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Defence Standard

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RELIABILITY AND MAINTAINABILITY

PART 8: PROCUREMENT OF
OFF - THE - SHELF
EQUIPMENT
(ARMP - 8)

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Reliability and Maintainability

Part 1 - Management Responsibilities and Requirements for Programmes and Plans

Part 2 - General Application Guidance on the use of Part 1 (ARMP-1)

Part 3 - Application of National R&M Requirements Documents

Part 4 - Guidance for Writing NATO R&M Requirement Documents

Part 5 - Guidance on R&M Training

Part 6 - In-Service R&M

Part 8 - Procurement of Off-The-Shelf Equipment

RELIABILITY AND MAINTAINABILITY

PART 8: PROCUREMENT OF OFF-THE-SHELF EQUIPMENT (ARMP-8)

PREFACE

i This Part of the Standard provides guidance on the measures to be taken for achieving acceptable levels of R&M in the procurement of Off-the-Shelf (OTS) equipment.

ii This Part of the Defence Standard was prepared by the Committee for Defence Equipment Reliability and Maintainability (CODERM).

iii This Standard has been agreed by the authorities concerned with its use and shall be incorporated whenever relevant in all future designs, contracts, orders etc and whenever practicable by amendment to those already in existence. If any difficulty arises which prevents application of the Defence Standard, the Directorate of Standardization shall be informed so that a remedy may be sought.

iv Any enquiries regarding this Standard in relation to an invitation to tender or a contract in which it is incorporated are to be addressed to the responsible technical or supervising authority named in the invitation to tender or contract.

v This Standard has been devised for the use of the Crown and its contractors in the execution of contracts for the Crown. The Crown hereby excludes all liability (other than liability for death or personal injury) whatsoever and howsoever arising (including, but without limitation, negligence on the part of the Crown its servants or agents) for any loss or damage however caused where the Standard is used for any other purpose.

vi It is Ministry of Defence policy for reliability and maintainability to be given equal priority with the parameters of performance, cost and timescale.

vii This Part of the Defence Standard includes Allied Reliability and Maintainability Publication (ARMP)-8, Edition 1, October 1991: Reliability and Maintainability in the Procurement of Off-The-Shelf Equipment.

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RELIABILITY AND MAINTAINABILITY

PART 8: PROCUREMENT OF OFF-THE-SHELF EQUIPMENT (ARMP-8)

0 Introduction

0.1 The UK has ratified the Allied Reliability and Maintainability Publication (ARMP)-8 through the NATO Standardization Agreement (STANAG) 4174.

0.2 STANAG 4174 is endorsed by the Committee for Defence Equipment Reliability and Maintainability (CODERM).

0.3 This Part of the Defence Standard implements the ARMP-8.

0.4 In continuance with Defence Standard 00-40 (Part 1), ARMP-8 is published as appendix A to this Part of the Standard.

1 Scope

This Part of the Standard applies to all materiel, within the defined parameters of "off-the-shelf", procured for use by MOD and NATO. It complements Defence Standard 00-40 (Part 1) (ARMP-1) and Defence Standard 00-40 (Part 2) (ARMP-2).

2 Related Documents

2.1 The following documents and publications are referred to in this Part of the Standard:

ARMP-8	Reliability and Maintainability in the Procurement of Off-the-Shelf Equipment (appendix A)
Def Stan00-40	(Part 1) (ARMP-1) Management Responsibilities and Requirements for Programmes and Plans
Def Stan 00-40	(Part 2) (ARMP-2) General Application Guidance on the Use of Part 1 (ARMP-1)

NOTE: NATO ARMPs 1 through 6 are implemented in the UK by Defence Standard 00-40 (Part 1) through (Part 6) respectively.

2.2 Reference in this Part of the Standard to any related document means in any invitation to tender or contract the edition and all amendments current at the date of such tender or contract unless a specific edition is indicated.

2.3 The documents listed may be obtained from the sources shown below:

DOCUMENT	SOURCE
Allied Reliability and Maintainability Publication (ARMP)	Directorate of Standardization Stan 2 Kentigern House 65 Brown Street GLASGOW G2 8EX
Defence Standard (Def Stan)	Directorate of Standardization Stan 1 (and as above)
NATO Phased Armaments Programming System (PAPS) - NATO Allied Administrative Publication (AAP/20)	Directorate of Standardization Stan 2 (and as above)
NATO Standardization Agreement (STANAG)	Directorate of Standardization Stan 2 (and as above)

3 Definitions

For the purposes of this Standard, the terms and definitions shown in annex A of appendix A of Defence Standard 00-40 (Part 1) (ARMP-1) shall apply.

4 Application

This Part of the Standard shall be used as guidance to the achievement of R&M requirements in the procurement of off-the-shelf materiel.

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ARMP-8
(Edition 1)

RELIABILITY & MAINTAINABILITY (R&M) IN THE PROCUREMENT OF
OFF-THE-SHELF (OTS) EQUIPMENT

ARMP-8

OCTOBER 1991

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NORTH ATLANTIC TREATY ORGANIZATION

MILITARY AGENCY FOR STANDARDIZATION (MAS)

NATO LETTER OF PROMULGATION

October 1991

1. ARMP-8 "Reliability & Maintainability (R&M) in the Procurement of Off-The-Shelf (OTS) Equipment" is a NATO UNCLASSIFIED publication. The agreement of interested nations to use this publication is recorded in STANAG 4174.

2. ARMP-8 is effective on receipt.

3. It is permissible to distribute copies of this publication to contractors and suppliers and such distribution is encouraged.

E STAI
Major General, NOAF
Chairman MAS

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RECORD OF CHANGES

Change Date	Date Entered	Effective Date	By Whom Entered

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CHAPTER ONE

INTRODUCTION

101 GENERAL

It is the aim of this ARMP to provide guidance concerning R&M with respect to Off-The-Shelf (OTS) equipments. It should be stressed, at this point, that project managers should exercise their judgement in many other fields of expertise, R&M being one consideration requiring special attention in the case of OTS procurement.

The strategy of using OTS procurement to satisfy user requirements has received emphasis within the NATO community. It is anticipated that this strategy will continue to see increased use. The approach for OTS procurement differs significantly from the traditional military procurement approach which is time consuming and involves the development of a system or equipment which is meant to meet a specific need. On the other hand, the procurement of a system or equipment through the OTS process is much quicker and could reduce or eliminate research and development costs. Information may be readily available with OTS procurement, such as failure rates, failure modes, test results and maintenance manuals. Furthermore, any safety hazards are more likely to have been identified and eliminated. One of the disadvantages of OTS procurement, however, is that it might not fully meet all of the operational requirements which were initially established.

The OTS procurement strategy poses special challenges. Project managers should determine the most effective ways and means of assuring that the OTS contractor delivers the levels of R&M which prior market investigations and surveys indicated were available, and at the same time, reduce testing and inspection to a minimum. Each OTS equipment will require R&M approaches tailored to each case with a great deal of engineering judgement and trade-offs involved.

102 SCOPE

This document outlines the measures to be taken for achieving an acceptable level of R&M in the purchase of OTS equipment during all procurement stages, including the market investigation. It details the specific requirements that should be adopted by both the purchaser and contractor.

Figure 1 shows the traditional NATO Phased Armaments Programming System (PAPS) phases and at what stages an OTS procurement may be initiated and conducted. The OTS process is shown in more detail in figure 2. It must be stressed that considerable flexibility should be given to OTS consideration in the interest of the overall programme cost and efficiency.

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SEQUENCE OF EVENTS IN THE
PROCUREMENT PROCESS

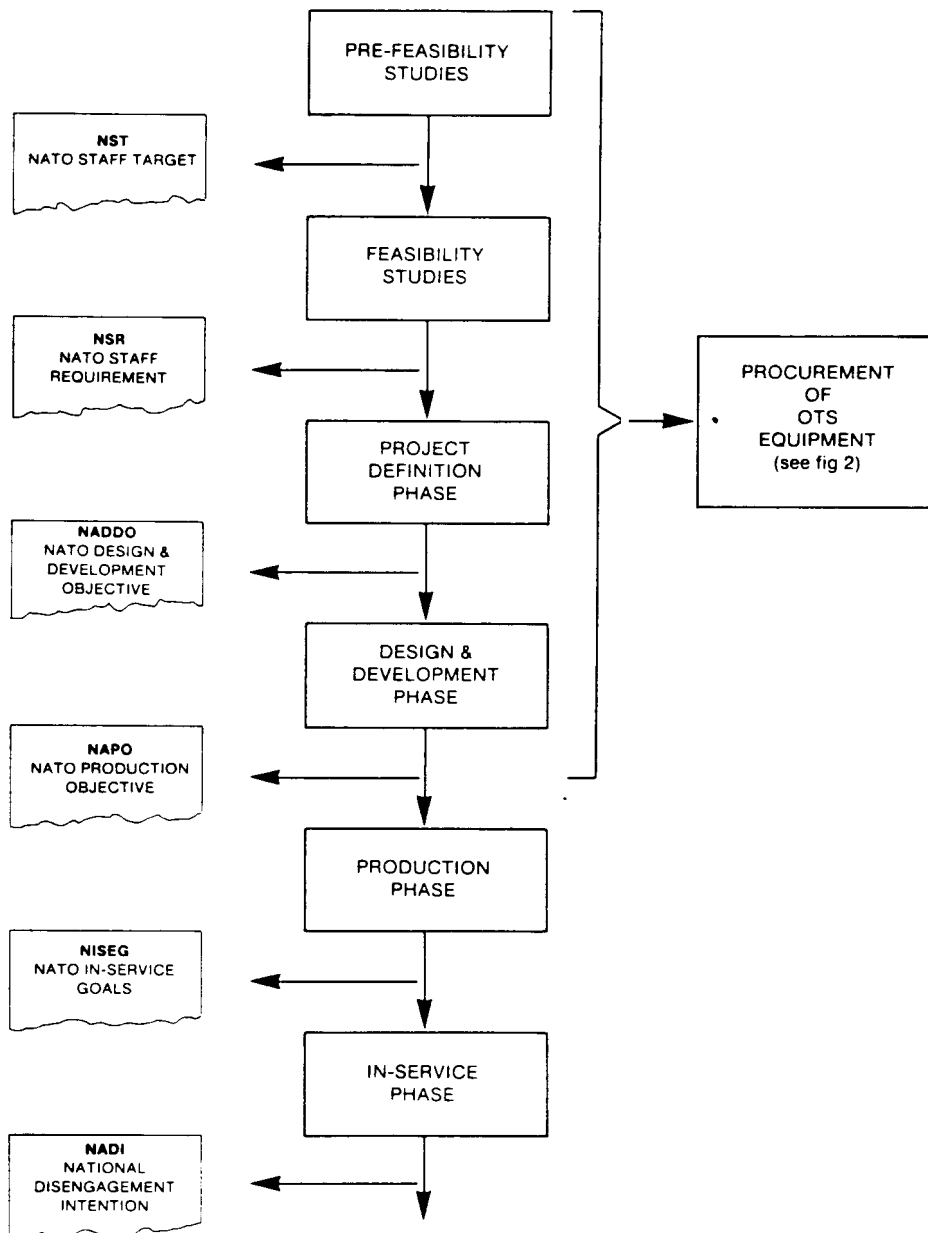


FIGURE 1

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PROCUREMENT OF OTS EQUIPMENT

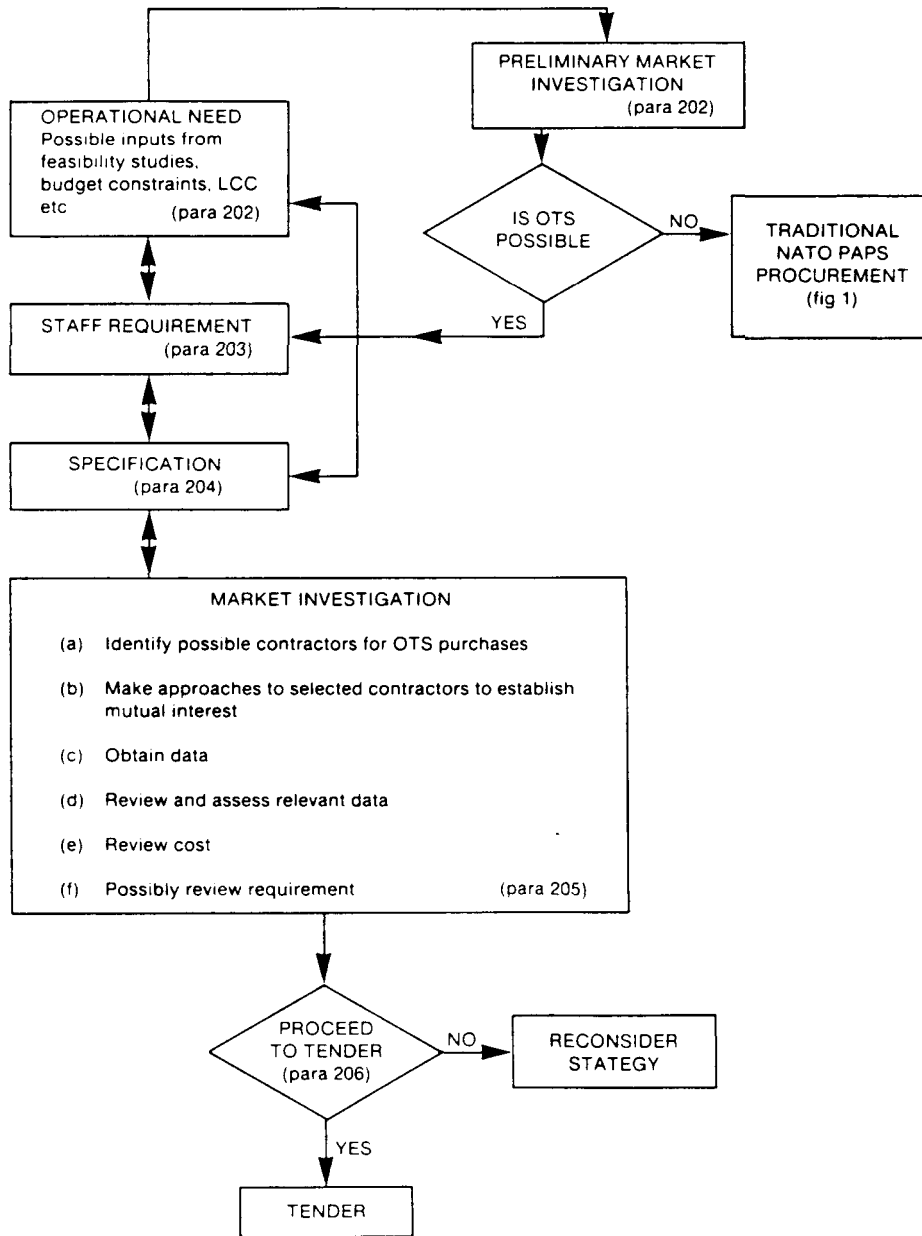


FIGURE 2

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Figure 2 describes the sequence of events in the OTS procurement process and how the preliminary market investigation may be initiated prior to the final definition of operational need or at any time thereafter. This process may further influence the operational need, the Staff Requirement, the specification or any combination of all three. The document delineates those R&M activities which should be considered for implementation during the procurement stages of OTS equipment. Stages include the formulation of the initial requirement, writing the specification, market investigation, and decision for contract award.

103 APPLICABILITY

ARMP-8 applies to all R&M activities which are directed towards the possible or actual purchase of equipment or materiel of an existing design. It applies to procurement of all OTS equipment irrespective of whether such equipment is purchased on a separate contract or as part of a larger contract.

104 TERMINOLOGY

A glossary of terms is contained in Annex A to ARMP-1.

105 RELATED DOCUMENTS

STANAG 4108	IMPLEMENTATION OF AQAPS
STANAG 4165	ALLIED MATERIEL STANDARDS PUBLICATIONS
STANAG 4174	ALLIED RELIABILITY AND MAINTAINABILITY PUBLICATIONS (ARMP'S)
ARMP-1	NATO REQUIREMENTS FOR RELIABILITY AND MAINTAINABILITY
ARMP-2	GENERAL APPLICATION GUIDANCE ON THE USE OF ARMP-1
ARMP-3	APPLICATION OF NATIONAL R&M DOCUMENTS
ARMP-4	GUIDANCE FOR WRITING NATO R&M REQUIREMENTS DOCUMENTS
ARMP-6	IN-SERVICE RELIABILITY AND MAINTAINABILITY
OTHER ARMP'S AS PUBLISHED	

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CHAPTER TWO

R&M PROCUREMENT PROCESS OF OTS EQUIPMENT

201 GENERAL

OTS refers to products that require little or no further development effort. It applies to materiel developed and used by other military services, other Government agencies or materiel which is in civil use. It also applies to materiel developed and in use by other countries.

This document also provides guidance in those cases where project managers consider development systems that include OTS sub-systems or equipments. Figure 2 depicts the flow of the strategy of OTS procurement for all cases.

The spectrum of OTS equipments ranges from commercial products procured off-the-shelf to be used in the same environment for which the items were designed (therefore requiring little if any research and development (R&D), or prior testing) through commercial, foreign or other service items, procured off-the-shelf, to be used in a military environment substantially different and more stressful than that for which the items were originally designed. An example of the former might be the purchase of a commercial personal computer using commercial software packages which would be operated in fixed installations or climatically controlled shelters or vans. An example of the latter might be the purchase of a personal computer with addition of electromagnetic interference (EMI) shielding techniques, circuit board stiffeners and a camouflage case. In some cases using OTS equipments may require a great deal of engineering effort to accomplish hardware and software systems integration. A typical example of such an integration effort might be the assembly of a communications shelter from a combination of OTS receivers, transmitters, antennae and other components.

OTS programmes present distinct advantages and certain challenges.

(a) Potential major benefits include:

- (i) The acquisition process may be shortened. Response to user needs may be faster.
- (ii) R&D costs and risks can be reduced or eliminated.
- (iii) There may be increased opportunity to use state-of-the-art technology to satisfy the needs of the user.

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(b) Among the challenges are the following:

- (i) Trade-offs may be required. User expectations may have to be modified to accommodate any advantages or limitations in the available designs.
- (ii) Essential integrated logistic support (ILS) activities may have to be accelerated and new logistic strategies may have to be devised.
- (iii) The amount of testing required should be limited based upon the evaluation of the available data, whether generated to commercial or military standards.

The R&M procurement strategy will differ for items falling in different portions of the OTS equipment spectrum. The essential difference between OTS purchase and conventional military procurement is that the purchaser does not have the benefit of participation in a conventional military development programme. The R&M strategy to be employed for any given OTS acquisition could be a compendium of various strategies depending upon where the OTS equipment falls in the spectrum. All of this involves judgements. It must be emphasized that there is no universal set of requirements that are applicable to OTS procurement.

202 OTS PROCUREMENT PROCESS START

At the start of the procurement process, the initial requirement or Staff Requirement will flow from an operational need and might reflect any earlier feasibility studies. A preliminary market investigation is made so that requirements can be analysed against available information or potentially applicable products. Should this preliminary analysis prove positive, a full scale market investigation is required and review made of the Staff Requirement to detail all essential and critical requirements including a clear description of environmental and operational conditions.

203 STAFF REQUIREMENT

A requirement must be generated with all pertinent R&M considerations as discussed in ARMP-4. Before a Staff Requirement is drafted there should be an exchange of views on the proposed requirements between the operational requirement staff, project manager, procurement agency specialists and R&M specialists. One of the objects of this exchange is to determine essential R&M requirements including mission duration, environmental and operational conditions. Such requirements will need to be agreed and a baseline specification developed in exactly the same way as it would be for any other type of procurement.

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The R&M requirements for successful purchase of OTS equipment should meet operational needs, be carefully tailored to the nature of the equipment or materiel being purchased and should also include considerations of life cycle costs (LCC) and logistics supportability. As is pointed out in ARMP-4, R&M requirements are essential at this stage. This is as true for OTS purchases as it is for all other types.

204 R&M ASPECTS OF THE SPECIFICATION

A number of important factors govern the R&M aspects of the specification as indicated below:

(a) Precise Statement

A specification must provide a precise statement of the R&M requirements. Such a statement provides a realistic specification against which potential suppliers may be asked to tender and defines the mandatory performance, environmental and mission characteristics, as laid down in the Staff Requirement. It must include a quantitative R&M requirement, maintenance data and requirements for configuration management. The purchaser should specify his requirement utilizing ARMP-4 and relevant NATO Standards. If the potential contractors respond with commercial Standards and practices then these Standards should be analysed to ensure that they are appropriate and relevant.

(b) Manufacturer's Data

By definition, the design authority, for OTS equipment, lies with the proprietary owner of the design. Most competent manufacturers will have comprehensive performance, rating, and maintenance data in their possession. Access to relevant data should be specified.

(c) Verification, Test and Evaluation of R&M

Within the specification there should be an outline of the required R&M verification procedures to be applied to the manufacture of the equipment which have direct effect on the R&M of the product. In particular, para 317, 319, 320, 321, 322 and 323 of ARMP-1 "NATO Requirements for Reliability and Maintainability" should be addressed. These paragraphs include discussion of environmental stress screening (ESS), R&M qualification tests, production reliability acceptance tests (PRAT), subcontractors, corrective actions and software R&M.

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No acquisition, including equipment or materiel obtained by OTS purchase, should be exempt from minimal essential test and evaluation to verify quality, including reliability, maintainability, safety, performance and availability characteristics; the only exceptions will be when previous test and performance data or market investigation provides sufficient evidence that these requirements are met. The combination of OTS equipments and other components with tested and evaluated equipment or materiel may well require additional testing and verification due to potential interface problems. Items requiring modification due to changes in environment or changes in function will also require additional testing and verification.

(d) Quality System

An appropriate quality system should be chosen from relevant Defence Standards, AQAPs or acceptable commercial Standards. Emphasis should be given to configuration control.

205 MARKET INVESTIGATION

The purpose of the market investigation is to collect and evaluate sufficient data to:

- (i) Finalize the Staff Requirement and specification.
- (ii) Develop an appropriate acquisition strategy to satisfy requirements.
- (iii) Support a definitive OTS procurement decision.

Data on R&M must be collected and evaluated in parallel with data on performance, cost and timescale; so that R&M will be given sufficient weighting in the procurement decision.

The market investigation may include submission of candidate equipment from various potential contractors for qualification testing and data gathering to determine suitability. The typical sequence of the market investigation phase with a description of activities is as below:

(a) Identify Possible Contractors for OTS Purchases

In contrast to routine suppliers of military equipment; potential suppliers of OTS equipment may well be unknown and have widely differing capabilities. They are more likely to be located abroad. Assistance in identifying potential contractors can be obtained from such sources as libraries, industry publications, journals, trade shows, Departments of Trade, other Ministries of Defence, Consulates or through advertising. The output should focus on identifying firms that deal with commodities similar to the one of interest, have known capabilities in the general area and have the motivation to become involved in the supply of such equipment.

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(b) Make Approaches to Selected Contractors to Establish Mutual Interest

Project managers may need to evaluate a large number of potential sources making numerous enquiries. Potential contractors should be asked to provide R&M information on the equipments sought and evidence on past R&M activities which have been applied. They can also be asked to provide R&M plans covering possible future production.

If the potential supplier expresses interest in the provision of OTS equipment, further and more detailed information should be sought. Details of significant R&M activities that have been undertaken during product design, development and production, including any existing plans for R&M improvement, should be requested, together with data relating to all aspects of procurement such as cost, quality, etc. A check list comparing the activities with ARMP-1 R&M TASKS could be utilized.

(c) Obtain Data

When it is clear that mutual interest exists and that potential products are available, various means such as a draft tender, or questionnaire may be used to obtain additional R&M data as described below:

1. Previous R&M Work

The potential supplier should be requested to provide any details of previous R&M work such as, R&M prediction, growth, demonstration, failure modes effects and criticality analysis (FMECA), failure modes and effects analysis (FMEA), derating, quality assurance policies and procedures commercially in use and any other activities such as those listed in ARMP-1. The potential supplier should also be requested to specify the failure definitions and the configuration of the equipment or equipments used in R&M programmes and any relevant field histories. Details of any significant R&M activities undertaken during previous product design and development work should also be requested.

2. R&M Qualitative and Quantitative Data

The potential supplier should be requested to provide details of relevant qualitative and quantitative information on such activities as warranty experience and field or end user data for OTS items considered.

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3. Critical and Life Limited Items

The potential supplier should be requested to declare any reliability critical items and any life limitations of components contained within the equipment. He should also be requested to declare any limitations with regard to changing technology which may cause obsolescence of components, maintenance procedures or test equipments.

4. Logistics and Maintenance

The potential supplier should be requested to declare the logistics and maintenance concepts under which the equipment has been designed. These should include such features as built-in test equipment (BITE), line replaceable units (LRUs), servicing support requirements, scheduled servicing, warranty coverage, support documentation and training requirements, software support, maintenance contracts and configuration management. In conjunction with the general ILS effort, the purchaser should ensure that all required maintenance items and documentation can be delivered. Reference can be made to ARMP-1, and in particular paras 202(b), 205, 306(b), 308 and 310 should be addressed. While the above represents a comprehensive list of the elements required for the R&M assessment, it is essential that all should be sensibly tailored to the requirement.

5. Software

OTS software, whether it is embedded in a system or purchased as a stand-alone package, poses difficulties in terms of suitability. As much information as possible should be gathered in order to assess the impact of software on reliability, quality and functionality. The following information, some of which could also apply to hardware, should be collected and evaluated:

- (i) Standards used in development.
- (ii) How long the software has been available.
- (iii) The size of the user base.
- (iv) How often new versions have been introduced.

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- (v) Whether large companies or Standards groups have adopted that software.
- (vi) Users of the software should be interviewed to determine their opinions as well as any problems they have encountered.
- (vii) New versions could be examined to determine if they were introduced to add new features or correct defects.
- (viii) Experience with faults that resulted in system shutdown or "crashes" should be of prime importance.
- (ix) Source language and design tools used.
- (x) Software maintenance information (rationale, methodology).

For further guidance refer to the relevant AQAPs.

6. Comparison with Purchaser's R&M Requirement

The potential supplier should be requested to provide a comparison with the purchaser's R&M requirement. He should also be requested to state if the equipment offered differs from any which has been previously evaluated and to state the effect that this may have on R&M. Also, he should state if the production quantity required could impact on R&M.

(d) Review and Assess Relevant R&M Data

The R&M data collected under 205(c), 1 thro' 6, should be reviewed and assessed for relevancy and sufficiency. All this information is used for comparison with the purchaser's specification and operational requirements, and may be used to provide a basis for life cycle costing and logistic support planning.

(e) Review Cost

In the light of all the data now available for the project as a whole, it is appropriate to review the costs.

(f) Review of Requirements

If the market investigation at this stage indicates that there is no cost-effective, suitable OTS equipment, it may be advisable to review the requirement. A trade-off between characteristics of available equipment, life cycle costs and minimum user needs may still make an OTS purchase possible.

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206 DECISION TO PROCEED TO TENDER

The review of data from the market investigation should:

- (i) Provide evidence on the extent to which potential contractors can meet the R&M requirements.
- (ii) Determine whether the requirement or specification should be altered.
- (iii) Enable the most suitable option or options, from the R&M point of view, to be selected. However, there are many other factors which the project manager should consider such as performance, LCC, timescale, safety, logistics, warranties, maintenance and manuals.

If the final assessment of all the factors is satisfactory the decision to proceed to tender can be made.

207 FINAL PROGRAMME CONSIDERATIONS

With a decision to proceed with an OTS purchase, and with the approval of the planning documents, the programme will proceed to a production phase or to a limited modification phase, perhaps under contract if the manufacturer needs to incorporate any modifications.

If the item is ready to enter into the production phase the purchaser may proceed directly to the tender and production contract. When the production decision is made, a tender package is assembled which may contain specific functional requirements, requirements for warranties and a test programme including production qualification testing and quality conformance requirements. OTS items which can be used without further development should require only minimal testing necessary to verify achievement of R&M requirements and other parameters in production. Acceptable warranty conditions may remove the need for additional testing, though this may entail additional support and maintenance burdens. The tender can require the potential contractors to submit information and data on a range of subjects including for instance: commercial warranties: testing performed, including test procedures and test results: R&M experience: commercial specification. This information can be used to assist in making the selection between competing contractors.

If the programme enters a limited modification phase, certain actions take place. A contract may be awarded for the necessary modifications of hardware and software components and essential testing and evaluation is performed to supplement available data. OTS items which require limited modification before use will require additional testing to validate and

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verify the effectiveness of such modifications and their effects on R&M. A precursor to such a contract is the tender offer to potential suppliers in which bidders' views, R&M data, ideas, and all of the information sought in the market investigation are more formally solicited and submitted. Responses will then be evaluated. Through negotiations with the potential suppliers and coordination with those responsible for the Staff Requirement, an updated system specification and R&M programme may be established. An important product of this modification phase should be finalization of the specification to be used in the subsequent tender for production.

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The following Defence Standard file reference relates to the work on this Part of the Standard 350/02/11.

Contract Requirements

When Defence Standards are incorporated into contracts users are responsible for their correct application and for complying with contract requirements.

Revision of Defence Standards

Defence Standards are revised when necessary by the issue either of amendments or of revised editions. It is important that users of Defence Standards should ascertain that they are in possession of the latest amendments or editions. Information on all Defence Standards is contained in Def Stan 00-00 (Part 3) Section 4, Index of Standards for Defence Procurement - Defence Standards Index published annually and supplemented periodically by Standards in Defence News. Any person who, when making use of a Defence Standard encounters an inaccuracy or ambiguity is requested to notify the Directorate of Standardization without delay in order that the matter may be investigated and appropriate action taken.