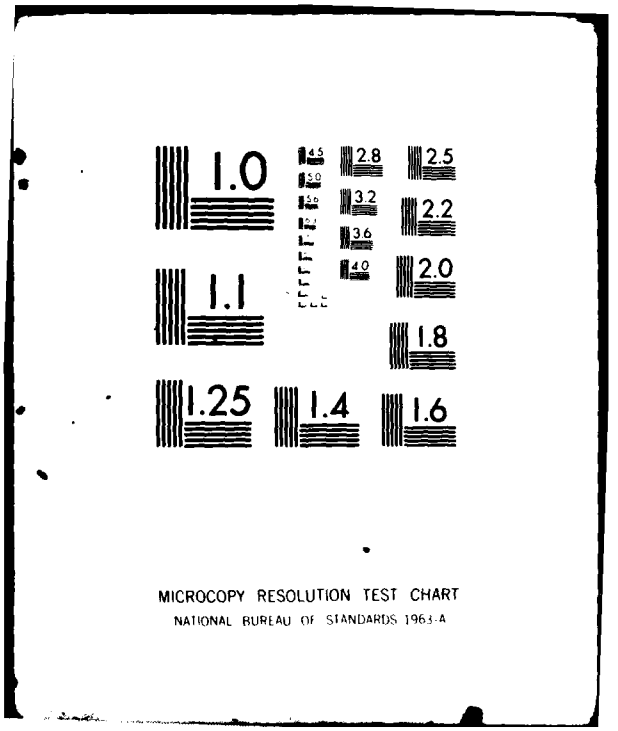
AD-A107 449 OFFICE OF NAVAL RESEARCH LONDON (ENGLAND) F/G 14/4
THIRD NATIONAL RELIABILITY CONFERENCE BIRMINGHAM, ENGLAND.(U)
SEP 81 M B KLINE
UNCLASSIFIED ONRL-C-8-81 NL

END
DATE FILMED
DTIC


1.0
1.1
1.25
1.4
1.6
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.8
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

LEVEL II

13

ONR LONDON CONFERENCE REPORT

C-8-81

OFFICE OF NAVAL RESEARCH

BRANCH OFFICE LONDON ENGLAND

THIRD NATIONAL RELIABILITY CONFERENCE
BIRMINGHAM, ENGLAND.

M. B. KLINE*

1 SEPTEMBER 1981

*Naval Postgraduate School, Monterey, CA

UNITED STATES OF AMERICA

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER C-8-81	2. GOVT ACCESSION NO. AD-A107449	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Third National Reliability Conference Birmingham, England		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER C-8-81
7. AUTHOR(s) M. B. Kline		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Office of Naval Research Branch London Box 39 FPO New York 09510		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE 1 SEPTEMBER 1981
		13. NUMBER OF PAGES 9
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVED FOR PUBLIC RELEASE/DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

data analysis
human factors
reliability management
reliability techniques
software
system modeling
risk analysis

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This conference on the subject of reliability covered a broad range of topics, from the many aspects of reliability management to considerations of hardware, software, and the human factors involved. The author summarizes some of the latest ideas in these many areas as they were presented by the featured speakers.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

C-8-81

THIRD NATIONAL RELIABILITY CONFERENCE
BIRMINGHAM, ENGLAND

The Third National Reliability Conference was held at the National Exhibition Centre in Birmingham, England, 29 April - 1 May 1981. The conference was sponsored jointly by the National Centre of Systems Reliability, Warrington, UK, and the Institute of Quality Assurance, London. Of the 250 to 300 people who attended the conference, approximately 90% were from the UK and other Western European countries; most of the remainder came from the United States, Israel, Japan and Australia. Nearly all the papers were prepublished in the Conference Proceedings and were handed out at the time of registration. A total of 66 presentations were made.

The conference was organized in the same manner as the Second National Reliability Conference, held in Birmingham in March 1979. The opening address was by Dr. P.A. Allaway, CBE, FENG, the recently retired chairman of EMI Electronics Ltd; his presentation was a general treatment of the problems of reliability and quality, and he also noted how the Japanese have taken the lead in both of these areas. A second invited paper was given by J.C. Warsop, who is a commander in the Royal Navy, and Deputy Director of Systems in the Ministry of Defence. His theme was the new emphasis on availability, reliability, and maintainability of Naval ships and weapon systems in the Royal Navy. (A new book of reference called *Availability, Reliability, and Maintainability* (BR 2552) will be issued shortly; this is similar to MILSTDS in the USA). Another opening invited paper was "The Targets for Safety - The CEGB Policy," by R.R. Matthews, Director of Health and Safety, CEGB. It dealt generally with safety problems and policies for nuclear reactor electric power generating plants.

The remaining conference sessions were spread over 3 days in concurrent meetings. The concurrent sessions usually contained 5 papers, with 30 minutes allocated to each paper (including questions) and a 30 minute coffee/tea break. When time permitted, a general panel discussion/question period was held after all papers had been presented. There also were 3 tutorial sessions on "Failure Free Design" (P.D.T. O'Connor, British Aerospace Dynamics Division), "Hazard Assessment" (B.W. Robinson, ICI Mond Division), and "Bayesian Methods" (DR. A.Z. Keller, Bradford Univ.).

There was a reception by the Lord Mayor of Birmingham one afternoon, and a formal conference banquet took place on Thursday evening. For this event, the speaker was Dr. N.L. Franklin, who had been managing director of the National Nuclear Corporation. His talk covered many of the technical and political problems in the development of nuclear energy in Britain. Since he was present at the time many of the critical decisions were made by the UK government, his review was most interesting to a reliability audience.

The conference sessions covered a wide range of reliability and reliability-related topics, including management, techniques, modeling, data collection and analysis, safety, risk, human factors, software, product liability and warranty, maintainability, availability, and life cycle costing, as well as applications to commercial, defense, and energy systems. In fact, the range of topics was comparable to the coverage in the Annual Reliability and Maintainability Symposium held in the US each January.

Reliability Management

This session led off with a presentation entitled "Reliability in Risk Management," by D.H. Slater and T.R. Moss, (RM Consultants Ltd.), who discussed the application of technological risk management to the areas of occupational health, community safety, and plant economics. The paper treated such methods such as failure modes and effect analysis and fault tree analysis. The second paper, "Reliability Growth Planning for Complex Systems" by I.F. Devereux, R. Buzzard, and G.G. Gray (Hunting Engineering, Ltd.) summarized a study by that company for the Ministry of Defence (Procurement Executive) which resulted in the publication of a report entitled "Guidelines for Reliability Growth Planning and Monitoring." R.C. Crombe and R.A. Merril presented the results of the collection and analysis of more than 21 system-years of field data on 10 Taylor Instrument Company Mod III process-control instrumentation systems which showed significant reliability growth. The results were impressive: as a result of learning curve improvements, design enhancements, and the implementation of a reliability assurance program, the average system delivered in 1979 showed 12 times better reliability for early system life than a comparable system delivered in 1975. J.G. Sayel and D.W. Newton (Univ. of Birmingham) presented a paper on a method for forecasting spares requirements which was based on the analysis of failure data from the field. The final paper by D. Hutchins (David Hutchins Associates) was a discussion of how the Japanese have been able to implement the "quality circles" approach in their manufacturing and how the West can benefit from the Japanese experience. This paper extended the "Japanese lesson" topic which Dr. Allaway brought up in his opening address.

Reliability Techniques - Statistical Methods

This session had three papers on statistical techniques, one dealing with reliability modeling, and one which described a method for safety analysis. A. Bendell (Dundee College of Technology) and W.B. Samson (Univ. of Stirling) discussed the use of rank-order distributions as a complement to fault-tree analysis and extreme-value theory in the estimation of the probabilities of rare events. This is one of the standard problems in reliability and safety analysis, where long times to failure produce few failure events. L.N. Harris (British Aerospace Dynamics Group) described the application of extreme value distributions to the assessment of mechanical component reliability, using stress-strength relationships. C.J. Weaton (Safety and Reliability Directorate)

and D.M. Hunns (National Centre of Systems Reliability) treated the use of hazard rate formulae for protective systems in which the components (identical or non-identical) are used in an r out of n voting configuration. Their paper contained a set of 164 indexed formulae for various r out of n combinations.

The paper by J.M. Kontoleon (Univ. of Wellongong, Australia) proposed the use of fault-tree logic and series-parallel reliability models for analyzing logic protective network; his approach includes both static and dynamic arrangements. Kontoleon employs a computer algorithm called SAFEGUARD, which is used to calculate fail-to-safe and fail-to-danger probabilities. A paper by J. Olivi (ISPRA, Italy) was devoted to the utilization of G.E.P. Box's Response Surface Methodology for Nuclear Safety analysis; the current state of the art in this area was reviewed.

Data Collection and Analysis

J. Sadler and P. Mahadevan (British Steel Corporation) opened this session by noting the critical importance of user-producer dialogue and the impact of user feedback on R&M data. This problem has plagued military procurement and utilization for decades, but as yet, nothing much has been done about it. Commercial industry, on the other hand, can more easily measure the cost-benefits of doing this in terms of profits, return on investment, and competitive position in the marketplace; and so the dialogue is recognized as necessary and useful. P.N.O. Mbaeyi (Univ. of Tuebingen, West Germany) presented a theoretical paper on the use of mathematical models and the reliability of data bases for making predictions; he used problems of biomedical diagnostics in his illustrations. S.E. Woods (Philips, Croydon) reported on the use of a Weibull analysis program to analyze data from color television reliability tests; this account included the statistical and computational problems which had been encountered.

J.P. Georgin, J.M. Lanore, and J.P. Signoret (Nuclear Safety Department, Atomic Energy Commission, France) compared the maximum likelihood estimate (MLE) and the upper bound estimate (UBE) for reliability evaluation. The paper by T.K. Alfsen, K.E. Egeland, T. Gjerstad (Rogaland Research Inst., Norway) and T.R. Moss (RM Consultants, UK) described the design of a computerized reliability information system.

Reliability of Defense Equipment

This session was a set of coordinated presentations by British military personnel. The initial paper by Commander D.G. Edwards, RN (Retired) and Lieutenant Commander I.B. Deane, RN, Ministry of Defence (Navy Department) showed how availability, reliability, and maintainability requirements are derived, and how they are expressed in the Naval User Specification for Ships, Systems, and Equipment. An illustrative example was worked through, to show how all the numbers were produced. Colonel G.M. Hutchinson, HQ, DGEME (Army), reviewed the Army's approach to the

specification and achievement of equipment reliability, and gave some details on the efforts to integrate this more fully into the design and development process. Group Captain D.J. Sledge, Ministry of Defence (Air Force Department), gave the Royal Air Force approach to specifying reliability requirements; his examples were the Tornado and Hawk projects. Among the lessons learned in the 1970s were the need to pay more attention to reliability during acquisition, and the importance of early life-cycle cost assessment. All departments agreed on the future strong commitment to R&M objectives.

K.A.P. Brown, Ministry of Defence (Procurement Executive), gave a glimpse into the approach of the upper levels of British Defence procurement management (equivalent to the US Department of Defense Acquisition Executive) to specifying and achieving R&M requirements. Key factors are the impact of R&M on mission and operational effectiveness, and the total cost of ownership. The general policy was highlighted by the publication in 1978 of the DCAD Technical Publication 1/77 Integrated on "The Achievement of Avionic Reliability and Maintainability through Integrated Management." There will soon be a new Defence Standard in R&M , and it will be stronger than just a guideline.

The final paper of the military session was presented by Group Captain A.B. Blackney, RAF, Head of the Maintenance Data Centre. The Centre maintains a large data bank of defect data for all RAF and RN aircraft. At present, the data bank contains 9 years of field feedback data. It is used by both the government and industry, for analysis and improvement of reliability for aircraft systems and also for the specification, test, and evaluation of new systems and equipments, such as the Tornado aircraft. I had the opportunity to spend a day visiting the Maintenance Data Centre (RAF Swanton Morley) and was impressed by the operations carried out at this activity. Analogous US facilities are the USAF Reliability Analysis Center at the Rome Air Development Center, New York, and the Government Industry Data Exchange Program (GIDEP) operated by the US Navy at the Fleet Analysis Center in California.

Reliability Techniques-System Modeling

All the papers in this session addressed the application of reliability modeling to commercial manufacturing, process control, and energy systems. M.O. Turpin (Perkins Engineering Limited) told of his company's approach to the quantitative reliability prediction and assessment of its products, with particular emphasis on diesel engines. Two sets of computer programs were described - the first is a set of interactive programs for analysis of development and field test data, while the second is an automated computer system for analysis of warranty claim data. Examples were given of typical outputs from each system. The work reported by S.B. Jensen (SINTEF, Norway) and J. Monsen (Norsk Hydro A.S., Norway) was an exploration of the usefulness of computer programs for reliability analysis of a subsea well system. A. Spanninga (Shell, UK, Exploration and Production) and F. Westwell (National Centre of Systems Reliability)

described a Monte Carlo simulation model used for making system performance predictions for the Brent oilfield gas disposal system. The model forecasts failures per year, days of downtime, and availability of the components, sub-system, and total system.

F.L. Brown (Standard Telephone and Cables Ltd.) and G.G. Pullum (Standard Telecommunications Laboratories Ltd.) examined the problems of modeling systems which may have dormant faults, with and without common elements. The analytical problem with using transition state diagram techniques is that, as the number of states grows, the modeling and solution of the resulting equations becomes laborious. R.N. Allan and A. Adraktras (UMIST) and J.F. Campbell (HM Nuclear Installations Inspectorate) gave some graphic/interactive computational techniques for assessing safety in complex systems. Their method allows for the determination of event trees, minimal cut sets, common mode failure analyses, and sensitivity studies. Although they were developed for safety analysis of nuclear reactors, the authors state that their methods can be applied to other systems.

Reliability of Mechanical Equipment

Most work reliability and maintainability techniques have been done for electronic components and equipments, and most of the data that have been collected have been on electronic items. While this electronic emphasis is understandable it has meant that R&M for mechanical components and equipments has lagged. This disparity has been recognized for some time, and in the past few years papers and sessions on mechanical items have begun to appear at R&M symposia. A good example of papers in this area was the one by G.C. Johnston (The Welding Inst.), who gave a statistical approach to fracture and fatigue mechanics, and applied the approach to the reliability of welds. The author explained the applicability of four distributions (exponential, normal, lognormal, and Weibull) which might be applicable to crack size and growth.

A.Z. Keller and A.R.R. Kamath (Univ. of Bradford) and V.D. Perera (Alfred Herbert Ltd.) presented a paper on the reliability and maintainability of computer numerically controlled machine tools (NCMTS). Field failure data on about 35 NCMTS were collected while the machines were under warranty for three years. The data showed that both lognormal and Weibull distributions were applicable for reliability, while the lognormal fit best for repair times. Another result was that the Duane reliability growth model gave a good fit to observed reliability growth of the system; for hydraulic and mechanical systems a damped-oscillation Duane version may be the model of choice.

C.J. Harris, M. Webster, and R.S. Sayles (Imperial College of Science and Technology) and P.B. Macpherson (Westland Helicopters Ltd.) studied bi-model failure mechanisms in rolling contact components such as ball and roller bearings. They found that surface-initiated failures play a more important role than had been previously believed. H.M. Thomas

(Rolls-Royce and Associates Ltd.) employed a statistical approach to estimate failure probabilities in pipes and vessels; of special importance in this application were the impact on plant failure of leakages, ruptures, and plant aging. The final paper of the session, by Professor A.D.S. Carter (Royal Military College of Science) addressed the problem of early life failures. He proposes a modified form of the Weibull distribution to achieve the postulated requirements for certain early-life and maintenance-induced failure parameters.

Electronics and Software Reliability

Of the five papers in this session, two were directed to electronics equipment reliability and three dealt with software. A.E. Mathew (Rex, Thompson and Partners) reviewed the application of fault-tree analysis in reliability design evaluation. According to the author, fault-tree analysis is better suited to systems which contain redundancy than is a failure-modes-and-effect analysis. He illustrated his point with the application to a communications receiver system, in which some of the system failure modes only arise as a result of multiple failures. D.J. Ager, G.F. Cornwall, and C.E. Stephens (British Telecom Research Laboratories) described a new test technique for testing digital microcircuits which may be sensitive to marginal power supply voltage levels. The technique uses lightspot which scans across the exposed silicon die of the circuit under test; this causes a change in the anomalous values of marginal voltage when the light is incident upon the defect site. Several examples were given to illustrate the practical application of this technique.

In their paper, M.B. Kline and N.F. Scheidewind (U.S. Naval Postgraduate School) compared hardware and software life cycles, and delineated the impact of life cycle consideration on hardware and software maintainability. Similarities and differences between hardware and software R&M concepts, terminology, design, and test techniques were examined, and emphasis was placed on the importance of giving proper consideration to both hardware and software R&M in the early planning phases of the system. G. Rzevski (Kingston Polytechnic) reviewed techniques for software reliability prediction and improvement; his treatment also considered ways of estimating quantitatively the complexity of software models. The list of references in Rzevski's paper was extensive and is perhaps one of the best sources to the literatures in this domain. G. Hart (formerly of Plessey Assessment Services Ltd.) discussed the software integrity of a computer system installed in a Royal Navy frigate; this investigation used a design-to-life cost study to examine the loss of system availability due to software failure. It was found that system behavior could be suitably represented by Weibull models.

Plant Reliability

A.J. Roberts (Group Safety Centre, British Petroleum) gave a method for making a cost-benefit analysis of a contingency ship-loading

facility; in case of loss of an existing major facility with several jetties, the contingent facility could be used for essential transfers of liquid petroleum gas and crude oil. D.S. Nielsen and D. Platz (Ris National Laboratory, Denmark) presented a probabilistic analysis technique which they used to assess the rate of occurrence of explosive hydrogen/chlorine gas mixtures in a chlorine production plant. Estimation of explosive condition likelihood was part of an overall risk-assessment study for the plant. E. Johnson (ICI Ltd., Mond Division) reported on the use of redundancy for on-line computer-control systems used in the process control industry, such as in a chemical plant. A comparison of the reliability of four systems using different redundancy schemes was given, along with a list of certain pitfalls to be avoided. N.E. Chang (Gibbs & Hill, Inc.) presented an overview of reliability-analysis techniques as applied to power-plant design; his paper treated failure modes and effect analysis, reliability block diagram, fault tree analysis, Markov process modeling, and Monte Carlo simulation. R.I. Wright and E.R. Shaith (Systems Reliability Service, UKAEA) used failure modes and effect analysis to assess the automatic control system of a ship's engines and gearbox. The main reference document was MIL-STD-1629A.

Product Liability and Warranty

Malcolm Lewis (legal consultant) gave an analysis of product liability in terms of the European product liability laws and the 1979 EEC amended directive on the subject. C.O. Smith (Univ. of Nebraska) discussed the legal basis for defining product liability and defects. He showed his approach by examining three specific products. In his paper, H. Abbott (Product Liability International, Lloyd's of London Press) traced the likely impact of strict liability laws in industrial practice. B.R. West (Commercial Union Assurance Group) treated the insurance side of product liability.

Life-Cycle Costing, Availability, and Maintainability

Life-cycle cost studies in the United States have yielded some remarkably consistent conclusions: for example, in-service costs account for more than half of the total life-cycle cost of systems; less than 20 percent of the equipments in a system account for more than 80 percent of system support costs; and so forth. D.J. Green, C.J. Parsons, and J.F. Smith (Hunting Engineering Ltd.), under UK Ministry of Defence sponsorship, developed a technique for assessing life-cycle cost implications for aircraft modification proposals. This technique has already been applied to 27 modifications, with these being about evenly split between mechanical and avionic equipment. J.M. Sheppard (Rex, Thompson & Partners) addressed the problem of the availability of items which are stored or inactive for long periods of time; some kind of test policy, of course, must be applied to the inventory of items. A mathematical model for optimizing test effectiveness was developed; it includes those cases where a failed component will cause the equipment to fail the test, and also those where a failed component will not cause the equipment to show

up as a failure. M. Sasaki and Y. Sasaki (The National Defense Academy, Japan) presented a paper on availability analysis for a combat tank system consisting of four major subsystems in series, each of which could contain both series and parallel redundant equipments. Five availability models were presented, two for continuous operation and three for intermittent use under varying maintenance policies. The models are illustrated with a quantitative example.

A.C. Durr (Plessey Assessment Services Ltd.) presented a reliability prediction method which may be especially useful for design-to-life-cycle costing which is done early in a project's life. The approach uses a modified-parts-count prediction method with weighting factors, and a underlying Weibull failure distribution. A. Brandowski and J. Potocki (Merchant Navy Academy, Poland) gave a short paper on maintenance strategies for marine equipment, and on the use of reliability data for controlling the maintenance.

Risk Analysis and Human Factors

A total systems approach to reliability, in addition to the well-established methods of active hardware reliability and the more recently developed concepts of software reliability, would include some indexing of storage reliability and the reliability of human operator and maintainer actions. D.E. Embrey (Univ. of Aston, in Birmingham) started with strong assumptions about the importance of human reliability in risk assessment. He also cautioned against the simple transfer of hardware reliability synthesis methods to the agglomeration of human data. Embrey proposed a new approach based on the use of multi-attribute utility (decision) theory. S.A. Salem and K.A. Solomon (Rand Corporation) summarized some of the issues and problems in establishing, and in achieving, levels of acceptable risk in both government and industry setting.

Rules often express policies about risk, and where risks can be high, there are important methodological problems in deriving optimal or near-optimal rules. C. Le Floch and A. Villemeur (Electricité de France) discussed a probabilistic method for use in the PWR - typed nuclear environment. The plants in this environment have safety systems which are supposed to function if certain plant states occur, but the safety systems themselves can fail without any necessary performance change in the main plant. Discrete operating rules can be formulated for this situation, and they reflect the several risks and costs involved. O. Muron (I.N.R.I.A.), J.P. Signoret (DSN, Commissariat a l 'Energie Atomique), and G. Cohen (ARMINES), France, showed that the operate-shutdown decision and test policy of safety systems in a nuclear power plant must be considered jointly using an economic criterion (loss of production) and a risk criterion (risk of accident). Their mathematical model produces optimal test policies and operate-shutdown rules in terms of these criteria. F.R. Farmer (Visiting Professor at Imperial College, London) took a general view on the developing pattern of safety thinking and safety practices; his paper illustrates once again how issues from the nuclear power industry have influenced risk analysis in other domains.

Reliability in Service Industries

Until recent years, fault detection in systems has not been given sufficient emphasis as a phenomenon worthy of intensive analysis. Indeed, the definition of mean-time-repair (MTTR) often "loses" fault detection time in a broad time band, and only recently have specifications contained explicit requirements on fault detectability. G.B. Jones (Plessey Telecommunications Systems Ltd.) presented a method for assessing the adequacy of fault detection features in R&M design. Y.S. Sherif (Univ. of Alabama in Huntsville) and M.L. Smith (Texas Tech Univ.) obtained availability and reliability estimates of utility and standby electric power systems, using Bayesian techniques. M. Sorum, T. Andersen, and M. Torhaug (Det Norske Veritas, Norway) studied the availability of a natural gas system. The effects of site locations on the reliability of automatic fire detection systems, using a Weibull distribution, factor analysis, and technical assessment were reviewed by S.T. Peacock (Univ. of Bradford) and T.A. Watson (National Centre of Systems Reliability). D.M. Walley (British Railways Board) described the reliability monitoring program which has been used for four years in the testing of the prototype advanced passenger trains. (UK trains regularly operate now at speeds of 110-125 mph, and this speed is expected to increase to 150 mph by 1987).

General Session

In the final session of the conference, A.C. Barrell (Health and Safety Executive) presented an overview of the HSE approach to the assessment of risk. J.M. Smith (British Aerospace Public Limited Company) gave a detailed discussion of the British Aerospace approach to design for economic maintenance of the British Aerospace 146 commercial airplane. J.B. Fussell (Univ. of Tennessee) and D. J. Campbell (JBF Associates, Inc.) reported the state-of-the-art for system reliability analysis in the US nuclear industry; their paper gave a listing of some of the computer programs which are now in use.

When reliability specialists meet, there are some natural expectations: one expects general enthusiasm for R&M concepts, reaffirmation of the benefits of early reliability efforts, polite wrangles over models and so forth. Certainly these expectations were realized in this Third Reliability Conference; however, in addition to being "bigger and better", the conference showed unmistakable signs of good health in the reliability business generally. Most of the papers reported sound analyses and/or effective applications. Though many interdisciplinary boundary areas remain soft, the sophistication of analysis is at a quite high level. In all likelihood those who attended went away with good feelings about the reliability domain itself, and about the conference as a means of expressing and communicating the best theory and practice in that domain.


FILMED
2-81