Data Management and Communication (DMAC) Implementation Plan

Version 1.0

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Table of Revisions

Revision	Description	Date	Author(s)
0.9	Initial publication	July 29, 2011	Jeff de La Beaujardière, Carmel Ortiz, Derrick Snowden
1.0	Internal review (Scott Kuester) comments incorporated.	Aug 30, 2011	Derrick Snowden

1 Scope and Purpose

This document outlines a plan for advancing the capabilities of the Integrated Ocean Observing System (IOOS®) Data Management and Communication (DMAC) subsystem and augmenting the number of data providers accessible through IOOS DMAC. Potential capabilities and providers were collected from analysis of existing IOOS reference documents[1]. A subset of those capabilities and providers will be targeted for deployment by the U.S. IOOS Program Office. The focus is on iterative development and incremental enhancements with fiscal years defining the schedule and budget granularity. The spending plan does not implement all possible data providers, all functional requirements, or all activities -- the scope of advances is narrowed to remain within budget. The plan strives to be defensible, but is subject to change based on resources, stakeholder input, or technology evolution.

The planning activity is a successor to the Data Integration Framework (DIF) pilot project carried out by the IOOS Program Office during fiscal year (FY) 2007-2010. The DIF established one service type (data request), at three NOAA data providers, providing observations of seven core variables in support of four NOAA customers. Now that the pilot project has formally concluded, the IOOS Program Office wishes to build on that work by fielding additional service types, data providers, and variables in order to progress towards a functioning DMAC capability for the benefit of additional customers.

[1] Primary reference documents:
1. DMAC Plan for Research and Operational IOOS (2005)
2. IOOS High-Level Functional Requirements (2009, v1.5)
3. IOOS Blueprint (2010, v1.0)
4. IOOS Registry/Catalog/Viewer Functional Requirements (2010)

2 Assumptions

This section contains the assumptions used in developing the DMAC Implementation Plan.

Funding

1) **Level funding:** Level funding for the IOOS Operations Division will allow the development of at least the basic DMAC components at a modest rate.
2) **Reduced scope:** With level funding, some components will not be built or will be provided by external entities (e.g., NSF OOI-CI) at no charge to IOOS.
3) **Cost:** The rough-order-of-magnitude estimates in the budget are approximately correct.

Collaborations

4) **IOOS Regional Association (RA):** The IOOS RA funding will be focused on regional observations and on connecting RA data to the IOOS system via national DMAC standards; an RA may be required to build and operationally host shared services in addition to data access services. RAs will also be encouraged to develop and contribute, to an open-source code repository, any reusable client software, product-generation services or other tools that result from supporting their own stakeholders.
5) **Customers:** The current plan includes only a notional schedule for supporting new customers by adding new variables from existing data providers or bringing new data providers on line. We assume that a process will be established for soliciting customers and determining what data should be put on line next. The "Proposed Focus-Area Centric Approach" outlined in the IOOS Blueprint (v1.0, p.3-14ff) suggests a possible process.
6) **Co-host some components:** Combining the functionality of the Data Catalog, Service Registry, Viewer, Data Integration Service and System Monitor into a single "IOOS Data Portal" (or other name t.b.d) will result in technical simplification and reduced development and O&M cost.

Technical Development

7) Components and capabilities: The components and capabilities derived from an analysis of the IOOS High-Level Functional Requirements compilation is an appropriate decomposition that includes all essential DMAC functionality.

8) **Iterative development:** Development of each new component will nominally occur in one or more increments of fiscal-year funding.
9) **Requirements prioritization:** When a component is scheduled for development, the functional requirements previously assigned to that component will be reviewed and prioritized (or discarded or augmented as appropriate), and then used to inform the Statement of Work for the development task.

10) **Data Provider Funding:** Funding will nominally be for two years – the first to establish the initial data access service and standardization, the second to improve and to perform the transition to operations.

11) **Adding new data providers gradually becomes less expensive as toolkits improve.**

Operations and Maintenance (O&M)

12) **O&M:** Operations and Maintenance funding will be provided for program-wide components (e.g., Catalog). Zero or minimal ongoing O&M will be provided to data providers, except for NDBC & CO-OPS as exemplar "reference implementations."

13) **Tech refresh:** Every third year, an assessment of existing implementations will be performed and technology refreshed as needed.

3 Requirements

3.1 Requirements Mapping to DMAC Components

The DMAC Implementation Plan was developed to meet a set of functional requirements. See Section 3.2 for the entire set of Functional Requirements. The Functional Requirements table is a compilation of IOOS- and DMAC-related requirements from several sources. These requirements have been mapped to components, subsystems or activities contained in the IOOS Blueprint v.1. Table 1 contains a summary of the number of functional requirements allocated to each component, subsystem or activity as a result of the mapping. Note that some categories have been added and are suggested for addition to the IOOS Blueprint. Those categories are marked with an asterisk (*)

The goal is to ensure that the functional requirements are taken into consideration as IOOS DMAC components are scheduled for development and the corresponding technical requirements are developed.

Note: A few requirements were outright duplications; many others are at least partly duplicative or overlapping. This will be taken into account as technical requirements are defined

Requirements Summary	
Total number of requirements	**374**
DMAC Data Services	-
Data Access Services	27
Data Subscription and Alert Services	1
Data Providers (73 identified initially and captured elsewhere)	-
Data Assembly Centers	9
Archive*	19
DMAC Components & Utility Services	
Service Registry	18
Data Catalog ~~Service~~	61
Mapping and Visualization Service	5
Format Conversion Service	2
Coordinate Transformation Service	5
Product Generation Service	7
Data Integration Service	4
Workflows	0
System Viewer	26
System Monitor	21
Standards and Documentation	
Metadata Standards	24

Requirements Summary		
Total number of requirements		**374**
QA/QC Standards		5
IT Security Standards		10
Controlled Vocabularies		6
Capability Maturity Levels*		1
	Subtotal	**251**
Other Requirements		
Guiding Principles*		13
Infrastructure*		0
Observing Subsystem		6
Modeling & Analysis Subsystem		2
Governance & Management		21
Training & Education		9
	Subtotal	**51**
Duplicate/Unclear/Out of Scope		-
Duplicate		17
Unclear		9
Out-Of-Scope		43
	Subtotal	**69**

Table 1 – DMAC Functional Requirements by Component/Capability

** - Not a category in IOOS Blueprint; recommended for addition.*

3.2 Functional Requirements

This section contains an explanation of the sources used and the various columns in the Functional Requirements table. The Functional Requirements table itself is not included in this plan, but is available upon request to the IOOS Program Office.

3.2.1 Sources

The sources of the Functional Requirements are:

1. Integrated Ocean Observing System High-Level Functional Requirements (HLFR), version 1.5, January 2009. http://www.ioos.gov/library/noaa_hlrd_v1_5_01_13_09.pdf - This document was itself a compendium of requirements from other documents. In the course of building the present spreadsheet, errors and omissions were discovered in the HLFR document; some of these problems are documented in the Notes column of the Technical Requirements.

2. IOOS Registry/Catalog/Viewer (RCV) Functional Requirements, 2010-11-03. - This unpublished document is currently being used to guide development of the IOOS Data Catalog.

3. DMAC Plan (DP), Ocean.US Pub. no. 6, March 2005 (Hankin et al., eds.) - Several requirements in the DP were omitted from the HLFR but have been added to this spreadsheet.

3.2.2 Explanation of Columns

Columns in the Functional Requirements table are described below.

- **Column (A) Identifier** for uniquely identifying each requirement. The prefix to each Identifier (FR-HLFR, FR-RCV or FR-DP) indicates source document for each functional requirement; numbering is from the corresponding document.
- **Column (B) Text of requirement** as found in source document. NOTE: The HLFR document at times edited the original text, sometimes introducing ambiguity or confusion; some of these instances have been noted in the Comments column.
- **Column (C, D) Original source document**, and page reference if available.
- **Column (E) IOOS component**, subsystem or category to which requirement was assigned.
- **Column (F) Capability** (if applicable) to which requirement was assigned. Each Component may have multiple Capabilities; each Capability may satisfy multiple requirements.
- **Column (G) Priority:** Mostly blank except for RCV portion; to be filled in as components are scheduled for development.
- **Column (H) % Done:** Mostly blank; to be filled in by further assessment and development.
- **Column (I) Notes/Clarifications:** Remarks by the editors.

4 Architecture Diagrams

This section provides high level diagrams of the target Organizational and Component Architecture for IOOS DMAC.

4.1 Organizational Architecture

Figure 1 provides a notional organizational architecture to illustrate which organization is responsible for building which DMAC component.

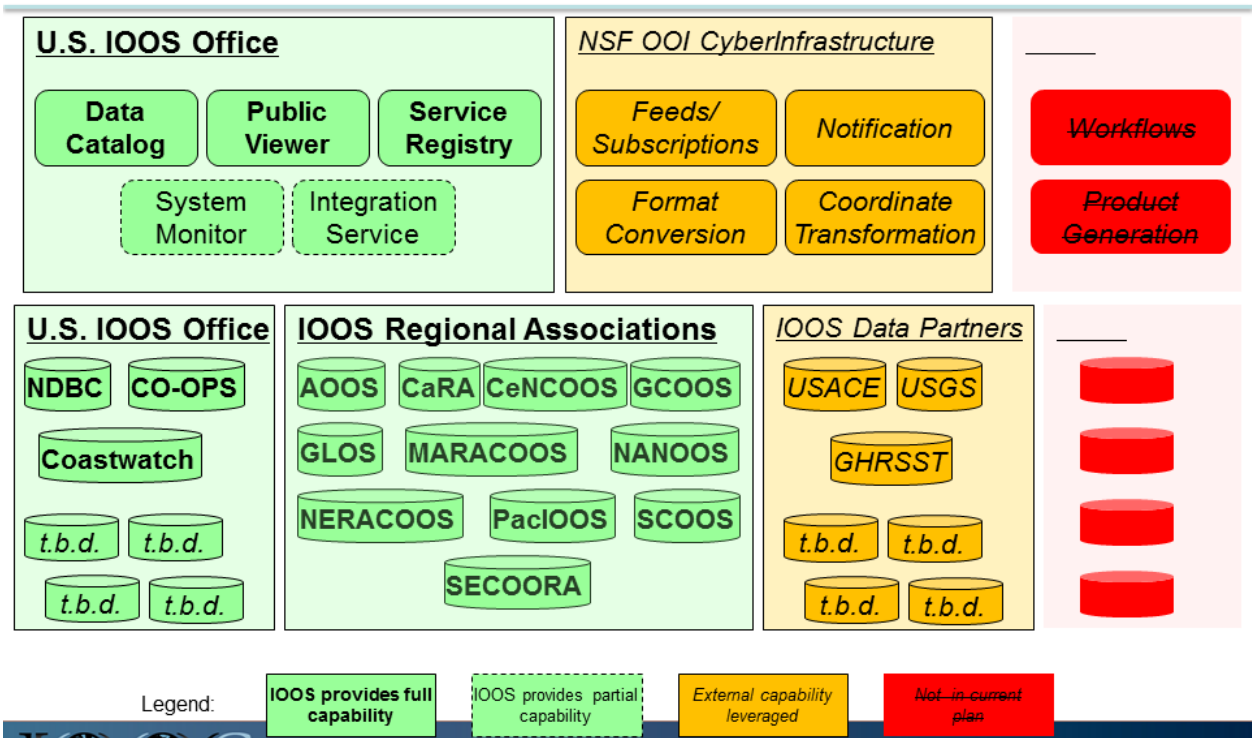

Figure 1 – IOOA DMAC Organizational Architecture

4.2 Component Architecture – Utility Services

Figure 2 provides a notional component architecture for the basic DMAC utility services, illustrating which high-level capabilities will reside in which components. Items with ~~strikethroughs~~ are not funded under the current plan.

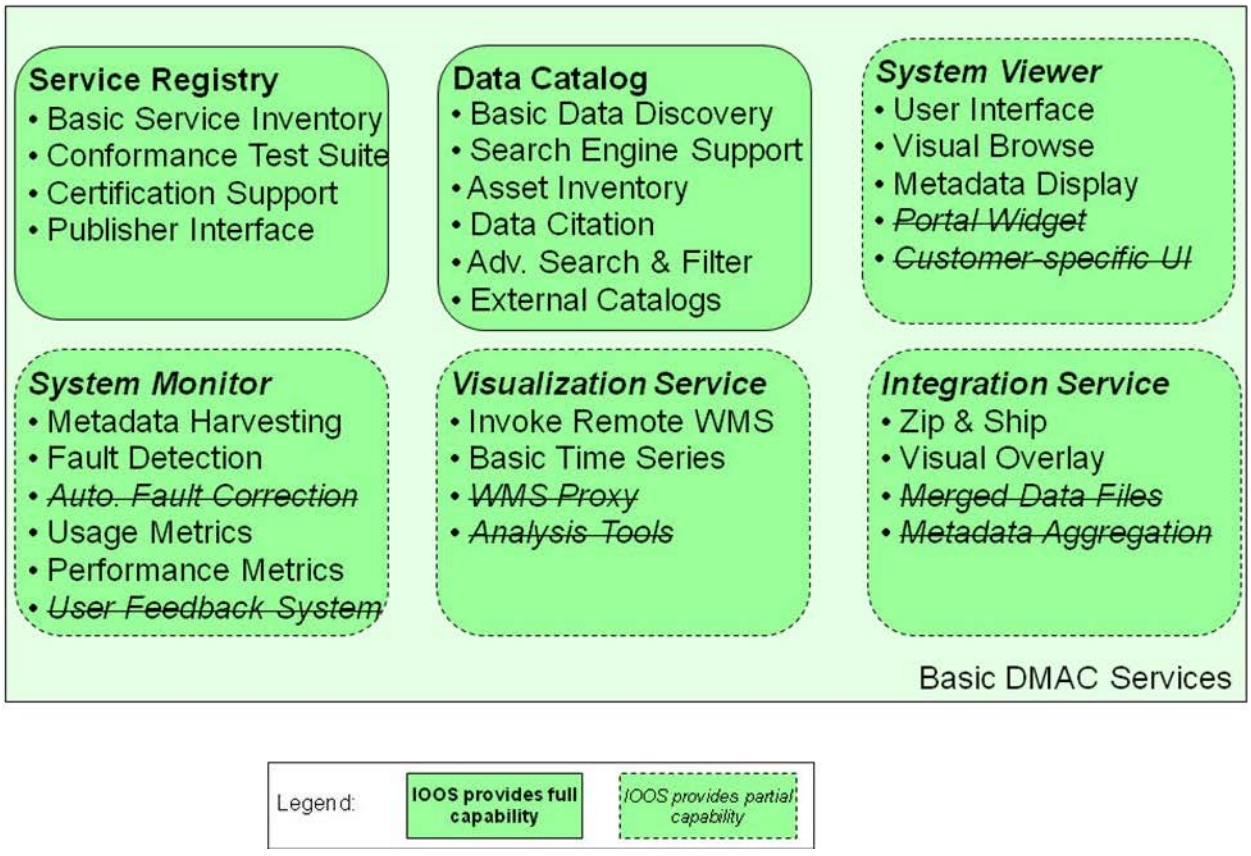

Figure 2 – IOOS DMAC Component Architecture

5 Detailed Implementation/Spend Plan

The table in this section provides the detailed DMAC Implementation/Spend Plan for fiscal years 2010-2018. The goal of this plan is to maximize implementation of functional requirements and data content within a level funding scenarios.

The plan content and layout is as follows:

- Far left column (**IOOS, RA, GHRSST**, etc) – indicates the organization responsible for funding the implementation activity
- $ - indicates that some IOOS funding has been allocated to that activity during that fiscal year.
- **RA $** - indicates the activity will be achieved using IOOS RA funding
- **? 0** - indicates that the activity is not funded under the current version of the plan, and therefore no organization has been identified to fund the implementation.
- "Capability deployed:" row – described what will be achieved for the DMAC component through that fiscal year's activities/funding.
- "Percent complete:" row – provides a rough order of magnitude of the level of implementation completeness for the component by fiscal year. Components that are fully implemented fairly early in the plan will achieve 100%; components that are never fully implemented due to resource constraints will remain less than 100%.
-

NON-RECURRING COSTS/FISCAL YEAR		2010	2011	2012	2013	2014	2015	2016	2017	2018
Data Providers/Observing Systems										
	Capability deployed:	NDBC, CO-OPS, CW	3 RAs, Bio:Srvy, FIU WQ, USACE WL	4 RAs, Bio:Tags, GHRSST	4 RAs, 1 satellite dataset	NODC (partial)	NODC, DP #A	DP #B,C, 1 satellite	DP #D,E,F	DP #G,H,I,J
	Percent complete:	6%	13%	21%	29%	29%	31%	34%	39%	44%
IOOS	HFR Support & RF Planning	**$**	**$**	**$**	**$**	**$**	**$**	**$**	**$**	**$**
IOOS	NDBC - Observations	**$**	**$**							

NON-RECURRING COSTS/FISCAL YEAR		2010	2011	2012	2013	2014	2015	2016	2017	2018
IOOS	NDBC - Data Assembly Center	**$**	**$**	**$**	**$**	**$**	**$**	**$**	**$**	**$**
IOOS	CO-OPS	**$**	**$**							
IOOS	CoastWatch	**$**								
IOOS	Satellite Data Provider (CW or PDA?)				**$**			**$**		
IOOS	USACE Water Level data	**$**								
IOOS	Biological Data - Surveys	**$**	**$**							
IOOS	Biological Data - Telemetry		**$**	**$**						
IOOS	Water Quality data - NCCOS/FIU		**$**							
RA	Data: RA #1		**RA $**							
RA	Data: RA #2		**RA $**							
RA	Data: RA #3		**RA $**							
RA	Data: RA #4			**RA $**						
RA	Data: RA #5			**RA $**						
RA	Data: RA #6			**RA $**						
RA	Data: RA #7			**RA $**						
RA	Data: RA #8				**RA $**					
RA	Data: RA #9				**RA $**					
RA	Data: RA #10				**RA $**					
RA	Data: RA #11				**RA $**					
GHRSST	Data: GHRSST*			**GHRSST**						
IOOS	Data: NOAA/NODC					**$**	**$**			
IOOS	Data: Obs Syst A (t.b.d.)						**$**			
IOOS	Data: Obs Syst B (t.b.d.)							**$**		
IOOS	Data: Obs Syst C (t.b.d.)							**$**		
IOOS	Data: Obs Syst D (t.b.d.)								**$**	
IOOS	Data: Obs Syst E (t.b.d.)								**$**	
IOOS	Data: Obs Syst F (t.b.d.)								**$**	

NON-RECURRING COSTS/FISCAL YEAR		2010	2011	2012	2013	2014	2015	2016	2017	2018
IOOS	Data: Obs Syst G (t.b.d.)									**$**
IOOS	Data: Obs Syst H (t.b.d.)									**$**
IOOS	Data: Obs Syst I (t.b.d.)									**$**
IOOS	Data: Obs Syst J (t.b.d.)									**$**
?	50+ more entries in DP spreadsheet	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
DMAC Capabilities										
Data Access Services										
	Capability deployed:	Ref. Impl. v.1	RI v.2, NMDSF report	RI v.3	CF in situ conv.		Tech Refresh			Tech Refresh
	Percent complete:	20%	60%	80%	100%	100%	100%	100%	100%	100%
IOOS	Data Provider Toolkit/Reference Impl.	**$**	**$**	**$**			**$**			**$**
IOOS	Data Models and Formats			**$**	**$**					
IOOS	Investigate Navy MetOc Data Svcs		**$**							
?	Offline data	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Data Subscription and Alert Services										
	Capability deployed:					Subscrip.				
	Percent complete:	0%	0%	0%	0%	100%	100%	100%	100%	100%
OOI-CI	Establish OOI-CI Data Distribution Net		**OOI-CI**	**OOI-CI**	**OOI-CI**					
IOOS	Link to OOI-CI DDN					**$**				
Service Registry										
	Capability deployed:		Basic Inventory	Conf. Tests	Publish. Interf.					

NON-RECURRING COSTS/FISCAL YEAR		2010	2011	2012	2013	2014	2015	2016	2017	2018
	Percent complete:	12%	25%	50%	100%	100%	100%	100%	100%	100%
IOOS	Basic Service Inventory	$	$					$		
IOOS	Conformance Test Suite			$						
IOOS	Certification Support			$						
IOOS	Publisher interface				$					
Data Catalog										
	Capability deployed:	Basic Search	Asset Inventory	Data Citation		Adv. Search	External Catalogs			
	Percent complete:	20%	40%	60%	70%	50%	100%	100%	100%	100%
IOOS	Basic Data Discovery	$	$					$		
IOOS	Search Engine Support		$							
RA	Asset Inventory		$							
IOOS	Data Citation			$						
IOOS	Advanced Search & Filter				$	$				
IOOS	External Catalogs						$			
System Viewer										
	Capability deployed:	User Interface	Visual Browse	Metadata Display						
	Percent complete:	20%	40%	60%	60%	60%	60%	60%	60%	60%
IOOS	User Interface	$			$			$		
IOOS	Visual Browse	$	$							
IOOS	Metadata Display			$						
?	Portal Widget	0	0	0	0	0	0	0	0	0
?	Customer-Specific Interface	0	0	0	0	0	0	0	0	0
System Monitor										

NON-RECURRING COSTS/FISCAL YEAR		2010	2011	2012	2013	2014	2015	2016	2017	2018
	Capability deployed:	Metadata Harvest	Fault Detect.		Usage Metrics	Perf. Metrics				
	Percent complete:	25%	38%	44%	63%	63%	63%	63%	63%	63%
IOOS	Metadata harvesting	$	$	$	$	$	$	$	$	$
?	Change Detection	0	0	0	0	0	0	0	0	0
IOOS	Fault Detection		$							
IOOS	Usage Metrics			$	$					
IOOS	Performance Metrics					$				
?	Automated Fault Correction	0	0	0	0	0	0	0	0	0
?	User Feedback System	0	0	0	0	0	0	0	0	0
Data Integration Service										
	Capability deployed:		Zip & Ship	Visual Overlay						
	Percent complete:	0%	25%	50%	50%	50%	50%	50%	50%	50%
IOOS	Zip & Ship		$							
IOOS	Visual Overlay		$	$						
?	Merged Data Files	0	0	0	0	0	0	0	0	0
?	Metadata Aggregation	0	0	0	0	0	0	0	0	0
Mapping and Visualization Service										
	Capability deployed:		Remote WMS	Time Series						
	Percent complete:	0%	25%	50%	50%	50%	50%	50%	50%	50%
IOOS	Invoke Remote WMS		$							
IOOS	Basic Time Series Graph			$						
?	WMS Proxy	0	0	0	0	0	0	0	0	0
?	Analysis Tools	0	0	0	0	0	0	0	0	0

	NON-RECURRING COSTS/FISCAL YEAR	2010	2011	2012	2013	2014	2015	2016	2017	2018
Format Conversion Service										
	Capability deployed:				Format Conv.					
	Percent complete:	0%	0%	0%	100%	100%	100%	100%	100%	100%
OOI-CI	Establish Format Conversion Service	**OOI-CI**	**OOI-CI**	**OOI-CI**						
IOOS	Link to Format Conversion Service				**$**					
Coordinate Transformation Service										
	Capability deployed:						Coord. Trans.			
	Percent complete:	0%	0%	0%	0%	0%	100%	100%	100%	100%
OOI-CI	Establish Coord. Transformation Svc	**OOI-CI**	**OOI-CI**	**OOI-CI**	**OOI-CI**	**OOI-CI**				
IOOS	Link to Coordinate Transformation Svc						**$**			
Product Generation Service										
	Capability deployed:					Tool Repos.	Service Invoc.			
	Percent complete:	0%	0%	0%	0%	14%	29%	29%	29%	29%
?	Regridding	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
?	Averaging	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
?	Summing	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
?	Conversion of missing data values	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
?	Other Data Products	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
IOOS	Repository for Prod Generation tools					**$**				
IOOS	Invoke RA-developed Prod Gen services					**$**				
RA	Product generation tools &									

NON-RECURRING COSTS/FISCAL YEAR		2010	2011	2012	2013	2014	2015	2016	2017	2018
	services									
Workflows										
	Capability deployed:									
	Percent complete:	0%	0%	0%	0%	0%	0%	0%	0%	0%
?	*(no workflow requirements provided)*									
Archiving/SIP development										
	Capability deployed:			HFR archive	Glider archive	Data #A archive	Data #B archive	Data #C archive	Data #D archive	Data #E archive
	Percent complete:	0%	0%	13%	25%	38%	50%	63%	75%	88%
IOOS	HFR		**$**	**$**						
IOOS	Regional Data Archiving			**$**	**$**	**$**	**$**	**$**	**$**	**$**
IOOS	Gliders				**$**					
IOOS	Other data type A					**$**				
IOOS	Other data type B						**$**			
IOOS	Other data type C							**$**		
IOOS	Other data type D								**$**	
IOOS	Other data type E									**$**
?	Other data type t.b.d.	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Modeling & Analysis Subsystem										
IOOS	Client Toolkits			**$**	**$**					
IOOS	Model Testbed Program Manager	**$**								
Other	Modeling Testbed 2010									
Standards and Documentation										

NON-RECURRING COSTS/FISCAL YEAR		2010	2011	2012	2013	2014	2015	2016	2017	2018
Metadata Standards										
	Capability deployed:	Metadata Format	Basic Metadata Content	Metadata Model	Improved Metadata Content	Metadata Tools	Provenance Metadata	Metadata Versioning		
	Percent complete:	14%	21%	29%	43%	57%	71%	86%	86%	86%
IOOS	Metadata Format	**$**								
RA	Metadata Content		**$**	**$**	**$**					
IOOS	Metadata Model			**$**						
IOOS	Metadata Tools				**$**	**$**				
IOOS	Provenance Metadata					**$**	**$**			
IOOS	Metadata Versioning						**$**	**$**		
?	Metadata Management System	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
QA/QC Standards										
	Capability deployed:			Manual A	B	C	D	E	F	G
	Percent complete:	0%	0%	4%	7%	11%	14%	18%	21%	25%
IOOS	QC Manual for data type A		**$**	**$**						
IOOS	QC Manual for data type B				**$**					
IOOS	QC Manual for data type C					**$**				
IOOS	QC Manual for data type E						**$**			
IOOS	QC Manual for data type F							**$**		
IOOS	QC Manual for data type G								**$**	
IOOS	QC Manual for data type H									**$**
?	20+ addl QC manuals	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
IT Security Standards										
IOOS	IT Security requirements assessment			**$**			**$**			**$**

NON-RECURRING COSTS/FISCAL YEAR		2010	2011	2012	2013	2014	2015	2016	2017	2018
IOOS	Evaluation of reference implementations				$			$		
IOOS	Implement mandatory security features					$			$	
?	Secure Data Transmission	0	0	0	0	0	0	0	0	0
Controlled Vocabularies										
IOOS	Semantic Interoperability	$								
Other Governance Activities										
IOOS	DMAC-ST support	$	$	$	$	$	$	$	$	$
IOOS	BEST Wkshop, Sanctuaries/Climate	$								
IOOS	Annual customer workshop			$	$	$	$	$	$	$
IOOS	Systems Eng/Documentation/Testing	$	$	$	$	$	$	$	$	$
IOOS	Certification process development*									
IOOS	Data provider assessments*									

RECURRING O&M COSTS		2010	2011	2012	2013	2014	2015	2016	2017	2018
Data Provider O&M										
	NDBC		$	$	$	$	$	$	$	$
	CO-OPS			$	$	$	$	$	$	$
	CoastWatch		$	$	$	$	$	$	$	$
	NCCOS/FIU			$	$					
	Biological Data - FIS			$	$					
	Biological Data - Telemetry				$	$				
	USACE Data			$	$					
	NODC - Access to Archived Data							$	$	

RECURRING O&M COSTS	2010	2011	2012	2013	2014	2015	2016	2017	2018
New Data Provider A (t.b.d.)							$	$	
New Data Provider B (t.b.d.)								$	$
New Data Provider C (t.b.d.)								$	$
New Data Provider D (t.b.d.)									$
New Data Provider E (t.b.d.)									$
New Data Provider F (t.b.d.)									$
DMAC Component O&M									
IOOS Obs Registry	$								
Registry/Catalog/Viewer			$	$	$	$	$	$	$

6 Work Breakdown Structure

A draft management Gantt chart was developed to define the discrete set of tasks, schedule and milestones required for IOOS Operations Division personnel to execute the DMAC Implementation Plan. This includes not only the activities outlined in the Detailed Implementation/Spend Plan in Section 5, but also tasks that involve only the efforts of Operations Division personnel but do not require additional funding. The management Gantt can serve as a work breakdown structure for the Operations Division for DMAC implementation efforts.

Copies of the draft management Gantt chart are available by request.

7 DMAC Metrics

The following are countable items that could be used to track progress in DMAC implementation and performance.

Primary DMAC Implementation Metrics:

The basic principles of DMAC implementation progress metrics include:

- DMAC implementation progress will be defined around discrete DMAC Releases.
- Implementation progress could be defined in 3 areas:
    - **DMAC Component Implementation** – a measure of the extent to which the 20 DMAC components have been implemented. Each component will be deployed in an iterative manner, gradually increasing the level of completion.
    - **Data Providers/Sources** - the number of sources of data/data providers serving data using IOOS-compatible standards/formats.
    - **Core Variables** - the number of core variables available from data providers/sources via DMAC data access services.
- How to define DMAC releases needs discussion. The general development/deployment approach will be iterative/spiral/incremental across numerous elements (rather than system-wide simultaneous releases) so we can choose to declare a DMAC release based on various criteria. Possible criteria includes calendar or fiscal year boundaries, or at points in time when there is significant increase in functionality or data to warrant declaration of a new version.

Other Potential DMAC Implementation Metrics:

1) Number of standalone service instances (other than data provider services) implemented. This will increase by 1 only when we build a new service. If we say "implemented or upgraded" then it increases when we move from v.1 to v.2 on an existing service.
2) Number of functional requirements satisfied. This number goes up by N whenever we launch or upgrade a service. There are ~500 on the current FR list; the FR list must be improved for this to be a useful metric.
3) Number of datasets archived. This number increases by 1 whenever a new data stream or data category starts getting ingested by the archive. The number does not change if you just add another buoy of a similar type. *(Note: A dataset is not a "variable" like Temperature; rather, a dataset is the set of all measurements of a particular phenomenon by a particular organization or group of platforms. For example, "temperature measured at CO-OPS water level stations" would be a different dataset from "temperature measured by NWS Weather buoys" and "sea surface temperature from the Aqua MODIS," even though all of these nominally have temperature as a "variable.")*

4) Number of sensor types or platform types with complete documentation.

Data metrics:

1) Number of in situ platforms from which data are available via IOOS services (in the last day? month? ever?). A buoy counts as 1. This number goes up by 1 whenever we add a platform to an existing network (e.g., buoy deployed), and goes up by N whenever we bring a new network of N platforms on line (e.g., NDBC adds the TAO array to their SOS).
   Value as of 2010-09-22: 1505
2) Total number of in situ sensors from which data are available via IOOS services. A buoy that measures water temperature, winds and waves counts as 3. This number goes up whenever a new sensor is put on an existing platform, or the number of platforms goes up.
   Value as of 2010-09-22: 3695 (see metrics.xls file)
3) Number of gridded datasets available through IOOS services. Need to be careful here -- for example, do the HFR 6km, 2km and 1km grids count as separate datasets? Are Chlorophyll grids in Hawaii and Caribbean counted separately? What about chlorophyll "daily merge" vs "masked swath"? These are all presently counted as separated grids in the Catalog.
   Value as of 2010-09-22: 78
4) Number of data provider service instances (SOS or TDS or WMS or t.b.d.) implemented.

Usage metrics:

1) Number of web hits [or unique "visits" or other HTTP statistic(s)] on the Catalog (per month).
2) Number of click-throughs from Catalog to data provider servers.
3) Number of web hits on each server, and/or Number of unique visits, Number of requests for data, Number of requests for metadata, Number of MB of data sent.
   August 2010 values:
   NDBC SOS=2.6M hits (6649 visits)
   CO-OPS SOS = 1.6M hits (4582 visits).
   See http://sdf.ndbc.noaa.gov/webstats/ and
   http://webstats.nos.noaa.gov/sum2010/opendapioosdif/overview.html

Performance Metrics:

1) Average response time for data requests.
2) Percent uptime for servers.
3) Scores on customer satisfaction surveys.

8 Plan Risks

This section enumerates the major risks that apply to the DMAC Implementation Plan.

Cost:

1) Funding decreases.
2) The rough-order-of-magnitude estimates in the budget turn out to be substantially too low.
3) O&M and tech refresh eventually consume all resources.

Schedule:

1) Component development takes longer than expected.
2) Developers fail to deliver promised components on time.

Performance & Quality:

1) Developers fail to deliver complete functionality.
2) Requirements gathered in previous years do not match current & future customers (CMSP, OA, NextGen, …)
3) The number of incompatible datasets will grow faster than our ability to make them compatible.
4) Requirements included in IOOS HLFR (2009, v1.5) are incomplete.

Program Management:

1) Competitive procurement requirements may dictate modifications to implementation plan.
2) Outsourced development approach is found to be unsuitable for funding that is limited and interrupted (during CRs)
3) Outsourced development approach is found to be unable to respond nimbly to evolving requirements.

9 Working Definitions

Term	Definition
Data	Measured or predicted values of environmental quantities at defined locations in space and time. Measurements may be either *in situ* or remote. Predictions may be model forecasts, assimilations or interpolations.
Data Collector	An entity that operates a sensor system, observing procedure or numerical model which produces data.
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.
Quality Controller	An entity that performs quality control on the data and documents the result in metadata. There may be several quality control steps in the data life cycle (e.g., real-time and delayed-mode).
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..
Service Provider	An entity that provides data access or utility services to U.S. IOOS.
Data Service	An online service that allows users to request data as needed (Data Request Service), or to be sent data on a continuing basis (Data Subscription Service), or to be sent data when user-specified condition(s) are met (Data Alert Service).
Utility Service	An online service that manipulates data to perform transformations or produce products.
Data Customer	An entity that consumes data from DMAC-compliant data services.