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**Ministry of Defence**

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**RELIABILITY AND MAINTAINABILITY  
ASSURANCE ACTIVITY**

**PART 1: IN-SERVICE RELIABILITY  
DEMONSTRATIONS**

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RELIABILITY AND MAINTAINABILITY

ASSURANCE ACTIVITY

PART 1: IN-SERVICE RELIABILITY DEMONSTRATIONS

PREFACE

**i** Defence Standard 00-43, Parts 1 and 2 describe two types of demonstration:

- (a) in-Service reliability demonstrations (ISRDs);
- (b) maintainability demonstrations (MDs).

**ii** ISRDs are covered in Part 1 and MDs in Part 2. Part 1 covers the purpose, rationale and procedures for ISRDs. Part 2 covers maintainability demonstrations, some of which may occur before the equipment is accepted into Service.

**iii** Many of the planning activities described in the two Parts will be combined for projects on which both reliability and maintainability are to be demonstrated as part of the procurement strategy.

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

**v** 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.

**vi** 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.

**vii** 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.

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RELIABILITY AND MAINTAINABILITY

ASSURANCE ACTIVITY

PART 1: IN-SERVICE RELIABILITY DEMONSTRATIONS

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Section One. General

0 Introduction

The sections in this Part of the Defence Standard describe the purpose, rationale and procedures for in-Service reliability demonstrations (ISRDs). The purpose of an ISRD is to demonstrate compliance with specified reliability requirements of an equipment or system. An ISRD is a final test to provide motivation and incentive to the contractor to ensure that the reliability programme is vigorously pursued. It supplements rather than replaces other activities in the reliability programme. However, an ISRD will not be appropriate for the purchase of every system, platform or equipment. Experience from completed ISRDs has shown the need for detailed guidance for both MOD and industry.

1 Scope

**1.1** This Part of the Defence Standard is a guidance document whose purpose is to inform MOD project staff on the requirements for an ISRD and how these should be formulated, and to industry on the implications if an ISRD is to be part of a contract. Consequently, it will not be appropriate to call up this Defence Standard in contracts; rather a directive based on this Part of the Standard will become part of the contract.

**1.2** This Part of the Defence Standard describes the factors that a project manager should consider before deciding whether to include an ISRD as part of his procurement strategy. It provides guidance on the actions to be taken for ISRDs at the specification, invitation to tender (ITT) and final contract stages. Guidance is given on preparation of the demonstration directive and the conduct of the demonstration. The requirements of a demonstration will vary between equipments and between Services, and this Defence Standard provides general guidelines and direction so that common procedures can be applied wherever possible.

2 WARNING

This Standard calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and in no way absolves the designer, the producer, the supplier or the user from statutory and all other legal obligations relating to health and safety at any stage of manufacture or use.

3 Related Documents

**3.1** The following documents and publications are referred to, or are relevant to this Part of the Standard:

Def Stan 00-40	Reliability and Maintainability
Part 1 (ARMP-1):	Management Responsibilities and Requirements for Programmed and Plans

**3.1 (Contd)**

Def Stan 00-40 (Contd)  
     Part 2 (ARMP-2): General Application Guidance on the Use of  
                             Part 1 (ARMP-1)  
     Part 6 (ARMP-6): In-Service R&M  
 Def Stan 00-41           Reliability and Maintainability  
                             MOD Practices and Procedures  
 Def Stan 00-44           Reliability and Maintainability  
                             Data Collection and Classification  
                             Part 1: Maintenance Data and Defect Reporting in The  
                                     Royal Navy, The Army and The Royal Air Force  
                             Part 2: Data Classification and Incident Sentencing -  
                                     General

**3.2** The Services and MOD(PE) have additional related Standards or guidance documents, at a more detailed level, for the preparation of specifications, plans and directives, as follows:

- (a) Naval Engineering Standard (NES) 1016 - Requirement for the In-Service Collection and Analysis of ARM Trial Data for Naval Systems.
- (b) Army HQ DGEME Standard Operating Procedures (SOP) Number 3210 - Formal Assessment of Equipment Reliability in Service.
- (c) MGO Instruction 3.21 - The Achievement of Reliability and Maintainability.

**3.3** 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.

DOCUMENT	SOURCE
Defence Standard (Def Stan)	Directorate of Standardization Kentigern House 65 Brown Street GLASGOW G2 8EX
Army HQ DGEME SOP	ES21b HQ QMG Monxton Road ANDOVER SP11 8HT
MGO Instruction	MGO Sec 3 Room 2184 MOD Main Building Whitehall LONDON SW1A 2HB

3.3 (Contd)

DOCUMENT	SOURCE
Naval Engineering Standard (NES)	Procurement Executive, MOD Sea Systems Controllerate Foxhill BATH                      5AB

4 Definitions

4.1 For the purpose of this Defence Standard the definitions given in the text and in Def Stan 00-40 (Part 1) (ARMP-1) apply, together with the following:

4.1.1 In-Service Reliability Demonstration (ISRD). An ISRD is the demonstration of the reliability achievement using production standard equipment under agreed in-Service environmental, operational, usage and support conditions.

NOTE: Production standard equipment is taken to include equipment of uniform build standard or having differences in build standard which are agreed not to affect the R&M characteristics of the equipment or system being demonstrated.

4.1.2 Fault, failure, defect. It is acknowledged that each of the Services uses the terms "fault", "failure" and "defect" in different ways. For the purposes of this document "fault", meaning the condition, is used to encompass the other terms. It is essential that an actual ISRD uses the terms defined in the contract specification.

## Section Two. Considerations

### **5 Aim**

The aim of an ISRD is to demonstrate the reliability achieved by an equipment against the requirements specified in the contract using production standard equipment under agreed in-Service conditions. Within the MOD a secondary aim is to provide evidence of the achievement to management and to the user.

### **6 Background**

**6.1** This section describes general factors which the sponsor and the Project Manager should consider. Consultation should take place between the Project Manager, his contracts advisers, the equipment manager or integrated logistic support (ILS) manager, the Operation Requirements (OR) staff and industry. Within the MOD such consultation will usually take place within the Concept Panel/ Panel A (see **10.2**). Controllerate and Service R&M specialist branches should always be consulted at an early stage.

**6.2** Although all three Services collect and analyse reliability data from in-Service equipment, it is recognized that there are gaps in this data base and that it is not, in general, capable of providing an accurate measure of an equipment's in-Service reliability. Thus, whilst the in-Service data collection systems, which are described in Def Stan 00-44 Part 1, may on occasions be capable of establishing compliance with specified levels of reliability, they are generally unsuitable for this purpose. To overcome this shortcoming, a dedicated ISRD will provide a detailed evaluation of an equipment's reliability when used under realistic in-Service conditions and will provide clear evidence whether the specified levels of reliability have been achieved by production standard equipment. A well constituted ISRD is an effective method of measuring this achievement and, if linked to payment arrangements, can provide significant motivation to the contractor throughout the project.

**6.3** It is unlikely that an ISRD would be the sole contractual provision for assuring reliability. An ISRD should be seen as complementary to other contractual provisions for assuring R&M such as interim milestone payments, incentives, warranties and fixed price contractor logistic support; for each project the Project Manager should consider the full range of options. In the case of off-the-shelf (OTS) procurement, evidence of previous achievement should be considered during tender evaluation. It may be that an OTS product has an in-Service history or has already been subjected to an ISRD. Such history should be evaluated carefully to establish whether the reliability levels achieved are representative or whether the extra assurance of a further ISRD is necessary and can be justified on cost grounds.

**6.4** An ISRD does not replace any of the activities in a reliability programme. Key programme activities such as reliability growth testing (RGT), reliability qualification testing and production reliability acceptance testing (PRAT) may be appropriate irrespective of whether an ISRD is planned. The ISRD should be seen as a final test to establish that the contractual requirements have been met and a means of motivating the contractor to achieve these requirements through a comprehensive and vigorous reliability programme. An ISRD defers final acceptance of the

**6.4** (Contd)

equipment until achievement of the contractual reliability requirements have been verified under Service conditions. Nevertheless, passing the ISRD shall not be regarded as diminishing the legal rights of the MOD if the equipment subsequently proves to be unreliable.

**6.5** An ISRD needs to be tailored to meet the requirements and limitations of each equipment. It will also depend on the ability of the user to provide the in-Service resources and environment for the demonstration. For example, an artillery gun would need a special demonstration using ammunition fired from a sample number of guns over an agreed number of battlefield days whereas the RAF may be able to demonstrate the achievement of R&M requirements for an aircraft by recording and monitoring faults over a large number of routine training sorties. Ships and their weapon systems may require a combination of the two. This Part of the Defence Standard identifies the common principles.

**6.6** An ISRD is a measurement of achievement and therefore shall not be considered an extension of reliability growth tests (RGTs) or other such development activities. The embodiment of modifications during the ISRD, whilst being beneficial in particular circumstances (see clause **19**) poses difficulties in management and analysis. The aim should be to maintain a uniform standard of equipment under the demonstration and modifications should not, in principle, be incorporated during the demonstration period.

**6.7** The actions to be taken following demonstration failure and, where appropriate, the consequences of requirements being surpassed, shall be clearly stated in the contract. An ISRD will not be effective without such linkage. Appropriate linking would typically be a continued commitment for further engineering action by the contractor at his expense to achieve the required reliability or the withholding of specifically linked interim payments. Such engineering action might be the investigation of faults, the design and proving of modifications and their fleet embodiment. Similarly an additional incentive payment might be made for exceeding specific levels of reliability if this had been offered and agreed as part of the contract.

**6.8** The decision in principle to undertake an ISRD will be made as early as possible and certainly before issue of the invitation to tender (ITT). It is essential that all the factors which influence cost and contractual risk are specified in the ITT and are subsequently made binding in the contract. Outline details of the ISRD need therefore to be specified in the ITT. Full details of the ISRD should then be agreed for issue as part of the contract if it is to provide the required motivation to ensure achievement of required reliability. A list of the vital actions and milestones for the preparation of an ISRD is included at annex A, grouped under activity for the Reliability Panels.

**6.9** The cost of mounting the demonstration will often fall to the Service as well as the MOD(PE) and needs to be funded in a timely fashion. Where large amounts of consumables such as ordnance, missiles and fuels are involved, these costs can be considerable.

**6.10** Selection of environmental, operational and usage conditions is of prime importance to the relevance of the ISRD result. They should reflect those in the specification and should not be exceeded. However, it may not

## 6.10 (Contd)

always be possible for the purposes of the ISRD, to generate in-Service conditions which reflect precisely those stated in the contract. In such cases it may be necessary to define a series of trials which, collectively, represent appropriate conditions to the satisfaction of all parties. The key element is that the ISRD uses production standard equipments operated by Service personnel after delivery to the Service and under defined conditions which, within the agreed limitations, most accurately reflect its specified use.

**6.11** The procedures for an ISRD contained in this Defence Standard apply equally to any demonstration in which it is required to provide evidence of reliability achievement and to demonstrate reliability on production equipment outside the controlled environment of the factory or laboratory.

## 7 Benefits

**7.1** Provided that the contract conditions and remedies are clearly specified, and the required support is provided, an ISRD can offer many benefits. These include the following.

**7.1.1** An ISRD fulfils the requirement of the Project Manager to provide evidence of achievement relative to the contract requirement. It also provides the baseline against which the continuing operational capability can be assessed.

**7.1.2** An ISRD extends the contractual influence and provides motivation for the achievement of reliability throughout development and into production.

**7.1.3** An ISRD provides clear evidence upon which to base contractual action.

**7.1.4** An ISRD provides a clear and early indication of reliability achievement in the operational environment.

**7.1.5** An ISRD provides assurance of the reliability of production standard equipment.

**7.1.6** A successful ISRD will provide the contractor with firm evidence of the reliability of his equipment which may be beneficial in promoting further orders from other purchasers.

**7.1.7** An ISRD collects high quality in-Service data which can be used to update the life cycle cost (LCC) estimates and the logistic support analysis (LSA) work.

## 8 Constraints

**8.1** An ISRD introduces a number of potential constraints. These can be minimized by careful and early planning to address the following aspects.

**8.1.1** An ISRD requires effort in both resources and time from MOD(PE) and the user; it may also be disruptive to planned tasks, duties and programmes. In some cases there will be considerable impact on the user's resources and it is essential that the user participates at an early stage of the planning.

**8.1.2** Some representative operational and environmental conditions may need to be varied or simulated. Where deviations from the specified conditions are necessary, these shall be clearly stated in the contract together with any anticipated affect on the results.

**8.1.3** Costs may be large, particularly where dedicated live firing of ordnance is required. Nevertheless it is an MOD management objective to improve reliability and measure its achievement; funds will therefore need to be made available once the requirements are identified by the Concept Panel/Panel A.

## Section Three. Management

### 9 General

**9.1** An ISRDR will involve three principal agencies: the MOD, the user and the contractor. Each will have responsibility for implementing specific elements of the ISRDR and it is therefore essential that overall management is coordinated. Concept Panels/Panels A and Project Panels/Panel B will, where formed, assist in the coordination of these management requirements.

**9.2** The ISRDR directive will be the primary managerial document relating to the conduct of the demonstration. To be fully effective, the ISRDR directive needs to provide the detail necessary to:

- (a) identify all managerial responsibilities;
- (b) identify all facilities necessary, including funding and personnel, together with the timescales for their implementation;
- (c) identify the procedures for conduct of the ISRDR;
- (d) identify all relevant contractual requirements and definitions, amplified as necessary with detailed guidance on their interpretation.

**9.3** Many terms and conditions of the ISRDR will affect cost and risk to the contractor and his equipment suppliers. It follows, therefore, that the issuing of an outline ISRDR directive as part of the ITT is essential. Any amendments to the ISRDR directive that affects risk or cost need to be agreed before contract award and the final directive needs to form part of the contract. Any subsequent amendments should be confined to matters of administration or management not affecting cost or risk.

**9.4 Logistics.** The logistic needs of some demonstrations will be considerable and may include ammunition, fuel, firing ranges, specialist facilities and associated manpower. The assessment of the logistic needs and their organization should be made at the earliest possible time by the Project Manager since some resources, such as firing ranges, may need to be allocated several years in advance. An ISRDR may also affect long term planning of training, exercises and deployments by the user.

**9.5 Directive.** A suggested format for the ISRDR directive is at annex B and includes some detailed guidance on the content of the paragraphs to be included. Those responsible for drafting the ISRDR directive are cautioned against copying paragraphs verbatim.

### 10 Responsibilities

**10.1** The remainder of this section outlines the managerial responsibilities of the main agencies involved with an ISRDR.

**10.2 MOD.** MOD will have overall responsibility for the ISRDR through the following agencies.

**10.2.1 Reliability panels.** In most projects, MOD will form a Concept Panel/Panel A to formulate the reliability requirements. Later, a Project Panel/Panel B will be formed to monitor the fulfilment of those requirements. A general guide describing ISRDR related actions which fall

**10.2.1 (Contd)**

to each panel is given at annex A. Such panels will coordinate the management described within this section and allocated to a particular organization.

**10.2.2 Project Manager (PM).** The PM is responsible for overall management of the ISRD and is responsible for issue of the ISRD directive. The PM will normally appoint a demonstration coordinator who will be a member of the reliability panels. The PM will convene a regular review meeting, perhaps as part of the reliability panel meeting, to monitor progress of the ISRD.

**10.2.3 Demonstration coordinator.** The demonstration coordinator is responsible for liaison with the user and contractor, and for coordination of all necessary facilities prior to and during the demonstration. He will be responsible for provision of all MOD manpower and resources to support the ISRD. He will report to the PM on a regular basis and will refer any unresolved disputes regarding categorizing (or sentencing) incidents to the PM. He will coordinate a final report at the end of the demonstration and submit it to the MOD(PE) PM. The report will be used to determine the basis of contractual compliance.

**10.2.4 Assessment team.** An assessment team will be formed by MOD consisting of MOD and/or Service staff and contractor representatives. The team should be formed 3-6 months before the demonstration in order to complete pre-ISRD training and familiarization. MOD and Service staff will be functionally controlled by the demonstration coordinator. The contractor representatives will be responsible to their Company. The assessment team will be responsible for monitoring and sentencing all appropriate arisings, and such additional tasking as may be agreed. The team will report regularly to the demonstration coordinator and to the contractor and will refer unresolved disputes regarding sentencing to the demonstration coordinator.

**10.3 User.** The user is responsible for in-Service operation and support of the equipment during the ISRD. The term user includes Service Command staff and the Operating Unit. In particular, the user will be responsible for making available to the assessment team all relevant Service data relating to the operation and support of the equipment. The user will be responsible for promptly investigating all fault arisings in accordance with the agreed maintenance policy (eg first and second line) and any additional policies agreed for the ISRD. All results will be made available to the assessment team.

**10.3.1 Service manager.** An ISRD service manager should be nominated to act as the focal point to coordinate the user's planning and implementation of the ISRD. The service manager will be responsible for providing the agreed Service manpower, resources and special procedures for the ISRD.

**10.3.2 Liaison officer.** A liaison officer at the Demonstration Unit should be appointed to liaise with the assessment team and demonstration coordinator.

**10.4 Contractor.** Only prime contractors have responsibility to the PM for implementing the ISRD. However, with the agreement of the PM, the prime contractor may request the attendance of sub-contractors to advise and support particular aspects of the demonstration without prejudice. The

**10.3** (Contd)

prime contractor is responsible for providing to the assessment team all relevant contractor data, including sub-contractor data, relating to the operating and support of the equipment. The prime contractor will also be responsible for prompt investigation of all fault arisings as defined by the maintenance policy (eg fourth line) and any additional policies agreed for the ISRD.

Section Four. Contractual Application

11 Invitation to Tender (ITT)

In order to include an ISRД as part of a contract, the intention to have an ISRД needs to be declared with the ITT; there are essential elements and information which shall be included in the ITT and which may considerably affect the responses from contractors. A draft demonstration directive should be included in the ITT to enable contractors to include, with their responses to the ITT, their plans for dealing with the ISRД.

12 Contractual Agreement

It is important to define carefully in the contract the scope or boundaries of the system or equipment being subjected to the ISRД. In many cases this will be more easily specified by noting the exceptions or exclusions. The demonstration directive needs to be included in the contract and it is essential that the R&M clauses in the specification and contract, including the demonstration directive, are accurate, comprehensive, unambiguous and consistent with each other. The specification needs to include the details of exclusions and clarifications which are expanded in the guidance given in section seven of this Part of the Defence Standard. The contract needs to cover the complete conduct of the demonstration and conditions should not be added later, as amendments to the directive, that will either invalidate or undermine the contract. Where amendments are unavoidable they should be very carefully considered before implementation.

13 Multiple Contractors

Instances may occur where a prime contractor does not have the responsibility for the overall reliability achievement of a large integrated system. For example a ship is a complex weapon system comprising a number of sub-systems and equipment whose reliability is the responsibility of the respective equipment PMs and their individual contractors or sub-contractors. Special arrangements will then be necessary to complete an ISRД satisfactorily and to manage the allocation and investigation of faults which will almost certainly cross several contractor boundaries. These arrangements may include:

- (a) additional resources for fault investigations and sentencing;
- (b) procedures for fault investigation where multiple contractors are involved;
- (c) arrangements for further sub-system ISRДs or integrated system reliability demonstrations;
- (d) the need to gather data at a more detailed level than the system reliability may require.

14 Purchaser and Contractor Risks

The parameters of the ISRД need to be clearly set out in both the contract and the demonstration directive, and the areas of risk for both purchaser and contractor should be identifiable. The parameters for the ISRД and its associated definitions, for example for incident, fault, attributable and non-attributable failure, need to be compatible with the specification,

## 14 (Contd)

the R&M programme and the demonstration plan. The statistical risks shall be evaluated as part of the demonstration plan and the confidence levels associated with the particular demonstration established. This subject is considered further in section six.

## 15 Corrective Action

**15.1 Modifications.** During a lengthy ISRD, for example on an aircraft, there may be a need to incorporate modifications for operational or safety reasons. The effect of such modifications on the rest of the system need to be considered and methods agreed to attribute any effects, good or bad, in the overall results. The consequential effect of such modifications need also to be considered. Specific modifications to improve reliability during the ISRD will not normally be allowed since this will complicate the analysis of the actual reliability levels of the equipment in the delivered state. The aim of the ISRD is to establish the actual achievement of reliability, not how much better certain modifications might make such levels.

**15.2 Reliability improvements.** Nevertheless for some lengthy ISRDs it will be likely that reliability improvement modifications will be proposed and possibly available during the period of the ISRD. Some might be simple and quick to incorporate. Each should be evaluated and if agreement can be reached on how the embodiment will affect the analysis and results of the ISRD then a rapid assessment, approval and embodiment procedure should be available to incorporate such modifications into the equipments concerned. Liability for the subsequent embodiment of any reliability modifications needs to be stated in the specification and contract. Any such modifications should be subject to an agreed method and period of validation. Such validation should be based on the maximum evidence available within the demonstration but, where project constraints apply, validation might be gained by an extension to the demonstration, based on a multiple of the previously observed mean time, or cycles or rounds etc, between faults of the failure mode affected by the modification. Alternatively, a limited demonstration on the immediately affected system could be considered at the end of the ISRD. It is advisable that the effectiveness of proposed modifications should be thoroughly proven by testing on test-rigs, trials equipment, or by prototypes prior to being authorized for incorporation with equipment taking part in the ISRD. For short ISRDs, lasting only weeks or a few months, reliability improvements cannot be allowed as they would cause considerable complications.

**15.3 Delayed repair.** In some circumstances during the ISRD it may be expedient to delay repair of a fault which does not affect the overall serviceability of the system. Repair might jeopardize an already tight timescale for the ISRD and deferment of the repair might be a sensible course of action. Care needs to be taken that such action does not precipitate further faults or degradation of associated systems or equipments. Provision for such action should be included in the ISRD directive.

Section Five. ISRDs Trials and Other Test Methods

**16 General**

There will be projects for which a full demonstration of reliability under representative in-Service conditions may be neither practical nor necessary, but for which some alternative demonstration may be required. In such cases the guidance given in this Standard should nevertheless be followed to the maximum extent possible and it should be noted that the further the demonstration environment and usage are away from that specified as the in-Service conditions, the less likely it is that the assessed reliability will represent that achieved in-Service.

**17 Pre-Delivery Trials of Production Equipment**

In some cases, it is the practice to demonstrate reliability during a pre-delivery trial of production equipment. An example of this is for some vehicles where reliability is demonstrated during test-track trials carried out by the intended user. Such trials should use the principles and procedures of an ISRd for the reliability assessment elements but would need to address any applicable differences between the trial environment and the in-Service environment. Furthermore, the effects of the duration of the trial on the accuracy of the assessment needs to be carefully considered.

**18 Peacetime Usage**

Peacetime usage may be proposed as an alternative to replicating the specified usage environment. Clearly, before peacetime usage can be accepted as enabling a representative measure of reliability, the similarity between the peacetime and specified environments needs to be confirmed. However, the similarity often exists, for instance with aircraft and electronic equipment, and extended peacetime use may satisfy ISRd conditions. In such cases, special care should be taken to address data collection and validation over the comparatively long timescale of a peacetime usage demonstration. Data collection procedures will probably require augmentation. In addition, particular attention should be paid to factors such as the effect on reliability of the pattern of usage including periods of storage, configuration control, maintenance procedures, and the need to prevent use of the equipment outside its specified usage boundaries. In addition, the timescale needs to be chosen to balance the conflicting priorities of an early result, which would provide feedback to influence ongoing production and demonstration accuracy which demands a long timescale.

**19 Combination with Other Methods**

**19.1** Demonstration of reliability may require combination of data from a number of trials. This Part of the Standard does not attempt to provide any mathematical rules for combination of such data. Nevertheless, where an in-Service element is included in a wider demonstration plan, those in-Service elements should follow ISRd guidelines.

**19.2** Expensive one-shot devices, such as missiles, may have components tested non-destructively and in isolation, for instance using production reliability acceptance testing (PRAT) (Def Stan 00-40 Pts 1 and 2 and Def Stan 00-41 refer). Additionally, some destructive testing of parts of the system may be completed on a sample basis. In-Service tests of the

**19.2** (Contd)

whole system, inevitably to destruction, can be costly and are often impractical; such tests may not generate sufficient data for reliability demonstration purposes. Nevertheless, in-Service firing trials do provide valuable additional data on system integration and overall reliability and, consequently, data from such trials should be used to the maximum.

**19.3** In some cases, where the required environment cannot otherwise be reproduced, limited use of testing on a specified rig or specialized test facility may be necessary. However, due consideration needs to be given to the limitations of such tests and always recognizing that they are only simulating the conditions and usage expected in-Service. Care should be taken to ensure that any interface problems are addressed if the test is being carried out on only part of a weapon system.

Section Six. Demonstration Plans

**20 General**

In the early stages of planning an ISRD, the reliability to be achieved may be expressed as a quantified value together with the statistical confidence to which it is to be demonstrated. Figures for sample size, duration and acceptance criteria may not be possible to quantify precisely at the ITT stage, but indicative values should always be given. However, the final ISRD directive needs to contain agreed and precise figures for inclusion in the contract. The duration is likely to be a compromise between low figures for economy of time and cost, and high figures for greater statistical confidence. The higher the reliability to be demonstrated the greater will be the duration for a given level of confidence. Specialist R&M advice is always to be sought on the statistical aspects.

**21 Statistical Plans**

ISRD plans may be either fixed length or sequential. Fixed length demonstrations are commonly used for ISRDs because the parameters, such as duration, acceptance criteria and statistical risk (or confidence, see clause 22) are-most readily understood. A fixed duration (missions, hours, km etc) helps planning of resources such as manpower and test facilities. A sequential demonstration plan, on the other hand, allows early termination if reliability is significantly high or low, thus saving on resources (Def Stan 00-41 provides further guidance on statistical plans). MOD and the contractor need to agree the basis of the statistical interpretations.

**22 Confidence Statements**

In any reliability demonstration, there are statistical risks to both contractor and purchaser of "good" equipment failing the demonstration and "bad" equipment passing. The risks of these undesirable conditions are termed the contractor's and purchaser's risks respectively. These risks will be taken into account in setting the duration and acceptance criteria. The purchaser's risk would be quoted against a reliability related to, and ideally equal to, the requirement. The contractor's risk would be quoted against a higher reliability, related to the level of reliability for which the contractor will design in order to ensure a good chance of passing the demonstration and for which, ideally, he has tendered. The values to be used in the ISRD need to be agreed before award of contract. Care need also be taken not to specify these reliability and confidence levels at values which would require a demonstration of larger numbers than the MOD is prepared to fund or a longer test than programme timescales will allow.

**23 Selection of Samples**

Limitations on which particular production samples may be included within the ISRD should be kept to a minimum. Ideally, any delivered production item may be selected provided it is representative of the standard which will continue to be used in-Service. Where the production standard varies (eg production is batched), samples should be drawn from all standards available at the time of the ISRD.

## Section Seven. Detailed Guidance on Demonstration Plans

### 24 Fault Definition

Definition of attributable and non-attributable faults is probably the single most important area of concern. Careful consideration of all eventualities and the specification of unambiguous criteria is most important. Reference to the definitions in the original specifications will be the starting point and no divergence from these definitions and parameters can be made except for agreed points of clarification.

### 25 Faults, Failures, Defects, Incidents and Sentencing

The use of the terminology of "faults", "failures" and "defects" need to be clearly defined. Incidents may not always lead to a fault or defect. Small faults such as filament replacements and screw replacements need to be defined as either counting or not counting towards the overall level of reliability depending on operational and logistic impact. Reference to the original reliability requirement in the specification will be necessary so that consistency is maintained. Furthermore, reference to any agreements achieved during development which have affected the categorization of small faults should be made. Faults which are rectified by adjustment need also to be adequately defined. Where they are caused by design, such as the positioning of micro-switches, they need to be counted; similarly where poor manufacture or initial setting has caused the need for subsequent adjustments, then these need also to be counted. Only in cases where in-Service rectification or maintenance activity causes the requirement for later adjustment should there be an exception. However, if rectification tasks result from errors in documentation provided by the contractor, then until the documentation faults are corrected, the incidents should be counted. Failures caused by human error in operation or maintenance are generally non-attributable. However, if the same human error persists then consideration needs to be given as to whether the fault should be attributable in particular circumstances and whether any redesign is warranted. Full records of why each non-attributable fault is so classified needs to be maintained. Sentencing of all incidents should be conducted by the assessment team and only where they cannot agree should the PM be asked to arbitrate at a regular review meeting.

### 26 No Fault Found (NFF) Items

Equipment users may experience symptoms which appear to indicate a fault but which, upon investigation, cannot be reproduced and the equipment passes all relevant diagnostic tests. Such arisings are termed "no-faults-found". In general, all arisings which indicate a fault are attributable until proven otherwise but the following should be observed and clarified for each ISRD:

(a) The depth of investigation which is necessary to prove or disprove the existence of a fault should be specified.

(b) Once a fault is confirmed and isolated to a particular equipment, in controlled conditions using agreed test procedures, it would be inappropriate subsequently to discount that fault if a later depth of maintenance could no longer reproduce it.

**26 (Contd)**

(c) A fault, which is indicated on several occasions within a single equipment but has not been isolated or rectified, (eg an intermittent fault, perhaps transferred between host systems by transfer of the identified equipment) should neither be discounted nor counted as multiple faults. The preferred option (except perhaps in the case of software) is to count the fault as a single attributable "undefined" fault pending further evidence; only final confirmation and isolation of the fault would provide the necessary evidence to prove or disprove whether a fault is attributable.

(d) Software related faults will repeat themselves, whenever identical circumstances are met, until corrected. Each ISRD must specify whether repeated identical symptoms, attributed to software, are counted as a single fault or as multiple faults. The advantage of multiple counting is that it more closely follows the operational effect; this is the preferred option.

**27 Secondary Failures**

The definition of secondary failures (such as the failure of a pump due to an actuator seal failure) needs to be carefully worded to preclude loose interpretation. An example definition is:

A secondary failure is an event which is caused directly by a fault in another component or system and is non-attributable except where in-built protection or warning devices should have prevented the event.

**28 Items Under Test**

The exact numbers of equipments under test should be specified together with any selection criteria or consideration of samples from different batches. Complications may occur with differing modification or build standards of particular batches and this may lead to disagreements on reliability levels between differing batches. Nevertheless, it is important to demonstrate a representative selection of several batches accepting any penalty of a longer more drawn out ISRD. The sample size itself needs to be carefully chosen to ensure that results obtained will be representative for all the batches. For some equipment, such as those fitted on board ships, the small in-Service population makes this difficult. Additionally the point at which the equipments are selected during the production process will also be important.

**29 Timing**

The timing of an ISRD affects the contractor's risk. Where a new equipment design is subject to an ISRD immediately upon first delivery there is a significant risk that early production problems and user inexperience will affect the result. Therefore, it may be appropriate to allow in-Service operation to stabilize for an agreed period before commencing the ISRD. On the other hand, delay in commencing the ISRD may reduce the subsequent opportunity to embody improvements, identified as necessary during the ISRD, into later production items. Individual projects need to determine the extent, if any, of such settling-in but this period is to be consistent with other statements regarding contractual timing of achievement, such as

**29 (Contd)**

"reliability shall be achieved at first entry to Service". On the other hand, to defer final payment for too long may be unacceptable to some contractors. The procedures to be adopted during any settling-in period should be declared and should include identification and embodiment of improvements and modifications. Only when any settling-in period is concluded will the period of stable configuration (no further modifications) apply as required at clause 15.

**30 Exclusions**

Any exclusions need to be defined in the contract but should be kept to an absolute minimum and will address any artificialities imposed during the ISRD and any constraints likely to be experienced.

**31 Environment**

The environment for the ISRD needs to be representative of that which was specified originally. Consideration needs to be given to how much of the environment, if any, needs to be simulated and the effect of the simulation in making the demonstration unrepresentative.

**32 Support Equipment**

The quantities and standards of all support equipment (eg tools, test equipment, servicing equipment, handling equipment and technical documentation, including Government Furnished Equipment (GFE)) needs to be defined.

**33 Adjustments**

Some servicing or maintenance activity can be defined as adjustment and the principles for sentencing incidents involving adjustment, and circumstances in which they are attributable, needs to be clearly laid down.

**34 Scheduled Servicing**

Routine scheduled servicing tasks will not be counted but faults found during these activities, which in all other respects fall within the attributable criteria, will be counted. Faults which can be attributed to poor scheduled servicing, or induced by scheduled servicing, will not count unless attributable to unsatisfactory documentation. The agencies responsible for routine servicing should be specified in the directive with any instructions for recording faults or defects found during the servicing.

**35 Special Servicing Instructions or Checks**

The application of any special servicing instructions or checks will not be counted as attributable arisings; however, any fault found during such inspections will be counted.

### **36 Built-In-Test (BIT)**

The existence of BIT and its effect on overall reliability should be specified. The failure of BIT itself may also have a serious and cumulative effect on reliability and the number of incidents. Furthermore, the inherent effectiveness of BIT to identify faults is subject to an overall confidence level and reliability in itself. Suitable provision, therefore, needs to be made to account for, or to discount, BIT errors and BIT induced faults.

### **37 Software**

Errors in software can produce equipments or systems that do not work as they should. Generally, software errors can be rectified so that under identical conditions they will not reoccur. Nevertheless, for every software error found there may be others which will not be found due to the time constraints on sample size. It is policy that software errors are always counted as faults against the system and will therefore be attributable in the ISRD until they are corrected. Software errors are also to be reported separately such that their effect on the reliability of each system or equipment can be assessed.

### **38 Fault Tracking**

Detailed arrangements need to be made for the repair of faulty items. Adequate tracking procedures and comprehensive fault reports will be required. Such reports will be required quickly and special handling procedures may be needed. It is essential that investigation of faults is undertaken quickly whether it is by in-Service repair organizations or by the contractor or sub-contractor.

### **39 Component Handling**

**39.1** Components removed for whatever reason, and particularly those removed as faulty, will need special identification. Equipment labels over stamped with "Equipment X Reliability Demonstration" will assist with tracking and identification. The assessment team will have to monitor each component and agree from the paperwork whether the fault is attributable or not. Depending on the number of components and the repair agencies involved it may be practical - for the demonstration only - to have the faults investigated at a single appropriate repair centre. Consideration should be given in such circumstances to special handling and monitoring by MOD(PE)QA staff. The contractor should be entitled to be represented at any in-Service repair centre; similarly MOD(PE) should be represented at any contractor's facility. All evidence of component faults should be retained until the end of the demonstration and the fulfillment of all contractual arrangements.

**39.2** For ships undergoing ISRDs at sea, investigation of faults by a repair centre ashore may cause unacceptable delay and such constraints need to be recognized. However, the advantages of a common standard of investigation and the ability to have a full investigation ashore, with all interested parties present, provides the most effective basis for investigation.

**39.3** Disposal of components and the necessity for contractor visibility of removed components needs to be addressed and balanced against the requirements of the Service. Components may be required by the Project Manager to allocate appropriate contractor or sub-contractor responsibility without detracting from the continuation of the ISRD.

**40** Spares

The spares support for ISRD activity should be provided over and above the normal DEFCON 82 or Advance Order List (AOL) provision. Such action is essential and will prevent items being lost into the "investigation loop" thereby reducing repair pools.

**41** Preparatory Work

Preparatory work for the ISRD itself will be required with both the user and the contractor. Early discussions with both will ensure that all actions are complete or in hand for the start of the ISRD.

**42** Effect on User

The ISRD will place a considerable load on the user and all efforts need to be made to minimize the effects and any disruption to other tasks.

## Section Eight. Data Classification and Analysis

### 43 Precedents

In any reliability programme the fault criteria needs to be agreed prior to contract. However, at this early stage the final configuration of the equipment, and any impact on reliability, may not be fully understood. During design and development further clarification of the fault criteria is therefore possible and due regard of such precedents need to be taken into account. Therefore, it may be necessary, before the start of the ISRD, to amend the demonstration directive and fault criteria previously agreed.

### 44 Analysis

The analysis of the result for contractual purposes should be straightforward if all the rules have been clearly established at the outset. It is important to consider the data which may be of value to the contractor or the in-Service manager should corrective action be needed. In cases where the demonstration was not conducted in accordance with the plan (sometimes for very good reasons) reliability specialist advice should be sought to determine the best method of analysis or the need to repeat any aspects as appropriate.

### 45 Data Gathering

Consideration needs to be given to the scope and detail of the data required during the demonstration. Special data gathering procedures should be considered and whether there is a need for automated data gathering of any kind. Some demonstrations may benefit from the use of specialist pieces of equipment such as data gathering units (DGUs), which may be hand-held, for the input of the required data. DGUs can speed up the collection and analysis of the data particularly if the assessment team are not required at the equipment site permanently (eg for shipborne demonstrations).

### 46 Documentation

For some ISRDs existing documentation may provide the necessary information but in most instances extra information, such as operating conditions, time and temperatures, will be required. This requirement means that additional documentation will need to be raised for the assessment team. All incidents, whether attributable or not, are to be recorded. In many field situations the documentation and data may have to be forwarded to the assessment team and this should be done as quickly as possible. The complete data, once they are available to the assessment team, are then to be evaluated by them, typically within three days. Any disputes not able to be resolved by both parties of the assessment team are then to be passed to the demonstration coordinator for resolution.

### 47 Recording Procedure

In most cases, other than single installations where few faults are expected, the use of automated data processing (ADP) methods will be extremely advantageous. If ADP is used, ideally a file should be maintained for each equipment in the sample. Relevant additional information is to be added where available or as it occurs. Any relevant maintenance, servicing data or records are also to be added as necessary.

47 (Contd)

For each planned mission, battlefield day or period of operation, additional information will need to be recorded either by the user or preferably by the assessment team. For instance, it may be highly relevant to record data not normally recorded such as weather conditions; recording of such data should not adversely affect the normal operation by the user. When faults arise the assessment team will either need to track the relevant maintenance card, to extract from it further information, or arrange for the relevant information to be made available or recorded. Examples of the type of information required to establish comprehensive records are at annex C.

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Reliability Panel Activity for an ISRD

**A.1** Whilst the following list is given under relevant panel activity each project may organize its panel activity in different ways.

**A.2** Panel A/Concept Panel Activity

- (a) consider benefits/constraints;
- (b) evaluate all types of contractual conditions;
- (c) consultation with PM, OR sponsor, ILS manager, Contracts Branch and industry;
- (d) consultation with specialist R&M cell;
- (e) discussion with user - who? how? where? and when? Resources required and impact on user;
- (f) environmental difficulties, operational or usage problems, need for artificial conditions;
- (g) arrange for support services and facilities even though ISRD is years away;
- (h) agree with contracts staff the procedures for ISRD milestone payments and for withholding payments for any non-achievement;
- (j) agree draft ISRD directive to issue with ITT;
- (k) tender assessment.

**A.3** Panel B/Project Panel Activity

- (a) appoint demonstration coordinator;
- (b) finalize directive;
- (c) agree contract including specific conditions, incentives and withholds for ISRD;
- (d) arrange resources and prepare plan to ensure everything in place at suitable time before needed;
- (e) personnel training and involvement in any pre-delivery trials or tests;
- (f) agree and arrange details of fault component handling and investigation.

**A.4** Panel C/In-Service Activity

- (a) use ISRD final report and MOD(PE) Project Manager's demonstration review as the baseline for subsequent in-Service R&M monitoring;

**A.4** (Contd)

(b) advice on any significant deterioration in R&M performance from the ISRD baseline, particularly with respect to original specification;

(c) monitoring the effect of modifications on R&M performance.

Outline Demonstration Directive

**B.1** The following outline demonstration directive is only one suggested way of laying down the necessary authoritative statements. There is no particular format and each project should adapt it or tailor it to suit particular needs.

**B.2** Some paragraphs give a suggested form of words (in plain text), **but others simply give guidance on the range and scope of the content required (emboldened).**

**C A U T I O N**

**B.3** Users of this documents are cautioned against copying paragraphs verbatim. Each project will be different and will require thought to ensure statements are appropriate, relevant and necessary.

IN-SERVICE  
EQUIPMENT XX MK 1 RELIABILITY & MAINTAINABILITY  
DEMONSTRATION DIRECTIVE

References:

- A. ....
- B. ....

INTRODUCTION

1. Reference should be made to any general contract condition such as part of the contract price being withheld until satisfaction of the ISRD. References A, B etc will detail the published contract, specification and Defence Standard 00-43 and each reference should be elaborated in this paragraph.
2. A short summary should be provided of what reliability requirements are to be demonstrated and how this will be done.
3. A statement of who will conduct the demonstration and where it will be held is required together with any general caveats. The designation of the units involved may be made specifically or generally as "the Demonstration Unit".
4. A statement should be included to the effect that "the demonstration shall not, except with agreement of the demonstration unit, cause any disruption to the fulfilment of peacetime training or maintenance tasks". The specification of definitions used should be included here by reference to an Annex.

AIM

5. A clear and concise aim of the directive is given, eg The aim of this directive is to define and explain the procedures which are to be used for conducting the equipment XX Mk 1 R&M In-Service Reliability Demonstration.

GENERAL

6. The in-Service achievement will be assessed using data recorded under normal RAF/Army/RN regulations on Forms . . . . . (or as otherwise specified), using approved maintenance procedures, tools and equipment and with the maintenance undertaken by trained personnel (including civilian tradesmen employed by the Service, or others as specified, eg suitably qualified aircrew).
7. The level of reliability to be demonstrated will determine the overall duration of the demonstration. A settling-in period of XXXX hrs/miles etc in RAF/Army/RN service will be accumulated, during which time, experience will be gained in equipment operation and maintenance, before the main Reliability Demonstration of XXXX hours/miles etc will be commenced. During the settling-in period training and trial-runs will be undertaken and demonstration procedures validated.

ADMINISTRATION

8. The constitution of an assessment team will be covered together with appointment of the Demonstration Coordinator if necessary. Responsibilities and authority vested in the coordinator and the team should be briefly covered. A statement of who is responsible for manning the posts should be stated.

9. The timetable for the demonstration should be expanded together with arrangements for selection and formation of the team.

10. Any special arrangements for financial support should be identified together with identification of assistance from in-Service Units and organizations. Details and arrangements for the provision of particular administration support should be listed, eg office space, power supplies, furniture, telephones, fax, typing support, photocopying facilities, stationery, computer support and consumables, protective clothing, stopwatches.

11. Further details should be given for each item where necessary. For example, the computer support should be specified to include suitable software for sorting the data and presenting reports, ie database, wordprocessing, spreadsheet, graphics and desk-top publishing.

12. A statement is required to allow the assessment team free access to all relevant equipment and records in both the Service and, subject to contract limitations, the contractor and sub-contractor.

13. The Service personnel on the assessment team shall be administratively controlled by ABC (eg Senior Unit Engineer) and XYZ, (eg Service Equipment Manager) who will act as the interface between them and the Demonstration Director or Project Manager.

14. The contractor's staff on the assessment team shall be administratively and functionally controlled by the Product Support Manager of X-Y-Z Company Limited, who will act as the interface between them and ABC, (para 13).

15. It may be necessary to state that the team shall be fully manned during and for a particular period after the demonstration. There will be a need for the preparation of a final report and possibly other post-demonstration duties.

ASSESSMENT TEAM TASKING

16. The assessment team's primary task is to plan, monitor and record the data from the R&M demonstration. In addition, however, the team shall:

- a. Provide representation on the MOD Project Panel.
- b. Investigate R&M actions arising from entry to service conference.
- c. Make recommendations for improvements to maintenance procedures, publications etc.

17. Additional tasks as directed by the Project Manager or demonstration coordinator should be listed provided that the demonstration is not adversely affected.

18. Any exclusions for involvement by the team in unit training or exercise should be noted.

PRE-DEMONSTRATION TRIAL

19. Before the demonstration is conducted a trial should be arranged for a set period to evaluate the procedures to be used in the demonstration. The scope and depth of this trial shall be specified and should be representative.

20. The use of identical procedures needs to be stressed. A report should be published by the team which identifies the notional results against all the specification R&M requirements and highlighting any shortcomings in procedures which require solution before commencement of the main demonstration.

RELIABILITY DEMONSTRATION

21. The numerical reliability requirements to be demonstrated shall be stated:

- a . . . . .
- b . . . . .
- c . . . . .

22. Direction is to be given for the team to investigate all defects or faults ensuring that the diagnosis recorded is correct. This responsibility must extend to all lines of servicing. Direction to the MOD Project Manager and to the contractor, is to be given to ensure full and free access to the technical information required by the team as relevant to the demonstration. It may be necessary to state that every effort should be made by the MOD Project Manager and the contractor to limit any adverse effects of any pre-existing contractual condition on such data requirements.

VENUE & TIMING

23. Specify the starting criteria in terms of dates and times. The venue or venues should be specified.

24. Details of the length or duration should be stated. If necessary a later stop point might be noted if necessary to agree the efficiency of any modifications.

25. The population of equipments at the Demonstration Unit and venue is to be specified. All equipments that have been accepted into Service should be available for inclusion in the population.

26. It may be necessary to note that if certain equipments are detached from the unit for operational reasons they are still to be retained in the demonstration population and the provisions of the directive still apply.

27. Any procedures should be stated for dealing with an equipment which for any reason has to be removed from the demonstration, including procedures for re-admittance.

28. Procedures for dealing and counting on equipment undergoing periodic or scheduled maintenance activity until it finishes that period of maintenance should be specified. Defects or faults found are still to be counted to the demonstration.

#### EQUIPMENT AND RESOURCES

29. The standard and quantities of both main and support equipments should be specified and any considerations for GFE or Company Furnished Equipment (CFE) included.

#### SENTENCING DATA

30. The clear definition of a fault or defect is vitally important. Rather than try to provide a single definition one way is to provide full information on incidents and exclusions allowed. All incidents together with any corrective maintenance activity will result in a fault or-defect and together with the corrective maintenance action, are to be recorded on Forms X, Y and Z. All incidents are attributable to the demonstration except where proven to be in the following categories:

- a. Faults in the GFE listed in the procurement specification. Equipment listed as CFE shall be attributable.
- b. Secondary faults directly caused by a fault in other component or system except where in-built protection or warning devices have prevent such an event.
- c. No fault could be found at any depth of subsequent servicing. Notwithstanding this exclusion, if the fault symptoms are reported more than once on the same equipment without fault or defect confirmation or rectification, a cross-reference link shall be entered in the demonstration computer database and a single attributable fault shall be assumed and counted against the first arising, unless and until other evidence is available.
- d. Proven misuse or operator error except where such error is the result of incorrect information supplied by the contractor.
- e. External impact or natural hazard except where the design specification includes protection against such hazard.
- f. Operation outside agreed limitations as described in the specification and contract.
- g. Minor faults or defects, taking less than (eg 5) minutes to rectify, to an agreed exclusion list. The exclusion list shall be published by the Project Manager or Demonstration Coordinator together with any resultant modification to the requirements specified in para 21 of this Directive.
- h. Scheduled maintenance. However faults or defects found during scheduled maintenance shall be attributable unless excluded elsewhere.

i. Replacement of lifed items operated beyond their agreed life recommendation or limit.

k. Faults or defects which are rectified by adjustment shall be attributable unless excluded elsewhere. Subsequent adjustments necessary to achieve successful operation are not attributable.

l. Faults or defects identified prior to the commencement of the demonstration, or during operation of the equipment outside the demonstration (para 27), and recorded as "acceptable to be deferred for rectification", shall not be attributable. Similar recording of an "acceptable deferred defect or fault" during the demonstration but not able to be rectified during the demonstration period will be recorded as attributable unless it can be proved to be excluded.

**31.** The user may, for operational reasons, require to fit temporary modifications which may not be fleet embodied or to an agreed or approved standard. These modifications will not invalidate the demonstration. However, the extent of the effect of these modifications on the reliability of the equipment is to be assessed by the assessment team and any fault or defect arising on the modified items or caused by them are to be discounted.

#### MAINTAINABILITY DEMONSTRATION

**32.** The Maintainability Demonstration details may be specified at this point in the Directive if the demonstration of maintainability is part of the contract. The detail of the content of these paragraphs is contained in Annex B to Part 2 of Defence Standard 00-43 (which will be issued after Part 1).

**NOTE:** Paragraphs 32-52 reserved for use if necessary.

#### GENERAL RECORDING

53. Details of all the incidents, attributable or not, that occur during the demonstration shall be recorded on MOD Forms X, Y and Z. Copies of the forms shall be taken and retained by the assessment team. The forms required are included at Annexes.

54. Identifying details of each form and subsequent investigations, including the following, shall be entered on the computer database:

- a. Equipment reference number.
- b. Running hours or usage, eg hours, distance, rounds fired etc.
- c. Climatic or environmental conditions.
- d. Description of fault or defect.
- e. Effect on mission.
- f. Action taken.
- g. System identification.

- h. Part No and Serial No of removed or replaced item(s).
- i. Elapsed time data if applicable for removed and refitted component.
- j. Man-hours recorded for repair (maintainability reasons).
- k. Man-hours, if amended for demonstration purposes (maintainability reasons).
- l. Results of further investigation.
- m. Decisions on sentencing: attributable, non-attributable, pending further investigation, modification discount (non-attributable), attributable (modification pending), transferred to deferred log.
- n. Narrative justification for sentencing decision.
- o. Other information.
- p. Cross-reference to other related documents or equipments.
- q. Activity or operation code.

55. Entries in the demonstration computer database against items k, l, m and n above shall not be erased but new information may be added.

56. Total equipment operating hours for the demonstration population are to be recorded on the database daily.

#### SENTENCING

57. All faults and defects are to be assessed by the assessment team. Using the definitions and exclusions given in this Directive together with any prescribed publications such as JSP . . . . , the team using its best judgement will sentence each incident as being "attributable", "non-attributable" or defer sentencing as "pending further investigation" or "transferred to deferred log". In long demonstrations, modifications may have to be allowed in some circumstances and will need information in the Directive. Faults or defects which are otherwise attributable but have a modification embodied which is agreed to prevent such faults or defects, shall be sentenced as "modification discount (non-attributable)". Sentencing must be a continuous activity. Faults or defects against which an unproven modification is pending but which are otherwise attributable will remain so until their effectiveness and integration is confirmed, agreed and costs of embodiment apportioned. For administrative purposes they may be grouped together as "attributable modification pending".

58. Where unanimous agreement cannot be reached between assessment team members, the appropriate details will be considered for arbitration by the MOD Project Manager and the contractor's project support manager.

59. If, notwithstanding the definitions, exclusions and procedures contained in the Directive, other arisings occur which need additional interpretation, then clarification shall be published under the joint signature of the MOD PE Project Manager and the contractor's project support manager. This clarification will then be applied to the Demonstration as though contained in this Directive.

60. Any incident sentenced as "pending" or "transferred" shall be resolved by [one month] after the end of the demonstration as "attributable" or "non-attributable" based on the best evidence available at that time. In the absence of any contradictory evidence, all such arisings shall be sentenced as "attributable".

#### MODIFICATIONS

61. **In general modifications during the demonstrations are not to be allowed (Section 4, para 15 of this Defence Standard). For long demonstrations where modifications are allowed, a clarification statement might be included here. For instance** - the contract allows modifications to be proposed and, subject to agreement by the MOD(PE) Project Manager, embodied to improve the maintainability and thereby achieve reductions in in-Service costs and improvement in operational availability. However, agreement and embodiment of such modifications will be allowed only in well justified circumstances and will require clear proof of effectiveness to the MOD(PE) Project Manager's satisfaction and agreement on apportionment of the funding of embodiment costs.

62. Previous occurrences of failures may be discounted from the demonstration after the efficacy of the modifications is proven to the satisfaction of the MOD(PE) Project Manager. Such proof will include a significant period (include definition of period if possible) of in-Service operation. If this cannot be achieved within the specified demonstration period then the period may be extended at no cost to the MOD, as necessary for the equipment concerned.

63. Modifications which significantly reduce (**include definition if possible**) the occurrence without totally eliminating the fault or defect, shall, when proven to the satisfaction of the MOD(PE) Project Manager or demonstration coordinator, have an amended fault or defect rate applied as if applying to the whole demonstration period.

64. Modifications, including those to publications, tools and support equipment which improve maintainability may similarly have the maintenance effort of previous arisings re-assessed. A revised man-hour rate (etc) will be agreed and retrospectively applied.

65. Any modifications accepted by the MOD(PE) Project Manager shall be incorporated at no cost to the MOD into all equipment supplied under the contract and, where appropriate, into all spares holdings, publications, tools and support equipment.

66. Other Modifications. **Any modifications embodied for safety or operational reasons should be noted as being essential.** However the effect of these modifications on the R&M Demonstration results shall be assessed and, if required by the MOD(PE) and contractor, an adjustment may be made to the R&M results.

COMPONENT HANDLING

67. All unserviceable components removed from the equipment shall be returned to a dedicated store. This shall apply to all items including small, normally disposable items.

68. All unserviceable equipment needs to be identified according to specified practical Service arrangements. Labels should be affixed and over stamped with "Equipment ABC Reliability Demonstration". The label must be affixed to the component at all times. A copy of the label shall be provided and retained by the assessment team. Any special reporting forms (eg for serious defects) are to be similarly over stamped.

69. Components within the Augmented Logistic Support (ALS) System. For equipments subjects to ALS, the central store is to be detailed as responsible for coordination and tracking of investigations on defective components. The assessment team is to monitor closely the components passing into the ALS store in order to reach agreement on diagnosis. Items classified by the ALS store filter as defective or requiring further investigation shall be considered defective pending any contradictory evidence provided by the contractor.

70. Components not subject to ALS Repair. All components are to be returned to the ALS store for record purposes. The assessment team shall, for components not subject to ALS repair, monitor and track their progress to different levels of repair. Any special handling methods to effect this are to be specified here together with the need for copies of paperwork to be provided to the assessment team.

TRAINING

71. **Training for the assessment team members must be specified here together with training needs to have been effected well in advance of the start of the demonstration.**

72. **Any need for the contractor to provide an equipment and/or a training course for members of the team must be specified. Special requirements for the course such as training on all systems and fault diagnosis should be specified.**

73. The MOD(PE) Project Manager shall arrange a course for the demonstration team in basic reliability theory and techniques.

74. **The MOD(PE) Project Manager shall arrange other relevant courses specified here (eg computer courses).**

75. **Funding and arrangements for payment for specified training will be noted.**

REVIEW MEETINGS

76. Regular Review Meetings shall be held by the MOD(PE) Project Manager and attended by the assessment team, the host unit, the service equipment manager, the contractor (and others as specified here). **Frequency and place should be noted together with noting the MOD(PE) Project Manager's responsibility to chair and provide a secretary for the meeting.**

77. The Review Meeting will review progress of the demonstration and, in particular, shall consider any incidents with disputed or unclear sentencing together with any modification proposals with R&M implications.

#### REPORTS

78. Regular reports shall be prepared and published by the assessment team throughout the demonstration and preliminary activities. **Frequency and timing of reports should be specified together with their content. A listing may be given here of subjects to be covered.** For instance:

- a. A summary of all incidents giving the sentencing classification and rectification man-hours.
- b. Current values of achieved R&M using the data so far collected and quoted against the requirement originally specified.
- c. Details and proposed solutions to any observed problems.
- d. Plan of future activity.
- e. Summary of any other team activity.

79. A final report shall be published within (X) months of the end of the demonstration. The report is submitted and received by the MOD(PE) Project Manager and the contractor and be used as a basis for agreement of contractual compliance.

80. The MOD(PE) Project Manager will publish a Demonstration Review, drawing as necessary on the Final Team Report, the experience of all participants and any related activities. Strengths and weaknesses will be covered by way of recommendations to future projects and central staffs. **The review shall have no contractual significance but a timescale for publication should be noted.**

#### SUMMARY

81. It may be useful to provide a short summary of the most important points of the arrangements for the demonstration. For example, where, when and how, and noting the final report which will form the basis for evidence of contractual compliance. A summary of the likely remedies, in the event of failing the demonstration, should be included (cross-reference should be made to the appropriate clause in the contract).

Type of Information to be Recorded During an ISRD

**C.1** Different equipments and types of ISRD will have differing needs for data to be recorded.

**C.2** Each piece of equipment being demonstrated should be allocated its own computer file. Basic historic and reference information on each equipment will be required as follows:

- (a) serial numbers and identifiers;
- (b) maintenance and servicing records to date;
- (c) usage and counts already achieved;
- (d) relevant modification state.

**C.3** For each demonstrated mission, battlefield day or operating session the following types of information may be required:

- (a) battlefield day serial number, mission profile and type or designation of session;
- (b) role or programme;
- (c) duration;
- (d) climatic and environmental conditions;
- (e) reported faults found between mission or since last part of demonstration;
- (f) details of those faults not confirmed.

**C.4** For all faults found during the demonstration, comprehensive data will be required. Examples of the type of information likely to be required by the assessment team, which will allow them to properly collate the results, are as follows:

- (a) originator reference number or serial number of work;
- (b) date and time;
- (c) equipment serial number;
- (d) usage;
- (e) reported symptom of fault;
- (f) affected system;
- (g) faulty item description if known;
- (h) faulty item part number and serial number;

**C.4** (Contd)

- (i) faulty item elapsed time indicator (ETI) reading or usage meter;
- (j) replacement item part number and serial number;
- (k) replacement ETI or usage meter reading;
- (l) installed position/zone/circuit reference;
- (m) fault details;
- (n) when/how found;
- (o) mission effect or effect on system;
- (p) safety effect;
- (q) other information as specified by the demonstration coordinator.



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The following Defence Standard file reference relates to the work on this Standard D/D Stan/350/02/12.

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