Transforming Defense Supply-Support Processes on Strategic Submarines

Improving Operational Availability and Reducing Costs

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Operational availability is the basic readiness requirement for a weapon system and is the base requirement that all development disciplines and system design must be adjusted to meet. It is the most critical requirement of a system acquisition program. Supply support is a major contributor to any end item's operational availability. It is one of the 12 integrated product support (IPS) elements and is the availability of organizational-, intermediate-, and depot-level repair parts, insurance spares, and replenishment parts in the supply system. Supply support includes the development of technical documentation that identifies the parts required to support the mainte-

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U.S. NAVY

nance philosophy. The transformation of some supply-support processes for strategic submarines can improve their operational availability and reduce costs.

The U.S. Navy Supply Information Chain

For decades, the approach to business process improvement in the Navy Supply System has been to automate existing business processes. This has not always worked efficiently when the business processes automated were designed to process data flows in a pre-computing era. Hence, data flows in today's Navy Supply System tend to follow the same workflow path as when paper forms were used in the pre-computing days.

Onboard data necessary to support logistics operations on U.S. Navy ships and submarines consists of equipment configuration management, maintenance, and inventory management data. Most of this data is produced and maintained ashore. Therefore, ships do not own most of the data resident in the onboard logistics information systems that they are responsible for maintaining. These ship's logistics information systems are the product of integration and reproduction of master shore-based databases, and their purpose is almost entirely for transaction support such as generating work orders and requisitions. Because of antiquated replication processes, latency created by the distribution methodology, and delays in personnel interaction, it is probable that a common piece of information, such as a catalog record for a repair part, can exhibit a different set of attributes on every ship. Because of this, a considerable amount of resources and effort are spent ensuring that shipboard data is reconciled and synchronized with ashore databases.

A gradual approach and automation for the sake of automation are not what the Services want or need, and this is reflected in recent, some would say monumental, efforts to upgrade the logistics infrastructure by implementing commercial Enterprise Resource Planning (ERP) systems.

Current Afloat Logistics Support Models

Traditional Multi-Echelon, Distributed Data Model

The traditional supply chain information model that has been in use by the Navy Supply System since the days before automation was commonplace, is a multi-echelon model consisting of shipboard systems, an intermediate support infrastructure, and an enterprise (wholesale or "system") infrastructure. The afloat model may use one or several shipboard systems for technical documentation management, another for maintenance management, and yet another system for supply and financial management. These transactional systems are based on data or hardcopy data products that are nothing more than replicas of data in master systems ashore. The output from these shipboard systems consists of transactions. As a result of this distributed data model philosophy, shipboard logistics data products are rarely a perfect reflection of the true ashore/centralized product. Furthermore, the effort to improve the data is driven down to the lowest echelon, where there is more data, less expertise, and less available resources.

Today, the Navy Supply System is undergoing significant transformation by adapting and implementing a commercial ERP system for financial management and supply management that will enable standardization of processes across the Navy enterprise. However, these enterprise initiatives still leave the shipboard systems essentially intact and subject to the same data distribution schemes as in the legacy framework.

Strategic submarines use additional information systems for strategic weapons system (SWS) logistics support. The SWS Maintenance Information Network (SWSMIN) is the automated, self-contained, mission-essential platform used to provide this support. SWSMIN does not directly interface with tactical systems and includes applications that provide a platform for interactive electronic technical manuals (IETMs) and coordinate the flow of maintenance information between the Trident ballistic missile submarines (SSBNs) and shore facilities. Within SWSMIN, Maintenance Applications (MA) is the computerized maintenance management system for SWS, and includes modules for Preventive Maintenance Management Program (PMMP), SWS Coordinated Shipboard Allowance List (COSAL), parts substitution, and parts requisition. However, SWS onboard spare parts are managed separately in Relational Supply (R-Supply), which acts as the single inventory management system afloat for Trident submarines. This means that SWS COSAL data must be replicated and synchronized not only between ashore and afloat systems but also between the two afloat maintenance systems (Organizational Maintenance Management System-Next Generation [OMMS-NG] and MA) in order to facilitate functionality required by both systems in order to generate repair parts requisitions. Therefore, sailors conducting SWS maintenance must interface with two systems and duplicate some work in order to obtain parts support for SWS subsystems.

Distance Support

In recent years, the Navy has begun implementing some engineered business process changes to go along with technological advances in information technology by incorporating distance-support concepts in the logistics support framework. Notwithstanding some issues such as bandwidth that need to be improved, Distance Support Afloat is considered an essential enabler for the transformation of the future Navy. However, these distance support initiatives can only provide access to centralized support and bring more information to the ship rather than true shipboard process reconceptualization.

The Littoral Combat Ship (LCS) Model

The LCS logistics support concept of operations fully embraces and implements a distance support model in order to enable labor and crew reductions afloat. To reduce workload and manning requirements on board LCSs, the Navy has implemented a full-service shore-based logistics and maintenance support infrastructure for the LCS platform. The shore-based logistics infrastructure includes a Maritime Support Detachment (MSD) and personnel at the LCS Class Squadron, who act as the single point of entry for repair, logistics, and personnel support for every ship in the class.

Conceptual SSBN SWS Model

SSBN Shipboard System Integration (SSI). The Trident Program provides the foremost strategic deterrent for United States national security and is the Navy's highest priority weapons program. The Trident system consists of the Ohio Class submarines, their associated weapons systems, an integrated logistics support system, ship systems and equipment, and dedicated Trident activities such as bases, training sites, and maintenance facilities. The Trident program has adopted an SWS integrated systems development approach known as SSI. Each individual SWS subsystem is managed by a separate technical branch and its respective prime contractors. This arrangement, although sound from a systems engineering perspective, requires careful and painstaking coordination of subsystem upgrades as well as logistics support. The SSI approach is an effort to re-baseline the shipboard subsystems in order to achieve efficiencies in lifecycle management of the SWS.

Removing Supply Chain Management Burden Afloat. The proposed vision for supporting the SSBN SWS platform can be described by an oversimplified analogy of the hotel minibar or supermarket self-checkout, wherein material is dedicated and available to a customer, a usage transaction takes place, and the system works behind the scenes to document, record, and restore the inventory to a specified level of support. To achieve this level of support for SWS on board SSBNs, several key objectives must be achieved: integration of supply, maintenance, and technical documentation systems; transfer of supply-support functions ashore; eliminating requirements for duplicative administrative and logistics systems afloat; and custodial responsibility for SWS spares assigned to the customer department (the end user).

The ultimate vision of the future SWS logistics support system is to enable a sailor to respond to a maintenance event by interfacing with a procedure, checklist, or other electronic technical document. From that same interface, the sailor should be able to initiate all required maintenance and logistics functions. For example, if a step in a procedure calls for inspecting a particular component and the sailor indicates that the component needs replacement, the afloat system should automatically initiate a maintenance action and tell the sailor where the onboard repair part is located. The sailor would retrieve the spare, and the system would record its use. Once the submarine returns to port or is able to transmit or connect to the ashore system, use transactions consisting essentially of the spare part's unique identifier would be transmitted ashore, where the master data is maintained and where all supply support and inventory management is coordinated.

Shore Supply Support. Very much like the LCS model, the SWS platform would be supported by an ashore team who would perform the supply-support functions necessary to maintain the shipboard inventory and related data at a high state of readiness. These functions would include: conducting physical inventories, initiating stock replenishment, tracking and delivering direct turnover material, performing data management functions on the ashore master database, and receiving and stocking material.

Because of antiquated replication processes, latency created by the distribution methodology, and delays in personnel interaction, it is probable that a common piece of information, such as a catalog record for a repair part, can exhibit a different set of attributes on every ship.

Many of the functions that would be assigned to the ashore team are traditionally conducted by the shipboard supply department. This transfer of functions would reduce workload afloat and enable additional efficiencies and improvement opportunities without additional bandwidth or persistent connectivity. Additionally, planned maintenance actions for post-patrol refit and for subsequent patrol could be more efficiently initiated ashore either by the ashore team or the off-crew even while the boat is at sea. (SSBNs have two crews: blue and gold.)

Integration of Supply, Maintenance, and Documentation. A key aspect of the conceptual SWS support model is the functional integration of supply, maintenance, and technical documentation. The system concept calls for ensuring that the content in electronic technical documents follows prescribed standards for referencing supply data that could be easily related to inventory and maintenance records. There would be no need for an interactive inventory management application afloat, because inventory-related data would be provided behind the scenes to the maintenance interface. When a sailor interacts with an electronic document, user-generated events (mouse click, keystroke, etc.) would trigger service requests to the maintenance service or the inventory service as necessary, and the sailor would not be required to have any knowledge of supply functions or procedures. Here are some example scenarios:

> **User-generated events (mouse click, keystroke, etc.) would trigger service requests to the maintenance service or the inventory service as necessary, and the sailor would not be required to have any knowledge of supply functions or procedures.**

- A sailor reading an electronic document clicks or highlights a part number. The system generates a service request (behind the scenes) to the inventory service to display material availability as well as to prompt the user whether a maintenance action should be initiated.
- A sailor initiates a maintenance action from an electronic procedure. The maintenance management system automatically records the associated procedure, equipment, and status to record the maintenance accomplished. Any subsequent material requirements identified by the user while in this procedure are added to the maintenance action's "shopping cart."
- The ashore team receives a defective material summary (DMS) report indicating that a specific repair part made by a specific manufacturer is defective and not ready for issue. Since each SWS spare part would be uniquely identified, with pedigree data recorded in the master ashore system, the ashore team is able to identify all impacted submarines and the location of all associated spare parts. Additionally, the ashore team is able to identify all maintenance procedures that may be affected by this material condition.

Custody of Material. If SSBNs are to achieve a self-service model afloat and maximize response time in support of SWS maintenance, access to material is a key component. Therefore, the concept calls for the customer department to maintain custody of the spares. This is possible for SWS spares, because there is only one customer. Other factors justify this from an inventory-management perspective: SWS maintainers already have custody of the most critical and expensive spares (SWS Block Modules, which are equivalent to maintenance assistance modules [MAMs]); SWS spares are already segregated from other stock; and SWS spares are low demand but pose a high inventory-management burden—so they lend themselves well to adopting this model.

Impacts and Results

Streamlining afloat logistics support systems for SWS into a single, integrated system would improve efficiency and reduce both workload afloat and the need for extensive data reconciliation and management efforts ashore. Additionally, R-Supply and OMMS-NG would not need to incur high design and development costs to provide SWS-unique functionality to a very small number of platforms. This also eliminates the costs for continuous management of SWS-related trouble reports, change proposals, and associated testing. Furthermore, minimization of logistics delay afloat will produce an increase in operational availability for all supported systems.

Implementation of this concept would reduce supply-department workload by eliminating inventory management burden for SWS. This includes stock replenishment, physical inventories, COSAL maintenance, and tracking of outstanding requisitions, receipts, and issues.

This model would also enable consistent and more efficient SWS supply support for all SSBNs. An SSBN crew's manning of logistics specialists (LSs) is similar to that of a fast-attack submarine (SSN). However, an SSBN crew of LSs and its supply officer today are required to manage vastly more inventory and configuration records due to SWS and receive no specialized training on SWS via their training pipeline. Efforts to improve training are currently under way. Implementing this new model would enable truly transferrable skills between SSN and SSBN LSs, alleviate the need for additional training afloat, and enable SSBN LSs to concentrate in supporting the rest of the platform.

Conclusion and Recommendations

Innovative and cost-effective integrated product support strategies that result in the most effective supply-support processes are the overarching goals of logisticians and engineers. Transforming supply-support processes, some of which were discussed in this article, can help result in the most effective supply-support system, improving operational availability and reducing costs. In an era where defense—including strategic submarines, budgets, and manpower—is austere, and where some Navy force materiel readiness is already in decline, transforming some supply-support processes that save effort, time, and money while increasing operational availability is not an option but a mandate. Any supply-support process transformation and value-added innovations to improve operational availability must consider costs, manpower, and impact on the strategic submarines and their crews, including maintenance requirements, training, time demands, and operations.

Logisticians and support organizations are doing a lot to improve processes and streamline logistics support infrastructure. Now is the time for program managers and operational commanders to promote change by requiring that systems adapt to support and enhance their operational mission—while reducing their costs.

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