The Center for Risk and Reliability

Center for Risk and Reliability : Structure, Philosophy and Activities

25 RE RELIABILITY ENGINEERING 1989-2014

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Director, Center for Risk and Reliability
Department of Mechanical Engineering
December 5, 2014

Presented to the Visiting Committee
Mechanical Engineering
University of Maryland

THE A. JAMES CLARK SCHOOL *of* ENGINEERING

UNIVERSITY OF MARYLAND

History and Mission of CRR

- Formed in 1985 as the umbrella organization for risk and reliability research at the A.J. Clark School of Engineering.
- Covers research involving systems and processes with applications to space missions, military and civil aviation, nuclear energy, petroleum facilities, medical devices, information systems, and civil infrastructures.
- Research arm of the Reliability Engineering educational program-- largest and most comprehensive degree granting graduate program in reliability engineering.

The Center for Risk and Reliability

CRR Faculty

- **Modarres, Mohammad**, Nicole J. Kim Eminent Professor and Director
- **Ayyub, Bilal M.** Professor, Civil & Environmental Engineering
- **Baecher, Gregory B.**, Glenn L. Martin Institute Professor, Civil and Environmental Engineering
- **Christou, Aris**, Professor, Mechanical Engineering
- **Cukier, Michel**, Associate Professor of Reliability Engineering, Director, Advanced Cybersecurity Experience for Students (ACES)
- **Droguett, Enrique**, Associate Professor, Reliability Engineering
- **Herrmann, Jeffrey**, Associate Professor, Mechanical Engineering and Institute for Systems Research
- **Kim, Jeong H.**, Professor of Practice, Clark School of Engineering
- **Mosleh, Ali**, Professor Emeritus, Reliability Engineering
- **Roush, Marvin**, Professor Emeritus, Reliability Engineering
- **Pertmer, Gary**, Associate Professor Department of Mechanical Engineering
- **Stamatelatos, Michael**, Adjunct Professor, Reliability Engineering
- **Vaughn-Cooke, Monifa**, Assistant Professor Mechanical Engineering

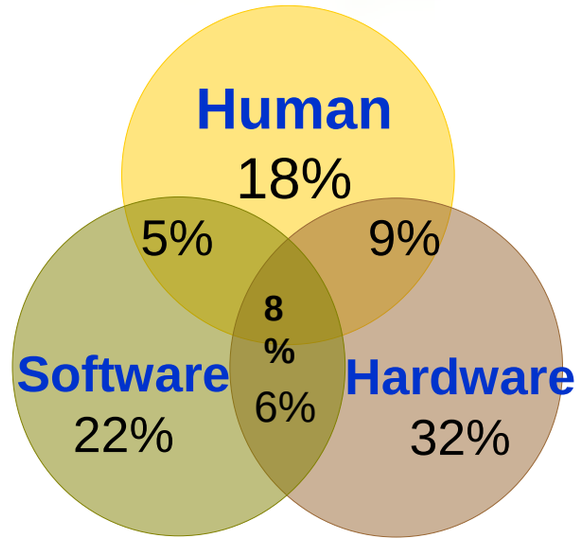
Research Areas

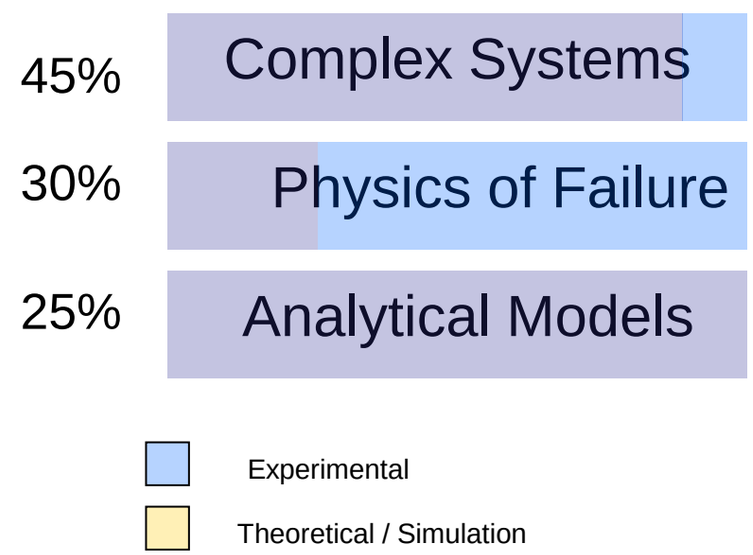
- Hybrid Systems Reliability (Systems of Hardware, Software and Human)
- Probabilistic Physics of Failure of Mechanical Systems
- Simulation-based Probabilistic Risk Assessment
- Bayesian Data Analysis and Predictive Models
- Uncertainty Characterization and Assessment
- Human Reliability and Socio-technical Systems Risk
- Software Reliability Microelectronics Reliability
- Prognostics and Health Monitoring of Complex Systems and Structures
- Healthcare Systems Risk Management and Medical Device Reliability
- Risk Based Design

Laboratories

- Cybersecurity Quantification
- Design Decision Support
- Hybrid Systems Integration and Simulation
- Probabilistic Physics of Failure and Fracture MechUMD Radiation Facilities: High-Energy Linear Accelerator (LINAC)

CRR Research Focus: Reduction of Failures





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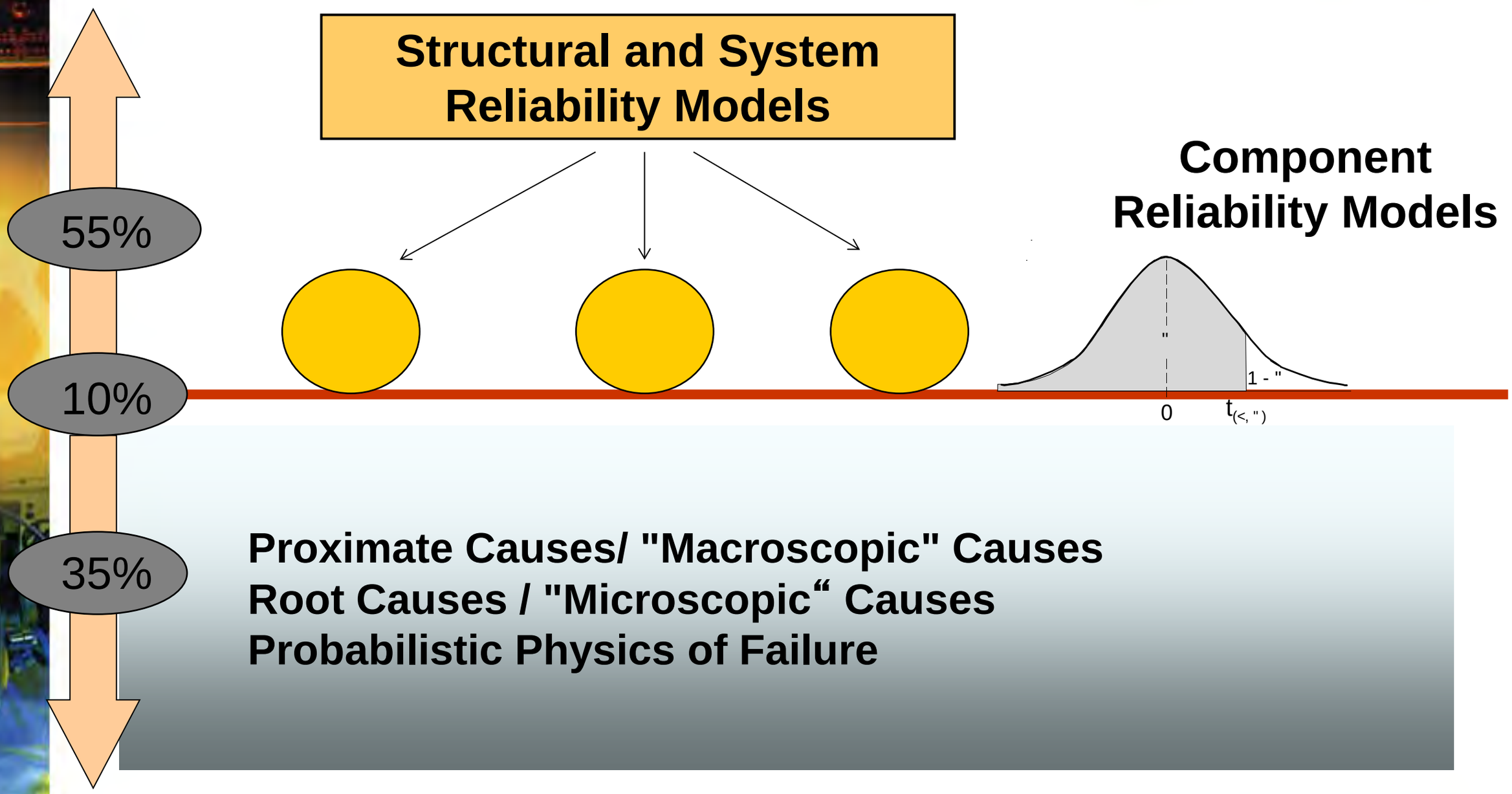
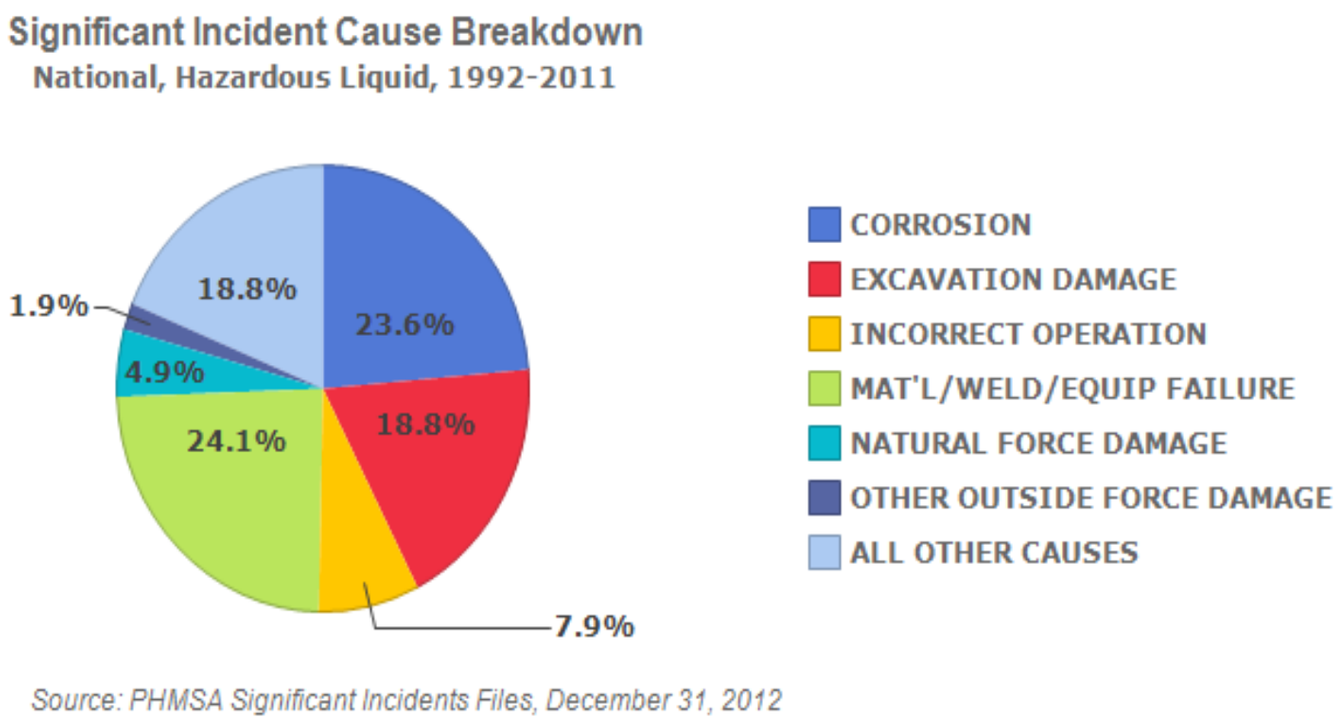
Distribution of Research Efforts



CRR’s New Initiatives

- Create a PHM center of excellence to support the petroleum industry
- Plans include development of an industrial consortium



Source: PHMSA Significant Incidents Files, December 31, 2012

CRR Research Partnerships

- **Recent Past and Present *Cooperative Research Agreements* with government agencies:**
  - **US NRC**
  - **ONR**
  - **NAVAIR**
  - **NASA**
  - **USDA**
  - **EC Halden Research Center, Norway**
  - **EEC Joint Research Center, Italy**
  - **Norwegian Institute of Technology**
  - **Monash University**
  - **Paul Scherrer Research Institute, Switzerland**
- **Partnership with industry:**
  - **Mantech**
  - **Wyle Labs (DoD's DTIC)**
  - **ARES Corporation**
  - **Corning Corp.**

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Samples of Publications

ARK SCHOOL *of* ENGINEERING

UNIVERSITY OF MARYLAND

Educational Program
Major Courses Offered

- Worldwide Leader in Reliability Engineering Education
- Established over 30 years ago, first under Nuclear Engineering and for over 25 years as an independent program

CORE AND INTERMEDIATE COURSES

- Fundamentals of Failure Mechanisms
- Reliability Analysis
- Fundamentals of Reliability Engineering
- Mathematical Techniques of Reliability Engineering
- Probabilistic Physics of Failure and Accelerated Testing
- Advanced Methods in Reliability Modeling

Research Courses

- Independent Studies in Reliability Engineering
- Master Thesis
- Ph.D. Thesis

TECHNICAL ELECTIVES

- Collection and Analysis of Reliability Data
- Reliability Engineering Management
- Microelectronics Device Reliability
- Probabilistic Risk Assessment
- Risk Management for Engineers
- Software Reliability and Integrity
- Information Security
- Other Interdisciplinary elective tracks meet needs of engineering community (i.e. take electives in Systems Engineering, Project Management, etc.)

Reliability Engineering

Degree Seeking:

- Professional Master of Engineering Program (requires the completion of 10 courses with NO thesis, scholarly paper, or comprehensive exam)
- Graduate Certificate in Engineering Program (requires the completion of 4 courses, highly focused, either as stand-alone or as stepping-stone to a master's)

Non-Degree Seeking:

- Taking Courses Ad Hoc (as relevant or needed for individual)

Reliability Engineering

Distance Education Technology & Services (DETS):

- On Campus Technology Enhanced Classrooms
- Classes Webcast to Accommodate Busy Work Schedules
- Courses Delivered Synchronously to Regional Remote Sites
- 100% Online Course Delivery
- Video Chat, Threaded Discussions, Posting Sites for Collaboration, Virtual Team Projects

Reliability Engineering

Customized/Flexible Curriculum:

- Core course curriculum set by faculty with flexible electives that allow the student to meet their work/career goals.
- Interdisciplinary elective tracks meet needs of engineering community (i.e. take electives in Systems Engineering, Project Management, etc.)

Practice-Oriented:

- Part-time working engineers may take classes with full-time research students, bringing real-world experience and problems to the classroom.
- Courses designed specifically for working engineers

25TH ANNIVERSARY SYMPOSIUM

Promise of a Discipline: Reliability and Risk in Theory and Practice

AGENDA

WEDNESDAY, APRIL 2, 2014

University of Maryland Reliability Engineering Symposium
Promise of a Discipline: Reliability and Risk in Theory and Practice
8:30 a.m. – 5:00 p.m.
Samuel Riggs IV Alumni Center
University of Maryland

University of Maryland Reliability Engineering 25th Anniversary Reception and Alumni Reunion
5:00 – 7:00 p.m.
Samuel Riggs IV Alumni Center
University of Maryland

TWENTY FIVE YEARS AGO, Maryland established the first degree-granting reliability engineering education program in the country and today it is one of the largest and most comprehensive graduate programs in the field of reliability and risk analysis of engineered systems and processes. The program offers MS, PhD, and Graduate Certificates in Reliability Engineering and Risk Analysis. All courses are available through traditional on-campus and online delivery modes.

The Center for
Risk and Reliability

www.crr.umd.edu

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RE RELIABILITY ENGINEERING
1989-2014

Promise of a Discipline: Reliability and Risk in Theory and Practice

25TH ANNIVERSARY SYMPOSIUM

APRIL 2, 2014
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University of Maryland
College Park, Maryland

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Thank you

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