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CONFERENCE OF NATIONAL ARMAMENTS DIRECTORS (CNAD)

Proposed NIAG Study on Reliability Prediction of Electronic Equipment

Note by the Secretary

References:
a. AC/259-D(2021)0068 – Proposals for Advisory Studies by the NIAG in 2022 dated 06 December 2021 and action sheet dated 12 January 2022
b. NIAG-N(2022)0009 – Agenda for the Exploratory Group meeting, dated 5 April 2022

1. BACKGROUND

1.1. The MTBF (Mean Time Between Failures) is a key parameter for several purposes. For instance, in particular during tender/bidding phases it is used as a contractual requirement in engineering design activities, for safety applications, diagnostics and Integrated Product Support (IPS).

1.2. Currently, several methodologies are available to perform the reliability prediction of electronic equipment (MIL-HDBK217F, 217Plus, Fides Guide 2009A, IEC61709 etc.) involving also different calculation approaches. The difficulty caused by the presence of several standards, which can be used for reliability prediction, produces incoherent results and/or discrepancies, which can impact both manufacturers and customers.

1.3. The scope of this study is to discuss and propose a common standard or a set of standards or a set of criteria to be used in order to achieve the best solution/s to calculate the electronic equipment reliability data for engineering, safety and IPS purposes.

2. OBJECTIVES OF THE STUDY

2.1. The objective of this Study is to provide users (e.g. industries, institutional bodies, etc.) with an appropriate toolbox for a correct understanding and use of reliability prediction methodologies for electronic equipment, and will answer the following questions:

2.1.1. Question 1: Why is it still so important today to predict the reliability of electronic equipment using the MTBF parameter? Are there alternative metrics? If yes, which ones?

2.1.2. Question 2: What is the current state-of-the-art regarding the reliability prediction of electronic equipment methodologies? As a minimum, the following aspects should be considered:

- Analysis of current standards, including data conversion methods, and comparison with from-the-field data;
- Current standards applicability to typical defence use environments (MIL-HDBK217F, 217Plus, Fides Guide 2009A, IEC61709 etc.) also focusing on hazard and safety analyses;
- Whether current standards are applicable to new technologies and emerging ones;
- Provide detailed and complete information about their users: institutional bodies, industries in NATO countries, NATO programs;
- Current level of adoption of the standard;
- User-friendliness of the standard;
- Whether any costs are applicable to use the standard;
- Whether current standards provide guidance on the manufacture and testing processes of components;
- Whether the standard includes any checklists involving the use of factors selected on a discretionary or subjective basis;
- Evaluation of system reliability: failure causes away from components effects (reliability process management) and COTS reliability data inclusion.

2.1.3. Question 3: Considering that MTBF values are used during tender / bidding phases, can some specific rules / conversion tools be introduced in order to ensure that all possible contractors are assessed on a common basis?

2.2. The expected output of the study is an appropriate guideline document including selection criteria to correctly apply the reliability prediction methods available today. The study will include an introduction to clarify the most common errors encountered when using the MTBF parameter or some other related parameters and a quick presentation of possible alternative future metrics.

2.3. With regard to the mission profiles conditions, typical defence environment definition should be considered.

2.4. The study affects integrated product support, logistics and safety aspects of electronic equipment design.

2.5. The study will address technologies, documentation analysis and comparisons between different methodologies concerning reliability prediction calculations (with numeric examples).

2.6. The study will be a complete toolbox for engineers and managers to properly understand and use reliability prediction methodologies for electronic equipment and will provide elements to write an appropriate STANAG/STANREC.

Study Report

2.7. The output from this study shall be in the form of a written report that documents the assumptions, inputs, methodologies, assessments and analyses by the study team to reach its conclusions and recommendations.

2.8. The study is open to industries from NATO nations and will be conducted at NATO Unclassified level.

2.9. The study should also produce an unmarked executive summary (one page maximum) that, subject to validation by the sponsor, is made publicly available for NIAG promotion and visibility purposes. Additionally the report will include a list of minimum ten keywords that will be used as metadata for future NIAG reference. The keywords will be strictly specific to the study, and will not include obvious elements such as NATO, NIAG, CNAD.

3. THE STUDY ORGANISATION

3.1. Industrial experts met virtually (via Teams) as a NIAG Exploratory Group, under the Chairmanship of the NIAG Vice-Chairman, Mr. Pablo Gonzalez, on 05 May 2022 to address the study requirements with representatives of the study sponsor and agreed to form a NIAG Study Group, to be designated **SG281**, to carry out the study.

3.2. The Exploratory Group noted that the final report is expected by June 2023.

3.3. The Exploratory Group elected the Study Management team as follows:

Chair	Buccini Claudio (IsselNord, Italy)
Vice-Chair	Baylakoğlu İlknur (Tübitak Bilgem, Turkey)
Rapporteur	Coraggio Maria (MBDA Italy, Italy)

3.4. Subject to CNAD approval, the Exploratory Group will hold a kick-off meeting, to be arranged by the newly elected Study Group Management Team, on 08 June 2022.

3.5. The sponsor advised that the Quick Reaction Team to support the study was led by Lt.Col. Michele Schiavoni (Italian MoD).

4. THE STUDY BUDGET

4.1. NIAG studies budgets are determined considering length/complexity of the study but also the number of participants to ensure a fairly comparable level of effort per participant across the NIAG study portfolio. Considering the number of participants at the Exploratory Group meeting and expected participants at the study kick-off meeting, it is proposed to allocate a budget of €260,000. The amount for the other NIAG studies to be executed in 2022 will be adjusted in order not to exceed the total approved budget for NIAG studies: €2,450,000.

4.2. The Exploratory Group noted that the study budget was equivalent to 580 'person-days' contribution, and estimated that the Industry involvement would be in the order of 54 experts from 12 participating countries.

5. RECOMMENDATIONS

5.1. The CNAD is invited to approve this study on reliability prediction of electronic equipment, under the sponsorship of the LCMG as proposed and to a cost of €260,000.

5.2. **Unless I hear to the contrary by 15:30 hrs on 03 June 2022**, I shall consider paragraph 5.1 approved. The Study Order will be issued accordingly.

(Signed) Silva Aher

Action Officer: JS VAUTIER (+6924)

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