

I. Interoperable Data Discovery, Access, and Archive

Data Management and Communications Plan for Research and Operational Integrated Ocean Observing Systems

Part III. Appendices

Appendix 6. Technology Maintenance and Refreshment
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Part III. Appendix 6: Technology Maintenance and Refreshment

This section presents the reasoning and issues concerning the life cycle maintenance and refreshment of the technology components of the DMAC. The other chapters of this document describe systems capabilities that are all reliant on technology, whether systems, hardware, or software. To ensure that the IOOS/DMAC meets the program goals, it is critical to ensure that the technology stays current and operational; to do so requires a concrete plan for maintenance and refreshment.

A Price Systems LLC paper defines Technology Refreshment as “*the periodic replacement of commercial off-the-shelf (COTS) components; e.g., processors, displays, computer operating systems, commercially available software (CAS) within larger ... systems to assure continued supportability of that system through an indefinite service life.*”¹ (We would add communications capabilities to this list.) That is, systems are being acquired that are ever larger and more complex, and that are built up out of components that are designed and built by commercial third parties. If the DMAC is viewed as a system of systems, this situation still applies; whether “component” in this context means a server or an application software suite, it still represents an item that must be replaced periodically in order for the overall system to meet its mission requirements.

For the IOOS and the DMAC to remain current, the technology must be refreshed during the system life for a number of reasons, including the following:

- The existing system component has malfunctioned and either cannot be repaired, or the repair costs exceed the replacement costs,
- The existing system component has reached its life expectancy,
- The surrounding technical infrastructure has evolved and is incompatible with the existing component under consideration,
- Newer technology has come to market that provides more capability for the same or lower Total Cost of Ownership,
- The requirements of the system have evolved to the extent that the system cannot meet the requirements with the existing technology.

Accordingly, this section recommends that the DMAC systems integrator be tasked with the development of a Technology Refreshment Plan (TRP) to incorporate the ideas introduced in this section. The above-referenced paper reflects three categories of Technology Refreshment:

- **Technology Upgrades**—A change that incorporates the next generation product or product upgrade to an existing technology or component which improves overall system functionality,

¹“Technology Refreshment - A Management/Acquisition Perspective,” available at <http://www.pricystems.com/downloads/pdf/technology%20refresh.pdf>

Part III. Appendix 6: Technology Maintenance and Refreshment

- Technology Refreshers—A change that incorporates a new product to avoid an ensuring end of life or product/COTS obsolescence, or to correct a problem identified via a customer,
- Technology Insertion—A change that incorporates a new product or function capability which is a result of industry growth or advanced development.²

The TRP should consider indicators that correspond to the categories of change shown above. For example:

Category	Indicators
Technology Upgrades	Vendor announcement of new technology
	Industry trends (e.g., Linux vs. proprietary operating systems)
Technology Refreshers	Reaching predefined age
	Component failure
	Repeated maintenance calls on the component
	Failure to meet the system requirement
	Mission failure
	Planned obsolescence of component resulting in vendor's inability to maintain
	The component's vendor has gone out of business or been acquired
Technology Insertion	Vendor or developer announcement of product line that meets or increases component capability
	Vendor or developer announcement of product line that decreases cost
	Industry trends (e.g., Linux vs. proprietary operating systems)
	Announcement of milestone of research and Development effort resulting in a new capability that can be applied to the DMAC

Initial phase of integration of the DMAC must consist of inventory and baseline of components in accordance with a Configuration Management Plan (CMP). The CMP will define the level of granularity at which to document the Configuration Items (CIs), for example, CIs could consist of integrated systems on down to individual computers, COTS software, etc. (Two types of Configuration Management can be conducted; an inventory and control of a baseline of inventoried items or management of specification items defining a baseline against which a repeatable manufacturing process is conducted. It is envisioned that the DMAC CMP will be concerned with primarily the first type, but both types will be addressed.)

²op. cit. Note 1.

Part III. Appendix 6: Technology Maintenance and Refreshment

Segment	Type of Component	Configuration Item Identifier	Anticipated Life	Obs.	CY00	CY01	CY02	CY03	CY04	CY05	CY06	CY07
Data Discovery	Hardware/Software	DD-SW-03-0001	1Y									
		DD-HW-03-0001	3Y									
		DD-SW-03-0002	3Y									
		DD-SW-03-0003	2Y									
		DD-HW-03-0002	3Y									
		DD-HW-03-0002	3Y									
		DD-SW-03-0004	2Y									
		DT-SW-03-0005	1Y									
Data Transport		DT-HW-03-0003	3Y									
Data Archival												

Figure 1: Example Refreshment Schedule against Configuration Items.

It is essential that the TRP be integrated with the Configuration Baseline; a sample template (partial) is shown in Figure 1. This represents a mapping of the Configuration Items to their planned life expectancy and replacement date. When CIs are to be replaced primarily on age, such a chart will allow the systems integrator to schedule and budget for replacements of the CIs. Note that DMAC is a system being integrated from existing components (e.g., smaller systems) that vary in age from current to legacy. The TRP must consider phasing of older components.

Issues resulting from the development of a detailed TRP must be reflected in the Systems Engineering Management Plan, as such issues must be considered in the design and integration of the DMAC. Some of the potential guidelines resulting from the TRP are as follows:

- Open Architecture—To the extent possible, systems should be acquired using components that are designed and built to open industry standards. Proprietary designs should be avoided. Open Source Software is preferred, as it provides for the highest degree of maintainability.
- Preference for COTS—Commercial off the shelf items are to be acquired preferentially over developmental items.
- Synchronization of components—Integrators should consider anticipated life spans of components and report a system life span that is the minimum of the components contained therein.

Just as a preference is indicated for COTS products rather than home grown, so too here, the DMAC will not attempt to reinvent the wheel on system life cycle maintenance. The authors recommend that in the preparation of the TRP, tailored approaches be considered, such as the Navy's Technology Assessment and Management Methodology (TeAM)³ or the Technology Refreshment Cost Estimating and Planning Model⁴.

³Technology Assessment and Management Methodology – An Approach to Legacy System Sustainment Dynamics, available at <http://smaplaboratory.uah.edu/dmsms98/papers/samuels.pdf>

⁴Technology Refreshment Cost Estimating and Planning Model: User's Guide, available at <http://www.its.berkeley.edu/nextor/pubs/RR-00-5.pdf>