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**RELIABILITY AND MAINTAINABILITY
DATA COLLECTION AND CLASSIFICATION**

**PART 2: DATA CLASSIFICATION AND
INCIDENT SENTENCING - GENERAL**

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Revision Note

Defence Standard 05-63/Issue 1, dated 18 October 1984, "Guidelines for Classifying Incidents for Reliability Estimation of Tracked and Wheeled Vehicles" and Defence Standard 05-59/Issue 2, dated 29 November 1985, "Maintenance Data and Defect Reporting in the Royal Navy, the Army and the Royal Air Force" are collectively revised in Defence Standard 00-44. This Part of the Standard addresses data classification and incident sentencing in general.

Historical Record

Arrangement of Defence Standard 00-44

- 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
- Part 3 - Incident Sentencing - Sea
- Part 4 - Incident Sentencing - Land
- Part 5 - Incident Sentencing - Air

RELIABILITY AND MAINTAINABILITY

DATA COLLECTION AND CLASSIFICATION

PART 2: DATA CLASSIFICATION AND INCIDENT SENTENCING - GENERAL

PREFACE

i This Standard describes MOD practices and procedures for Reliability and Maintainability (R&M) data collection and classification in the three Services.

ii This Part of the Standard addresses data classification and incident sentencing in general, both within the MOD and/or MOD contracts.

iii This Part of the Standard has been prepared by the Committee for Defence Equipment Reliability and Maintainability (CODERM) Techniques Subcommittee Working Group-2. It reflects the conclusions of consultations among various authorities within the MOD and within industry.

iv 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.

v 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.

vi 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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PART 2: DATA CLASSIFICATION AND INCIDENT SENTENCING - GENERAL

0 Introduction

0.1 In the procurement and Service use of Defence equipment emphasis is placed on the specification and achievement of optimum R&M in order to realize better availability and reduced life cycle costs. An important element in procurement programmes and Service use is the assessment of achieved R&M; both to monitor progress, and for contractual purposes.

0.2 Equipments are rarely used in isolation, and it is often necessary to directly compare, or use, data from more than one equipment and/or source. Consequently, it is desirable that a common method of data classification is used. Of equal importance is the need to use a viable system that can be contractually enforced.

0.3 Data classification is the process by which incident data are sorted into different categories, (eg cause, significance, maintenance requirement, etc) applicable to the R&M parameters being assessed. This is achieved by first sentencing the raw incident data according to formal rules and then sorting the sentenced incident data into the required classifications. Incident sentencing is a sub-activity of data classification and both are described in this Part of the Standard.

1 Scope

1.1 This Part of the Standard describes, in general, the common aspects of data classification and incident sentencing to be used within the MOD and on MOD contracts.

1.2 Some guidance is given on the data reporting necessary to support data classification and incident sentencing. The classifications (categories) noted in Def Stan 00-40 (Part 1) are defined.

1.3 Guidance is given on incident sentencing and the use of a summary code. The role of the Incident Sentencing Committee (ISC) within the R&M Panel system is described.

1.4 Where standard methods for incident sentencing have been adopted they are detailed in relevant Parts of the Standard and are available to the Directorate General Defence Contracts (DGDC) and other MOD departments. This Part of the Standard can thus be used in contracting for R&M.

2 Related Documents

2.1 The following publications are referred to in this Standard:

Def Stan 00-40 (Part 1) (ARMP-1)
"Achievement of Reliability and Maintainability
Part 1: Management Responsibilities and Requirements for R&M Programmes and Plans"

Def Stan 00-40 (Part 2) (ARMP-2)
"Reliability and Maintainability
Part 2: General Application Guidance on the Use of Part 1 (ARMP-1)" This will be useful to contractors, and others, in interpretation of Def Stan 00-40 (Part 1) (ARMP-1).

2.1 (Contd)

Def Stan 00-44 (Part 1)

"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"

2.2 Reference in this Part of the Standard to any related document means the edition and all amendments current at the date on which the reference is made to this Part of the Standard, unless a specific edition is indicated.

2.3 Def Stans noted at **2.1** can be obtained from:

The Directorate of Standardization
Stan 1
Kentigern House
65 Brown Street
GLASGOW G2 8EX

3 Definitions

3.1 A glossary of some important terms used in this document is contained in annex A.

4 Data Reporting

4.1 The information needed for data classification is provided through the use of an R&M data recording system that should record all usage and incident data. The methods by which these data are to be collected need to be fully defined before data collection commences.

4.2 During any test or trial, whether procurement or in-Service, care should be taken to ensure that adequate R&M data are collected. For R&M assessment there are two main types of data required:

(a) usage data;

(b) incident data, which provides information on all occurrences and observations which arise during a reporting period.

Each of these types of data comprise a variety of individual data elements which need to be recorded to support R&M assessment tasks, including incident sentencing.

4.3 As data collection can be a tedious and difficult task, reporting forms should be kept simple and unambiguous, and the use of tape recorders, automatic data capture methods, elapsed time indicators (ETIs), etc are recommended where they can be shown to be cost effective.

4.4 The scope of incident data recording will vary with the requirements of a project. Incident data reporting is not confined to the identification of faults and failures which affect the ability of equipment to perform or be operated satisfactorily. Other events, such as observed deterioration, may also be reported as incidents as well as actions, such as modifications, scheduled maintenance and the repair/replacement of faulty items. Each incident shall be uniquely identified by a separate database entry and a unique reference, usually a number.

4.5 R&M data recording systems include, but are not limited to a Data Reporting, Analysis and Corrective Action System (see Def Stan 00-40 (Part 1) - DRACAS). Def Stan 00-44 (Part 1) describes the data reporting methods used by the three Services and these should be used for in-Service R&M programmes. If further data are required, it may be necessary to impose additional data reporting systems.

5 Data Classification

5.1 Data classification is a general term used to describe the process by which incidents are examined and classified for the purpose of R&M assessment. It is performed to quantify R&M from the recorded data in accordance with defined criteria such as those set out in an R&M plan. R&M assessment is a separate and subsequent exercise from data classification.

5.2 Def Stan 00-40 (Part 1) calls for incidents to be classified under four main headings listed below:

- (a) cause;
- (b) significance (criticality);

NOTE: To avoid confusion with definitions used elsewhere the term "significance" is used in this Standard in place of "criticality".

- (c) frequency;
- (d) chargeability.

However, other classifications could be more appropriate to particular projects and should be agreed before the R&M programme commences.

5.2.1 Cause. In all phases of a project it is essential that every effort is made to establish the exact cause of an incident, and that all data relating to the incident are recorded. It is only by the thorough investigation of an incident that problems can be highlighted and the necessary corrective action taken. Typical failure causes are listed below - this list is not exhaustive:

- (a) inadequacy of design;
- (b) quality of manufacture;
- (c) inadequate procedures;
- (d) no fault found;
- (e) human error (operator or maintainer);
- (f) secondary failure.

5.2.2 Significance. The effect that an incident has upon the performance of equipment determines its significance. The two most important categories of significance are mission and basic failures. An incident that prevents an equipment from performing one or more of its mission essential functions may be categorised as a mission failure. An incident

5.2.2 (Contd)

that requires corrective maintenance may fall into the category of basic failure. Generally, mission failures are also counted as basic failures. The criteria for establishing significance should be defined before data recording commences.

5.2.3 Frequency. It is the frequency with which failures occur that is used to establish failure rates, to assess reliability growth and to establish reliability levels. To do this each incident needs to be uniquely recorded in such a manner that an accurate count of failures can be made. Care should be taken to ensure that individual failures are not counted more than once as a result of related incidents, eg repair. It should be noted that in this context frequency means the sum of all failures of an item not the sum of the failure modes.

5.2.4 Chargeability. This is primarily concerned with establishing which incidents are attributable to aspects of the project for which the contractor is responsible. This includes all aspects of design, manufacture, operation and maintenance of items produced by the contractor including contractor furnished equipment (CFE). A contractor would not normally be responsible for purchaser supplied equipment (PSE), excepting interfaces and any detrimental effect that installation has on R&M of the PSE. The criteria for establishing chargeability should be defined before data recording commences.

6 Incident Sentencing

6.1 R&M programmes generate large amounts of data which require quick and accurate assessment. The process is simplified by dividing it into two stages, the first being to sort the raw incident data according to formal sentencing rules, and the second to classify the sentenced incident data into the required categories for R&M assessment.

6.2 Incident sentencing involves the allocation of a summary coding to all recorded incidents using a formal procedure. The sentence summarizes the incident according to defined rules and failure criteria which are derived from the Staff Requirement (SR). A detailed explanation of the methods used in the three Branches of the MOD are given in subsequent Parts of this Standard.

6.3 For other purposes such as project management, either for the contractor or the purchaser, it may be desirable to summarize additional data and this can be done with additional codes. To avoid confusion, these additional codes should be kept separate.

6.4 The advantages of using codes to summarize incident data are:

- (a) the implications of the incident are determined by addressing clearly defined questions;
- (b) codings are impartial, ensuring the database is non-selective;
- (c) by using a formal system, reasons for classification can be traced;
- (d) use of a formal system ensures standardization which permits the use of results from different tests and sources;

6.4 (Contd)

(e) allows many classifications to be made by sorting combinations of the summary code.

6.5 Once incidents have been sentenced they can be readily classified by further sorting against more specific questions.

7 Incident Sentencing Procedure

7.1 The sentencing of incidents is a relatively simple matter where the considerations are entirely objective, but becomes more complex where subjective judgments have to be made. Incident sentencing is typically completed in two stages, primary and formal. Primary sentencing is usually undertaken by the data collection authority and involves the preliminary allocation of an incident sentencing code at the same time as the data is incorporated into the equipment/project database. This primary sentence, assigned by the data collection authority, does not constitute an authoritative codification because it is based solely on the judgement of an individual and, usually, on incomplete information. Formal sentencing is normally carried out by the Incident Sentencing Committee (ISC) see clause 8. Nevertheless, the allocation of a primary sentence to all incidents is a useful expedient for reducing discussion on routine incidents where the sentencing code is clear, and is a useful start to discussion enabling the ISC to concentrate on matters where the coding is unclear or contentious.

7.2 Precedence. As a project develops it will become apparent that certain incidents will, if the sentencing is consistent, always be ascribed a common coding. It is good practice to keep a list of these codings as a Precedence List. This will make for quick and consistent coding at the ISC, although care needs to be exercised to ensure that the precedent is relevant to the incident in question.

8 Incident Sentencing Committee (ISC)

8.1 Where the assessed reliability has contractual implications an ISC is the most effective method of sentencing incidents. Ultimate responsibility for data classification and incident sentencing lies with the MOD Project Manager, who generally delegates it to the R&M Panel and thence to the ISC. The ISC should be a multi-disciplinary team (eg design, maintenance, operations, quality) and should include representatives from the prime contractor, the design authority, MOD project management, reliability advisers and the user. The exact composition of an ISC will vary, but it is vital to ensure that adequate expertise is available to enable informed discussion and thereby to ensure that incidents are correctly sentenced.

8.2 The prime function of an ISC is to examine and sentence all incidents. The ISC may also revise previously sentenced incidents in response to new information; in part the committee does this by instigating investigations into the causes of failures and progressing these investigations to a conclusion. The composition and terms of reference of an ISC should be agreed at the beginning of a project and specified in the R&M plan. Once incidents have been formally sentenced, the sentence can only be changed by the ISC and/or the R&M Panel.

8.3 ISC meetings should be an open forum for discussion of all facts relating to the incidents being sentenced, and should invite contributions from all members. The Chairman of the ISC shall, normally, be a member of the MOD project management team. Sentencing is facilitated by observing the following:

(a) the ISC should have adequate representation and authority, and contain adequate technical expertise;

(b) the sentencing procedures should be familiar to and understood by all members of the ISC.

8.3.1 Formal voting is not used in incident sentencing. Where a consensus cannot be reached then sentencing may be deferred if further investigation is required. If a consensus still cannot be reached then the incident should be sentenced by the Chairman; and the MOD PE Project Manager shall be advised accordingly.

8.3.2 Referring incidents to the R&M Panel, for sentencing, is not recommended and should be rarely used. In general, the ISC is better fitted to sentence incidents.

8.3.3 Incidents that have been sentenced by the ISC are submitted to the R&M Panel for ratification.

Definitions

A.1 For the purpose of this Defence Standard the following definitions apply:

A.2 Incident

The term "incident" used in the context of this Standard relates to each database entry reported on the R&M data recording system regardless of the nature of the record. Comments and maintenance actions, for example, are referred to as incidents in the same way as equipment faults or failures. This wider usage of the word "incident" should not be confused with terms defined elsewhere.

A.3 Observation

Technical observations from "hands-on" personnel are used for keeping a record of problems which are not faults or failures in their own right. An item, for example, may be superficially degraded but still fully capable of operating satisfactorily. These records are useful in anticipating failures from progressive, worsening fault conditions. The observation of a degraded condition may initiate a design review, even though a failure has not arisen.

A.4 Test or Trial

The term test or trial is used to denote any exercise used to provide data for the estimation of equipment R&M. Examples include, but are not limited to, development trials, performance tests and in-Service reliability demonstrations (ISRDS).

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The following Defence Standard file reference relates to the work on this Standard - D/D Stan 350/03/12.

Contract requirements

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

Revision of Defence Standard

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.