IEEE NEWSLETTER

RELIABILITY GROUP

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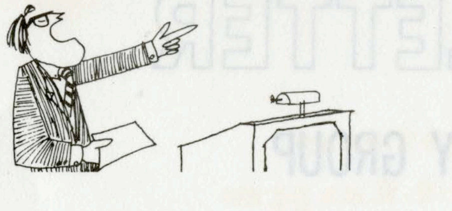
EDITOR'S NOTES

Welcome, Paul Gottfried! Congratulations upon your appointment as Editor of the IEEE Reliability Group Newsletter. Please accept our sincere wish for success as editor and our vote of confidence for the growth of the Reliability Group Newsletter under your capable direction.

Paul is immediately assuming his new duties as editor for the next issue of the newsletter, July 1968. Please address newsletter inputs to Mr. Paul Gottfried at Booz, Allen Applied Research, 4733 Bethesda Avenue, Bethesda, Maryland 20014; (301) 656-2200.

Sincerely,

Leonard G. Schneider



CHAPTER NEWS

Baltimore

Mr. Paul L. Neyhart, Radio Corporation of America in Camden, New Jersey, gave a talk on "Reliability Predictions - Data Sources, Their Strengths and Weaknesses" to thirty-eight attendees at the Baltimore Chapter's September 25, 1967 meeting.

Binghamton

Chairman H. J. Beal reports the Binghamton Chapter co-sponsored with the American Society of Quality Control a "One Day Reliability and Quality Control Symposium" on March 16, 1968 at Harpur College in Binghamton, New York. Ten attendees heard Mr. John Mailhot, General Electric Company in Johnson City, New York, speak on "F-111 Flight Control System, Including Reliability Aspects" at the chapter's January 9 meeting. At least two additional monthly group meetings are planned to conclude the program this fiscal year.

Boston

Mr. Donald R. Earles, Raytheon Company in Bedford, Massachusetts, spoke to sixty-five attendees on "Life Cycle Costing Implementation" at the Boston Chapter's December 7, 1967 meeting.

Canaveral-Daytona Beach

"Introduction of PRICE/APIC - NASA Data System" was the subject of the Canaveral-Daytona Beach Chapter's meeting held on October 23, 1967. Mr. E. Ray Richt, Jr. from George C. Marshall Space Flight Center in Huntsville, Alabama was guest speaker and twelve persons attended.

Connecticut

Three fall meetings were held by the Connecticut Chapter with attendance ranging from eleven to forty-five members. Mr. George Grant from Durland and Associates in Darion, Connecticut presented a paper entitled "Designing Maintainable Circuits" at the October 18, 1967 meeting. "Wearout Life Vs Constant Failure Rate" was the subject discussed by Speaker Dorian Shainan from Rath and Strong, Incorporated of Boston, Massachusetts at the chapter's November 14, 1967 meeting. Two speakers, Mr. Craig Simpson from Sperry Semiconductor, Norwalk, Connecticut and Mr. John Cocking from General Instruments, Hicksville, New York spoke on "The Fabrication and Use of the MOS" and "The Reliability and Failure Modes of the MOS" at the December 11, 1967 meeting.

Mohawk Valley

An attendance of twenty-three and twenty-four members was recorded at the Mohawk Valley's two fall meetings. "A High Reliability Program for a Semiconductor Diode" was the subject of a talk given by Mr. Albert Fox from General Electric Company, Semiconductor Products Division, Syracuse, New York at the September 26, 1967 meeting. Mr. W. J. McFarland from General Electric Company, Research and Development Division, Schenectady, New York spoke on "The Use of Bayes' Theorem for Reliability Estimation Purpose" at the chapter's December 5, 1967 meeting.

Mr. David F. Barber, chairman of the Mohawk Valley Chapter, reports that Mr. Peter Gott from Philco-Ford Corporation, Lansdale, Pennsylvania and Mr. B. Fovel from General Electric Company, Utica, New York presented papers entitled "Quality Defects in Integrated Circuits" and "Automatic Integrated Circuit Testing" at their January 24, 1968 chapter meeting. "Reliability Growth in Real Life" was discussed by Mr. Ernest O. Codier at the March 26, 1968 meeting held in Rome, New York.

New York - Long Island

The January 23, 1968 meeting of the New York-Long Island Chapter featured two speakers from the Sperry Gyroscope Company. Dr. Maurice J. Kirby's subject was "Unreliability or Incomplete Maintenance" while Mr. Alfred L. Geraci spoke on "A Space Program of Proven High Reliability." Chairman J. J. Drvostep reported twenty attendees at this January meeting.

Secretary-Treasurer Alfred E. Martin reports that sixty-five attendees at the chapter's February 20, 1968 meeting heard Mr. T. E. McDuffie, senior scientist from Naval Applied Science Laboratory, Brooklyn, New York, and Mr. J. J. Staller, president and technical director of Microsystems Technical Corporation, Norwood, Massachusetts, give talks on "Microelectronics and Cost Effectiveness" and "Microelectronic Packaging and Reliability."

Philadelphia

Seventy-three members attended the Philadelphia Chapter's November 28, 1967 meeting. Mr. Richard Soltau, Microelectronics Division of the Philco-Ford Corporation at Blue Bell, Pennsylvania, gave a talk on "Microcircuit Reliability Evaluation and Failure Analyses." Other activities included a "Tour of Philco-Ford Microcircuit Test and Failure Analysis Facilities at Blue Bell Plant in Pennsylvania."

San Diego

The San Diego Chapter meeting held on February 26, 1968 included the installation of the following new officers elected for a two-year term ending December 31, 1969.

Chairman:	Thomas W. Wright
Vice Chairman:	Robert D. Patti
Secretary-Treasurer:	George C. Stiehl

"An Integrated Information System for Reliability and Quality Assurance" was the subject of a talk given at the February meeting by Mr. William P. Hart, Jr., International Telephone and Telegraph (ITT) Cannon Electric Company, Pasadena, California. Mr. Hart is past chairman of the Los Angeles Chapter.

San Francisco

Twenty-one attendees heard Mr. Frederick Tator, Philco-Ford, Palo Alto, California, discuss "Computerized Reliability Analysis Using REACT" at the San Francisco Chapter meeting on January 25, 1968.

Twin Cities

Mr. George Raymond, Univac Federal Systems Division of Sperry Rand Corporation, St. Paul Minnesota, addressed seventy-four attendees on the topic of "Reliability is Still a Problem of Quality" at the Twin Cities Chapter meeting held on November 21, 1967.

Washington, D.C.

"The DoD Tactical Satellite Communications System" was discussed by Mr. Grogan Shelor from the Department of Defense, Pentagon, Washington, D.C. at the Washington Chapter's January 8, 1968 meeting which was attended by 152 persons. Mr. Stanley A. Rosenthal, director of Operations of the Space Division for the Kollsman Instrument Company, Long Island, New York, spoke to twenty-six attendees on "A Management View of the Role of Reliability" at the chapter's November 15, 1967 meeting.

chapter meetings

CHAPTER	DATES OF MEETINGS	TIME AND PLACE	SUBJECT	SPEAKER	CONTACT
Binghamton	To be announced	To be announced	Impact of Periodic Checkout on Availability	K. A. Lyman	E. P. Hojak IBM Corp., Owego, New York 13827
Canaveral/ Daytona Beach	April 4, 1968	6:00 p.m. - Cocoa Beach, Florida	IR Non-Destructive Testing Techniques	John R. Yoder Barnes Engineering Co., Stamford, Conn.	P. J. Mulligan G. E. Co., Daytona Beach, Florida, 258-3546
Connecticut	May 15, 1968	Time to be announced Burndy Library, Norwalk, Conn.	Relationship between Theoretical and Operational Reliability	To be announced	Alan Knapp, Norden Div. of United Aircraft Corp., Norwalk, Conn. 838-4471, Ext. 4559 or Edward Haddad, General Dynamics, Electric Boat Division, Dept. 456, East Point Road, Croton, Conn., 466-2305
Philadelphia	April 24, 1968	Quality Courts Motel Route 73, near Exit 4 of New Jersey Turnpike	Evaluating Consumer Products	Dr. Mendenhall of Consumer's Union	Helen Yonan Philadelphia, Pa., 594-8106 B. Tiger, 16-5 RCA, Camden, N.J.
Philadelphia	May 21, 1968	Univ. of Pennsylvania Philadelphia, Pa. 9:00 a.m. to 5:00 p.m.	All day conference on Failure Analysis	Experts on Failure Analysis, Failure Mechanisms, Relationship to Reliability	Helen Yonan Philadelphia, Pa., 594-8106 R. E. Killion RCA, Moorestown, N.J.
San Francisco	April 18, 1968	6:00 p.m. - Meet the Speaker 7:00 p.m. - Dinner Stanford View Restaurant 8:00 p.m. - Program PH 104, Stanford Univ.	Design Review Techniques	To be announced	C. E. Leake Lockheed Missile and Space Co., 60-50 Bldg. 529, Sunnyvale, Calif. 94088, (409) 742-3629
San Francisco	May 15, 1968	Ibid	Reliability Physics	R. C. Stewart Lockheed Missile and Space Company	C. E. Leake
San Francisco	June 20, 1968	Ibid	Part Screening Techniques	Ben Croghan Lockheed Missile and Space Company	C. E. Leake
Washington	April 24, 1968	8:00 p.m. - PEPCO Auditorium 929 E Street, N.W. Washington, D.C.	Effects of Sustained Temperature Cycling on Electronic Parts	Jack Q. Reynolds Manager of Reliability for Collins Radio Company, Cedar Rapids, Iowa	A. O. Plait Communications and Systems, Inc. 6565 Arlington Blvd. Falls Church, Va. 22046, (703) 533-8877 Ext. 308/309

personalia

CONGRATULATIONS to the recipients of the 1967 RELIABILITY AWARD presented by the Reliability Group of the Institute of Electrical and Electronics Engineers at the 1968 Annual Symposium on Reliability held in Boston, Massachusetts in January.

DR. ROBERT C. SEAMANS, JR. received the award in recognition for his exemplary leadership and direction to NASA and industry resulting in achievement of outstanding mission reliability on United States space programs. Dr. Seamans was appointed Deputy Administrator of NASA in December 1965 by President Johnson and served until January 5, 1968.

DR. RONALD G. HERD, general manager of Kaman Systems Center, Kaman Aircraft Corporation, received the 1967 Reliability Award for having moderated the outstanding session of technical papers on the topic of reliability. Dr. Herd is well known for his work in the reliability field during the past sixteen years and having projected a large number of papers and technical reports at Kaman Aircraft.

DR. MARTIN MESSINGER and DR. MARTIN L. SHOOMAN, members of the engineering faculty at the Polytechnic Institute of Brooklyn, New York, were recipients of the award for having submitted the year's outstanding technical paper on the topic of reliability. This paper dealt with the topic of rapidly increasing complexity of reliability mathematical models and the difficulties inherent in trying to perform a detailed analysis of complex reliability structures.

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MR. ABRAHAM SCHNAPF received the 1967-1968 Reliability Award given by the American Society for Quality Control (Electronic Division) for having demonstrated a high order of creative leadership as project manager or the TIROS weather satellite program for the Radio Corporation of America at Princeton, New Jersey. Mr. Schnapf's leadership is exemplified by the fact that, in spite of constant upgrading of performance and increased sophistication of hardware, the reliability has steadily improved resulting in a record series of sixteen consecutive spacecraft successes.

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MR. GEORGE EBEL's appointment to represent the Reliability Group on the Ad Hoc Committee for the proposed IEEE Manufacturing Technology Council has been announced by Mr. H. E. Reese, vice chairman of Ad Com's Technical Operations Committee. Mr. Ebel is manager of Production Engineering, CONRAC Corporation, West Caldwell, New Jersey.

training courses

INSTITUTE ON COMPUTER AIDS TO SYSTEMS EFFECTIVENESS, THE UNIVERSITY OF WISCONSIN, MILWAUKEE, WISCONSIN, MAY 20-21, 1968:

The objective of this institute is to provide attendees with an up-to-date survey of current applications of computers programmed to achieve higher systems effectiveness and to review selected examples of operational computer programs. Inquiries should be directed to Mr. David P. Hartman, Institute Director, DN-105, Civic Center Campus, 600 West Kilbourn Avenue, Milwaukee, Wisconsin 53203. Telephone (414) 228-4823.

SEMINAR ON FAILURE ANALYSIS, MAY 21, 1968, UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA, PENNSYLVANIA:

The Philadelphia Section and Reliability Group of the Institute of Electrical and Electronic Engineers are sponsors of the Seminar on Failure Analysis. Sessions include (A) System Assurance Through Failure Analysis, (B) Case Histories of Screening Techniques Based on Knowledge of Failure Mechanisms, (C) Failure Analysis in Microelectronics. The luncheon speaker will discuss "Reliability Through Cause and Effect Study." For further information and registration, please write or call Mr. Joseph Chalupa, Radio Corporation of America, Building 16-5, Camden, New Jersey 08102, (609) 963-8000, PC-3338 or Miss Helen B. Yonan, The Institute of Electrical and Electronic Engineers Office, Philadelphia Section, Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia, Pennsylvania 19104, (215) 594-8106 or 8134.

INSTITUTE ON COMPUTER AIDED TESTING AND FAILURE DIAGNOSTICS OF SOLID STATE SYSTEMS, THE UNIVERSITY OF WISCONSIN, MADISON, WISCONSIN, MAY 23-24, 1968:

This sixth annual conference will present a survey of the most recent advances in the field of Computer Aided Testing and Failure Diagnostics of Solid State Systems. Nationally recognized experts will discuss their state-of-the-art research. Inquiries should be directed to Mr. Rolf G. Schuenzel, Institute Director, 725 Extension Building, 432 North Lake Street, Madison, Wisconsin 53706.

hints and kinks

By
Paul Gottfried
Booz, Allen Applied Research Inc.

On several occasions in the past, this column has alluded to the problems in achieving communication between the Reliability profession and the rest of the world. This subject attained some prominence recently when General Bunker, in the Keynote Address to the 1968 Symposium on Reliability, delivered some comments of exceptional clarity.

Further reflection has led your correspondent to the renewed realization that communication should be a two-way street. We not only should do more to get our message across, we also should try to find out what others want or need from us. In both cases, we must assume the burden of the effort.

One way to get the ball rolling would be to invite appropriate speakers to our local and national meetings. There have been isolated instances of talks in the general category of "Somebody-or-other looks at Reliability," and many of these presentations have been rather disappointing. Still, careful selection should provide speakers who have something to say to us. Some possibilities:

- Lawyers involved in product-liability damage suits. Since the courts are taking a broader view of manufacturer's implied responsibility, this is a growing field -- the problem may be in finding a lawyer who is not too busy to talk to us.
- Representatives of consumer interests (it doesn't have to be Betty Furness or Ralph Nader).
- Buyers and Contracting Officers -- the people who have to describe and administer requirements neither they nor the courts understand.
- Legislators (or their aides) who don't know how to resolve the conflict between buying on price and buying dependability.

Who knows, we may learn something -- and so may they.

BUILT-IN TEST EQUIPMENT FOR THE MAINTENANCE OF COMPLEX ELECTRONIC SYSTEMS, NEW YORK UNIVERSITY, NEW YORK, NEW YORK, JULY 22-26, 1968:

This short course will be conducted in conjunction with the operations of Project SETE (Secretariat to the Electronic Test Equipment Coordination Group) which is a scientific information center operated by New York University for various U. S. Government agencies. Further information may be obtained from Mr. Mari Fields, (212) LU 4-0700, Extension 776.

SECOND ANNUAL COMPUTER-AIDED ANALYSIS AND DESIGN SUMMER INSTITUTE, UNIVERSITY OF MISSOURI, COLUMBIA, MISSOURI, AUGUST 1968:

The first workshop (August 5-9) will include an intensive course in FORTRAN IV programming that will enable participants to obtain a general knowledge of computer programming methods which can be applied to his particular area of interest. The second workshop (August 12-16) will deal with the analysis and design of electronic circuits by means of large-scale computers. Detailed information may be obtained from Dr. George W. Zobrist, Department of Electrical Engineering, College of Engineering, University of Missouri, Columbia, Missouri 65201.

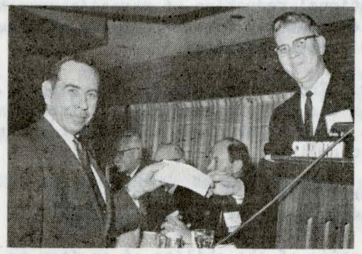
awards

The IEEE Reliability Group was pleased to present Group Chapter Awards for the first time at the 1968 Annual Symposium on Reliability. The Group Chapter Awards are presented in honor of P. K. McElroy who has done so much for so many years to advance the professionalism of Reliability. The purpose of the P. K. McElroy Award is to motivate chapters, and especially chapter officers, to structure a program in their chapter which is as complete as possible in the encouragement of advances in all professional areas of Reliability.

At our 1968 Symposium, awards were presented by our Chairman, Ed Jahr, to the following chapters:

o Boston Chapter which received $100 as the first place winner

o Binghamton Chapter which received $50 as the second place winner



o Huntsville Chapter which received $25 as the third place winner

Howard W. Williams as the 1967 Chairman of the Boston Chapter first place winner received a certificate commemorating his service to this Chapter.

Some of the accomplishments of these award winning chapters were; holding worthwhile and interesting meetings, all-day Symposiums on Reliability subjects, papers presented by Chapter members at the 1967 Reliability Symposium, and sponsorship of Reliability training sessions.

Their accomplishments can be exceeded in 1968 by any Chapter which employs the talent within its membership. Get an award in your Chapter during 1968!

STANDING COMMITTEE CHAIRMEN OF THE IEEE RELIABILITY GROUP (G-7) AD COM

Mr. E. F. Jahr, Ad Com chairman of the IEEE Reliability Group, announces the names of standing committee chairmen for 1968.

EDUCATION, DEVELOPMENT & STANDARDS
W. T. Sumerlin
Vice-Chairman

- Committee on Education - H. C. Jones
- Committee on Training - G. B. Beckhart
- Committee on Standards - J. J. Naresky
- Committee on Adv. Techniques - R. Kuehn
- Committee on Computer Aided Reliability Analysis and Design (CARAD) - C. Purdue

TECHNICAL OPERATIONS
H. E. Reese, Jr.
Vice-Chairman

- Tech. Com. on Maintainability - S. O. Houck
- Tech. Com. on Reliability Physics - C. M. Ryerson
- Tech. Com. on Human Effects - To be appointed

PUBLICATIONS
G. L. Beyer, Jr.
Vice-Chairman

- Newsletter - P. Gottfried
- Transactions - J. A. Connor
- Publicity - R. B. Mulock

MEETINGS CHAPTERS & MEMBERSHIP
V. R. Monshaw
Vice-Chairman

- National Meetings
- Professional Relations
- Speakers' Committee - J. King
- Chapter Activities - To be appointed
- Membership - R. L. Williams

OTHERS:

AWARDS - M. P. Smith

CONSTITUTION & BYLAWS - M. P. Smith

NOMINATIONS - M. P. Smith

OPERATIONS COMMITTEE OF AD COM

Chairman (Current) - E. F. Jahr
Jr. Past Chairman - M. P. Smith
4 Vice Chairmen - Listed Above
Treasurer - R. M. Jacobs
Secretary - L. L. Schneider

RELIABILITY Definitions

The following list of Reliability Definitions, as approved by the Reliability Definitions and Standards Committee, has been submitted by Chairman J. J. Naresky to the IEEE Standards Committee for inclusion in the forthcoming IEEE Dictionary of Terms. Most of the definitions on the list have been agreed upon by the International Electrotechnical Commission (IEC) Technical Committee No. 56 (Reliability), and will soon be published as an approved IEC Document.

ACCELERATED TEST. A test in which the applied stress level is chosen to exceed that stated in the reference conditions in order to shorten the time required to observe the stress response of the item, or magnify the response in a given time. To be valid, an accelerated test must not alter the basic modes and/or mechanisms of failure, or their relative prevalence.

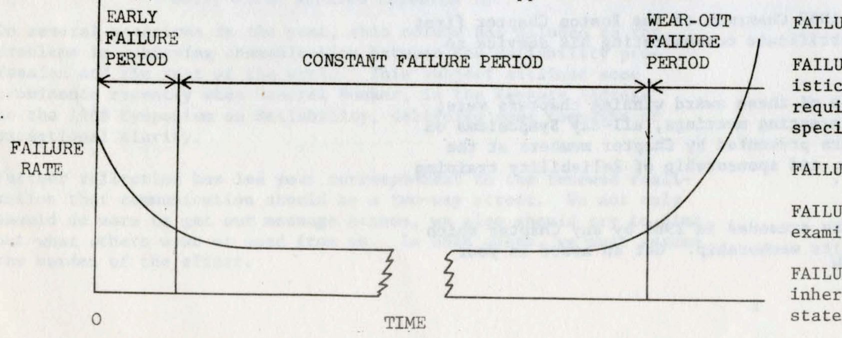
ACCELERATION FACTOR. The ratio between the times necessary to obtain a stated proportion of failures for two different sets of stress conditions involving the same failure modes and/or mechanisms.

ACTIVE REDUNDANCY. See Redundancy, Active.

BURN-IN. The operation of items prior to their ultimate application intended to stabilize their characteristics and to identify early failures.

CATASTROPHIC FAILURE. See Failure, Catastrophic.

CONSTANT FAILURE PERIOD. That period during which failures of some items occur at an approximately uniform rate. Note: The curve below shows the failure pattern when this definition applies to an item.



DEBUGGING. The operation of an equipment or complex item prior to use to detect and replace parts which are defective or expected to fail, and to correct errors in fabrication or assembly.

DEGRADATION FAILURE. See Failure, Degradation.

DERATING. The intentional reduction of stress/strength ratio in the application of an item, usually for the purpose of reducing the occurrence of stress related failures.

EARLY FAILURE PERIOD. That early period, beginning at some stated time and during which the failure rate of some items is decreasing rapidly. Note: The curve below shows the failure pattern when this definition applies to an item.

(Curve omitted - refer to figure under "Constant Failure Period")

FAILURE. The termination of the ability of an item to perform its required function.

FAILURE, CATASTROPHIC. Failures which are both sudden and complete.

FAILURE, COMPLETE. Failures resulting from deviations in characteristic(s) beyond specified limits <u>such</u> as to cause complete lack of the required function. Note: The limits referred to in this category are special limits specified for this purpose.

FAILURE, DEGRADATION. Failures which are both gradual and partial.

FAILURE, GRADUAL. Failures that <u>could</u> be anticipated by prior examination.

FAILURE, INHERENT WEAKNESS. Failures attributable to weakness inherent in the item itself when subjected to stresses within the stated capabilities of that item.

(CONTINUED)

FAILURE, MISUSE. Failures attributable to the application of stresses beyond the stated capabilities of the item.

FAILURE, PARTIAL. Failures resulting from deviations in characteristic(s) beyond specified limits but <u>not such</u> as to cause complete lack of the required function.

FAILURE, RANDOM. Any failure whose cause and/or mechanism make its time of occurrence unpredictable.

FAILURE, SECONDARY. Failure of an item caused either directly or indirectly by the failure of another item.

FAILURE, SUDDEN. Failures that <u>could not</u> be anticipated by prior examination.

FAILURE, WEAR-OUT. A failure which occurs as a result of deterioration processes or mechanical wear and whose probability of occurrence increases with time.

FAILURE CAUSE. The circumstance which induces or activates a failure mechanism.

FAILURE CRITERIA. Rules for failure relevancy such as specified limits for the acceptability of an item.

FAILURE MECHANISM. The physical, chemical or other process which results in a failure.

FAILURE MODE. The effect by which a failure is observed; for example, an open or short circuit condition, or a gain change.

FAILURE RATE. At any point in the life of an item, the incremental change in the number of failures per associated incremental change in time.

FAILURE RATE, ASSESSED. The failure rate of an item determined within stated confidence limits from the observed failure rates of nominally identical items. Note: Alternatively, point estimates may be used, the basis of which must be defined.

FAILURE RATE, EXTRAPOLATED. Extension by a defined extrapolation or interpolation of the assessed failure rate for durations or stress conditions different from those applying to the conditions of that assessed rate.

FAILURE RATE, OBSERVED. The ratio of the total number of failures in a single population to the total cumulative observed time on that population. The observed failure rate is to be associated with particular, and stated, time intervals (or summation of intervals) and stress conditions. Note 1: The criteria for what constitutes a failure should be stated. Note 2: Cumulative observed time is a product of items and time or the sum of their products.

FAILURE RATE, PREDICTED. The failure rate of an equipment or complex item computed from its design considerations and from the reliability of its parts in the intended conditions of use.

FAILURE RATE ACCELERATION FACTOR. The ratio of the accelerated testing failure rate to the failure rate under stated reference test conditions and time period.

INSTANTANEOUS FAILURE RATE (Hazard). At a particular time, the rate of change of the number of items which have failed divided by the number of items surviving.

ITEM (in reliability). An all-inclusive term to denote any level of hardware assembly; i.e., system, segment of a system, subsystem, equipment, component, part, etc. Note: Item includes items, population of items, sample, etc. where the context of its use so justifies.

ITEM, NON-REPAIRED. An item which is not repaired after a failure.

ITEM, REPAIRABLE. An item which is repaired after a failure.

MEAN LIFE. The arithmetic mean of the times-to-failure of a group of nominally identical items.

MEAN LIFE, ASSESSED. The mean life of a non-repaired item determined within stated confidence limits from the observed mean life of nominally identical items. Note: Alternatively, point estimates may be used, the basis of which must be defined.

MEAN LIFE, EXTRAPOLATED (for non-repaired items). Extension by a defined extrapolation or interpolation of the assessed mean life for durations or stress conditions different from those applying to the conditions of that assessed mean life.

MEAN LIFE, OBSERVED. The mean value of the lengths of observed times to failure of all specimens in a sample of items under stated stress conditions. Note: The criteria for what constitutes a failure should be stated.

MEAN LIFE, PREDICTED (for non-repaired items). The mean life of an item computed from its design considerations and, where appropriate, from the reliability of its parts in the intended conditions of use.

MEAN-TIME-BETWEEN-FAILURES (for repairable items). The product of the number of items and their operating time divided by the total number of failures.

MEAN-TIME-BETWEEN-FAILURES, ASSESSED. The mean-time-between-failures of a repairable item determined within stated confidence limits from the observed mean-time-between-failures of nominally identical items. Note: Alternatively, point estimates may be used, the basis of which must be defined.

MEAN-TIME-BETWEEN-FAILURES, EXTRAPOLATED. Extension by a defined extrapolation or interpolation of the assessed mean-time-between-failures for durations or stress conditions different from those applying to the conditions of that assessed mean-time-between-failures.

MEAN-TIME-BETWEEN-FAILURES, OBSERVED (for repairable items). For a stated period in the life of an item, the mean value of the lengths of observed times between consecutive failures under stated stress conditions. Note 1: The criteria for what constitutes a failure should be stated. Note 2: This is the reciprocal of the failure rate observed during the period.

MEAN-TIME-BETWEEN-FAILURES, PREDICTED. The mean-time-between-failures of a repairable complex item computed from its design considerations and from the failure rates of its parts for the intended conditions of use. Note: The method used for the calculation, the basis of the extrapolation and the time, stress conditions should be stated.

MEAN-TIME-TO-FAILURE (for non-repaired items). The total operating time of a number of items divided by the total number of failures.

MEAN-TIME-TO-FAILURE, ASSESSED. The mean-time-to-failure of a non-repaired item determined within stated confidence limits from the observed mean-time-to-failure of nominally identical items. Note: Alternatively, point estimates may be used, the basis of which must be defined.

MEAN-TIME-TO-FAILURE, EXTRAPOLATED. Extension by a defined extrapolation or interpolation of the assessed mean-time-to-failure for durations or stress conditions different from those applying to the conditions of that assessed mean-time-to-failure.

MEAN-TIME-TO-FAILURE, OBSERVED (for non-repaired items). For truncated tests for a particular period, the total cumulative observed time on a population divided by the total number of failures during the period and under stated stress conditions. Note 1: Cumulative observed time is a product of units and time or the sum of these products. Note 2: The criteria for what constitutes a failure shall be stated. Note 3: This is the reciprocal of the failure rate observed during the period.

MEAN-TIME-TO-FAILURE, PREDICTED. The mean-time-to-failure of a non-repaired complex item computed from its design considerations and from the failure rates of its parts for the intended conditions of use. Note: The method used for the calculation, the basis of the extrapolation and the time, stress conditions, should be stated.

MTBF. See Mean-Time-Between-Failures.

MTTF. See Mean-Time-To-Failure.

NON-REPAIRED ITEM. See Item, Non-Repaired.

OPERATIONAL RELIABILITY. See Reliability, Operational.

PREDICTED RELIABILITY. See Reliability, Predicted.

RANDOM FAILURE. See Failure, Random.

REDUNDANCY. In an item, the existence of more than one means of performing its function.

REDUNDANCY, ACTIVE. That redundancy wherein all redundant items are operating simultaneously rather than being switched on when needed.

REDUNDANCY, STANDBY. That redundancy wherein the alternative means of performing the function is inoperative until needed, and is switched on upon failure of the primary means of performing the function.

RELIABILITY. 1. The ability of an item to perform a required function under stated conditions for a stated period of time. 2. The characteristic of an item expressed by the probability that it will perform a required function under stated conditions for a stated period of time. Note: Definition 2 is most commonly used in engineering applications. In any case where confusion may arise, specify the definition being used.

(CONTINUED)

RELIABILITY, ASSESSED. The reliability of an item determined within stated confidence limits from tests or failure data on nominally identical items. The source of the data shall be stated. Results can only be accumulated (combined) when all the conditions are similar. Note: Alternatively, point estimates may be used, the basis of which shall be defined.

RELIABILITY, EXTRAPOLATED. Extension by a defined extrapolation or interpolation of the assessed reliability for durations or stress conditions different from those applying to the conditions of that assessed reliability.

RELIABILTIY, INHERENT. The potential reliability of an item present in its design.

RELIABILITY, OPERATIONAL. The assessed reliability of an item based on field data.

RELIABILITY, PREDICTED. The reliability of an equipment computed from its design considerations and from the reliability of its parts in the intended conditions of use.

RELIABILITY, TEST. The assessed reliability of an item based on a particular test with stated stress and stated failure criteria.

REPAIRABLE ITEM. See Item, Repairable.

SECONDARY FAILURE. See Failure, Secondary.

SCREENING TEST. A test or combination of tests, intended to remove unsatisfactory items or those likely to exhibit early failures.

STEP STRESS TEST. A test consisting of several stress levels applied sequentially for periods of equal duration to a sample. During each period a stated stress level is applied and the stress level is increased from one step to the next.

STANDBY REDUNDANCY. See Redundancy, Standby.

TIME (as used in reliability definitions). Refers to any duration of observations of the considered items - either in actual operation or in storage, readiness, etc. - but excludes down-time due to a failure. Note: In definitions where "time" is used, this parameter may be replaced by distance, cycles, or other measures of life as may be appropriate. This refers to terms such as acceleration factor, wear-out failure, failure rate, mean life, mean-time-between-failures, mean-time-to-failure, reliability, and useful life.

USEFUL LIFE. The length of time an item operates with an acceptable failure rate.

WEAR-OUT failure. See Failure, Wear-Out.

WEAR-OUT FAILURE PERIOD. That period during which the failure rate of some items is rapidly increasing due to deterioration processes. Note: The curve below shows the failure pattern when this definition applies to an item.

(Curve omitted - refer to figure under "Constant Failure Period")

IEEE RELIABILITY GROUP

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