

## **CHAPTER 10**

### **R&M GUIDANCE FOR THE ACQUISITION OF OFF THE SHELF (OTS) EQUIPMENT AND SYSTEMS BASED ON OTS COMPONENTS**

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## **1 INTRODUCTION**

**1.1** The approach for using Off The Shelf (OTS) technology in MoD procurement in terms of Reliability and Maintainability (R&M) does not differ from traditional MoD equipment procurement where the system or equipment is designed and developed to meet the specific need. The procurement/acquisition process should employ the three basis objectives outlined in Def Stan 00-40. These are:

- a) the Purchaser's R&M requirements shall be determined and demonstrated to be understood by the Purchaser and Supplier;
- b) a programme of activities shall be planned and implemented to satisfy the requirements;
- c) the purchaser shall be provided with assurance that the R&M requirements have been satisfied.

**1.2** The aim of this document is to emphasise guidance on the R&M activities with respect to the use of OTS technology in MoD. These guidelines provide an approach to OTS procurement in terms of R&M which satisfies the requirements of Defence Standard 00-40 Part 1, but embraces the objectives of OTS acquisition, chiefly lower acquisition costs and timescales.

**1.3** OTS refers to systems/components that require little or no further development. Where relevant, distinction is made between Commercial Off The Shelf (COTS) and Military Off The Shelf (MOTS) products. It is important to note that this guidance also applies to development system(s) that include OTS components in the design.

## **2 ISSUES WITH USING OTS TECHNOLOGY**

### **2.1 General**

**2.1.1** The following issues should be considered for OTS solutions or for systems based on OTS components as it is considered that they represent typical risks for MOTS/COTS procurement.

### **2.2 Predefined Specification**

**2.2.1** COTS products will be manufactured to meet specific commercial standards, which may not align with military standards e.g. military environmental requirements. Similarly MOTS products may have been developed to meet specific military requirements that differ from that required.

**2.2.2** A predetermined specification may result in requirement trade-off's being required throughout the acquisition process, with the military specific requirements being major cost and risk drivers. Trades offs should only result in modification to the OTS product if critical to the performance of the system or demonstrated to be cost effective (making allowance for the risks associated with modification of a developed product).

## **2.3 Obsolescence**

**2.3.1** COTS products can have a short commercial life resulting in rapid obsolescence as the commercial market drives technology advances. MOTS products may have already been in service for many years and therefore close to obsolescence.

**2.3.2** Obsolescence results in a need for a change management process which allows for obsolescence and if required enhancements in technology.

## **2.4 Limited Influence Over Contractor**

A military procurement including a limited batch of COTS equipment may represent an insignificant proportion of product sales; therefore the MoD will have little influence in getting changes incorporated or bugs fixed.

## **2.5 Integration**

**2.5.1** Interfacing components may require modification, as the OTS interface equipments will be manufactured to a specific requirement. For example, this might require EMC/EMI shielding of a COTS power supply as COTS electronic equipment frequently uses less stringent (and less costly) circuit conditioning.

**2.5.2** Integration results in the need to obtain sufficient design information to allow integration of the OTS solution into the overall design, without a reduction in R&M.

# **3 ACQUISITION PROCESS**

## **3.1 Concept Stage**

The URD should be developed in exactly the same way as for any other type of procurement as the URD is function based and should not mandate specific systems. Therefore both development and OTS systems may be potential procurement solutions at this stage.

## **3.2 Establishing R&M Requirements**

**3.2.1** R&M Requirements are developed within the SRD and should include mandatory requirements whether or not the system includes OTS products. The SRD should include requirements for a system that can cope with obsolescence and (if required) be upgraded to allow for changes to functionality or performance.

A number of activities are required in order to define R&M requirements, these may include:

- a) Analysis of the Operating and Environmental Conditions in order to define the full range of environmental conditions and the definition of a realistic duty cycle (GR-77, Part C [Reference 2]);
- b) R&M assessment (mathematical or simulation modelling) providing a representation of the likely R&M characteristics of the system in service taking account of factors such as configuration, operating modes and duty cycle in order to provide a quantitative indication of the system R&M and identify system R&M risks.

**3.2.2** One of the difficulties with OTS solutions is they may not meet all the requirements defined within the SRD. Different OTS solutions have different features and capabilities, and therefore different trade-offs to determine what can realistically be achieved for each solution. The trade-off studies should aim to optimise a system with respect to technical and economic factors, with R&M being equally important to time, cost and performance.

**3.2.3** An initial R&M Case should be produced at this stage, which documents the R&M requirements and their measurement base and should include the anticipated usage and environment. References to other documents or evidence and any assumptions made should be included. The purchaser should also identify R&M risks to be included in the overall project risk register.

### **3.3 R&M Planning & Assurance**

**3.3.1** A risk based R&M Programme Plans and R&M Case are still required both for the purchaser and supplier, however, if the programme is much shorter than a traditional procurement these documents are expected to be a lot smaller.

**3.3.2** The R&M Programme Plan is a means by which the purchaser and supplier can specify and manage the R&M programme which meets the R&M objectives defined in Defence Standard 00-40 Part 1 [Reference 1]. The third objective within Defence Standard 00-40, Part 1 states “The purchaser shall be provided with progressive assurance that the R&M requirements are being, or will be, satisfied”; this should be through the provision of an R&M Case in accordance with Defence Standard 00-42 Part 3, R&M Assurance Guidance, R&M Case.

### **3.4 Contracting For R&M**

**3.4.1** An Invitation To Tender (ITT) should define the mandatory performance, environmental and operational characteristics, which the supplier shall demonstrate to be understood. If the supplier responds with commercial standards and practices, these standards need to be compared with the requirements within the SRD to ensure they are compliant. Where differences are identified, a process of requirements trade-off should be entered and either, purchaser expectations will be modified within the SRD or if the deficit is identified as being critical to the performance of the system then the need for a change in the OTS product design should be identified.

**3.4.2** However, a modification to an OTS product leads to a common risk with OTS procurements due to an unrealistic perception of the purchaser. The ‘perception’ of the purchaser is that they are buying a COTS product while, in reality, modifications are being required of the product. Even apparently minor modifications can have a dramatic impact on the reliability and therefore purchasers must be aware of this risk and must ensure mitigation measures (such as development testing) are put in place where modification occurs. This risk becomes even more significant where COTS products are modified by a third party (such as a “system integrator”) who may not have full product knowledge.

**3.4.3** Access to the suppliers R&M design and development data should be specified within the ITT. This data could include details of any significant R&M activities undertaken during the design and development of the OTS product e.g. design reviews, FMECA, FTA, Data Reporting, Analysis and Corrective Action System (DRACAS), test results or field data. This data will provide assurance that the R&M requirements will be satisfied. If the OTS supplier

has a DRACAS, the purchaser should plan to feed into the suppliers DRACAS (see Def Stan 00-40 Part 1).

**3.4.4** If insufficient data is available to provide assurance that the R&M requirements will be met, further assurance is required to verify the reliability, maintainability and availability characteristics of the OTS system through tailored applications of standard R&M techniques but for OTS equipment, specifically:

- a) R&M Modelling to examine the R&M relationships of the system elements. This will provide a quantitative indication of their contribution to the system R&M. These models should be further refinements of the earlier phase models to incorporate more detailed design information.
- b) A Production Reliability Acceptance Test (PRAT) providing the purchaser with assurance that the reliability of production standard items meets or exceeds the specified requirements.
- c) Similar to PRAT, Maintainability should also be tested; however a single test may be sufficient to confirm the maintainability of the system.
- d) Reliability Demonstration (RQT or In-Service R&M) providing the purchaser with assurance that the R&M characteristics of the in-service system meets or exceeds the specified requirements (PtCCh39-41).

**3.4.5** The impact of software on R&M should be considered throughout the procurement process, evidence of a robust software design and development process is required and rigid control and monitoring procedures have been implemented. This is a common R&M risk area in COTS products, where specific code is required for military applications and hence the product is no longer COTS.

**3.4.6** Access to the design information for interfacing components should be specified within the ITT, to allow for successful integration without a reduction in R&M.

**3.4.7** R&M Critical Items should be identified and their effect established. Action should be taken to either remove or reduce the effect of R&M critical items, which may result in the need for a change in the OTS product design.

**3.4.8** Derating should be used where appropriate in order to limit the stresses which may be applied to a component/system, to levels below their specified maximum, in order to improve reliability (PtCCh7).

**3.4.9** The human impact on R&M should be assessed in terms of whether the system is to be used for a different purpose and/or by users and maintainers with different skill levels to what it was designed for (see Def Stan 00-250, Part 1 to 4 inclusive [Reference 3]).

**3.4.10** Ensure the OTS supplier provides evidence that their solution can deal with obsolescence and the final contract incorporates an upgrade programme including additional testing and verification to provide assurance that the R&M requirement is met. This should include the identification of Life Limited Items with the expected life determined. A replacement plan should be developed, which optimises the replacement intervals in terms of

support costs and system availability e.g. if replacement periods align with planned maintenance periods.

### **3.5 Delivery of Capability**

**3.5.1** The monitoring/control of the OTS supplier is essential especially if the military requirement represents a significant proportion of product sales. The purchaser should ensure the supplier is capable of producing the desired levels of R&M and the required R&M evidence is provided to support the development of the R&M Case including the investigation of the OTS suppliers data to confirm that they meet the R&M requirements defined in the SRD and they are relevant for the defined environment and operational conditions. Ensure the manufacturer demonstrates the ability to undertake repairs and provide spares over the proposed lifetime of the system.

**3.5.2** The purchaser should ensure that any verification, test & evaluation activities are conducted for any upgraded/modified systems within the OTS system.

## **LEAFLET A10/0**

### **REFERENCES**

- 1 Reliability and Maintainability (R&M) Part 1 Management Responsibilities and Requirements For Programmes and Plans, Defence Standard 00-40, Part 1.
- 2 Applied R&M Manual for Defence Systems (GR-77).
- 3 Human Factors For Designing Of Systems: Principles and Process, Defence Standard 00-250, Parts 1 to 4.

