THE FUNDAMENTAL PRINCIPLES OF INTEGRATED LOGISTIC SUPPORT

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ABSTRACT

The scope of this article is to provide a working guide to Integrated Logistic Support and the related Logistic Support Analysis processes, from a system or equipment concept to its disposal.

Introduction

Integrated Logistic Support (ILS) is the term used to describe a disciplined and structured approach to logistic support planning. Its aim is to reduce the Life Cycle Costs (LCC) of an equipment or system whilst achieving optimum availability by addressing the requirements of support from the earliest stages of the procurement cycle. Taken in isolation none of the techniques used by the ILS process are revolutionary. The designers have always paid regard to maintainability, and the support organisations have always provided the necessary back-up, but whereas in the past the tendency has been to 'support the design', the process of ILS seeks to 'design for support'.

Background

The concept of ILS evolved in the U.S.A. where the Department of Defence (DOD) found itself spending an ever increasing proportion of the cost of ownership of a system on 'in service support'. The traditional view that acquisition was the most significant cost driver gave way to the realisation that support outstripped acquisition costs several times over. Because of shrinking defence budgets, the ever increasing costs of ownership and a Chief of Defence Procurement directive, the Ministry of Defence is now applying the principles of ILS to all new projects and in some cases retrospectively for updates of existing systems or equipments. They are modelled on the American DOD experience, which has shown that the application of ILS resulted in reduced LCC and improved weapon system availability.

Integrated Logistic Support Elements

The disciplined approach covers the elements listed at (FIG. 1).

Availability, Reliability and Maintainability (AR&M)

AR&M activities have a highly significant influence on the design of a system/equipment for supportability and affordability. The outputs from this programme are one of the primary inputs to the whole logistic support analysis activity.

Design Interfaces

Defines the relationship of logistics connected design parameters, such as AR&M objectives and support resource requirements.

Maintenance Planning

The process is conducted to evolve and establish the maintenance concepts and requirements for the lifetime of the system, both in peace and war. It is closely

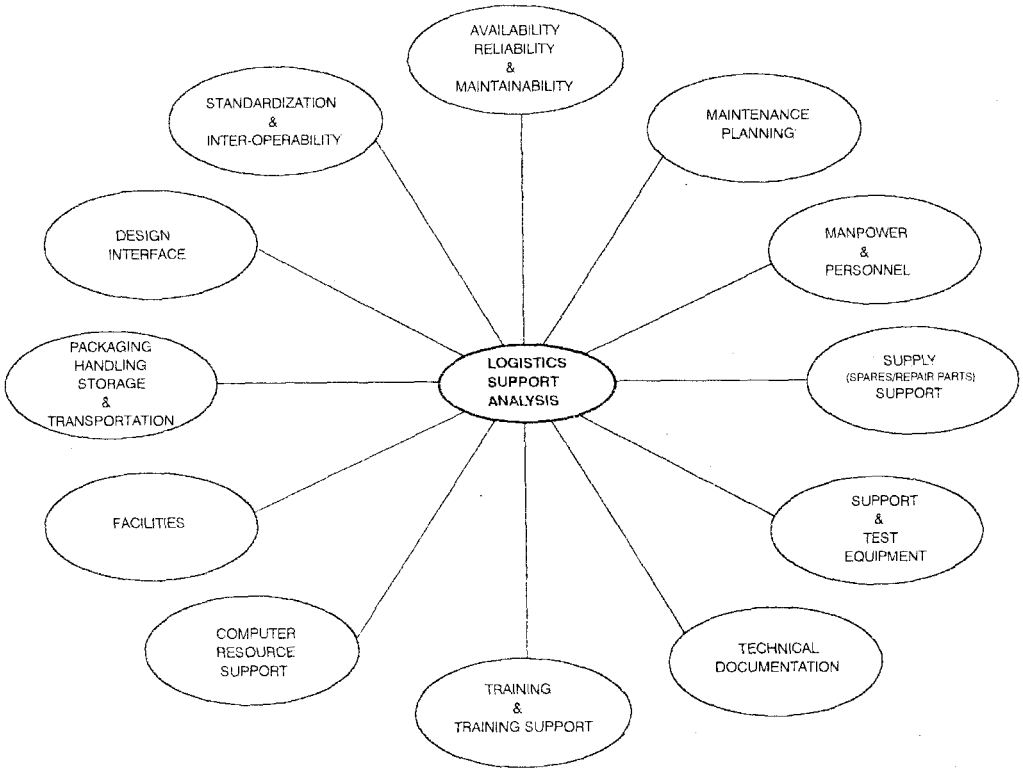

FIG. 1—ILS ELEMENTS

linked to performance objectives and therefore to the prediction and testing of reliability.

Manpower and Personnel

Identifies, justifies and makes provision to acquire the optimum number of military and civilian personnel, with the skills/ranks necessary, to operate and support the system in both peace and war.

Supply (Spares) Support

Addresses all management procedures and techniques to acquire, catalogue, receive, store, transfer and issue all appropriate items, including provisioning for initial support.

Support and Test Equipment

Identifies the equipment required to support the operation and maintenance requirements of a system, including common range test equipment, ATE etc. and establishes how they will be supported.

Technical Documentation

This includes all recorded information, regardless of form, of an instructive or technical nature; e.g. maintenance manuals, drawings etc.

Training and Training Support

This addresses the process, procedures, techniques training devices and equipment needed to train regular, reserve and civilian personnel to operate and support the system.

Computer Resource Support

Identifies the facilities, hardware, software, manpower and skills needed to operate and support embedded systems.

Facilities

To identify if the system requires new facilities for repair activities, storage etc. or if existing facilities are sufficient.

Packaging, Handling, Storage and Transportation

Ensures the system, and its support items are preserved, packaged, handled and transported correctly. This includes environmental considerations and preservation requirements for long and short term storage and world-wide transportation.

Standardization and Interoperability

Scrutinises the system to component level, together with its support equipment, to ensure that standardization and interoperability are balanced against minimum cost of acquisition and ownership.

Terms and Definitions

The terms and definitions used in the ILS toolbox are numerous and it is intended to list and qualify only but a few, these are:

Logistic Support Analysis (LSA)

The structured step by step analysis of the design from a logistic viewpoint. It starts when ideas are being formulated, and in common with the rest of the design process, it is then refined and expanded as more and better data becomes available.

Logistic Support Analysis Record (LSAR)

LSA both requires and generates data for which the LSAR is required and is a highly structured database. This uniform structure permits the rapid collection, manipulation and extraction of its contents so that it can form the central reference point for all logistic planning. The LSAR does not hold all of the results of every analytical task, it reflects the end results of these tasks and the support decisions that have to be made.

Note: For a number of minor projects and most 'off the shelf' (OTS) equipment buys, utilisation of an LSAR is not normally necessary.

Failure Modes, Effects and Criticality Analysis (FMECA)

An analysis to identify potential design weaknesses through systematic, documented consideration of the following:

- All likely ways in which a component or equipment can fail.
- Causes for each mode of failure.
- The effects of each failure (which may be different for each mission, phase of a mission or mode in which a system or equipment is used).

Level of Repair Analysis (LORA)

A systematic procedure to determine the cost of different maintenance options.

Reliability Centred Maintenance (RCM)

A systematic approach for identifying the frequency and type of maintenance required. This could include scheduled, preventative or condition based maintenance.

Condition Based Maintenance (CBM)

Based on the condition of an equipment at any one time as shown by monitoring techniques. The primary aim of CBM is to avoid the unnecessary stripping of fully functional equipment on the basis of running time alone.

LSA

LSA is the principle tool of ILS and consists of a series of analytical tasks. It requires the use of FMECA, RCM, LORA and trade-off analyses, perhaps to strike a balance between performance and cost, and to provide a means of:

- Assessing and influencing the Availability, Reliability, Maintainability and Testability (ARM&T) of a design.
- Identifying and developing the most cost effective support option for the design.
- Evaluating the logistic and operational effectiveness of the delivered support package.
- Identifying the major 'cost drivers'.
- Achieving the lowest affordable LCC aligned with specified performance.

Analytic Tasks

LSA consists of 15 main tasks (called the 100, 200, 300, 400 and 500 series tasks) which are currently broken down into 83 sub tasks. Each sub task has a specific aim within the procurement cycle of an equipment or system and an early decision is to determine which of them are applicable to a specific project. Many of the tasks are of a repetitive nature and are revisited throughout the procurement cycle. The purpose of each main task is as follows:

100 Series Tasks

Programme Planning and Control Tasks:

101 – Identifies the tasks which would provide the best return on investment.

102 – Identifies management responsibilities and activities and outlines the approach toward accomplishing analysis tasks.

103 – Programme and design reviews. To ensure the programme is proceeding in accordance with contractual milestones and that support related design requirements will be achieved.

The above 100 series tasks therefore manage the project and the LSA effort, which requires the development of an LSA strategy. This is the essential tailoring (selecting the applicable sub tasks) for the LSA plan and decisions regarding design reviews, procedures and schedules. This 'front end analysis' is the responsibility of the MoD programme manager, advised by the ILS manager.

200 Series Tasks

Establish support objectives and support related design goals/constraints through comparison with existing systems:

201 – Use study. Identifies and documents the relevant supportability factors related to the intended use of the new system/equipment.

202 – Identifies design supportability constraints based on existing and proposed support resources which have advantages because of cost, manpower, readiness or support policy considerations.

203 – Comparative analysis. Compares new with existing design criteria and focuses the LSA effort where there is the best potential for improvement.

204 – Technological opportunities. Identifies and evaluates design opportunities for improvement of support requirements in the new system/equipment.

205 – Support and supportability related design factors. The purpose of this task is to establish maintenance concepts, personnel capabilities and limitations, spare/repair part requirements, test equipment compatibility and standardisation requirements.

The tasks contained in the 200 series section identify the operational role and intended use of the new system. They also establish support resource constraints, readiness and supportability design requirements and measures of logistic support. During the early phases of a procurement programme, these analytical tasks provide the greatest opportunity for the MoD to influence the design of the system and its support.

300 Series Tasks

Identifies and evaluates support alternatives:

301 – Functional requirements identification. Identifies the tasks that must be performed in order to operate and maintain the new system or equipment.

302 – Support system alternatives. Establishes viable support alternatives showing advantages and disadvantages.

303 – Evaluation of alternatives and trade-off analysis. Determines the best approach (support, design, operation) which satisfies the requirements, drawing a balance between cost, performance, readiness and supportability.

The tasks contained within this section are repetitive and are applied to successive phases up to production and production design changes.

400 Series Tasks

Determination of logistic support resource requirements:

401 – Task analysis. Identifies support requirements for each task and provides source data for the preparation of technical manuals, training programmes, manpower and personnel lists etc.

402 – Early fielding analysis. Assesses the impact of introduction of the new system/equipment on existing systems and determines essential logistic support resources in a combat environment.

403 – Post production support analysis. To analyse life cycle support requirements of the new system/equipment prior to closing of production lines, to assure that adequate logistic support will be available throughout the system/equipment life.

This portion of the LSA defines the requirements for the ILS Elements. The tasks can be general or very detailed, producing extensive procedural and parts listing documentation.

500 Series Tasks

Supportability assessments:

501 – Supportability test, evaluation and verification. To assess the achievement of specified support requirements. Identify the reasons for not meeting project objectives and methods of correcting deficiencies and enhancing system availability.

This task demonstrates contractual compliance with design requirements and exposes support problems for corrective action.

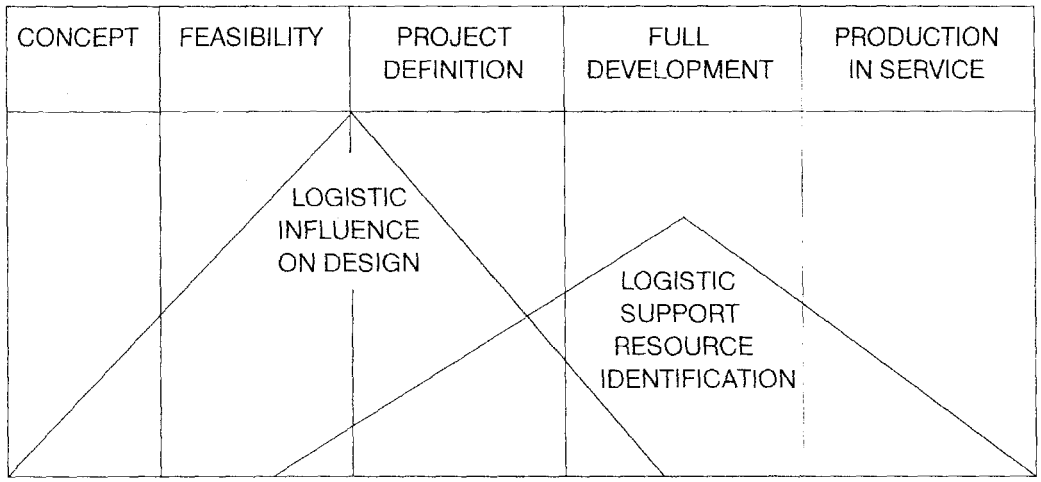

FIG. 2—LSA ACTIVITY DURING PROJECT PHASES

LSA Tasks and the Procurement Cycle

As indicated at (FIG. 2), LSA activities are undertaken, during each project phase, with the same tasks and sub tasks being revisited many times. (FIG. 3) gives an indication of what tasks are applicable, when they are applicable and who has the lead responsibility; e.g. MoD, contractor or a combination of both.

Current Projects

All three Services are now applying the principles of ILS to certain equipment/system projects, including for the navy, the Joint Tactical Information Distribution System (JTIDS). However, the first major Royal Navy project to utilise the processes of ILS, on a whole ship basis, is Project HORIZON. This is a tripartite project being undertaken in collaboration with France and Italy for the design and procurement of the Common New Generation Frigate (CNGF). From a U.K. point of view, it is intended that the CNGF will replace the Type 42 destroyers and is currently due to enter service around 2002.

Conclusions

In applying ILS techniques, the aim is to carry out only those LSA tasks that will give a reasonable return on investment and those that will contribute to the acquisition of effective support. Whilst the example given at FIG. 3 depicts a full ILS programme, it can by selective application of tasks, be tailored to meet any procurement project, including purchase of 'off the shelf' equipment. The introduction of ILS represents a fundamental change to traditional support planning methods. The adoption of a more structured, principled approach in equipment procurement should result in:

- Improved reliability/availability.
- More standardisation.
- Ease of maintenance.
- Significant economies in the 'in service' support resources.
- Reduce the cost of ownership.

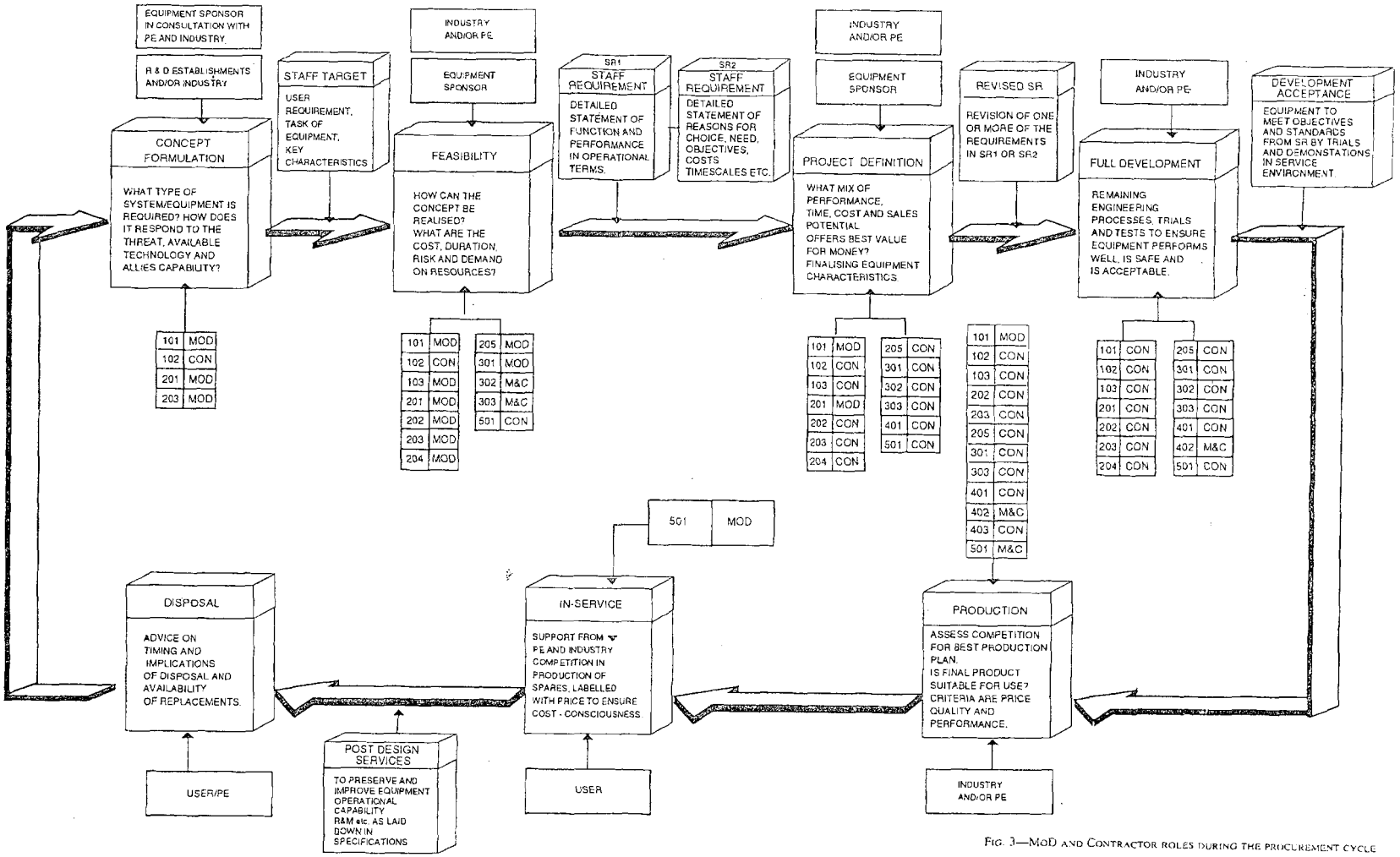

FIG. 3—MOD AND CONTRACTOR ROLES DURING THE PROCUREMENT CYCLE