AECTP 100

ENVIRONMENTAL GUIDELINES
FOR
DEFENCE MATERIEL

(January 2006)

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NORTH ATLANTIC TREATY ORGANIZATION

NATO STANDARDISATION AGENCY (NSA)

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ENVIRONMENTAL GUIDELINES FOR DEFENCE MATERIEL

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ENVIRONMENTAL GUIDELINES FOR DEFENCE MATERIEL

1. SCOPE

1.1 Purpose

The purpose of this 'Allied Environmental Conditions and Test Publication' is to guide project managers, programme engineers, and environmental engineering specialists in the planning and implementation of environmental tasks. An important function of AECTP 100 is to provide guidance to project managers on the application of AECTP 200 'Environmental Conditions', AECTP 300 'Climatic Environmental Tests', AECTP 400 'Mechanical Environmental Tests' and AECTP 500 'Electrical/Electromagnetic Environmental Tests.'

1.2 Application

The guidance provided in AECTP 100 is applicable to joint NATO defence materiel projects. It may also be applied to defence materiel (multi-) national projects and is compatible with NATO publication AAP-20, 'Handbook on the Phase Armaments Programming System (PAPS).' AECTP 100 should be useful to environmental engineering specialists during the procurement cycle.

1.3 Limitations

Although laboratory testing is a valuable tool in the materiel development process, there are certain inherent limitations that must be recognised when applying AECTP 100 through 500. The test methods in AECTP 300 through 500 do not include all possible forcing functions that may affect system performance or integrity in its service use. These methods are limited to those currently developed for laboratory testing and cannot apply all known possible stress combinations present in natural field/fleet service environments. Therefore, caution must be used in extrapolating laboratory test results to predict the performance, durability and suitability of materiel in actual service use. AECTP 100 through 500 were not developed specifically to cover the following applications, but in some cases they may be applied:

(a) Weapon effects other than electromagnetic pulse (EMP);

(b) Munitions safety tests ;

(c) Packaging testing;

(d) Suitability of clothing or fabric items intended for military use;

(e) Environmental stress screening (ESS) methods and procedures.

1.4 Definitions

Listed in Annex C are NATO environmental definitions compared to national environmental definitions. An Environmental Documentation Flow Chart is included in Annex D.

2. REFERENCE/RELATED DOCUMENTS

- NATO AAP 20	Handbook on the Phase Armaments Programming System (PAPS)
- STANAG 2895	Extreme Climatic Conditions and Derived Conditions for Use in Defining Design/Test Criteria for NATO Forces Materiel
- STANAG 4370	Environmental Testing
- MIL-STD-810	Test Method Standard for Environmental Engineering Considerations and Laboratory Tests
- Defence Standard 00-35	Environmental Handbook for Defence Materiel
- GAM-EG-13	Essais Généraux en Environnement des Matériels
- CIN-EG01	Guide pour la prise en compte de l'Environnement dans un Programme d'Armement
- AWT 951, Teil 2	Erprobung von Wehrmaterial
- IEC 60068	Environmental Testing

3. CONTENT OF AECTP 100 THROUGH 500

3.1 The content of the series of five AECTP under covering STANAG 4370 is summarised below. The use of these documents is addressed in paragraph 6.

AECTP 100 - Environmental Guidelines for Defence Materiel

AECTP 100 contains the general introduction for the use of the complete series of AECTP 100 through 500. AECTP 100 also provides guidance on the management of the total environmental engineering task for materiel development projects. The focus of this guidance is the environmental project tailoring process which can accommodate different methods of procurement and a range of test types including safety and reliability testing. The documentation that supports the management guidelines is also described.

AECTP 200 Environmental Conditions

AECTP 200 provides information and guidance on climatic, mechanical and electrical environments that are induced in materiel during its life cycle. AECTP 200 Category 230, 240 and 250 respectively describe the climatic, mechanical and electrical environments. For climatic environments, examples include those that occur as a result of a materiel being enclosed or covered during transportation, storage, transit, deployment and use. The content of AECTP 200 Category 230 supersedes that in STANAG 2895 addressing natural environments. For mechanical environments, examples include those that occur as a result of the proximity of materiel to excitations arising from its configuration, mode of transportation, storage, host platform and use. For electrical environments, examples include radiated, conducted, magnetic and electrostatic conditions that occur during materiel transportation, storage, deployment and use. Test procedures for the environments defined in AECTP 200 are presented in AECTP 300 through 500. Note that the environmental descriptions in these documents are only examples and should not be used to derive test severities.

AECTP 300 - Climatic Environmental Tests

AECTP 300 provides a series of climatic test methods for use during the design, development and qualification of materiel. The test methods are presented in a prescriptive style so that they can be readily invoked by the user. As far as has been possible the test methods included are those internationally agreed and published.

AECTP 400 - Mechanical Environmental Tests

AECTP 400 provides a series of mechanical test methods for use during the design, development and qualification of materiel. The test methods are presented in a prescriptive style so that they can be readily invoked by the user. As far as has been possible the test methods included are those internationally agreed and published.

AECTP 500 - Electrical/Electromagnetic Environmental Tests

AECTP 500 provides a series of electrical test methods for use during the design, development and qualification of materiel. The test methods are presented in a prescriptive style so that they can be readily invoked by the user. As far as has been possible the test methods included are those internationally agreed and published.

4. THE ENVIRONMENTAL PROJECT TAILORING PROCESS

4.1 Environmental Project Tailoring

4.1.1 Environmental Project Tailoring (EPT) is the process of assuring that materiel is designed, developed and tested to requirements which are directly derived from the anticipated service use conditions.

4.1.2 A test programme should normally reflect environmental stresses anticipated throughout the materiel's life cycle, and tests should be based on the anticipated environmental scenarios. The specified tests and their severities should be derived from the most realistic environments, either single or in combination. In particular, data obtained from real-world platforms as influenced by natural environmental conditions should be used to determine test criteria.

4.1.3 Specific test procedures and severities are necessary to provide adequate confidence in the performance, reliability and safety of the materiel. Test severity levels are often more severe for tests conducted for materiel safety, because these severities need to reflect the maximum levels to be expected in service.

4.2 Responsibilities and Tasks of Project Managers and Environmental Engineering Specialists

4.2.1 Responsibilities of Project Managers

It is the responsibility of each Project Manager to provide assurance that materiel will perform satisfactorily while exposed to and following environmental stresses which are likely to be encountered in service as defined in materiel specifications. The Project Manager determines the particular strategy for the project. This strategy is to be defined in the Project Manager's General Environmental Management Plan (GEMP). To ensure the process is conducted effectively and economically, Project Managers should:

(a) Involve environmental engineering specialists in relevant tasks associated with the materiel specification, definition and performance validation (see paragraph 4.2.3);

(b) Ensure the appropriate resources are allocated in order that all these tasks can be properly accomplished;

(c) Ensure the life cycle environments anticipated for the materiel in service are adequately specified in the 'Requirements' documents. In order to enable specialists to conduct valid studies, 'Requirements' documents should state the real deployment scenarios which the materiel is expected to encounter;

(d) Task environmental engineering specialists to develop environment-related management documents, environmental test programme documents and environmental planning documents. These documents (which are addressed in paragraphs 5.1 to 5.5) should be available as early as possible in the project for approval by the Project Manager;

(e) Ensure materiel provided for environmental testing is representative of that which is intended for service;

(f) Approve any changes to the agreed environmental plans;

(g) Ensure the performance of materiel is validated against the life cycle environmental profile.

4.2.2 Responsibilities of Environmental Engineering Specialists

Environmental Engineering Specialists are responsible for the application, as appropriate, of Environmental Project Tailoring to test programmes. Tailoring tasks, which cannot be implemented during the tailoring process, should be reported to the Project manager as early as possible.

4.2.3 Tasks of Environmental Engineering Specialists

Environmental Engineering Specialists develop documents that govern and record the application of environmental tasks in accordance with the General Environmental Management Plan. These documents are described in paragraphs 5.2 to 5.5. Where appropriate, arrangements should be made to ensure that modifications to the design that have been made during the course of the project are verified by further testing. The specialists should advise and assist in resolving potential conflicts between the performance requirements and the ability to resist effects of the environments. They should participate actively during project development to harmonise the decisions made concerning the actual environments to which materiel will be subjected. The maximum advantage is achieved when environmental issues are addressed during the first conceptual studies.

5. DOCUMENTATION

5.1 <u>General</u>

5.1.1 The following documents are required to support the planning and implementation of environmental engineering tasks. The documents are shown as a flow chart in Annex D.

5.2 <u>General Environmental Management Plan</u>

5.2.1 The purpose of the General Environmental Management Plan (GEMP) is to define, as early as possible in the project, the major requirements and plans involving environmental engineering tasks and testing. This plan may be used to provide cost estimates for the required resources.

5.2.2 The GEMP is one of the first tasks to be completed during the procurement of defence materiel, and defines the plans for accomplishing the other environmental tasks throughout the remainder of the project. The plan should reflect the type of procurement, for example, as a development project or as an off-the-shelf purchase. It will include a list of the documents (see paragraphs 5.2 to 5.7) to be prepared and will provide a schedule showing required completion dates.

5.2.3 During preparation of the GEMP, guidance should be obtained from Environmental Engineering Specialists.

5.3 Life Cycle Environmental Profile

5.3.1 The purpose of the Life Cycle Environmental Profile (LCEP) document, sometimes known as the Environmental Requirement, is to define the events which could influence the materiel function and which are expected to occur during the life of the materiel, thus enabling logical decisions to be made regarding design and test requirements. Sufficient information is required to define all of the expected (natural and induced) climatic, mechanical and electrical environments, along with expected duration and probability of exposure. Information contained in the LCEP will subsequently be used to prepare the Environmental Design Criteria and the Environmental Test Specification.

5.3.2 The LCEP defines all of the events (conditions) to which the materiel will be subjected from the time it leaves the factory until it is removed from service. The LCEP includes transport, handling, storage, operational use, and maintenance operations, with the respective frequencies of occurrence.

The LCEP should contain as appropriate:

(a) A Service use profile describing each of the specific events that can occur during the life of the materiel. These specific events should include, for example, transportation methods, geographical locations and types of storage enclosures and approximate duration of each event (see Annex A and Annex B);

(b) The configuration of the materiel as it could modify the effects of the environments to which the materiel is exposed;

(c) All relevant types of platforms (e.g., man, aircraft, ground vehicles, ships);

(d) The geographical locations (e.g., deployment) where the materiel will be stored and operated during its lifetime;

(e) A summary of environments (and combinations thereof), which lists the expected environments to which the materiel could be exposed during its service life (see Annex A and Annex B). Extensive guidance on the identification of environments is provided in AECTP 200.

(f) Identification of the operational (e.g., operating, stand-by, testing, non-operating) state associated with each phase of the life cycle including expected function and associated performance. The LCEP is intended to define all possible realistic environmental conditions to which materiel will be exposed during its life. Guidance is given in AECTP 200.

5.3.3 The LCEP must be completed in time to serve as a prime input to the preparation of the Environmental Design Criteria, the Environmental Test Specification.

5.4 Environmental Design Criteria

5.4.1 The purpose of the Environmental Design Criteria (EDC) is to identify probable environments or combinations of environments that could impact safety, availability, reliability, maintainability or operational capability of the materiel. Compliance with the EDC is generally verified by tests in conjunction with an assessment, but in some cases may also be verified by studies, computer models, etc.

5.4.2 The EDC document defines specific environments (see AECTP 200, 'Definition of Environments') which have been selected as design requirements, and gives rationale for their selection. The rationale for the selection of a specific design requirement should clearly state whether the decision is based on an extreme value or otherwise, and specify the duration of exposure. Additionally, the rationale should include:

(a) probability of occurrence of a particular environment or a combination of environments;

(b) expected effects and failure modes;

(c) effect of possible failure on mission success.

5.4.3 The EDC document forms the basis for the Environmental Test Plan.

5.5 Environmental Test Specification

5.5.1 The purpose of the Environmental Test Specification (ETS) is to contain a definition of all the proposed environmental tests, together with rationale for each test, in such a manner that all personnel and organisations involved in the development of the materiel understand how the EDC will be verified.

5.5.2 The Environmental Test Specification defines all of the equipment, organisational responsibilities, test conditions and methods necessary to conduct the tests. This specification also includes the configuration, quantity of test items, test sequence and inspection of the test item before, during and after testing. Where possible, test methods should be selected from AECTP 300 'Climatic Environmental Tests', AECTP 400 'Mechanical Environmental Tests' and AECTP 500 'Electrical/Electromagnetic Environmental Tests'.

5.5.3 The Environmental Test Specification includes, where relevant, quantification of the performance parameters that characterises each service function and associated technical functions including the limits of acceptability. The specification links them with the life cycle profile situations by specifying the corresponding normal, limited and extreme environmental domains which are defined as follows:

(a) Normal Environmental Domain: The range of environments (characteristics and levels) within which the materiel is expected too fully satisfy all performance specifications. Within this range, product reliability can also be assessed;

(b) Limited Environmental Domain: The range of environments (characteristics and levels) within which the materiel is expected to satisfy reduced performance specifications and will comply with all safety requirements. The materiel will satisfy full performance levels when returned to the normal environmental domain. Reliability cannot be properly assessed;

(c) Extreme Environmental Domain: The range of environments (characteristics and level) within which the materiel fails to satisfy its performance requirements but meets its safety requirements. The failure to perform satisfactorily may be irreversible.

5.6 Environmental Test Instruction

5.6.1 The purpose of an Environmental Test Instruction document is to set out the precise and detailed instructions necessary for laboratory staff to conduct a particular environmental test.

5.6.2 The content of an Environmental Test Instruction is based on the summary definition for a particular test contained in the Environmental Test Specification.

5.6.3 Guidance on the details to be specified in an Environmental Test Instruction, relating to the manner in which the test is to be conducted, is given in the relevant test method included in AECTP 300, 400 or 500.

5.7 Environmental Test Report

5.7.1 The purpose of the Environmental Test Report (ETR) is to record in a totally objective manner, the results of all environmental testing which might have a bearing on the quality, reliability and safety of the materiel.

5.7.2 The Environmental Test Report records the results of all environmental testing, including whether or not the materiel met specified performance requirements. Included in the Environmental Test Report is a detailed record of each test with appropriate data and test records, a list of the test equipment used, a description of the test facility, a description of the instrumentation system, and the test procedure used to perform the test. Anomalies that occur and deviations from the test plan are to be included.

5.7.3 The Environmental Test Report is prepared when all testing has been completed. It shall be reviewed for technical accuracy, but care should be taken to retain the objectivity of the report. Attention must be given to the fact that the results in the Test Report cover all the major requirements and plans for environmental tasks and testing as defined in the GEMP. The Environmental Test Report is to be prepared in time to serve as guidance in making the decision to begin production and to introduce the materiel into service. Note that the ETR (or parts of it) are often drafted during the test programme since the test programme can take years to complete. It is finalised when the test programme is complete. Otherwise details of tests could be lost as people leave the test facility or memory fades!

6. THE USE OF AECTP 100 THROUGH 500

6.1 General

6.1.1 The strategy embodied in AECTP 100 through 500 centres on a ‘flow down’ process to select the most effective test methods, severity’s and programme schedule for materiel to meet in-Service conditions.

6.1.2 The ‘flow down’ process systematically demonstrates materiel compliance with the environmental descriptions that have been derived directly from the Life Cycle, also known as the Manufacture to Target or Disposal Sequence (MTDS). Consequently, the documentation supporting the flow down process, as described in Paragraph 5, should be used as a management tool for ensuring that materiel is fit for Service use.

6.1.3 Although this AECTP favours the flow down process, it also accommodates 'minimum integrity' testing strategies. It also acknowledges the 'hardening' testing strategies that predominate in commercial standards such as IEC 68.

6.1.4 A consequence of the development of progressive editions of AECTP 100 through 500 is the increasing harmonisation of its content with that of commercial test methods, where such standards exist and where they are appropriate for the testing of defence materiel.

6.1.5 The following paragraphs show how the content of the AECTP should be utilised to derive environmental descriptions and environmental design criteria; also to select test methods for materiel qualification to be included in the Environmental Test Specification.

6.2 Environment Descriptions and Environmental Design Criteria

6.2.1 An essential precursor to deriving environmental descriptions for the Life Cycle Environmental Profile (LCEP) is access to the definitive (i.e.: fully agreed) Life Cycle or MTDS.

6.2.2 The steps to be undertaken to derive environmental descriptions include:

(a) Breakdown the Life Cycle into elements where the materiel 'state' is identical, for example: packaged state, arming state, etc.

(b) Use AECTP 200 to identify the transportation, storage, deployment and use environments applicable to each state, ignoring only the trivial environments.

(c) Use AECTP 200 to compile the initial environmental description and characteristics for each environment. AECTP 200, Leaflet 2311 should be used for the natural climatic environments.

(d) Finalise environmental descriptions for each condition using statistical approaches where relevant to derive amplitudes, especially for power spectral density and/or shock spectra formats. Also finalise evaluations of the number of occurrences and their duration where relevant. Guidance is given in AECTP 200 on many of these aspects.

6.2.3 In AECTP 200 the description of the environmental characteristics is supported by examples. For specific materiel, amplitudes and duration of environments must be confirmed by measured data or precedent.

6.2.4 Completion of the above steps enables the LCEP document to be finalised. This completion, in turn, allows the Environmental Design Criteria (EDC) document to be compiled.

6.2.5 The steps to be undertaken to determine environmental design criteria include:

(a) Identify the critical environmental conditions from the LCEP document (derived using AECTP 200) that are likely to influence the design of the materiel.

(b) Use AECTP 200 through 500 to assist the derivation of design levels. Also use these AECTP to support the design activity by selecting the test methods that are the most likely to reveal realistic design weaknesses. The selected test methods are most likely to be minimum integrity test methods for this application.

6.2.6 Completion of these steps enables the EDC document to be finalised, the content of which allows detail design tasks to proceed.

6.3 Test Methods For Materiel Qualification

6.3.1 It is strongly recommended that the test methods for materiel qualification are compatible with the environmental project tailoring (EPT) process described in Paragraph 4 of this AECTP. In particular, tailored test methods and severities are preferred to minimum integrity test methods and severities. Test methods and severities based on 'hardening' concepts, i.e.: those methods and severities that cannot be directly related to the LCEP for the materiel should be avoided.

6.3.2 The inputs needed to select test methods for materiel qualification include the LCEP document, materiel design features and knowledge of the materiel's potential failure modes.

6.3.3 The steps to be undertaken to select test methods and associated severities include:

(a) Identify the primary potential failure modes including any vulnerability to fretting and/or sine tones.

(b) Review the LCEP and EDC documents for environmental descriptions to which compliance of the materiel is to be demonstrated.

(c) Consider the type of test methods most likely to induce realistic failure modes.

(d) Re-examine potential failure modes regarding the extent to which combined mechanical/climatic tests, such as vibration/temperature or vibration/(temperature/humidity/altitude), are necessary.

(e) Use AECTP 200 through 500 and available specific tailored test data to select the most relevant test methods and associated test severities.

6.3.4 Completion of these steps then enables the test methods and severities, also the test programme schedule, to be optimised to obtain the most cost-effective solution. The optimisation activities should proceed as follows:

(a) Eliminate non-restraining environmental conditions and their associated tests, ensuring that potential failure modes are stressed elsewhere. Guidance is given in AECTP 200 Leaflet 2410.

(b) Add in to the remaining tests, where applicable, additional conditions to compensate for the effects of the eliminated tests.

(c) Introduce 'composite' tests where relevant and where possible to cover, for example, several modes of transportation or deployment platforms.

(d) Finalise test severities and duration's including any requirements for stepped levels to cover the range of potential failure mechanisms. Guidance is given in AECTP 200 Leaflet 2410.

(e) Check the compatibility of the selected test methods in terms of any conflicts that could arise from mixing 'minimum integrity' tests, or 'hardening' tests, with 'tailored' tests in a test sequence.

(f) Check that the order of the test programme reflects the actual sequence of environmental conditions as defined in the Life Cycle, and where necessary amend the test programme to suit.

6.3.5 Completion of these optimisation steps enables the Environmental Test Specification (ETS) document to be finalised, followed by the Environmental Test Programme schedule. When the content of these two documents is available, design evaluation and development activity can be undertaken with confidence, followed by the formal materiel qualification task to demonstrate compliance with the environmental descriptions as specified in the LCEP and EDC documents.

ANNEX A

TYPICAL ENVIRONMENTAL FACTORS IN A GENERALISED LIFE CYCLE ENVIRONMENT

SITUATIONS	NATURAL	INDUCED
1. STORAGE PHASE		
a. Depot	Controlled or known temperature and humidity	Shock due to handling. Vibration due to handling. Conducted EM interference due to testing. Nuclear effects.
b. Sheltered	High temperature (Dry/Humid). Low temperature/ freezing. Salt Mist. Chemical attack. Mould growth. Diurnal (cycling Temp)	Shock due to handling. Vibration due to handling. Conducted EM interference due to handling. Susceptibility to EM radiation. Nuclear effects.
c. Open	High temperature (Dry/Humid). Low temperature/ freezing. Sand and dust Salt mist. Solar radiation. Mould growth. Chemical attack. Rain, hail, snow, ice. Diurnal (cycling Temp)	Shock due to handling. Vibration due to handling. Conducted EM interference due to testing. Susceptibility to EM Radiation. Electrostatic discharge (Handling). Lightning. Nuclear effects.
2. TRANSPORTATION PHASE		
a. Road	High temperature (Dry/Humid). Low temperature. Rain, hail, snow, ice. Sand and dust. Solar radiation. Immersion.	Shock due to road surface and handling. Vibration due to road surface and engine. Susceptibility to EM radiation. Lightning. Electrostatic discharge when handling.

Note . The situations and environments are not intended to be comprehensive but to serve as a guide only.

TYPICAL ENVIRONMENTAL FACTORS IN A GENERALISED LIFE CYCLE ENVIRONMENT

SITUATIONS	NATURAL	INDUCED
b. Rail	High temperature. Low temperature. Rain, hail, snow, ice. Sand and dust. Solar radiation.	Shock due to rail transport and handling. Vibration due to rails.
c. Air	Low temperature. Reduced pressure. Sand and dust. Rapid Pressure Change.	Shock due to landing and handling Vibration due to engines and airflow.
d. Sea	High temperature-humid. Low temperature. Rain, hail, snow, ice. Salt mist. Temporary immersion. Mould growth. Sand and dust.	Shock due to wave motion, underwater weapon detonation and handling. Vibration due to wave motion and engine.
3. DEPLOYMENT PHASE		
a. Man Carried	High temperature. (Dry/Humid). Low temperature/ freezing. Rain, hail, snow, ice. Sand, dust and mud. Salt Mist. Solar radiation. Mould growth. Chemical attack.	Shock due to weapon firing and handling. Acoustic noise. Nuclear effects. EM Interference. Chemical and biological attack. Corrosive atmosphere Free-fall. Electrostatic discharge.
b. Tracked & Wheeled Vehicles .	High temperature (Dry/humid). Low temperature/freezing Rain, hail, snow, ice.	Shock due to road surface, Weapon firing, detonation and handling. High temp. in glassed enclosure. Vibration due to road surface and engines.

TYPICAL ENVIRONMENTAL FACTORS IN A GENERALISED LIFE CYCLE ENVIRONMENT

SITUATIONS	NATURAL	INDUCED
	Sand, dust and mud. Salt mist. Solar radiation. Mould growth. Chemical attack. Temperature shock. Immersion.	Acoustic noise. Nuclear effects. EM interference. Electrostatic, Lightning. Chemical and biological attack. Corrosive atmosphere.
c. Fixed Wing & Rotary Aircraft	High temperature Dry/Humid). Low temperature/freezing. Rain. Sand and dust. Salt mist. Solar radiation. Rain and dust erosion. Mould growth. Chemical attack. Bird strike. Low pressure. Hail. Rapid temp/humidity change.	Shock due to assisted take-off, landing and weapon blast. Vibration due to runway surface. Manoeuvre, gunfire, aerodynamics blade tones/engines. Turbulence and engine. Aerodynamic heating. Nuclear effects. EM interference. Electrostatic. Lightning. Corrosive Atmosphere. Noise
d. Ship & Submarine	High temperature (Dry/humid). Low temperature/freezing. Rain, hail, snow, ice. Salt mist. Solar radiation. Mould growth. Chemical attack.	Shock due to weapon firing, detonation and wave slam. Vibration due to waves, engine and acoustic noise. Nuclear effects. EM interference. Electrostatic. Lightning. Increased pressure (submarine). Corrosive atmosphere. Underwater weapon detonation.
e. Static Equipment	High temperature (Dry/Humid) Low temperature/freezing. Rain, hail, snow, ice.	Shock due to weapon firing and detonation. Vibration due to engines.

TYPICAL ENVIRONMENTAL FACTORS IN A GENERALISED LIFE CYCLE ENVIRONMENT

SITUATIONS	NATURAL	INDUCED
	Salt mist. Solar radiation. Mould growth. Chemical attack.	Acoustic noise. Nuclear effects. EM interference. Electrostatic. Lightning. Corrosive atmosphere.
f. Projectile Free Flight	Rain and dust erosion.	Shock due to firing and target impact. Acceleration due to firing. Aerodynamic heating. Acoustic noise. Nuclear effects. EM interference. Electrostatic. Lightning.
g.Torpedo Launch	Immersion. Thermal shock.	Shock due to launch boost separation and target impact. Vibration due to engine and hydrodynamic and aerodynamic turbulence. Launch acceleration. Acoustic noise. Nuclear effects. EM interference.
h. Missile Free Flight	Rain and dust erosion.	Shock due to launch, boost separation and target impact. vibration due to engine and aerodynamic turbulence. Launch acceleration. Aerodynamic heating. Acoustic noise. Nuclear effects. EM interference. Electrostatic. Lightning.

ANNEX B

SERVICE LIFE ANALYSIS

This flow chart illustrates an example of a possible method for analysing the service life of materiel. A sequence of possible environmental situations is shown in this flow chart. The frequencies of occasions or the duration's for which the situations might occur are shown in Table B-1.

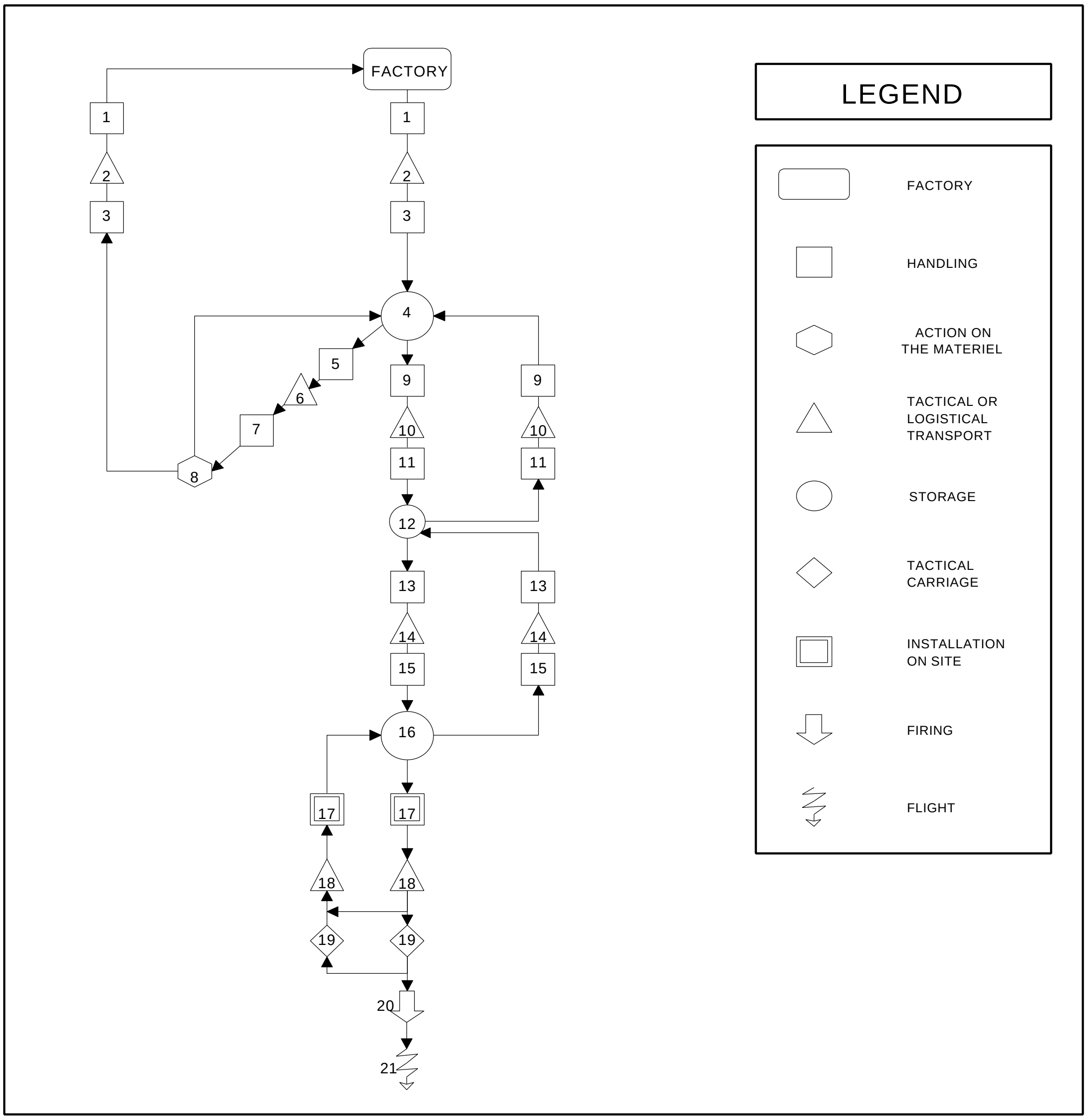

Figure B-1. Service Life Analysis.

Situation N°: (1)	Service Environment	Occasion/Duration
1.	Handling	5
2.	Logistic Transport	5
3.	Handling	5
4.	Long Term Storage	10 years
5.	Handling	8
6.	Transport to place of stockpile surveillance	8
7.	Handling	8
8.	Stockpile surveillance	5
9.	Handling	-
10.	Transport to forward depot	-
11.	Handling	-
12.	Storage in forward depot	1 year
13.	Handling	5
14.	Transport to external storage	5
15.	Handling	5
16.	External storage	1 month
17.	Installation on site	11
18.	Tactical transport	11
19.	Tactical carriage	5
20.	Firing	1
21.	Flight	1

(1) See Figure B-1

Table B-1. Situation, Service Environment, Occasion And Storage Duration

ANNEX C

DEFINITIONS

For the purpose of STANAG 4370 and AECTP 100 through 500, this Annex contains the following definitions:

- NATO Environmental Definitions;
- National Environmental Definitions compared to NATO Environmental Definitions;

NATO ENVIRONMENTAL DEFINITIONS

1. Environment: The total set of physical, chemical and biological conditions.

2. Environmental Engineering Specialist: One who is skilled in one or more environmental engineering areas. These include, but are not necessarily limited to: natural and induced environments and their effects on military materiel; expertise in measuring and analysing field environmental conditions; formulating environmental test criteria; determining when environmental laboratory tests are appropriate/valid substitute for natural field/fleet environmental tests, and evaluating the effects of specific environments on materiel.

3. Environmental Project Tailoring: The process of assuring that materiel is designed, developed and tested to requirements which are directly derived from the anticipated Service use conditions.

4. Environmental Test Equipment: The laboratory and/or test equipment that is used (in whole or part) to produce, monitor or record environmental conditions necessary to stress the test item.

5. Environmental Test Instruction: A set of detailed procedures including the parameters, levels and instructions for the conduct of a particular test or series of tests on a specific test item. This plan governs test control, data analysis and administrative aspects.

6. Environmental Requirement: A detailed statement of the environmental conditions for which specified materiel is to be exposed.

7. Environmental Test Specification: A detailed statement of the parameters and their ranges to which the test item is to be subjected and the criteria against which the test item will be assessed.

8. Flow Down Process: The environmental engineering process that provides a procedure for determining environmental conditions, test methods and severity's from the defined life cycle, in conjunction with the knowledge of the materiel's possible failure modes.

9. Life Cycle: The life cycle defines all of the events to which the materiel will be subjected from the time it leaves the factory until it is removed from Service.

10. Test, Acceptance: Examination and verification of products against contract specification requirements.

11. Test Configuration: A detailed description of the test item state (i.e. in a storage/shipping container, operational configuration, etc.), and its interface and/or orientation with any associated materiel and the test equipment during the test.

12. Test, Developmental: A set of engineering type tests to verify status of technical progress, verify that design risks are minimised, substantiate achievement of contract technical performance, and certify readiness for the operational test.

13. Test, Hardening: The use of environmental testing methods to provide failure mode data for the improvement of materiel reliability. Specific environments simulated during hardening tests may not occur in the actual materiel life cycle.

14. Test, Operational: A range of testing and experimentation conducted in realistic operational environments, with military personnel that are representative of those expected to operate, maintain and support the system when fielded or deployed.

15. Test, Qualification: Tests included in the qualification process, intended to verify that the defined materiel meets user requirements, to determine the adequacy of any corrective actions indicated by previous tests.

NATIONAL ENVIRONMENTAL DEFINITIONS COMPARED TO NATO ENVIRONMENTAL DEFINITIONS

The definitions used in this document are in line with the main following national documents:

US: MIL-STD-810 'Test Method Standard for Environmental Engineering Considerations and Laboratory Tests';
UK: Defence Standard 00-35 'Environmental Handbook for Defence Materiel';
FR: GAM-EG-13 'Essais Généraux en environnement des Matériels';

NATO: NATO Staff Requirement.

US: Mission Need Statement
UK: User/Systems Requirements Document Staff Requirement
FR: Fiche de Caractéristiques Militaires

NATO: General Environmental Management Plan

US: Environmental Engineering Management Plan
UK: Environmental Management Plan
FR: Plan de Prise en Compte de l'Environnement

NATO: Life Cycle Environmental Profile

US: Life Cycle Environmental Profile
UK: Manufacture to Target or Disposal Sequence + Environmental Requirement
FR: Profil de Vie plus Conditions d'environnement associées (part of Spécifications Techniques de Besoin)

NATO: Environmental Design Criteria

US: Environmental Issues/Criteria List
UK: Environmental Input to Design Specifications
FR: Spécifications Techniques de Besoin + Cahier des Charges Fonctionnel

NATO: Environmental Test Specification

US: Environmental Test Specification
UK: Environmental Test Specification
FR: Part of Programme d'Essais en Environnement

NATO: Environmental Test Programme

US: Environmental Test Project/Programme
UK: Environmental Test Programme
FR: Programme d'Essais en Environnement

NATO: Environmental Test Instruction

US: Environmental Test Instruction/Plan
UK: Environmental Test Instruction
FR: Procédure d'Essai

NATO: Environmental Test Report

US: Environmental Test Report
UK: Environmental Test Report
FR: Rapport d'Essai en Environnement

NATO: Compliance Statement

US: Compliance Statement
UK: Compliance Statement
FR: Acceptation or Prononcé de Qualification

ANNEX D

ENVIRONMENTAL DOCUMENTATION FLOW CHART