Ministry of Defence

JSP 886
DEFENCE LOGISTIC SUPPORT CHAIN MANUAL

VOLUME 7
SUPPORTABILITY ENGINEERING

PART 8.04
RELIABILITY AND MAINTAINABILITY

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FOR TECHNICAL REASONS, EXTERNAL LINKS ON THIS INTERNET VERSION HAVE BEEN REMOVED.

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2.1	15 Mar 12	New Chapter 2: DRACAS added.
2.2	20 Aug 12	Additional process guidance added
3.0	03 Dec 12	New Chapter 3: Support Maturity Levels added. POC updated.

Contents

CHAPTER 1: INTRODUCTION TO RELIABILITY AND MAINTAINABILITY

CONTEXT

1. This part provides key points of policy and guidance for the specification, development and management of Reliability and Maintainability (R&M) for Through Life Support (TLS).

2. R&M also encompasses the discipline of Reliability Centred Maintenance (RCM), which is closely related and forms an integral part of Supportability Engineering. Both R&M and RCM can have a profound effect on Availability, especially on operations and during peacetime training. Failure to follow MOD policy in either of these important areas will jeopardise Capability, inflate Through Life Costs (TLC) and undermine Safety and Morale.

3. R&M is a generic term which embraces the qualities of:

a. Availability.

b. Reliability.

c. Maintainability.

d. Durability.

e. Reliability Centred Maintenance (RCM).

f. Testability.

POLICY

4. It is MOD policy that the following process and procedure are applied to all MOD projects.

a. R&M shall be afforded full consideration, along with equipment performance, cost and project timescale, through the life of the equipment.

b. R&M shall be addressed in Initial Gate and Main Gate Business Cases, to the satisfaction of the Investment Appraisal Board.

c. Robust and measurable R&M requirements shall be included in procurement and support contracts.

d. RCM shall be included in procurement contracts, to derive preventive maintenance programmes for new capabilities.

e. Progressive Assurance shall be used to demonstrate that contractual R&M requirements have been met during Demonstration, Manufacture and In-service.

f. RCM shall be used to review and revise preventive maintenance programmes at regular intervals during the In-service phase.

g. Project Team (PT) Leaders shall appoint competent Focal Points (FPs) to manage routine R&M activities through the life of the equipment. FPs should complete specific FP training available through the Defence Academy.

h. All equipment users shall be able to report faults, failures and serious incidents to the PT supporting the equipment via an effective Equipment Failure Reporting (EFR) process. The PT shall analyse these reports, initiate corrective action where required and provide feedback to the originator. In order to reduce cost and simplify Logistic IS systems, preference is for the use of standard systems rather than bespoke systems, standard systems are listed at Chapter 2.

5. In recognition of the diversity of platforms, equipment and other support strategies an element of tailoring of the best practice, techniques and methodologies may be required to optimise and achieve these goals.

PROCESS

6. Process, procedure and guidance are provided in the DEFSTAN 00-40 series.

7. Best practice guidance is published by the Safety and Reliability Society (SaRS). Specifically recommended are:

a. Interactive process maps showing which Reliability related activity should be done at specific stages of the CADMID cycle Ministry of Defence PT Reliability & Maintainability Processes.

b. Detailed guidance on these activities is published in GR-77: Applied R&M Manual for Defence Systems.

Support Maturity Levels

8. The maturity of the product R&M can be assessed during the life cycle of a project using the 9 Support Maturity Levels (SMLs) which are defined, along with suggested project milestones, by which time these should be achieved in Volume 7 Part 2 Chapter 2.

9. To enable the project to assess maturity of support using SMLs, measures of effectiveness for each SML are given in Figure 1 of Chapter 3. Project specific measures of effectiveness are to be agreed with the contractor and included in the development and/or support contract. Corresponding project risks are also identified in this figure.

KEY PRINCIPLES

10. The principles of Progressive Assurance (DEFSTAN 00-42: R&M, Assurance Activity) and the R&M Case have been adopted as a means by which the R&M qualities of products are managed through their life cycle, in recognition that different products and technologies require particular or unique engineering activities. This is achieved by satisfying the following objectives:

a. The Purchaser shall determine the R&M requirements and demonstrate that the requirements and their implications are understood by the Purchaser and the Supplier; (DEFSTAN 00-40: Reliability & Maintainability).

b. A programme of activities shall be planned and implemented to satisfy the Purchaser's R&M requirements.

c. The Purchaser shall be provided with assurance that the R&M requirements have been satisfied. The R&M case and supporting evidence will be found in the project Through Life Management Plan (TLMP).

11. The Supplier is free to propose the activities required to fulfil the second objective. The third objective is to be satisfied by the provision of progressive assurance, accumulated during the design, the development and the early production processes. This assurance will be provided to the Purchaser by means of R&M Case Reports, supported by the appropriate closed loop reliability related issues management system (i.e. Data Recording and Corrective Action System (DRACAS)), specified within the R&M Case Evidence Framework. DEFSTAN 00.42 Part 3 is the main reference, supported by the R&M processes on the Acquisition Operating Framework (AOF).

12. R&M data forms an essential building block of any Integrated Logistics Support (ILS) programme. To maximise the benefits and minimise costs it is imperative that ILS and R&M activities are co-ordinated from the outset.

ASSOCIATED STANDARDS AND GUIDANCE

13. The following documents provide associated Standards and Guidance:

a. JSP 471: Defence Nuclear Accident Response.

b. JSP 482: MOD Explosives Regulations.

c. JSP 886: Volume 5 Part 2: Land Equipment Support.

d. BR1313 Maintenance Management in Surface Ships.

e. MAP-01: Manual of Maintenance and Airworthiness Processes.

f. DEFSTAN 00-40: Reliability & Maintainability.

g. DEFSTAN 00-42: R&M Assurance Activity.

h. DEFSTAN 00-44: R&M Data Collection & Classification.

i. DEFSTAN 00-45: Using RCM to Manage Engineering Failures.

j. DEFSTAN 00-49: Guide to R&M Terminology Used In Requirements.

k. Ministry of Defence PT Reliability & Maintainability Processes.

l. GR-77: Applied R&M Manual for Defence Systems.

OWNERSHIP AND POINTS OF CONTACT

14. Ownership of Logistics policy in support of the Logistics Process falls to the Assistant Chief of Defence Staff Logistics Operations (ACDS Log Ops) as Chief of Defence Materiel (CDM) Process Architect. This role is exercised through the Defence Logistics Working Group (DLWG). R&M policy is sponsored by the DES JSC SCM-EngTLS-Reliability.

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CHAPTER 2: DATA RECORDING, ANALYSIS AND CORRECTIVE ACTION SYSTEM (DRACAS) AND EQUIPMENT FAILURE REPORTING (EFR)

CONTEXT

1. Many approaches to Data Recording, Analysis and Corrective Action System (DRACAS) end with the entry to service, benefit can be delivered by continuing into the in-service phase as the discipline of DRACAS will allow in-service "events" to be collected, analysed, corrected, and tracked within a closed loop. This will allow the product to be improved overtime resulting in lower whole life costs, better understood and reduced safety and operational risks.

2. The system should be easy to use and provide feedback to the user. The information gained by the Project Team (PT) allows the identification and prioritisation of remedial work on the design, operation or maintenance of the equipment.

PROCESS

3. The established MOD Equipment Failure Reporting (EFR) systems to allow users to report faults, failures and serious incidents for incorporation into the DRACAS are:

a. **Maritime Environment:** RN Form S2022: Report of Shortcoming in Material, Design, Support or Documentation. BR1313 Maintenance Management in Surface Ships, Chapter 5: Form S2022 or S2022A.

b. **Land Environment:** AF G8267A / B: Equipment Failure Report (Army). Guidance in JSP 886 Volume 5 Part 2: Land Equipment Support. Chapter 3: Equipment Fault Reporting.

c. **Military Air Environment:** MOD Form 760: Narrative Fault Reporting (Air). Guidance in MAP-01: Manual of Maintenance and Airworthiness Processes. Chapter 7.5: Fault Reporting.

d. **Munitions:** MOD Form 1671: Munitions Accident / Near Miss Report. Guidance in JSP 482 MOD Explosives Regulations. Chapter 25: Munitions Incidents Reporting and Investigation.

e. **Nuclear:** JSP 471: Defence Nuclear Accident Response.

4. These systems should be used in preference to bespoke systems for front-line reporting and feedback, it is the PT's responsibility to ensure that these standard MOD systems feed into the project DRACAS and that appropriate resource is available to action reports in a timely fashion, ensure appropriate feedback to the user.

CHAPTER 3: RELIABILITY AND MAINTAINABILITY SUPPORT MATURITY LEVELS

1. The maturity of the product R&M can be assessed during the life cycle of a project using the 9 Support Maturity Levels (SML) which are defined, along with suggested project milestones, by which time these should be achieved in Volume 7 Part 2 Chapter 2.

ULTIMATE SUCCESS CRITERIA

2. The Ultimate Success Criteria are

a. The Reliability, Maintainability and Testability characteristics of the system, sub-systems, through to LRU are fully understood and these characteristics meet the mission needs efficiently and effectively.

b. The user has confidence that the system will meet the needs, and missions will not be compromised by poor Reliability, Maintainability and Testability characteristics.

c. The Reliability, Maintainability and Testability process enables the right size of support chain to be determined, and risks to Reliability, Maintainability and Testability can be identified and managed.

d. The known Reliability, Maintainability and Testability characteristics mean that the range and scale of spares is optimised.

e. The impact of changes in use pattern or environment are monitored and understood, resulting in an updated understanding of the reliability characteristics of the system and appropriate changes to the support chain.

ASSESSMENT OF PROJECT MATURITY

3. To enable the project to assess maturity against the success criteria, the measure of effectiveness for each SML detailed in Figure 1 is to be agreed with the Contractor and included in the development or support contract.

Figure 1: Reliability and Maintainability Support Maturity Levels SML)

SML	Measure of Effectiveness	Risk if not in place
1	• Initial R&M case in accordance with DEFSTAN 00-42 Part 3, including: a) R&M Risk evaluation b) Draft Evidence Framework c) Initial assumptions about expected deployment and usage pattern of the capability d) Initial failure definition e) Appropriate Reliability Metrics f) Explanation of the need for the Reliability, Maintainability and Testability Metrics • R, M & T Strategy	• Risks not understood from the outset, resulting in inefficient and/or ineffective R&M programme, with Performance, Cost, Time impacts • Evidence requirements not understood resulting in inadequate programme • Risk that the supplier will design a solution which does not meet the usage needs of the customer • Customer and supplier do not have a common understanding of expectation resulting in future conflict • Understanding of the requirement will be lost, resulting in inappropriate trade-offs/refusal to make a sensible trade • Requirements on MOD and contractor not understood, so that inappropriate resourcing (either side), results in inability to deliver the programme

SML	Measure of Effectiveness	Risk if not in place
2	• Updated R&M case in accordance with DEFSTAN 00-42 Part 3 • Comprehensive assessment of the needs for Reliability, Maintainability and Testability trials and demonstrations	• Risk that the project is drifting from programme, resulting in time/cost overruns/poor performance • Funding/time will not be available to deliver the trials, resulting in immature systems entering service, with subsequent impact on the user (mission success) and the support chain
3	• Updated R&M case in accordance with DEFSTAN 00-42 Part 3 • An initial understanding of likely failure modes for each design option • Outline whole life costs for each support option	• Risk that the focus is on the technology performance rather than ensuring that the deliver system will work
4	• Updated R&M case in accordance with DEFSTAN 00-42 Part 3 including clear evidence that reliability has been considered to the same depth as the design is being assessed and that the Reliability, Maintainability and Testability assumptions are aligned to other design and support assumptions • Key failure modes are understood for the design solution • An increased confidence in the understanding of the whole life costs for each support option	• Risk that misalignment between assumptions will result in over confidence about the capability of the system, or inappropriate support decisions being made
5	• Updated R&M case in accordance with DEFSTAN 00-42 Part 3 including clear evidence that the support solution particularly the maintenance schedule has been developed with a full understanding of the Reliability, Maintainability and Testability characteristics of the system • Baseline Reliability, Maintainability and Testability predictions have been quantified including resource and effort requirements	• Risk that the maintenance schedule will not address the actual failure modes of the system
6	• Updated R&M case in accordance with DEFSTAN 00-42 Part 3 - with clear evidence that the range and scale of spares is based on the Reliability, Maintainability and Testability characteristics and subsequent maintenance schedule • Maintainability can be demonstrated • Sufficient test facilities are available	• Risk inappropriate Range/scale of spares will be available, resulting in inability to meet demands and/or excessive stock being purchased
7	• Updated R&M case in accordance with DEFSTAN 00-42 Part 3 including clear evidence that the final design meets the Reliability, Maintainability and Testability requirements • Operational data is being gathered • Evidence that In-service usage, failures, repairs, spares usage and servicing/preventative maintenance effort is being appropriately monitored and recorded. • Evidence (via regular monitoring) that the In-Service R,M&T is as required • Evidence that based on the In-Service R,M&T achievement the Support Solution is being appropriately maintained to retain the Capability.	• Risk that immature systems will be delivered to the user, resulting in impact on the user (Mission success), and overloading the support solution

SML	Measure of Effectiveness	Risk if not in place
8	• Updated R&M case in accordance with DEFSTAN 00-42 Part 3 - including clear evidence of an effective data recording and corrective action system, DRACAS, which captures reliability issues and deals with them • Operational data is being gathered • Evidence that In-service usage, failures, repairs, spares usage and servicing/preventative maintenance effort is being appropriately monitored and recorded. • Evidence (via regular monitoring) that the In-Service R,M&T is as required • Evidence that based on the In-Service R,M&T achievement the Support Solution is being appropriately maintained to retain the Capability.	• Risk that the impact of changing usage pattern is not understood, resulting in poorer performance and/or increased cost • Risk that in-service Reliability will not be adequately managed, resulting in increasing issues impacting on Performance, Cost, Time. • Risk that the Support Solution is not being updated to compliment changing Reliability achievement, and/or changing usage patterns.
9	• Updated R&M case in accordance with DEFSTAN 00-42 Part 3 - identifying the final Reliability, Maintainability and Testability characteristics of the system	• We will fail to learn from previous system, resulting in poor reliability characteristics of future systems