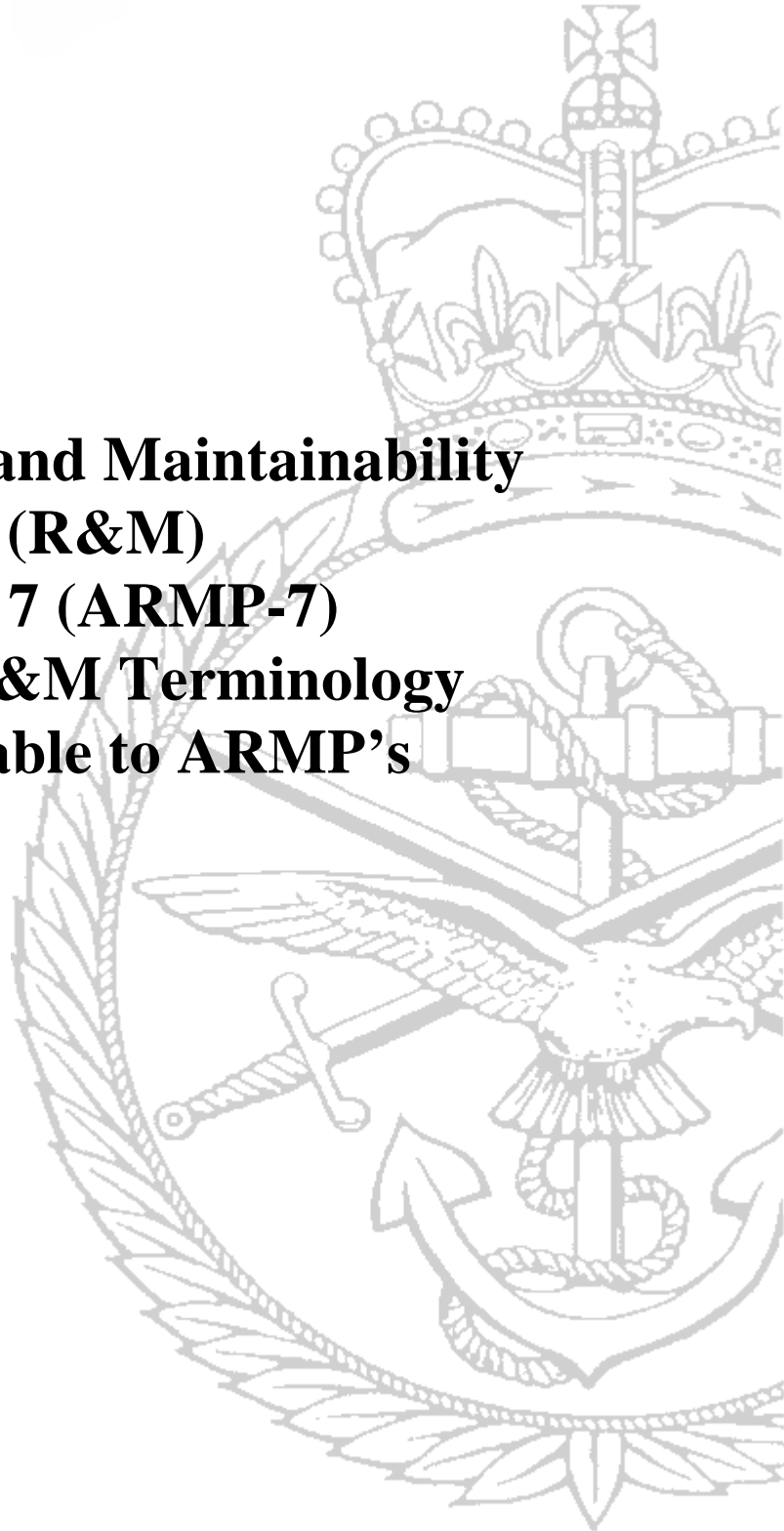




Ministry of Defence Defence Standard 00-40

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Reliability and Maintainability (R&M) Part 7 (ARMP-7) NATO R&M Terminology Applicable to ARMP's



AMENDMENT RECORD

Amd No	Date	Text Affected	Signature and Date

REVISION NOTE

This standard is raised to Issue 1 to update its content.

HISTORICAL RECORD

Arrangement Of Defence Standard 00-40

Part 1 - Management Responsibilities and Requirements for Programmes and Plans

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

Part 6 - In-Service R&M

Part 7 - NATO R&M Terminology Applicable to ARMPs

PREFACE

Reliability Maintainability

NATO R&M Terminology Applicable to ARMPs

- a.** This Part of the Defence Standard states explicitly the exact meaning of the Reliability and Maintainability (R&M) terminology used by NATO in the Allied R&M Publications (ARMPs).
- b.** Defence Standard 00-49 indicates that ARMP-7 is the preferred source document for definitions of R&M Terminology. As this Part of the Defence Standard contains ARMP-7 it is to be regarded as the preferred source document for Definitions of R&M Terminology.
- c.** This Standard has been agreed by the authorities concerned with its use and is intended to be used 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 (DStan) shall be informed so that a remedy may be sought.
- d.** 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 or contract.
- e.** Compliance with this Defence Standard shall not in itself relieve any person from any legal obligations imposed upon them.
- f.** This Part of the Defence Standard includes ‘Allied Reliability and Maintainability Publication – 7’ (ARMP-7).

TEXT

Reliability Maintainability

NATO R&M Terminology Applicable to ARMPs

0 INTRODUCTION

The MOD considers the term ‘Reliability and Maintainability’ (R&M) to be generic and interprets it to encompass related specific concepts such as availability, supportability, testability etc.

In accordance with the mandated hierarchy of Standards this Part of the Defence Standard is the preferred source document for definitions of R&M Terminology. Where a required term is not defined in this part of the Defence Standard reference should then be made to Defence Standard 00-49

1 SCOPE

This part of the Defence Standard addresses only those R&M terms that are referred to in the ARMPs.

2 WARNING

The Ministry of Defence (MOD), like its contractors, is subject to both United Kingdom and European laws regarding Health and Safety at work, without exemption. All Defence Standards either directly or indirectly invoke the use of processes and procedures that could be injurious to health if adequate precautions are not taken. Defence Standards or their use in no way absolves users from complying with statutory and legal requirements relating to Health and Safety at work.

3 RELATED DOCUMENTS

3.1 The following documents and publications are referred to in the text of this Standard :

Defence Standard 00-49	MOD Guide to terminology definitions
STANAG 4174	Allied Reliability and Maintainability Publications
AAP-6	NATO Glossary of Terms and Definitions
ISO 8402-1994	International Organization for Standardisation (ISO) No 8402
	Quality Management and Quality Assurance - Vocabulary
IEC-50(191)	Glossary of International Terms

3.2 Reference in this 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.

3.3 In consideration of **3.2** above, users shall be fully aware of the issue and amendment status of all related documents, particularly when forming part of an invitation to tender or contract. Responsibility for the correct application of Standards rests with the user.

3.4 DStan can advise regarding where related documents are obtained from. Requests for such information can be made to the DStan Helpdesk. How to contact the helpdesk is shown on the outside rear cover of Def Stans.

4 DEFINITIONS

Relevant definitions are contained in ARMP-7 which is attached to this Part of the Standard.

4.1 APPLICATION

This part of the Standard and in particular the ARMP-7 Appendix A of this Part of the Standard shall be used for Definition of R&M Terminology.

NATO/PFP UNCLASSIFIED

ORIGINAL: ENGLISH/FRENCH

6th March 2001

DEF STAN 00-40 (PART 7)
DOCUMENT

PFP(CPG/QA)D(98)5
LIMITED

DISTRIBUTION

Silence procedure ends:
3 December 1998

GROUP OF NATIONAL DIRECTORS FOR QUALITY ASSURANCE
CNAD PARTNERSHIP GROUP (CPG)

ARMP-7 EDITION 1
NATO R&M TERMINOLOGY APPLICABLE TO ARMPs

- References: 1. PFP(CPG/QA-SG/B)DS(98)1, paragraph 6(2)
2. PFP(CPG/QA)DS(98)1, paragraph 6(1)d

Note by the International Staff

1. Following agreement by Sub-Group B on Quality Programme Methodology Implementation and Documentation (Reference 1), ARMP-7 Edition 1 on NATO R&M Terminology Applicable to ARMPs is forwarded to Heads of Delegation of the NATO members of AC/250/CPG (in English and French) for approval under a silence procedure ending on **3 December 1998**.

2. Unless the Secretary of AC/250/CPG, Defence Support Division, International Staff, hears to the contrary by close of business on 3 December 1998, ARMP-7 Edition 1 will be deemed to have been approved and will be forwarded for ratification and publication.

3. Under cover of this Document, copies have also been provided to Heads of Delegation of AC/250/CPG Partner participants for information purposes.

(Signed) D. Phaetos

ANNEX: Draft ARMP-7 Ed.1 (English and French)

NATO UNCLASSIFIED

ARMP-7

Edition 1

**ALLIED
RELIABILITY AND
MAINTAINABILITY
PUBLICATION**

**NATO R&M
TERMINOLOGY APPLICABLE TO
ARMPs**

MARCH 2001

NORTH ATLANTIC TREATY ORGANISATION
MILITARY AGENCY FOR STANDARDISATION (MAS)

NATO LETTER OF PROMULGATION

December 1998

1. ARMP-7 (Edition 1) "NATO R&M TERMINOLOGY APPLICABLE TO ARMPs" is a NATO UNCLASSIFIED publication. The agreement of interested nations to use this publication is recorded in STANAG 4174.
2. ARMP-7 (Edition 1) is effective on receipt.
3. It is permissible to distribute copies of this publication to Contractors and Suppliers and such distribution is encouraged.

A. GRONHEIM
Major General, NOAF
Chairman MAS

RECORD OF CHANGES

Change date	Date entered	Effective date	By whom entered

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PREFACE

1. This glossary is compiled by direction of the Group of National Directors for Quality Assurance in accordance with Part 1 of AAP-6 NATO Glossary of Terms & Definitions - Policy & Procedures for the NATO Terminology Standardisation Programme. This glossary is not exhaustive. It is not designed to compete with any existing Reliability and Maintainability (R&M) glossary of terms, as it is only relevant to terms included in Allied Reliability and Maintainability Publications (ARMPs) which are not explicitly defined in those documents. In addition, where the terms in this glossary differ from NATO-agreed terms, they are to be considered for ARMP use only. Its purpose is to explain specialist terms in the ARMPs, thereby promoting mutual understanding.

2. The use of ISO 8402-1994 and IEC-50(191) terms has been approved by the appropriate organisations.

3. This glossary is intended for incorporation, by reference, into contracts.

4. The glossary is published in the two official languages of NATO: English and French.

5. The Concise Oxford Dictionary (New Edition) is the reference source for English in ARMP-7. Le Petit Robert, Dictionnaire alphabétique et analogique de la langue française (New Edition) is the reference source for French in ARMP-7.

6. The source of the definition is indicated by enclosing the short title of the source in parentheses, following the definition, e.g. **Reliability/Fiabilité**. The ability of an item to perform a required function under stated conditions for a specified period of time (**AAP-6**). Where a term, used in a definition, is defined elsewhere in ARMP-7, then the term is highlighted in **bold type**. The detailed titles of the sources quoted in this publication are compiled at Annex A.

7. Proposals for new terms and definitions or changes to or deletion of existing terms and definitions are to be made in accordance with paragraph 5 Part 1 of AAP-6(V).

8. All suggestions and inquiries concerning this glossary should be directed to the:

NATO Secretary
Armaments Planning, Programmes & Policy Directorate
Defence Support Division
NATO HQ, 1110 Brussels, Belgium.

NATO TERMINOLOGY

Accept Criteria/Critères d'acceptation

The limits for R&M parameters which will lead to an acceptance of tested items if the values measured during an R&M demonstration are within prescribed limits.

Accessibility/Accessibilité

A measure of the relative ease of admission to the various areas of an item for the purpose of operation or **maintenance**.

Adjustment/Ajustement - Réglage

Changing (by electronic, electrical or physical means) a variable in an item to cause a change in its output characteristics.

Administrative Delay Time/Délai administratif

Administrative Delay: The accumulated time during which an action of corrective **maintenance** on a faulty item is not performed due to administrative reasons. (IEC-50(191))

Alert Time/Temps d'alerte

That element of **up-time** during which an item is assumed to be in specified operating conditions, and is awaiting a command to perform its intended mission.

Availability/Disponibilité

The ability of an item to be in a state to perform a required function under given conditions at a given instant of time or over a given time interval, assuming that the required external resources are provided. (IEC-50(191))

Basic Reliability/Fiabilité de base

The ability of an item to perform its required functions without **failure** or **defect** for the duration of its **life profile**.

NOTE: **Reliability** is deemed to include **Durability** (defined below).

Built-In-Test (BIT)/Autotest

An integral capability of the equipment which provides an on-board test capability to detect, diagnose, or isolate system **failures**. The **fault** detection and, possibly, isolation capability is used for periodic or continuous monitoring of a system's operational health, and for observation and, possibly, diagnosis as a prelude to **maintenance** action.

Built-in Test Equipment (BITE)/Équipement de test intégré

Any device permanently mounted in the equipment and used for the express purpose of testing the equipment, either independently or in association with external test equipment.

Burn-In /Rodage

The operation of an item to stabilise its characteristics. Basically, a **reliability** conditioning procedure which is a method of ageing an item by operating it under specified environmental and test conditions in accordance with an established procedure in order to eliminate early **failures** and age or stabilise the item prior to final test and shipment.

CALS/CALS

An acronym for Continuous Acquisition and Life Cycle Support, previously the acronym stood for Computer-aided Acquisition and Logistic Support. It is an effort to document and utilise technical information, in a digitised format, for weapon system acquisition, design, manufacturing and support. Its intent is to accrue to military services the benefits available from digital technology.

Common(Critical)Failure Mode/Mode commun de défaillance (critique)

Failures of distinct components caused by an initiating event.

Concurrent Engineering/Ingénierie concourante

A systematic approach to the integrated, concurrent design of products and their related processes, including manufacture and support. This approach is intended to cause the developers, from the outset, to consider all elements of the product life cycle from conception through disposal, including **quality**, cost, schedule and user requirements.

Confidence Level/Niveau de confidence

That probability that a given statement is true. The statement in question normally refers to whether a given parameter lies between two limits, is above a lower limit, or is below an upper limit.

Configuration Control/Contrôle de la configuration

The establishment of an agreed build standard for an item and the procedure for controlling change to that standard, in order that it may be defined at any time.

Consumer's Risk/Risque client

The probability of accepting equipment with a true **mean time between failure** (MTBF) equal to the lower test MTBF. The probability of accepting equipment with a true MTBF less than the lower test MTBF will be less than the **consumer's risk**.

Contractor Data Requirements List/Liste des données contractuelles

A contractual term which refers to all the written documents (i.e. reports, drawings, procedures, data) which a contractor is obligated, under the contract, to provide to the procuring activity. This is over and above any hardware or services which the contractor may be also obligated to provide.

Corrective Action/Mesures correctives

Action taken to eliminate the causes of an existing non conformity, **defect** or other undesirable situation in order to prevent recurrence. (ISO 8402/1994)

Corrective Maintenance (See Corrective Maintenance Time)/Maintenance Corrective (Voir Temps de Maintenance Corrective)

Maintenance actions carried out to restore a defective item to a specified condition. (AAP-6)

Corrective Maintenance Time (See Corrective Maintenance)/Temps de maintenance corrective (Voir maintenance corrective)

That part of the **maintenance** time including that due to **logistic delays**, during which corrective **maintenance** is performed on an item. (BS 4778)

Critical Failure/Défaillance critique

A **failure** that could result in injury to persons or that prevents an item from performing an essential mission.

Critical Item/Entité critique

An item whose **failure** could result in a **critical failure** or that requires special effort during development/production.

NOTE: examples, that might be tailored for each contract, are listed below:

1. the failure of which would critically affect system safety, cause the system to become unavailable or unable to achieve mission objectives, or cause extensive/expensive maintenance and repair.
2. the **failure** of which would prevent the acquisition of data to evaluate system **safety, availability**, mission success, or need for **maintenance/repair**.

3. an item which has stringent performance requirement(s) in its intended application relative to state-of-the-art techniques for the item.
4. a **single point failure** which causes system **failure**.
5. an item which is stressed in excess of specified **derating** criteria.
6. an item which has a limitation which warrants controlled surveillance under specified conditions.
7. an item which is known to require special handling, transportation, storage, or test precautions.
8. an item which is difficult to produce or manufacture relative to state-of-the-art techniques.
9. an item which has exhibited an unsatisfactory operating history or which does not have sufficient history of its own to provide confidence in its **reliability**.
10. an item which has past history, nature, function or processing with a deficiency warranting a total traceability.
11. an item that can be produced by one company only.
12. long lead time items.

Defect/Défaut

Any non-conformance of an item with specified requirements, or a condition which experience indicates could result in a non-conformance.

Derating/Réduction des caractéristiques de fonctionnement (dégrèvement).

Using an item in such a way that applied stresses are below rated values.

Derating factor/Taux de réduction des caractéristiques de fonctionnement

Complement-to-1 of the quotient of actual stress to the rated stress value.

Diagnostics/Diagnostic

The detection, isolation and analysis of **faults** and **failures**.

Discrimination ratio/Taux de discrimination.

It is one of the standard test plan parameters, it is the ratio of the upper test MTBF to the lower test.
(MIL-HDBK-781)

Early Life Failures/Défaillances de jeunesse, Défaillances prématurées

Failures which occur in the early life of an item. The early life of an item is normally characterised as a period in which the **failure** rate of the item is considerably higher than that of the subsequent period. Such **failures** are usually amenable to removal by **burn-in** or **environmental stress screening**.

Environmental Stress Screening (ESS)/Déverminage

A series of tests conducted, at an early stage, under environmental stresses to disclose weak parts and workmanship **defects** for correction.

Failure/Défaillance

The inability of an item to perform within previously specified limits.

NOTE: Failures may be classified as to such aspects as cause, degree, relevancy, chargeability, dependency and responsibility.

Failure Analysis/Analyse de défaillance

The logical, systematic examination of a failed item to identify and analyse the **failure** mechanism, the **failure** cause and the consequences of **failure**. (IEC-50(191))

Failure Mode/Mode de défaillance

The consequences of the mechanism through which the **failure** occurs, ie short, open, fracture, excessive wear.

Failure Modes and Effects Analysis (FMEA)/Analyse des modes de défaillance et de leurs effets (AMDE)

A procedure by which each potential **failure mode** of a component, equipment or sub-system in a system is analysed to determine the results or effects thereof on the overall system and to classify each potential **failure mode** according to its severity.

Failure Modes, Effects & Criticality Analysis (FMECA)/Analyse des modes de défaillance de leurs effets et de leur criticité (AMDEC)

A qualitative method of **reliability** analysis which involves a **fault** modes and effects analysis together with a consideration of the probability of their occurrence and of the ranking of the seriousness of the **faults**. (IEC-50(191))

Failure Rate/Taux de défaillance

The number of **failures** of an item per unit measure of life, expressed in hours, cycles, kilometres, events as applicable to the item. (A-LP-001-000/AM-000)

Fault/Panne

The state of an item characterised by inability to perform a required function, excluding the inability during preventive **maintenance** or other planned actions, or due to lack of external resources.

NOTE: A fault is often the result of a **failure** of the item itself, but may exist without prior **failure**. (IEC-50(191))

Fault Tolerant/Tolérant aux pannes

Fault Tolerance: The attribute of an item that makes it able to perform a required function in the presence of certain given sub-item **faults**. (IEC-50(191))

Fault Tree Analysis (FTA)/Analyse par arbre de défaillance (AAD)

An **FTA** provides a diagrammatic means of showing the logical relationship between a particular system **failure mode** and the basic **failure** causes. (DEF STAN 00-41)

Human Engineering/Ergonomie

The area of human factors, which applies scientific knowledge to the design of items to achieve effective man-machine integration and utilization including operations, **maintenance**, support and disposal of the system.

Human Error/Erreur humaine

A human action that produces an unintended and unwanted result.

Inactive Time/Temps d'inaction

That time during which an item is in an inactive or non-operational inventory, i.e. it is being held in reserve for potential future assignment to the inventory of an operational unit.

NOTE: The distinction between **inactive time** and down time is that down time implies that the item is both on the inventory of an operational unit and dysfunctional, whereas **inactive time** would only mean that the item is not in an operational unit's inventory.

Incident/Incident

The initial indication of a possible **defect** or **failure**.

Infant Mortality (See Early Life Failure)/Mortalité infantile (Voir défaillance de jeunesse)

Inherent Maintainability/Maintenabilité intrinsèque

The **maintainability** potential present in a design, i.e. the **maintainability** which is dependent solely on the **quality** of design and assumes perfect **quality** of manufacture and correct use in the field.

Inherent Reliability/Fiabilité intrinsèque

The **reliability** potential present in a design, i.e. the **reliability** which is dependent solely on the **quality** of design and assumes perfect **quality** of manufacture and correct use in the field.

In-Service R&M Demonstration/Démonstration de F et M sur le terrain

A procedure to demonstrate the **reliability** and **maintainability** achieved by an equipment against the requirements specified in the contract using production standard equipment under agreed In-Service conditions.

Interchangeability/Interchangeabilité

A condition which exists when two or more items possess such functional and physical characteristics as to be equivalent in performance and **durability**, and are capable of being exchanged one for the other without alteration of the items themselves, or of adjoining items, except for adjustment, and without selection for fit and performance.

(AAP-6)

Intrinsic Availability/Disponibilité intrinsèque

The probability that the system/equipment is operating satisfactorily at any point in time when used under stated conditions, where the time considered is **operating time** and repair time (active).

Thus, **intrinsic availability** excludes from consideration all free time, storage time, **administrative delay time** and **logistic delay time**.

Intrinsic R&M (See Inherent Reliability and Inherent Maintainability)/F&M inhérentes (Voir Fiabilité intrinsèque et Maintenabilité intrinsèque)**Life Cycle Cost (LCC)/ Coût du cycle de vie du matériel**

The sum total of the direct, indirect, recurring, non-recurring and other related costs incurred, or estimated to be incurred, in the design, development, production, operations, **maintenance**, support and disposal of a major system over its anticipated useful life span.

Life Limited Item/Article à durée de vie limitée

An item that has a limited and predictable useful life and could be considered for replacement on a pre-planned basis for **reliability**, **safety** or economic reasons.

Life Profile/Profil de vie

A time-based description of the events and environments an item experiences from manufacture to final expenditures or removal from the operational inventory, to include one or more **mission profiles**.

Line of Maintenance/Ligne de maintenance

An echelon in an organisation where specified levels of **maintenance** are to be carried out on an item.

NOTES:

1. Examples of **maintenance** echelons are: field, repair shop, manufacturer.
2. The **maintenance** echelon is characterised by the skill of the personnel, the facilities available, the location etc.

Line Replaceable Unit (LRU)/Élément remplaçable sur place

A unit designated to be removed upon **failure** from a larger entity (equipment, system) in the operational environment.

Logistics /Logistique

The science of planning and carrying out the movement and **maintenance** of forces. In its most comprehensive sense, those aspects of military operations which deal with:

- a. design and development, acquisition, storage, movement, distribution, **maintenance**, evacuation and disposition of materiel;
- b. movement, evacuation and hospitalisation of personnel;
- c. acquisition or construction, **maintenance**, operation and disposition of facilities; and
- d. acquisition of furnishing of services. **(AAP-6)**

Logistic Delay Time/Délai Logistique

Logistic Delay: That accumulated time during which a **maintenance** action cannot be performed due to the necessity to acquire **maintenance** resources, excluding any administrative delay.

NOTE: Logistic delays can be due to, for example, travelling to unattended installations, pending arrival of spare parts, specialists, test equipment, information and suitable environmental conditions. **(IEC-50 (191))**

Logistic Support (See **Logistic Support Analysis**)/**Soutien logistique** (Voir **analyse de soutien logistique**)

Logistic Support Analysis (LSA)/Analyse de soutien logistique (ASL)

The selective application of scientific and engineering efforts undertaken during the acquisition process, as part of the system engineering process, to assist in:

- a. causing support considerations to influence design;
- b. defining support requirements that are related optimally to design and to each other;
- c. acquiring the required support;
- d. providing the required support during the operational phase at minimum cost.

During the later production and in-service phase LSA is conducted on a repetitive basis in order to meet life cycle costs, readiness and **supportability** objectives. **(ALP 10)**

Maintainability/Maintenabilité

The probability that a given **maintenance** action, for an item under given conditions of use, can be carried out within a stated time interval, when the **maintenance** is performed under stated conditions and using stated procedures and resources.

NOTE: The term "**maintainability**" is also used to denote the **maintainability** performance quantified by this probability. **(IEC-50 (191))**

Maintainability Demonstration (See also **Maintainability Verification**)/**Démonstration de la maintenabilité** (voir aussi **vérification de la maintenabilité**)

A **maintainability verification** performed as a compliance test. **(IEC-50 (191))**

Maintainability Model/Modèle de maintenabilité

A mathematical model used for prediction or estimation of **maintainability** performance measures of an item.

(IEC-50 (191))

Maintainability Prediction/Prévision de la maintenabilité, Prédiction de la maintenabilité

An activity performed with the intention of forecasting the numerical values of a **maintainability** performance measure of an item, taking into account the **maintainability** performance and **reliability** performance measures of its sub-items, under given operational and **maintenance** condition. **(IEC-50 (191))**

Maintainability Qualification Test (MQT)/Essai de qualification de la maintenabilité (EQM)

A compliance test carried out prior to the production phase to ensure that the design can accommodate the **maintainability** requirements.

Maintainability Verification/Vérification de la maintenabilité

A procedure applied for the purpose of determining whether the requirements for **maintainability** performance measures for an item have been achieved or not.

NOTE: The procedure may range from analysis of appropriate data to a **maintainability demonstration**. (IEC-50 (191))

Maintenance/Maintenance

1. All action taken to retain materiel in or to restore it to a specified condition. It includes inspection, testing, servicing, classification as to serviceability, repair, rebuilding and reclamation.
2. All supply and repair action taken to keep a force in condition to carry out its mission
3. The routine recurring work required to keep a facility (plant, building, structure, ground facility, utility system or other real property) in such condition that it may be continuously utilised, at its original or designed capacity and efficiency for its intended purpose. (AAP-6)

Maintenance Concept/Concept de maintenance

A description of the planned general scheme for **maintenance** and support of an item in the operational environment. The **maintenance concept** provides the practical basis for design, layout and packaging of the system and its test equipment and establishes the scope of **maintenance** responsibility for each level (echelon) of **maintenance** and the personnel resources (**maintenance** manning and skill levels) required to maintain the system.

Maintenance Down Time/Temps d'immobilisation dû à la maintenance

The interval between the time a system/equipment is made available for preventive or corrective **maintenance** until that **maintenance** action is successfully completed.

Malfunction (See Fault)/Mauvais fonctionnement (Voir panne)

Man-Machine Systems/Système de travail

A system comprising of persons and equipment interacting together to perform a function.

Markov Chain/Chaîne de Markov

A stochastic process on a discrete time basis that has finite or a denumerable number of infinite states and in which the probabilities of occurrence of future states depend only on the present state and not on the history of prior states. A stochastic process is one which can be modelled by a family of random variables (R(t).

NOTE: Markov Chains are a complex concept. For more detailed information, further references should be sought.

Mean Mission Time to Restore Functions/Durée moyenne de rétablissement des fonctions

The expected (average) time it takes to restore mission functions during a mission scenario.

Mean Time Between Critical Failures (See Mean Time Between Failures and Critical Failures)/Temps moyen entre défaillances critiques (Voir temps moyen entre défaillances et défaillances critiques)

Similar to **Mean Time Between Failures** except that only **critical failures** are counted. It is a measure of expected time between **critical failures**.

Mean Time Between Failure (MTBF)/Temps moyen entre défaillances (MTBF)

A measure of the expected (average) time during which a system will continuously perform within its specified limits under stated conditions. It can be estimated by dividing life units (hours, miles, rounds etc) accrued during a stated period under stated conditions by the number of **failures** during the period and is a basic measure of **reliability** for repairable items.

Mean Time Between Maintenance Actions/Durée moyenne entre actions de maintenance

A measure of the expected (or average) time between all **maintenance** (preventive and corrective) actions. It can be estimated by dividing the total number of system life units (hours, miles, rounds etc) by the total number of **maintenance** actions (both preventive and corrective) during a stated period of time. It provides information related to the demand for **maintenance** manpower.

Mean Time to Failure (See Mean Time Between Failure)/Durée moyenne sans panne (durée moyenne de fonctionnement avant défaillance) MTTF (Voir temps moyen entre défaillances)

This is similar to **Mean Time Between Failure** but applies to non-repairable systems. It is a measure of the expected life till **failure**. It can be estimated by dividing the total number of **failures** within a population into the total number of life units of the population during a stated period under stated conditions.

Mean Time To Repair (MTTR)/Temps moyen de réparation (MTTR)

The average or expected time it takes to repair an equipment. It can be estimated by the total elapsed **corrective maintenance time** divided by the total number of **corrective maintenance** actions during a given period of time.

Mission Profile/Profil de mission

A time-phased description of the events and environments an item experiences from initiation to completion of a specified mission. It identifies the tasks, events, durations, operating conditions and environments for each phase of a mission.

Mission Reliability/Fiabilité en mission

The probability that an item will perform its required functions for the duration of a specified **mission profile**. (See **Mission Profile**)

Mission Time/Temps de mission

That element of **up-time** required to perform a stated **mission profile**.

Monte Carlo Computer Simulation Techniques/Techniques de simulation informatisé de Monte Carlo

A method utilising random sampling to obtain inputs for computer **simulation** trials and obtaining approximate solutions in terms of a range of values each of which has a calculated probability of being the solution to the problem.

NOTE: This is a complex concept. For more detailed information further references should be sought.

Non Operating Time/Temps de non utilisation opérationnelle

The amount of time that a system/equipment is not operating but assumed to be operable. **Non Operating Time** refers only to systems not committed to a specific mission.

Operating Time/Temps d'utilisation opérationnelle

The time during which the system or equipment is turned on and actively performing at least one of its functions.

Operational Availability (See also **Intrinsic Availability**)/**Disponibilité opérationnelle**
(Voir aussi **disponibilité intrinsèque**)

The probability that an equipment/system at any instant in the required **operating time** will operate satisfactorily under stated conditions where the time considered includes operating, corrective and **preventive maintenance**, **administrative delay time** and **logistic delay time**.

Overhaul/Révision

The effort, usually performed at depot level, when a complete disassembly inspection, rework and reassembly, of an item is required to restore the item to a 'like new' condition.

Parts Control Programme/Programme de contrôle des pièces

A documented policy and procedure intended to control the method for selecting and using parts to enhance system/equipment performance and **reliability**.

Parts Count Analysis/Analyse de décomptes des composants

A method of predicting item **reliability** utilising models which need part types and quantity, part quality levels and equipment environment. This prediction method is normally utilised during early design phases and assumes the time to **failure** of the parts is exponentially distributed, i.e. a constant **failure rate**. (MIL-HDBK-217)

Parts Stress Analysis (See also **Parts Count Analysis**)/**Analyse des contraintes de composants** (Voir aussi **analyse des décomptes des composants**)

A method of predicting item **reliability** utilising models which require additional information to that in **Parts Count Analysis**, particularly stresses on parts (e.g. temperature, power or current rating, complexity etc). It is normally applied at later design phases for trade-offs between **reliability** versus part selection. The **parts stress analysis** method assumes the time to **failure** of the parts is exponentially distributed (i.e. a constant **failure rate**).

Petri Net/Réseau de Petri

A method of modelling systems in which activities of one component of the system may occur simultaneously with activities of other components of the system. A **Petri Net** model is composed of four parts: a set of places P, a set of transitions T, an input function I and an output function O. The input function I maps elements of the transition set to a collection of places known as the input places of the transitions. Analogously the output function O maps transition elements to a collection of places known as the output places.

NOTE: This is a complex concept. For more detailed information, further references should be sought.

Preconditioning (See also Burn In, Early Life Failures and ESS)/Préconditionnement (Voir aussi rôdage, défaillance de jeunesse et ESS)

A method of ageing an item by operating it under specified environmental (normally high temperature or vibration) in order to eliminate **early life failures** prior to final test or shipment.

Premature Failure (see Early Life Failure)/Défaillances prématurées (Voir aussi défaillance de jeunesse).**Preventive Maintenance/Maintenance préventive**

The **maintenance** carried out at predetermined intervals or according to prescribed criteria and intended to reduce the probability of **failure** or the degradation of the functioning of an item.

Producer's Risk/Risque producteur

The probability of rejecting equipment which has a true MTBF equal to the upper test MTBF. The probability of rejecting equipment which has a true MTBF greater than the upper test MTBF will be less than the **producer's risk**. (MIL-HDBK-781)

Production Reliability Acceptance Test (PRAT)/Essai d'acceptation de fiabilité en production (EAFF)

A test conducted under specified conditions, by, or on behalf of, the purchaser, using delivered or deliverable production items, to determine the producer's compliance with specified **reliability** requirements.

Provisioning/Approvisionnement

The process of determining and acquiring the quantity and type of support items, spares, repair parts, tools and test equipment necessary to operate and maintain an item for an initially stated period of time.

Quality/Qualité

The totality of characteristics of an item that bear on its ability to satisfy stated and implied needs. (ISO 8402)

R&M Assurance/Assurance F et M

The implementation of adequate planned and systematic actions necessary to provide confidence that an item will satisfy given **reliability** and **maintainability** requirements.

R&M Model/Modèle F et M

A mathematical model used for prediction or estimation of R&M performance measures of a product.

R&M Programme Plan/Plan de programme F et M

A plan that defines the management and technical tasks to be undertaken and the organisations responsible for them.

Random Failure/Défaillance aléatoire

A **failure** whose time of occurrence is predictable only in a probabilistic sense (i.e. not deterministic).

Random Vibration/Vibration aléatoire

A vibration whose magnitude is non periodic and is described by a probability distribution which gives the fraction of the total time the vibration occurs within a specified range of magnitudes.

Reaction Time/Temps de réaction

That element of **up-time** needed to initiate a mission, measured from the time the command is received.

Reject Criteria/Critère de rejet

The limits for R&M parameters which will cause a rejection of tested items when the limits are reached or exceeded during an R&M demonstration.

NOTE: Possible parameters for **reject criteria** are the number of chargeable **failures** (for **reliability**) or repair times (for **maintainability**).

Reliability/Fiabilité

The ability of an item to perform a required function under stated conditions for a specified period of time. (AAP-6)

NOTE: The term **reliability** is also used as a **reliability** characteristic denoting a probability of success, or a success ratio.

Reliability and Maintainability Allocation and Apportionment/Allocation et distribution de fiabilité et de maintenabilité

The allotment of **reliability** and **maintainability** requirements to sub-systems such that, if these sub-system requirements are met, the allotment will result in satisfactory system level **reliability** and **maintainability**.

Reliability and Maintainability Assessment/Évaluation de fiabilité et de maintenabilité

The determination of the R&M values of an item within stated confidence limits, from test or field data, on nominally identical items. The source of the data must be stated.

NOTE: Alternatively, point estimates may be used, the basis of which must be defined.

Reliability Block Diagram (RBD)/Bloc diagramme de fiabilité

A **reliability** model that provides a pictorial representation of a system **reliability** performance and shows the logical connection of (functioning) components needed for system success.

NOTE: In the symbolic representation, no distinction is made between open circuit, short circuit or other **fault** modes, however in the numerical evaluation this is possible.

Reliability Centred Maintenance (RCM)/Maintenance axée sur la fiabilité

A method for establishing a scheduled (preventive) **maintenance** programme which will efficiently and effectively achieve the **inherent reliability** and **safety** levels of equipment. It is methodology which can be applied to the development of a preventive **maintenance** programme and results in improved component **reliability** and minimised overall programme costs. The intended end result is improved overall equipment **safety, availability** and economic operation.

Reliability Demonstration/Démonstration de fiabilité

A demonstration using statistical evaluation of tests or operating data to show that system/equipment **reliability** meets the specified quantitative requirements.

Reliability Growth/Croissance de la fiabilité

The improvement in a **reliability** parameter caused by the successful correction of deficiencies in item design or manufacture.

Reliability Growth Model/Modèle de croissance de fiabilité

A mathematical model to monitor/control the improvement of a **reliability** parameter generated by the successful correction of deficiencies in system/equipment design or manufacture.

NOTE: Usually a distinction is made between parametric and non-parametric **reliability growth models**. Parametric models allow users to plan, monitor/control and predict the **reliability growth**.

Reliability Growth Test/Essai de croissance de fiabilité (ECF)

A series of tests conducted to disclose deficiencies in item design and manufacturing and to verify that corrective **actions** will prevent recurrence. It measures the degree of improvement in item **reliability** as a result of **corrective actions** in the design and manufacturing processes.

Reliability Prediction/Prévision de fiabilité

The **reliability** computed from the observed, assessed or extrapolated **reliability** of its parts for the stated conditions of use, and taking into account the design of a product.

Reliability Qualification Test/Essai de qualification (démonstration) de fiabilité

A test conducted under specified conditions, by, or on behalf of, the government, using items representative of the approved production configuration, to determine compliance with specified **reliability** requirements as a basis for production approval.

Reliability Stress Analysis/Analyse des contraintes de fiabilité

The study of the **reliability** effects of stresses (electrical, mechanical, thermal ...) on a product and their distributions taking into account the operational requirement.

Safety/Sécurité

The likelihood of a product to maintain throughout its life cycle an acceptable level of risk that may cause an injury to personnel or major damage to the product or its environment.

Scheduled Maintenance (See **Preventive Maintenance**)/**Maintenance programmée** (Voir **maintenance préventive**).

Screening/Tri-sélection

A process for inspecting items to remove those that are unsatisfactory or those likely to exhibit **early life failure**. Inspection includes visual examination, physical dimension measurement and functional performance measurement under specified environmental conditions.

Secondary Failure/Fault/Défaillance/panne secondaire

A **failure** of an item, caused either directly or indirectly by a **failure** or a **fault** of another item.

(IEC-50 (191))

Selection Time/Temps de sélection

Time necessary to select requisite test equipment/programmes.

Shelf Life/Durée stockage - Durée de conservation

The length of time an item can be stored under specified conditions and still meet specified requirements.

Simulation/Simulation

The representation of selected behavioural characteristics of one physical or abstract system by another system.

Single Point Failure/Point de défaillance unique

The **failure** of an item which would result in **failure** of the system and is not compensated for by redundancy or alternative operational procedure.

Sneak Analysis/Analyse de conditions insidieuses

Sneak circuit analysis: a procedure conducted to identify latent paths which cause occurrence of unwanted functions or inhibit desired functions assuming all components are functioning properly.

Spare Parts Scaling/Barémisation des pièces de rechange

The determination of how many spares of each type should be held to support an equipment by the unit in which it is fitted, its supporting base(s) and depot(s), having considered the numbers of equipment fitted, likely **failure rate** and proximity of the alternative sources.

Standby Mode/Mode repos

That mode of an item during which it is not fully operating but assumed to be completely operable.

Standby Operation/Opération de repos - Opération d'attente

A sequence of elementary activities carried out during a quasi-operational state.

Supportability/Aptitude au soutien

A measure of the degree to which all resources required to operate and maintain the system/equipment can be provided in sufficient quantity and time.

System Life Cycle/Cycle de vie d'un système

The period divided into phases, ranging from the first considerations on the need for a system/equipment through the development and in-service stages down to phasing-out and disposal.
(ALP 10)

Tailoring/Adaptation

The process by which the individual requirements (paragraphs, sub-paragraphs or sentences) of the selected documents are evaluated to determine the extent to which each requirement is most suitable for a specific system or equipment acquisition and the modification of these requirements, where necessary, to ensure that each achieves an optimal balance between operational needs and cost. This process must take care not to exclude those R&M requirements which are determined as essential to meeting operational needs.

Testing Process/Processus d'essai

A series of tests conducted to disclose deficiencies or to verify that **corrective actions** will prevent recurrence and to determine compliance with specified R&M requirements.

Up-Time/Temps réel de fonctionnement

That period of time during which an item is in a condition to perform a required function.
(MIL-HDBK-338)

Wear Out Failure/Défaillance par vieillissement - Défaillance par usure

A **failure** whose probability of occurrence increases with the passage of time, as a result of processes inherent in the item.
(IEC-50 (191))

REFERENCES

AAP-6	NATO glossary of terms and definitions, issued by NATO, Military Agency for Standardisation
ALP 10	Allied Logistic Publication No 10, Guidance on Integrated Support for Multinational Equipment Projects (ILS), issued by NATO Logistic Directorate
A-LP-001-000/AM-000	Canadian Forces Technical Order - Reliability Vol. 1: Equipment Reliability Requirements (Land)
BS 4778	British Standard 4778, Quality Vocabulary, issued by British Standards Institution
DEF STAN 00-41	UK Defence Standard 00-41, Reliability and Maintainability, MOD Guide to Practices and Procedures, issued by Ministry of Defence
IEC-50(191)	International Electrotechnical Vocabulary, Chapter 191: Dependability and Quality of Service issued by International Electro-technical Commission
ISO 8402/1994	International Organization for Standardisation (ISO) No 8402 Quality Management and Quality Assurance - Vocabulary
MIL-HDBK 338	US Military Handbook 338, Electronic Reliability Design Handbook, issued by Department of Defense
MIL-HDBK 781	US Military Handbook 781 Reliability Test Methods, Plans and Environments for Engineering Development Qualification, and Production

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