

# Center for Risk Management of Engineering Systems



Our research addresses extreme and rare events, risk-informed engineering decisions, and priority setting for technology investments. Applications have included transportation projects, roadway lighting, roadway guardrails, airborne containment sensors, navigation lock walls, voice-data switch and network performance, critical infrastructure protection, military operations infrastructure and environment, information systems acquisition, climate and environmental change, real estate development, population behaviors in disasters, and aerospace system safety.

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"Addressing threats and opportunities for large-scale systems, across a variety of uncertain future and emergent conditions."



### **Risk, Resilience, System Safety, and Reliability**

Developing theory, methods, and tools to assist in the management of risk for a variety of engineering systems.

### **Multiple Criteria Analysis and Scenarios**

Allocating resources to competing projects is typically driven by multiple quantified objectives generated from the top-level goals of a large-scale system. We are working to develop better decision-aiding diagrams of top-level goals and resources that complement the existing multiobjective combinatorial optimization models, to better refine and choose among the optimization-generated portfolios of projects.

### **Land Development and Infrastructure Corridors**

Critical network infrastructures are increasingly vulnerable to adjacent development due to compromise of performance of infrastructure and increases in costs of maintenance or increasing capacities. Tradeoffs between risk and opportunity can be quantified and evaluated in order to make strategic decisions for protecting the infrastructure. Risk management should anticipate development with investments that avoid surprise and regret. We approach risk management through the coordination and layering of analytical models of large-scale systems such as energy, water, and transportation.

### **Energy Systems and Environmental Management**

Climate change and other emergent conditions combine to influence strategic priorities for the management of both natural and man-made systems. We integrated scenario analysis with multicriteria analysis to quantify the potential impacts of uncertain future and emergent conditions to strategic priorities for energy, transportation, and other large-scale systems.

### **RECENT RESEARCH DEVELOPMENTS**

- Integrating scenario analysis and multicriteria analysis.
- Future and emergent conditions for energy systems.
- Business processes for risk and safety organizations.
- Diversification of flood protection for future and emergent conditions.

### **RECENT GRANTS**

- Federal Aviation Administration – Prioritization of Risk of Runway Incursions at Towered Airports
- US Army Corps of Engineers – Diversification of Project Portfolios for Nonsystematic Risks of Variability and Change in Water Resources Systems
- DOD/US Army – Energy Security of Army Installations & Islanding Methodologies
- Virginia Department of Transportation – Risk of Land Development Adjacent to Transportation Corridors

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