- Business Management
- Contracts
- Subcontractor Management
- Procurement
- Configuration and Data Management
- Quality Assurance and Control
- Risk Management
- Training.

18.5% of the aggregate service component development costs are applied to these functional.

5.1.2 Systems Engineering

Activities included in the System Engineering include functions listed below:

- Requirements Definition
- System Architecture
- Technical Management
- System Test and Integration
- Data Modeling and Architecture
- Business Process Engineering.

8% of the aggregate service component development costs are applied to these functional elements.

5.2 IOOS Governance

5.2.1 IOOS Policies and Standards

Activities included in IOOS Policies and Standards include functions listed below:

- Establish IOOS operational policies including Security policies, data archiving policies, etc.
- Establish IOOS data and metadata standards
- Determine data presentation styles
- Education and Outreach
- Build International Partnership
- Manage document deliverable development and distribution
- Financial Oversight

IOOS Governance costs were determined by estimating a number of committees focused on various IOOS business processes and by estimating deliverables owned by the IOOS Governance group. Labor costs were determined by estimating the number of participants in each committee, the frequency of each meeting, and duration of each scheduled meeting.

Committee participants many include the following:

- Federal Agencies
- Regional Associations
- Data providers,
- IOOS Program Office,
- IOOS contractors representing engineering/architecture, researchers, and commercial organizations.

The deliverable (materials) estimates are based on the number of deliveries per year added to labor estimates based on LM deliverable productivity rates.

5.2.2 IOOS Education and Outreach

Activities included in the Education and Outreach cost account include functions such as those listed below:

- Promoting literacy and use of IOOS data and data products through web and portal pages
- Creating and managing a program to fund activities to commercialize application of IOOS data
- Managing various marketing activities (i.e. TV/ Radio spots, hosting conferences, etc).

The IOOS Education and Outreach group is envisioned to provide workshops to support marketing, public education and outreach, technology, and literacy. Workshop participants may include Federal Agencies, Regional Associations, data providers, IOOS Program Office representatives, researchers, and commercial organizations. It is assumed workshop publications such as newsletters and other communication notifications will be posted on the IOOS Portal. The estimate is based on determining the number of participants and the number of times a workshop is scheduled within a year. Posting workshop technical material and communication notifications on the IOOS Portal are based on 1.5FTE per year for the duration of the program.

5.3 IOOS Infrastructure Services

5.3.1 Core Infrastructure Services

The core infrastructure services to be placed in operations during the implementation phase as described in the Conceptual Design document include:

- Security Services. Security Services include components supporting encryption, digital signature, PKI, security controls, account session management, and identify management.
- Enterprise Services. Enterprise Services include components supporting external system interfaces, directory services, message queue management, IOOS business/commerce services, and IOOS library services.

- Interoperability Services. Interoperability Services include translation functionality between multiple data standards.
- Portal Services. Portal Services provides access to all IOOS products and services to general public and other users.
- Data Services. Data Services obtains data from various sources and delivers data to a data consumer in a format and mechanism that conforms to IOOS standards.
- Data Collection Services. Data Collection Services include components supporting data assembly, quality control, dissemination, and metadata management.
- Data Storage Services. Data Storage Services include components supporting data archives, data repository, data retention, data access policies, data retention, and data catalog.

5.3.2 IOOS Facilities

The development and production facilities to be established in support of the implementation phase of IOOS include:

- IOOS Program Support Facility
- IOOS Service Center (ISC)
- IOOS Service Center Backup Site
- IOOS Data Assembly Center (DAC)
- IOOS Communications Network facilities

Facility costs were derived using industry standards and past Lockheed Martin program experiences. Costs for facility space are assumed to be \$25/ sq. ft. on a national average basis. Facility size estimates were based on the seat count required by the staff at peak hours, in addition to providing adequate lab space (33% of the overall facility size) to support IOOS operations.

The IOOS Service Center is a facility housing the people and systems in support of the entire IOOS program, including Program Management, Systems Engineering, and Operations Supports.

The initial cost of the Data Assembly Center (DAC) is estimated at a higher cost based on the larger size and robust hardware/ software capabilities required of an industry standard data center. Costs based on disk storage are assumed to be \$3M/petabytes. Long term archive costs were assumed to be based on tape storage with a cost of \$300K/petabytes.

5.3.3 Agency and Regional Association Integration

This section describes WBS line items 1.4, 1.5, and 1.6.

For each Federal Agency, the development estimate for integration is based on reviewing existing Agency programs with FY06 budget information provided by NOAA. The Agency

programs are evaluated based on the degree of system complexity - simple or complex. A simple system is considered to be an operational DMAC IT system or Modeling and Analysis IT system. A complex system is considered to be an operational Observing system which includes sensors, supporting communication networks, and current research endeavors. Simple system is assumed to contribute three IOOS service components. A complex system is assumed to contribute eight IOOS service components.

To determine the labor for each Federal Agency's integration development, the total number of simple and complex systems is multiplied by the service component labor estimates.

For each Regional Association, the development estimate is based on the labor estimate of a mid-size Federal Agency since it is expected that there will be significant variances in system complexity across the Regional Associations. For each Regional Association, one simple and two complex systems were factored into the labor estimate.

Material costs are determined as a percentage of the integration labor estimates. This percentage number was determined based on Lockheed Martin's experiential data from a variety of programs that had project and design elements comparable to IOOS in scope, scale and size.

6. COST TABLES

All cost numbers in the following cost tables are in millions. IOOS implementation is assumed to start FY2008.

6.1 IOOS Total Cost – Consolidated

The total IOOS costs is the sum total of life cycle costs of developing and maintaining IOOS infrastructure service components as well as developing and maintaining IOOS service components at all participating stakeholders. The latter represents the lifecycle costs of the IOOS integration layer. The costs by the three subsystems shown in the table are determined by a simple allocation of the total integration layer costs as follows:

- DMAC – 60%
- Modeling and Analysis – 20%
- Observing – 20%

Table 6.1-1 IOOS Total Costs (Implementation and Operations & Maintenance FY08-FY27)

WBS	Cost Element	Labor	Other Direct Costs	Total
1.1	Program Management	\$ 275.0	\$ 30.0	\$ 305.0
1.2	Governance	\$ 75.0	\$ -	\$ 75.0
1.3	IOOS Infrastructure Services	\$ 1,550.0	\$ 140.0	\$ 1,690.0
1.4	DMAC Subsystem	\$ 2,635.0	\$ 220.0	\$ 2,855.0
1.5	Observing Subsystem	\$ 900.0	\$ 80.0	\$ 980.0
1.6	Modeling and Analysis Subsystem	\$ 955.0	\$ 80.0	\$ 1,035.0
	Total	\$ 6,390.0	\$ 550.0	\$ 6,940.0

‘Other Direct Costs’ include material, facilities and travel costs.

6.2 IOOS Implementation Phase Costs – Year by Year

Table 6.2-1 IOOS Implementation Cost - Year by Year (FY08-FY12)

WBS	Cost Element	FY08	FY09	FY10	FY11	FY12	Total
1.1	Program Management	\$ 16	\$ 15	\$ 19	\$ 20	\$ 15	\$ 85
1.2	Governance	\$ 6	\$ 7	\$ 7	\$ 7	\$ 8	\$ 35
1.3	IOOS Infrastructure Services	\$ 86	\$ 77	\$ 90	\$ 95	\$ 57	\$ 405
1.4	DMAC Subsystem	\$ 20	\$ 190	\$ 315	\$ 206	\$ 174	\$ 905
1.5	Observing Subsystem	\$ 6	\$ 48	\$ 70	\$ 80	\$ 116	\$ 320
1.6	Modeling and Analysis Subsystem	\$ 10	\$ 44	\$ 76	\$ 131	\$ 79	\$ 340
	Total	\$ 144	\$ 381	\$ 577	\$ 539	\$ 449	\$ 2,090

6.3 Operations and Maintenance

Operations and Maintenance phase of the IOOS Program is dedicated to the operations and maintenance of the IOOS framework and IOOS infrastructure services and the maintenance of IOOS service components developed and contributed by each agency and regional association. The period of performance for the operations and maintenance phase is 15 years commencing FY13 and ending in FY27. However, IOOS infrastructure services needed to allow integration between Agency and RA service components are implemented and transition into an operations and maintenance state during the 5-year implementation phase itself. For this reason, costs associated with operations and maintenance commence in FY09.

Table 6.3-1 IOOS Operation and Maintenance Costs - Year by Year (FY08-FY14)

WBS	Cost Element	FY08	FY09	FY10	FY11	FY12	FY13	FY14
1.1	Program Management	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 12	\$ 12
1.2	Governance	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 2	\$ 2
1.3	IOOS Infrastructure Services	\$ -	\$ 3	\$ 6	\$ 12	\$ 18	\$ 65	\$ 67
1.4	DMAC Subsystem	\$ -	\$ 1	\$ 6	\$ 26	\$ 35	\$ 103	\$ 106
1.5	Observing Subsystem	\$ -	\$ -	\$ 1	\$ 4	\$ 8	\$ 32	\$ 36
1.6	Modeling and Analysis Subsystem	\$ -	\$ -	\$ -	\$ 2	\$ 11	\$ 37	\$ 38

WBS	Cost Element	FY08	FY09	FY10	FY11	FY12	FY13	FY14
	Subtotal	\$ -	\$ 4	\$ 13	\$ 44	\$ 72	\$ 251	\$ 261

Table 6.3-2 IOOS Operation and Maintenance Costs - Year by Year (FY15-FY21)

WBS	Cost Element	FY15	FY16	FY17	FY18	FY19	FY20	FY21
1.1	Program Management	\$ 13	\$ 13	\$ 14	\$ 14	\$ 14	\$ 15	\$ 15
1.2	Governance	\$ 2	\$ 2	\$ 2	\$ 2	\$ 3	\$ 3	\$ 3
1.3	IOOS Infrastructure Services	\$ 70	\$ 74	\$ 75	\$ 77	\$ 80	\$ 84	\$ 85
1.4	DMAC Subsystem	\$ 110	\$ 113	\$ 117	\$ 120	\$ 124	\$ 127	\$ 131
1.5	Observing Subsystem	\$ 37	\$ 38	\$ 39	\$ 41	\$ 42	\$ 43	\$ 44
1.6	Modeling and Analysis Subsystem	\$ 39	\$ 40	\$ 41	\$ 43	\$ 44	\$ 45	\$ 46
	Subtotal	\$ 271	\$ 280	\$ 288	\$ 297	\$ 307	\$ 317	\$ 324

Table 6.3-3 IOOS Operation and Maintenance Costs - Year by Year (FY22-FY27)

WBS	Cost Element	FY22	FY23	FY24	FY25	FY26	FY27	Total
1.1	Program Management	\$ 15	\$ 16	\$ 16	\$ 17	\$ 17	\$ 17	\$ 220
1.2	Governance	\$ 3	\$ 3	\$ 3	\$ 3	\$ 3	\$ 4	\$ 40
1.3	IOOS Infrastructure Services	\$ 88	\$ 90	\$ 95	\$ 96	\$ 100	\$ 100	\$ 1,285
1.4	DMAC Subsystem	\$ 135	\$ 139	\$ 143	\$ 142	\$ 134	\$ 138	\$ 1,950
1.5	Observing Subsystem	\$ 45	\$ 47	\$ 49	\$ 50	\$ 51	\$ 53	\$ 660
1.6	Modeling and Analysis Subsystem	\$ 48	\$ 49	\$ 51	\$ 52	\$ 54	\$ 55	\$ 695
	Subtotal	\$ 334	\$ 344	\$ 357	\$ 360	\$ 359	\$ 367	\$ 4,850

6.4 IOOS Costs by Stakeholder

Table 6.4-1 IOOS Costs by Stakeholder

Stakeholder	Development	O&M	Total
Lead Agency	\$ 542	\$ 1,586	\$ 2,128
NOAA	\$ 753	\$ 1,529	\$ 2,282
EPA	\$ 52	\$ 119	\$ 171
NASA	\$ 52	\$ 122	\$ 174
NAVY	\$ 5	\$ 11	\$ 16
NSF	\$ 70	\$ 157	\$ 227
USGS	\$ 146	\$ 296	\$ 442
USACE	\$ 20	\$ 47	\$ 67
MMS	\$ 124	\$ 277	\$ 401
Other Agencies	\$ 102	\$ 204	\$ 306
Regional Associations (11)	\$ 227	\$ 499	\$ 726
Total	\$ 2,093	\$ 4,847	\$ 6,940

6.5 Operations and Maintenance of Existing Systems/Programs

Costs indicated in the tables of this subsection were extracted from NOAA-provided and publicly available IOOS-related budget information. These costs are not in any way related to the costs provided in earlier sections. They are being provided for the convenience of ascertaining the overall IOOS of costs picture.

These costs are assumed to include all planned enhancements (such as increasing the number of buoys in a Federal Agency’s observing program). The costs were adjusted for inflation in the out years.

Table 6.5-1 Operations and Maintenance of Existing Systems (FY08-FY14)

Organization Name	FY08	FY09	FY10	FY11	FY12	FY13	FY14
EPA	\$ 29	\$ 30	\$ 31	\$ 31	\$ 32	\$ 33	\$ 34
Navy	\$ 52	\$ 53	\$ 55	\$ 57	\$ 58	\$ 60	\$ 62

Organization Name	FY08	FY09	FY10	FY11	FY12	FY13	FY14
NOAA	\$ 378	\$ 389	\$ 401	\$ 413	\$ 426	\$ 438	\$ 451
NSF	\$ 11	\$ 11	\$ 12	\$ 12	\$ 12	\$ 13	\$ 13
MMS	\$ 2	\$ 2	\$ 2	\$ 3	\$ 3	\$ 3	\$ 3
USGS	\$ 120	\$ 123	\$ 127	\$ 131	\$ 135	\$ 139	\$ 143
USACE	\$ 3	\$ 3	\$ 3	\$ 3	\$ 3	\$ 3	\$ 3
USCG	\$ 5	\$ 6	\$ 6	\$ 6	\$ 6	\$ 6	\$ 7
NASA	\$ 19	\$ 20	\$ 20	\$ 21	\$ 22	\$ 22	\$ 23
Other Agencies	\$ 106	\$ 109	\$ 112	\$ 115	\$ 119	\$ 122	\$ 126
Regional Associations (11)	\$ 44	\$ 45	\$ 47	\$ 48	\$ 49	\$ 51	\$ 53
Subtotal	\$ 769	\$ 791	\$ 816	\$ 840	\$ 865	\$ 890	\$ 918

Table 6.5-2 Operations and Maintenance of Existing Systems (FY15-FY21)

Organization Name	FY15	FY16	FY17	FY18	FY19	FY20	FY21
EPA	\$ 35	\$ 36	\$ 38	\$ 39	\$ 40	\$ 41	\$ 42
Navy	\$ 64	\$ 66	\$ 68	\$ 70	\$ 72	\$ 74	\$ 76
NOAA	\$ 465	\$ 479	\$ 493	\$ 508	\$ 523	\$ 539	\$ 555
NSF	\$ 14	\$ 14	\$ 14	\$ 15	\$ 15	\$ 16	\$ 16
MMS	\$ 3	\$ 3	\$ 3	\$ 3	\$ 3	\$ 3	\$ 3
USGS	\$ 147	\$ 151	\$ 156	\$ 161	\$ 166	\$ 171	\$ 176
USACE	\$ 3	\$ 3	\$ 3	\$ 4	\$ 4	\$ 4	\$ 4
USCG	\$ 7	\$ 7	\$ 7	\$ 7	\$ 8	\$ 8	\$ 8
NASA	\$ 24	\$ 24	\$ 25	\$ 26	\$ 27	\$ 27	\$ 28
Other Agencies	\$ 130	\$ 134	\$ 138	\$ 142	\$ 146	\$ 151	\$ 155
Regional Associations (11)	\$ 54	\$ 56	\$ 57	\$ 59	\$ 61	\$ 63	\$ 65
Subtotal	\$ 946	\$ 973	\$ 1,002	\$ 1,034	\$ 1,065	\$ 1,097	\$ 1,128

Table 6.5-3 Operations and Maintenance of Existing Systems (FY22-FY27)

Organization Name	FY22	FY23	FY24	FY25	FY26	FY27	Total
EPA	\$ 44	\$ 45	\$ 46	\$ 48	\$ 49	\$ 51	\$ 774
Navy	\$ 78	\$ 81	\$ 83	\$ 86	\$ 88	\$ 91	\$ 1,394
NOAA	\$ 572	\$ 589	\$ 607	\$ 625	\$ 644	\$ 663	\$ 10,158
NSF	\$ 17	\$ 17	\$ 18	\$ 18	\$ 19	\$ 19	\$ 296
MMS	\$ 4	\$ 4	\$ 4	\$ 4	\$ 4	\$ 4	\$ 63
USGS	\$ 181	\$ 186	\$ 192	\$ 198	\$ 204	\$ 210	\$ 3,217
USACE	\$ 4	\$ 4	\$ 4	\$ 4	\$ 5	\$ 5	\$ 72
USCG	\$ 8	\$ 9	\$ 9	\$ 9	\$ 9	\$ 10	\$ 148
NASA	\$ 29	\$ 30	\$ 31	\$ 32	\$ 33	\$ 34	\$ 517
Other Agencies	\$ 160	\$ 164	\$ 169	\$ 174	\$ 180	\$ 185	\$ 2,837
Regional Associations (11)	\$ 67	\$ 69	\$ 71	\$ 73	\$ 75	\$ 77	\$ 1,184
Subtotal	\$ 1,164	\$ 1,198	\$ 1,234	\$ 1,271	\$ 1,310	\$ 1,349	\$ 20,660

7. REFERENCED PROGRAMS

The cost estimate for IOOS was based on our experience in designing and implementing a large number of programs that have project and design elements comparable to IOOS in scope, scale and size, including the following:

7.1 SBInet

Secure Border Initiative (SBI) is a DHS initiative to develop an integrated systems approach to the immigration enforcement problem. SBInet is a system of systems similar to IOOS' business objectives and provides focus on engaging SBInet executives, subject matter experts, and key stakeholders to identify the key aspirations, relationships, and business challenges associated with achieving operational control of the border. SBInet cost estimates were used to validate the IOOS program business process challenges and performance aspirations. Cost estimates for the IOOS Core Services were leveraged from this program because of similar complexity and size. The IOOS deliverables highlight IOOS business and technical interface challenges and the strategic context.

7.2 e-Customs Partnership (eCP)

The basis of estimate for the IOOS Governance was determined by LM's experience in managing the eCP's Trade Support Network. The eCP Trade Support Network is responsible for developing a series of workshops, or other supporting materials (i.e. templates, questionnaires, checklists), as necessary, to facilitate the inclusion and participation of agencies in eCP. The IOOS Technical Governance assumptions were determined from the eCP program management tools, guidance, plans, processes, and procedures.

7.3 BMS ERA

Bristol-Myers Squibb (BMS) Company is a worldwide pharmaceutical and related healthcare products company whose principal businesses are medicines and nutritionals. The BMS Electronic Records Archive (ERA) System provides the capability to ingest and preserve pharmaceutical records for as long as it must be retained to support the business practices. The record can be rendered in the future to an authorized user who may or may not have access to the technologies under which the record was created. BMS ERA cost data and program experience was used to determine the security services development costs.

7.4 NARA ERA

National Archives and Records Administration (NARA ERA) provides for the retention, control, transmission, and access to electronic records and management of records lifecycle activities. NARA ERA facility fit-up and SOA cost data and program experience was used to determine the following:

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- IOOS service centers and data archive storage center sizing and personnel cost
 - Design and cost estimates for Preservation, Metadata Catalog, Indices, and Archival Storage service components