

Reliability Analysis Center



RAC

Catalog

of Products and Services



training

implementation

reliability

data collection

consultation

software

publications

<http://rac.alionscience.com>

RAC Mission Statement

The Reliability Analysis Center provides the information, tools, training, and technical expertise in the engineering disciplines of Reliability, Maintainability, Supportability, and Quality (RMSQ) to support accurate decision making and implement cost-effective solutions throughout all phases of a product or system life cycle.

Understanding your needs and requirements, both short- and long-term, is the most critical aspect of successfully implementing an optimized solution. Optimizing your product or process RMSQ means maximizing the positive impact on your overall mission or business goals and objectives through evaluation of your situation and requirements.

At RAC, our mission is only successful if yours is. Our staff of over 50 RMSQ engineers, world renowned technical resources, and broad spectrum of products and services are ready and capable to provide custom tailored solutions to improve your readiness, availability, and total cost of ownership. RAC is constantly expanding our resources to better serve you. Whether you need RMSQ education, handbooks, software tools or long-term support, RAC is your RMSQ solution focal point.

Patrick T. Hetherington
RAC Director

Doing Business with RAC

It's easy to do business with RAC because of our unique status as a competitively awarded government contract. Commercial customers simply provide a purchase order. Government agencies contact us or our Government Program Manager directly and we will work with you to evaluate your needs and prepare a statement of work. By providing a government funds transfer document such as a Military Interdepartmental Purchase Request (MIPR) to RAC's government contracting agency, the Defense Information Systems Agency (DISA), you avoid a lengthy contracting cycle, with work beginning in a matter of weeks.

For more details, contact us and we will assist you in the process.

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About the Reliability Analysis Center

The Reliability Analysis Center (RAC) has served as a Department of Defense (DoD) Information Analysis Center (IAC) for more than 35 years. As an IAC, RAC is a Center of Excellence and technical focal point for information, data, analysis, training, and technical assistance in the engineering fields of Reliability, Maintainability, Supportability, and Quality (RMSQ).

Although chartered by the DoD, RAC undertakes a variety of other government organization and industrial support projects each year. Our 50+ local engineers are backed by Alion Science and Technology resources at our 17 locations with over 1,700 employees of various technical backgrounds and expertise.

New this year, RAC has incorporated a new nomenclature into our product line: Standards (STD), Handbooks (HDBK) and Technical Reports (TR). Through our product line, RAC has always strived to fulfill our IAC mission to promote standardizations in the industry, provide guidance to practitioners, and to report on the state-of-the-art in RMSQ technology. Now, the nomenclature of our products will be more reflective of these functions as Standards, Handbooks and Technical Reports, respectively.

This catalog briefly describes the products and services offered by RAC. For further information regarding products, training, and consulting or engineering services call RAC toll-free (888) RAC-USER (722-8737) or (315) 337-0900, or visit our web site at <<http://rac.alionscience.com>>.

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RAC Consulting Services

RAC's technical staff is ready to work as strategic partners at all levels and in all areas of RMSQ. We help clients identify problems and implement solutions that positively impact their most important organizational goals: safety, mission success, market share, life cycle cost, profitability, and productivity. We are ready to provide short-term, quick responses to immediate needs, or long-term studies and independent analysis. The following represents a sampling of RMSQ activities RAC has performed for clients.

- Reliability Program Assessment, Planning, and Development
- Failure Reporting, Analysis, and Corrective Action System (FRACAS)
- PRISM® Reliability Modeling and Prediction
- Reliability/Maintainability Test Planning and Control & Evaluation
- Parts Control Programs and Part Qualification
- Physics of Failure and Failure Analysis Techniques
- Systems/Equipment Lifetime Extension Analysis
- Component Obsolescence Planning
- Failure Mode, Effects & Criticality Analysis (FMECA)
- Fault Tree Analysis (FTA)
- Worst Case Circuit Analysis (WCCA)
- Maintainability Analysis
- Reliability-Centered Maintenance (RCM) and Predictive Maintenance
- Environmental Stress Screening (ESS) Planning
- Mechanical Reliability and Maintainability
- Application and Use of Commercial-off-the-Shelf/Non-Developmental Item (COTS/NDI)
- Derating Analysis
- Source Evaluation and Selection
- Design Evaluation

RAC's engineers and consultants are recognized experts in the field totaling over 1,000 engineering-years of experience. In addition, RAC engineers are backed by access to RAC's vast data and information resources. RAC databases house over 10¹² part hours of reliability data and our bibliographic resources total over 130,000 publications.

RAC consistently performs more than 30 RMSQ efforts at any one time. Our customers include the Department of Defense, Defense Contractors, NASA, the Pentagon, and Fortune 500 technology and scientific companies as well as smaller companies. We have served in the aerospace, transit, medical, telecommunications, safety, and automotive communities to name a few. The table below has been included to demonstrate the breadth of technical capability represented by the technical staff that consistently works on RAC activities. Although these personnel normally make up the staffing of RAC projects, other resources from Alion Science and Technology's 1,700 employees and 17 locations are available as needed.



RAC Staff Member Capabilities

	Technical Subject Areas																			
	Reliability Programs	Reliability Data Collection/Analysis	Reliability Modeling/Prediction	Parts Control Programs/Part Qualification	Reliability Problem Solving	Systems/Equipment Lifetime	Failure Mode, Effects & Criticality Analysis	Fault Tree Analysis	Worst Case Circuit Analysis	Testability and Maintainability Analysis	Reliability-Centered Maintenance	Electrostatic Discharge Susceptibility Analysis	Reliability/Maintainability Test Planning and Control	Environmental Stress Screening Planning	Mechanical Reliability and Maintainability	Finite Element Analysis	Quantitative Services	Total Quality Management	Environmental Characterization	Component Obsolescence
Staff Members	20	33	28	14	16	7	28	25	14	17	9	7	22	19	7	6	7	8	15	10

Reliability Programs

Reliability Program Planning and Development

Effective and disciplined reliability program management requires careful planning that includes a detailed understanding of the product user's and/or customer's needs; a reliable process for translating these needs into technical design requirements and specifications; and the buy-in of upper management and the corporate culture that recognizes that reliability can be an important attribute in the success of a product/system in an increasingly competitive marketplace. The primary benefit is the ability to consistently understand and meet customers' needs at an optimal price for the customer and an optimal cost for the manufacturer or service provider.

Reliability Audit/Maturity Assessment

A reliability maturity assessment is a review of the policies, procedures, and activities defined by an organization to constitute its reliability program with the intent of identifying shortcomings and recommending improvements.

The maturity assessment determines the level of maturity of these policies, procedures, and activities and the effectiveness of the reliability program in designing, developing, manufacturing a product so that it performs as intended in the end use environment. The baseline for the assessment is a model reliability program that is a composite of the best practices observed by the RAC in working with many companies from a wide range of industries.

Parts Control Program Development

A parts control program provides an organized order of preference for the selection and control of parts to be used in the design of a product or system. Minimum screening levels are identified and tailored to meet critical item identification and control procedures. The major goals of a parts control and qualification program are to select parts/materials that can (1) withstand the manufacturing and operating environments, (2) perform reliably over the design life of the product/system, and (3) cost-effectively meet the product/system performance objectives. To meet these issues in an era of rapid technology and procedural change, an organized parts selection, application and control program is an essential element of system engineering.

Proposal/Source Selection Support

With Acquisition Reform, solicitations for new procurements or major modification can only state Reliability & Maintainability (R&M) performance requirements and not HOW those requirements are to be achieved. This presents several challenges to those responsible for R&M. RAC will help organizations meet these challenges by identifying and incorporating requirements into solicitations as well as evaluating R&M in competing proposals.

Design Evaluation

The ability to grow the reliability of equipment and systems has traditionally been defined in the context of a formal test program such as Reliability Growth Test (RGT) or Test Analyze and Fix

(TAAF). Consensus is shifting towards a more proactive approach to achieving reliability.

RAC can evaluate a reliability design, and make recommendations that will positively impact the reliability growth of the system/equipment without relying on a formal test program. The objective is to evaluate the design reliability and project reliability growth without relying on a costly reliability test program.

Failure Reporting, Analysis, and Corrective Action System (FRACAS)

A FRACAS is recognized as one of the most valuable tools for reliable products and systems. While it is always better to prevent problems, it is vital to identify and correct reliability problems which do occur, preferably before the product is released to the customer. Losses associated with an ineffective FRACAS can include significant direct costs in factory rework, parts/materials scrap, or warranty service, and even greater indirect costs associated with dissatisfied customers. The results of an effective FRACAS serve as a major contributor to reliability growth, efficient maintenance, and continuous process improvement.

Reliability Modeling and Prediction

Reliability Modeling and Predictions

Modeling and predictions allow an early, initial assessment of a design, and determination of progress towards meeting R&M objectives and customer needs. Predictions also provide a quantitative means of evaluating reliability design alternatives and trade-offs, highlighting opportunities for improvement early in the product life. RAC will use prediction methodologies to meet customer requirements including MIL-HDBK-217 and Telcordia as well as PRISM®.

PRISM® Reliability Predictions

RAC's PRISM reliability assessment methodology ties together several tools into a comprehensive system reliability prediction. The PRISM methodology includes new RACRates component reliability prediction models and means for assessing the reliability of systems due to significant non-component variables. PRISM has gained wide acceptance in the R&M user community and was developed to overcome the many inherent limitations of MIL-HDBK-217 and 217-type modeling methodologies.

Supportability and Logistics

Component Obsolescence Planning

The issue of component, materials, and technology obsolescence is critical to the continued operation of reliable and maintainable products and systems. This becomes particularly true when items are stored for extended periods of time before use, and as product/system lifetimes are extended in reaction to declining material acquisitions. The benefits of a component/material obsolescence management program include a higher likelihood of continued part availability and the use of preferred manufacturing processes.

Maintainability Analysis

Maintainability analysis is most effectively applied in the early product or system design phase to translate proposed design approaches into maintenance and repair strategies that match the reliability, maintainability and quality program objectives. The combined results of these analyses provide a clear description of the maintenance concept/service strategy that define the required repair levels; spares quantities and availability; test equipment and tool needs/availability; and required repair personnel skill levels.

Reliability-Centered Maintenance (RCM)

An effectively designed RCM program results in maintenance that is event-based (miles driven, operating hours, etc.), rather than time-based. Development of such a program depends on a determination of how a product/system can fail, the consequences of failure, and the classification of failure distributions (infant mortality, random failures, or wear out). Careful planning of a preventive maintenance strategy can greatly reduce the customer's cost of ownership.

Application and Use of COTS/NDI

Both government and commercial agencies prefer to use Commercial-off-the-Shelf (COTS) and Non-developmental Items (NDI) rather than face time, cost, and uncertainty of a new product development. However, the careful selection and application of COTS/NDI must take into account reliability issues and provide for a means of evaluating COTS from a reliability perspective. An effective COTS program minimizes risk and increases the probability mission success.

System Lifetime Extension

As defense and corporate budgets for new development projects decline, the emphasis on lifetime extension analyses as a viable means for prolonging existing product/system useful life will increase. Lifetime extension analysis assesses the implications of extending the useful life of a product or system beyond that for which it was originally designed. Careful decisions, based on sound technical and market data, have to be made in assessing the feasibility of lifetime extension.

Reliability Design Analyses

Failure Modes, Effects, and Criticality Analysis

Failure modes, effects, and criticality analysis (FMECA) represents a bottom-up assessment of a hardware/software/process design to determine the consequences of a failure on the overall product/system performance or effectiveness of the process. The objective of the analysis is to determine the criticality, or prioritized ranking, of a failure in a system or process so that corrective action can be identified and implemented. An FMECA can be used to improve a design, help determine maintenance strategy and troubleshooting procedures/guidelines, and assist in training.

Fault Tree Analysis

Fault Tree Analysis (FTA) is a top-down analysis approach that looks at how a failure at the product or system level (i.e., undesired top-level event) can occur, based on the behavior of its lower-level assemblies, components, and interfaces. When properly applied, FTA is extremely useful as an evaluation tool for driving preliminary design approaches. After a product/system becomes available in the market, the results of the FTA can serve as a troubleshooting tool.

Finite Element Analysis

Finite element analysis (FEA) is a computer simulation technique for modeling and analyzing the effects of mechanical loads and thermal stresses applied to a part and/or material used in a product or system. FEA is a powerful method for identifying areas of stress concentration that are susceptible to mechanical or thermal failure before manufacturing and testing begin, thereby providing valuable information during product/system design and development, and reducing or eliminating the costs associated with materials scrap and rework.

Derating Analysis

Derating is defined as the method of assuring that stresses, either environmental or operational, are applied below rated values to enhance reliability by decreasing failure rates. The purpose of a derating analysis is to protect against inherent variabilities in an operating environment and part operating characteristics. It essentially prevents small changes in operating characteristics (usually temperature) from creating large increases in failure rate. The amount of derating needed (40%, 50%, 60%, etc.) depends on how well the designer can predict the variation in operating parameters.

Test Planning and Evaluation

A reliability and maintainability test strategy involves an effective balance of test types (design of experiments; accelerated, growth, or demonstration tests; ESS; etc.) at appropriate levels of hardware/software "assembly" to accomplish the R&M program objectives and add value for the customer. The strategy considers items such as risk vs. cost, test asset availability, and accurately characterized environmental and customer usage profiles. The outcome is an efficient and cost-effective test approach that meets R&M design and performance goals, and ensures that inherent R&M performance is retained during manufacturing and customer use.

Environmental Stress Screening Plans

Marginal design tolerances, workmanship errors, and manufacturing process variations can create latent defects in a manufactured product which may not be apparent during normal acceptance testing, but can result in failures later in the manufacturing process, or under the stresses of the end use operational environment. These latent deficiencies produce a high failure rate in the early phases of the product/system life cycle. An effective method for reducing the number of delivered latent defects in a product is environmental stress screening (ESS).

Reliability Data Publications

RAC-STD-6100:

Electronic Parts Reliability Data

A compilation of reliability data on both commercial and military electronic components for use in reliability analyses. It contains failure rate data on integrated circuits, discrete semiconductors (diodes, transistors, optoelectronic devices), resistors, capacitors, and inductors/transformers. A summary section presents failure rates sorted by generic component type, quality level, and environment. A detailed section presents component specific data including part number, manufacturer, package type, etc.

Order Code: EPRD

Price: \$395 US, \$435 Non-US

RAC-STD-6200:

Nonelectronic Parts Reliability Data

A database of failure rates for a wide variety of component types including mechanical, electromechanical, and discrete electronic parts and assemblies. It contains more than 1,000 pages of data on over 25,000 parts. NPRD reflects field experience in military and commercial applications, concentrating on items not covered by other failure rate sources. This is an indispensable data source for engineers tasked to perform reliability analyses on system designs.

Order Code: NPRD-95

Price: \$195 US, \$215 Non-US

RAC-STD-6300:

Failure Mode/Mechanism Distributions

A cumulative compendium of failure mode and mechanism data, quantified by providing their relative probabilities of occurrence. Data contained in this publication can be used to support reliability analyses such as an FMECA. The scope of the publication is electrical, electronic, mechanical and electromechanical parts, and assemblies.

Order Code: FMD-97

Price: \$100 US, \$120 Non-US

RAC-STD-6400:

Electrostatic Discharge Susceptibility Data

Electrostatic discharge (ESD) is a major cause of electronic device and system failure. This publication contains ESD susceptibility data for 22,000 devices, including microcircuits, discrete semiconductors, and resistors. A detailed section contains the commercial part number, device description, manufacturer, ESD classification (per MIL-STD-1686A and MIL-STD-883 Method 3015.7), date code, data source information, resistance and capacitance used in the discharge circuit, failure voltage, pin combination, and failure criteria.

Order Code: VZAP-95

Price: \$195 US, \$215 Non-US

RAC-STD-DATASET:

Combined Set of EPRD, NPRD-95, FMD-97, and VZAP-95

Take advantage of significant cost savings while having the combined set of RAC databases at your fingertips.

Order Code: DATASET

Price: \$795 US, \$895 Non-US

Reliability Databases

RAC databases are presented in electronic database format for the Windows computer platform. Databases contain data collected



from a wide variety of sources including both military and commercial products. These data sets are assembled into a tool that provides efficient search and retrieval of information. Containing a built-in search engine, information may be searched by part type and part number. Additional filters are available to specify application environment and quality levels. Automated help is included. Databases are provided for each individual data product (as previously described in the Reliability Data Publications section) or as a comprehensive set that includes all four data products in a single database.

This tool operates in a Windows 95, 98, 2000, NT or XP environment.

This tool operates in a Windows 95, 98, 2000, NT or XP environment.

RAC-STD-6100: Electronic Parts Reliability Data (EPRD)

Order Code: EPRD-CD

Price: \$275 US, \$315 Non-US

RAC-STD-6200: Nonelectronic Parts Reliability Data (NPRD)

Order Code: NPRD-95C

Price: \$125 US, \$145 Non-US

RAC-STD-6300: Failure Mode/Mechanism Distributions (FMD)

Order Code: FMD-97CD

Price: \$100 US, \$120 Non-US

RAC-STD-6400: Electrostatic Discharge Susceptibility Data (VZAP)

Order Code: VZAP-95C

Price: \$125 US, \$145 Non-US

RAC-STD-DATASET: RAC Automated Databook (all four data products)

Order Code: CDSET

Price: \$600 US, \$625 Non-US

Site Licenses/Distribution Rights

Data from the RAC databases is available for both site license and unlimited distribution. Site licenses are applicable when the data is to be put on a shared computer resource within a single facility. An unlimited distribution agreement pertains to situations in which secondary distribution is to be made as a part of a saleable software product. Current availability and pricing is as follows:

Database	Site License	Unlimited Dist.
EPRD	\$4,000	\$10,000
NPRD	\$2,000	\$6,500
FMD	\$1,000	\$3,000
VZAP	\$1,000	\$3,000

RAC Data Sharing Consortium

The RAC Data Sharing Consortium (DSC) serves as a central repository of reliability data and includes information on field performance and component obsolescence. The repository allows companies to eliminate or reduce expensive testing and improve the overall quality and reliability of their systems by sharing data between organizations.

The DSC, is free to organizations supplying data and is available to others for a reasonable fee. Contact David Dylis at: <ddylis@alionscience.com>, or visit the DSC web site at: <http://rac.alionscience.com/consortium>.

Reliability Analysis Center Training Program

You will **learn from the experts** with RAC's world-renowned professional reliability training program. Courses are taught by practicing professionals using relevant experience and real-world examples.

RAC's two to three day training programs are designed to give students a firm understanding of the tools and techniques needed to design and maintain reliable systems and equipment.

RAC offers a variety of media, locations, and expanded subject coverage to foster the awareness and implementation of state-of-the-art RMSQ techniques that improve the performance of your products and systems over the long-term. RAC training options include open registration/standard courses, on-site training, and distance learning. RAC also offers custom in-house courses tailored to impact those areas most critical to your organization's goals. This solution offers the **Best Value** for organization's training four or more individuals.

Open Course Offerings

RAC courses are presented three times annually in an open registration format. This forum provides interaction with many companies all sharing similar concerns from various perspectives. Keep abreast of what courses are coming your way at <<http://rac.alionscience.com/rac/jsp/training/ractraining.jsp>>. Our open courses include:

Electronic Design Reliability

This intensive three-day course is structured for all key participants in the reliability engineering process including systems and circuit design engineers, quality and reliability engineers, and members of related disciplines having little or no previous reliability training. The course deals with both theoretical and practical applications of reliability. Course hand-outs include a course manual and RAC's publication "Reliability Toolkit: Commercial Practices Edition."

Course Instructor: Norman B. Fuqua has 40 years experience in the reliability-engineering field including teaching reliability techniques and application for the last 22 years. He holds a BSEE from the University of Illinois, is a senior member of IEEE, and a Registered Professional Engineer.

Price: \$1,095

Mechanical Design Reliability

This three-day course is a practical application of fundamental mechanical engineering to system and component reliability. Designed for the practitioner, this course covers the theories of mechanical reliability and demonstrates the supporting mathematical theory. For the beginner, the essential tools of reliability analysis are presented and demonstrated. These applications are further solidified by practical problem solving and open discussion. Course handouts include a course manual and RAC's publication "Reliability Toolkit: Commercial Practices Edition."

Course Instructor: Ned H. Criscimagna is a Senior Engineer with 37 years experience in engineering, maintenance, and system acquisition. He received his BSME from the University of

Nebraska-Lincoln and his MS in Systems Engineering from the Air Force Institute of Technology. He is an ASQ Certified Reliability Engineer and a SOLE Certified Professional Logistician.

Price: \$1,095

PRISM®

This two-day course is designed to give the PRISM® user an in-depth understanding of the PRISM methodology and the actual use of the software itself. Each student has access to his/her own computer and is given two full days of actual hands-on PRISM exposure. After completing this course the user should have sufficient knowledge and expertise to effectively utilize all of the features of this modern reliability assessment tool on their own.

Course Instructor: Nathan D. Holzhauer is a Reliability Engineer at the Reliability Analysis Center. He brings to the classroom practical PRISM project experience, as well as an understanding of the PRISM methodology and development process. Mr. Holzhauer received his BS in Engineering Physics from St. Bonaventure University in 1998 and a Certificate in System Safety and Reliability from the University of Washington.

Price: Free with PRISM Software Purchase

Reliability Engineering Statistics

This course is a three-day, applications-oriented course on statistical methods. Designed for the practitioner, this course covers the main statistical methods used in reliability and life data analysis. Course materials include the course manual and RAC's publication "Practical Statistical Tools for the Reliability Engineer."

Course Instructor: Jorge Luis Romeu is a Senior Engineer with Alion Science and Technology with 30 years of experience applying statistical and operations research methods in teaching, research, and consulting. Romeu holds a PhD in Operations Research, is a Chartered Statistician Fellow of the Royal Statistical Society (RSS) and of the Institute of Statisticians (IoS), and a member of the American Statistical Association (ASA) and the International Association for Statistical Education (IASE).

Price: \$1,095

System Software Reliability

This three-day course is tailored for reliability engineers, systems engineers, quality assurance engineers, and software engineers and testers. Featuring hands-on software reliability measurement, analyses and design, it is intended for those individuals responsible for measuring, analyzing, designing, automating, implementing or ensuring software reliability for either commercial or government programs. Practical approaches are stressed with many examples included. It is not necessary to have a software background or a reliability background to attend the course. Hand-outs include a training course manual and a copy of Ann Marie Neufelder's book entitled "Ensuring Software Reliability."

Course Instructor: Ann Marie (Leone) Neufelder is the President of SoftRel, a software reliability research, development, and testing organization. She co-authored two industry standards on software reliability and has published "Ensuring Software

Training

Reliability” with Marcel Dekker Inc. Ann Marie is a 1983 graduate of Georgia Tech with a BS degree in Industrial Systems Engineering.

Price: \$1,095

Accelerated Testing

This three-day results-oriented course provides both an in-depth introduction to the underlying statistical theory and methods as well as a complete overview and step-by-step guidance on practical applications of the accelerated testing theory using ReliaSoft’s ALTA, a software tool designed expressly for the analysis of accelerated life test data. Each student will receive a course manual and ReliaSoft’s ALTA software package, which is a \$995 value.

Course Instructor: Mr. Pantelis Vassiliou is the President of ReliaSoft Corporation, and holds a MS degree from the University of Arizona in Reliability Engineering.

Price: \$1,695*

*Includes a copy of ReliaSoft ALTA Software

Fundamentals of RCM Analysis

This three-day course is based on the Naval Air Systems Command’s RCM process presented in NAVAIR 00-25-403, Guidelines for the Naval Aviation Reliability Centered Maintenance Process. The course provides practical knowledge and includes case studies and information that can be incorporated into any RCM process. The course reviews the role of RCM in industry today and will address the history and benefits of RCM, as well as issues related to sustaining an RCM Program.

Course Instructor: JC Leverette is a Senior Engineer at Information Spectrum, Inc. and is currently the Program Manager for RCM efforts there. Mr. Leverette was the recipient of the 1997 RADM Claud A. Jones Award, from the American Society of Naval Engineers, for development of the RCM based T-45 Integrated Maintenance Program. He was a contributor to the development of Society of Automotive Engineers Standard JA-1011, Evaluation Criteria for Reliability Centered Maintenance Processes. Mr. Leverette has 15 years experience in RCM and related fields. He holds a BS degree in Aerospace Engineering from the University of Florida.

Price: \$1,095

Weibull Analysis

This three-day hands-on workshop starts with an overview of best practice Weibull analysis techniques plus a quick illustrative video of three case studies. The New Weibull Handbook[®] by Dr. Abernethy, the workbook provided for the class, is covered beginning with how to make a Weibull plot, plus interpretation guidelines for “good” Weibulls and “bad” Weibulls. All students will receive WinSMITH™ and VisualSMITH™ Weibull software and will get experience using the software on case study problems from industry. Computers are provided. This class will prepare the novice or update the veteran analyst to perform the latest probability plotting methods such as warranty data analysis. It is produced and presented by the world-recognized leaders in Weibull research.

Course Instructor: Mr. Wes Fulton is founder/CEO of Fulton Findings™ and the creator of WinSMITH™, WeibullSMITH™,

VisualSMITH™, Monte CarloSMITH™, and BiWeibullSMITH™ software packages. He has 16 years experience as Program Engineer for Garrett AiResearch. A lecturer in statistical modeling, he developed the Fulton Factor used in set comparison and originated the concept of equivalent probability and confidence known as “assurance.”

Price: \$1,495*

*Includes WinSMITH™ and VisualSMITH™ Software

Human Factors

This three-day class is intended to motivate designers to consider the impact of humans early in the development of systems and processes, when the opportunities for improvement are the greatest. Students will gain an understanding and appreciation of human factors and human reliability information. Each student will also receive a copy of RAC’s publication “A Practical Guide to Developing Reliable Human-Machine Systems and Processes.”

Course Instructor: Dr. Kenneth P. LaSala is the Director of KPL Systems, a consulting firm that specializes in reliability, maintainability, systems engineering, human factors, and elements of information technology. Dr. LaSala received the 1989 Society of Logistics Engineers (SOLE) Field Award for Reliability and Maintainability. He has been the President of the IEEE Reliability Society and is the chairman of the IEEE Reliability Society Human Interface Technology Committee. He received the BS degree in Physics from Rensselaer Polytechnic Institute, the MS in Physics from Brown University, and the PhD in Reliability Engineering from the University of Maryland.

Price: \$1,095

Practical Quality Function Deployment

The three-day Quality Function Deployment (QFD) Workshop is a “hands on” and interactive session designed to address both theory and practice of QFD. QFD is a systematic methodology focused on understanding and deploying the “voice of the customer” into every aspect of the product and service offering; thereby, increasing the customers perception of value. A course manual and QFD planning template will be provided to participants as well as a list of reference material.

Course Instructor: Robert F. Taylor is an independent consultant with 15 years of industry experience applied to the development of new products in the electronics and industrial equipment sector. He received his BE degree in Mechanical Engineering from Manhattan College and MS in Manufacturing Systems Engineering from Lehigh University.

Price: \$1,095

Statistical Process Control and Process Capability

Statistical Process Control (SPC) course is a three-day “hands on” session which will provide an understanding of the associated statistical methods to effectively apply SPC to any process. This course is targeted at practitioners; the concepts and tools are presented during this course are particularly relevant to quality, manufacturing, design, strategic sourcing and operations. A course manual will be provided to participants as well as a list of reference material. The course manual will include illustrative examples of key methods taught during the workshop.

Course Instructor: Robert F. Taylor is an independent consultant with 15 years of industry experience in the development of new products in the electronics and industrial equipment sector; delivering in excess of \$150M in annual revenues across businesses served. He received his BE degree in Mechanical Engineering from Manhattan College and MS in Manufacturing Systems Engineering from Lehigh University.

Price: \$1,095

Reliability Growth and Repairable System Data Analysis

This three-day course will address state-of-the-art methods for planning and evaluating the reliability of complex systems during three key life cycle phases: design, development testing and customer field use. Areas covered include failure mode management strategy, the Crow (AMSAA) model and the Crow Projection model for managing reliability growth in development and Crow Power Law model for assessing the reliability of repairable systems. Course handouts include a course manual and RAC's publication "Reliability Toolkit: Commercial Practices Edition."

Course Instructor: Dr. Larry Crow developed the Crow (AMSAA) reliability growth model that has been incorporated into US DoD military handbooks and international standards. He chaired the tri-service committee to develop MIL-HDBK-189, Reliability Growth Management and is the principal author of the document. He received the 1976 Army Material Development and Readiness Command Systems Award for Individual Achievement and is a US delegate on reliability and maintainability to the International Electromechanical Commission (IEC). Dr. Crow is an elected Fellow of the American Statistical Association and the Institute of Environmental Sciences.

Price: \$1,095

On-Site Training



Bring RAC Training to Your Facility

RAC provides training courses to government and industry in virtually every aspect of reliability and quality. On-site training is often more cost-effective for organizations and is the best value for organizations training four or more individuals. On-site courses are tailored to your specific products and processes. Subjects addressed by RAC's on-site training include:

- Electronic Design Reliability
- Mechanical Design Reliability
- PRISM
- Reliability Engineering Statistics
- Accelerated Testing
- System Software Reliability
- Fundamentals of RCM Analysis
- Weibull Analysis
- Human Factors
- Practical Quality Function Deployment
- Statistical Process Control and Process Capability
- Reliability Growth and Repairable System Data Analysis

RAC's on-site training programs are customer learning experiences tailored to meet the needs of particular organizations. RAC will work with your company to design a course format that emphasizes key elements to quickly make sound reliability engineering practices routine in your development process. RAC instructors have years of diverse practical reliability problem solving experience that will benefit every organization. Scheduling is flexible and most importantly, you can train 30 people for the same cost as sending four people to one of our standard open courses.

Distance Learning

Electronic Design Reliability

Having difficulty finding time and resources to attend one of RAC's training programs? To learn at your own pace, RAC's distance learning is structured for all individuals working in the reliability engineering realm, including systems and circuit design engineers, program managers, quality engineers, and members of related disciplines. Let RAC's world renowned Electronic Design Reliability Training course come to you. This course will cover all aspects of a reliability program as it pertains to electronic equipment, and is intended to leave the student better prepared to implement reliability into the product. The course includes a video CD with 14 hours of training, a course manual, and test material to evaluate your progress. A demo session is available at http://rac.alionscience.com/distance_learning.

Order Code: Media
DSTL-CD CD-ROM Price: \$495 US, \$545 Non-US

Computer-Aided Reliability Training

Are you a manager, administrator or purchasing professional that needs to have an understanding of the terms, benefits, and elements of a reliability program? RAC's Computer Aided Reliability Training (CART) is for you. Intended to give a high level awareness, CART is a self-paced interactive program to make you reliability wise. The tool is PC compatible.

Order Code: CART Price: \$100 US, \$120 Non-US



Best Practices

RAC-HDBK-1000:

Reliability Toolkit: Commercial Practices Edition

The “Reliability Toolkit: Commercial Practices Edition” is intended to help both the commercial and military sectors deal with developing and manufacturing reliable products in today’s competitive world. The Reliability Toolkit addresses the use of best commercial practices. Over 80 topics, representing every aspect of a product’s reliability over its life cycle, have been well received by nearly 12,000 Toolkit owners to date. Among the topics are mechanical reliability, electromagnetic compatibility, life-time extension, benchmarking, durability, performance-based requirements, and manufacturing variability.

Order Code: CPE

Price: \$25 US, \$35 Non-US

RAC-HDBK-2000:

Maintainability Toolkit

The Maintainability Toolkit provides common sense and up-to-date information for planning and carrying out those activities needed to develop maintainable products and services. It discusses the fundamental precepts of maintainability and provides guidance on identifying needed activities and implementing those activities. Appendices provide details on maintainability design criteria, testing and demonstration, educational and other resources, and reference documents.



Order Code: MKIT

Price: \$50 US, \$60 Non-US

RAC-HDBK-4000:

Quality Toolkit

A compact, but comprehensive, reference for quality practitioners, this document discusses the philosophy and methodology of the most successful quality approaches and provides working details for a broad array of tools used to manage, measure, test, maintain, and improve quality. The roles of ISO 9000 and related quality standards are explained. Lists of available quality awards and sources for quality training are provided. Appendices provide definitions, useful mathematical tables, a list of current quality standards, and sources for currently available software tools for quality engineers and managers.



Order Code: QKIT

Price: \$50 US, \$60 Non-US

RAC-HDBK-KITSET

Combined Set of CPE, MKIT, and QKIT

Order Code: KITSET

Price: \$100 US, \$120 Non-US

RAC-HDBK-1360:

Supporting Commercial Products in Military Applications

This handbook will assist program managers and others in addressing and establishing a sound support strategy for commercial items in military weapon systems.

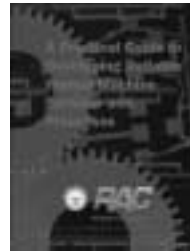
The handbook has three parts. Part one addresses supportability issues with commercial items in a military system environment. Part two covers reliability issues such as assessing reliability of commercial items and system availability models. Part three covers budgeting issues and presents ways to plan, manage, and track commercial item support.

Order Code: SCPMA

Price: \$50 US, \$60 Non-US

RAC-HDBK-1190:

A Practical Guide to Developing Reliable Human-Machine Systems and Processes



An important element in the level of reliability achieved in the field is the human. This book specifically addresses the relationship between the human element and system or process reliability. It provides an easy-to-use guidebook focusing on developing reliable human-machine systems and processes. This new guide:

- Helps designers consider the impact of humans early in the development of systems and processes.
- Acts as a bridge between introductory tutorials and short courses on human factors and human reliability and more extensive texts on human factors.
- Provides a highly understandable and readily accessible source of human factors and human reliability information.
- Presents current information on rapidly changing aspects of human-oriented design.

The guide includes sections on human performance, human reliability requirements and activities, human engineering analysis, qualitative and quantitative metrics for human-machine systems and processes, and human engineering design guidelines.

Order Code: HUMAN

Price: \$75 US, \$85 Non-US

RAC-HDBK-3180:

Operational Availability Handbook



This handbook presents a practical overview of the concept of operational availability and several supportability measures and their use in different phases of a system’s life cycle. It is intended to be a practical guide. Although several useful equations are provided, it is not intended to be an exhaustive mathematical or engineering treatise. This handbook is based on one initially developed, by the Department of the Navy in the mid 1980s to address the combined consideration of Operation Availability and cost in all levels of systems acquisition and design related decision-making. This handbook generalizes and broadens the application of the concepts and incorporates the tenets of acquisition reform, organizational re-alignment, and provides additional clarity to the interaction between Operation Availability and cost of ownership. Although many of the terms and initiatives discussed herein are unique to the military, the basic concepts are also applicable to industrial and commercial products.

Order Code: OPAH

Price: \$50 US, \$60 Non-US

RAC-HDBK-3190:**Integrated Supply Chain Management**

A supply chain is a group of activities organized to deliver a product or service to customers. From that standpoint, supply chains have existed in one form or another ever since the dawn of commerce. However, in recent years, the attention of business and industry has become focused more strongly on the concept of supply chain management as a force for competitive advantage. This business strategy is based upon the concept of the total value chain.

This handbook focuses on implementing a customer-focused supply chain management system. It describes the set of activities associated with planning and executing processes for delivering products and services to end customers, provides a brief summary of some supply chain models that have been published over the past 5-10 years, and presents the concepts and definitions of total cost of ownership and life cycle cost. It presents supply considerations for designing a supply chain, guidelines for optimizing the chain, and methods for managing supply chain management.

Order Code: ISCM

Price: \$75 US, \$85 Non-US

Blueprints for Product Reliability

The RAC "Blueprints for Product Reliability" is a six part series of documents that provide insight and guidance in applying sound reliability practices. They provide information on those approaches to planning and implementing effective reliability programs based on experience, lessons learned, and state-of-the-art techniques. Topics include: defining reliability programs, developing reliability goals/requirements, designing for reliability, assessing reliability progress, measuring product reliability, and ensuring reliable performance. The approaches and procedures are based on best practices used by commercial industry and on the concepts documented in many of the now-rescinded military standards. They address products ranging from new commercial consumer products to highly specialized military systems.

RAC-HDBK-1001: Blueprints for Product Reliability

Order Code: BPSET

Price: \$50 US, \$60 Non-US

RAC-TR-1600:**Benchmarking Commercial Reliability Practices**

Benchmarking is a process for finding the world-class standards for a product, service or system and then adjusting one's own products, services, and systems to exceed those standards. This publication provides an understanding of the best R&M practices being used by commercial industry. Areas of divergence and commonality among commercial reliability practices are identified, as well as the general commercial approach to designing, developing, and manufacturing reliable products. Insights into the motivations behind commercial companies' approaches are provided.

Order Code: BENCH

Price: \$50 US, \$60 Non-US

RAC-HDBK-1610:**Evaluating the Reliability of Commercial Off-the-Shelf (COTS) Items**

Both government and commercial agencies prefer to use Commercial Off-the-Shelf (COTS) products, rather than face the cost, time, and uncertainty of a new product development. However, an item designed for one use environment may not be suitable in another. This risk must be addressed in selecting COTS. The reliability issues, means for evaluating COTS from a reliability perspective, ways to minimize risk, and contracting advice are presented in this RAC document, along with some case studies. The focus is online replaceable units (LRUs) or weapon replaceable assemblies (WRAs) rather than piece parts.

Order Code: COTS

Price: \$75 US, \$85 Non-US

Analysis Guides**RAC-HDBK-1110:****Electronic Derating for Optimum Performance**

This publication presents electronic part stress derating parameters for 21 part types. It includes an introduction to part stress derating theory, part derating definitions, part application guides, and part failure mode and mechanism frequency. The derating section includes application recommendations and specific electrical and environmental derating parameters. Two levels of stress derating are described, one for office type environments and one for uncontrolled conditions such as those found in an automobile or aircraft.

Order Code: D-RATE Price: \$75 US, \$85 Non-US

**RAC-HDBK-1120:****Failure Mode, Effects and Criticality Analysis**

Failure Mode, Effects and Criticality Analysis (FMECA) is a "bottom-up" technique to form conclusions about a system's reliability by examining the reliability and interactions of its component parts. This publication describes FMECA techniques and provides examples of constructing FMECA worksheets. It also provides component failure distribution values necessary to apportion modal failure rates in the criticality analysis.

Order Code: FMECA

Price: \$75 US, \$85 Non-US

RAC-HDBK-1130:**Failure Reporting, Analysis and Corrective Action System (FRACAS) Application Guidelines**

Effective use of a closed-loop failure reporting, analysis and corrective action system (FRACAS) during design and production is vital to preventing failures in delivered products. Those reliability problems that do occur in delivered products will be most quickly and efficiently resolved by continued use of FRACAS in the field. FRACAS is therefore an essential tool for achieving customer satisfaction.

Publications

To help the user assure the efficiency of his FRACAS, this guidebook provides background to better understand FRACAS and its critical elements, defines how a FRACAS can be tailored to the user's needs, and suggests extensions of FRACAS beyond the traditional boundaries of hardware failures.

Order Code: FRACAS

Price: \$75 US, \$85 Non-US

RAC-HDBK-1140:

Fault Tree Analysis Application Guide

Fault Tree Analysis (FTA) is a "top-down" approach to assess the effects of faults on system performance. This handbook covers FTA components, symbols and procedures, including fundamentals of fault tree construction, definition of fault and failure types, levels of examination, tailoring, and both quantitative and qualitative analysis. After a thorough discussion of FTA fundamentals, the guide presents detailed examples of actual FTAs.

Order Code: FTA

Price: \$75 US, \$85 Non-US

RAC-TR-4420:

Introduction to Concurrent Engineering

This document presents an overview of Concurrent Engineering (CE) (i.e., the use of multi-discipline design teams to perform the simultaneous design and production of a product). The intent is to encourage product developers to consider all elements of the product life cycle from conception through disposal, including quality, cost, schedule, and user design requirements. The document also explores a number of specific tools which may be used to assist the reader in the implementation of CE.

Order Code: CRTA-CE

Price: \$75 US, \$85 Non-US

RAC-HDBK-1210:

Practical Statistical Tools for the Reliability Engineer

Statistical techniques are the most valuable tools of the reliability engineer. This text provides basic training in probability, statistics, and distributions, followed by detailed discussions of the application of these concepts to measuring reliability, demonstrating reliability, reliability growth testing, sampling, statistical quality control, and improving processes. The discussions are detailed to the extent that practical use can be made of the tools, and the limitations to each tool are clearly defined to keep a novice from misapplication.



Order Code: STAT

Price: \$75 US, \$85 Non-US

RAC-HDBK-1300:

Microelectronics Failure Analysis Techniques: A Procedural Guide (Book 1 of 2)

This guide is a resource for beginner and experienced failure analysts and quality and reliability engineers in the semiconductor industry. The most useful failure analysis techniques employed by industry have been assembled in this one document. Also provided are the detailed steps necessary to establish and operate a cost-effective failure analysis laboratory.

GaAs Microcircuit Characterization & Failure Analysis Techniques: A Procedural Guide (Book 2 of 2)

A companion document to "Microelectronics Failure Analysis Techniques: A Procedural Guide," this publication presents the failure analysis techniques most used by government and industry leaders in the field of Gallium Arsenide processes. This handbook provides a general technical discussion of each major GaAs failure analysis technique currently in use, together with application examples and suggestions. It is a useful tool for the beginning failure analyst as well as a convenient reference source for the experienced failure analyst or practicing quality, reliability, and project engineer.

Order Code: MFAT-1&2

Price: \$100 US, \$120 Non-US

RAC-HDBK-1170:

Mechanical Applications in Reliability Engineering

Reliability engineering practices are presented from two primary perspectives - part reliability engineering and system reliability engineering. Unlike many reliability documents, this document establishes a clear distinction between the tools and terminology which are associated with each perspective. The context is oriented toward mechanical reliability applications within reliability engineering. Such topics as the mechanisms of mechanical failure, mechanical failure theories, part failure data evaluation, system failure data evaluation, and failure mode evaluation tools for products are discussed.

Order Code: NPS

Price: \$75 US, \$85 Non-US

RAC-HDBK-1150:

Testability Design and Assessment Tools

Testability is the extent to which a system or unit design supports fault detection and fault isolation (FD/FI) within the bounds of specific time, confidence, complexity, and cost effectiveness constraints. Systems developed under Design for Testability (DFT) criteria provide necessary test points to facilitate incorporation of Built-In-Test (BIT) and support Automated/External Test Equipment (ATE/ETE) while meeting FD/FI requirements. This publication surveys the field of automated testability analysis tools, providing both experienced and beginner analysts with the information needed to locate, evaluate, and select the proper tools.

Order Code: CRTATEST

Price: \$50 US, \$60 Non-US

RAC-HDBK-1160:

Worst Case Circuit Analysis Application Guidelines

Worst Case Circuit Analysis (WCCA) addresses the ability of a circuit design to meet operational requirements under the worst possible combinations of electrical and environmental circumstances. Extreme Value Analysis, Root Sum of Squares, and Monte Carlo approaches are addressed within this book. Elements of the WCCA described include hierarchical circuit description, interface and environmental requirements, part tolerance values, performance attributes, and worst cases for each attribute. Recommendations for improving the design to eliminate non-compliant areas are also included.

Order Code: CRTAWCCA

Price: \$75 US, \$85 Non-US

The New Weibull Handbook – Fourth Edition

By arrangement with Dr. Robert B. Abernethy, the New Weibull Handbook is available through the RAC.

This is the leading text in the world for reliability and statistical analysis for predicting life, safety, survivability, risk, cost, and warranty claims. Life data analysis includes Weibull, normal, log normal, binomial, Poisson, exponential, Kaplan-Meier, Probit, and Crow-AMSAA methodologies. The text presents “best practices” for alternative methods such as maximum likelihood versus regression estimates, confidence and predictive intervals, test substantiation, sudden death, sample size requirements, accelerated testing, cost analysis, failure predictions, spare parts inventory control, optimal parts replacement, and risk analysis.

Order Code: WHDK

Price: \$100 US, \$110 Non-US

Reliable Application of Components

RAC’s Reliable Application of Components series includes practical information relating to the proper application of various part types in reliable designs.

RAC-HDBK-1320:

Analog Testing Handbook

This publication provides (with updates) the test methods and circuits needed for the electrical testing of analog microelectronic devices and problem areas associated with their implementation. It describes each test parameter required to fully evaluate the performance of a particular device family. Developed jointly by Rome Laboratory and RAC, each chapter addresses a separate device family, such as operational amplifiers, comparators, and data converters. Detailed information is included on device families and categories and their key parameters.

Order Code: ATH

Price: \$50 US, \$60 Non-US

RAC-HDBK-1410:

Reliable Application of Capacitors

This publication specifically addresses capacitors and provides information which will allow a user to select and apply these devices in a reliable manner. It provides information on failure modes of the various capacitor types, their observed failure rates, and specific areas of concern when selecting a capacitor. The purpose is not to provide a tutorial on the design and construction of capacitors, but to put into perspective the reliability issues involved in capacitor selection and application. A thorough bibliography is provided.

Order Code: CAP

Price: \$50 US, \$60 Non-US

RAC-HDBK-1420:

Reliable Application of Multichip Modules

This publication addresses hybrid microcircuits, multichip packaging, and multichip modules (MCMs). It is designed to provide

practicing designers, component and reliability engineers, and their managers with an overview of the methodology and tools which will ensure that these components and their vendors are selected, controlled and tested in a manner that is most effective for the specific end product and market and provides guidance for the reliable application of these parts.

Order Code: MCM

Price: \$50 US, \$60 Non-US

RAC-HDBK-1430:

Reliable Application of Optoelectronic Devices

Developments in optoelectronic components and related materials technologies continue to outpace documentation of life expectancy data relevant to their application. The purpose of this publication is to present information that can be used to assist optoelectronic designers in enhancing the reliability of their products. The handbook provides a critical review of selected optoelectronic devices having a broad range of applications in commercial and defense systems. Its intent is to provide the reader with a centralized resource of information that allows the designer to apply optoelectronic devices in a reliable and robust manner.

Order Code: OPTO

Price: \$75 US, \$85 Non-US

RAC-HDBK-1440:

Reliable Application of Plastic Encapsulated Microcircuits

The application of plastic encapsulated microcircuits (PEMs), even in military and telecommunication areas with strict reliability demands and harsh environments, is of great interest. The interest stems from the real and perceived improvement in cost, availability, manufacturing quality, and reliability of plastic integrated circuits. Recent data shows that the failure rate of PEMs has decreased significantly from about 100 failures per million hours in the 1970’s. This revised publication includes additional information on parts control/procurement, failure modes and mechanisms, and reliability/quality data on PEMs. A reliability prediction model based on current reliability data for PEMs is also provided.

Order Code: PEM2

Price: \$75 US, \$85 Non-US

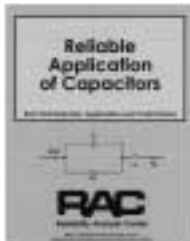
RAC-HDBK-1450:

Processes for Using Commercial Parts in Military Applications

This handbook is intended to help bridge the gap between the use of military specifications and standards and acquisition reform as it applies to “a new way of doing business” in acquiring military systems/equipment. The handbook is written to provide an overview of the acquisition reform process, including its relationship to systems engineering functions and its impact on reliability/quality issues. In addition, practical experience and “lessons learned” are contained in case history synopses.

Order Code: PUCP

Price: \$25 US, \$35 Non-US



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Application Guides

RAC-HDBK-1460:

Electrical Overstress/Electrostatic Discharge (EOS/ESD) Guidelines

Electrical Overstress (EOS) and Electrostatic Discharge (ESD) are an increasing threat to microelectronic circuits due to increased component density. This handbook addresses some of the important issues involved and describes sound engineering practices for minimizing the threat. This publication was authored by visiting Clarkson University Professor Henry Domingos while on sabbatical at RAC.

Order Code: EOES

Price: \$35 US, \$45 Non-US

RAC-HDBK-1470:

ESD Control in the Manufacturing Environment

This up-to-date publication presents a detailed plan for development of an ESD control program in an ISO 9000 context. This plan can be applied to any manufacturing environment and to any electronic product. The advantages and disadvantages of available ESD prevention products and test methods for verifying the effectiveness of each are also explored. This revised edition includes timely information addressing the impact of DoD acquisition reform, the emergence of ISO 9000, the development of new ESD materials and equipments, and new developments in the field of ESD training.

Order Code: SOAR-6U

Price: \$50 US, \$60 Non-US

RAC-HDBK-338/470:

R&M Design Handbook CD Set

MIL-HDBK-338 "Electronic Reliability Design Handbook" and MIL-HDBK-470 "Maintainability Design Handbook" are two of the most comprehensive resources available to R&M engineers. These handbooks are available in a two CD set in Adobe Acrobat® portable document format (PDF). Searches and bookmarks make finding relevant information extremely fast in the over 1,500 pages of documentation. Both documents will assist procuring activities and development organizations in understanding the principles, concepts, terminology, applications, and aspects of reliability and maintainability design.

Order Code: MILCDSET

Price: \$100 US, \$110 Non-US

RAC-TR-3150:

Survey of Military Logistics Initiatives

Facing increasing commitments and decreasing resources, the Department of Defense and the military services began to look for a new way of doing business. Defense Acquisition Reform is perhaps the most familiar symbol, even among the civilian population, of this new way of doing business. Less publicized, perhaps, are the many initiatives being pursued to reduce the cost of logistic systems while increasing their effectiveness.

Order Code: LOGI

Price: \$50 US, \$60 Non-US

RAC-HDBK-1180:

RAC Thermal Management Guidebook

In light of the vital influence of temperature on the reliability of electronic equipment and the ever more harsh environments under which a product must operate, a major responsibility of the design team is ensuring that the thermal design approach is adequate. RAC engineers collaborated with the Hughes Aircraft Company to develop this handbook which is an update of a guide previously developed for Rome Laboratory. It provides guidelines for ensuring the development of a thermally adequate, cost-effective product.

Order Code: RTMG

Price: \$75 US, \$85 Non-US

RAC-HDBK-3100:

Quantitative Methods for Supportability Analysis: A Guide to Mathematical Methods Applicable to Problems in Supportability and Logistics

This document presents a brief discussion of the various quantitative methods applicable to supportability analysis. Each section contains the name of the technique, its purpose and application, the basic concept, required input variables, the algorithm, expected outputs, and an example problem.

Order Code: SID-1

Price: \$20 US, \$30 Non-US

RAC-HDBK-3110:

System Level Automation Tool for Engineers (SLATE)

This report documents the evaluation of the SLATE suite of tools for use in the Integrated Requirements Support System.

Order Code: SID-15

Price: \$10 US, \$12 Non-US

RAC-HDBK-3120:

The Language of Logistics

A glossary of terms used in logistics and supportability investment decision analyses, along with a list of acronyms and abbreviations.

Order Code: SID-2

Price: \$10 US, \$12 Non-US

RAC-HDBK-3130:

A Methodology for Comparing Supportability Models

This report presents a method for qualitatively and quantitatively comparing supportability models. The methodology presented compares the sortie generation capabilities of simulation models documenting the results and analyzing the findings.

Order Code: SID-5

Price: \$20 US, \$30 Non-US

RAC-HDBK-3140:

Service Life Extension Assessment

With the declining defense budget and industry constraints on new capital outlays, the option of extending the lifetime of existing products and systems needs to be explored. This document discusses the complex issues associated with life extension and the process involved in a life extension analysis. Issues include the impact on life cycle cost and parts obsolescence problems.

Order Code: SLEA

Price: \$50 US, \$60 Non-US

RAC-HDBK-2400:

Practical Application of Reliability-Centered Maintenance

Reliability-Centered Maintenance (RCM) is a tool for identifying and planning preventive maintenance (PM). This handbook helps managers understand the basis for, and benefits and limitations of RCM. It provides guidance to maintenance planners for applying RCM, using logic trees to identify potential PM and to determine the PM required to preserve safety or minimize maintenance costs. This handbook provides an application perspective of RCM, presents new information, and consolidates information heretofore addressed in several documents.

Order Code: RCM

Price: \$75 US, \$85 Non-US

RAC-HDBK-7020:

A Practical Framework for Acquirers and Providers of Systems Engineering Services

This handbook provides the technical foundation for integrating product and process development. This integration requires the simultaneous development of system products and life-cycle processes to satisfy user needs, multidisciplinary teamwork, and a systems engineering approach. The guide is intended to assist those working in the acquisition community to define, perform, manage, and evaluate systems engineering efforts in defense system acquisitions and technology developments. The scope and requirements of systems engineering are defined in terms of what should be done and how these efforts should be tasked.

This guide captures the key aspects of the DoD reform initiatives to better integrate requirements; implement multidisciplinary teamwork, including potential suppliers, early in establishing the requirements; establish clear measurements of system responsiveness; encourage innovation in products and practices; focus on process control rather than inspection; encourage risk management rather than risk avoidance; eliminate functional stove-pipes by encouraging the use of integrated product teams; reduce the time it takes to acquire products and services; increase teamwork and cooperation within the government and industry; and encourage tailoring of standard processes to fit specific project needs.

Order Code: SYS1

Price: \$75 US, \$85 Non-US

RAC-HDBK-7010:

A Practical Approach to Systems Engineering Processes and Basic Capability Maturity

This document is one of a set of two guides on systems engineering. It provides a practical approach to system engineering based on generic systems engineering processes and management activities spanning the full systems life cycle. It maps and incorporates the process areas and activities of the Software Engineering Institute's (SEI) Systems Engineering Capability Maturity Model (SE-CMM), as well as standards and models being developed by other organizations. The

handbook describes 115 Basic Activities (BA) in 18 Process Areas (PA). Fifty-five of the Basic Activities are in the Engineering Process Area.

Order Code: SYS2

Price: \$75 US, \$85 Non-US

Software Reliability

RAC-HDBK-1510:

Software Engineering Process Group Handbook

The Capability Maturity Model for Software (CMM) is a powerful tool for evaluating and for improving software. Its five levels, 18 key process areas, and over 300 practices provide a complex structure that needs to be closely examined to determine the underlying capability of an organization. Based upon this understanding of an organization's strengths and weaknesses, the software improvement teams, called Software Engineering Process Groups, can identify and prioritize those critical activities required for improvement. This handbook provides a step-by-step roadmap that describes the improvement process.

Order Code: SPAT

Price: \$25 US, \$35 Non-US

RAC-HDBK-1520:

Introduction to Software Reliability: A State-of-the-Art Review

Today's products and systems are becoming increasingly software intensive. Often, the reliability of the software has been ignored in the development process, with analyses and other normal reliability tasks assuming that the software has a reliability of one (perfectly reliable). This publication acquaints reliability practitioners with the fundamentals of software development as they apply to system reliability, enabling consideration of "total system" reliability rather than just addressing hardware. Different software development processes are discussed along with models and differences between hardware and software reliability definitions and concepts.

Order Code: SWREL

Price: \$50 US, \$60 Non-US

Quality Improvement

RAC-HDBK-4120:

Business Process Reengineering for Quality Improvement

The continuous improvement approaches of Total Quality Management (TQM) are not always successful in achieving the breakthrough strategies required to quickly transform organizations to compete in today's market. As a result of the necessity for speed of change, Business Process Reengineering (BPR) was born. BPR addresses the fundamental, radical, and process-focused strategies required to help organizations quickly gain a competitive edge. This publication focuses on answering some of the most frequently asked questions relating to BPR.

Order Code: BPRO

Price: \$25 US, \$35 Non-US

Publications

RAC-HDBK-4100:

A Guide for Implementing Total Quality Management (TQM)

Based on solid TQM consulting experience, this handbook spells out the steps for instituting a continuous quality improvement program. The approach is based upon a participative management philosophy, employee involvement and teamwork, and use of proven quantitative methods. An eight-stage improvement strategy is presented. Requirements for the Deming and Baldrige Quality Awards are also discussed.

Order Code: SOAR-7

Price: \$50 US, \$60 Non-US

RAC-HDBK-4110:

Process Action Team Handbook

Managers and workers fight a never-ending battle to improve the quality of products while controlling cost. Process Action Teams (PATs) typically act as the active agent of positive change in a TQM program but are oftentimes not provided with adequate tools or guidance. This publication provides a complete handbook for managers and workers leading or working within a Process Action Team.

Order Code: SOAR-8

Price: \$25 US, \$35 Non-US

RAC-HDBK-4200:

TQM Toolkit

Total Quality Management (TQM) is a business approach that focuses on customer satisfaction. TQM tools, such as the "Seven Basic Tools," are listed widely in the literature but usually discussed only superficially. This publication explains all the common tools of TQM to the extent that the non-specialist can make practical use of them.

Order Code: TOMTKIT

Price: \$50 US, \$60 Non-US

Software Products

RAC-STD-6500:

PRISM System Reliability Assessment Software Tool



PRISM is an integrated software tool for predicting system and component reliability. PRISM incorporates:

- RACRates, the next generation of component reliability models derived from RAC's extensive failure rate database.
- A comprehensive searchable database of observed field failure rates, modeled after RAC's successful NPRD and EPRD databook series.
- A system development process grading methodology that considers the impact of both good and bad processes on inherent system reliability.
- A graphical system breakdown structure that provides intuitive insight into the reliability assessment process.
- A diverse set of tabular and graphical output reports to pinpoint visibility of high failure rate drivers.
- The ability to perform sensitivity analysis at any level of system indenture to gain insight into the effect of changes in environmental stress and operating profile characteristics on estimated field reliability.

- The ability to use data on predecessor systems, or to incorporate test data as the current system is developed and matures throughout its life cycle (using Bayesian analysis), to provide more realistic estimates of field reliability.
- System Bill of Material import functionality.
- The capability to import information into a component library database.
- Free training to registered PRISM users.

Visit <http://rac.alionscience.com/prism> to download a demonstration version of the PRISM software.

This tool operates in a Windows 95, 98, 2000, NT or XP environment.

Order Code: PRISM

Price: \$1995 US, \$2195 Non-US

RAC-STD-6600:

Selection of Equipment to Leverage Commercial Technology (SELECT)



The objective of SELECT PC software is to quantify the estimated reliability and risk of using equipment designed for relatively benign environments in applications where the expected stresses (temperature, vibration/mechanical shock, humidity, etc.) are considerably more severe.

This tool operates in a Windows 95, 98,

or NT environment.

Order Code: SELECT

Price: \$300 US, \$340 Non-US

RAC Journal

RAC publishes a free quarterly technical periodical, the RAC Journal. The Journal features informative articles covering engineering advances, policy and standards activities, technology applications, and upcoming events related to Reliability, Maintainability, Supportability, and Quality (RMSQ). The focus is on providing practical knowledge that can be applied to improve RMSQ. The RAC Journal is mailed within the United States to over 25,000 individuals quarterly and can be downloaded at the RAC web site (go to <http://rac.alionscience.com> and click on "Journal").

We encourage you to submit ideas and technical articles for consideration. The RAC Journal provides an excellent opportunity to inform other R&M professionals world-wide of your specific concepts, practices, and improvement ideas in the RMSQ areas.

For further information on how to submit an idea or technical article, please contact Ned Criscimagna, the RAC Journal editor.

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
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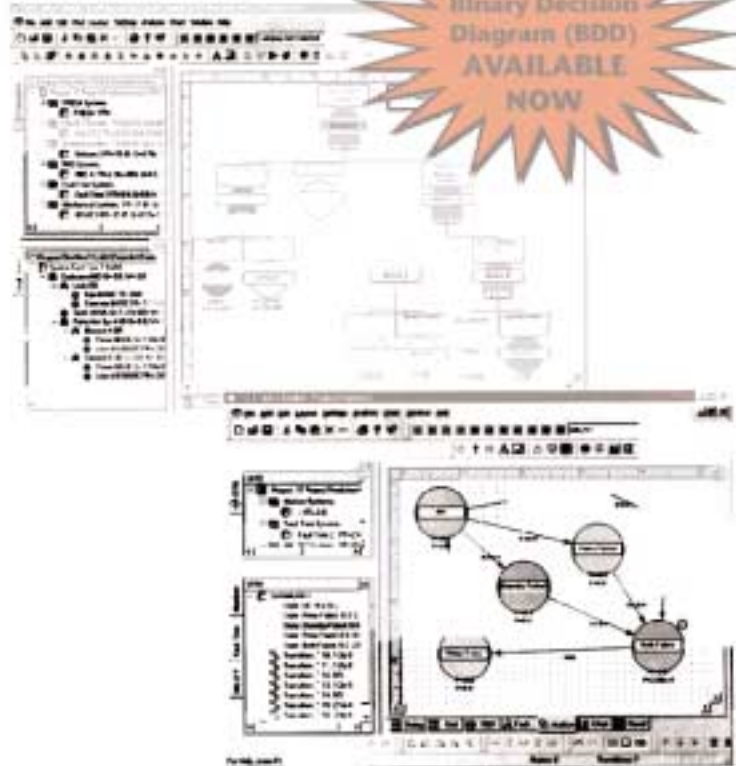
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- 299B Reliability Prediction
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- NSWC Mechanical Reliability Prediction
- Maintainability Analysis
- Failure Mode, Effects and Criticality Analysis
- Reliability Block Diagram
- Fault Tree Analysis
- Markov Analysis
- SpareCost Analysis

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- Design FMEA
- Process FMEA
- Control Plan
- Document Control and Audit (DCA)
- Calibration Analysis
- Concern and Corrective Action Management (CCAR)
- Statistical Process Control (SPC)

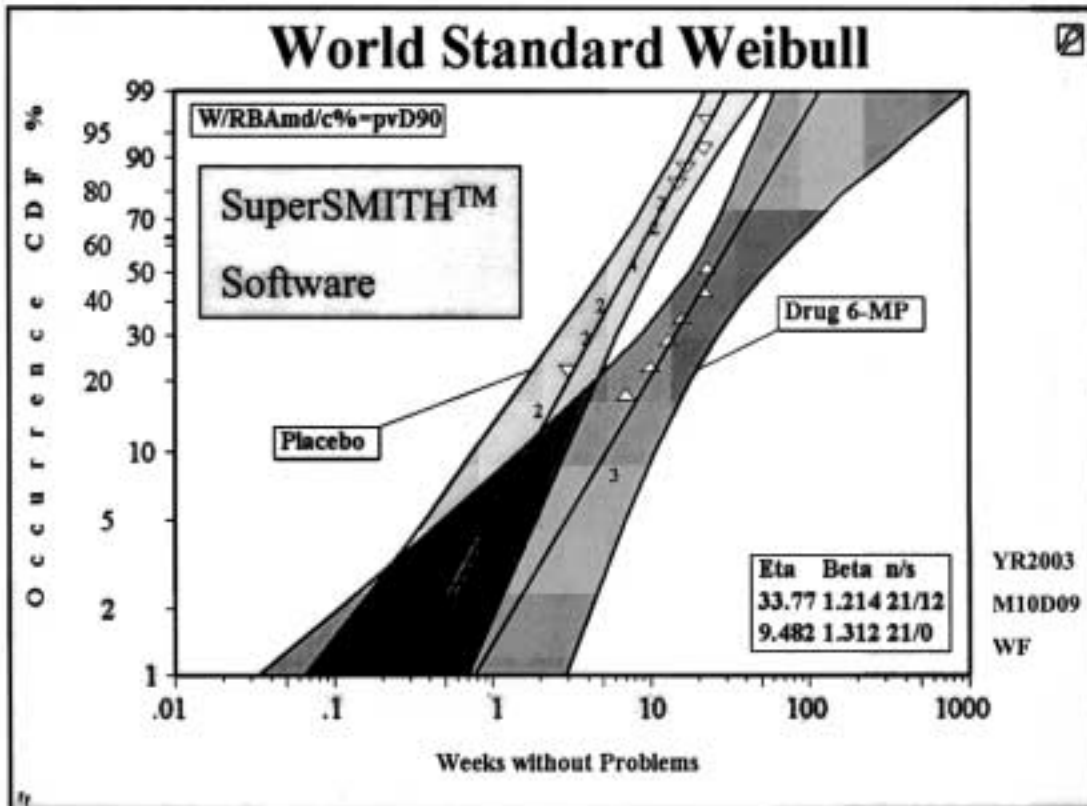


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