Journal of Management (JOM)
Volume 11, Issue 3, Sep- Dec 2024, pp. 95-105, Article ID: JOM_11_03_008
Available online at https://iaeme.com/Home/issue/JOM?Volume=11&Issue=3
ISSN Print: 2347-3940; ISSN Online: 2347-3959; Journal ID: 4261-8672
Impact Factor (2024): 17.99 (Based on Google Scholar Citation)
DOI: https://doi.org/10.34218/JOM_11_03_008

LOGISTIC SUPPORT DATA MANAGEMENT DURING THE IN-SERVICE PHASE OF NAVAL SHIPS FOR OPTIMIZATION OF THE LIFE CYCLE COST

Arshad T K
Research Scholar, Banasthali Vidyapith, India.

Dr. Jitendra Singh Rathore
Assistant Professor, Banasthali Vidyapith, India.

Prof. Dr. Latha Krishnadas
Professor & AVP, NSRIC Inc., Toronto, Canada.

ABSTRACT

Naval ships are relatively high-value assets housing a large number of equipment and complex systems. The equipment onboard a typical modern-day naval ship would range from the conventional electro-mechanical machinery, piping, and instrumentations, to the most advanced communication, navigation, and weapon systems using state-of-the-art technologies. The volume of logistics support data associated with these assets is immense and the effective management of this data plays a major role in determining the Life Cycle Cost (LCC) of the naval ships.

Efficacious asset logistics support functions and data management will not only lead to cost savings but also ensure increased asset availability, and improved operational efficiency, thereby positively impacting the Return on Investment (RoI) and the Life

Cycle Cost of the asset. The availability of accurate and comprehensive logistics support data enables efficient maintenance planning, identifying optimum maintenance strategies such as Reliability Cantered Maintenance (RCM), predictive maintenance and Condition Based Maintenance (CBM), facilitates performance monitoring, ensures compliance with regulations, and aids in asset disposition decisions.

Non-availability of relevant logistics support data of the assets is one of the major constraints limiting the capability of the navies to conduct in-depth analysis for identifying the measures to optimize the Life Cycle Cost of the ships. This paper focuses on identifying the key functional areas of assets logistics support and data management, and the methods of managing it effectively during the in-service phase of the vessel for optimizing the Life Cycle Cost of the naval ships.

Keywords: Naval Ships, Logistics Support, Maintenance, Data Management, Life Cycle Cost (LCC), Maintenance Cost, Ship Availability.

Cite this Article: Arshad T K, Jitendra Singh Rathore, Latha Krishnadas. (2024). Logistic Support Data Management during the In-Service phase of Naval Ships for optimization of the Life Cycle Cost. *Journal of Management (JOM)*, 11(3), 95-105.

https://iaeme.com/MasterAdmin/Journal_uploads/JOM/VOLUME_11_ISSUE_3/JOM_11_03_008.pdf

1. INTRODUCTION

The current global economic challenges faced by the world countries is forcing them to curtail the defence budget and focus on optimizing the Life Cycle Cost of their military assets. The defence sector spending for acquisitions is something that cannot be curtailed beyond a certain extent as it has got direct impact on the maintenance of peace and security of any country. Therefore, the relevance of data management for optimizing the efforts and the cost for logistics support of the assets, especially during the in-service phase, is very high, as it helps directly in minimizing this spending from the defence budget.

Ideally, the management of logistics support data pertaining to a naval ship and the equipment onboard is a process that starts from its conceptual phase and needs to be carried out until the disposal phase, and sometimes beyond that, if the asset is reused in its existing or modified state. A large volume of data pertaining to the operation and maintenance is produced or modified during the in-service phase of the ship's life cycle. A good understanding of the

relevance of data management with respect to the various functions associated with the logistics support processes is necessary for the successful management of the related data. The identification of the right data to be recorded and managed for each asset is as important as the quality of the data in determining the effectiveness of the data management process and the impact on its Life Cycle Cost.

2. LOGISTICS SUPPORT DATA

The logistics support data pertaining to an asset can be primarily classified into two types – Asset Master Data and Asset Operational Data.

Asset Master Data or Asset Engineering Data consists of the initial data that are being produced and uploaded during the induction of the asset into the Computerised Maintenance Management System (CMMS) or Enterprise Asset Management (EAM) System. An asset could be inducted into the EAM either during the acquisition of a new ship or it could be inducted as a part of an upgrade or as a part of the obsolescence management. Asset Master Data needs to be managed from the induction through the in-service phase, until the disposal of the asset. Asset Master Data includes the configuration information, Bill of Material (BoM), maintenance management information such as the Preventive Maintenance Schedule (PMS), Job Information cards (JIC), Technical Manuals, Ship's Handbooks, As-Fitted Drawings, Trials and quality inspection records, Onboard and Base Spares establishment lists, etc.

Asset Operational Data consists of the data that is generated during the operational lifecycle of the asset. This includes the Running Hour information, maintenance notifications, ILS notifications equipment failure information, spare utilization, obsolescence information, modifications and upgrades, inventory information, store transactions etc.

The availability and accessibility of good quality Asset Master Data and Asset Operational Data is a key factor that determines not only the efficient management, availability, and reliability of naval ships, systems and equipment onboard through its lifecycle, and also its Life Cycle Cost. Furthermore, availability of accurate logistics support and operational data will also help in integrating the implementing the Artificial Intelligence (AI) and Machine Learning (ML) based systems to enhance the operational capabilities and optimise the maintenance of the naval ships (French et al., 2021). There are a variety of data and information sources for obtaining the asset logistics support data during the in-service phase and the importance of the respective data and information depends upon the ship’s active cyclic

mode(Ford et al., 2013). The management of data pertaining to the logistics support of the naval ships, systems and equipment onboard will facilitate more informed and efficient management of the naval sustainment programs and aid in comprehensive data analytics leveraging the advantages of the associated advanced technologies(Haase et al., 2023).

3. SIGNIFICANCE OF LIFE CYCLE COST

Warships are normally considered as a system of systems containing several integrated systems that are linked structurally, mechanically, electrically, hydraulically, pneumatically, and electronically (Ford, McMahon & Rowley, 2013). A ship's life cycle typically consists of 5 phases – Conceptual, Design and Engineering, Construction, Operation and Sustainment, and the Disposal phase. The Life Cycle Cost of the vessel or equipment is the expected value of net costs throughout the entire life of the ship or equipment from conceptualizing to disposal. Any initial cost and all subsequent expected cost of significance, including disposal costs, are included in the economic Life Cycle Cost criteria (Gualeni, P. & Maggioncalda, M., 2018). To maximize the profitability of the Shipbuilding in general, there is a need to evaluate the economic performances of ships from a life cycle perspective, including the operational and maintenance aspects, which constitute a large portion of the Life Cycle Cost. The cost associated with the Operation and Sustainment phase, also known as the In-Service phase, are estimated to include costs for manning, training, fuel, maintenance, refits, spares and consumables, modernization, and upgrades, and to be approximately 70% of the total life-cycle cost (Ford, McMahon & Rowley, 2015).

4. LOGISTICS SUPORT DATA MANAGEMENT ACTIVITIES

The activities associated with the logistics support data management varies according to the type of data being managed. Typical data management activities associated with the Asset Master Data which are relevant for the logistics support of the asset through its life cycle, are reviewing the master data supplied by various vendors, uploading of the master data, validating and cleansing the master data at the time of uploading and during the lifecycle to remove the duplicates and errors identified, updating the changes to the master data, periodical auditing of the master data for its quality and accuracy, and reporting of the master data and its status to the stakeholders.

Typical data management activities associated with the Asset Operational Data which are relevant for the logistics support of the asset through its life cycle, include collating and

validating the operational data, recording the data associated with the operation of the asset or its transactions, monitoring the Asset Operational Data to identify abnormalities or discrepancies, maintaining the data, analysing the data as a part of performance management or investigations or for identifying opportunities for improvement, and reporting the operational data and analytic information to the relevant stakeholders.

The Asset Master Data as well as the Asset Operational Data needs to be archived upon the disposal or decommissioning of the asset, for future references, analysis, investigations and research activities.

5. FUNCTIONAL AREAS OF DATA MANAGEMENT

The logistics support data management activities could be functionally grouped to facilitate coordinated and integrated data management actions in order to optimize logistic footprints and improve the effectiveness of the logistics support activities. The asset logistics support data management is closely connected and intertwined with the asset management functions and the effective management of the logistics support data associated with the assets is mandatory to ensure efficient management of the asset.

The typical functional areas associated with the logistics support data management in the naval ship Through Life Support (TLS) domain are Asset Management, Maintenance Management, Inventory Management, Procurement Management, Warehouse Management, Project or Program Management and Finance or Budgeting Management.

The Asset Management function is primarily responsible for ensuring that the asset management processes are adhered to, and for creating and maintaining the Asset Master Data, configuration data and maintenance data. The Maintenance Management function primarily manages the maintenance notifications and service requests, in addition to the planning, scheduling, monitoring, analysing and reporting of the maintenance execution. The Inventory Management function primarily manages the material cataloguing, material requirement planning and the inventory. The Warehouse Management function is primarily responsible for managing the receipt of the materials and their storage and distribution in accordance with the Warehouse Management processes. The Procurement Management function is primarily responsible for the management of the contracts for the procurement of material and services. The Project or Program Management function is primarily responsible for the initiation, planning, budgeting, execution, handover, and closure of the project or program. The Finance

and Budgeting Management function is primarily responsible for planning and managing the budget for the logistic support of the forces.

6. ASSET DATA MANAGEMENT

The Asset Data Management function is the nerve centre for logistics support data management that involves the management of the Asset Master Data, Configuration Data, Maintenance Master Data, and Obsolescence and Change Management Data.

Asset Master Data Management deals with acquiring, reviewing, and uploading and updating of Asset Master Data provided by the OEMs, Shipyard and the ILS service provider onto the CMMS or EAM system. The Asset Master Data have to be analysed, cleansed and updated in coordination with the relevant stakeholders prior to the upload. The data needs to be periodically audited to identify the gaps, errors, completeness, and discrepancies and necessary actions have to be initiated to bridge any gaps identified.

Configuration Data Management involves the acquiring, reviewing, and uploading and updating of Configuration Data provided by the OEMs, Shipyard and the ILS service provider onto the CMMS or EAM system. The Configuration Data have to be analysed, cleansed, updated and aligned in accordance with the CMMS or EAM system Template and Master Data Baseline prior to the upload. Configuration Status Accounting (CSA) and in-service configuration audits have to be performed to ensure the availability of the correct configuration information at all times.

Maintenance Master Data includes the Preventive Maintenance Schedules (PMS), Job Information Cards (JIC), Ship's Handbooks, Technical Manuals of the equipment, As-Fitted Drawings, Onboard and Base spares establishment lists, etc. provided by the stakeholders at the time of induction of the asset in to the CMMS and EAM system. Maintenance Master Data Management involves the acquiring, reviewing, and uploading and updating of Maintenance Master Data provided by the OEMs, Shipyard and the ILS service provider onto the CMMS or EAM system. The Maintenance Master Data have to be analysed, cleansed, updated and aligned in accordance with the CMMS or EAM system Template and Master Data Baseline prior to the upload. Thereafter Maintenance Master Data needs to be reviewed periodically during the life cycle of the asset in order to update it in line with the changes in maintenance strategies adopted from time to time for the optimization of maintenance efforts and resources.

In the modern days of fast paced technological advancements there is a need to manage the obsolescence of the equipment in a proactive manner. The management of the Obsolescence

and Change Data pertaining to the equipment is highly critical for optimising its Life Cycle Cost. It can be seen that the modern navies plan well in advance, even at the time of acquisition, the upgrade of the systems during the lifecycle of the asset in order to mitigate obsolescence risks. The management of the Obsolescence and Change Data involves monitoring and analysing operational and maintenance data for identifying the risk of obsolescence. This would involve not only the engagement with the Ship Builders and OEMs for managing obsolescence information but also the update of the Obsolescence and Change data, including the Engineering Change Proposals (ECP) and master data associated with the approved ECPs onto the CMMS or EAM system.

One of the key elements that ensures the efficient management of the master data of the equipment is the engagement with the OEMs to identify opportunities for logistics support cost optimization and improving the material state and availability of the equipment. Localisation plans could be developed with the OEMs for parts of critical equipment in order to improve the effectiveness of the logistics support and the supply chain, and the data pertaining to the any such initiatives have to be promptly updated in the CMMS or EAM system.

7. MAINTENANCE DATA MANAGEMENT

The planning and execution of the maintenance of naval ships and equipment onboard generates a large volume of data. Maintenance Data Management involves the management of data associated with the maintenance notifications for planning, scheduling, monitoring, execution, analysis, and reporting of the maintenance as well as the data pertaining to the refits and the warranty management.

The maintenance notifications are normally initiated by the end-user in the case of Corrective Maintenance and mostly automatically by the CMMS or EAM system in the case of Preventive Maintenance. Managing the notifications in the CMMS or EAM system for Preventive and Corrective Maintenance and improving the quality and prompt updating of information furnished by stakeholders in the notifications is one of the key elements of the Maintenance Data Management. ILS Notifications will have to be raised in the CMMS or EAM system for any gaps or changes identified during the maintenance with respect to the Asset Master Data. It should be ensured that all maintenance information such as the resources and materials used, time taken for the maintenance, changes in configuration made, if any, etc. are recorded in the EAM system. The maintenance data is analysed periodically to identify the opportunities for maintenance optimization and improvement, and dashboards and reports for

maintenance status reporting to the platform and asset management authorities are developed as a part of the Maintenance Data Management.

The availability of the ship, resources, materials and facilities for the conduct of the maintenance are confirmed by the maintenance planner prior to the scheduling of the maintenance. In case of non-availability of material or resources Material or Service Purchase Requests are created to arrange the required material or external services. Management of Refit and Warranty Data is another major activity to be undertaken as a part of the Maintenance Data Management. Refit Data Management involves the preparation and update of Refit Work Packages, material requirements and work completion status, whereas the Warranty Data Management involves maintaining and updating the warranty information in the CMMS or EAM system.

8. INVENTORY DATA MANAGEMENT

The Inventory Data Management is critical to ensure the availability of the right material at the right time and right place for undertaking the maintenance of naval ships, systems and equipment onboard. Inventory Data Management involves the cleansing of the material master data to remove duplicates and incorrect entries and updating information pertaining to the to the Material Master data in the Enterprise Resource Planning (ERP) system as well as the CMMS or EAM system.

Availability of good quality of inventory data is necessary to undertake the inventory analysis in order to identify the opportunities for optimization and for improving the Probability of No Stock Shortage (PNSS). Various factors such as the rate of consumption, inventory turnaround, criticality, PMS requirements, and procurement lead time, etc. are all considered while carrying out the inventory analysis. Classification and categorization of material, parts and components using inventory control tools is also an important activity undertaken as a part of Inventory Data Management.

9. PROCUREMENT DATA MANAGEMENT

The procurement of materials and services is a key element of the logistics support for the upkeep and maintenance of the assets. The procurement function is closely integrated with all functional areas of logistics support. The main activities involved in the management of data pertaining to procurement management are the creation and processing of Request for

Quotations (RFQ) in the Enterprise Resource Planning (ERP) system and Techno-Commercial analysis of quotations. Creation of Purchase Order (PO) in ERP system and updating the Goods received and Service Completion information is also a part of the Procurement Data Management.

10. WAREHOUSE AND STORE DATA MANAGEMENT

The main activities involved in the management of data pertaining to warehouse and stores management includes the recording of material inspection and acceptance information confirming the adherence to the specifications updating the material receipt records and delivery documentations, and the update of the maintenance information pertaining to the stored equipment and materials.

11. PROJECT AND CONTRACT DATA MANAGEMENT

Project and contract management associated with the logistic support of naval ships is normally a centralized function and it deals project and contract data of large value and of strategic nature. The main activities involved in the management of data pertaining to the project and contract management include the creation, management and update of project and contract documents in the ERP system to achieve specific project objectives according to the project acceptance criteria within agreed parameters. Updating and recording all project and contract management information, including the correspondences and correspondence log, and analysis of project data to develop Project Dashboards and reports, is also undertaken as a part of the Project and Contract Data Management.

12. FINANCE AND BUDGET DATA MANAGEMENT

The budget planning process is an activity which is normally undertaken every year to generate the budget requirements for the upcoming financial year. The key inputs for the consolidation of the finance and budget information are obtained from the stakeholders as well as through the analysis of historic data available with the organization. The main activities involved in the management of data pertaining to the finance and budget includes the compilation of the budget inputs and expenditure information, recording and updating budget information and expenditure information in the ERP system, and analysing the fiscal inputs and historic data for budget planning and fiscal information reporting.

13. CONCLUSION

Asset logistics support data management and its analysis is essential for optimising the Life Cycle Cost of the naval ships, systems and the equipment onboard. Availability of reliable and updated asset logistics support data helps in making informed decisions on managing the assets, efficient maintenance planning and implementation of the most effective maintenance strategy. It also helps to monitor the performance of the assets and supports in ensuring the regulatory compliance. Effective asset data management ensures the availability of accurate and updated technical information pertaining to the ship, systems and equipment onboard, at all times.

The efficient management of the logistics support data and the availability and accessibility of good quality Asset Master Data and Asset Operational Data is a key factor which determines not only the efficient logistics support management, availability and reliability of any asset through its lifecycle, but also its Life Cycle Cost. Therefore, it is imperative that a logistics support data management program with dedicated qualified and experienced resources at all levels of asset management organization, be established as a part of the Logistics Support initiatives to ensure that the investments made by the navies for the acquisition of naval ships, systems and equipment onboard, as well as the logistics support management systems are utilized to the optimum level.

REFERENCES

[1] Ford, G., McMahon, C., & Rowley, C. (2013). Naval Surface Ship In-service Information Exploitation. Procedia CIRP, 11, 92–98.

[2] Ford, G., McMahon, C., `& Rowley, C. (2015). An Examination of Significant Issues in Naval Maintenance. Procedia CIRP, 38, 197–203.

[3] French, R., Fukumae, W. Y., Hun, K. S., Matuga, O., & O'shaughnessy, C. R. (2021). Data Management for Artificial Intelligence Machine Learning Implementation across the Department of Navy.

[4] Gualeni, P., & Maggioncalda, M. (2018). Life cycle ship performance assessment (LCPA): A blended formulation between costs and environmental aspects for early design stage. International Shipbuilding Progress, 65(2). https://doi.org/10.3233/ISP-180144.

[5] Haase, J., Walker, P. B., Berardi, O., & Karwowski, W. (2023). Get Real Get Better: A Framework for Developing Agile Program Management in the U.S. Navy Supported by the Application of Advanced Data Analytics and AI. Technologies, 11(6). https://doi.org/10.3390/technologies11060165

Citation: Arshad T K, Jitendra Singh Rathore, Latha Krishnadas. (2024). Logistic Support Data Management during the In-Service phase of Naval Ships for optimization of the Life Cycle Cost. Journal of Management (JOM), 11(3), 95-105.

Abstract Link: https://iaeme.com/Home/article_id/JOM_11_03_008

Article Link:
https://iaeme.com/MasterAdmin/Journal_uploads/JOM/VOLUME_11_ISSUE_3/JOM_11_03_008.pdf

✉ **editor@iaeme.com**