58th CEEES MEETING Rotterdam 2012

MINUTES TAB R&ESS

1 ADOPTION OF THE 57th TAB R&ESS MEETING MINUTES

The minutes were adopted.

2 APOLOGIES FOR ABSENCES

Harry Roossien is apologized (duty of in-coming CEEES president)

3 INTRODUCTION OF (NEW) MEMBERS

Erik Veninga is replacing Jacob Boudewijn at the R&ESS TAB.

. It was suggested during the 54th meeting in Mechelen to make an overview of core members and virtual members, where it was referred to the set-up some years ago. Below the proposed list.

Core Members (Wien meeting)		Virtual Members
Henri Grzeskowiak (ASTE)	present	Michel Holy
		Sami Millyniemi
Helge Palmen (KOTEL)	present	Antii Turtola (VTT/KOTEL)
Harry Roossien (PLOT)	apologized	Klaus Kangas (KOTEL)
Erik Veninga (TNO)	present	Roman Betschen (SSEE)
Werner Wittberger (SSEE)	present	Hubert Dollenmeier (SSEE)

Contact data of core members

Name	1st name	Company/Society	Phone	email
GRZESKOWIAK	Henri	HG Consultant /ASTE	+33 6 10 90 44 79 +33 9 75 46 11 11	henri@grzeskowiak.fr
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WITTBERGER	Werner	Rheinmetal Air Defence/SSEE	+41 4331 63456	werner.wittberger@rheinmetall-ad.com

4 REPORT

The agenda of the meeting proposed the review of 4 drafts of RP (Recommended practice)

4.1 Review of CEEES Publication n° 9.

The future evolution of the publication n° 9 has been discussed.

First proposal has been to widened its content to reliability issues in the product development. This is already well covered in many documents that may be free downloaded on many Web Sites .

Henri G. has made available on a dedicated site a lot of documents that can be downloaded.
To access the site:
- Install an FTP software like filezilla (free on Google) and start execution
- Fill in the following four windows:
  site: ftp.grzeskowiak.fr
  login: RESS-TAB
  password: -2$1tB0Es0
  port: 21

(NB: I remind that access to ftp from institutions is generally limited and you should seek an agreement from your IT department; I also remind you that you can create new folders and make your doc accessible to colleagues ; attention: the files are in read and write mode, i.e. you can inadvertently delete a file.)

Second proposal was to bring only small improvements to CEEES Publication n° 9..
To keep in mind the proposals , we may find in appendix 3 a list of proposals made on publication n°9 during previous meetings.

Third proposal is to develop an electronic- Interactive list of documents related to Environmental Engineering and Reliability

The idea of an electronic interactive document is investigated which contains but is not limited to information out of CEEES Publication No 4. Newcomers can find information on current standards and will know which one to buy for a certain task. (see appendix 1)

4.2 ASTE document on HA-ESS

Reminder of the Mechelen report :

> SSEE is working on an updated version of their ESS book. Within this book HA-ESS might be addressed as well. This information can be aligned with the ASTE document, but therefore the consequences should be reviewed. It could be two separate documents, but then the information could be inconsequent and not of benefit for the readers and TAB.
> Next to technical, the commercial interests are part of this document, a strategic discussion between SSEE and CEEES need to take place, Werner is best to take this action point and start with sending out the contents list of the current SSEE ESS book. (AR 8)
> Henri/Werner will organize a strategic meeting with Henri Grzeskowiak, Werner Wittberger, Marco Huber and Thomas Reichert. (AR 9)

Nothing new has been discussed on that topic at the Wien , Liege and Rotterdam meetings.

Reminder of comments received from Harry :

> After first review following issues could help to bring the document from national to european level:

- add explanations and clarifications
  . on distributions/shift
  . on type of failmodes (not unrealistic failmodes)
  . on thermal cycling gradient
  . on precipitation and detection testing vs on/off andstep back.
- add or combine with other practices
  . add statistics (Weibull)
  . add relations to confidence level and test coverage
  . add other standards, to make it an overall document

Since we could do this in the existing document and make it even better, there is a need to have the document, preferably in word-format.
If I receive the document from ASTE: Environmental Stress Screening for Electronic Equipment using Highly Accelerated Tests guide, DEV HA ESS R25 2006, it will be used only for the above reasons. It will be used for review and update, not be used for commercial reasons.

4.3 Environmental Engineering documents

Reminder of the Mechelen report :

There was no input and review is postponed till next meeting. There is an action for all core-members to look through the documents and present next time what they think need to be done.
(Red. Harry: in the GA it was emphasized that the quality of these document need to be assured and that peers review would be necessary. It might be that not all models are correct or in right perspective (Dave)).

Nothing new has been discussed on that topic at the Wien , Liege nor Rotterdam meetings. No remark has been provided either by Thomas Reichert representing the climatic TAB nor by David Richards representing the mechanical TAB.

5 Tour of table

Werner for the Swiss Society :

- Ueli Grossen will be the next president of the Swiss Society
- 45 corporate , 25 individual , 3 honorary members

Technical Symposium: October 25th & 26st, 2012:

- **Session 1, short lectures (5 … 10 minutes) followed by open discussion**
  - Storage test of electronic boxes in free environment.
  - Calibration of humidity sensors
  - Protection from corrosion during transport
- **Session 2:**
  - Basis and origin of standards
  - Trends in transport surveillance
  - Packaging for transport, damages
- **Session 3:**
  1. Inverters used in Photovoltaic
     - MODULWECHSELRICHTER
     - STRANGWECHSELRICHTER (ENGL. STRING INVERTER)
     - ZENTRALWECHSELRICHTER

  2. Two surprise Topics

Workgroups:

ESS-book, second edition, in progress in close cooperation with GUS

Seminar

Proposed seminars HASS/HALT and Specifications due to number of registrations not executed.

Helge for the Finnish Society:

- On going project on handbook on reliability suppliers topic (handling of reliability topics during the supplier phase)

  Conferences and open meetings

  KOTEL has organised one conference in 2011: Virtual environmental testing for electronic product reliability

  KOTEL has also organised two open meetings for members of our working group Members; the themes were :

  - design and specifications
  - environment and reliability

  Projects

  Two projects have been completed:

  - KOTEL 071: Virtual environmental testing for electronic product reliability (VET)
  - KOTEL 081: Acceleration of aging and corrosion tests for PCBA reliability (CORRE)

  One project is in preparation:

  - KOTEL 112: Supplier DfR handbook – Guidelines for ensuring reliability requirement fulfilment

  Working group activities

  KOTEL have seven working groups, but only three have been active during 2011:

  - WG5 Environmental testing
  - WG6 Reliability technology
  - WG19 Environment and electronics

  One new working group in under investigation:

  - WG21 Energy and Thermal Management

Erik (for the PLOT) :

- Erik replaces Jacob Boudewijn at the R&ESS TAB
- Reliability is not only testing but also an engineering approach
  - o How to implement in the design
  - o How be more pro-active
- Meeting in November with presentation of a new approach

Henri (for ASTE) :

Creation of a MECA-CLIM commission (Henri is the chairman) ; this is a working group taking the following of the previous CIN EG mécanique and CIN EG climatique, within the frame of Ministry of defense; French MOD is disengaging from all the standardization areas considered as dual (responding to the needs of civil and military prducts) , in favor of AFNOR.

So the FRANCE is preparing 6 AFNOR norms (to be finished by end 2014) :

- Pr NFX 50144-1 : general management of the environment in a product life cycle
- Pr NFX 50144-2 : the 4 steps process of tailoring the environmental tests to the product life profile
- Pr NFX 50144-3 : application of the Pr NFX 50144-2 to the mechanical environment
- Pr NFX 50144-4 : application of the Pr NFX 50144-2 to the climatic environment
- Pr NFX 50144-5 : guarantee coefficient
- Pr NFX 50144-6 : test factor

6 ACTION LIST

Ref.	Resp.	Action
AR 1	Helge	Make proposal for explanation of other issues in the graphs ‘reliability growth’
AR 2	Veninga (instead of Boudewijn)	Put ‘too simple assumptions’ into perspective and make short explanation on the models
AR 3	Werner	Make proposal to add text to the publication which brings MTBF into the right perspective
AR 4	Boudewijn	Ask Isabelle Vervenne for latest information/references and give that info to Werner
AR 5	Werner	Add the references for MTBF (K.K. Bothe and Isabelle Vervenne/input Boudewijn)
AR 6	Harry	Come up with proposal for software reliability, where and what to add in the publication
AR 7	Harry	Add text to ‘assure’ product maturity in production and field
AR 8	Werner	Sent out contents current ESS book
AR 9	Werner/Henri	Have discussion between SSEE and CEEES about ASTE document
AR10	Henri	Introduce an overview of the tools used by the Reliability Experts

Annexe 1: electronic- Interactive list of documents related to Environmental Engineering and Reliability


PAPERS
PUBLICATION
HASS
HALT
BOOKS
SAFETY
Guidelines
Production
Requirements
Software
Communication
Test
Verification
Prediction
Models
Engineering
Reliability

Safety	ISO 26262 all parts	2011	Road vehicles -Functional safety
	ISO 26262 parts 2 & 3	2011	Road vehicles -Functional safety
	Expert Group 17	2011	Dependability & Safety (Final Report)
	EUROCAE ED 79A	2010	Certification considerations for highly-integrated or complex aircraft systems
	IEC 61508 all parts	2010	Functional safety of electrical / electronic / programmable electronic safety- related systems
	AOP-42	2009	Integrated design analysis for munition initiation systems and other safety critical systems
	AOP-38 Ed 5	2009	Glossary of terms and definitions concerning the safety and suitability for service of munitions, explosives and elated products
	DEF Stan 00-56	2007	Safety Management Requirements for Defence Systems
	AOP-52	2006	Guidance on Software Safety Design and Assessment of Munitions-Related Computing Systems
	RG Aero 00027	2005	Programme management - Guide to RAMS management
	MIL-STD 882 E	2005	Standard Practice for System Safety
	STANAG 4297	2001	Guidance on the assessment of the safety and suitability for service of munitions for NATO armed forces
	EUROCAE ED 80	2000	Design assurance guidance for airborne electronic hardware, RTCA DO 254
	AOP-15	1998	Guidance on the assessment of the safety and suitability for service of munitions for NATO armed forces
	ARP 4761	1996	Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment
	EUROCAE ED 12	1992	Software considerations in airborne systems and equipment certification, RTCA DO 178 B

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Reliability	SAE JA 1010/1	2011	Maintainability Program Standard & Implementation Guide
	BS 5760-18	2010	Guide to the Demonstration of Dependability Requirements-The Dependability case
	ARMP-7 Ed2	2008	NATO R&M Terminology applicable to ARMP's
	ARMP-1	2008	NATO Requirements for Reliability and Maintainability (SAE JA 1000 & 1000-1; SAE JA 1010 & 1010-1)
	DEF Stan 00-42 part 3	2008	Reliability and Maintainability Assurance Activities- Relibility and Maintainability Case
	IEC 60300-1&2	2003	Dependability management
	IEC 60050-191 am 2 Ed 1	2002	International Electrotechnical Vocabulary. Chapter 191: Dependability and quality of service
	IEC 61703 Ed1	2001	Mathematical expressions for reliability, availability maintainability and maintenance support terms
	STANAG 4174	2001	Allied Reliability and Maintainability Publications (ARMP 1,4,6&7)
	SAE JA 1000/1	1999	Reliability Program Standard & Implementation Guide)
	DEF Stan 00-40 part 1	1999	Reliability and Maintainability: Management responsibilities and requirements for programmes and plans
	MIL-HDBK 470 A	1997	Designing and developing Maintainable Products and Systems

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Requirements	BS 5760-18	2010	Guide to the Demonstration of Dependability Requirements-The Dependability case
	ARMP-4	2008	Guidance for writing NATO Reliability and Maintainability Requirements Document
	IEC 60300-1&2	2003	Dependability Management
	IEC 60300-3 part 4	2003	Dependability Management - application guide - Guide to the specification of dependability requirements
	TE000-AB-GTP-020	1992	Environmental Stress Screening Requirements and Application Manual for Navy Electronic Equipment
	DIN EN 50126-1	1999	Specification, Proof of Reliability, Availability, Maintenance and Safety

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Prediction Models	HRD5	2008	Telecommunication UK (similar to CNET RDF 93)
	NSWC-98/LE1	2007	Handbook of Reliability Prediction Procedures for Mechanical Equipment
	Telcordia (Bellcore)	2007	TR-332/SP-332
	RIAC-HDBK-217 Plus	2006	Handbook of 217Plus TM Reliability Prediction Models
	GJB Z 299C	2006	Military, China, GJB/z 299B
	IEC-61165	2005	Application of Markov techniques
	FIDES	2004	FIDES Guide 2004 A Reliability Methodology for Electronic Systems
	IEC-TR 62380	2004	Reliability data handbook-Universal model for reliability prediction of electronics components, PCBs and equipment’
	RDF 2000	2003	France (Alion System Reliability Center / UTEC 80810)
	PRISMR	2000	RAC, Incorporates NPRD/EPRD
	MIL-HDBK-217 FN2	1995	Military Handbook Reliability Prediction of Electronic Equipment
	CNET RDF 93	1995	France
	NPRD/EPRD	1995	Nonelectronic Parts Reliability (NPRD) and Electronic Parts Reliability (EPRD) databasees by RAC
	ReliaSoft	1992	WEIBULL++, ALTA, DOE++, RGA, BLOCKSIM, RENO, λPREDICT, XFMEA, RCM++, MPC, XFRACAS

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Engineering				
	Techniques & Methods	ISO 26262 part 4	2011	Road vehicles -Functional safety
		IEC 61165	2006	Application of Markov Techniques
		IEC 60812	2006	Analysis Techniques for system Reliability - Procedure for Failure Mode and Effect Analysis (FMEA)
		IEC 61078	2006	Analysis Techniques for system Dependability -Reliability Block Diagram (RBD) and boolean methods
		MIL STD 882 E	2005	Standard Practice for System Safety
		IEC 61508 part 7	2000	Functional safety of electrical / electronic / programmable electronic safety- related systems - Definitions and abbreviations
		SAE ARP 4761	1996	Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment
		IEC 61025	1992	Fault Tree Analysis (FTA)
	Prediction	IEC 61709	2010	Electronic components - Reliability - Reference condition for failure rates and stress models for conversion
		UTEC-CC 80811	2010	Reliability Methodology for Electronic Defence Systems - Fides Guide
		NPDR 2010	2010	Non-Electronic Parts Reliability Data
		NPDR 95	1995	Non-Electronic Parts Reliability Data
		NSWC-94/L07	1994	Handbook of Reliability Prediction Procedures for Mechanical Equipment
	Design Assessment	IEC 60319	1999	Presentation and specification of reliability data for electronic components
		MIL-HDBK 338 B	1998	Electronic Reliability Design Handbook
		MIL -HDBK 251	1978	Reliability / Design Thermal Applications

	Maintainability	IEC 60300-3 part 10	2009	Dependability management - application guide - Maintainability
		MIL -HDBK 2084	1995	Maintainability of Avionic and Electronic Systems and Equipment
		IEC 60706 part 2	1992	Maintainability of Equipment - Maintainability requirements and studies during design and development phase, replaced by IEC 60300
		MIL -HDBK 470	1989	Designing and Developing Maintainable Products and Systems
		DOD-HDBK 791	1988	Maintainability Design Techniques
		MIL -HDBK 472 N1	1966	Maintainability Prediction
	Testability	MIL-HDBK 2165 A	1995	Testability Handbook For Systems and Equipments
		IEC 60706-5	1992	Maintainability of Equipment - Part 5: Testability and Diagnostic Testing

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Test & Verification		ISO 26262 part 7	2011	Production and operation
		ARMP-6	2008	Guidance for Managing in-service Reliability and Maintainability
	Reliability Growth	MIL-HDBK 189	2011	Reliability Growth Management
		IEC 62429	2007	Reliability growth - Stress testing for early failures in unique complex systems
		IEC 61164	2004	Reliability Growth-Statistical test and estimation methods
		IEC 61014	2003	Programmes for reliability growth
	Data Collection & Failure Analysis	IEC 60300-3 part 2	2009	Dependability management - Part 3-2: Application guide - Collection of dependability data from the field)
		ATA Spec 2000		Reliability Data Collection / Exchange
		RG Aero 00033		Programme management fracas: failure reporting analysis and corrective actions system
		STANAG 4158		Guidelines for classifying incidents for reliability estimation of tracked and wheeled vehicles
		DEF Stan 00-44		Reliability and Maintainability Data Collection and Classification
	Test Method	MIL-STD-883 H	2010	Test Method Standard Microcircuits
		IEC 60300-3-5	2009	Dependability management - Reliability test conditions and statistical test principles
		ARMP-6	2008	Guidance for Managing In-service R&M
		IEC 61163-1	2006	Reliability stress screening - Part 1: Repairable assemblies manufactured in lots
		MIL-STD 690 D	2005	Failure Rate Sampling Plans and Procedures
		IEC 60068-3-5	2001	Environmental Testing Part 3-5: Supporting documentation and guidance; confirmation of the performance of temperature chambers

		IEC 61650	1997	Reliability data analysis techniques - Procedures for the comparison of two constant failure rates and two constant failure (event) intensities
		MIL-HDBK 2164	1996	Environmental Stress Screening Process for Electronic Equipment
		MIL-HDBK 781	1996	Reliability Test Methods, Plans, and Environments for Engineering Development, Qualification, and Production
		MIL-HDBK-344 A	1993	Environmental Stress Screening (ESS) of Electronic Equipment
		MIL-STD-781 D	cancelled	Reliability Testing for Engineering Development, Qualification and Production
		MIL-STD-2164 (EC)	cancelled	Environmental Screening Process for Electronic Equipment

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Software	ISO 26262 part 6	2011	Road vehicles -Functional safety
	ARMP-9	2008	Guide to the management of software R&M
	IEEE STD 1633	2008	Recommended Practice on Software Reliability
	ISBN-10: 1852339500	2006	System software reliability, Hoang Pham, Springer series in Reliability Engineering series ISSN 1614-7839
	IEC 61508	2000	Functional safety of electrical / electronic / programmable electronic safety- related systems
	BS 5760-8	1998	Guide to the Assessment of Reliability of Systems containing Software
	EUROCAE ED 12 B	1992	Software considerations in airborne systems and equipment certification; DO-178 B
			Software Safety and Reliability, Hermann / IEEE Computer Society

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Communication			
	DIN EN 50128	2012	Software for Train Control and Supervision
	IEC 61907	2010	Communication network dependability engineering
	DIN EN 50155	2008	Electronical Equipment for Rail Vehicles
	DIN EN 50129	2003	Safety relevant electronical Systems for Signaltechnik

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Production			
	IEC 60068-1-1…-3.5	2008	Environmental testing standards
	IEC 61163-2	1998	Reliability stress Screening - Part 2: Electronic components
	IEC Standard 61163	1995	Reliability Stress Screening - Part 1: Repairable Items manufactured in lots
	AMC-R 702-25	1987	AMC Environmental Stress Screening Program
	DOD 4245.7 (D)	1984	Transition from Development to Production
	NAVMAT P-9492	1979	Navy Manufacturing Screening Program (Decrease corporate costs increase fleet readiness
	MIL-STD-785 B (notice 3)	cancelled	Reliability Program for Systems and Equipment Development and Production

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BOOKS	e-Handbook of Statistical Methods	2012	NIST/SEMATECH [http://www.itl.nist.gov/div898/handbook/
	Shock and Vibration Handbook by Cyrill M.Harris and Allan G. Piersol 5th Edition	2002	
	Accelerated Stress Testing Handbook by H.Antony Chan and Paul J. Englert	2001	
	Reliability Engineering Handbook volumes 1 and 2 by D. Kececioglu	2000	
	Accelerated Reliability Engineering: HALT and HASS by Gregg K. Hobbs	2000	
	Synthesis of an ESS Survey at European Level / ISBN: 3-9521118-1-3	1999	Confederation of European Environmental Engineering Societies
	Environmental Engineering Handbook	1997	Swedish Environmental Engineering Society
	Quality and Reliability of Technical Systems Prof. Dr. A. Birolini	1997	Theory, Practice, Management, 2nd Edition
	Profit mit ESS / ISBN: 3-9521118-1-3	1996	Swiss Society of Environmental Engineering
	Reliability & Life Testing Handbook volumes 1 and 2 by D. Kececioglu	1993	
	Reliability Engineering Handbook volumes 1 and 2 by D. Kececioglu	1991	
	Accelerated testing handbook by D.S.Peck and O.D.Trapp / ISBN: 0-932787-X 5th Edition	1991	
	The ESS handbook by J. Diakema		

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Technical papers regarding ESS	ANNUAL RELIABILITY & MAINTAINABILITY SYMPOSIUM RAMS	1972 to 2012	Proceedings available with IEEE
	START	2002	Selected Topics in Assurance Related Technologies publications of the Reliability Analysis Center RAC http://rac.alionscience.com
	Accelerated Reliability Test Results: Importance of Input Vibration Spectrum and Mechanical Response of Test Article by: S.Jawaid (Quantum Corporation), P.Rogers (Unholtz-Dickie Corporation)	2000	2000 Proceedings Annual RAM Symposium
	Reliability & Failure of Electronic Materials & Devices by: Milton Ohring	1998	ISBN: 0125249853
	Failure Modes and Mechanisms in Electronic Packages by: Puligandla Viswanadham and Pratrap Singh	1998	ISBN: 0412105918
	Overview of Accelerated Stress Testing Principles by: H. Anthony Chan (AT&T Labs)	1997	Third IEEE Workshop on Accelerated Stress Testing
	Safety Screen, Design Improvement and Vendor Control by: Gary Hazard	1997	Third IEEE Workshop on Accelerated Stress Testing
	Environmental Stress Screening 2000	1997	National Centre for Manufacturing Sciences Project NCMS No. 160301

	Hidden Assumptions in Temperatrure and Vibration Test Time Compression Models Used for Durability Testing by: Hank Caruso (Westinghouse)	1997	1994 Proceedings IES
	Electrodynamic versus Pneumatic Shakers for Stress Screening by: W. Tustin	1997	Third IEEE Workshop on Accelerated Stress Testing
	Failure Mechanisms in Semiconductor Devices by: E. Ajith Amerasekera, Farid N. Najm	1997	ISBN: 0471954829
	SP Report 1994: 30 Proposed Nordtest Method Reliability Stress Screening of Components, A guide for component user	1994	SP Swedish National Testing Research Institute and Nordtest
	SP Report 1994: 31 Background Information to Reliability Stress Screening of Components, A guide for component user	1994	SP Swedish National Testing Research Institute and Nordtest
	SP REPORT 1994:31 Background Information to Reliability Stress Screening of Components, A guide for component user	1994	SP Swedish National Testing Research Institute and Nordtest
	Vibration Screens for IBM Mainframe Computers "Innovative Strategy Achieves Quality and Reliability Enhancements" by: S.M.Goldfarb and H.B.Schwartz	1993	1993 Proceedings - Institute of Environmental Sciences

	Effects of Random Vibration on a Mature Product and Process by: Mark Terenzoni (Shiva Corporation)	1993	1993 Proceedings - Institute of Environmental Sciences
	Reliability Engineer's Toolkit	1993	ROME Laboratories Quanterion Solutions
	Environmental Stress Screening of Spares and Repairs	1992	1992 Proceedings - Institute of Environmental Sciences
	Reliability Stress Screening of printed wiring assemblies by: Arne Börjesson, Per Halkjaer Jacobson, Valter Loll	1991	Nordtest-Remiss Nr 985-91
	Accelerated testing handbook by: D.S.Peck and O.D.Trapp	1991	ISBN: 0-932787-X
	Precipitation and Detection Screen by: Gregg K. Hobbs	1990	Hobbs Ewngineering Corperation
	ESS at Final Assembly Level Actual Results-Optimisation Method by: Bernard Geniaux, Electronique Serge Dassault, France	1987	The Journal of Environmental Sciences Jan/Feb 1988
	Product Integrity Through Environmental Stress Screening by: Robert L. Anderson		Institute of Environmental Sciences Back

HALT	Highly Accelerated Life Testing "Testing with a different purpose" by: N. Doertenbach	2000	Qual/Mark
	Summary of HALT and HASS results at an Accelerated Reliability Test Centre (ARTC) by: M. Silverman (Qual/Mark Corporation)	2000	Qual/Mark / HALT / HASS
	High Accelerated Life Testing for Design and Process Improvements by: Ann Marie Hopf (Array Technology)	2000	Qual/Mark
	Synthese de la Table Ronde sur le theme des methodes de fiabillsation practiquees dans le domaine de l'avionique	1999	Table Ronde ASTELAB 99 SEXTANTE AVIONIQUE AEROSPATIALE
	Les essais aggraves dans la perspective du deverminage by: Jean-Pierre (NortelNetworks)	1999	ASTELAB
	Accelerated Testing	1999	START / RAC (Department of Defence)
	HALT and HASS on the Voice Memo II by: Michael Silverman (Centigram Communications Corporation)	1999	Qual/Mark
	HALT problems early in design by: G. Coleman (Sharetree Systems)	1998	Industrial Technology
	Straight talk about accelerated Stress Testing by: E.R.Hnatek & E.L.Kyser (Tandem Computer)	1998	Proceedings IES
	How many axes are best for you by: P.O'Shea	1998	Evaluation Engineering

	Stress Your Products Approriately and Contain Your Costs by:Paul O'Shea	1998	EE-Evaluation Engineering
	What HALT and HASS can do for your products by: G.K.Hobbs	1997	EE-Evaluation Engineering
	HALT A Tutorial on Equipment, Process & Implementation by: Charles Felkins	1997	Third Workshop on Accelerated Testing
	Exceeding the Limits of Traditional Reliability Tests by: Harry Mc Lean	1994	Mmedical Device & Diagnostic Industry
	Le role des essais dans la maitrse de la fiabilite	1993	ASTE Commission ASTE "Fiabilite & Environment
	Highly Accelerated Life Test by: G.K.Hobbs	1990	Hobbs Engineering Corporation
	HALT used in Design for Product Ruggedization HASS used in Production for Process Monitoring		Qual/Mark (extract from a seminar of G.K.Hobbs)
	HALT and ESS for Quick-To-Market Scenarios by: C. Ascarrunz & E.L.Kyser (Tandem Computers)		
	Highly Accelerated Life Testing - A Learning Experience by: Ted Parker & Alan Metzer (Honywell Inc.)		Back

HASS	Vibration as applied to HALT and HASS	1996	Hobbs Engineering Corporation
	Advanced HALT and HASS	1996	Hobbs Engineering Corporation
	Accelerated Qualit Maturity for Avionics	1996	Hobbs Engineering Corporation Accelerated Reliability Symposium Edward O. Minor (BOEING Company)
	Highly Accelerated Stressing of Products With Very Low Failure Rates by: Harry McLean, Reliability Engineer, Hewlett-Packard Co. Vancouver Division, Vancouver, Washington	1992	Proceedings Institute of Environmental Sciences
	Highly Accelerated Stress Screen HASS by:Gregg.K. Hobbs	1990	Hobbs Engineering Corporation
	HASS from concept to completion by: D.Rahe	1988	Qual/Mark Evaluation Engineering

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GUIDELINES	IEST-RP-PRR0001.1 Management and Technical Guidelines for the ESS Process	1999	Institute of Environmental Sciences
	CIN-EG-01	1999	GUIDELINES FOR ACCOUNTING FOR THE ENVIRONMENT IN MILITARY PROGRAMMES
	Environmental Stress Screening Guidelines for Assemblies	1990	Institute of Environmental Sciences
	USAF R&M 2000 Process	1988	Office of the Special Assistant for Reliability and Maintainability HQ USAF/LE-RD
	RADC Guide To Environmental Stress Screening RADC-TR--86-138, In House Report by Eugene Fiorentino AD-A174 333	1986	ROME Air Development Centre, Air Force Systems Command, Griffiss Air Force <<base, NY 13441-5700
	Environmental Stress Screening A Tutorial ISBN: 0-915414-85-6	1985	Institute of Environmental Sciences
	Navy Maufacturing Screening Program	1979	NAVMAT P-9492 Dept. Of the Navy
	Deverminage des Materiels Electroniques		ASTE

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PUBLICATION	N° 9	2009	CEEES Technical Advisory Board Reliability & ESS -RELIABILITY - For a Mature Product From the Beginning of Useful Life ISSN 1104-6341

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Appendix 2 : List of standards by TC 56 of the IEC

신뢰성 관련IEC 표준 리스트

- **Dependability management**

- **IEC 60300-1 (2003-06)** Dependability management - Part 1: Dependability management systems
- **IEC 60300-2 (2004-03)** Dependability management - Part 2: Guidelines for dependability management
- **IEC 61160 (2006-02)** Design review

- **Terminology**
- **IEC 60050-191** International Electrotechnical Vocabulary - Chapter 191: Dependability and quality of service
- **IEC 61703 (2001-09)** Mathematical expressions for reliability, availability, maintainability and maintenance support terms

- **General dependability**

- **IEC 60300-3-4 (1996-08)** Dependability management - Part 3: Application guide - Section 4: Guide to the specification of dependability requirements
- **IEC 61160 (2006-02)** Design review

● **Maintainability**

- **IEC 60300-3-10 (2001-01)** Dependability management - Part 3-10: Application guide - Maintainability
- **IEC 60706-2 (2006-03)** Guide on maintainability of equipment. Part 2 - Section Five: Maintainability studies during the design phase
- **IEC 60706-3 (2006-04)** Guide on maintainability of equipment. Part 3 - Sections Six and Seven. Verification and collection, analysis and presentation of data
- **IEC 60706-5 (1994-11)** Guide on maintainability of equipment - Part 5: Section 4: Diagnostic testing

● **Maintenance support**

- **IEC 60300-3-11 (1999-03)** Dependability management - Part 3-11: Application guide - Reliability centered maintenance
- **IEC 60300-3-12 (2001-12)** Dependability management - Part 3-12: Application guide - Integrated logistic support
- **IEC 60300-3-14 (2004-07)** Dependability management - Part 3-14: Application guide - Maintenance and maintenance support
- **IEC 62402** In preparation. NWI Obsolescence management - Application guide
- **IEC 60300-3-16 Ed. 1.0** In preparation. Dependability management - Part 3-16: Application guide - Guideline for the specification of maintenance support services

● **Reliability/availability**

[Reliability testing]

- **IEC60300-3-5(2001-03)** Dependability management-Part3-5: Application guide - Reliability test conditions and statistical test principles
- **IEC 60605-2 (1994-10)** Equipment reliability testing - Part 2: Design of test cycles
- **IEC 60605-3-1 (1986-09)** Equipment reliability testing. Part 3: Preferred test conditions. Indoor portable equipment - Low degree of simulation
- **IEC 60605-3-2 (1986-09)** Equipment reliability testing. Part 3: Preferred test conditions. Equipment for stationary use in weather protected locations - High degree of simulation
- **IEC 60605-3-3 (1992-11)** Equipment reliability testing - Part 3: Preferred test conditions - Section 3: Test cycle 3: Equipment for stationary use in partially weather protected locations - Low degree of simulation
- **IEC 60605-3-4 (1992-07)** Equipment reliability testing - Part 3: Preferred test conditions - Section 4: Test cycle 4: Equipment for portable and non-stationary use - Low degree of simulation
- **IEC 60605-3-5 (1996-03)** Equipment reliability testing - Part 3: Preferred test conditions - Section 5: Test cycle 5: Ground mobile equipment - Low degree of simulation
- **IEC 60605-3-6 (1996-08)** Equipment reliability testing - Part 3: Preferred test conditions - Section 6: Test cycle 6: Outdoor transportable equipment - Low degree of simulation
- **IEC 60605-4 (2001-08)** Equipment reliability testing - Part 4: Statistical procedures for exponential distribution - Point estimates, confidence intervals, prediction intervals and tolerance intervals
- **IEC 60605-6 (1997-04)** Equipment reliability testing - Part 6: Tests for the validity of the constant failure rate or constant failure intensity assumptions
- **IEC 61070 (1991-11)** Compliance test procedures for steady- state availability
- **IEC 61123 (1991-12)** Reliability testing - Compliance test plans for success ratio
- **IEC 61124 (2006-03)** Reliability testing - Compliance tests for constant failure rate and constant failure intensity
- **IEC 60410 (1973-01)** Sampling plans and procedures for inspection by attributes

[Reliability screening]

- **IEC60300-3-7(1999-05)** Dependability management-Part3-7: Application guide - Reliability stress screening of electronic hardware
- **IEC 61163-1 (1995-08)** Reliability stress screening - Part 1: Repairable items manufactured in lots
- **IEC 61163-2 (1998-11)** Reliability stress screening - Part 2: Electronic components

- **IEC 61649 (1997-05)** Goodness-of-fit tests, confidence intervals and lower confidence limits for Weibull distributed data
- **IEC 61650 (1997-08)** Reliability data analysis techniques - Procedures for comparison of two constant failure rates and two constant failure (event) intensities
- **IEC 61710 (2000-11)** Power law model - Goodness-of-fit tests and estimation methods

[Reliability growth]

- **IEC 61014 (2003-07)** Programmes for reliability growth
- **IEC 61164 (2004-03)** Reliability growth - Statistical test and estimation methods

[Reliability modeling and analysis]

- **IEC 60319 (1999-09)** Presentation and specification of reliability data for electronic components
- **IEC 61709 (1996-10)** Electronic components - Reliability - Reference conditions for failure rates and stress models for conversion
- **IEC60300-3-2(2004-11)** Dependability management-Part3-2: Application guide - Collection of dependability data from the field
- **IEC 62309 (2004-07)** Dependability of products containing reused parts - Requirements for functionality and tests
- **IEC 60300-3-4 (1996-08)** Dependability management - Part 3: Application guide - Section 4: Guide to the specification of dependability requirements
- **IEC 60812 (1985-07)** Analysis techniques for system reliability - Procedure for failure mode and effects analysis (FMEA)
- **IEC 61025 (1990-10)** Fault tree analysis (FTA)
- **IEC 61078 (1991-11)** Analysis techniques for dependability - Reliability block diagram method
- **IEC 61165 (1995-01)** Application of Markov techniques
- **IEC 62308** In preparation. Reliability assessment methods
- **IEC 60300-3-1 (2003-01)** Dependability management - Part 3-1: Application guide - Analysis techniques for dependability - Guide on methodology

[Technical risk analysis]

- **IEC60300-3-9 (1995-12)** Dependability management-Part3: Application guide - Section 9: Risk analysis of technological systems

- **IEC 62198 (2001-04)** Project risk management - Application guidelines Risk assessment methods
- **IEC 61882 (2001-05)** Hazard and operability studies (HAZOP studies) - Application guide
- **IEC 60300-3-3 (2005-08)** Dependability management - Part 3-3: Application guide - Life cycle costing

[System aspects of dependability]

- **IEC 60300-3-15** In preparation Dependability management - Part 3-15: Guidance to engineering of system dependability
- **IEC 62347** In preparation. Guidelines for establishing criteria for system dependability specifications
- **IEC 61713 (2000-06)** Software dependability through the software life-cycle processes - Application guide

IEC 60300-3-2 (2004-11) Dependability management - Part 3-2: Application guide - Collection of dependability data from the field

Reliability general

IEC 60529 Degrees of protection provided by enclosures (IP Code)Applies to the classification of degrees of protection provided by enclosures for electrical equipment with a rated voltage not exceeding 72,5 kV. Has the status of a basic safety publication in accordance with IEC Guide 104.

IEC 60529P Degrees of protection provided by enclosures (IP Code) - PACK including normative references

IEC 60812 Analysis techniques for system reliability - Procedure for failure mode and effects analysis (FMEA)

IEC 60863 Presentation of reliability, maintainability and availability predictions

IEC 61014 Programmes for reliability growth

IEC 61025 Fault tree analysis (FTA)

IEC 61070 Compliance test procedures for steady-state availability

IEC 61078 Analysis techniques for dependability - Reliability block diagram method

IEC 61123 Reliability testing - Compliance test plans for success ratio

IEC 61124 Reliability testing - Compliance tests for constant failure rate and constant failure intensity

IEC 61160 Formal design review

IEC 61163-1 Reliability stress screening - Part 1: Repairable items manufactured in lots

IEC 61163-2 Reliability stress screening - Part 2: Electronic components

IEC 61164 Reliability growth - Statistical test and estimation methods

IEC 61165 Application of Markov techniques

IEC 61649 Goodness-of-fit tests, confidence intervals and lower confidence limits for Weibull distributed data

IEC 61650 Reliability data analysis techniques - Procedures for comparison of two constant failure rates and two constant failure (event) intensities

IEC 61703 Mathematical expressions for reliability, availability, maintainability and maintenance support terms

IEC 61709 Electronic components - Reliability - Reference conditions for failure rates and stress models for conversion

IEC 61710 Power law model - Goodness-of-fit tests and estimation methods

IEC 61713 Software dependability through the software life-cycle processes- Application guide

IEC 61882 Hazard and operability studies (HAZOP studies) - Application guide

IEC 62198 Project risk management - Application guidelines

Equipment reliability testing

IEC 60605-2 Equipment reliability testing - Part 2: Design of test cycles

IEC 60605-3-1 Equipment reliability testing. Part 3: Preferred test conditions. Indoor portable equipment - Low degree of simulation

IEC 60605-3-2 Equipment reliability testing. Part 3: Preferred test conditions. Equipment for stationary use in weather protected locations - High degree of simulation

IEC 60605-3-3 Equipment reliability testing - Part 3: Preferred test conditions - Section 3: Test Cycle 3: Equipment for stationary use in partially weather protected locations - Low degree of simulation

IEC 60605-3-4 Equipment reliability testing - Part 3: Preferred test conditions - Section 4: Test cycle 4: Equipment for portable and non-stationary use - Low degree of simulation

IEC 60605-3-5 Equipment reliability testing - Part 3: Preferred test conditions - Section 5: Test cycle 5: Ground mobile equipment - Low degree of simulation

IEC 60605-3-6 Equipment reliability testing - Part 3: Preferred test conditions - Section 6: Test cycle 6: Outdoor transportable equipment - Low degree of simulation

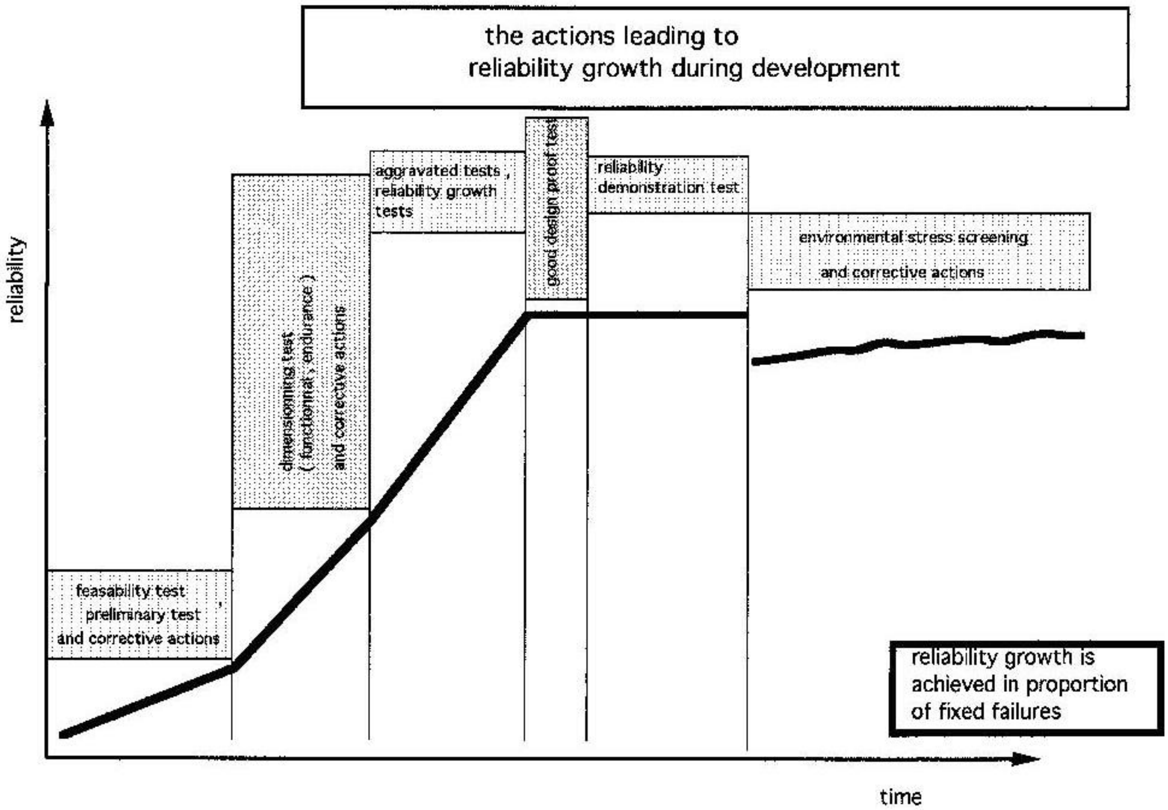
IEC 60605-4 Equipment reliability testing - Part 4: Statistical procedures for exponential distribution - Point estimates, confidence intervals, prediction intervals and tolerance intervals

IEC 60605-6 Equipment reliability testing - Part 6: Tests for the validity of the constant failure rate or constant failure intensity Assumptions

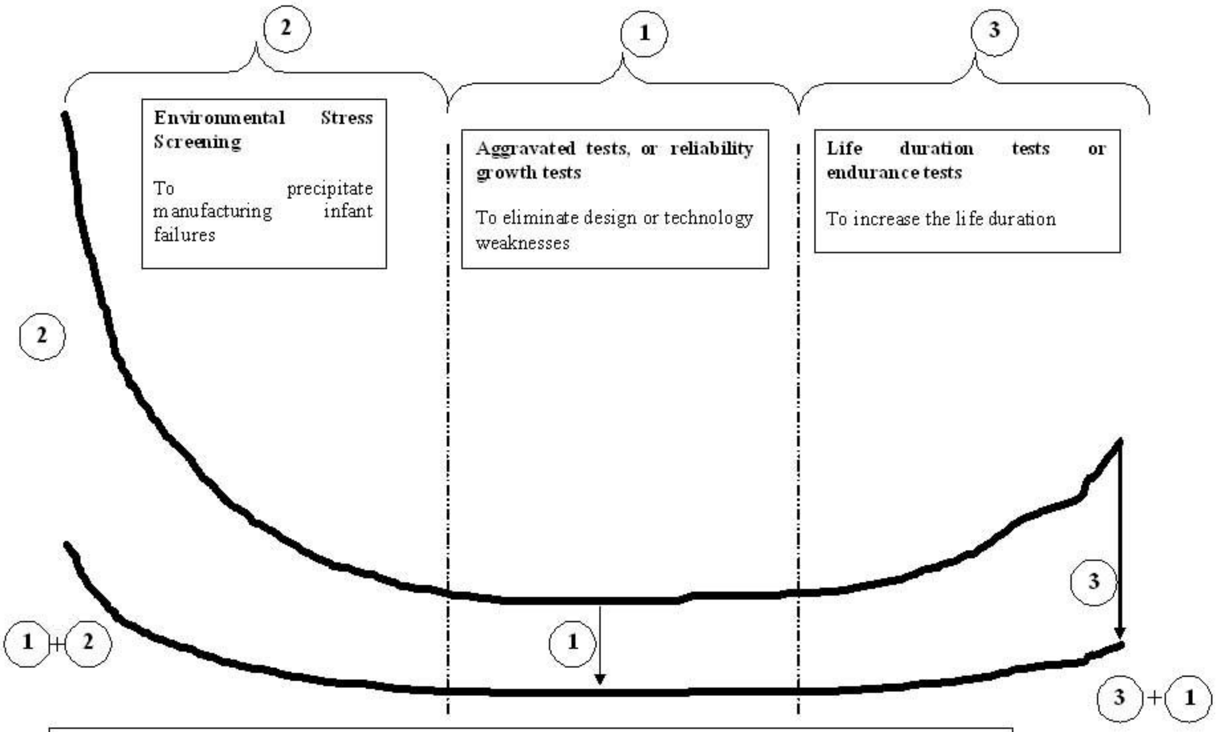
Appendix 3: proposals made on publication n°9 during previous meetings

New pictures suggested (from Henri, in Helge's notes) were studied, but no decisions were made. The proposer of those pictures must be present to fully understand the message of those pictures. Some terms were incorrect. Those should be checked and used consistently during improvement of the publication.

The picture "Actions leading to reliability growth during development" shows that shift to production will lower reliability level. The reason to this should be explained in the publication. The development phases should also be indicated in the picture. The picture includes only tests, but should other issues also be explained? This might require another graph or a table showing for example the use of FMEA, RCA, design rules (and use of derating), DfR (design for reliability) methods etc.
Emphasis was on the word 'might'. The TAB agreed that an explanation need to be given and made an action point for that. Helge is most aware of the Interlaken inputs and the expert background and took the action to come up with a proposal for explanation. (AR 1)



Henri explains why "*the shift to production will lower reliability level"* : at the beginning of production of a new equipment, the production processes (and often some limited aspects of the design) are still under maturation. That is clearly disclosed by the rate of ESS precipitation, generally much higher at the beginning of production of a new equipment. Several months can be required for reaching the maturation.



Impact of different types of tests and of other actions on product reliability

A discussion during the Wien meeting pointed out that some of the members of the R&ESS TAB are attached to the community of Reliability expertise and others to the community of Environmental Engineering Expertise.
The content of the CEEES Publication n° 9 was more intended to the second one type of experts. Henri has proposed (AR 10) to introduce some inputs in order to open the Publication n° 9 to the first type of expertise, but only with the idea to give an overview of the different techniques used by Reliability Experts to the intention of the Environmental Engineering Expertise

> *Too simple assumptions about failure rate behavior in time (infant mortality - constant failure rate or exponential distribution – wear-out period and mechanisms) may be risky in estimating guarantee issues, lifetime etc. Reliable results require quite a large number of test samples as well as long test times. The failure modes and mechanisms found in accelerated testing should be the same as in the field data.*
> Input from Werner was that often exponential models are used, but that other models are of interest too. The TAB discussed about the different reliability models (as well because of inputs in other documents). The PLOT Reliability workgroup had different presentation on reliability models under chair of Boudewijn. He focused on statistical analysis as key issue too. Therefore Boudewijn is asked to make an explanation on the models. (AR 2)

This action (AR 2) is still to be realized.

> *About MTBF calculations based on HALT results: Klaus Kangas recommends to see for example "A method of estimating product field failure rate from results of HALT data", http://www.ewh.ieee.org/soc/cpmt/tc7/ast2008/Bio_Harry_McLean.pdf. Some case examples exist, but does the nature of the HALT approach really allow this?*
> There are doubts within the TAB about the validity of MTBF calculations, especially on the new test techniques like HALT. Werner and his staff members use MIL 217F MTBF

calculations, and pinpointed towards full system level. Relationships towards field information are for older systems possible, but often overhauled by new technology. Werner is asked by the TAB to bring the MTBF calculations into perspective and do a proposal to add in the publication. For example: 'although the relationships between MTBF and field data are sparse, if you like to do calculations you can refer to ……' (AR 3)

As references is the pdf from Harry McLean found to be insufficient. A better reference is the book by K.K. Bothe, World Class Reliability. Another good reference from practical site is from Isabelle Vervenne, who gave some presentations on HALT and MTBF this year within PLOT. Therefore Boudewijn will ask her. (AR 4)

This info will be added to the references list by Werner. (AR 5)

The meeting also thought that something should be mentioned about the reliability of software. The test methods covered in the publication do not include testing or evaluation of software, which should be mentioned. Also it could be added that methods to evaluate maturity of software exist, but the actual reliability of software is difficult to estimate. About terms in general: check for correct English terms and search for example in Wikipedia, http://www.weibull.com/hotwire/issue21/hottopics21.htm, etc.

The importance of software is increasing rapidly, not only the application software, but as well test software. This software as such can constitute a fail mode. With increasing monitoring for new test techniques, as in HALT and HA-ESS, this topic is missing in the document. Therefore the TAB decided to honor this argument and come with a proposal chapter for 'software'. Perhaps on page 10 'Validaton of function'. Harry is asked to come up with a proposal where and what to address. (AR 6)

More notes by Klaus Kangas:

About MTBF calculations based on HALT results: Klaus Kangas (Interlaken) recommends seeing for example "A method of estimating product field failure rate from results of HALT data", http://www.ewh.ieee.org/soc/cpmt/tc7/ast2008/Bio_Harry_McLean.pdf. Some case examples exist, but does the nature of the HALT approach really allow this?
There are doubts within the TAB about the validity of MTBF calculations, especially on the new test techniques like HALT. Werner and his staff members use MIL STD 217FN2 [2] for MTBF calculations, and pinpoint towards full system level.
Relationships towards field information are for older systems possible, but often overhauled by new technology. Werner is asked by the TAB to bring the MTBF calculations into perspective and do a proposal to add in the publication. For example: "although the relationships between MTBF and field data are sparse, if you like to do calculations you can refer to…" (AR 3)

Failure rate estimates based on MIL-HDBK-217 F Notice 2, could be made, based on the guidance in ANSI/VITA 51.1 (2008). This is not a revision of the handbook, but a standardization of the inputs to the MIL-HDBK-217F Notice 2 calculations to give more consistent results. There exists also updates on prediction models, for example IEC technical report IEC TR 62380: 2004 on the subject and an updated model / handbook by the RIAC, "The RIAC Handbook of 217 Plus Reliability Prediction Models" (2006).
Since MTBF is mentioned in different perspectives and was discussed in broad sense in this TAB again. There are different ways to calculate the MTBF (MIL, Milstress, Relpred, Telcordia, Vidas), it might be of interest to add a separate chapter 'MTBF' or 'Product Life Time Calculation'.

Systems in use (by Werner):

Customer feedback by means of occurrence reports contain field data which are valid for the precise mission the equipment under test is experiencing with its users.
If the feedback information is sufficient, the analysis of the data can be structured into showstoppers (mission failures), major and minor problems. The ratio between total operating

time and total numbers of failures shows the Mean Time to Failure (MTTF). For constant failure rates this is referred to as the Mean Time between Failures (MTBF) [1].
Feedback from customers is always late and therefore can only be used for deployed systems to discover developing problems if MTTF – figures versus time change too quickly. Very often one discovers different behaviour in maintenance (due to cost reduction plans).

- Klaus KANGAS declares in an email :

- at the moment, you can add me to the group who think that HALT cannot be used to estimate field MTBF failure, BUT I think that HALT is a very good way to find out weak points from the product to make the product more robust and possibly in this way to give more lifetime
- I think it will be hard to understand if failure modes that occur in HALT (soft and hard) could ever occur in a real field case, especially if manufacturer doesn't know very well how and where the product is used. Another case that makes this hard is if you test the whole product in HALT chamber: finding the root cause of a complex product could be very hard, when speed of stresses is this high. Then HALT for a subassembly is a wise thing to do, but you will not get interface etc. whole product failure modes that could occur only when all parts are attached to each other. To make it even harder, let's consider that the whole product has a complex SW, and maybe throw in some components with chemical liquid material....
- It is important to consider the statistical points of view, confidence bounds and to have enough test samples to have reliable failure rate and prober failure distribution used. Can we really trust to say (only based to HALT results) that in the field e.g. 95% of tested products will survive 3years (without failure) when confidence (lower) level is 90%, when product is used according x specification, and in this case not having any months lasting lifetime tests with lesser stresses values than in HALT...? . There is also a space limit in HALT chamber, so would mean quite many HALT tests for bigger products to have enough statistical data.
- Testing in HALT chamber is not cheap. Also to find & understand the root causes and physics of failure takes time and money (well ok also costs to analyze normal lifetime test data...)

Henri has responded that :

The probability density function of a Weibull random variable *x* is:

$$f(x;\lambda,k) = \begin{cases} \frac{k}{\lambda}\left(\frac{x}{\lambda}\right)^{k-1} e^{-(x/\lambda)^k} & x \geq 0, \\ 0 & x < 0, \end{cases}$$

where *k* > 0 is the *shape parameter* and λ >0 is the *scale parameter* of the distribution. Its complementary cumulative distribution function is a stretched exponential function. The Weibull distribution is related to a number of other probability distributions; in particular, it interpolates between the exponential distribution (*k* = 1) and the Rayleigh distribution (*k* = 2).

The hidden assumption in the article of Harry Mc Lean intitled “From HALT Results to an Accurate Field MTBF Estimate " is that the shape parameter is constant whatever the stress level applied to the unit under test (see the article attached there - this article doesn't give the folowed methodology in detail and the associated assumptions) .
Demonstration of that assumption supposes long duration tests which is the contrary of the seeken objective (i.e. shorten the test duration).

This assumption can be verified in particular for a failure mode following the exponential distribution where k=1 ; some authors consider that for a complex system constituted of many different sub assemblies the trend of the system associated distribution is exponential one. But it could not be generalized . Otherwise, the accelerated tests would have been replaced by Highly Accelerated Tests …which is not the case.

Henri has grapped on Google books some pages of Mac Lean book (see attached in the attached documents)) : it seems that this issue is not at all addressed in it, that is not a surprise.

In other words:

- with accelerated tests we are in the known world (in a limited domain of stress amplitudes : the model of acceleration is known, the associated parameters are known, the invariance of the shape parameter is supposed);
- in the case of aggravated tests (so called Highly Accelerated Tests) , we are in an unknown world, but still assume that the correction of the identified defects ,even in the case they are not relevant to increase the margins will not degrade the product;

And about when is a product mature? =>This is challenging – not necessarily clear even at end-of-life… Problems may rise due to problems in hw – sw joint operation. Suppliers or subcontractors may make changes without announcement and infant mortality issues may be repeated.

This is more part of product quality assurance/control. Integration of HALT in production lines (HASS), requalifications or market reviews, but as well incoming inspections can reduce the risk of infant mortalities. Harry will propose some text to add this perspective. (AR 7)

Response of Henri : a mature product is a product characterized by a completeness of industrialization (production line operational, testing tools available and industrial having achieved a good level of FPY (first pass yield) and having disclosed in operational conditions a reliability close to its inherent reliability . The inherent reliability is a measure of the overall “robustness” of a system or piece of equipment. It provides an upper limit to the reliability and availability that can be achieved. In other words, no matter how much inspection or maintenance you perform, you will never exceed the inherent reliability. It corresponds to the current state of the art.

It was unclear if the document is fully checked on the English language (Red. Harry: in the GA Dave addressed that the text and storyboard was fine today, but when we make additions, we have to be critical towards this.)

Comparison of Estimation Techniques (Werner Wittberger) :

D.J. Wilkins uses HALT / HAST in early project phases to discover problems where their elimination is cost effective, because only a few demonstration models, prototypes are involved. See also [1].

Harry McLean uses HALT over the entire product life. In his presentation he addresses the correlation between field and HALT stresses. Hopefully his advice as to which acceleration model to use for the estimation of the Product’s Field Failure Rate (linear, exponential or quadratic) is given to the readers of his book.

Harry McLean’s proposal of “A Method of Estimation Product Field Failure Rates from HALT/HALT Plus TM” is therefore very welcome.

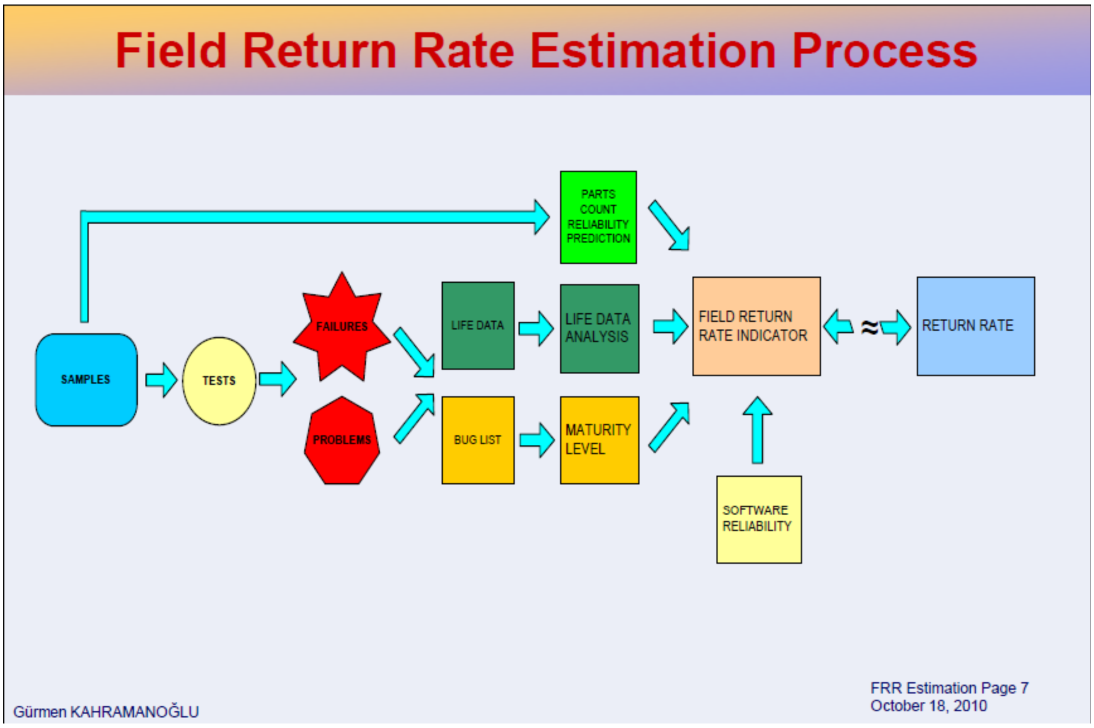
The method uses 3 different acceleration models and asks for an exact definition of the HALT process according to his book: HALT, HASS and HASA Explained [4].

Gürmen Kahramanoğlu presented in 39 slides his idea of a Field Return Rate Estimation Process which compromises the size and complexity of the equipment under observation, results of Life Data Analysis based on various models and last but not least the maturity level.

Given the impact and amount of changes on the 2009 version of this document it is proposed to make a 2012 version of the publication.

Gürmen Kahramanoğlu from VESTEL ELECTRONICS points out in a paper presented in October 2010 under IEEE/ASTR/CPMT that the main stress factors are: temperature, humidity, voltage, temperature cycling and vibration. In addition to component failure rate and failure rates arising from accelerated testing, he creates a failure rate which is calculated from "Maturity Level" of the product and contains:
- Electro Static Discharge
- Voltage Variation, Interruptions, Dips
- Lightning Surge
- Inrush Current while Turning on
- Loose Plug
- Opening the Product at Low Temperature

The usage of the Arrhenius Model, Corrosion-Voltage Model, Modified Coffin-Manson Method and the Basquin-Model are explained in detail.



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The TAB members including Henri agree to prepare a 2012 edition of the publication.

Proposed by Werner proposal for an add-on to Publication N°9 :

Producers need a tool to estimate the Field Return Rate in time to decide if the maturity of their new component, device or system is in line with the requirements. They need to know the return rate of their product including both the infant mortality and the constant failure rate phases.

More than one tool promises to give the right results. Even for in-house equipment with small changes of temperature and humidity, a number of parameters have to be considered involving not only the equipment to be delivered but also the environment of use.
- Electro Static Discharge
- Voltage Variation, Interruptions, Dips
- Lightning Surge
- Inrush Current while Turning on
- Loose Plug
- Opening the Product at Low Temperature

The estimation process according to [5] is in favour because it addresses all the known parameters whereas [3] is fixed to three different acceleration models only and does not address parameters which are not included within HALT.

The validity of the accelerated test should be confirmed by checking if the shape parameter “m” of the Weibull distribution remains unchanged by the accelerated stress [TOSHIBA, 7].

References (AR 5 Werner)

[1] -Reliability- for a Mature Product from the Beginning of Useful life
The Different Type of Tests and Their Impact on Product Reliability
CEEES Technical Advisory Board Reliability & ESS Publication N° 9 -2009- ISSN 1104-6341

[2] MIL-HDBK 217 F, Reliability Prediction of Electronic Equipment 12/1991 (notice 1, 1992-07-10, notice 2, 1995-04-28)

[3] http://www.ewh.ieee.org/soc/cpmt/tc7/ast2008/Bio Harry McLean.pdf

[4] HALT, HASS, and HASA EXPLAINED Accelerated Reliability Techniques Revised Edition 2009, Harry McLean, and ISBN 978-0873897662

[5] Field Return Rate Estimation Process, October 18, 2010, Gürmen Kahramanoğlu , http://www.ieee-astr.org/kahramanoglu_ASTR2010.pdf

[6] http://www.weibull.com/hotwire/issue21/hottopics21.htm, Dennis J.Wilkins, Issue 21, November 2002

[7] http://www.semicon.toshiba.co.jp/eng/product/reliability/device/testing ,
http://www.semicon.toshiba.co.jp/eng/product/reliability/device/estimation ,

[8] World Class Reliability, K.K. Bothe

[9] Isabelle Vervenne, presentations on HALT and MTBF, (AR 4 Boudewijn)