67th CEEES R&ESS TAB REPORT
Wednesday March 15th, 2017, 14.00 hr to 17.30 hr
Location: VTT (ESPOO - Helsinki)

Moderator and author of the report: Henri GRZESKOWIAK - (ASTE, France)
Editor of these minutes: Henri GRZESKOWIAK

AGENDA

1 Opening (14.00 hr.)
   1.1 Welcoming address

<table>
<thead>
<tr>
<th>David DELAUX</th>
<th>ASTE/VALEO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Henri GRZESKOWIAK</td>
<td>ASTE/HG Consultant</td>
</tr>
<tr>
<td>Helge PALMEN</td>
<td>KOTEL/VTT Expert Services</td>
</tr>
<tr>
<td>Pasi VALIMAKI</td>
<td>KOTEL/DANFOSS-Drives</td>
</tr>
<tr>
<td>Patrycja PERRIN ASTE</td>
<td>ASTE</td>
</tr>
<tr>
<td>Davy PISSOORT</td>
<td>BSTEE/KU Leuven</td>
</tr>
<tr>
<td>Pulli SAARINEN</td>
<td>KOTEL/KONECRANES</td>
</tr>
<tr>
<td>Kirsi SAARINEN-PULLI via call-conf</td>
<td>KOTEL/KONE</td>
</tr>
</tbody>
</table>

1.2 Apologies for absence
   Harry ROOSSIEN – (PLOT / PLANTRONICS)

2 agenda
   • adoption of the R&ESS TAB report from previous Paris meeting
   • standards by Dave Richards
   • examination of Climatic Round Robin proposals submitted by ASTE
   • presentation of David PISSOORT on a new project related to EMC

3 R&ESS TAB report from previous Paris meeting

Mechanical Round Robin Exercise (see annex 1)
Henri presented the mechanical Round Robin Exercise, initially proposed to the joined TABS of the CEEES and due to disagreements between members of the TABS on what should be the content of such a RR exercise, ASTE has decided to withdraw its proposal and to continue by its own under
the frame of ASTE. Nethertheless, this mechanical Round Robin Exercise is still open to European participants that may take contact with Henri if they are willing to participate.

See in Annex 1 slides on mechanical Round Robin exercise which were presented during last ASTELAB held in October 2016 in Paris.

**Climatic Round Robin Exercise**

Henri first recall the climatic Round Robin Exercise, initially proposed to the joined TABS of the CEEES during the last Paris CEEES meeting held in October 2016 at Valeo (La Verrière). See in Annex 2 slides on climatic Round Robin exercise which were presented during last ASTELAB held in October 2016 in Paris.

The comments on this proposal were first it should be more appropriate to call it a survey and not a RR exercise and second Dave Richards proposed to make a counter proposal (see it in annex 3).

It is normally to the climatic TAB to continue the preparation of a future Round Robin or Survey on the basis of all the previous documents (i.e. initial ASTE proposal and Dave counter proposal).

### 4 FIDES:

The FIDES guide is available on the WEB.

Use the following Link:


David evocated a recent work funded by french Institute: IMDR (DGA, THALES, VALEO, SERMA, SAGEM, MBDA, AIRBUS, SAFRAN, RENAULT) concerning the development of the reliability model of an electrolytical condensator.
Root cause diagram:

Generic formula:

\[ \lambda = \lambda_{\text{physique}} \cdot \Pi_{\text{film}} \cdot \Pi_{\text{PM}} \cdot \Pi_{\text{Process}} \]

\[ \lambda_{\text{physique}} = \lambda_{0, \text{condensateur}} \sum_{i} \left( \frac{L_{\text{annuel}}}{8760} \right) \cdot \left( \Pi_{\text{Thermo-électrique}} + \Pi_{\text{FCY}} + \Pi_{\text{Mécanique}} + \Pi_{\text{RH}} \right) \cdot (\Pi_{\text{Induit}}) \]
New formulation of degradation with humidity factor:

\[ \Pi_{RH} = \gamma_{RH} \left( \frac{R_{H \text{ambiante}}}{70} \right)^{4.4} \exp \left\{ 1604.09 \left[ \frac{1}{293} - \frac{1}{(T_{\text{ambiante}} - T_{\text{carte}} + 273)} \right] \right\} \]

5 \quad \text{SAFI: (Statistical Analysis For Industries) – status in Jan 2017}
FOREVER: Reliability for Plastics in extreme conditions

Objective: Reliability design of plastics (Test & Modelling) under extreme conditions

Technology and target functions:
- EUROPE extreme conditions
- Right optimization design and cost

Collaborative project:
- Renault – Valeo – ENSMA – CEVAA – Analyse & Surface – HGC
- 3 years – 3 ME (total budget) – Valeo 1.3ME (R&D expenses)

Design to Cost

EMC project

Project Goal

- Train young engineers in the domain of “EMI Risk Management”
- I.e. how to make sure that safety- or mission-critical systems will “never” fail due to EMI?
- EM-disturbances go much broader than what is covered by CE-certification: combined stresses, non-covered frequency bands, IEMI, ageing effects, etc.
- And how to do this cost-effectively? Preferably using Components-Off-The-Shelf
- Important for many sectors: automotive, medical, Industry 4.0, railways, avionics, etc.
8 Miscellaneous:

Helge mentioned the important work in which he is involved on the “licensing” of Nuclear Power Plant Equipments dedicated to the safety monitoring of the NPP. These equipments are not normally submitted to high levels of radiation but depending of the cases to high pressure, either high temperature and/or high vibration.

David has evoked the subject of big data. Pasi says that he feels the actual situation was between two worlds: the old one with equipments not configured for big data processing and the new emerging generation with increasing smart features. Kirsi says that her concern is more with the quality of data than the quantity of data. This is true, for example, for data useful for product maintenance. There are so many ways to look at them and not all are so reliable. She doesn’t feel to have a problem with the amount of data. Pasi has indicated that the drives they are producing in his company are so diverse that considering all the informations coming back from them becomes a problem of big data. And it’s not possible to design for the worst case because nobody wants then to buy such a product. The average approach should be more acceptable. Pasi has mentioned a project within KOTEL on the reliability of polymers. It’s not a scientific project but more engineering. The applications concern the packages, the isolators, the elastomers, power electronics components: polyamides.

9 Closing (5.30 pm)
Round Robin exercise

Mechanical Environment

Organized by ASTE

Presented by Henri GRZESKOWIAK – HG Consultant
Round Robin test or exercise: definition and application

A Round Robin test is* an interlaboratory test (measurement, analysis, or experiment) performed independently several times. This can involve multiple independent scientists performing the test with the use of the same method in different equipment, or a variety of methods and equipment. In reality it is often a combination of the two, for example if a sample is analysed, or one (or more) of its properties is measured by different laboratories using different methods, or even just by different units of equipment of identical construction.

Extended application in the specific context of this exercise:

- Inter participants comparison on the process of transformation of the given input in the expected output
- Input: life cycle environmental profile; the environment is described by time histories (temporal data)
- Output: mechanical environmental test (either vibration and/or shock test)
- Relevant Methods: all the methods capable of this transformation of the given input in the given output

- Objective of the exercise:
  - advancement of each participant by analyse of cause of abnormal deviations that might appear and make the corresponding corrections (on the tools used, on the practice in the application of the methods, …) essentially confidential
  - comparison and exploitation of the results once corrected: a report will be published
General considerations

1. This Round Robin Exercise is proposed by ASTE; the participants are welcomed from any country in the world

2. The methods which may be applied in response to the proposed Round Robin Exercise are those capable to transform the supplied input data in a mechanical environmental test (or in several tests)

3. The supplied input data are not consistent with the values of any standardized data of any kind. The consequence is that the scope of this exercise isn’t consistent with the use of the corresponding standards methods
Description of the exercise

- Consists in developing a mechanical environment test specification, likely to produce similar effects (or degradations) on the product under laboratory test than in the operational use; the operational environment is represented in this exercise by a certain amount of temporal records for each situation; the records that are given for each situation are the only information available. From each set of records of each situation, one can extract the environment representing each situation.
Input and output

• Input: several time histories associated to each situation of the life profile

• Output: the type of test and its duration of application in testing laboratory is to be proposed as the final output of this exercise. The chosen duration(s) should be justified.
Scenario of life profile

<table>
<thead>
<tr>
<th>Nº</th>
<th>situation</th>
<th>event</th>
<th>duration</th>
<th>occurrence</th>
<th>Number of measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Logistic transport by road</td>
<td>1-1 Shock</td>
<td>1</td>
<td>1</td>
<td>5 time histories S1-1 records 1 to 5 records 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-2 Vibration</td>
<td>10</td>
<td>1</td>
<td>6 time histories S1-2 records 1 to 6 records 6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-3 Vibration</td>
<td>10*</td>
<td>20*</td>
<td>5 time histories S1-3 records 1 to 5 records 5</td>
</tr>
<tr>
<td>2</td>
<td>Logistic transport by road</td>
<td>2 Vibration</td>
<td>10</td>
<td>1</td>
<td>6 time histories S2 records 1 to S2 records 6</td>
</tr>
<tr>
<td>3</td>
<td>Logistic transport by air</td>
<td>3 Vibration</td>
<td>2h</td>
<td>1</td>
<td>4 time histories S3 records 1 to S3 records 4</td>
</tr>
<tr>
<td>4</td>
<td>Logistic transport by railway</td>
<td>4 Vibration</td>
<td>5</td>
<td>1</td>
<td>6 time histories S4 records 1 to S4 records 6</td>
</tr>
<tr>
<td>5</td>
<td>Tactical transport</td>
<td>5 Vibration</td>
<td>2**</td>
<td>100**</td>
<td>5 time histories S4 records 1 to S4 records 5</td>
</tr>
</tbody>
</table>

Nota: the name given to each situation is only there for illustration purposes; the associated time histories are not consistent with the values associated to these situations in international standards.
## Associated input data

<table>
<thead>
<tr>
<th>situations description</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S1_1=</strong> Logistical transportation with carrier 1 (shocks)</td>
<td>5 files: S1_1_record_1.csv à S1_1_record_5.csv</td>
</tr>
<tr>
<td><strong>S1_2=</strong> Logistical transportation with carrier 1-2</td>
<td>6 files: S1_2_record_1.csv à S1_2_record_6.csv</td>
</tr>
<tr>
<td><strong>S1_3=</strong> Logistical transportation with carrier 1-3</td>
<td>5 files: S1_3_record_1.csv à S1_3_record_5.csv. <strong>Attention:</strong> records 1 and 2 are identical; so you should not use record 2.</td>
</tr>
<tr>
<td><strong>S2 =</strong> Logistical transportation with carrier 2</td>
<td>6 files: S2_record_1.csv à S2_record_6.csv</td>
</tr>
<tr>
<td><strong>S3 =</strong> Logistical transportation with carrier 3</td>
<td>4 time histories sequences: 3 can be supposed to be stationary (record 1;2;4); record 3 is not stationary: it belongs to an other family than records 1;2;4. To simplify the exercise, it is recommended to discard the record 3 in a first step. The 3 records 1;2;4 should permit to characterize the associated variability of the environment of the situation S3.</td>
</tr>
<tr>
<td><strong>S4 =</strong> Logistical transportation with carrier 4</td>
<td>6 files: S4_record_1.csv à S4_record_6.csv</td>
</tr>
<tr>
<td><strong>S5 =</strong> Logistical transportation with carrier 5</td>
<td>5 files: S5_record_1.csv à S5_record_5.csv</td>
</tr>
</tbody>
</table>
Conditions of acquisition

<table>
<thead>
<tr>
<th></th>
<th>S1-1, S1-2, S1-3, S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sampling frequency (Hz)</td>
<td>2048</td>
<td>8192</td>
<td>2048</td>
<td>2048</td>
</tr>
</tbody>
</table>

Nota: the conditions of acquisition aren’t to be discussed within the proposed exercise; the data are supposed to be valid (i.e. no aliasing, ...
Situation S1
Situation
S1-2
&
S1-3
Situation S2
Situation S3
Situation S4
Situation S5
Preliminary calibration

- **Scope:**
  - This preliminary calibration to the participants is only intended to those using the FDS and MRS method.

- **Objective:**
  - Allow to compare the results of calculation of FDS, SRS or MRS on various existing analysis systems on simple cases in order to compare the different results obtained.

- **Spectral Approach:**
  - input : PSD 0.01 g²/Hz from 20 to 2000 Hz with a 1 h duration
  - Output : associated FDS and MRS to the above PSD
  - Conditions of application:
    - Q=10
    - b=8
    - K=C=1
    - 100 calculation points linearly distributed from 10 to 2500 Hz
    - Calculation using the complete formulation of Rice and the approximated Rayleigh relation
Preliminary calibration

• Temporal approach:

  – signal called TEST, stationnary, built over a duration of 40 s with sufficient high sampling frequency in order to calculate the FDS and MRS up to 2500 Hz
    (this signal has been built starting from the PSD considered above in the spectral approach)

  – a non-stationary signal constituted by the record identified as S2-1 which is associated to the situation S2. A reconstruction of this signal is to be made as the FDS and MRS calculations are requested up to 1000 Hz; the FDS and MRS should be calculated for the original and for the reconstructed signals. If the reconstruction of the signal is not available, then only the original signal will be considered.

*
Different representants for the fatigue and maximal strain

- Type 1: as described in the Norm NFX 50144-3
- Type 2: Damage Potential Spectrum (see following)
FDS type 2  Damage Potential Spectrum (Henderson/Piersol)
Utilized in STANAG 4370 - leaflet 2410 ANNEX C COMBINATION OF SPECTRA (FATIGUE DAMAGE SPECTRA)

- This is a simplified expression of SDF, defined from the relationship established for random vibration in the case of a narrow band response

\[
\bar{D} = \frac{K^b}{C} n_0^+ T (\sqrt{2} z_{ms})^b \Gamma \left(1 + \frac{b}{2}\right)
\]

where the effective relative displacement is also approached by an expression obtained for a broadband noise:

\[
z_{ms} = \sqrt{\frac{Q G_{S0}}{4 \omega_0^2}}
\]

- Power Spectral Density of acceleration is defined

\[
G_{S0} = \text{DSP de l’accélération} \quad \text{DP}(f_0) \approx f_0 T \left(\frac{G_{S0}}{f_0^2}\right)^{b/2}
\]

- No calculation from a signal as a function of time or for a different type of vibration (sine, swept sine, sine on noise, ...)

Damage Potential Spectrum

taking into account publications H. A. Gaberson on Pseudo Velocity Shock Spectrum

- H. A. Gaberson recalls that the stress is proportional to the speed.
- With this assumption, the PSDA involves the PSD on speed rather than acceleration and becomes equal to:

\[
DP(f_0) = f_0 T \left( \frac{G_{V0}}{\xi f_0} \right)^{b/2}
\]

- Where \( G_{V0} \) is the PSD of the velocity
- **Remark:** in general acceleration is measured rather than velocity. It is simpler to calculate the damage from acceleration and the result is exactly the same.
Status of advancement

• Responses received 11th october 2016 : 8

• Next steps :
  – Phase 1: analyse of cause of abnormal deviations that might appear and make
    the corresponding corrections (on the tools used, on the practice in the
    application of the methods, …) : under progress till end of year 2016
  – Phase 2: comparison and exploitation of the results once corrected : a report
    will be published by mid 2017 ; this report , after validation by the
    participants, will be distributed freely on the site of ASTE.

• All new responses by the end of 2016 will be
  considered in the above described phases.
To participate to the RR exercise

- Collaborative site
  - Henri Grzeskowiak has prepared a collaborative site dedicated to this exercise, at the following address*: 
    - [https://grzeskowiak.myds.me/file](https://grzeskowiak.myds.me/file)
    - login : CEEES
    - password : CEEES
    - With this login and PW , you can read the content of all the boxes ( and download them, in particular the data-bases containing the input files for this exercise in the Userbox "Common Ressources »). You have also a read and write access on the box User15.
    - For those who are willing to participate to this Round Robin exercise, please send an email to Henri Grzeskowiak ([henri@grzeskowiak.fr](mailto:henri@grzeskowiak.fr)) and he will open for you a dedicated Userbox with a number XX that I'll send to you personally with a login and a PW permitting to write ( and read) in the box UserXX. 
    - All the content of the boxes should be normally anonymous, except the Userbox15 to be used as an open box for exchanges between members of CEEES.
Some publications Worldwide
Concerning tailoring the mechanical environment
Some publications Worldwide

- Evaluation of Vibration Test Severity by FDS and ERS
  *D.H. Cho*, *Korea Aerospace Industries, Corée*

- Investigation of the Durability Transfer Concept for Vehicle Prognostic Applications
  *nCode with US Army TARDEC, USA*

- Analysis of Nonstationary Vibroacoustic Flight Data Using a Damage-Potential Basis
  *The Aerospace Corporation - Rubin Engineering Company, USA*

- Characterization and Synthesis of Random Acceleration Vibration Specifications
  *University Twente, Pays-Bas*

- CBM for vibrating equipment on rotorcraft

- Et Helicopter Vibration Shock and Vibration Qualification of Equipment
  *nCode + AgustaWestland, UK*
Some publications Worldwide

- Comparaison of Test Specifications and Measured Field Data
  *Blekinge Institute of Technology, Karlskrona, Suède*

- Deriving Gaussian Fatigue Test Spectra from Measured non Gaussian Service Spectra
  *Munich University of Applied Sciences + Knorr-Bremse SfS GmbH, Allemagne*

- Desenvolvimento de Testes Acelerados de Fadiga Aplicados a Atuadores Electrónicos de Turbocompressores
  *Universidade Federal de Uberlândia, Faculdade de Engenharia Mecânica, Brésil*

- Development of Shock and Vibration Test Specifications for Telecommunication Equipment in Automotive Environments
  *VTT Manufacturing technology et Nokia Research Center, Finlande*
Some publications Worldwide

- Development of Vibration Specifications for LRUs on Fighter Aircraft from Flight Data
  
  National Aerospace Laboratories, Bangalore, Inde

- Experimental evaluation of the FDS-based equivalence approach for the mission synthesis in accelerated life tests
  
  Dept. of Engineering for Industry, University of Bologna, Italie

- Extreme Response and Fatigue Damage for FPSO Structural Analysis
  
  American Bureau of Shipping, Houston, TX, USA

- Fatigue Damage Spectrum anf Ford Motor Company
  
  Vibration Research Corporation, USA

- Fatigue Damage for Sweep-Sine and Random Accelerated Vibration Testing
  
  Institute for Electric Rotary Systems, Slovenie

- Fatigue Damage Spectrum Calculation Based on Vibration Specifications
  
  Chrysler Group + Oakland University, USA

  
  Chrysler Group, USA
Some publications Worldwide

- Fatigue Margins Established by Unit and Spacecraft Protoqualification Tests
  *The Aerospace Corporation, El Segundo, California*

- How do I Measure the Life of my Product
  *Calvin College, Grand Rapids, Michigan*

- Implementing the Fatigue Damage Spectrum and Fatigue Damage Equivalent Vibration Testing
  *Stress Engineering Services, Inc., Houston*

- Interest of equivalent damage methods for railway equipment qualification to vibrations
  *Vibratec, France*

- Evaluation of Vibration References with Equivalent Kurtosis and Dissimilar Amplitude Probability Densities
  *Redstone Test Center, Army Test and Evaluation Command, USA*
Some publications Worldwide

• Mission Synthesis of Sine-on-Random excitations for accelerated vibration qualification testing
  _Thèse, Bologne, Italie_

• Methods for Accelerating Dynamic Durability Tests
  _nCode, UK_

• Generating Accelerated Loading Profiles from Measured Time Series Data
  _University of Manitoba, Canada_

• On the Shaker Simulation of Wind-Induced Non-Gaussian Random Vibration
  _School of Reliability and System Engineering, Beihang, China + Mechanical Engineering, Blekinge Tekniska Högskola, Karlskrona, Suède_

• Ottimizzazione delle prove su pista dei veicoli usando Spettri di Danno a Fatica
  _nCode + CNH – Modena, Italie_
Some publications Worldwide

- Qualification testing of racecar equipment subject to engine-induced vibrations - How to derive a test profile using a mission synthesis procedure
  *Siemens Industry Software NV, Leuven, Belgique*

- Reliability Fatigue Design Synthesis and Experimental Validation of Accelerated Vibration Durability Test
  *Valeo, France*

- Tailoring of Vibration Test Specifications for a Flight Vehicle
  *Research Centre Zmarat, Hyderabad, Inde*

- Understanding how Kurtosis is transferred from input Acceleration to Stress Response and its Influence on Fatigue Life
  *nCode UK and NASA Langley Research Center, Virginia, USA*

- Using fatigue damage spectrum for accelerated testing with correlation to end-use environment
  *General Motors Company and Vibration Research Corporation, USA*
Some publications Worldwide

- Vibration Durability Testing and Design Validation Based on Narrow Frequency Band
  *Blekinge Institute of Technology, Karlskrona, Suède*
- Vibration provning - skräddarsydd efter analys av fältmätdata
  *Volvo Lastvagnar, Suède*
- Comparison of Multi-Axis and Single Axis Testing on Plate S
  *Sandia National Laboratories, USA*
- Response Spectrum Methods in Tank-vehicle Design
  *Blekinge Institute of Technology, Karlskrona, Suède*
- A Method of Accelerating Durability Tests by Pseudo Damage Editing
  *Mahesh Software Systems, Pvt, Ltd, Inde*
- Vibration Test Specification Design and Reliability Analysis
  *Automotive Research & Testing Center, Lukang, Taiwan*
Round Robin (or Survey ?) exercise
Climatic Environment
Organized by ASTE or CEEES (tbd)

Presented by Henri GRZESKOWIAK – HG Consultant
For a Round Robin on Climatic Environmental Engineering? Issues, comparing what?

In Environmental Engineering:
- the work done at the national and international standardization levels leads to overall advanced reproducibility of conducting environmental testing,
- conversely, it was never verified the reproducibility of the definition of a demonstration program associated with a need to use, that is to say, the method used to define:
  - actual environments to which a material is likely to face,
  - the needs in 'resistance' equipment (to design, to demonstrate),
  - the evaluation methods of equipment capacity to support and operate properly in these environments for a given use.

Issues: evaluate the reproducibility of
- tailoring the environments,
- building a demonstration program (analysis, simulations, tests),
- defining the criteria of success (for a qualification of equipment)

This first RRClim thus intended:
- shared preferred methods by the various bodies involved (and consequently to discard the non recommended approaches),
- to compare the variety of associated results.
1- Define, describe expected uses

- RRClim proposes a given situation
  - each participant declines it in its own referential,
  - by adding / removing items even based on assumptions,
  - the inter-comparison consists in a list of fields used.

"That each participant considers necessary to define a situation of life profile ». The result of the inter-comparison of the table consists of fields used with the list of participants that use

Examples: the system is run under the circumstances a and b
- 1 month of storage at Toulon (France)
- temporary storage, marine ISO container into a port
- 1 year stationary use in Toulon
- Ground fixed equipment (eg metered)
- system outdoors without additional protection or intervention on the equipment for the duration of employment
2. Define, describe the natural environment? (meteorological description) to which is exposed hardware

- **RRClim** proposes a given situation (of product Life Cycle)
  - each participant determines the environment characterizing this situation,
  - by adding / removing items even based on assumptions
  - the intercomparison is about values associated with each environmental agent

- **Example:**
  - The inter-comparison focuses on the values associated with each agent
  - The result of the inter-comparison is a chart to assess the variety of responses
  - E.g.:
  - Temperature and humidity
  - Rainfall
  - (Characterizing for the previous 2 situations: 1 month storage at Toulon (France) and 1 year of use stationary Toulon)
ASTE contribution

3- Define, describe the induced environment? Outside close hardware

- RRClim proposes to declinate the situation:
  - Each participant determines the induced environment (system input)
  - Each participant specifies consedered assumptions
  - The inter-comparison focuses on the values associated with each agent
  - The result of the inter-comparison is a chart to assess the variety of responses
  - Application:
    - Specify the induced temperature and humidity (inside the container)
    - For a system (a vehicle) in temporary storage, ISO 20 « navy » in the port of Toulon (France)
    - For 1 month, during the month of August
4- The environment in the heart of the product?
(applied to a component, a sub-assembly, ...)

• RRClim proposes to declinate the situation
  – Each participant determines the environment? internal (a subset of the system)
  – Each participant indicates taken assumptions is brought to
  – The inter-comparison focuses on the values associated with each agent
  – The result of the inter-comparison is a chart presenting the variety of responses
  – Application
  – From the temperature readings (pink curve) of the air bag of a vehicle subject to a dry temperature test (green curve)
  – Specify the temperature of air bag of a vehicle in ISO 20 'navy in the port of Toulon (France) for 1 month, during the month of August
### RRClim : proposed intercomparisons 2017

#### RRClim 2017 ?

<table>
<thead>
<tr>
<th>RRClim</th>
<th>2017</th>
<th>éléments</th>
<th>À comparer</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔ 2017</td>
<td>1</td>
<td>expected situations</td>
<td>Situations, life profile</td>
</tr>
<tr>
<td>✔ 2017</td>
<td>2</td>
<td>natural environment</td>
<td>Sources of the environment description</td>
</tr>
<tr>
<td>✔ 2017</td>
<td>3</td>
<td>induced environment</td>
<td>Measurements, models, norms</td>
</tr>
<tr>
<td>✔ 2017</td>
<td>4</td>
<td>the environment internal to the product</td>
<td>Tests, models, simulation</td>
</tr>
<tr>
<td>✔ 2018</td>
<td>5</td>
<td>the failure modes</td>
<td>Which-ones, Cumulative or no, combined</td>
</tr>
<tr>
<td>✔ 2018</td>
<td>6</td>
<td>the ageing phenomena</td>
<td>Life duration expectation</td>
</tr>
<tr>
<td>…</td>
<td>7</td>
<td>Identification of limits in the usage of the product</td>
<td></td>
</tr>
<tr>
<td>…</td>
<td>8</td>
<td>Reliability objectives</td>
<td>MTBF, MTTF, life duration, …</td>
</tr>
<tr>
<td>…</td>
<td>9</td>
<td>Safety objectives</td>
<td>Norms, ..</td>
</tr>
</tbody>
</table>
Other example of case that could be submitted for the RRclim

- Product: Unsealed relay
- Pellets Contacts: Nickel Plated
- Expected life of 10 years
- No maneuvers
- Ground fixed equipment protected from the direct arrival of bad weather
- Usage: Paris
ASTE contribution

Other example of case that could be submitted for the Rrclim (following)

1. Possible mode(s) of failure of this relay
2. Identification of the environmental agents which influence the mode(s) of failure
3. Caracterization of these environmental agents
4. Withhold degradation law(s) associated with the mode(s) of failure
5. Assumptions on the values of the parameters that intervene in the law(s)
6. Proposal of accelerated test(s) associated
CEEES contribution

• Dave Richards (UK) will propose an alternative text for such a survey by the end on November, that will be submitted for discussion among the CEEES members.
Climatic Survey Questionnaire

1. Which climatic environmental conditions do you typically consider in the design and evaluation of your company’s products?

- Temperature,
- Solar radiation,
- Thermal shock,
- Humidity,
- Water (including; rain, condensation, dew and immersion),
- Snow and ice (including; hail and freeze/thaw),
- Pressure (including; atmospheric, elevated ground, altitude, induced),
- Dust (including sand),
- Salt and/or corrosive atmosphere,
- Contaminating fluids,
- Fungus and biological conditions
- Wind
- Other *(please specify)*

2. Do you design and evaluate your company’s products to be used:

- In a single geographical location,
- In a single country,
- In a single continent,
- World-wide
- Essentially world- wide but with some restrictions
- Other *(please specify)*

3. Do you design and evaluate your company’s products by considering the climatic environmental conditions singularly or in combination with other environments?

- By considering the climatic environmental conditions singularly
- By considering the climatic environmental conditions in combination with others
- Both.

4. If you design and evaluate your company’s products by considering a combination of the climatic environmental conditions, which are the most commonly adopted?

- Temperature / humidity
- Temperature / solar radiation
- Temperature / pressure,
- Temperature / vibration
- Temperature / humidity / altitude
- Dust and sand,
- Other *(please specify)*

5. How do you establish the appropriate severities for these climatic environmental conditions for your company’s products?

- Historic precedence (i.e. what you have used previously)
- Supplied by customer,
- Company proprietary knowledge,
- National or International standards,
- Measured information,
- Other *(please specify)*
6 If you use National or International standards, please indicate those you typically consider.

IEC EN 60068
IEC EN 60721 (Parts 2, 3 or 4)
EUROCAE 14 / DO 160,
Mil Std 810
GAM EG 13
STANG 4370 AECTP 300
Other (please specify)……………………………………………………………………

7 If you use Measured climatic information, please indicate how you acquire such data.

World Meteorological Organisation (WMO) data,
Use of environmental data loggers,
Use laboratory measurements,
Analytical methods,
Company proprietary knowledge,
Other (please specify)……………………………………………………………………

8 When you evaluate your company’s products against climatic environmental conditions is it to establish the products;

Reliability,
Life evaluation
Capability
Approval / certification / acceptance by customer
other (please specify)……………………………………………………………………

9 How do you typically DESIGN your company’s products against climatic environmental conditions;

By use of analytical modelling,
By use of existing knowledge databases (Calce etc.)
By company proprietary knowledge / data
Other (please specify)……………………………………………………………………

10 How do you typically EVALUATE your company’s products against climatic environmental conditions;

By laboratory testing,
By field testing,
By analytical modelling,
By use of existing databases (Calce etc.)
By company proprietary knowledge / data
Other (please specify)……………………………………………………………………

11 When you DESIGN your company’s products against temperature conditions for, do you consider?

Steady state temperatures,
Natural varying daily temperatures,
Temperatures induced by operation of the equipment,
Temperatures induced by solar radiation.
Thermal shocks,
Kinetic heating,
Temperatures arising from use on elevated ground,
Temperatures arising from use at altitude (such as in aircraft),
Temperatures arising from use in space,
Other (please specify).........................................................................................................................

12 When you TEST your company’s products against temperature conditions for, do you consider?

   Steady state temperatures,
   Natural varying daily temperatures,
   Temperatures induced by operation of equipment,
   Temperatures induced by solar radiation.
   Thermal shock,
   Kinetic heating,
   Temperatures arising from use on elevated ground,
   Temperatures arising from use at altitude (aircraft etc.),
   Temperatures arising from use in space,
   Other (please specify).........................................................................................................................

13 When you DESIGN your company’s products against water conditions for, do you consider?

   Rain,
   Condensation,
   Dew,
   Immersion,
   Snow,
   Ice,
   Hail,
   Freeze/Thaw,
   Other (please specify).........................................................................................................................

14 When you TEST your company’s products against water conditions for, do you consider?

   Rain,
   Condensation,
   Dew,
   Immersion,
   Snow,
   Ice,
   Hail,
   Freeze/Thaw,
   Other (please specify).........................................................................................................................