Ministry of Defence

JSP 886
THE DEFENCE LOGISTICS SUPPORT CHAIN MANUAL

VOLUME 7
INTEGRATED LOGISTIC SUPPORT

PART 3
SUPPORTABILITY ANALYSIS

VERSION RECORD		
Version Number	**Version Date**	**Description**
1.0	23/07/08	Conversion from Web content (as Logistic Support Analysis Guide)
1.1	04/10/10	Amendment to Annex D Appendix 2 and inclusion of new Appendix 3 and Appendix 4
2.0	28/01/11	Complete update.
2.1	08/02/11	Editorial and Re-Formatting Changes.
2.2	06/07/11	Updated Contact Information.
2.3	05/12/12	POC's amended, ISILSC reference added, Radiological Source Paragraph 27. (Page 21).
2.4	24/07/13	New Chapter 6 - Procedures for Conducting SA on UOR to CORE
2.5	14/07/14	POCs amended. Reference to JSP 392 added.

CONTENTS

CHAPTER 1: SUPPORTABILITY ANALYSIS POLICY

CONTEXT

1. This part of JSP 886 provides key points of policy on the application of Supportability Analysis (SA) within Integrated Logistic Support (ILS).

POLICY

2. It is MOD policy that Supportability Analysis be applied to all MOD Equipment Acquisition Projects. It is a key technique in the application of ILS, as promulgated in Volume 7 Part 1 of this JSP, which states that SA will be performed.

PRECEDENCE AND AUTHORITY

3. The authority to apply ILS is promulgated from DE&S Corporate Governance Portal Index.

MANDATED REQUIREMENTS

4. It is a requirement that projects will implement a SA programme. Failure to apply SA to a product as part of ILS, will impact Through Life Finance (TLF), product availability, maintainability and safety.

ASSURANCE AND PROCESS

Assurance

5. SA is a technique within the ILS process, which is independently assured against Governing Policy 2. 1. Guidance for Assurance can be found in JSP 899.

6. **Assurance**: Governing Policies are externally assessed by the Support Improvement Team, independently identifying risks to delivery and assisting in the provision of a coherent support solution.

Process

7. SA is to be tailored to the project and applied throughout the CADMID cycle.

   a. During the design stage of a project (represented by the Concept, Assessment and Demonstration stages in the CADMID[1] acquisition cycle), the SA process assists the design engineer to incorporate supportability requirements into product design. As the project progresses and designs become fixed, the SA process generates information documented within the Information Repository, which defines the specific resources required to support a product throughout the In-Service phase. This data is used to plan, procure, deliver and manage support resources to ensure deployed systems meet the readiness and supportability objectives at optimum TLC.

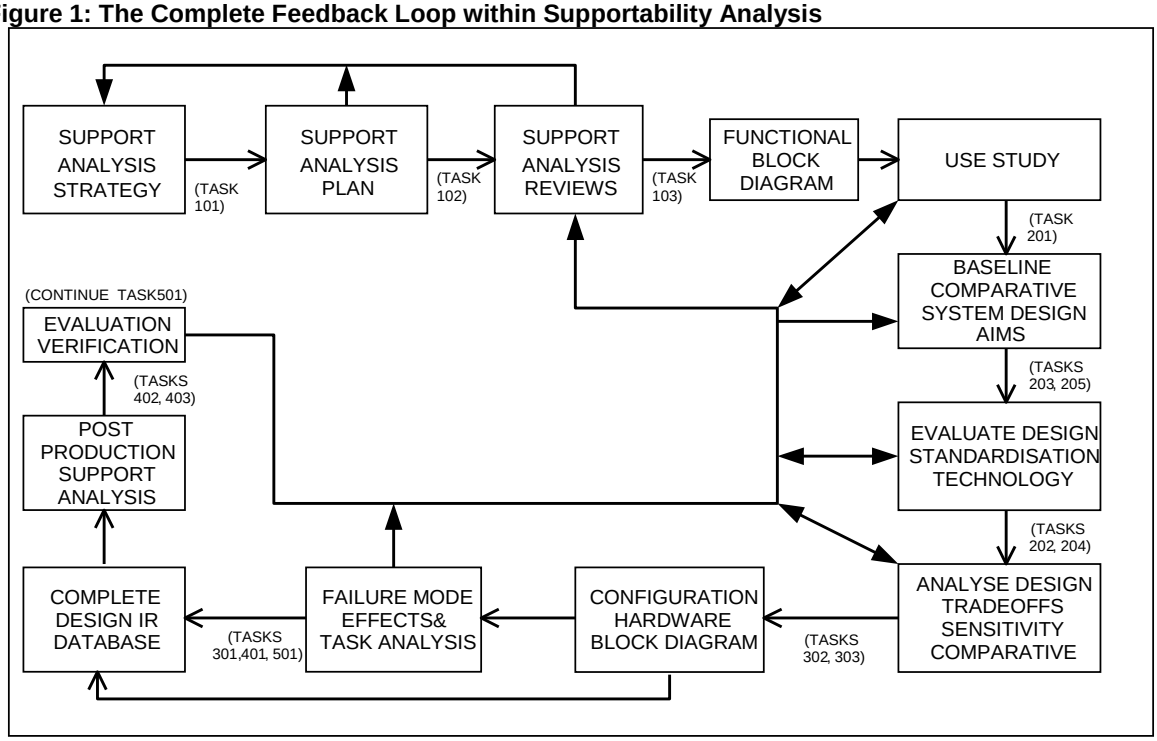
   b. During the Manufacture and In-Service stages of the project, SA continues. In-Service performance data is compared with data in the Information Repository to

[1] The MOD Acquisition Cycle – CADMID (Concept, Assessment, Demonstration, Manufacture, In-Service and Disposal).

identify high cost and readiness drivers. Corrective action will be taken, possibly under the terms of the Contract. The SA feedback loop is depicted at Figure 1.

8. The SA process is not limited to full design and development Item (FDI) but is also applicable to a Non-Development Item (NDI), a Commercial Off The Shelf (COTS) procurement, or any possible hybrid combinations as described in the SA Strategy.

Figure 1: The Complete Feedback Loop within Supportability Analysis



KEY PRINCIPLES

9. SA is a key principle in delivering an integrated support solution, a structured method of analyzing the support implications of products and applied throughout the CADMID cycle. During product development the aim is to identify features of the design that can result in excessive cost In-Service. Once identified, these areas can be the subject of trade-offs to revise the design in order to reduce later costs.

10. SA requirements are identified in Def Stan 00-600 and are divided into five groups:

a. Programme planning and control; concentrates on the cost-effective way of applying the analysis and determines the activities to be performed

b. Mission and support systems definition; describes the SA analysis in the early phases of a project, to identify areas where design may be modified to aid product supportability

c. Preparation and evaluation of alternatives; identifies trade-offs that can be performed on a more developed design and alternative product support options.

d. Determination of support resource requirements; identifies the full support requirement for the product and ensures through life supportability, to inform the development of the support solution.

e. Supportability assessment; reviews the SA to evaluate effectiveness and confirm the realisation of predicted benefits.

11. All Projects will have SA applied. The scope of this will differ with each project, as these will contain varying factors, including COTS products. Tailoring exercises must be carried out and completed throughout the CADMID cycle, to suit each individual Project.

12. A Supportability Analysis Plan (SAP) will be produced by the Contractor, to identify how they will meet the contracted SA Requirements, as stated in the ILS Statement Of Work. The way the SA delivers effective integration of support aspects within the Project shall be specifically identified within the Programme plan.

13. The SAP will describe in detail how the SA programme will be conducted to meet the requirements. Specific areas to be covered are:

a. SA programme schedule including activity responsible agency.

b. Management structure and organization.

c. Application of SA to the proposed solution.

d. SA activities selected to meet the requirements and depth of analysis.

e. Product breakdown structure and candidate items list.

f. Control of Subcontractors SA programmes.

g. Interface requirements.

h. SA Control Number system.

i. Government Furnished Information (GFI) requirement.

j. Government Furnished Equipment (GFE) requirement.

k. Government Furnished Facilities (GFF) requirement.

l. SA data updates and validation.

m. Data collection.

n. Information Repository system.

SOFTWARE

14. SA is applied to software in the same manner as hardware but has specific emphasis on safety critical aspects.

15. JSP886 Volume 7 Part 4 Software Support outlines the MOD policy to be followed to ensure that software being introduced to service is supportable through life and in the most cost effective manner.

ASSOCIATED STANDARDS

16. Def Stan 00-600.

OWNERSHIP AND POINTS OF CONTACT

17. Formulation of policy on the subject of SA within the JSC is vested in DES IMOC SCM-TLS-TL and is subject to ratification by the Defence Logistics Policy Steering Group (DLPSG).

18. Enquiries concerning the technical content of this instruction should be addressed to:

DES IMOC SCP-ILS2
Tel: Mil: 9679 Ext 82689. Civ: 030679 82689
E-Mail: DES IMOC SCP-ILS2

19. Enquiries concerning the accessibility and presentation of this instruction should be addressed to the JSP 886 Editorial team:

ACDS LOGOPS JSP886 ET1
Tel: Mil: 9679 Ext 80953. Civ: 030679 80953
E-Mail: ACDSLOGOPS-JSP886ET1C2

CHAPTER 2: GENERAL REQUIREMENTS

SCOPE

1. This document provides information and guidance for interpretation of SA requirements, to meet the overall objectives of the Acquisition and Through Life Management of Defence products. It can apply equally to a contractor or the MOD SA requirements. This advice and guidance is not intended for use as a contractual document. It can be used to identify SA[2] activities to be completed to meet the contracted requirements in accordance with the Project specific tailored Def Stan 00-600 requirements.

2. Related documents that are applicable to implementing SA are listed below:

Table 2.1: Documents Applicable to Implementing Supportability Analysis

Reference	Description
Def Stan 00-600	Integrated Logistic Support Requirements for MOD Projects.
ASD S1000D	International Specification for Technical Publications Utilising a Common Source Database.
ASD S2000M	International Specification for Materiel Management Integrated Data Processing for Military Equipment.
Def Stan 00-40	Reliability and Maintainability.
Def Stan 00-45	Using Reliability Centred Maintenance to Manage Engineering Failures.
Def Stan 05-57	Configuration Management Policy and Procedures for Defence Materiel.

SUPPORTABILITY ANALYSIS MANAGEMENT AND INFORMATION REPOSITORY

Supportability Analysis Management

3. The management of SA can be divided into three main areas:

   a. Determining and providing resources to enable the SA process to take place.

   b. Integrating and conducting the SA process.

   c. Implementing the results of the SA process.

The Supportability Analysis Process

4. The SA process to meet the contracted tailored requirements of Def Stan 00-600 shall form the basis for preparation, analysis and dissemination of all support and support related information for all products supplied, designed or produced by the contractor. For a specific product an Integrated Support Plan (ISP) and a Support Analysis Plan (Task 102) will be required. In these documents the Contractor will outline his organisation, management and control arrangements for the project. This will include staff levels with assigned authority and responsibilities for the integration of the SA activity with the product design and other support related activity covering the ILS elements specified in the tender requirements or the Contract. It might be appropriate, depending on the phase and size of the project, for a Contractor to:

   a. Appoint a manager to exercise control of the ILS functions and be accountable for the SA programme, including deliverables specified in the contract.

---

[2] SA does not use the traditional LSA Task numbering system, where applicable LSA Task numbers are identified in parenthesises for guidance only.

b. Assign a manager(s) to oversee each aspect of the SA programme.

c. Identify responsibilities for management and control of the use and dissemination of data and other analysis results using the SA process.

5. Integrate the SA process with that of the design and associated manufacturing processes.

The Supportability Analysis Activities

6. SA activities are identified in Table 2. 2 and guidance to activity and sub activity applicability by CADMID stage is given in Tables 2. 4 to 2. 13, for FDI and COTS projects.

Table 2.2: Supportability Analysis Activities

Activity Series	Purpose	Activity / Sub Activity
Programme Planning and Control (100 series)	To provide for formal programme planning and review actions	Develop SA strategy (Task 101) Supportability Objectives (Task 101. 2. 1) Cost Estimate (Task 101. 2. 2) Updates (Task 101. 2. 3) SA Plan (SAP) (Task 102) SA Plan (Task 102. 2. 1) Updates (Task 102. 2. 2) SAP Format (Task 102. 2. 3) Programme and Design Reviews (Task 103) Establish Review Procedures (Task 103. 2. 1) Design Reviews (Task 103. 2. 2) Programme Reviews (Task 103. 2. 3) SA Review (Task 103. 2. 4) SA Guidance Conferences (Task 103. 2. 5)
Mission and Support Systems Definition (200 series)	To establish supportability objectives and supportability related design goals, thresholds and constraints through comparison with existing systems and analyses of supportability, cost and readiness drivers.	Use Study (Task 201) Supportability Factors (Task 201. 2. 1) Quantitative Factors (Task 201. 2. 2) Field Visits (Task 201. 2. 3) Use Study Reports and Updates (Task 201. 2. 4) Mission Hardware, Software, Firmware and Support System Standardization (Task 202) Supportability Constraints (Task 202. 2. 1) Supportability Characteristics (Task 202. 2. 2) Recommended Approaches (Task 202. 2. 3) Risks (Task 202. 2. 4) Comparative Analysis (Task 203) Identify Comparative Systems (Task 203. 2. 1) Baseline Comparison System (Task 203. 2. 2) Comparative System Characteristics (Task 203. 2. 3) Qualitative Supportability Problems (Task 203. 2. 4) Supportability, Cost and Readiness Drivers (Task 203. 2. 5) Unique System Drivers (Task 203. 2. 6) Updates (Task 203. 2. 7) Risks and Assumptions (Task 203. 2. 8) Technological Opportunities (Task 204) Recommended Design Objectives (Task 204. 2. 1) Updates (Task 204. 2. 2) Risks (Task 204. 2. 3)
		Supportability and Supportability Related Design Factors (Task 205) Supportability Characteristics (Task 205. 2. 1) Sensitivity Analysis (Task 205. 2. 2) Identify Proprietary Data (Task 205. 2. 3) Supportability Objectives and Associated Risks (Task 205.2.4) Specification Requirements (Task 205. 2. 5)

Activity Series	Purpose	Activity / Sub Activity
		NATO Constraints (Task 20 5 . 2. 6) Supportability Goals and Thresholds (Task 205. 2. 7)
Preparation and Evaluation of Alternatives (300 series)	To optimize the support system for the new item and to develop a system which achieves the best balance between cost, schedule, performance and supportability.	Functional Requirements Identification (Task 301) Functional Requirements (Task 301. 2. 1) Unique Functional Requirements (Task 301. 2. 2) Risks (Task 301. 2. 3) Operations and Maintenance Tasks (Task 301. 2. 4) Design Alternatives (Task 301. 2. 5) Updates (Task 301. 2. 6) Support System Alternatives (Task 302) Alternative Support Concepts (Task 302. 2. 1) Support Concepts Updates (Task 302. 2. 2) Alternative Support Plans (Task 302. 2. 3) Support Plan Updates (Task 302. 2. 4) Risks (Task 302. 2. 5) Evaluation of Alternatives and Trade-off Analysis (Task 303) Trade-off Criteria (Task 303. 2. 1) Support System Tradeoffs (Task 303. 2. 2) System Trade-offs (Task 303. 2. 3) Readiness Sensitivities (Task 303. 2. 4) Manpower and Personnel Trade-offs (Task 303. 2. 5) Training Trade-offs (Task 303. 2. 6) Level Of Repair Analysis (Task 303. 2. 7) Diagnostic Trade-offs (Task 303. 2. 8) Comparative Evaluations (Task 303. 2. 9) Energy Trade-offs (Task 303. 2. 10) Survivability Tradeoffs (Task 303. 2. 11) Transportability Trade-offs (Task 303. 2. 12) Support Facility Trade-offs (Task 303. 2. 13)
Determination of Logistic Support Resource Requirements (400 series)	To identify the logistic support resource requirements of the new system in its operational environment(s) and to develop plans for post manufacture support.	Task Analysis (Task 401) Task Analysis (Task 401. 2. 1) Analysis Documentation (Task 401. 2. 2) New/Critical Support Resources (Task 401. 2. 3) Training Requirements and Recommendations (Task 401. 2. 4) Design Improvements (Task 401. 2. 5) Management Plans (Task 401. 2. 6) Transportability Analysis (Task 401. 2. 7) Provisioning Requirements (Task 401. 2. 8) Validation (Task 401. 2. 9) ILS Output Products (Task 401. 2. 10) Information Repository Updates (Task 401. 2. 11) Provisioning Screening (Task 401. 2. 12) Early Fielding Analysis (Task 402) New System Impact (Task 402. 2. 1) Sources of Manpower and Personnel Skills (Task 402. 2. 2) Impact of Resource Shortfalls (Task 402. 2. 3) Combat Resource Requirements (Task 402. 2. 4) Plans for Problem Resolution (Task 402. 2. 5) Post Production Support Analysis (Task 403) Post Production Support Plan (Task 403. 2. 1)
Supportability Assessment (500 series)	To assure that specified requirements are achieved and deficiencies corrected.	Supportability Test, Validation, Evaluation and Task Evaluation (Task 501) Test and Evaluation Strategy (Task 501. 2. 1) System Support Package Component List (Task 501. 2. 2) Objectives and Criteria (Task 501. 2. 3) Updates and Corrective Actions (Task 501. 2. 4) Supportability Assessment Plan (Post Production) (Task 501. 2. 5) Supportability Assessment (Post Production) (Task 501. 2. 6)

Logistic Information Repository Management.

7. Engineering disciplines and ILS functional elements are integrated to maximize the applicability of data developed by each, and is held in the Logistic Information Repository (LIR). These processes might be performed by separate (MOD and Contractor) organisations supported by separate automated systems.

8. Benefits of integration include:

a. Reduced duplication of effort.

b. Improved consistency and quality of the data.

c. Improved quality of the item or product under development.

d. Improved influence on design for product supportability.

9. The Information Repository provides an organized database that consolidates the engineering and logistics data necessary to identify the detailed support requirements of a product. Further advice and guidance on Information Management is given in JSP 886 Volume 7 Part 5.

10. The information contained in the Information Repository is used to:

a. Develop the maintenance requirements.

b. Determine the impact of specific design features on logistic supportability.

c. Determine how the proposed support system affects product R and M characteristics.

d. Influence the design.

e. Provide initial information for trade-off analyses, WLF studies, and logistic support modelling.

f. Provide source data for the preparation of logistic products.

11. A single Information Repository will be created for each project; however, on large projects, sections of the Repository may be developed separately for major sub - assemblies. If this is done, care must be taken to ensure that the Logistic Control Number (LCN) structure is coherent across the entire project.

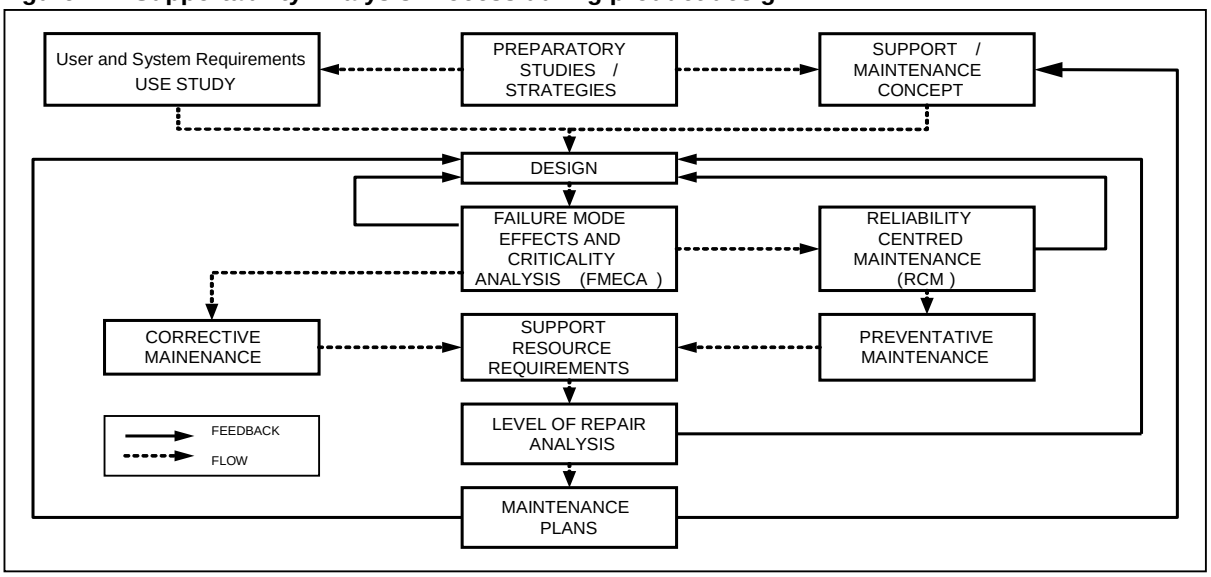
12. The management and control of the relationship between the computing resources used to host the Information Repository and other Information Technology (IT) systems must be considered. The need to import and export data to the Information Repository must be planned using the information management requirements described in Def Stan 00-600.

APPLICATION OF SUPPORTABILITY ANALYSIS AND LOGISTIC INFORMATION REPOSITORY TO PROJECTS

Supportability Analysis Process

13. The SA process is applicable through all stages of a project. From a MOD perspective, it commences in the Concept phase, with the consideration of supportability aspects. The results of these considerations are fed into the design process to optimize support. However, not all projects have the freedom to influence the design. In cases where SA cannot influence the design for supportability, activities will be tailored to the requirements of the project, possibly limited to identifying and recording the logistic support of an existing design. Even such a reduced SA shall include analysis of the maintenance requirements to provide the necessary data for decision making and for determining the logistic support. The SA process is iterative and continues to be applied throughout the useful life of the product. This process is depicted in Figure 2. 1.

Figure 2.1: Supportability Analysis Process during product design



14. Generally, the SA process cannot be undertaken to the maximum depth of the product breakdown structure in a single stage and analysis to the maximum depth for all items may not be justified in all cases. Usually, the analysis starts with assessment of the functional breakdown to identify the main SA Candidate Items, then progressively analyses the support for increasing levels of indenture of the product breakdown structure. If significant support cost savings are identified in later analysis by a change that also affects earlier analysis, then the earlier work must be reassessed to confirm its validity.

Application of Supportability Analysis to Software

15. Specific guidance on the application of SA to software is provided in Chapter 4.

Design Influence

16. The greatest influence of design for supportability is achieved in the Concept, Assessment and early part of the Demonstration phases. These phases shall contain early analysis results including trade-off studies affecting supportability. Identified risk factors that can prejudice the optimum achievement of supportability shall be highlighted.

17. The individual SA activity titles from Def Stan 00-600 and responsibilities are shown in Table 2. 3. The term Responsible Agency indicates who shall be responsible for initiating action under each activity. It is stressed that the table is provided for guidance only and not all activities will be appropriate to all stages of every project.

Table 2.3: SA Activity Responsibilities

Title	Responsible Agency
Develop SA Strategy (Task 101)	Sponsor and Project Team (PT)
SA Plan (Task 102)	PT
Programme and Design Review (Task 103)	PT and or Contractor
Use Study (Task 201)	Sponsor and PT
Mission Hardware, Software, Firmware and Support System Standardization (Task 202)	Contractor
Comparative Analysis (Task 203)	Contractor
Technological Opportunities (Task 204)	Contractor
Supportability and Supportability Related Design Factors (Task 205)	Contractor
Functional Requirements Identification (Task 301)	Contractor
Support System Alternatives (Task 302)	Contractor
Trade-off Analysis (Task 303)	Contractor
Task Analysis (Task 401)	Contractor
Early Fielding Analysis (Task 402)	PT, User and or Contractor
Post Production Support Analysis (Task 403)	PT, User and or Contractor
Supportability Test, Evaluation and Verification (Task 503)	PT, User and or Contractor

SUPPORTABILITY ANALYSIS ACTIVITIY APPLICABILITY

18. Tables 2. 4 to 2. 13 below provide examples of the typical matching between the SA activities and CADMID life-cycle stages for a:

a. Full scale development project (FDI) project.

b. Commercial Off The Shelf (COTS) project.

The Programme Planning and Control Activities

19. The Programme Planning and Control activities (100 series tasks) concentrate on planning the most cost-effective way of applying the analysis. They determine what activities will be planned, when, and on which product

Table 2.4: Programme Planning and Control activities for FDI Project

Activity Description	C	A	D	M	I	D
Development of a SA strategy (Task 101)	Define the policy for SA					
Supportability Objectives (Task 101. 2. 1)	G					
Cost Estimate (Task 101. 2. 2)	G					
Updates (Task 101. 2. 3)		G	G	G	G	G
SA Plan (Task 102)	Define activities and responsibilities					
SA Plan (Task 102. 2. 1)	G				M	
Updates (Task 1012. 2. 2)		G	G	G	M	
SAP Format (Task 102. 2. 3)	G	G	G	G	M	
Programme and Design Reviews (Task 103)	How will work be monitored					
Establish Review Procedures (Task 103. 2. 1)	G	G	S	S	M	
Design Reviews (Task 103. 2. 2)	G	G	G	G	M	
Programme Reviews (Task 103. 2. 3)	G	G	G	G	M	
SA Review (Task 103. 2. 4)	G	G	G	G	M	
SA Guidance Conferences (Task 103. 2. 5)	G	G	G	G	M	

Key: G - Generally Applicable, M - Applicable to Modifications, N - Not Applicable, S - Selectively Applicable

Table 2.5: Programme Planning and Control activities for COTS Project

Activity Description	C	A	D	M	I	D
Development of a SA strategy (Task 101)	Define the policy for SA					
Supportability Objectives (Task 101. 2. 1)	G					
Cost Estimate (Task 101. 2. 2)	G					
Updates (Task 101. 2. 3)		G	G	G	G	
SA Plan (Task 102)	Define activities and responsibilities					
SA Plan (Task 102. 2. 1)	G					
Updates (Task 102. 2)		G	G[3]	G[3]	M[3]	
SAP Format (Task 102. 2. 3)	G	G	G[3]	G[3]	M[3]	
Programme and Design Reviews (Task 103)	How will work be monitored					
Establish Review Procedures (Task 103. 2. 1)	G	G				
Design Reviews (Task 103. 2. 2)	G	G				
Programme Reviews (Task 103. 2. 3)	G	G	S			
SA Review (Task 103. 2. 4)	G	G	S			
SA Guidance Conferences (Task 103. 2. 5)	G	G	S			

Key: G - Generally Applicable, M - Applicable to Modifications, N - Not Applicable, S - Selectively Applicable

The Mission and Support Systems Definition Activities

20. The Mission and Support Systems Definition activities (200 series tasks) describe the SA "Front End" analyses that are appropriate to the assessment and early part of the Demonstration phase. These activities are used to identify areas where there can be benefit in modifying the design, to aid the supportability of the product, and consolidating all the findings in a report.

Table 2.6: Mission and Support System Definition activities for FDI Project

Activity Description	C	A	D	M	I	D
Use Study (Task 201)	Identify the current support system					
Supportability Factors (Task 201. 2. 1)	G	G			M	
Quantitative Factors (Task 201. 2. 2)	G	G			M	
Field Visits (Task 201. 2. 3)	G	G			M	
Use Study Reports and Updates (Task 201. 2. 4)		G	G		M	
Mission Hardware, Software, Firmware and Support System Standardization (Task 202)	Identify possible standardization with existing systems					
Supportability Constraints (Task 202. 2. 1)	G	G	G	G	M	
Supportability Characteristics (Task 202. 2. 2)	G	G	G		M	
Recommended Approaches (Task 202. 2. 3)	G	G	G	G	M	
Risks (Task 202. 2. 4)	G	G	G	G	M	
Comparative Analysis (Task 203)	Identify problems with current systems					
Identify Comparative Systems (Task 203. 2. 1)	G	G			M	
Baseline Comparison System (Task 203. 2. 2)	G	G	G		M	
Comparative System Characteristics (Task 203. 2. 3)	G	G			M	
Qualitative Supportability Problems (Task 203. 2. 4)	G	G	G		M	
Supportability, Cost and Readiness Drivers. (Task 203. 2. 5)	G	G	G		M	
Unique System Drivers (Task 203. 2. 6)	G	G			M	
Updates (Task 203. 2. 7)		G	G		M	
Risks and Assumptions (Task 203. 2. 8)	G	G			M	
Technological Opportunities (Task 204)	Identify possible new ideas					
Recommended Design Objectives (Task 204. 2. 1)	G	S			M	
Updates (Task 204. 2. 2)		G	S		M	
Risks (Task 204. 2. 3)		G	S		M	
Supportability and Supportability Related Design Factors (Task 205)	Provide guidance to design team					
Supportability Characteristics (Task 205. 2. 1)		G	G		M	

[3] Applicable to Support System only.

Sensitivity Analysis (Task 205. 2. 2)		G	G		M	
Identify Proprietary Data (Task 202. 2. 3)		G	G		M	
Supportability Objectives and Associated Risks (Task 205. 2. 4)		G	G		M	
Specification Requirements (Task 205. 2. 5)			G		M	
NATO Constraints (Task 205. 2. 6)		G	G		M	
Supportability Goals and Thresholds (Task 205. 2. 7)			G		M	

Key: G - Generally Applicable, M - Applicable to Modifications, N - Not Applicable, S - Selectively Applicable

Table 2.7: Mission and Support System Definition activities for COTS Project

Activity Description	C	A	D	M	I	D
Use Study (Task 201)	Identify the current support system					
Supportability Factors (Task 201. 2. 1)	G	G			M[1]	
Quantitative Factors (Task 201. 2. 2)	G	G			M[1]	
Field Visits (Task 201. 2. 3)	G	G			M[1]	
Use Study Reports and Updates (Task 201. 2. 4)		G	G		M[1]	
Mission Hardware, Software, Firmware and Support System Standardisation (Task 202)	Identify possible standardization with existing systems					
Supportability Constraints (Task 202. 2. 1)	G	G	G[1]	G[3]	M[3]	
Supportability Characteristics (Task 202. 2. 2)	G	G	G[3]		M[3]	
Recommended Approaches (Task 202. 2. 3)	G	G	G[3]	G[3]	M[3]	
Risks (Task 202. 2. 4)	G	G	G[3]	G[3]	M[3]	
Comparative Analysis (Task 203)	Identify problems with current systems					
Identify Comparative Systems (Task 203. 2. 1)	G	G				
Baseline Comparison System (Task 203. 2. 2)	G	G	G			
Comparative System Characteristics (Task 203. 2. 3)	G	G				
Qualitative Supportability Problems (Task 203. 2. 4)	G	G	G			
Supportability, Cost and Readiness Drivers. (Task 203. 2. 5)	G	G	G			
Unique System Drivers (Task 203. 2. 6)	G	G				
Updates (Task 203. 2. 7)		G	G			
Risks and Assumptions (Task 203. 2. 8)	G	G				
Technological Opportunities (Task 204)	Identify possible new ideas					
Recommended Design Objectives (Task 204. 2. 1)	G	S				
Updates (Task 204. 2. 2)		G				
Risks (Task 204. 2. 3)		G				
Supportability and Supportability Related Design Factors (Task 205)	Provide guidance to design team					
Supportability Characteristics (Task 20. 52. 1)		G	G			
Sensitivity Analysis (Task 205. 2. 2)		G	G			
Identify Proprietary Data (Task 205. 2. 3)		G	G			
Supportability Objectives and Associated Risks(Task 205. 2. 4)		G	G			
Specification Requirements (Task 205. 2. 5)			G			
NATO Constraints (Task 205. 2. 6)		G	G			
Supportability Goals and Thresholds (Task 205. 2. 7)			G			

Key: G - Generally Applicable, M - Applicable to Modifications, N - Not Applicable, S - Selectively Applicable

The Preparation and Evaluation of Alternative Activities

21. The Preparation and Evaluation of Alternative activities (300 series tasks) identify any detailed trade-offs that can be performed once the design is more defined and also different ways of supporting the product. These are generally performed later in the Assessment phase, or early in the Demonstration Phase.

Table 2.8: Preparation and Evaluation of Alternative activities for FDI Project

Activity Description	C	A	D	M	I	D
Functional Requirements Identification (Task 301)	Identify functions (tasks inventory) risks, design deficiencies, and support drivers.					
Functional Requirements (Task 301. 2. 1)	G	G	G		M	
Unique Functional Requirements (Task 301. 2. 2)	G	G	G		M	
Risks (Task 301. 2. 3)	G	G	G		M	
Operations and Maintenance Tasks (Task 301. 2. 4)	G	G	G		M	
Design Alternatives (Task 301. 2. 5)	G	G	G		M	
Updates (Task 301. 2. 6)	G	G	G		M	
Support System Alternatives (Task 302)	Identify different support options					
Alternative Support Concepts (Task 302. 2. 1)	G	G			M	
Support Concepts Updates (Task 302. 2. 2)	G	G	S		M	
Alternative Support Plans (Task 302. 2. 3)	S	S	G		M	
Support Plan Updates (Task 302. 2. 4)	S	S	G		M	
Risks (Task 302. 2. 5)	G	G	G		M	
Trade-off Analysis (Task 303)	Assess design and support options. Determine preferred support options. Assist design studies					
Trade-off Criteria (Task 303. 2. 1)	G	G	G		M	
Support System Trade-offs (Task 303. 2. 2)	G	G	G		M	
System Trade-offs (Task 303. 2. 3)	G	G	G		M	
Readiness Sensitivities (Task 303. 2. 4)	G	G	G		M	
Manpower and Personnel Trade-offs (Task 303. 2. 5)	G	G	S		M	
Training Trade-offs (Task 303. 2. 6)	G	G	G		M	
Level Of Repair Analysis (Task 303. 2. 7)	G	G	G		M	
Diagnostic Trade-offs (Task 303. 2. 8)	G	G	S		M	
Comparative Evaluations (Task 303. 2. 9)	G	G	S		M	
Energy Trade-offs (Task 303. 2. 10)	G	G	S		M	
Survivability Trade-offs (Task 303. 2. 11)	G	G	G		M	
Transportability Trade-offs (Task 303. 2. 12)	G	G			M	
Support Facility Trade-offs (Task 303. 2. 13)	G	G			M	

G - Generally Applicable, M - Applicable to Modifications, N - Not Applicable, S - Selectively Applicable

Table 2.9: Preparation and Evaluation of Alternative activities for COTS Project

Activity Description	C	A	D	M	I	D
Functional Requirements Identification (Task 301)	Identify functions (tasks inventory) risks, design deficiencies, and support drivers.					
Functional Requirements (Task 301. 2. 1)	G	G	G		M	
Unique Functional Requirements (Task 301. 2. 2)	G	G	G		M	
Risks (Task 301. 2. 3)	G	G	G		M	
Operations and Maintenance Tasks (Task 301. 2. 4)	G	G	G		M	
Design Alternatives (Task 301. 2. 5)	G	G	G		M	
Updates (Task 301. 2. 6)	G	G	G		M	
Support System Alternatives (Task 302)	Identify different support options					
Alternative Support Concepts (Task 302. 2. 1)	G	G			M	
Support Concepts Updates (Task 302. 2. 2)	G	G	S		M	
Alternative Support Plans (Task 302. 2. 3)	S	S	G		M	
Support Plan Updates (Task 302. 2. 4)	S	S	G		M	
Risks (Task 302. 2. 5)	G	G	G		M	
Trade-off Analysis (Task 303)	Assess design and support options. Determine preferred support options. Assist design studies					
Trade-off Criteria (Task 303. 2. 1)	G	G	G		M	
Support System Trade-offs (Task 303. 2. 2)	G	G	G		M	
System Trade-offs (Task 303. 2. 3)	G	G	G		M	
Readiness Sensitivities (Task 303. 2. 4)	G	G	G		M	
Manpower and Personnel Trade-offs (Task 303. 2. 5)	G	G	S		M	
Training Trade-offs (Task 303. 2. 6)	G	G	G		M	

Activity Description	C	A	D	M	I	D
Level Of Repair Analysis (Task 303. 2. 7)	G	G	S		M	
Diagnostic Trade-offs (Task 303. 2. 8)	G	G	S		M	
Comparative Evaluations (Task 303. 2. 9)	G	G	S		M	
Energy Trade-offs (Task 303. 2. 10)	G	G	S		M	
Survivability Trade-offs (Task 303. 2. 11)	G	G	S		M	
Transportability Trade-offs (Task 303. 2. 12)	G	G			M	
Support Facility Trade-offs (Task 303. 2. 13)	G	G			M	

Key: G - Generally Applicable, M - Applicable to Modifications, N - Not Applicable, S - Selectively Applicable

The Determination of Support Resource Requirements

22. The Determination of Support Resource Requirements activities (400 series tasks) identify in full the support requirements of the product and ensure that it will continue to be supportable throughout its life. These activities can be the most resource intensive to complete and therefore shall be performed as late as practical, ideally once the design has been finalised, but noting the lead time to effect the support requirements.

Table 2.10: Determination of Support Resource activities for FDI Project

Activity Description	C	A	D	M	I	D
Task Analysis (Task 401)	Identify and document detailed support requirements. Complete full RCM analysis. Provide source data for ILS documentation					
Task Analysis (Task 401. 2. 1)		S	G		M	
Analysis Documentation (Task 401. 2. 2)		S	G		M	
New / Critical Support Resources. (Task 401. 2. 3)		S	G		M	
Training Requirements and Recommendations (Task 401. 2. 4)		S	G		M	
Design Improvements (Task 401. 2. 5)		S	G		M	
Management Plans (Task 401. 2. 6)		S	G		M	
Transportability Analysis (Task 401. 2. 7)		G	S		M	
Provisioning Requirements (Task 401. 2. 8)		S	G		M	
Validation (Task 401. 2. 9)		S	G		M	
ILS Output Products (Task 401. 2. 10)		S	G		M	
Information Repository Updates. (Task 401. 2. 11)		S	G		M	
Provisioning Screening (Task 401. 2. 12)		S	G		M	
Early Fielding Analysis (Task 402)	Determine effects on existing support organisation					
New System Impact (Task 402. 2. 1)			G		M	
Sources of Manpower and Personnel Skills (Task 402. 2. 2)			G		M	
Impact of Resource Shortfalls. (Task 402. 2. 3)			G		M	
Combat Resource Requirements. (Task 402. 2. 4)			G		M	
Plans for Problem Resolution (Task 402. 2. 5)			G		M	
Post Production Support Analysis. (Task 403)	Establish requirements after production stops					
Post Production Support Plan. (Task 403. 2. 1)		G	G	G	M	

Key: G - Generally Applicable, M - Applicable to Modifications, N - Not Applicable, S - Selectively Applicable

Table 2.11: Determination of Support Resource activities for COTS Project

Activity Description	C	A	D	M	I	D
Task Analysis (Task 401)	Identify and document detailed support requirements. Complete full RCM analysis. Provide source data for ILS documentation					
Task Analysis (Task 401. 2. 1)		S	G		M	
Analysis Documentation (Task 401. 2. 2)		S	G		M	
New / Critical Support Resources. (Task 401. 2. 3)		S	G		M	
Training Requirements and Recommendations (Task 401. 2. 4)		S	G		M	
Design Improvements (Task 401. 2. 5)		S	G		M	
Management Plans (Task 401. 2. 6)		S	G		M	
Transportability Analysis (Task 401. 2. 7)		G	S		M	
Provisioning Requirements (Task 401. 2. 8)		S	G		M	
Validation (Task 401. 2. 9)		S	G		M	
ILS Output Products (Task 401. 2. 10)		S	G		M	
Information Repository Updates. (Task 401. 2. 11)		S	G		M	
Provisioning Screening (Task 401. 2. 12)		S	G		M	
Early Fielding Analysis (Task 402)	Determine effects on existing support organisation					
New System Impact (Task 402. 2. 1)			G		M	
Sources of Manpower and Personnel Skills (Task 402. 2. 2)			G		M	
Impact of Resource Shortfalls. (Task 402. 2. 3)			G		M	
Combat Resource Requirements. (Task 402. 2. 4)			G		M	
Plans for Problem Resolution (Task 402. 2. 5)			G		M	
Post Production Support Analysis. (Task 403)	Establish requirements after production stops					
Post Production Support Plan. (Task 4013. 2. 1)		G	G	G	M	

Key: G - Generally Applicable, M - Applicable to Modifications, N - Not Applicable, S – Selectively Applicable

The Supportability Assessment Activities

23. The Supportability Assessment activities (500 series tasks) involve a review of the SA to determine whether it achieved its objectives and where lessons can be learnt. They also cover the analysis of supportability data as it becomes available from standard supply, maintenance and readiness-reporting systems.

Table 2.12: Supportability Assessment activities for FDI Project

Activity Description	C	A	D	M	I	D
Supportability Test, Validation. Evaluation and Task evaluation (Task 501)	Develop the procedures to verify that the support system is achieving the objectives. Continued monitoring through life to adapt to changes.					
Test and Evaluation Strategy (Task 501. 2. 1)	G	G	G		M	
System Support Package Component List (Task 501. 2. 2)		G	G	G	M	
Objectives and Criteria (Task 501. 2. 3)		G	G	G	M	
Updates and Corrective Actions. (Task 501. 2. 4)		G	G	S	S	
In Service Supportability Assessment Plan (Task 501. 2. 5)			G	S	M	
In Service Supportability Assessment. (Task 501. 2. 6)					G	

Key: G - Generally Applicable, M - Applicable to Modifications, N - Not Applicable, S - Selectively Applicable

Table 2.13: Supportability Assessment activities for COTS Project

Activity Description	C	A	D	M	I	D
Supportability Test, Evaluation Verification (Task 501)	Develop the procedures to verify that the support system is achieving the objectives. Continued monitoring through life to adapt to changes.					
Test and Evaluation Strategy (Task 501. 2. 1)	G	G	G			
System Support Package Component List (Task 501. 2. 2)		G	G	G		
Objectives and Criteria (Task 501. 2. 3)		G	G	G		
Updates and Corrective Actions. (Task 501. 2. 4)		G	G	S[1]	S[1]	
In Service Supportability Assessment Plan (Task 501. 2. 5)			G	S[1]		
In Service Supportability Assessment.					G	

Key: G - Generally Applicable, M - Applicable to Modifications, N - Not Applicable, S - Selectively Applicable

LOGISTIC INFORMATION REPOSTITORY DEVELOPMENT

24. The population of the Logistic Information Repository usually commences in the Demonstration phase, or earlier if a Baseline Comparison System (BCS) is used, to record the results generated by conducting SA. The population and refinement of the Information Repository may continue throughout the product life cycle.

Supportability Analysis Candidate List Item (CLI)

25. The SA process shall start by identifying those elements of the product that are candidates for analysis. The SA CIL identifies each part of the product that shall be considered for further analysis through the performance of SA activities. The primary source for the identification of MSI is the Failure Mode Effects and Criticality Analysis (FMECA) process. As the analysis proceeds, the preliminary candidate list is extended as lower level assemblies and items are identified through further analysis. Eventually every item in the product that requires support activity, or is involved with the operation of the product, may be considered as a candidate. Piece parts and materials used to manufacture items are not normally included in the CIL. Candidate Items identified as being non-significant as a result of analysis will be removed from the CIL.

26. SA candidates shall not be limited to just the product MSI but shall include support, test and training equipment; consideration will also be given to transportation, storage, packaging and handling, supply support and facilities. The CIL is maintained and updated throughout the SA programme and becomes a guide for ensuring that all support significant items in the product are properly addressed by the SA process.

27. It is important when selecting candidate items that all ILS elements are given consideration, not just maintenance. For example items such as radioactive sources which require no maintenance are logistically significant as they are subject to stringent packaging, handling and storage regulations. They may also require control as individually managed items which will impact on supply support considerations. JSP 392 Radioactive Materials gives further guidance on treatment of radioactive sources.

Maintenance Planning

28. Maintenance Planning is a principal ILS element. The maintenance plan is developed from the SA process. This process may include the application of Failure Modes and Effects Analysis (FMEA) / FMECA, Reliability-Centred Maintenance (RCM) and Level Of Repair Analysis (LORA) techniques together with task analysis (Task 401). Where appropriate, Supportability Analysis for Software (SAS) shall be applied.

29. Task analysis will be carried out to a level and depth commensurate with the type of project procurement and the project phase in the life-cycle. For a project undergoing design and development, the task analysis process will be conducted by the contractor to establish maintenance concepts and support resource requirements for that product. This process shall include:

a. Critical failure modes, identified by the FMECA, are analysed using RCM logic, to ensure product is designed to eliminate critical failure. Where this is not possible, preventive maintenance tasks are identified. The results of RCM are used, within both the Procurement and In-Service project phases, to optimise TLC whilst maintaining performance and availability requirements. The FMEA / FMECA and RCM lead to identification of corrective and preventive maintenance activities respectively, which enables the support resource requirements to be determined. The FMEA / FMECA / RCM standards to be used will be agreed with the MILSM.

b. The application of LORA to determine the level at which an item will be repaired or discarded. This will normally be based on economic factors unless there are overriding operational requirements.

Supportability Analysis Tailoring

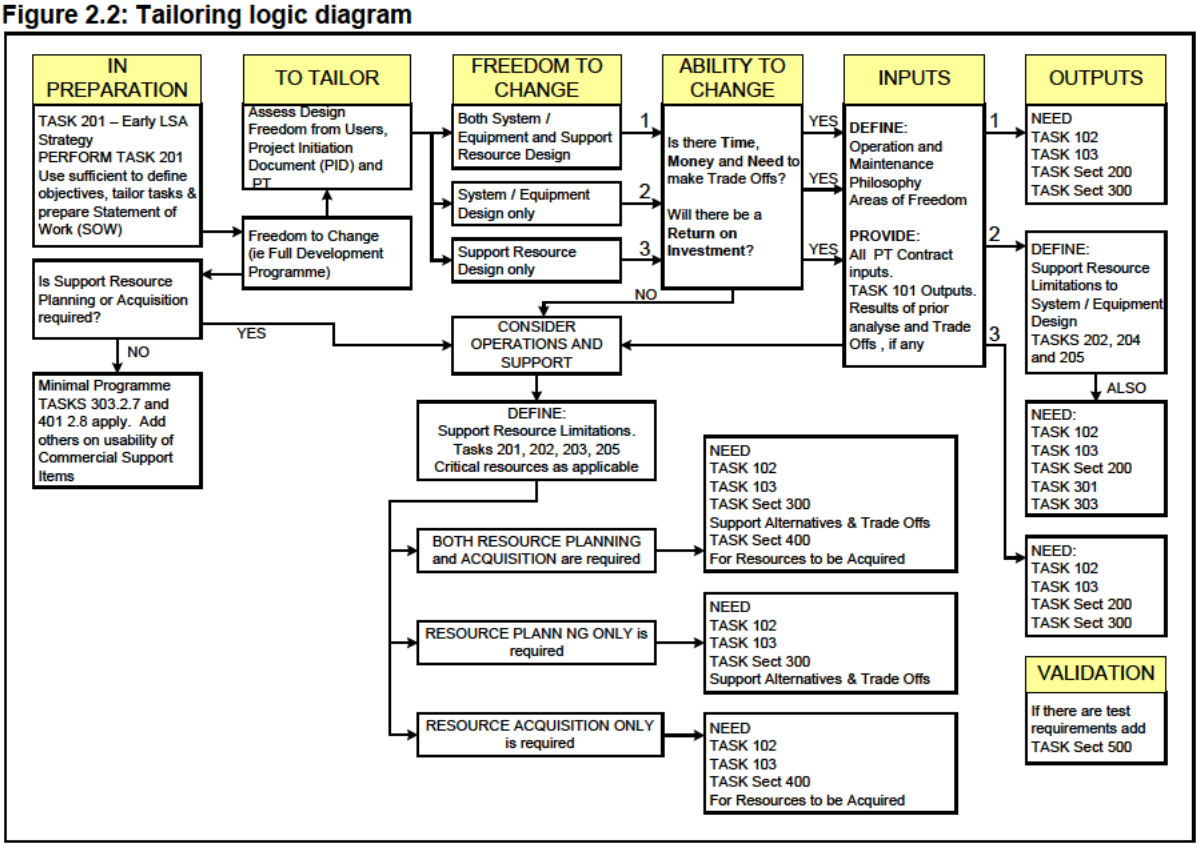
30. The MOD ILSM and Contractor ILSM will need to consider all the SA activities, detailed in Table 2. 2, to identify specific activities to meet the contracted requirements for a particular project. The activities required will vary within a single project, as a product will consist of an amalgam of new design and existing or COTS elements. The design will also require the completion of different activities at different project stages, as well as the same activities undertaken to different levels of detail, during different project stages. Also see Chapter 3.

31. Figure 2. 2 shows the tailoring logic and the tailoring process will therefore need to be undertaken a number of times, both for the different design stages and the different product categories. The overriding objectives will be to identify tasks that are:

a. Beneficial, in terms of influencing the design and reducing Through Life Costs (TLC).

b. Capable of being undertaken with the expected level of design and / or support data available at that time.

Figure 2.2: Tailoring logic diagram



Supportability Analysis Risk Areas

32. Failure to establish an SA Plan or tailor SA requirements or activities to specifically meet the needs of the Project, can result in one or all of the following:

a. Excessive costs.

b. Performance of unwanted analysis whilst failing to complete needed studies.

c. Development of excessive documentation while overlooking critical information needs.

d. Procurement of inappropriate levels or untimely supply of support resources.

CHAPTER 3: APPLICATION GUIDANCE FOR IMPLEMENTATION OF SUPPORTABILITY ANALYSIS PROGRAMME REQUIREMENTS

INTRODUCTION

General

1. This chapter provides rationale and guidance for the selection and tailoring of SA activities listed at Table 2. 2 above in Chapter 2. This chapter is to be used to tailor SA activities in the most cost effective manner to meet project objectives. However, it is not to be referenced or implemented in contractual documents. No requirements are contained in this chapter; the users of this chapter can include any customer who wishes to identify SA activities to a supplier.

2. The Contractor will tailor SA activities and Sub Activities to meet the SA requirements set out in the Contract. The selected activities will be included in the SA Plan (SAP) and will be agreed and progress monitored through the Logistic Support Committee (LSC) or In Service Logistic Support Committee (ISLSC)

How to Use this Chapter

3. This section provides guidance on structuring SA programmes and on applying the individual activities and sub activity requirements. The user shall first review the major considerations affecting the development of the SA programme contained in General Application Guidance for SA Programmes and then refer to the appropriate parts of Detailed Guidance for Task Sections Activities and Sub Activities sections below, based on the activities and sub activities selected.

GENERAL APPLICATION GUIDANCE FOR SUPPORTABILITY ANALYSIS PROGRAMMES

SA Process

4. As described above, SA is an iterative and multi-disciplinary activity with many interfaces.

5. The SA process is divided into two general parts:

   a. Analysis of supportability.

   b. Assessment and verification of supportability.

6. The iterative nature of this process and the input-output relationship of the interfaces change with the procurement phases as described below.

Analysis of Supportability

7. This portion of the SA process commences at the product level to affect design and operational concepts; identify overall logistic support resource requirements of alternative concepts; and to relate design, operational, and supportability characteristics to product readiness objectives and goals. The product level analysis is characterised by use studies, comparative analysis and driver identification, identification of technological opportunities, and trade-offs between support, operational, and design concepts and

between alternative support concepts such as in-house support versus contractor support, built-in versus external test capability, and varying numbers of maintenance levels. Once product level trade-offs are made, the analysis shifts to lower product indentures and toward support product optimization within the framework established by the product level analysis. This analysis defines the logistic support resource requirements of the product through an integrated analysis of all operator and maintenance functions and tasks to determine task frequencies, task times, personnel and skill requirements supply support requirements, etc, to include all elements of ILS. Optimization is achieved at this level through allocation of functions and tasks to specific maintenance levels, LORA, RCM analyses, and formulating design recommendations to optimize maintenance times and logistic support resource requirements. Data from this level of the SA is used as direct input into the development of data products associated with each ILS element such as provisioning lists, personnel and training requirements, and electronic documentation. This ensures compatibility between ILS element documents and permits common use of data which apply to more than one logistic element.

Assessment and Verification

8. This part of the SA process is conducted throughout the product life cycle to demonstrate, within stated confidence levels, the validity of the analysis and products developed from the analysis, and to adjust the analysis results and products as required. This part of the process starts with early planning for verification of support concepts and continues through development, procurement, deployment, and operations to include assessment and verification of post deployment support.

Interfaces

9. Coordination of SA interfaces is a major management challenge which requires final resolution at the working level. The SA sub activities above are structured to facilitate assignment of applicable sub activities to the community most directly involved without loss of overall task integrity. For a specific procurement programme, SA interfaces will be described in the SAP (Task 102) which shall be reviewed to ensure that input-output relationships, responsibilities, and timing of activities are properly addressed to prevent overlap and duplication. The following general guidance may be useful in addressing the interface problem.

Inputs and Outputs for System Level Supportability Analysis

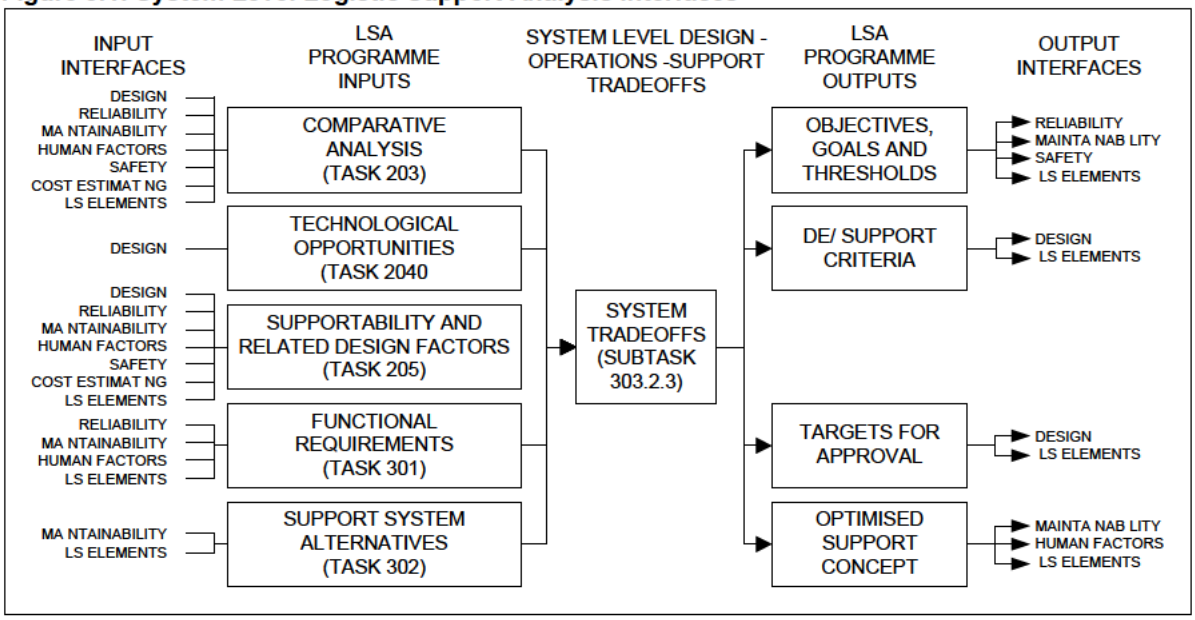
10. Some of the system level SA involves system analysis / engineering at the hardware-operating-support trade level (Sub-task 303. 2. 3). Product system level SA is an input to and subset of these trade-offs and is in turn a collection, synthesis, and system analysis of inputs from various specialised areas.

11. It is necessary to consider support investment and Operating and Support (O and S) costs, as well as other procurement costs, in major system procurements. Through Life Costs (TLC) estimates compare the investment and support resource requirements for various system alternatives. The cost methodology shall explicitly address the resource requirements to achieve specified levels of readiness for given assumptions concerning hardware / software, R and M characteristics, usage rates and scenarios. Various segments of TLC and O and S costs are vital to proper Trade-off decisions. Cost uncertainty in some areas of resource requirements, such as manpower and energy, is such that sensitivities need to be addressed. Major elements of TLC are to be addressed.

The objective is to minimise cost within major constraints such as system readiness objectives.

12. Figure 3. 1 shows examples of major relationships in input-output form. The outputs from the system level SA impact the interfacing activities in that they constitute boundary conditions or goals for specialised engineering programmes and ILS element concepts and plans.

Figure 3.1: System Level Logistic Support Analysis interfaces



Refinement and Extension of the System Level Supportability Analysis

13. As development progresses, the SA is iterated and extended to lower indenture levels with the input-output concept described above still functioning. Boundary conditions, constraints, and objectives are refined and expanded based on inputs from specialised engineering and ILS element areas. Additionally, the support system is optimised within the boundaries and objectives established. Specific sub activity trade-offs within engineering specialities and ILS elements are conducted to provide specific boundaries for follow-on analysis. These will include the Built-In-Test (BIT) versus external test trade-offs (Sub-task 303. 2. 8) and training trade-offs (Sub-task 303. 2. 6).

Task Analysis Interfaces

14. SA includes the requirement for all activities to be analyzed, however, specific activity areas (eg , operator tasks or critical maintenance tasks) may be analyzed as part of the HFI programme to provide the required input. Additionally, detailed task analysis input data is supplied by R and M, and safety specialists.

Resource Requirements Identification

15. This step in the SA process involves identification of all logistic support resource requirements. This identification involves inputs from design and specialised engineering areas and all resource requirements are summarised in the SA data base. These requirements are then fed to the various ILS element managers for their use in further development of management plans and products for individual ILS elements.

Major Criteria

16. The MOD policy for through life application of ILS is contained in JSP 886 Volume 7 Part 1. The four prime factors that govern system procurement programmes are cost, time, performance, and supportability. The SA process affects all four prime factors; therefore, it provides significant input into product decisions. While specific criteria and emphasis will vary from one procurement to another, three prime issues have emerged at the system level which affect procurement decisions and which are outputs of the SA process. These are described below.

Manpower and Personnel Constraints

17. Problems associated with manpower and personnel shortages, in terms of quantity, skills, and skill level prevail. The problem must be approached through the design process as well as the more traditional manpower and personnel approaches of the Services. New product manpower quantities and skill level demands must be managed accordingly, beginning with the earliest conceptions of the new product.

System Readiness

18. Logistic related design parameters (such as R and M), logistic support resources (such as spares and manpower), and logistic system parameters (such as resupply time) must be related to system readiness objectives and goals. Such objectives may vary from system to system, and from peacetime to wartime. Operational availability is frequently a good peacetime measure, while operational availability, sortie rates (surge and sustained), battlefield day missions and percent coverage are frequently used wartime measures which are key for peacetime readiness and wartime capability. System readiness measures are equal to performance, time, and cost as design parameters, and must be managed accordingly, beginning with the earliest conception of new product.

Cost

19. It is necessary to consider support investment and Operating and Support (O and S) costs, as well as other procurement costs, in major system procurements. Through Life Costs (TLC) estimates compare the investment and support resource requirements for various system alternatives. The cost methodology shall explicitly address the resource requirements to achieve specified levels of readiness for given assumptions concerning hardware / software, R and M characteristics, usage rates and scenarios. Various segments of TLC and O and S costs are vital to proper Trade-off decisions. Cost uncertainty in some areas of resource requirements, such as manpower and energy, is such that sensitivities need to be addressed. Major elements of TLC are to be addressed. The objective is to minimize cost within major constraints such as system readiness objectives.

Strategy in Developing Analysis Requirements

20. The key to a productive but cost effective SA is the concentration of available resources on activities which most benefit the programme. Such concentration is called the SA strategy. This involves the establishment of an SA programme which will evolve achievable supportability and support system objectives. The broad objectives of SA are to influence product design, structure the most effective support concept, and to define logistic support resource requirements. These general objectives must be translated into more specific objectives for individual projects, particularly in early phases when maximum

flexibility exists. Objectives are further refined until they become firm project goals or requirements. Development of an analysis strategy involves a large number of interacting variables. Strategy considerations and the possible impact of these variables must be addressed in the tailoring process. SA activities and sub activities must be tailored and scheduled to meet project decision points. The guidance included here is designed to assist in the tailoring process; however, it is not all inclusive and requires adaptation to specific projects.

ACTIVITY SELECTION AND FOCUSING

General

21. Selection of SA activities must take place at the sub activity level since the sub activities are generally written for specific phases and types of projects. The rationale for selecting particular sub activities involves a wide range of considerations.

22. Figure 2, above in chapter 2, portrays a general tailoring logic tree which shall be followed in selecting activities. The initial selection of activities and sub activities can be adjusted for the following considerations:

a. The amount of design freedom.

b. Time phasing adjustments if project is an Urgent Operational Requirement (UOR).

c. Work already done.

d. Data availability and relevancy.

e. Time and resource availability.

f. In-Service information needs.

g. Desired activities not in the standard.

h. Procurement considerations.

23. Additional guidance on these factors is given below. Most of the factors above tend to reduce or restrict the amount of SA activity. However, selections shall be checked. If the sub activities are not covered, their feasibility and use must be assessed. If it is impossible or unwise to do these sub activities, the reasons shall be documented.

Focusing

24. After the initial selection of sub activities is completed, further focusing is needed to concentrate effort in areas which offer a high return on investment and to specify other requirements. Considerations under focusing shall include:

a. Modification or restriction of the sub activity to significant areas.

b. Specification of sub activities such that they can easily be assigned to the most appropriate support community.

c. Specification of models and associated data to be used.

d. Specification of areas or activity requiring project approval.

25. The Contractor shall be specific in defining SA needs for activities and sub activities. Often 10 to 20 percent of the subsystems control 80 to 90 percent of the support demands. Some Trade-off Analysis (Task 303) evaluations and trade-offs are very general and will benefit from greater specificity to focus on key areas. Models and definitions, particularly for TLC, to be used for a particular analysis shall be specified. Model considerations are discussed in greater depth under Procurement Considerations below. The remainder of this section discusses the specific impact of the various factors to be considered in the development of the SA strategy.

FACTORS IMPACTING ON STRATEGY

Type of Project / Change

26. Project categories include a new project, product improvement project, modifications under a Post Design Services (PDS), or COTS project. Major modifications may require a repeat or new approach to some of the analysis work already done. The type of project impacts objectives and sub activity selection and focusing. On a product improvement project or a PDS modification programme, potential SA objectives might focus on:

a. Support risks on the changed part of the product.

b. Opportunities for improvement on the total product through improvement in supportability characteristics. New or high technology products increase the risk in attainment of supportability goals, and the consequent need for activity to reduce these risks. Modernization using previously proven technology has less risks of goal attainment and may offer more opportunity to reduce logistic support burdens through use of newer (but not necessarily high risk) technology. Such considerations can obviously impact preliminary objective determination. Additionally, alternative support concepts may be more limited for product level contracts due to a fixed system support concept.

Readiness Goals

27. Readiness goals are the primary management focus beginning with project initiation. If such goals are ambitious, one focus of the early analyses shall be toward readiness related system design and support objectives, such as R and M and turnaround time. Systems / products which have large support personnel demands or which have high O and S costs present greater investment opportunities for improvement than those with low demands or costs and, therefore, shall receive greater consideration in selecting preliminary SA objectives.

Amount of Design Freedom

28. The amount of design freedom of the Product is a key consideration in sub activity selection. Design freedom is related to project considerations such as phasing. The objective of most of the front end SA sub activities is to influence selection of design characteristics to achieve improvements in readiness, supportability, and cost. If the design is fixed, there may be little benefit from doing these activities. Some of the factors listed in this section give suggestions in this regard. Product improvement and product modification projects might limit design freedom to specific subsystems unless areas of no or minor change are open to redesign opportunity to reduce logistic support burdens.

UOR projects tend to negate various possible SA sub activities, but they also tend to use existing technology and plan on pre-planned product improvement rather than employ new technology, the point of design freedom thus shifts. Design freedom may exist for the support system but not the mission system. SA effort and objectives shall be focused accordingly. The SA objective of causing supportability requirements to be an integral part of product requirements and design can best be achieved if designers are focused toward supportability objectives commencing with the design effort.

Technical Information

29. Technical information generated and documented during the design process must be disseminated among designers and supportability specialists to identify interfacing problems between design concepts and operators, maintainers, and support equipment. Technical design information such as diagnostic features, electro / mechanical interfaces, R and M predictions, item functions, adjustment requirements, and connector and pin assignments, which determines supportability, shall be an integral part of design documentation. When design freedom exists, the Contractor SA plan shall describe the generation, control, and approval of this type of information.

Time and Resources Available

30. To influence design, SA requires time and resources. An activity whose results will not be available in time to affect design shall not be specified unless the potential improvement can be scheduled as part of a pre-planned product improvement. UOR projects, as their name implies, tend to reduce the time to do design influence SA activities. If project funds are limited, it may be possible to perform some activities, such as early scoping of the SA, comparative analysis, and driver identification, by use of in-house capabilities. Another possible approach when funds are limited is to capitalize on the inter-relationships between some activities and sub activities. For example, the comparative SA feeds driver identification, which in turn feeds selection of targets for improvement. If for some reason only one of these activities can be afforded, then the targets for improvement will be the logical selection of the three. Such an approach obviously loses precision since judgements are substituted for hard data on the deleted activities. It shall, therefore, be employed only as a last resort. If the in-house capability is limited but funds are available, such sub activities might also be accomplished by the Contractors with special expertise.

Work Already Done

31. Work already accomplished can impact sub activity selection. Activities such as comparative analysis, driver identification and improvement initiatives may already have been done as inputs to the preparation of project initiation (eg, Product Approval Committee Submission) or other requirements documents. The quality of this work shall be assessed. If adequate, it may need updating rather than a complete revision. Similarly, project initiation or other requirements documents may prescribe objectives or constraints which tend to bound the scope of the SA. However, it is essential to test the realism of such constraints or objectives and the SA which supported their specification prior to accepting them as hard bounds.

Past Experience and Historical Data

32. The availability, accuracy, and relevancy of experience and historical data bases on similar existing systems are crucial for accomplishment of some activities and sub

activities above. Available databases shall be examined to determine if extensive work is needed to provide focus or relevancy. If such databases are not available, estimated data shall be considered, particularly if the data needed is in an area of possible high return on investment or risk.

Procurement Considerations

33. The LSC and ISLSC shall agree and specify the SA activities that are to be done solely by the MOD or independent agency, those that are to be shared between the MOD and the Contractor, and those that are to be performed solely by the Contractor (see Tables 2. 4 to 2. 14, above in Chapter 2).

34. Once done, the SA portion of the contracting plan can be developed and work requirements written into the procurement documentation. It is very useful to allow the prospective performing activities suppliers, under the bidding terms of the procurement, to recommend adding or deleting SA requirements and to provide a detailed sub activity definition and schedule. Additionally, prospective performing activities suppliers shall be encouraged to make use of cost effective data generation procedures. The prospective contractor's tailoring process and cost reduction efforts shall be a factor in the assessment of its capability to perform the SA programme. Procurement project objectives must be considered in preparing procurement documents. Supportability objectives for this type of procurement will best be served through design influence and generation of an Information Repository for subsequent detailed SA when the technology is utilised. Other SA activities become equally important for full development projects. The nature of the procurement may compel the contractor into doing some SA activity in order to make a rational bid. More procurement considerations are discussed in the following paragraphs.

Activity Documentation

35. The development and maintenance of good documentation covering the results of SA activities contained in this chapter serve the following purposes:

a. Provides an audit trail of analyses performed and decisions made affecting the supportability of a product.

b. Provides SA results for input to follow-on SA activities later in the product's life cycle.

c. Provides source data for use by ILS element functional managers and a standard method of recording ILS element data from functional managers.

d. Provides input into procurement project documents.

e. Helps prevent duplication of analyses.

f. Provides an experience data base for use on future procurement programmes.

g. Provides input to Supportability case body of evidence.

Supportability Analysis Activity Responsibilities - Individual

36. SA activities performed as part of a product SA programme may be performed as a MOD activity, contractor activity, or both (tables 2. 4 to 2. 14 above in Chapter 2). Activity documentation must be developed to the degree that will allow another activity to use the

results as input data to perform other SA activities, or as input to conduct the same activity to a more detailed level in a later procurement phase. When some activities are performed by the MOD and others are performed by a Contractor, procedures must be established and agreed to provide for the data interchange between the two parties (further advice and guidance is given in JSP 886 Volume 7 Part 5.

The Contract Data Requirements List (CDRL)

37. The CDRL will identify data and information that the Contractor will be required to deliver under the Contract. By appropriately completing the CDRL and deleting unwanted data in the applicable Product Descriptions (PD) (JSP 886 Volume 7 Part 1 Annex), the LSC or ISLSC will structure the deliverable data products to cost effectively meet project requirements.

Supportability Analysis Data

38. There is a considerable distinction between data and the documentation of data. Additionally, there are a large number of different forms of documentation for SA data which frequently overlap. Because of these factors, SA programme data and data formatting requirements must be carefully scoped to meet project needs in a cost effective manner. Factors which affect data and documentation costs include the following:

a. **Timing of Preparation and Delivery**. Documentation or recording of data shall coincide with the generation of such data in the design and SA sequences in order that such data will not have to be recreated at added expense at a later date. Delivery of data shall be postponed until needed, in order to acquire data in its most complete form without repetitive updates.

b. Use of the Data by the Contractor.

c. Special formatting requirements.

d. Degree of detail required.

e. Degree of research required to obtain the data.

f. Accuracy and amount of verification required.

g. Duration of responsibility for data contents.

h. Availability and accuracy of source data from which to construct documentation.

Supportability Modelling

39. The use of models to perform some aspects of SA is dependent upon product complexity. For complex systems, a model is to be used in order to relate the product design, operational, and support parameters to system performance. Models are defined as systematic analytical processes used to predict system parameters. They can vary from a simple analytical equation for inherent availability, to a complex simulation model covering a multiple end item environment and all levels of maintenance. As a general rule, models used early in the life cycle will be system level models requiring a small amount of input data. Later in the procurement process, as the design becomes better defined and a support concept is established, a more detailed model might be more applicable. Models used during the SA process shall only be as complex as required to analyze the problem

at hand. Simple, easy to apply models requiring little input data shall be used whenever possible to enhance the timeliness of the results. When system readiness, life cycle cost, O and S cost, or other models are specified in the ITT or RFP, the Project needs to assess the proposal to evaluate the Bidder's understanding of the model and its results. Model estimates and data shall be traceable from the operational and support concepts to the R and M predictions and design. There shall be evidence that design features justify the input data used.

DETAILED GUIDANCE FOR SA SERIES ACTIVITIES AND SUB ACTIVITIES

Programme Planning and Control (Task 100 Series).

40. General Considerations:

a. Programme Management provides effective management of the SA effort requires:

b. Planning which identifies all the required actions.

c. Scheduling which identifies the timing of each required action and who is responsible for each action.

d. Execution through timely management decisions.

41. Management procedures shall be established and agreed through LSC or ISLSC to ensure that the right information is available at the right time, so that timely decisions can be made. SA planning and management shall always be performed by the project. The basic elements of SA planning and management outlined in the three activities (Tasks 101, 102 and 103) have to be accomplished even when they do not appear as contractual requirements.

Identifying Supportability Analysis Activity Requirements

42. The determination of what SA activities shall be performed for a given procurement project and life cycle phase was covered in activity Selection and Focusing.

Timing

43. Scheduling activity accomplishment is critical for the SA programme to achieve its objectives. The criteria that must be applied for proper scheduling of SA actions is to ensure that:

a. All required actions are completed and data available when it is needed.

b. Only the required actions are done and only the required data is available to prevent wasting resources and time. Factors to consider when scheduling SA activities include the following:

c. In order to achieve design influence during the early phases of procurement, SA activities shall be completed and supportability information available when product alternatives are being considered. Later in the procurement process, SA activities shall be completed and supportability information available to ensure that the ILS elements are identified, tested and fielded on a timely basis.

d. When comparing alternatives, do not analyze below the level necessary to evaluate differences. Lower level analyses can be conducted after an alternative is selected.

e. Sometimes it can be too late in a procurement project to do some SA activities. For example, when design is fixed, design oriented trade-offs offer little or no return on investment.

Programme Execution

44. A successful SA programme requires that the identified activities be conducted by the identified time. Assurance of this is achieved through continual monitoring of the SA, through Logistic Support or In Service Logistic Support Committees, to identify problems as they occur, and having an established mechanism to make management decisions to eliminate or minimize them. Efficient programme execution requires that working arrangements between the SA programme and other system engineering programmes be established to identify mutual interests, maximize the benefits of mutually supporting activities, and minimize effort overlap.

Development of a Supportability Analysis Strategy (Task 101)

45. This activity is the earliest planning activity for an SA programme and is the key first step in developing the most cost effective programme. Analysing probable design and operational approaches, supportability characteristics, and available data before finalizing activity requirements ensures that the SA programme is focused on the key areas which provide maximum supportability impact on design. The small investment in this activity is essential to ensure a good return on future investments. While most are germane to developing a strategy for the concept and feasibility study activity, this activity is generally applicable prior to preparation of any ITT containing SA requirements.

Supportability Analysis Plan (SAP) (Task 102)

46. The SAP is the basic tool for establishing and executing an effective SA programme. It shall effectively document what SA activities are to be accomplished, when each activity will be accomplished, who will be responsible for their accomplishment, and how the results of each activity will be used. The SAP may be a stand alone document or may be included as part of the programme ISP when one is required. Plans submitted in response to ITT documents assist the project in evaluating the prospective Contractor's approach to and understanding of the SA requirements, and the organizational structure for performing SA activities.

47. The SAP is generally submitted in response to an ITT document and becomes a part of the Contract when approved by the Project. It will detail which SA Activities and Sub Activities the Contractor will perform to meet the contracted requirements and allocate responsibilities. When requiring a SAP, the Project shall allow the Contractor to propose additional requirements or modifications, with supporting rationale to show overall project benefits, to those requirements contained in the ITT document. The SAP shall be a dynamic document that reflects current project status and planned actions. Accordingly, procedures must be established for updates when conditions warrant. Project schedule changes, test results, or SA activity results may dictate a change in the SAP in order for it to be used effectively as a management document.

Programme and Design Reviews (Task 103)

48. This activity is directed toward four types of reviews:

a. Review of design information from a supportability standpoint.

b. Product design reviews.

c. Formal product programme reviews.

d. Detailed SA programme reviews.

49. The first type of review (Sub-task 103. 2. 1) provides supportability specialists the authority with which to manage design influence and trade-offs. For most contractors this type of review is a normal operating practice. This sub activity is only applicable during design and design modification efforts and, therefore, shall not be applied to non-developmental or COTS procurement projects. Contractor procedures for this type of review will be included in the SAP.

50. Product design reviews and programme reviews (Sub-tasks 103. 2. 2 and 103. 2. 3) such as preliminary design reviews, critical design reviews, and production readiness reviews are an important management and technical tool of the project. They shall be specified in the SAP to ensure adequate staffing and are typically held periodically during a procurement programme to evaluate overall project progress, consistency, and technical adequacy. An overall SA programme status shall be an integral part of these reviews whether conducted internally, with subcontractors, or with the Project. The results of contractor's internal and subcontractor reviews shall be documented and made available to the Project on request at the Logistic Support or In Service Logistic Support Management Committees.

51. In addition to the product Project and design Reviews, specific reviews of the SA programme shall be periodically conducted (Sub-task 103. 2. 4). These reviews shall provide a more detailed coverage of items addressed at programme and design reviews and shall address progress on all SA activities specified in the SOW. Representative discussion items include activity results, data, status of assigned actions, design and supportability problems, test schedule and progress, and the status of sub contractors efforts. SA reviews shall be conducted as part of ILS reviews when possible, and shall be specified and scheduled in the SAP for Programme and Design reviews (Task 103). An integral part of this review process is the conduct of a detailed guidance conference (see Def Stan 00-600) prior to Contract award to ensure a thorough and consistent understanding of the SA requirements between the Project and the Contractor. Additionally, the Project must establish review policies which maximize the resources available for review. Sampling versus 100 percent review of SA data, scheduling reviews on an as required rather than a fixed schedule basis, and concentrating on drivers and high risk areas are some of the considerations that shall be addressed in establishing the review policies.

52. In addition to formal reviews, useful information can often be gained from contractor data which is not submitted formally, but which can be made available through an accession list. This list is a compilation of documents and data which the project can order, or which can be reviewed at the Contractor’s facility. Typically, the details of design analyses, test planning, test results, and technical decisions are included. This data constitutes a source of information not otherwise available.

MISSION AND SUPPORT SYSTEMS DEFINITION (TASK 200 SERIES)

General Considerations

53. It is essential to conduct SA early in a procurement project to identify constraints, thresholds and targets for improvement, and to provide supportability input into early trade-offs. These analyses can identify supportability parameters for the new product which are reasonably attainable, along with the prime drivers of supportability, cost and readiness. The drivers, once identified, provide a basis for concentrated SA to identify targets and methods of improvement. Mission and support systems definition activities are generally conducted at system and subsystem levels early in the system procurement process (Concept, and Assessment Phases). Identification and SA of risks play a key role due to the high level of uncertainty and unknowns early in the life cycle. Performance of these activities requires examination of current operational systems and their characteristics, as well as projected systems and capabilities that will be available in the time frame that the new product will reach its operational environment. New product supportability and supportability related design constraints shall be established, based upon support systems and resources that will be available when the new product is fielded. When supportability analyses have been performed prior to formal project initiation during mission area or weapon system analysis, the range and scope of activities in this activity series shall be appropriately tailored to prevent doing the same SA twice.

Use Study (Task 201)

54. The use study is the pre-requisite SA activity to all others in an SA programme (except the SA strategy activity [Task 101]). It must be done to satisfy MOD requirements and to provide the basis for all ILS planning and readiness analyses for the new product. The operational concept specifies how the new product will be integrated into the Service structure and deployed and operated in peacetime and wartime to satisfy the mission need. This concept provides the framework around which the support system must be developed. The Use Study analysis establishes the quantitative supportability factors required for readiness and ILS resource projections. Because of the significant impact of the operational concept on readiness analyses and ILS planning, the Use Study shall look at both the most probable and worst case scenarios for peacetime and wartime employment of the new product. Field visits (Sub-task 201. 2. 3) to operational units and workshops can provide a significant input into the Use Study in terms of identifying existing capabilities, resources, and problems. Field visits can be useful once the operational environment for the new product is identified in sufficient detail to determine existing operational units and depots that will most likely be involved in the operations and support of the new product.

Mission Hardware, Software, Firmware and Support System Standardization (Task 202)

55. In many cases, utilization of existing logistic support resources can substantially reduce TLC, enhance readiness, minimize the impact of introduction of the new product, and increase the mobility of the operational unit using the new product. Factors that support these potential benefits are the following:

a. Use of existing items or support arrangements avoids the development costs that will be incurred to develop new items or support.

b. Cost to develop new training programmes may be avoided.

c. The probability that the resource will be available for use may be greater.

d. Commonality of support items between end items in an operational unit may require fewer items to be moved in times of mobilization, thereby increasing the operation units' readiness.

e. Personnel proficiency in using support and test product can be increased through an increase in frequency of use of the same item, rather than having to learn how to use different items.

56. The same potential benefits may apply to using resources under development. In this case, the cost of development may be spread over a number of end items or support arrangements. However, the risk involved is increased because the developmental item is unproven in an operational environment and is subject to project delays or cancellation. Support system standardization requirements can also arise from MOD or Service support policies. Examples of these requirements can include standard software language requirements or use of standard multi-system test equipment.

57. Once existing and planned resources have been analyzed and the benefits determined, then product requirements and constraints must be identified and documented in order to achieve the benefits. Supportability and supportability related design requirements to achieve the benefits from support system standardization must be established prior to initiation of the design effort so that the cost of redesigning to meet requirements can be minimized. At the same time, performance of this activity shall only define requirements to the level necessary based on the projected level of design effort. For example, only system and subsystem level support standardization requirements shall be identified if only system and subsystem level design alternatives are to be developed and evaluated.

58. Identification of existing logistic support resources available can be accomplished through use of MOD and Service level handbooks, catalogues, and registers which identify available support equipment; test, measurement, and diagnostic equipment; tools and tool kit contents; personnel skills; and other resources. Field visits conducted as part of the Use Study development (Task 201) can also identify existing capabilities and resources available to support the new product.

59. Standardization through mission hardware and software standardization programmes and parts control programmes can help minimize product and parts proliferation, reduce TLC, increase system readiness, and increase standardization and inter-operability levels between Services and countries. A comprehensive standardization programme will include participation from supportability activities as well as the other system engineering disciplines, due to the impacts of standardization on mission performance, R and M, safety, quality and survivability. Standardization approaches will generally be investigated starting in the Concept phase due to Standardization and Interoperability (S and I) considerations and continue to progressively lower levels of indenture throughout the procurement programme. The standardization programme can normally provide the required data for Quantative Factors and Field Visits (Sub-tasks 202. 2. 2 and 202. 2. 3). Additionally, care shall be exercised in the performance of this activity to assure that standardization requirements are not established on poor performance items, support arrangements or items and support arrangements which can be significantly improved.

Comparative Analysis (Task 203)

60. There are three major purposes for accomplishing Comparative Analysis:

a. To define a sound analytical foundation for making projections for new product parameters and identifying targets of improvement.

b. To identify the supportability, cost, and readiness drivers for the new product.

c. To identify risks involved in using comparative system data in subsequent analyses.

61. A major key to having an effective SA programme is the efficient SA Process and use of the data obtained on comparative systems. This process is also called an historical data review. It involves making good use of information available from other products so that the new product will be an improvement in supportability as well as performance. When a realistic comparative system can be established, information on the comparative system helps identify the following:

a. High failure rate potential of subsystems and components.

b. Major downtime contributors.

c. Design features which enhance supportability.

d. Potential supportability problem areas that include design features which degrade supportability.

e. Design concepts with potential safety or human factors impacts.

f. Gross requirements for logistic support resources.

g. Design, operational, and support concepts which drive the logistic support requirements, O and S costs, and achieved readiness levels of the product.

Comparative Systems

62. Identifying comparative systems and subsystems and establishing Baseline Comparative Systems (BCS) requires a general knowledge of the design, operational, and support characteristics of the new product and the type of parameter to be projected. If design parameters (R and M, etc) are to be projected, then current operational products which are similar in design characteristics to those of the new product design characteristics shall be identified. If major subsystems have been identified for the new system, the BCS for projecting design parameters may be a composite of sub systems from more than one system. If support parameters (resupply time, turnaround times, transportation times, etc) are to be projected, then current systems (support systems) which are similar to the new product's support concept must be identified. This may be a support system completely different than the one supporting similar product in design characteristics.

63. The level of detail required in describing comparative systems will vary depending on the amount of detail known on the new product design, operational and support characteristics, and the accuracy required in the estimates for new product parameters. Comparative systems and subsystems are normally identified by the project. BCSs shall

be established at a level commensurate with expected design progression. The level of comparison shall be specified, as well as data sources to be used. Comparative Analysis (Task 203) contains two sub activities, Identify Comparative Systems and Baseline Comparative Characteristics (Sub-tasks 203. 2. 1 and 203. 2. 2) which are designed to provide for different levels of detail in identifying comparative systems. For example, if the design concept for the new product is very general, then only a general level comparative system description (Sub-task 203. 2. 1) shall be established. When more detail and accuracy are required, then Baseline Comparative Characteristics (Sub-task 203. 2. 2) shall be used. However, as more detail is required the cost of the SA increases, therefore, the appropriate sub activity shall be selected accordingly.

64. Assumptions made in establishing a comparative system and associated risks involved play an important role in determining the accuracy of the new product projections. Low similarity between the new product design, operation, or support concept and existing systems shall be documented and new product projections treated accordingly. Additionally, inherent risks are involved in constructing composite comparative systems, unless environmental and operational differences are identified and the supportability, cost, and readiness values adjusted accordingly.

65. Qualitative Supportability Problems (Sub-task 203. 2. 4) on existing systems shall be thoroughly analyzed to provide insight into areas for improvement during the development of the new product.

66. Supportability, Cost, Readiness and Unique System Drivers are identified, (Sub-task 203. 2. 5 and 203. 2. 6) so that areas of improvement can be identified, and supportability and supportability related design constraints can be formulated to achieve the improvements. Major problems on existing systems shall be identified and approaches to eliminate or reduce these problems shall be developed. As with other activities in this chapter, the timing and scope of this effort shall be commensurate with the timing and scope of the product design effort, in order for the constraints to be effective. Feasibility study phase analyses will be at the system and subsystem level so that system and subsystem level constraints can be defined prior to entry into the Demonstration phase.

67. Supportability, cost, and readiness drivers may be identified from a number of perspectives; drivers can be specific ILS elements, specific support functions (eg alignment or calibration requirements), specific mission subsystems / components, or specific features of the operational scenario / requirement. Proper driver identification is a pre-requisite to establishment of the most effective constraints for achieving improvements. Care shall be exercised to ensure that true drivers are identified and not the effects of a driver. For example, supply support cost is not a cost driver if it is a result of poor reliability of a subsystem. In this case, the subsystem reliability will be the cost driver. The identification of drivers is dependent upon the availability of data on comparative systems. When citing Supportability, Cost, Readiness and Unique System Drivers activities (Sub-tasks 203. 2. 5 and 203. 2. 6), the Contractor shall consider the data bases available to support driver identification. Additionally, this activity can be performed by speciality areas and the results consolidated under the SA programme. For example, manpower, personnel, and training SA may be performed by HFI and training specialists, and maintainability comparisons may be done under the R and M programme.

Technological Opportunities (Task 204)

68. This activity shall be performed by design personnel in conjunction with supportability specialists. It is designed to identify potential technological approaches to achieve new

product supportability improvements. It will identify the expected effect of improvements on supportability, cost, and readiness values so that supportability and supportability related design objectives for the new product can be established. Particular attention shall be devoted to the application of technological advancements to product drivers and areas where qualitative problems were identified on comparative systems. Improvements can be developed at any level (system, subsystem, or below), however, they shall be prioritised based on the contribution of each to system and subsystem level supportability values.

Supportability and Supportability Related Design Factors (Task 205)

69. This activity establishes the supportability parameters governing the new product development. These parameters will include objectives, goals and thresholds, qualitative and quantitative constraints, and product specification requirements. Supportability Characteristics (Sub-task 205. 2. 1) quantify the supportability impact of alternative concepts which serve as a basis for the remaining Sub-tasks.

70. The type of parameter developed as a result of performing Supportability and Supportability Related Design Factors (Task 205) will depend on the phase of development. Generally, prior to conducting a feasibility study, supportability objectives will be established during Sensitivity Analysis (Sub-task 205. 2. 2). These objectives are established based on the results of previous mission and support systems definition activities, especially the opportunities identified as a result of Technological Opportunities analysis (Task 204), and are subject to trade-offs to achieve the most cost effective solution to the mission need. After the feasibility study and prior to the Demonstration phase, goals and thresholds are established during Specification Requirements analysis (Sub-task 205. 2. 5) which is not subject to trade-off. Thresholds represent the minimum essential levels of performance that shall be satisfied at specified points in the procurement programme.

71. Overall product objectives or goals and thresholds shall be allocated and translated to arrive at supportability requirements to be included in the system, sub system, or support system specification in Identify Proprietary Data analysis (Sub-task 205. 2. 3). This sub activity is necessary to ensure that specification parameters include only those which the contractor can control through design and support system development. The support burden and other effects of the Government Furnished Assets (GFA), administrative and logistic delay time, and other items outside the control of the Contractor shall be accounted for in this process. For example, if the overall threshold for manpower is 100 man-hours per product per year, and a government furnished subsystem requires 25 man-hours per product per year, then the Specification shall reflect a threshold of 75 man-hours per product per year for contractor developed hardware. This translation from supportability objectives or goals and thresholds to specification requirements is also important for readiness parameters. When the item under procurement is a complete system, then applicable readiness parameters may be suitable for inclusion in the system specification. However, if the item under procurement is less than a system (ie, sub system or product going into a system) then other parameters will be more appropriate (eg logistic related R and M parameters).

72. When performing Identification of Proprietary Data (Sub-task 205. 2. 3), thorough consideration shall be given to possible supportability incentives. However, incentives shall be at the system level (possibly subsystem for some procurements) to prevent optimization approaches at lower levels which do not represent optimum system level solutions.

PREPARATION AND EVALUATION OF ALTERNATIVES (TASK 300 SERIES) - GENERAL CONSIDERATIONS

Iterations

73. The activities contained in this series are highly iterative in nature and are applicable in each phase of the life cycle. Additionally, they are generally performed in sequence; that is, functions are identified (Task 301), alternatives are developed to satisfy the functions (Task 302), and evaluations and trade-offs are conducted (Task 303). This process is then iterated to increasingly lower levels of indenture and detail in the classic system engineering manner.

Timing

74. The identification of functions, development of alternatives, and trade-off analyses shall be conducted to a level of detail and at a time consistent with the design and operational concept development. In the early phases of the life cycle, functions and alternatives shall only be developed to the level required to analyze differences and conduct trade-offs. More detail can be developed after trade-offs are made and the range of alternatives is narrowed. At the same time, the support plan shall be finalised at a time which allows for the development and testing of the necessary ILS element resources to carry out the support plan.

Functional Requirements Identification (Task 301)

75. Identification of the operating and maintenance functions for the new product shall coincide with critical design decisions to ensure development of a system which achieves the best balance between cost, time, performance and supportability. Special emphasis shall be placed on the functional requirements which are supportability, cost, or readiness drivers for the new product, or which are new functions that shall be performed based on new design technology or new operational concepts.

76. Identification of the functions which are drivers provides a basis for developing new support approaches or design concepts to enhance the supportability of the new product. Identification of the new functional requirements provides the basis for management attention due to the potential supportability risks. Functional flow block diagrams are a useful tool in identifying functional requirements and establishing relationships between functions.

77. Additionally, other system engineering programmes provide a significant input to the functional requirements identification process. For example, HFI specialists may be best qualified to identify and analyze operations functions; transportation specialists may be best qualified to identify and analyze transportation requirements, etc. The SA programme under Functional Requirements Identification (Task 301), consolidates the functional requirements developed by the appropriate speciality areas to assure the support system developed for the new product satisfies all functional requirements.

78. Functional Requirements Identification (Task 301) is designed to provide for varying levels of detail from system and subsystem level functions (Sub-tasks 301. 2. 1, 301. 2. 2 and 301. 2. 3) to detailed Operations and Maintenance Tasks requirements (Sub-task 301. 2. 4). Appropriate sub activity requirements shall be identified based on the level of design definition and schedule requirements.

79. Operations and Maintenance Task requirements (Sub-task 301. 2. 4.) are identified using FMECA, RCM analysis and a detailed review of the product functional requirements.

80. The FMECA identifies the failure modes of the system and its components, thus identifying the corrective maintenance requirements.

81. The RCM identifies preventive maintenance requirements to:

a. Detect and correct incipient failures either before they occur or before they develop into major defects,

b. Reduce the probability of failure,

c. Detect hidden failures that have occurred, or

d. Increase the cost effectiveness of the product's maintenance programme.

82. The review of the product functional requirements identifies those maintenance tasks which are neither corrective nor preventive but must be performed in order for the product to operate as intended in its environment. These tasks include operations, turnaround tasks, reloading, mission profile changes, transportation tasks, etc.

83. A FMECA systematically identifies the likely modes of failure, the possible effects of each failure, and the criticality of each effect on mission completion, safety, or some other outcome of significance. The FMECA requirements will generally be included under the R and M programme; however, FMECA requirements for a system shall be developed in conjunction with the SA programme requirements due to the necessity of having FMECA results to conduct some SA activities. In particular, the FMECA provides the basis for built-in and external test specification and evaluation. This co-ordination shall consider the timing of the FMECA, level of detail and documentation requirements.

84. RCM consists of a systematic approach of analysing product R and M and safety data to determine the feasibility and desirability of preventive maintenance tasks, to highlight maintenance problem areas for design review consideration, and to establish the most effective preventive maintenance programme for the new product. RCM logic is applied to the individual failure modes of each repairable item in the product identified during the FMECA, through a progressive determination of how impending failures can be detected and corrected in order to preserve, to the degree possible, the inherent levels of reliability and safety in the product.

85. Activity requirements to satisfy the product functional requirements which are not identified during the FMECA and RCM analysis are generally system level activities. These activities must be analyzed relatively early in the life cycle (Assessment phase and the start of the Demonstration phase), so that the product design can be appropriately defined to preclude supportability problems. These activities are often constrained by product requirements (eg turnaround time cannot exceed a certain value or the system must be transportable via a given mode), and the detailed analysis must be conducted in a timely fashion so that design influence decisions can be made when the requirements are exceeded.

Support System Alternatives (Task 302)

86. Support alternatives for a new product shall cover each element of ILS applicable, and satisfy all functional requirements. Initial support alternatives will be system level

support concepts which address the supportability, cost, and readiness drivers and the unique functional requirements of the new system. After trade-off and evaluation of these alternatives (Task 303), the alternatives will be formulated at a lower level for further trade-offs and evaluations. Conducting this SA in an iterative fashion from the top down helps ensures efficient use of resources in conducting the SA. Support alternatives shall be formulated to equivalent levels of detail for trade-offs and evaluation, and then further detail developed after the trade-off SA is conducted. This process continues in an iterative manner throughout the product procurement process until the system level support concept is refined into a detailed support plan covering all levels of maintenance, all items of hardware and software requiring support, and all operations and maintenance tasks. Where applicable, workshop maintenance inter-servicing considerations shall be included in alternative support concepts.

87. Alternative support systems are formulated by synthesizing alternatives for individual ILS elements into support systems. During this process, the following points must be considered:

a. Inter-relationships that exist between the ILS elements (eg manpower, personnel and training alternatives may depend upon support product alternatives).

b. Formulation of detailed alternatives for one element of ILS may not be cost effective until higher level system alternatives are evaluated and selected.

c. In some cases, formulating support alternatives may be an inherent feature of models used in the evaluation and trade-off process. This is especially true for many LORA models used during Full Scale Development where repair versus discard alternatives and alternative maintenance levels for repair and discard are automatically formulated and analyzed during execution of the model. .

Evaluation of Alternatives and Trade-off Analysis (Task 303)

88. Trade-off analysis between design, operational and support alternatives is an inherent part of system development. Optimum benefits are realised when these analyses are conducted considering all system factors (cost, schedule, performance and supportability) before the system is finalised. The nature of the trade-off models and techniques used and the magnitude, scope, and level of detail of the SA will depend upon both the procurement phase and the system complexity. Trade-offs early in the project will generally be inter-disciplinary and broad in scope. As development progresses, trade-offs are progressively refined, inputs become more specific, and outputs influence a smaller number of related parameters.

89. Trade-offs between the Support alternatives identified for the new product are conducted to identify the support approach which best satisfies the requirements. These trade-offs are conducted by using a model or manual procedure which relates the design, operation and logistic support resource factors of alternatives to the supportability requirements for the product. Alternatives can then be ranked and the sensitivity of the results to changes in key design, operation or support factors can be determined. Results, including the rationale for selection and rejection of alternatives, shall be documented for subsequent iterations and refinements. Trade-off analysis results, both between support alternatives and between support, design, and operational alternatives, become a prime data input into the system decision process. As such, the trade-off analysis results must include identification of assumptions and risks involved.

90. Trade-off Criteria activity (Sub-task 303. 2. 1) provides the general requirements for each evaluation and trade-off performed under Evaluation of Alternatives and Trade-off Analysis (Task 303). Support System and System Trade-offs (Sub-tasks 303. 2. 2 and 303. 2. 3) are continuing requirements throughout a product life cycle to analyze alternative support approaches and alternative design, operations and support approaches respectively. The remaining sub activities represent key trade-offs and evaluations that are frequently applicable during given phases of the life cycle. For a given procurement programme, the range of potential trade-offs and evaluations is essentially limitless. Procedures shall be agreed between the Project and contractor to allow for specific evaluations and trade-offs to be identified and conducted as necessary throughout the procurement process. In selecting and conducting trade-offs and evaluations for a given procurement programme, the following factors shall be considered:

a. System readiness analysis (Sub-task 303. 2. 4) shall always be considered a high priority.

b. Select the trade-off sub activities which deal with the supportability, cost and readiness drivers of the system. Additionally, the scope of the selected trade-off and evaluation sub activities can be limited to the drivers.

c. Some trade-offs and evaluations lend themselves to being performed by a specific community for input into the SA programme. For example, the Diagnostic Trade-off (Sub-task 303. 2. 8) may best be performed under the Maintainability Programme; the Training Trade-off (Sub-task 303. 2. 6) may best be performed by training specialists, etc.

d. Care shall be exercised in using man-hours as a criteria parameter for Manpower and Personnel Trade-offs (Sub-task 303. 2. 5) because of two factors. First, each integral number of people has a range of man-hours associated with it. Adding or reducing man-hours has no effect on the number of people required until either the upper or lower limit of the range is breached. Then, and only then, does the number of people required change. Second, there is not a direct correlation between man-hours and number of people required unless personnel skills are considered. For example, the same number of man-hours may equate to one person or many people, depending on the number of different skills required.

e. Conceptual phase Level of Repair Analyses (Sub-task 303. 2. 7) shall only analyze gross concepts.

f. Where applicable (eg in considering contractor versus in-house support alternatives), ensure that realistic personnel costs are used. Often Service published personnel costs do not include costs associated with recruitment, retention, etc, and use of these personnel costs may bias the trade-off results.

DETERMINATION OF LOGISTIC SUPPORT RESOURCE REQUIREMENTS (TASK 400 SERIES)

General Considerations

91. Logistic support resource requirements associated with proposed product alternatives must be identified and refined as the product progresses through its development. The extent of identification depends upon the magnitude and complexity of the new product and the phase of the procurement cycle. As development progresses and

the basic design and operational characteristics are established, this determination becomes a process of analysing specific design and operational data to more completely identify detailed logistic support resource requirements. This portion of the SA defines the requirements of the principal elements of ILS. This SA can be costly and involve development of a considerable amount of documentation. In determining the timing and scope of SA activities in this section, the following shall be considered:

a. Early identification of logistic support resource requirements shall be limited to new or critical requirements so that available resources are effectively used and sufficient procurement time is allocated to the development and testing of these requirements. This identification shall be accomplished as part of Support System Trade-offs (Sub-task 303. 2. 2) and documentation shall be limited to the minimum essential data.

b. Resource requirements for different system alternatives shall only be identified to the level required for evaluation and trade-off of the alternatives.

c. Logistic support resource requirements must be identified in a time frame which considers the schedule for developing the required documentation for each element of ILS. Schedule accomplishment of these activities considering the time required to provision, develop electronic documentation, establish training programmes, etc.

d. There are different levels of documentation that can be applied to the identification of logistic support resource requirements (eg supply support requirements can be identified through documentation of only a few data elements early in a project while later the total range of data elements required to accomplish initial provisioning can be documented.)

e. Detailed input data for identification of logistic support resource requirements is generated by many system engineering functions. Therefore, SA and documentation requirements and timing must be a co-ordinated effort between the SA programme and other system engineering programmes to avoid duplication of effort and ensure timely availability of required input data.

Conduct Task Analysis (Task 401)

92. This activity provides the detailed identification of requirements for all elements of ILS to operate and support the new product. It also includes SA requirements to identify areas where supportability enhancements can be achieved. During performance of this activity, the following will be determined for each operation and maintenance task:

a. Maintenance level.

b. Number of personnel, skill levels, skill specialities, man-hours and elapsed time.

c. Spares, repair parts and consumables required.

d. Support equipment; test, measurement and diagnostic equipment (TMDE); and test programme sets (TPS) required.

e. Training and training materiel required along with recommended training locations and rationale.

f. Procedural steps required to perform the task.

g. Facilities required.

93. Interval for, and the frequency of, task performance in the intended operational environment. The annual operating basis for task frequencies must be carefully selected and widely understood to prevent misuse of the information generated by this task.

PACKAGING, HANDLING, STORAGE AND TRANSPORTATION REQUIREMENTS.

94. The timing and depth for performance of Task Analysis (Task 401) is governed by the level of design and operation definition and by the Project schedule. The SA cannot be cost effectively performed until required input information from the design activity is available, and cannot be delayed beyond a point that does not allow sufficient time to conduct the activity SA and use the results to develop ILS element documentation (eg technical manuals, personnel requirements list, etc) in a timely manner. During the Assessment phase and early in the Demonstration phase, efforts shall be limited to only essential information. During the latter part of the Demonstration phase, this activity will be performed for all product components. During Manufacture and deployment of the system, this activity will be performed on any design changes.

95. The scope of this activity can be effectively tailored to cost effectively meet project needs through identification of system hardware and software on which the SA will be performed, identification of indenture level to which the SA will be carried out, identification of the maintenance levels that will be included in the analysis, and the identification of the amount of documentation required. This tailoring process must be done in conjunction with other system engineering programmes and must consider the requirements of each ILS functional element.

96. Task analysis (Task 401) is probably the area of a SA programme which requires the most co-ordination and interfacing in that it involves essentially every system engineering discipline and ILS functional element manager. When properly interfaced, task analysis provides a very cost effective means for ensuring supportability of the product and developing an integrated support system for the product. When not properly interfaced, SA can be a very costly process which duplicates other analyses and generates incompatible ILS products. Design, R and M, HFI, safety, and others are all involved in satisfying the SA requirements of Task Analysis. The SA programme integrates and translates these inputs into output products required for preparation of ILS documents.

Early Fielding Analysis (Task 402)

97. This activity is designed to ensure an effective fielding of the new product with all required resources. New System Impact analysis (Sub-task 402. 2. 1) is designed to quantify the effect on existing systems from the new product deployment. This impact determination is necessary for the procurement decision process to result in improved overall force capability, and to assure planning to accommodate the new product effectively. Sources of Manpower and Personnel Skills analysis (Sub-task 402. 2. 2) specifically address the manpower and personnel impact of the deployment. This sub activity identifies where the necessary people and skills will come from for the new product, and what impact will be felt from this on other systems. Impact of Resource Shortfalls analysis (Sub-task 402. 2. 3) identifies the effect on system readiness for varying levels of logistic support resources. SA forms the quantitative basis for budget requirements. Combat Resource Requirements (Sub-task 402. 2. 4) identifies logistic support resource requirements in alternative operational environments and provides the basis for war maintenance reserve stocks and mobilization plans and requirements.

Problem resolution planning (Sub-task 402. 2. 5) requires plans to be developed to alleviate any potential fielding problems for the new product. These sub activities shall only be selectively applied to product level procurements

Post Production Support Analysis (Task 403)

98. This activity is intended to ensure potential post production support problems are identified and addressed. Re-procurement problems, closing of production lines, obsolescence of design, expected discontinuances of business by manufacturers, etc, in the post deployment environment cause problems in assuring an adequate supply of spare and repair parts. If these factors are determined to present potential problems, plans must be established early to ensure that effective life cycle support will be available for the new product.

SUPPORTABILITY ASSESSMENT (TASK 500 SERIES) - GENERAL CONSIDERATIONS

Types of Assessment

99. There are two general areas of supportability assessment covered in this series; assessment as part of the formal test and evaluation programme, and assessment after deployment through analysis of operational, maintenance and supply data on the product in its operational environment. In the first case, the assessments are made prior to deployment and, where applicable, upon initial deployment during follow-on test and evaluation. In the second case, the assessments are made based upon data available on the product in its normal operating environment.

Test and Evaluation

100. The supportability test and evaluation programme shall serve three objectives:

a. Provide measured data for supportability and supportability related design parameters for input into system level estimates of readiness, O and S costs and logistic support resource requirements;

b. Expose supportability problems so that they can be corrected prior to deployment; and

c. Demonstrate contractual compliance with quantitative supportability and supportability related design requirements.

101. Test and evaluation planning, scheduling and cost investment shall be related to these objectives to maximize the return on investment. Development of an effective test and evaluation programme requires close co-ordination of efforts between all system engineering disciplines to prevent duplication of tests and to maximise test programme effectiveness. R and M of logistics demonstrations, environmental tests, endurance / durability tests, and other tests shall be used, including the use of electronic publications, in satisfying supportability assessment requirements. A well integrated test programme involves establishing test conditions that maximise the use of the test results. This is an important factor considering that the availability of hardware and time to conduct tests and evaluations are generally at a premium for most procurement, and that test results are a vital feedback loop because they represent the first hard data available for the new product.

Test Environment

102. One major factor that determines the use of test results to satisfy the objectives of the supportability test and evaluation programme is the test environment. Historically, there has been a large gap between test results and field-observed parameters. This gap is to a large degree caused by conducting tests in ideal environments, using contractor technicians to perform maintenance during test, ignoring some test results, and not using the planned resources (technical manuals, tools, test equipment, personnel, etc) during the tests. Realistic test environments shall be established considering the intended operational environment and the intended logistic support resources (all elements of ILS) that will be available to operate and maintain the product after deployment. While a total simulation of the field environment may not be practical or cost effective, test environments shall be established to be as close as possible, and known differences between the test and field environments must be accounted for in using test results to update system level projections for readiness, O and S costs and logistic support resource requirements. Additionally, expected levels of maturity to supportability parameters shall be applied to test and evaluation results to get a good projection of expected supportability.

Post-Production Assessments

103. A system's ultimate measure of supportability is determined by how well it performs in its environment after deployment. Analysis of feedback data from the operational environment is the necessary final step in verifying that the product has met its objectives and in evaluating post deployment support. In some cases, this assessment can be made using field feedback data that is routinely available from standard readiness, supply, and maintenance reporting systems; while in other cases, data from standard reporting systems must be supplemented in order to meet the verification objective within acceptable confidence levels. Any requirement for supplemental data shall be weighed against the cost and resources to obtain the data and any impact upon using units to gather the data.

Supportability Test, Validation, Evaluation and Task Evaluation (Task 501)

104. Initial supportability Test and Evaluation Strategy planning (Sub-task 501. 2. 1) occurs prior to the life cycle phase in which the tests will be conducted. This planning shall include identification of the resources (hardware, time and support) required for testing. Test and evaluation strategies shall be based on the supportability and supportability related design requirements; the supportability cost, and readiness drivers; and areas with a high degree of risk associated with them. Test and evaluation plans shall include supportability objectives and criteria integrated with other system engineering test requirements. Pre-concept planning shall include strategies for evaluation (during Assessment phase testing), of design and operational features that affect the feasibility of the product's supportability, cost and readiness objectives. During the Assessment phase, planning shall include strategies for demonstrating (during Demonstration phase), established supportability and supportability related design objectives within stated confidence levels through the intermediate / general support maintenance level; evaluation of operability and operator training; demonstration of the adequacy of the logistic support plan to include all elements of ILS; and quantification of requirements for fuel, ordnance, supply and other ILS elements. Pre-production planning shall include strategies for assessing (during Follow On Test and Evaluation (FOT&E)) mission hardware, software and support items not fully tested prior to production; demonstration, in an operational environment, that initial production items meet the thresholds for mature systems; and, refinement of operating tactics, training requirements and Service concepts as required.

105. Detailed test plans and criteria are established (Sub-task 501. 2. 2) based on the test and evaluation objectives of the product. An important category of data that needs to be provided by the SA programme is the identification of the ILS elements that shall be provided to testing activities for test and evaluation. This identification is an integral part of Functional Requirements Identification (Task 301), Evaluation of Alternatives and Trade-off Analysis (Task 303), and Task analysis (Task 401). Supportability Test, Validation, Evaluation and Task Evaluation (Task 501) provides detailed plans for test and evaluation of these resources.

106. Data resulting from testing will be analyzed as part of Objectives and Criteria analysis (Sub-task 501. 2. 3) to accomplish the following:

a. Correct deficiencies discovered during test, and validate corrective actions implemented to eliminate deficiencies identified during previous tests.

b. Update system level projections for readiness, O and S costs and logistic support resource requirements.

c. Identify the amount of improvement required in supportability and supportability related design parameters to meet established goals and thresholds.

d. Identify achievement or non-achievement of contractual requirements.

e. Provide an assessment of supportability for input into the materiel procurement decision process.

f. Update Information Repository data.

g. Provide a data base of experience information for subsequent comparative analyses on future product procurements.

107. Updates and Corrective Action (Sub-task 501. 2. 4) and Post Production Supportability Assessment Plan (Sub-task 501. 2. 5), provide the requirements for post production assessment of the new product. In those cases where existing standard field reporting systems will not provide the necessary data or accuracy to conduct this analysis, then supplemental data collection programmes must be planned, approved, budgeted for and implemented. Update and Corrective Action activities (Sub-task 501. 2. 4) will normally occur prior to production, and data review and analysis (Sub-task 501. 2. 5) will occur following deployment. Care shall be exercised in planning this activity to ensure that field results are collected during normal field operations. Collecting data immediately after deployment may be biased if any of the following situations are in effect:

a. New product fielding teams are with the product.

b. Operator and maintenance personnel received training from other than the intended normal training sources.

c. Initial supply support was obtained from other than standard supply systems.

d. Interim support resources are being used pending deployment of other items (eg support and test equipment).

108. Analysis of data obtained from field reporting systems provides significant information for product enhancements through logistic support resource modifications, product

improvement programmes or modifications of operating tactics. Additionally, comparative SA between field results, test and evaluation results, and engineering estimates can provide information for use on future procurement programmes to better project supportability, cost, and readiness parameters.

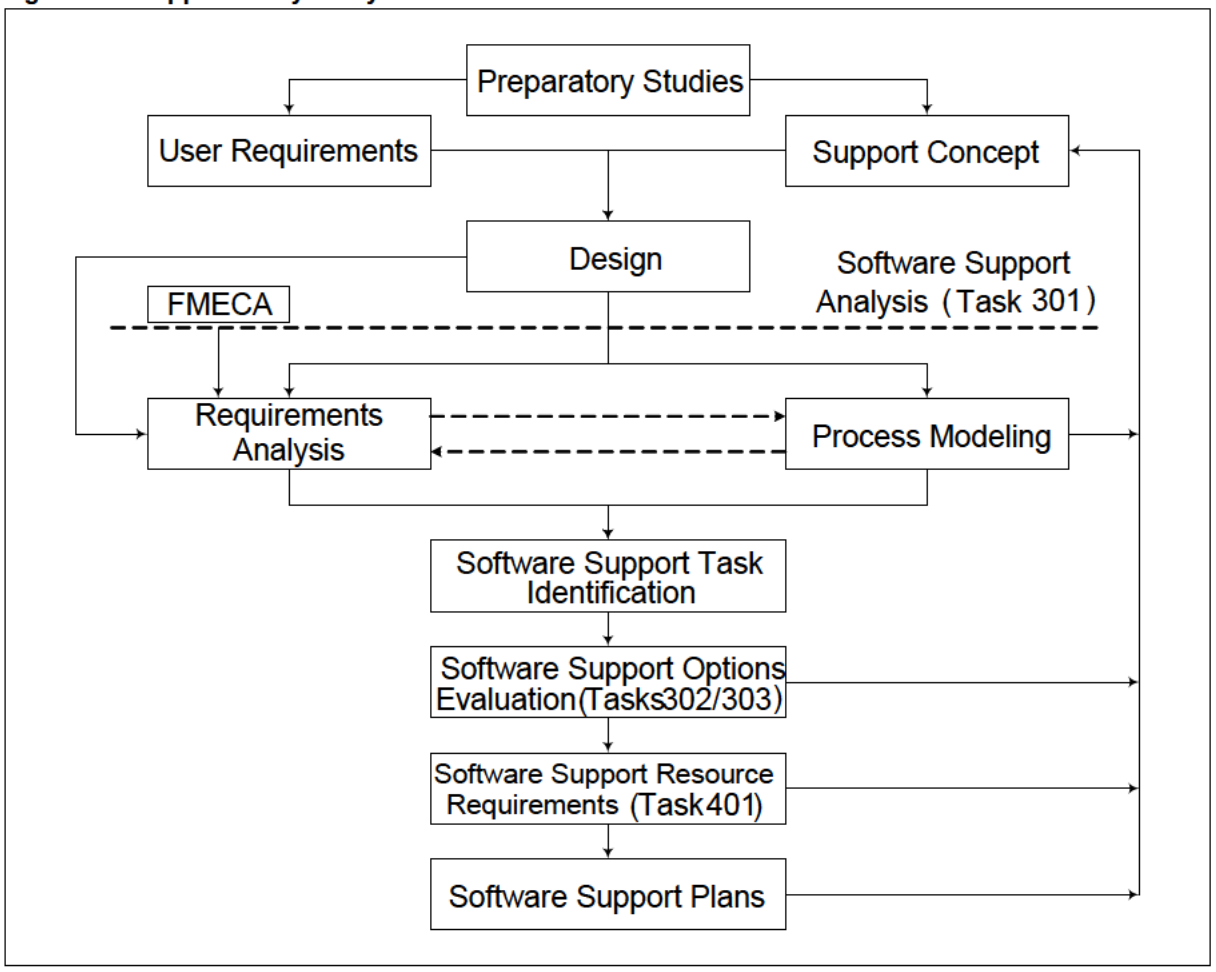
CHAPTER 4: APPLICATION OF SUPPORTABILITY ANALYSIS TO SOFTWARE

GENERAL

Introduction

1. The SA strategy for any project involving software will apply SA activities concurrently to hardware and software elements. However, at the detailed level of activity application, there are some distinct techniques and considerations for software, which are described in this chapter. The overall SA process for software is illustrated in Figure 4. 1.

Figure 4.1: Supportability Analysis Process for Software



2. Software Support (JSP 886 Volume 7 Part 4) is affected by the overall product design and the software development process. The overall product design will determine the functionality and performance required of the software and any constraints within which it is to operate. The software development process will also influence the number of residual faults in the software at the end of development and the ease with which the software can be modified. Contracts for software procurement typically define the software functionality and any required development standards. Therefore, little scope is provided for optimizing designs for supportability. As a result, SA for software aspects must commence before such contracts are defined.

Applicability of Supportability Analysis Activities to Software

3. In broad terms, most SA sub activities may be applied to software as they stand. This chapter describes the application of SA sub activities in the context of an overall SA process for software. This includes annotations and additional information, where appropriate, to highlight any specific interpretation or activity which shall be undertaken for software. Where any specific sub activity description has no such modifications, the sub activity shall be interpreted and applied equally for hardware and software within the overall product context. Additional guidance on the application of SA activities to software elements of systems is provided in this chapter.

4. The following two SA sub activities are considered not to be applicable to software:

a. Energy Trade-Offs (Sub-task 303. 2. 10) - is technically incompatible.

b. RCM (Sub-task 301. 2. 4. 2) - is considered inappropriate for reasons which are discussed under the coverage of Software Supportability Analysis later in this chapter.

Early Project Phase Activity

5. SA activities undertaken in respect of software items during the early, pre-design phases of a project offer the greatest potential benefits for supportability and for the achievement of optimum TLC. The realization of such benefits is conditioned, however, by the nature of the system and the procurement strategy (eg developmental versus COTS), and the extent to which design influence is possible.

6. In the concept and feasibility stages of a project, preliminary SA activities may be undertaken by the MOD, by selected contractors or by a combination of both. The output will be used to compile the supportability aspects of the formal system requirement, and the formulation of provisional software support concepts. The main areas of interest are as follows:

a. **Prime Product Technical Requirements**. These fall into the categories of functional requirements (eg test and testability, system monitoring, data recording etc) and non-functional requirements (eg growth capacity).

b. **Development Standards**. Contractual standards to be applied in respect of software design and development, quality and configuration management.

c. **Support System Requirements**. The attributes and performance / service levels required for the software support system.

7. These areas of a system requirement might be compiled through the SA activity mapping illustrated in Table 4. 1. (Note that the analysis issues listed are indicative rather than exhaustive, and will vary between projects). These SA activity mappings for software aspects shall be considered in conjunction with the product-level guidance given in JSP 886 Volume 7 Part 6: Tailoring.

Table 4.1: Mapping Supportability Analysis Activities to the Generation of System Software Requirements

Requirements Area	Analysis Issues	Relevant SA Activities				
		Note 1	Note 2	Note 3	Note 4	Note 5
Prime Product Technical Requirements	Functional Aspects: Built in test, diagnostics and monitoring Recovery, reconfiguration, degradation, mode reversion Data recording / access / upload / download	✸		✸	✸	✸
	Functional Aspects: Growth capacity, memory, processing, data communications			✸		✸
Development Standards	Design / Development Methods and Tools: Requirements Capture, Systems Analysis, Code, Test, etc.		✸	✸	✸	
	Implementation Standards: Language, Data Communications, Firmware, Security, Documentation, etc.		✸	✸	✸	
	Management: Project / Quality / Configuration Management Standards		✸	✸		
Support System Requirements	Readiness / Responsiveness Release Frequencies Intellectual Property Rights Use of Customer Resources Support concepts (through Task 302)	✸	✸	✸		✸

Notes:

1. Use Study (Task 201).
2. Standardization (Task 202).
3. Comparative Analysis (Task 203).
4. Technological Opportunities (Task 204).
5. Supportability and Supportability Related Design Factors (Task 205).

8. The target for the application of SA activities in the early project phases will generally be the application software for the envisaged system, and the system architecture (eg processing / data communications / security) over which the functionality will be provided. The primary purpose of any preliminary application of SA activities is the clear identification of requirements and constraints, and issues requiring further analysis. This will facilitate linkage into any subsequent SA activity iterations which might be performed. The format of any output reports will vary according to the project phase and the nature of the system, and will be agreed with the MILSM.

SUPPORTABILITY ANALYSIS FOR SOFTWARE

9. Once software development or procurement has been initiated, the SA process may proceed as illustrated in Figure 4. 1 (subject to Tailoring requirements). SA activities during and after software implementation are mainly concerned with the capture or definition of information needed to support the software.

10. Supportability Analysis for Software (SAS) is a technique to assist in the application of Functional Requirements Identification (Task 301) to the software aspects of systems. The objectives of SAS are to identify potential requirements for, and constraints affecting, software support and to identify software requirements to enhance system availability and supportability.

11. SAS comprises two broad activities: requirements analysis and process modelling. Guidance on the conduct of these activities is provided in this section. The necessary depth of application is variable and will depend upon the project phase, the type of

procurement and the role of the product. The normal approach to the balance between costs and time for the analysis effort and the level of detail shall apply.

12. The applicability of Failure Modes Effects and Criticality Analysis (FMECA) and Reliability Centred Maintenance (RCM) to software is as follows:

a. FMECA is relevant to software, in that the analysis applied to the overall product shall identify, for any particular failure mode, whether the associated functionality is provided by, or dependent on, software. Further guidance on this topic is given below, within the description of software support requirements analysis.

b. RCM is not directly applicable to software, since software 'failures' will always be the result of unintended features of the design, rather than wear out or breakage. However, depending on its assessed safety criticality, a software item might attract a safety integrity level (recorded in the Information Repository). This will be traceable, through a SA report, to the software tools and methods which have been selected to provide the required assurances for integrity / reliability.

13. **The Application of SAS**. SAS will be carried out on Software Support Significant Items (SSSI) as part of Functional Requirements Identification (Task 301). The following clauses describe how the techniques outlined above shall be applied in practice.

Software Support Resource Requirements

14. Software support resource requirements will be analyzed and quantified in conjunction with the application of Task Analysis (Task 401) to the overall product. Software support activities relating to the operational use of a product, and mission preparation and recovery, are essentially product-level activities. A similar approach will apply to software embodiment activities carried out at the product level. However, activities concerned with software modification require some particular considerations, as outlined below.

a. **Release Frequency.** Specialist tools might be used to generate detailed predictions for the expected rate and volume of change to a software program. However, based on information generated by the Use Study, the assessment of comparative systems and the application of SAS, a planned release frequency may be determined. There is provision for this to be recorded in the Information Repository. Unless the MOD specifies otherwise, the release frequency shall be a balance between the resources and costs for a range of release frequency options, and the need for the user to be able to take advantage of progressive improvements in functionality and performance.

b. **Sharing of Resources between Development and Support Functions.** The nature of developmental software procurements often involves the continuation of development work for a considerable period beyond the initial in-service date of the parent product. Where concurrent development and support activity require some use of common facilities or resources, their capacity to satisfy the expected overall utilization requirements shall be assessed. Alternative resource proposals shall be made where necessary.

c. **Critical Resources.** Certain elements in a software modification facility represent 'bottlenecks' (ie single, critical resources) in the overall change development and implementation process. The resource requirements analysis shall

identify such items and estimate the average utilization factor. Remedial action shall be proposed where necessary.

d. **Consolidated Software Team Resources.** Where it is recommended that support for a software item is undertaken by the customer, the support plan shall provide a consolidated support team description covering all required functions and resources, including infrastructure aspects such as QA and CM.

Use of Software Metrics

15. A software metric is any attribute of a software product or its development process, about which data may be collected and analyzed. Such activity might fall into a number of non-logistics domains, such as project monitoring and process improvement, but will also be of value to the SA process in helping to quantify support resource requirements.

16. Despite these benefits, it is difficult to define a standard set of software metrics which will be appropriate and usable for all types of MOD project. MOD might nevertheless specify or prefer the use of particular methods and tools for estimating software support resources and costs. Where no such preference is stated, the Contractor shall propose an approach to generating and analyzing appropriate detailed supporting data. In either case, the form and content of deliverable reports associated with such methods and tools shall be defined and agreed with the MILSM.

Software Support Planning

17. Software support planning will be integrated with the product level analysis of support requirements and support system alternatives. The activity of SAS represents the application of Functional Requirements Identification (Task 301) to software, and will consider relevant aspects of the output from FMEA (ie software-induced failure modes).

18. For software support functions not involved with software modification, the consideration of support system alternatives will be through application of the standard SA process. However, for the application of Comparative Analysis (Task 203), and Support System Alternatives (Task 302) to the software modification function, contractors shall take into account a number of special considerations as detailed in JSP 886 Volume 7 Part 4.

CHAPTER 5 – ACTIVITY INPUTS AND OUTPUTS

PROGRAMME PLANNING AND CONTROL (100 SERIES TASKS)

DEVELOPMENT OF AN EARLY LOGISTIC SUPPORT ANALYSIS STRATEGY (TASK 101)

Purpose

1. To develop a proposed SA programme strategy for use early in an acquisition and through life product management programme, and to identify the SA requirements.

Activity Description

2. Prepare supportability objectives for the subject product, identify and document the risk of not accomplishing these objectives, and identify proposed SA requirements (Task 101. 2. 1).

3. The proposed supportability objectives and analysis requirements will be based on the following factors:

   a. The probable design, maintenance concept, and operational approaches for the new product, and gross estimates of the Reliability and Maintainability (R and M), Operational and Support (O and S) costs, logistic support resources and readiness characteristics of each design and operational approach.

   b. The availability, accuracy, and relevance of: readiness, O and S cost, and logistic support resource data required to perform the SA activities and sub activities proposed by the Contractor.

   c. The potential design impact of performing the SA activities and sub activities.

   d. The approach to specifying software supportability and software engineering requirements.

4. Estimate the cost to perform each activity and sub activity identified under Prepare Supportability Objectives (Task 101. 2. 1) and cost effectiveness of performing each, given the projected costs and schedule restraints (Task 101. 2. 2).

5. Update the SA Strategy as required based on analysis results, programme schedule modifications and project decisions (Task 101. 2. 3).

Activity Input.

6. Expected mission and functional requirements for the new product.

7. Expected project funding and schedule constraints and other known key resource constraints that will impact support of the product such as projected deficits in numbers or skills of available personnel, limited priorities on strategic materiel, etc.

8. Databases available from the project / contractor for use in SA activities.

9. Delivery identification of any data item required.

10. Previously conducted MOD or Service mission area and product analyses, which are pertinent to the new product.

Activity Output

11. A SA Strategy outlining proposed supportability objectives for the new product and proposed SA requirements in each phase of the project which provide the best return on investment. Prepare supportability objectives and Estimate the cost.

12. SA Strategy updates as applicable.

LOGISTIC SUPPORT ANALYSIS PLAN (TASK 102)

Purpose

13. To develop a Supportability Analysis Plan (SAP) which identifies and integrates all SA activities, identifies management responsibilities and activities, and outlines the approach toward accomplishing analysis tasks.

Activity Description

14. Prepare a SAP which describes how the SA programme will be conducted to meet project requirements (Task 102. 2. 1). The SAP may be included as part of the Integrated Support Plan (ISP) when an ISP is required. The SAP will include the following elements of information, with the range and depth of information for each element tailored to the project phase:

a. A description of how the SA programme will be conducted to meet the system and logistic requirements defined in the applicable project documents.

b. A description of the management structure and authorities applicable to SA. This includes the interrelationship between line, service, staff, and policy organizations.

c. Identification of each SA activity that will be accomplished and how each will be performed. Identification of the major trade-offs to be performed under System Trade-Offs (Task 303. 2. 3), when applicable.

d. A schedule with estimated start and completion points for each SA programme activity. Schedule relationships with other ILS programme requirements and associated system engineering activities will be identified.

e. A description of how SA activities and data will interface with other ILS and system oriented activities and data. This description will include analysis and data interfaces with the following programmes, as applicable:

(1) Product Design.

(2) Product Reliability.

(3) Product Maintainability.

(4) Human Factors Integration.

(5) Standardization.

(6) Parts Control.

(7) System Safety.

(8) Packaging, Handling, Storage, and Transportability.

(9) Initial Provisioning.

(10) Product Testability.

(11) Survivability.

(12) Technical Documentation.

(13) Training and Training Equipment.

(14) Facilities.

(15) Support Equipment.

(16) Test and Evaluation.

f. Product Breakdown Structure (PBS) identification of items upon which SA will be performed and documented, including software items. Identification of an SA candidate item list, and SA candidate item selection criteria. The list will include all items recommended for analysis, items not recommended and the appropriate rationale for selection or non-selection.

g. Explanation of the SA control numbering system to be used.

h. The method by which supportability and supportability related design requirements are disseminated to designers and associated personnel.

i. The method by which supportability and supportability related design requirements are disseminated to subcontractors and the controls levied under such circumstances.

j. Government data to be furnished to the contractor.

k. Procedures for updating and validating of SA data to include configuration control procedures for SA data.

l. SA requirements on Government furnished equipment/materiel (GFE/GFM) and subcontractor/vendor furnished materiel including end items of support equipment.

m. The procedures to evaluate the status and control of each activity and identification of the organizational unit with the authority and responsibility for executing each activity.

n. The procedures, methods and controls for identifying and recording design problems or deficiencies affecting supportability, corrective actions required, and the status of actions taken to resolve the problems.

o. Description of the data collection system to be used by the Contractor to document, disseminate and control SA and related design data.

p. A description of the Logistic Information Repository (LIR) system to be used.

q. Update the SAP as required, subject to project approval, based on analysis results, programme schedule modifications and project decisions (Task 102. 2. 2).

r. The applicable PD for the format of the Supportability Analysis Plan identified in Part 2 of this JSP applies to the creation of this Plan and will be specified when required as a deliverable data item (Task 102. 2. 3).

Activity Input

15. Identification of each SA activity required under this standard and any additional activities to be performed as part of the SA programme.

16. Identification of the contractual status of the SAP and approval procedures for updates.

17. Identification of any specific indoctrination or SA training to be provided.

18. Duration of the SAP to be developed.

19. Delivery identification of any data item required.

20. Product requirements and development schedule.

21. Activity and sub activity requirements specified in the SA strategy (Task 101).

Activity Output

22. Supportability Analysis Plan.

23. Supportability Analysis Plan updates as applicable.

PROGRAMME AND DESIGN REVIEWS (TASK 103)

Purpose

24. To establish a requirement for the contractor to plan and provide for official review and control of released design information with SA programme participation in a timely and controlled manner, and to assure that the SA programme is proceeding in accordance with the contractual milestones so that the supportability and supportability related design requirements will be achieved.

Activity Description

25. Establish and document design review procedures which provide for review and control of released design information with SA programme participation in a timely and controlled manner (Task 103. 2. 1). These procedures will define accept/reject criteria pertaining to supportability requirements, the method of documenting reviews, the types of design documentation subject to review and the degree of authority of each reviewing activity.

26. Formal review and assessment of supportability and supportability related design Contract requirements shall be an integral part of each product design review (eg System Design Review (SDR), Preliminary Design Review (PDR), Critical Design Review (CDR),

etc) (Task 103. 2. 2). The Contractor will schedule reviews with subcontractors, as appropriate, and inform the project in advance of each review. Results of each product design review will be documented. Design reviews will identify and discuss all pertinent aspects of the SA programme. Agendas will be developed and coordinated to address at least the following topics as they apply to the project phase activity and the review being conducted:

a. SA conducted by activity and EBS element.

b. Supportability assessment of proposed design features including supportability, cost, and readiness drivers and new or critical logistic support resource requirements.

c. Corrective actions considered, proposed, or taken, such as:

d. Support alternatives under consideration.

e. Product alternatives under consideration.

f. Evaluation and trade-off analysis results.

g. Comparative analysis with existing systems/product.

h. Design or redesign actions proposed or taken.

i. Review of supportability and supportability related design requirements (with review of specifications as developed).

j. Progress toward establishing or achieving supportability goals.

k. SA documentation required, completed, and scheduled.

l. Design, schedule, or analysis problems affecting supportability.

m. Identification of supportability related design recommendations to include a description of the recommendation; whether or not it has been approved or is pending, and rationale for approval (eg cost savings, maintenance burden reductions, supply support reductions, reliability improvements, safety or health hazard reduction etc).

n. Other topics and issues as appropriate.

27. Formal review and assessment of supportability and supportability related design requirements will be an integral part of each product programme review specified by the Contract (Task 103. 2. 3). Programme reviews include, but are not limited to, ILS management team meetings, reliability programme reviews, maintainability programme reviews, technical data reviews, test integration reviews, training programme reviews, human factors integration programme reviews, system safety programme reviews and supply support reviews. The Contractor will schedule programme reviews with subcontractors, as appropriate, and inform the project in advance of each review. Results of each product project review will be documented. Programme reviews will identify and discuss all pertinent aspects of the SA programme. Agendas will be developed and coordinated to address at least the topics listed under Design Reviews (Task 103. 2. 2) as they apply to the project phase activity and the review being conducted.

28. The SA programme will be planned and scheduled to permit the contractor and the project to review programme status (Task 103. 2. 4). The status of the SA programme will be assessed at SA reviews, LSC or ISLSC specified by the Contract. The Contractor will schedule SA reviews with subcontractors, as appropriate, and inform the project in advance of each review. Results of each SA review will be documented. SA reviews will identify and discuss all pertinent aspects of the SA programme to a more detailed level than that covered at design and programme reviews. Agendas will be developed and coordinated to address at least the topics listed under Design Reviews (Task 103. 2. 2) as they apply to the project phase activity and the review being conducted.

29. Guidance Conferences are to be held as required by Def Stan 00-600. (Task 103. 2. 5).

Activity Input

30. Identification and location of design, programme, and SA reviews required.

31. Advance notification requirements to the project of all scheduled reviews.

32. Recording procedures for the results of the reviews.

33. Identification of project and contractor follow-up methods on review of open items.

34. Delivery identification of any data item required.

Activity Output

35. Design review procedures which provide for official review and control of released design information with SA programme participation in a timely and controlled manner.

36. Agendas for and documented results of each design review to include design recommendations identified in accordance with 28h above.

37. Agendas for and documented results of each product programme review.

38. Agendas for and documented results of each product SA review.

39. Schedules and agendas for, and documented results of each provisioning related activity or conference.

MISSION AND SUPPORT SYSTEMS DEFINITION (200 SERIES TASKS)

USE STUDY (TASK 201)

Purpose

40. To identify and document the pertinent supportability factors related to the intended use of the new product.

Activity Description

41. Identify and document the pertinent supportability factors related to the intended use of the new product (Task 201. 2. 1). Factors to be considered include mobility requirements, deployment scenarios, mission frequency and duration, basing concepts,

software supportability, anticipated service life, interactions with other systems/end items, operational environment, and human capabilities and limitations. Both peacetime and wartime employment will be considered in identifying the supportability factors. Previously conducted mission area and weapon system analyses which quantified relationships between hardware, software, mission, and supportability parameters and which are pertinent to the new product will be identified and documented.

42. Document the quantitative data resulting from Identify and Document the pertinent Supportability Factors (Task 201. 2. 1) which must be considered in developing support alternatives and conducting support analyses (Task 201. 2. 2). This data will include but not be limited to the following:

a. Operating requirements, consisting of the number of missions per unit of time, mission duration, and number of operating days, miles, hours, firings, flights, or cycles per unit of time.

b. Number of systems supported.

c. Transportation factors (eg mode, type, quantity to be transported, destinations, transport time and schedule).

d. Allowable maintenance periods (including relevant software support activities).

e. Environmental requirements to include hazardous materials, hazardous waste, and environmental pollutants.

f. Number of operator, maintainer, and support personnel available to support the requirements of the new system.

43. Conduct field visits to operational units and support activities which most closely represent the planned operational and support environment for the new product (Task 201. 2. 3).

44. Prepare a Use Study report documenting the information developed during performance of: Document the pertinent Supportability Factors, Document quantitative data, and Conduct field visits (Tasks 201. 2. 1, 201. 2. 2, and 201. 2. 3). Update the Use Study as more detailed information on the intended use of the new product becomes available (Task 201. 2. 4).

Activity Input

45. Intended mission and use information on the new product including locations, type of units, depot locations, etc.

46. Locations for field visits when required. (Task 201. 2. 3)

47. Delivery identification of any data item required.

Source documentation available related to the intended use of the new system.

48. Previously conducted mission area and weapon system analyses which quantified relationships between hardware, software, mission, and supportability parameters and which are pertinent to the new product.

Activity Output

49. Pertinent supportability factors related to the intended use of the new system.

50. Quantitative data, to include a human factors integration target audience description, resulting from Document the pertinent Supportability Factors (Task 201. 2. 1), which must be considered in conducting support analyses and developing support alternatives.

51. Field visit reports.

52. Use Study and updates as better information becomes available.

MISSION HARDWARE, SOFTWARE FIRMWARE AND SUPPORT SYSTEM (TASK 202)

Purpose

53. To define supportability and supportability related design constraints for the new product based on existing and planned logistic support resources which have benefits due to cost, manpower, personnel, readiness or support policy considerations, and to provide supportability input into mission hardware and software standardization efforts.

Activity Description

54. Identify existing and planned logistic support resources which have potential benefits for use on each product concept under consideration (Task 202. 2. 1). All elements of ILS shall be considered. Define in quantitative terms supportability and supportability related design constraints for those items which shall become programme constraints due to cost, manpower, personnel, readiness, or support policy considerations and benefits.

55. Provide supportability, cost, and readiness related information into mission hardware and software standardization efforts (Task 202. 2. 2). This input will be provided to a level commensurate with the level of mission hardware and software standardization being pursued.

56. Identify recommended mission hardware and software standardization approaches which have utility due to cost, readiness or supportability considerations and participate in the system/ product standardization effort (Task 202. 2. 3). This activity will be performed to a level of indenture commensurate with the design development.

57. Identify any risks associated with each constraint established (Task 202. 2. 4). For example, known or projected scarcities, dependence on limited software support resources, and developmental logistic support resources will represent possible risk areas when establishing standardization constraints.

Activity Input

58. Mandatory supportability and supportability related design constraints for the new product due to standardization requirements. These will include any standardization and interoperability (S and I) constraints.

59. Information available from the Project relative to existing and planned logistic support resources to include a human factors integration target audience description.

60. Mandatory mission hardware and software standardization requirements.

61. Delivery identification of any data item required.

62. Alternative system concepts under consideration.

63. Use Study (Task 201).

Activity Output

64. Quantitative supportability and supportability related design constraints for the new product based upon support standardization considerations.

65. Supportability, cost, and readiness characteristics of mission hardware and software standardization approaches under consideration.

66. Recommended mission hardware and software standardization approaches which have utility due to cost, readiness, or supportability considerations.

67. Documented risks associated with each constraint established.

COMPARATIVE ANALYSIS (TASK 203)

Purpose

68. To select or develop a Baseline Comparison System (BCS) representing characteristics of the new product for:

a. Projecting supportability related parameters, making judgements concerning the feasibility of the new product supportability parameters, and identifying targets for improvement.

b. Determining the supportability, cost, and readiness drivers of the new product.

Activity Description

69. Identify existing systems and subsystems (operational and support) useful for comparative purposes with new product alternatives. Different existing systems will be identified when new product alternatives vary significantly in design, operation, or support concepts, or where different existing systems are required to adequately compare all parameters of interest. (Task 203. 2. 1)

70. Select or develop a BCS for use in comparative analyses and identifying supportability, cost, and readiness drivers of each significantly different new product alternative. A BCS may be developed using a composite of elements from different existing systems when a composite most closely represents the design, operation, and support characteristics of a new product alternative. Different BCS or composites may be useful for comparing different parameters of interest. Previously developed BCS will be assessed to determine the extent to which they can fill the need for the new product. (Task 203. 2. 2)

71. Determine the O and S costs, logistic support resource requirements, R and M values, software supportability characteristics and readiness values of the comparative systems identified. Identify these values at the system and subsystem level for each BCS established. Values will be adjusted to account for differences between the comparative system's use profile and the new product use profile where appropriate. (Task 203. 2. 3)

72. Identify qualitative environmental, health hazard, safety and supportability problems on comparative systems, including software support process problems, which shall be prevented on the new product. (Task 203. 2. 4)

73. Determine the supportability, cost and readiness drivers of each comparative system or BCS. These drivers may come from the design, operating, or support characteristics of the comparative systems and represent drivers for the new product. For example, repair cycle time may be the prime readiness driver; a particular subsystem may be the prime manpower driver; software modification personnel, tools and facilities may be a cost driver, or energy cost may be the prime cost driver. (Task 203. 2. 5)

74. Identify and document any supportability, cost, or readiness drivers for the new product resulting from subsystems or product in the new system for which there are no comparable subsystems or product in comparative systems. (Task 203. 2. 6)

75. Update the comparative systems, their associated parameters, and the supportability, cost and readiness drivers as the new product alternatives become better defined or as better data is obtained on the comparative systems and subsystems. (Task 203. 2. 7)

76. Identify and document any risks and assumptions associated with the comparative systems and their associated parameters and drivers, such as a low degree of similarity between the new product and existing systems or the lack of accurate data on existing systems. (Task 203. 2. 8)

Activity Input

77. Information available from the Project relative to current operational systems.

78. Delivery identification of any data item required.

79. Level of detail required for comparative system descriptions.

80. Description of new system alternatives under consideration.

81. Use Study (Task 201) (to include the target audience description).

82. Previously developed BCS which are relevant to the new product.

Activity Output

83. Identification of existing systems and subsystems useful for comparative analysis with new product alternatives.

84. O and S costs, logistic support resource requirements, R and M, software supportability characteristics (where applicable) and readiness values of the comparative systems and subsystems.

85. Identification of qualitative environmental, health hazard, safety, supportability and disposal problems on comparative systems which shall be prevented on the new product. This will include identification of operations and maintenance tasks associated with comparative systems which adversely impact system performance due to product design and are to be avoided in the design of the new system.

86. Supportability, cost, and readiness drivers of the new product based on comparative systems/ product.

87. Supportability, cost, and readiness drivers for the new product resulting from subsystems or product in the new system for which there are no comparable subsystems or product in comparative systems.

88. Updates to comparative system descriptions and their associated parameters.

89. Risks and assumptions associated with the use of the comparative systems and subsystems and the parameters established for them.

TECHNOLOGICAL OPPORTUNITIES (TASK 204)

Purpose

90. To identify and evaluate design opportunities for improvement of supportability characteristics and requirements in the new product.

Activity Description

91. Establish design technology approaches and software engineering approaches where applicable, to achieve supportability improvements on the new product over existing systems and subsystems (Task 204. 2. 1). These design approaches will be established through the following:

a. Identifying technological advancements, software engineering developments where applicable and other design improvements which can be exploited in the new product development and which have the potential for reducing logistic support resource requirements, reducing costs, reducing environmental impact, improving safety, or enhancing system readiness.

b. Estimating the resultant improvements that will be achieved in the supportability, cost, environmental impact, safety and readiness values.

c. Identifying design improvements to logistic elements (such as support equipment and training devices) that can be applied during the new product development to increase the effectiveness of the support system or enhance readiness.

92. Update the design objectives as new product alternatives become better defined. (Task 204. 2. 2)

93. Identify any risks associated with the design objectives established, any development and evaluation approaches needed to verify the improvement potential, and any cost or schedule impacts to implement the potential improvements. (Task 204. 2. 3)

Activity Input

94. Delivery identification of any data item required.

95. Information available from the project relative to technology evaluations and improvements.

96. Current reliability, maintainability, and support system design approaches for state-of-the-art systems and product.

97. Supportability, cost and readiness values and drivers for comparative systems from Comparative Analysis (Task 203).

98. Qualitative supportability problems on existing product from Comparative Analysis (Task 203).

Activity Output

99. Recommended design specifications to achieve improvements on the new product.

100. Updates to the design objectives established as new product alternatives become better defined.

101. Any risks associated with the design objectives established, any development and evaluation approaches needed to verify the improvement potential, and any cost or schedule impacts to implement potential improvements.

SUPPORTABILITY AND SUPPORTABILITY RELATED DESIGN FACTORS (TASK 205)

Purpose

102. To establish:

a. Quantitative supportability characteristics resulting from alternative design and operational concepts.

b. Supportability and supportability related design objectives, goals and thresholds, and constraints for the new product for inclusion in project approval documents, product specifications, other requirements documents, or contracts as appropriate.

Activity Description

103. Identify the quantitative supportability characteristics resulting from alternative design and operational concepts for the new product. Operational characteristics will be expressed in such terms as crew size per product / system, aptitude and skill requirements of each job in the crew, and performance standards for each task and system operating mode. Supportability characteristics will be expressed in terms of feasible support concepts, estimates of manpower requirements, aptitude and skill requirements for each job associated with the system, performance standards for each maintenance task, R and M parameters (including software upload / download times, software change traffic and release frequencies where applicable), system readiness, O and S cost, and logistic support resource requirements. Both peacetime and wartime conditions will be included. (Task 205. 2. 1)

104. Conduct sensitivity analyses on the variables associated with the supportability, cost, and readiness drivers for the new Product. (Task 205. 2. 2)

105. Identify any hardware and software for which the Project will not or may not have full design rights due to constraints imposed by regulations or laws limiting the information the

contractor must furnish because of proprietary or other source control considerations. Include alternatives and cost, schedule, and function impacts. (Task 205. 2. 3)

106. Establish supportability, cost, environmental impact and readiness objectives for the product. Identify the risks and uncertainties involved in achieving the objectives established. Identify any risks associated with new technology planned for the new product. (Task 205. 2. 4)

107. Establish supportability and supportability related design constraints for the new product (hardware and software) for inclusion in specifications, other requirements documents, or contracts as appropriate. The design constraints will address, but are not limited to, those constraints related to hazardous material, hazardous waste, and environmental pollutants. These constraints will include both quantitative and qualitative constraints. Document the quantitative constraints in the LIR. (Task 205. 2. 5)

108. Identify any constraints that preclude adoption of a NATO product to satisfy the mission need. (Task 205. 2. 6)

109. Update the supportability, cost, and readiness objectives and establish supportability, cost and readiness goals and thresholds as new product alternatives become better defined. (Task 205. 2. 7)

Activity Input

110. Applicable programme documentation.

111. Delivery identification of any data item required.

112. Identification of supportability and supportability related design factors associated with GFE / GFM.

113. Description of new product alternatives under consideration including new technology planned for the new product.

114. Supportability, cost, and readiness values and drivers for comparative systems from Comparative Analysis (Task 203).

115. Technological opportunities for the new product from Technological Opportunities (Task 204).

116. Supportability and supportability related design constraints for the new product based upon support system, mission hardware, mission software or mission firmware standardization considerations (Task 202).

Activity Output

117. Supportability characteristics resulting from alternative Mission Hardware, Software Firmware and Support System design and operational concepts including efforts to eliminate design rights limitations.

118. Supportability, cost, and readiness objectives for the new Mission Hardware, Software Firmware and Support System and associated risks. Supportability risks associated with new technology planned for the new product.

119. Qualitative and quantitative supportability and supportability related design constraints for the new system. LIR data documenting the quantitative supportability and supportability related design constraints.

120. Identification of any constraints that preclude adoption of a NATO product to satisfy the mission need.

121. Updated supportability, cost, and readiness objectives. Supportability, cost, and readiness goals and thresholds for the new product.

PREPARATION AND EVALUATION OF ALTERNATIVES (300 SERIES TASKS)

FUNCTIONAL REQUIREMENTS IDENTIFICATION (TASK 301)

Purpose

122. To identify the operations and support functions that must be performed in the intended environment for each product alternative under consideration and then to identify the human performance requirements for operations, maintenance and support and to document those requirements in activity inventory.

Activity Description

123. Identify and document the functions that must be performed for the new product to be operated and maintained in its intended operational environment, for each design alternative under consideration (Task 301. 2. 1). These functions will be identified to a level commensurate with design and operational scenario development, and will include both peacetime and wartime functions. Identify hazards, including hazardous material, hazardous waste and environmental pollutants associated with those functions identified.

124. Identify those functional requirements which are unique to the new product due to new design technology or operational concepts, or which are supportability, cost, or readiness drivers (Task 301. 2. 2). Identify hazards, including hazardous material, hazardous waste and environmental pollutants associated with those functions identified.

125. Identify any risks involved in satisfying the functional requirements of the new product (Task 301. 2. 3).

126. A task inventory will be prepared for the new product or facility. This task inventory will identify all tasks that operators, maintainers, or support personnel must perform with regard to the new product (hardware and software) under development, based on the mission analysis, scenarios/conditions and the identified functional requirements (ie functional analysis) (Task 301. 2. 4). Activities will be identified to a level of detail commensurate with design and operational scenario development. The task inventory will be organized in terms of a task classification which defines mission, scenario/conditions, function, job, duty, activity, sub activity and activity elements. The task inventory will be composed of task descriptions, each of which consists of:

a. An action verb which identifies what is to be accomplished in the task.

b. An object which identifies what is to be acted upon in the task.

c. Qualifying phrases needed to distinguish the activity from related or similar tasks.

127. Task descriptions will be clear and concise. Hazardous materials, generation of waste, release of air and water pollutants and environmental impacts associated with each activity will be identified. Where the same task appears in the duty of more than one role and is therefore identified in collective tasks for training purposes, it will be identified as such within the task inventory. Task descriptions may be supplemented by graphical displays or time line charts. Task descriptions will be limited to information germane to the task, not the qualifications of personnel involved, necessary tools or job aids. Operations, preventive maintenance, corrective maintenance and other support tasks such as preparation for operation, post operation, calibration and transportation will be identified by the following methods:

128. The results of the Failure Modes, Effects, and Criticality Analysis (FMECA), or equivalent analysis, will be analyzed to identify and document corrective maintenance task requirements (Task 301. 2. 4. 1). The FMECA, or equivalent, will be documented to the indenture level consistent with the design progression and as specified by the project. System FMECA will include identification of software-specific failure modes or those which may be caused either by a software anomaly or a hardware fault. Such results will be used as an input to the software support analysis to facilitate identification of the immediate system support activities and the longer term corrective action to modify the software. In addition, outputs from the software support analysis will be considered in the overall system FMECA. Data produced as a result of FMECA or equivalent analysis shall be documented in the LIR.

129. Preventive maintenance task requirements can be identified by conducting a Reliability-Centred Maintenance (RCM) analysis (Task 301. 2. 4. 2). The RCM analysis will be based on the FMECA data and documented in the LIR.

130. Operations, maintenance and other support tasks will be identified through analysis of the functional requirements of the new product taking into account mission analysis, and scenarios/conditions under which the new product will be operated (Task 301. 2. 4. 3). The analysis will examine each system function allocated to personnel and determine what operator or support personnel tasks are involved in the performance of each system function.

131. Participate in formulating design alternatives to correct design deficiencies uncovered during the identification of functional requirements or operations and maintenance task requirements (Task 301. 2. 5). Design alternatives which reduce or simplify functions requiring logistic support resources will be analyzed. Identification and analysis of software operations and support tasks may be used to provide corrective feedback into system level design/specification.

132. Update the functional requirements and operations and maintenance task requirements as the new product becomes better defined and better data becomes available (Task 301. 2. 6).

Activity Input

133. Delivery identification of any data item required.

134. Detailed RCM procedures and logic to be used in conducting the RCM analysis.

135. Identification of product hardware, software and firmware on which this activity will be performed and the indenture levels to which this analysis will be carried.

136. Identification of the levels of maintenance for hardware, software and firmware which will be analyzed during performance of this activity to identify functions and activities.

137. Any documentation requirements over and above LIR data such as functional flow diagrams or design recommendation data resulting from the activity identification process.

138. Requirement for a FMECA in accordance with appropriate standard.

139. Description of product concepts under consideration.

140. Supportability, cost, and readiness drivers from Comparative Analysis (Task 203).

141. FMECA results.

142. Use study (Task 201).

Activity Output

143. Documented functional requirements for new product alternatives in both peacetime and wartime environments.

144. Identification of those functional requirements which are unique to the new product or which are supportability, cost, or readiness drivers.

145. Identification of any risks involved in satisfying the functional requirements of the new product.

146. An activity inventory documented in the LIR, or equivalent format approved by the project, identifying activity requirements, to include activities descriptions on system hardware software and firmware and to the indenture levels specified by the project.

147. Identification of design deficiencies requiring redesign as a result of the functional requirements and operations and maintenance activity identification process.

148. Updates to the identified functional requirements and operations and maintenance task requirements (including software support) as the new product becomes better defined and better data becomes available.

SUPPORT SYSTEM ALTERNATIVES (TASK 302)

Purpose

149. To establish viable support system alternatives for the new product for evaluation, trade-off analysis and determination of the best system for development.

Activity Description

150. Develop and document viable alternative system level support concepts for the new product alternatives which satisfy the functional requirements of the new product within the established supportability and supportability related design constraints (Task 302. 2. 1). Each alternative support concept will be developed to a level of detail commensurate with the product support and operational concept development and will address all elements of

ILS. The same support concept may be applicable to multiple new product design and operational alternatives. Support concept alternatives will be prepared to equivalent levels of detail to the degree possible for use in the evaluation and trade-off of the alternatives. The range of support alternatives considered will not be restricted to existing standard support concepts but will include identification of innovative concepts which can improve system readiness, optimize manpower and personnel requirements or reduce O and S costs. Contractor logistic support (total, in part, or on an interim basis) will be considered in formulating alternative support concepts.

151. Update the alternative support concepts as system trade-offs are conducted and new product alternatives become better defined (Task 302. 2. 2). Alternative support concepts will be documented at the system and subsystem level and will address the supportability, cost and readiness drivers and the unique functional requirements of the new product.

152. Develop and document viable alternative support plans for the new product to a level of detail commensurate with the product support and operational scenario development (Task 302. 2. 3).

153. Update and refine the alternative support plans as trade-offs are conducted and the new product design and operational scenario become better defined (Task 302. 2. 4).

154. Identify risks associated with each support system alternative formulated (Task 302. 2. 5).

Activity Input

155. Delivery identification of any data item required.

156. Functional requirements for product alternatives under consideration from Functional Requirements (Task 301).

157. Supportability and supportability related design constraints for the new product from Supportability and Related Design Factors (Task 205).

158. Description of new product alternatives under consideration.

Activity Output

159. Alternative system level support concepts for new product alternatives.

160. Updated alternative support concepts as system trade-offs are conducted and new product alternatives become better defined.

161. Alternative support plans for the new product commensurate with the product support and operational scenario development.

162. Updated alternative support plans as trade-offs are conducted and the new product becomes better defined.

163. Risks associated with each support system alternative formulated.

EVALUATION OF ALTERNATIVES AND TRADE-OFF ANALYSIS (TASK 303)

Purpose

164. To determine the preferred support system alternative(s) for each product alternative and to participate in alternative system trade-offs to determine the best approach (support, design, and operation) which satisfies the need with the best balance between cost, schedule, performance, readiness, and supportability.

Activity Description

165. For each evaluation and trade-off to be conducted under this activity (Task 303. 2. 1):

a. Identify the qualitative and quantitative criteria which will be used to determine the best results. These criteria will be related to the supportability, cost, environmental impact and readiness requirements for the product.

b. Select or construct analytical relationships or models between supportability, design and operational parameters, and those parameters identified for the evaluation criteria. In many cases, the same model or relationship may be appropriate to perform a number of evaluations and trade-offs. Parametric and cost estimating relationships (PER / CER) may be appropriate for use in formulating analytical relationships.

c. Conduct the trade-off or evaluation using the established relationships and models and select the best alternative(s) based upon the established criteria.

d. Conduct appropriate sensitivity analyses on those variables which have a high degree of risk involved or which drive supportability, cost or readiness for the new system.

e. Document the evaluation and trade-off results including any risks and assumptions involved.

f. Update the evaluations and trade-offs as the product becomes better defined and more accurate data becomes available.

g. Include both peacetime and wartime considerations in the analyses.

h. Assess the impact on existing or planned weapon, supply, maintenance and transportation systems based on the trade-off decision.

i. Assess life cycle support considerations to include post production support and obsolescence issues.

166. Conduct evaluations and trade-offs (Task 303. 2. 2) between the support system alternatives identified (Task 302) for each product alternative. For the selected support system alternative(s), identify and document any new or critical logistic support resource requirements. Any restructured personnel job classification will be identified as a new resource.

167. Conduct evaluations and trade-offs between design, operations and support concepts under consideration (Task 303. 2. 3).

168. Evaluate the sensitivity of system readiness parameters to variations in key design and support parameters such as R and M, software support, spares budgets, resupply time, and manpower and personnel skill availability (Task 303. 2. 4).

169. Estimate and evaluate the manpower and personnel implications of alternative product concepts in terms of total numbers of personnel required, job classifications, skill levels and experience required. This analysis will include organizational overhead requirements, error rates and training requirements (Task 303. 2. 5).

170. Conduct evaluations and trade-offs between design, operations, training and personnel job design to determine the optimum solution for attaining and maintaining the required proficiency of operating and support personnel. Training evaluations and trade-offs will be conducted and will consider shifting of job duties between job classifications, alternative technical publications concepts, alternative mixes of formal training, on-the-job training, unit training and use of training simulators (Task 303. 2. 6).

171. Conduct Level of Repair Analyses (LORA) in accordance with an appropriate standard commensurate with the level of design, operation, and support data available. Identify Source, Maintenance, and Recoverability (SMR) characteristics from the LORA for those items identified as provisioned item candidates (Task 303. 2. 7). Software support activities concerned purely with the handling (eg up/download) of software items will be included in the LORA for the associated product hardware item.

172. Evaluate alternative diagnostic concepts to include varying degrees of Built-In-Test (BIT), off-line-test, manual testing, automatic testing and diagnostic connecting points for testing and identify the optimum diagnostic concept for each product alternative under consideration (Task 303. 2. 8).

173. Conduct comparative evaluations between the supportability, cost and readiness parameters of the new product and existing comparative systems / product (Task 303. 2. 9). Assess the risks involved in achieving the supportability, cost and readiness objectives for the new product based upon the degree of growth over existing systems / product.

174. Conduct evaluations and trade offs between product alternatives and energy requirements (Task 303. 2. 10). Identify the petroleum, oil, and lubricant (POL) requirements for each product alternative under consideration and conduct sensitivity analyses on POL costs.

175. Conduct evaluations and trade offs between product alternatives and survivability and battle damage repair characteristics in a combat environment (Task 303. 2. 11).

176. Conduct evaluations and trade offs between product alternatives and transportability requirements (Task 303. 2. 12). Identify the transportability requirements for each alternative under consideration and the limiting constraints, characteristics, and environments on each of the modes of transportation. For software, this equates to data transfer characteristics, for which specific guidance may be found in Part 4 Volume 7 of this JSP.

177. Conduct evaluations and trade offs between product alternatives and support facilities (including power/utilities, roads, etc.) requirements (Task 303. 2. 13). Identify the facility requirements for each support system alternative under consideration and the limiting constraints, characteristics, and environment on each type of facility.

Activity Input

178. Delivery identification of any data item required.

179. Method of review of identified evaluations and trade offs to be performed, evaluation criteria, analytical relationships and models to be used, analysis results, and the sensitivity analyses to be performed.

180. Specific evaluations, trade-offs, or sensitivity analyses to be performed, if applicable.

181. Specific analytical relationships or models to be used, If applicable

182. Any limits (numbers or skills) to operator or support personnel for the new product.

183. Manpower and personnel costs for use in appropriate trade offs and evaluations which include costs related to recruitment, training, retention, development, and staff turnover rates.

184. Support alternatives for the new product from Support System Alternatives (Task 302).

185. Description of product alternatives under consideration.

186. Supportability and supportability related design objectives, goals and thresholds, and constraints for the new product from Supportability and Related Design Factors (Task 205).

187. Historical CER/PER that exist which are applicable to the new product.

188. Job and activity inventory for applicable personnel job classifications.

189. The results of the human factors integration activity performance analysis, prepared in accordance with Def Stan 00-250.

Activity Output

190. For each evaluation and trade off performed under this activity:

a. Identification of the evaluation criteria, analytical relationships and models used, selected alternative(s), appropriate sensitivity analysis results, evaluation and trade-off results, and any risks involved.

b. Trade-off and evaluation updates, as applicable.

191. Recommended support system alternative(s) for each product alternative and identification of new or critical logistic support resource requirements.

192. Recommended product alternative(s) based on cost, schedule, performance, readiness, and supportability factors.

193. Product readiness sensitivity to variations in key design and support parameters.

194. Estimates of total manpower and personnel requirements for alternative product concepts.

195. Optimum training and personnel job design for attaining and maintaining the required proficiency of operating and support personnel.

196. LORA results.

197. Optimum diagnostic concept for each product alternative under consideration.

198. Comparisons between the supportability, cost, and readiness parameters of the new product and existing comparable product.

199. Trade off results between product alternatives and energy requirements.

200. Trade off results between product alternatives and survivability and battle damage repair characteristics.

201. Trade off results between product alternatives and transportability requirements.

202. Trade off results between product alternatives and facilities requirements

DETERMINATION OF LOGISTIC SUPPORT RESOURCE REQUIREMENTS (400 SERIES TASKS)

TASK ANALYSIS (TASK 401)

Purpose

203. To analyze required operations and maintenance tasks for the new product to:

a. Identify logistic support resource requirements for each task.

b. Identify new or critical logistic support resource requirements.

c. Identify transportability requirements.

d. Identify support requirements which exceed established goals, thresholds, or constraints.

e. Provide data to support participation in the development of design alternatives to reduce O and S costs, optimize logistic support resource requirements, or enhance readiness.

f. Provide source data for preparation of required ILS documents (technical manuals, training programmes, manpower and personnel lists, etc).

Activity Description

204. Conduct a detailed analysis of each operation, maintenance and support task contained in the task inventory from Functional Requirements (Task 301) and determine the following (Task 401. 2. 1):

a. Logistic support resources required (considering all ILS elements) to perform the task.

b. Task frequency, task interval, elapsed time and man-hours in the product intended operational environment and based on the specified annual operating base.

c. Maintenance level assignment based on the established support plan after Evaluation of Alternatives and Trade-off (Task 303).

d. Environmental impact of the tasks including use of hazardous materials, generation of hazardous waste and its disposal, and release of air and water pollutants.

205. Document the results of Task Analysis (Task 401. 2. 1) in the LIR (Task 401. 2. 2).

206. Identify new or critical logistic support resources required to perform each task and hazardous materials, hazardous waste and environmental impact requirements associated with those resources (Task 401. 2. 3). New resources are those which require development to operate or maintain the new product. These can include support and test equipment, facilities, new or special transportation systems, new computer resources, and new repair, test, or inspection techniques or procedures to support new design plans or technology. Critical resources are those which are not new but require special management attention due to schedule constraints, cost implications, or known scarcities. Unless otherwise required, document new and modified logistic support resources in the LIR to provide a description and justification for the resource requirement.

207. Based upon the identified task procedures and personnel assignments, identify training requirements and provide recommendations concerning the best mode of training (formal classroom, on-the-job, or both) and the rationale for the recommendations (Task 401. 2. 4). Document the results in the LIR.

208. Analyze the total logistic support resource requirements for each task and determine which tasks fail to meet established supportability or supportability related design goals or constraints for the new product (Task 401. 2. 5). Identify tasks which can be optimized or simplified to reduce O and S costs, optimize logistic support resource requirements, reduce environmental impact including use of hazardous materials, generation of hazardous waste and its disposal, release of air and water pollutants, and environmental impact or enhance readiness. Propose alternative designs and participate in the development of alternative approaches to optimize and simplify tasks or to bring task requirements within acceptable levels.

209. Based upon the identified new or critical logistic support resources, determine what management actions can be taken to minimize the risks associated with each new or critical resource (Task 401. 2. 6). These actions can include development of detailed tracking procedures or schedule and budget modifications. The project will consider the desirability and effectiveness of combining Spares Acquisition Integrated with Production (SAIP) when the end item is, or will be, in production.

210. Conduct a transportability analysis on the product and any sections thereof when sectionalisation is required for transport (Task 401. 2. 7). When the general requirements of Def Stan 00-3 are exceeded, document the transportability engineering characteristics in the LIR. Participate in the development of design alternatives when transportability problem areas are identified.

211. For those support resources requiring initial provisioning, document the Provisioning Technical Documentation (PTD) in the LIR (Task 401. 2. 8).

212. Validate the key information documented in the LIR through performance of operations and maintenance tasks on prototype product (Task 401. 2. 9). This validation

will be conducted using the procedures and resources identified during the Task Analysis (Task 401. 2. 1) and updates will be made where required. Validation requirements will be coordinated with other system engineering demonstrations and tests (eg maintainability demonstrations, reliability and durability tests) to optimize validation time and requirements.

213. Prepare output summaries and reports to satisfy ILS documentation requirements as specified by the project (Task 401. 2. 10). These will include all pertinent data contained in the LIR at the time of preparation.

214. Update the data in the LIR as better information becomes available and as applicable input data from other system engineering programmes is updated (Task 401. 2. 11). Following delivery and acceptance of the initial provisioning data, the Contractor will notify the project of approved changes to the provisioning data via design change notices (DCN).

215. Identify provisioning and other procurement data to be submitted for MOD screening in order to facilitate support system standardization, reprovisioning screening, and item entry control reviews (Task 401. 2. 12).

Activity Input

216. Identification of product hardware and software on which this analysis will be performed.

217. Identification of indenture levels to which this analysis will be carried.

218. Identification of the levels of maintenance which will be documented during performance of this activity.

219. Known or projected logistic support resource shortages.

220. Schedule and budget ceilings and targets.

221. Any supplemental documentation requirements over and above the LIR. (eg transportability clearance diagrams, etc.)

222. Delivery identification of any data item required.

223. Information available from the project relative to:

224. Existing and planned personnel skills, capabilities, and programmes of instruction.

225. Lists of standard support and test equipment.

226. Facilities available.

227. Training devices available.

228. Existing transportation systems and capabilities.

229. Description of personnel capabilities (target audience) intended to operate and maintain the new product at each level of maintenance.

230. Any limits (numbers or skills) to operators or support personnel for the new product.

231. Annual operating basis for task frequencies.

232. Operations and maintenance task requirements from Functional Requirements (Task 301).

233. Results of human factors integration task performance analysis.

234. Recommended support plan for the product identified in the Evaluation of Alternatives and Trade-off (Task 303).

235. Supportability and supportability related design goals and requirements from Supportability and Related Design Factors (Task 205).

236. Products developed to support initial provisioning of support items.

Activity Output

237. Completed LIR data on product hardware and software to the indenture level specified by the project, or equivalent format approved by the project.

238. Identification of new or critical logistic support resources required to operate and maintain the new system.

239. Alternative design approaches where tasks fail to meet established goals and constraints for the new product or where the opportunity exists to reduce O and S costs, optimize logistic support resource requirements, or enhance readiness.

240. Identification of management actions to minimize the risks associated with each new or critical logistic support resource requirement.

241. Validation of key information documented in the LIR.

242. Output summaries and reports as specified by the project containing all pertinent data contained in the LIR at the time of preparation.

243. Updated LIR data as better information becomes available and as applicable input data from other system engineering programmes is updated.

244. Identification of appropriate parts and NATO Stock Numbers (NSN), configuration status and parts sources based on provisioning data submitted for MOD screening. Screening results will be included within the requested provisioning documentation as called out by sub activities Provisioning Requirements and LIR Updates (Tasks 401. 2. 8 and 401. 2. 11).

EARLY FIELDING ANALYSIS (TASK 402)

Purpose

245. To assess the impact of introduction of the new product on existing systems, identify sources of manpower and personnel to meet the requirements of the new product, determine the impact of failure to obtain the necessary logistic support resources for the new product and determine essential logistic support resource requirements for a combat environment.

Activity Description

246. Assess the impact on existing systems (weapon, supply, maintenance, transportation) from introduction of the new product. This assessment will examine impacts on repair facility workload and scheduling, provisioning and inventory factors, automatic test equipment availability and capability, manpower and personnel factors, training programmes and requirements, software support requirements, POL requirements, and transportation systems and will identify any changes required to support existing weapon systems due to new product requirements. (Task 402. 2. 1)

247. Analyze existing manpower and personnel levels to determine from where the required manpower and personnel for the new product will be obtained. Determine the impact on existing operational systems from using the identified sources for manpower and personnel. (Task 402. 2. 2)

248. Assess the impact on product readiness resulting from failure to obtain the required logistic support resources in the quantities required. (Task 402. 2. 3)

Do not duplicate analyses performed under Evaluation of Alternatives and Trade-Off Analysis (Task 303).

249. Conduct survivability analyses to determine changes in logistic support resource requirements based on combat usage. These analyses will be based on threat assessments, projected combat scenarios, product vulnerability, battle damage repair capabilities and component essentialities in combat. Identify and document recommended logistic support resources (eg battle damage repair kits) and sources to satisfy the requirements. (Task 402. 2. 4)

Do not duplicate analyses performed under Evaluation of Alternatives and Trade-Off Analysis (Task 303).

250. Develop plans to implement solutions to problems identified in the above assessments and analyses. (Task 402. 2. 5)

Activity Input

251. Delivery identification of any data item required.

252. Information available from the project relative to:

a. Existing and planned sources for manpower and personnel skills.

b. Capabilities and requirements of existing and planned systems.

c. Projected threats, combat scenarios, product vulnerability, projected attrition rates, battle damage repair capabilities, and essentialities in combat.

253. Logistic support resource requirements for the new product from Task Analysis (Task 401).

254. Results from Evaluation of Alternatives and Trade-Off Analysis (Task 303)

Activity Output

255. Impact from the introduction of the new product hardware, and software on current and planned weapon and support systems.

256. Sources of manpower and personnel skills to satisfy the manpower and personnel requirements of the new product.

257. Product readiness impacts from failure to obtain required logistic support resources to operate and maintain the new product.

258. Essential logistic support resource requirements for a combat environment and identification of sources to satisfy these requirements.

259. Plans to alleviate problems recognised during the performance of this Early Fielding Analysis:

a. Assessing the impact on existing systems.

b. Analyzing existing manpower and personnel levels.

c. Assessing the impact on product readiness.

d. Conducting survivability analyses.

IN SERVICE SUPPORT ANALYSIS (TASK 403)

Purpose

260. To analyze life cycle support requirements (including software support requirements) of the new product prior to closing of production lines to ensure that adequate logistic support resources will be available during the product remaining life.

Activity Description

261. Assess the expected useful life of the product. Identify support items associated with the product that will present potential problems due to inadequate sources of supply after shutdown of production lines. Develop and analyze alternative solutions for anticipated support difficulties during the remaining life of the product. Develop a plan that ensures effective support during its remaining life along with the estimated funding requirements to implement the plan. As a minimum, this plan will address manufacturing, hardware and software support, repair centre, data modifications, supply management, configuration management and obsolescence. (Task 403. 2. 1)

Activity Input

262. Information available from the project relative to:

a. Existing and planned sources of supply.

b. Expected lifetime of the product.

c. Product reliability and maintainability data.

d. Costs associated with in-house and contractor manufacturing and repair alternatives.

263. Delivery identification of any data item required.

264. Supply and consumption data available on the product in its operational environment.

265. Planned product improvements to the product.

266. Early fielding analysis results from Early Fielding Analysis (Task 402).

Activity Output

267. A plan and its associated cost which identifies logistic support resource requirements for the product throughout its remaining life along with the method to satisfy the requirements.

SUPPORTABILITY ASSESSMENT (500 SERIES TASKS)

SUPPORTABILITY TEST, EVALUATION AND VERIFICATION (TASK 501)

Purpose

268. To assess the achievement of specified supportability requirements, identify reasons for deviations from projections and identify methods of correcting deficiencies and enhancing system readiness.

Activity Description

269. Formulate a test and evaluation strategy to ensure that specified supportability and supportability related design requirements are achieved, or achievable, for input into system test and evaluation plans (Task 501. 2. 1). The test and evaluation strategy formulated will be based upon quantified supportability requirements for the new product; the supportability, cost and readiness drivers; and supportability issues with a high degree of risk associated with them. Trade-offs will be conducted between the planned test length and cost and the statistical risks incurred. Potential test programme limitations in verifying supportability objectives based on previous test and evaluation experience and the resulting effect on the accuracy of the supportability assessment will be documented.

270. Develop a System Support Package (SSP) components list identifying support resources that will be evaluated during logistic demonstration and will be tested/validated during development and operational tests (Task 501. 2. 2). The components lists will include:

a. Supportability test requirements.

b. Applicable Maintenance Allocation Chart (MAC).

c. Electronic Documentation.

d. Spares and repair parts.

e. Training devices/product.

f. Special and common tools.

g. Test, Measurement and Diagnostic Equipment (TMDE).

h. Operations and maintenance manpower/personnel requirements.

i. Training courses

j. Transportation and materiel handling equipment

k. . Calibration procedures and equipment.

l. Mobile and/or fixed support facilities.

m. Software support facilities and tools.

n. Other support equipment.

271. Establish and document test and evaluation programme objectives and criteria and identify test resources, procedures and schedules required to meet the objectives for inclusion in the coordinated test programme and test and evaluation plans (Task 501. 2. 3). The objectives and criteria established will provide the basis for ensuring that critical supportability issues and requirements have been resolved or achieved within acceptable confidence levels.

272. Analyze the test results and verify/assess the achievement of specified supportability requirements for the new product (Task 501. 2. 4). Determine the extent of improvement required in supportability and supportability related design parameters in order for the product to meet established goals and thresholds. Identify any areas where established goals or thresholds have not been demonstrated within acceptable confidence levels. Do not duplicate analyses performed in Evaluation of Alternatives and Trade-off (Task 303). Develop corrections for supportability problems uncovered during test and evaluation. These can include modifications to hardware and software support plans, logistic support resources or operational tactics. Update the documented support plan and logistic support resource requirements as contained in the LIR based upon test results. Quantify the effects of these updates on the projected cost, readiness and logistic support resource parameters for the new product.

273. Analyze standard reporting systems to determine the amount and accuracy of supportability information that will be obtained on the new product in its operational environment (Task 501. 2. 5). Identify any shortfalls in measuring achievement against the supportability goals that were established for the new product, or in verifying supportability factors which were not tested during the procurement phases of the item's life cycle. Develop viable plans for obtaining required supportability data from the field which will not be obtained through standard reporting systems. Conduct trade-off analyses between cost, length of data collection and number of operational units in which to collect data and statistical accuracy to identify the best data collection plan. Document the data collection plan selected to include details concerning cost, duration, method of data collection, operational units, predicted accuracy and intended use of the data.

274. Analyze supportability data as it becomes available from standard supply, maintenance, and readiness reporting systems and from any special data collection programmes implemented on the new product (Task 501. 2. 6). Verify achievement of the objectives and thresholds established for the new product. In those cases where

operational results deviate from projections, determine causes and corrective actions. Analyze feedback information and identify areas where improvements can be cost effectively accomplished. Document recommended improvements.

Activity Input

275. Delivery identification of any data item required.

276. Information available from the project relative to standard reporting systems.

277. Previous test and evaluation experience on comparable systems.

278. Supportability and supportability related design factors (Task 205).

279. Supportability, cost, and readiness drivers for the new product from Comparative Analysis (Task 203).

280. Evaluation of Alternatives and trade-off results (Task 303).

281. Test results.

282. Supportability data on the new product in its operational environment from standard maintenance, supply, and readiness reporting systems and any special reporting system developed for the new product.

Activity Output

283. Test and evaluation strategy for verification of supportability and identification of potential test programme limitations and the effect on the accuracy of the supportability assessment.

284. System support package components lists.

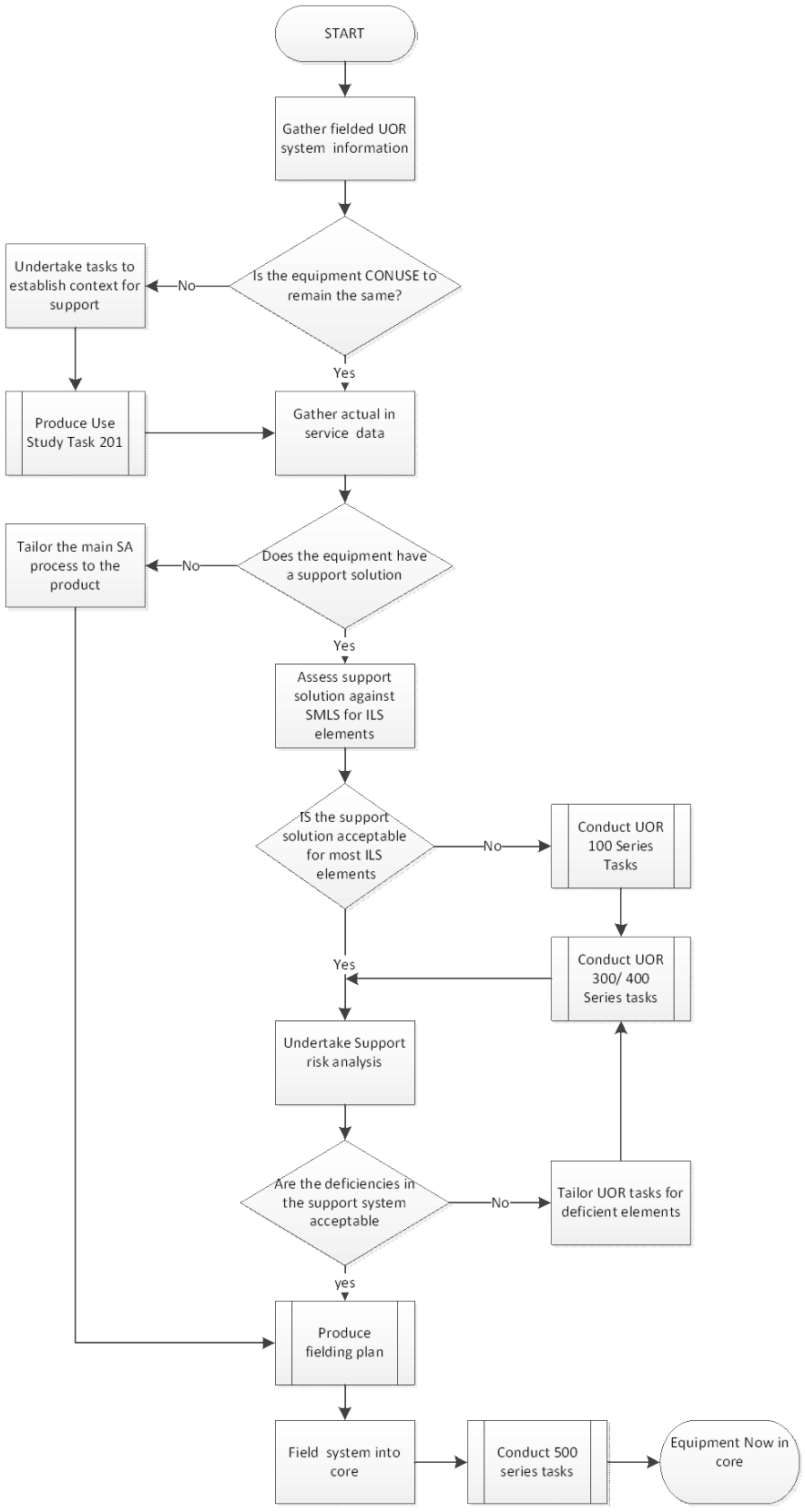
285. Test and evaluation plan for supportability to include test and evaluation objectives, criteria, procedures/methods, resources, and schedules.

286. Identification of corrective actions for supportability problems uncovered during test and evaluation. Updated support plan, logistic support resource requirements and LIR data based upon test results. Identification of improvements required in order to meet supportability goals and thresholds.

287. Detailed plans to measure supportability factors on the new product in its operational environment.

288. Comparison of achieved supportability factors with projections, identification of any deviations between projections and operational results, reasons for the deviations, and recommended changes (design, support, or operational) to correct deficiencies or improve readiness.

CHAPTER 6: PROCEDURES FOR CONDUCTING SA ON UOR TO CORE



INTRODUCTION

1. The introduction into Core capability of a large number of equipment purchased under an Urgent Operational Requirement (UOR) is probably a unique situation for the MOD. Equipment purchased as a UOR has previously been adopted into core, but not on the scale expected with the draw down from operation Herrick.

2. These procedures have been written to tailor the normal Supportability Analysis process used to support DEFSTAN 00-600 to suit the UOR to core transition.

Process

3. The UOR to core migration process is unusual in that for MOD the activities required constitute a subset of those normally undertaken for a Military Off The Shelf (MOTS) procurement, with fielding process which is normally conducted as one of the last activities conducted in reverse at the start.

4. The production of a supportability case in conjunction with this modified SA process should be undertaken to demonstrate that support risks have been reduced to an acceptable level.

ESTABLISH UOR BASELINE

5. It is impossible to produce a well defined support solution for an existing product without first establishing a definitive logistic baseline. Records derived from the initial purchase of equipment, may not reflect what equipment is still in existence in a state fit to be incorporated into the core capability.

6. Prior to starting support solution development the following will need to be determined:

   a. The number of units to be taken onto core;

   b. The availability profile of units to be taken into core;

   c. The requirements for any associated support and test equipment / special tools to be taken into core.

These activities effectively consist of generating a fielding plan from the user to DE&S.

ESTABLISH FUTURE CONCEPT OF USE (CONUSE)

7. The first traditional Supportability Analysis Task required is the establishment of the context in which the equipment is to be operated and supported.

8. If the equipment is to be operated in the same way as during the UOR period then verification and documentation of the operating concept and any associated documentation is all that will be required.

9. If the equipment is not to be operated in the future in the same way as for the UOR requirement, or is to have significant other operational requirements placed upon it then the operating context must be specified prior to developing a support solution. Consideration should be given to generating a Use Study (Task 201)

GATHER AVAILABLE IN SERVICE DATA

10. The development of an effective support solution is sensitive to the availability of good quality data to support decision making.

11. Every effort should be made to gather data regarding the operation and support of the equipment during operation Herrick.

12. An assessment of the quality of the data should be made.

EVALUATE EQUIPMENT SUPPORT SOLUTION

13. Due to the nature of UOR procurement it is possible that the equipment may not have a credible support solution.

14. If there is no support solution in place then one will need to be developed following the normal SA process.

15. Most UOR equipments will have some form of support solution in existence. The solution might not however be suitable for use in the core environment due to proposed changes in use and or constraints imposed by policy.

Assess Support System Against SMLs

16. The existing support solution should be assessed against the Support Maturity Level (SML) criteria for each ILS element. If the support solution is not acceptable for a range of ILS elements then as comprehensive a support solution development process that can be resourced should be undertaken.

17. For a support solution with major deficiencies it will be necessary to undertake some of the tailored 100 series Supportability Analysis task to develop a strategy and plan for a support solution get well programme.

18. A supportability case should be generated to demonstrate the effectiveness of the existing support solution.

Address Support System Deficiencies

19. For a system with major deficiencies the planning process will need to identify which of the 300 and 400 series SA tasks will need to be conducted to generate a credible support solution.

20. For a support solution that has been deemed generally acceptable only the deficient elements will need to be addressed. The UOR to Core recommended SA tasks should be further tailored to include only activities required to address the deficient ILS element.

21. The supportability case should be updated to demonstrate the effectiveness of the improvements made to the existing support solution.

Conduct Support System Risk Analysis

22. The support system risks should be assessed and the activities to address support system deficiencies repeated until the risks have been reduced to an acceptable level.

23. The supportability case should be used to document this activity.

FIELD SYSTEM INTO CORE

Produce Fielding Plan and Field System

24. Once an effective support system has been developed a fielding plan should be produced, using the fielding plan template hosted on the ILS community of interest MOSS team site.

Incorporate into Review and Approval Procedures

25. The system should be fielded into the core capability and an in service monitoring regime for the equipment should be incorporated into the supporting project teams normal in service support procedures.

TAILORED UOR TO CORE SA PROCESS TASKS

Activity Series	Purpose	Activity/Sub Activity
Programme Planning and Control (100 series)	To provide for formal programme planning and review actions	Develop SA strategy (Task 101) Supportability Objectives (Task 101. 2. 1) Cost Estimate (Task 101. 2. 2) Updates (Task 101. 2. 3) SA Plan (SAP) (Task 102) SA Plan (Task 102. 2. 1) Updates (Task 102. 2. 2) SAP Format (Task 102. 2. 3)
Mission and Support Systems Definition (200 series)	To establish supportability objectives and supportability related design goals, thresholds and constraints through comparison with existing systems and analyses of supportability, cost and readiness drivers.	Use Study (Task 201) Supportability Factors (Task 201. 2. 1) Quantitative Factors (Task 201. 2. 2) Use Study Reports and Updates (Task 201. 2. 4) Mission Hardware, Software, Firmware and Support System Standardization (Task 202) Supportability Constraints (Task 202. 2. 1) Supportability Characteristics (Task 202. 2. 2) Recommended Approaches (Task 202. 2. 3) Risks (Task 202. 2. 4)
Preparation and Evaluation of Alternatives (300 series)	To optimize the support system for the new item and to develop a system which achieves the best balance between cost, schedule, performance and supportability.	Functional Requirements Identification (Task 301) Functional Requirements (Task 301. 2. 1) Unique Functional Requirements (Task 301. 2. 2) Risks (Task 301. 2. 3) Operations and Maintenance Tasks (Task 301. 2. 4) Updates (Task 301. 2. 6) Support System Alternatives (Task 302) Alternative Support Concepts (Task 302. 2. 1) Support Concepts Updates (Task 302. 2. 2) Alternative Support Plans (Task 302. 2. 3) Support Plan Updates (Task 302. 2. 4) Risks (Task 302. 2. 5) Evaluation of Alternatives and Trade-off Analysis (Task 303) Trade-off Criteria (Task 303. 2. 1) Support System Tradeoffs (Task 303. 2. 2) System Trade-offs (Task 303. 2. 3) Readiness Sensitivities (Task 303. 2. 4) Manpower and Personnel Trade-offs (Task 303. 2. 5) Training Trade-offs (Task 303. 2. 6) Level Of Repair Analysis (Task 303. 2. 7) Diagnostic Trade-offs (Task 303. 2. 8) Comparative Evaluations (Task 303. 2. 9) Energy Trade-offs (Task 303. 2. 10) Survivability Tradeoffs (Task 303. 2. 11) Transportability Trade-offs (Task 303. 2. 12) Support Facility Trade-offs (Task 303. 2. 13)
Determination of Logistic Support Resource Requirements (400 series)	To identify the logistic support resource requirements of the new system in its operational environment(s) and to develop plans for post	Task Analysis (Task 401) Task Analysis (Task 401. 2. 1) Analysis Documentation (Task 401. 2. 2) New/Critical Support Resources (Task 401. 2. 3) Training Requirements and Recommendations (Task 401. 2. 4) Design Improvements (Task 401. 2. 5) Management Plans (Task 401. 2. 6) Transportability Analysis (Task 401. 2. 7) Provisioning Requirements (Task 401. 2. 8)

Activity Series	Purpose	Activity/Sub Activity
	manufacture support.	Validation (Task 401. 2. 9) ILS Output Products (Task 401. 2. 10) Post Production Support Analysis (Task 403) Post Production Support Plan (Task 403. 2. 1)
Supportability Assessment (500 series)	To assure that specified requirements are achieved and deficiencies corrected.	Supportability Test, Validation, Evaluation and Task Evaluation (Task 501) Updates and Corrective Actions (Task 501. 2. 4) Supportability Assessment Plan (Post Production) (Task 501. 2. 5) Supportability Assessment (Post Production) (Task 501. 2. 6)