AGENDA, 16 January 2007, 2 P.M. TO 3:30 P.M.
NATIONAL SCIENCE FOUNDATION
Room 530
CRITICAL INFRASTRUCTURE TASK GROUP
SUBCOMMITTEE ON DISASTER REDUCTION

Agenda

2:00 Welcome and Introductions .... Pauschke

2:05 Discuss Focus and Mission of the Working Group .... All

2:20 Review Grand Challenge #4 .... All

3:00 Discuss White Paper Focus Areas .... All

3:30 Close and Next Actions .... Pauschke; Wallace

4:00 Adjourn .... Pauschke

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Grand Challenge #4: Recognize and Reduce Vulnerability of Interdependent Critical Infrastructure

Protecting critical infrastructure systems, or lifelines (e.g., communications, electricity, financial, gas, sewage, transportation, and water), is essential to developing disaster-resilient communities. The interdependencies of these complex, coupled systems must be better understood and modeled to prevent cascading failures and protect public health before and after a hazard event. Some overarching research requirements and technology development questions include: What factors affect the systems' robustness? Can new cyberinfrastructure paradigms be adapted to facilitate breakthroughs in simulating large complex systems of coupled systems? Can cyberinfrastructure contribute toward the design and deployment of resilient, self-healing infrastructure systems? What new/cost-effective technologies, including low cost sensors, high-speed computations, ad hoc communication networks, and smart materials, have the potential to operate infrastructure in a far more flexible and robust manner? How can risk management frameworks provide end-to-end "source to society" models for understanding the consequences of disasters on critical infrastructure and enable communities to develop informed risk mitigation strategies?

Challenges:

Develop science and technology to prevent cascading failures in public infrastructure systems. Develop tools and models to provide a more robust understanding of infrastructure interdependencies in order to protect the public infrastructure, to allow continuity of services, and to prevent cascading failures. Robust infrastructure systems should guard against damage from natural and technological hazards and feature redundant, rapidly resolving systems that allow any failures to be isolated and repaired with no disruption to other components. Additionally, infrastructures must be designed to protect people from secondary or cascading hazards. Risk assessment tools should be used to determine the impacts of planned development so appropriate measures can be taken to mitigate threats to infrastructure.

Enhance the ability to protect public health before and after a hazard event. Increased understanding of hazard events and their impact on public health can help protect the public before and after a hazard event. Communities should be designed to maintain sanitary conditions and prevent contamination to water supplies during and after hazard events. Scientific knowledge of potential threats to public health should be used in the creation of emergency response plans. Delivery of emergency services must be uninterrupted by the hazard. Public health conditions must be rapidly and effectively addressed to minimize the impact on people, animals, and the environment.

To meet this Grand Challenge, the following key research requirements and major technology investments also must be addressed:

Key research requirement: Develop improved assessment methods for analyzing the vulnerability and interdependence of infrastructure systems. Develop innovative assessment models for emergency response procedures including addressing all threats to public health rapidly and effectively.

Major technology investment: Develop information acquisition systems that can be used to validate valuations of resilience and response. Identify and deploy cost-effective technologies that ensure survivability of critical utilities and other infrastructures.

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Grand Challenge #4: Hazard by Hazard

Coastal Inundation

- ● Model the impacts of events affecting the infrastructure, including the effects of seismic activity and waves;
- ● Examine the interaction between wind and inundation to determine the impact on building foundations and critical infrastructure;
- ■ Focus research on new mitigation technologies for purpose of avoidance, resistance, rapid repair and restoration of critical infrastructure and other essential facilities; and
- ♦ Provide the technical basis for revised codes and standards for critical infrastructure and essential facilities by using risk and vulnerability assessment tools.

Drought

- ■ Investigate drought predictions and indicators to improve operational decision making for water supply, transportation, hydropower, and irrigation;
- ■ Incorporate social science research into effective public communications calling for demand reduction during drought and improving demand-side efficiencies; and
- ■ Develop improved information for water supply operation, transportation, hydropower, irrigation augmentation systems, and for the development of new supplies and estimation of demand-side efficiencies.

Earthquake

- ■ Produce comprehensive seismic design guidelines for major specialized structural systems (e.g. ports and harbors);
- ■ Develop performance criteria based on actual infrastructures, research, and other work for design and retrofit methods;
- ■ Improve system reliability and survivability by applying newly emerging sensor technologies to control structural response in critical systems;
- ■ Improve lifeline survivability through applying improved decision-making tools, redundancy, automated network assessment and shutoff systems, system hardening and network optimization technologies;
- ♦ Predict collateral damage and cascading failures based on models of infrastructure interdependencies;
- ♦ Research soil-structure interaction to prevent failures caused by liquefaction; and
- ♦ Develop automated early-warning systems capable of reducing impact to critical infrastructure in urban centers at a distance from the earthquake epicenter.

Flood

- ● Analyze the vulnerability of infrastructure systems to flood hazard, identify critical infrastructure vulnerable to flooding and propose mitigation strategies; and
- ■ Conduct vulnerability analysis to reduce the risk of cascading failures and identify the potential impact of flooding on water supply and waste-water and fortify those structures and systems.

■ Short-term action ● Medium-term action ♦ Long-term effort

Heat Wave

- ♦ Provide a technical basis for revised standards and codes that integrate local climatological and meteorological knowledge to improve standards for the built environment, improve safety and increase power distribution infrastructure, railway, roadway and pipeline resistance to excessive heat.

Human and Ecosystem Health Hazards

- ● Assure that access to critical care facilities, emergency response and emergency management services is maintained following disasters;
- ● Assess what infrastructures are at risk during any detrimental event that can create a subsequent human or ecological disaster; and
- ● Repair adequately critical infrastructure immediately following a disaster.

Hurricane

- ■ Examine the interaction between wind, storm surge, and shallow water waves to determine the impact on building foundations and critical infrastructure;
- ■ Assess the vulnerability of critical communication, transportation infrastructure and essential facilities to hurricanes;
- ■ Develop an improved loss estimation modeling tool (e.g. HAZUS); and
- ♦ Create robust and storm-ready communication systems, essential facilities and transportation infrastructure.

Landslide

- ♦ Inventory and assess the vulnerability of the Nation's most critical infrastructure to landslide hazards; and
- ♦ Provide the technical basis for codes and standards and local zoning decisions that will locate hospitals, schools, power plants and other essential facilities away from the risk area or retrofit to provide adequate protection from the assessed landslide risk.

Space Weather

- ■ Incorporate the use of risk analysis techniques to guide loss-reduction efforts at the federal, state and local levels, and produce a power grid risk assessment throughout the United States; and
- ■ Develop comprehensive preventive and pre-event recovery plans.

Technological

- ■ Create advanced computational models to assess the public health, economic and environmental impacts of technological disasters on communities, and to assess the effectiveness of hazard identification, prediction, preparedness and mitigation methods; and
- ♦ Develop disaster resilient technologies to mitigate the effects of technical hazards on critical infrastructures.

Tornado

- ■ Develop and deploy new technologies that aid in better design, rapid repair and restoration of critical infrastructure and other essential facilities; and,
- ■ Measure the response of bridges and other highway structures to tornadoes, including stability, serviceability and functionality leading up to and through the tornado event; and
- ■ Develop mitigation strategies with local authorities, such as burying power and communication cables.

Tsunami

- ● Develop risk assessments and inundation models to inform the location of lifelines, hospitals, schools, power plants and utilities, fire and police stations and equipment away from the risk area or harden those structures for adequate protection from the assessed tsunami risk.

■ Short-term action ● Medium-term action ♦ Long-term effort

Volcano

- ● Translate results from volcano hazard assessments into risk assessments based on up-to-date assessment of population, property and infrastructure at risk;
- ● Evaluate the potential long-term impact of increased sediment loads following eruptions on streams, rivers, wetlands, lakes and dams, near all high-threat volcanoes; and
- ■ Develop plans for minimizing disruption to power grids, communication pathways, and transportation on the ground and in the air.

Wildland Fire

- ■ Assess the fire-safe characteristics of community designs, including layout, landscaping, and structure design, and building materials, and make recommendations for improved fire safety. Improve information and tools for homeowners and planners on fire-safe construction, landscaping, and community planning;
- ■ Develop data and validated models to assess how well different community and landscape designs and post-fire restoration activities mitigate fire risk and damage, including offsite effects such as flooding and erosion, and damage to transportation and energy infrastructure; and
- ■ Develop improved approaches to increase the resistance of infrastructure and communities to damage from wildland fire and its aftereffects.

Winter Storm

- ● Educate individuals and emergency managers about the varying impacts of winter weather on critical infrastructure based on specific meteorological and sociological parameters (e.g., time of day, day of week, urban vs. rural, surface temperature);
- ■ Develop protocols and standards for rapid repair and restoration of critical infrastructure and other essential facilities subjected to wind, snow, and ice loads;
- ■ Model the potential effects of severe winter weather on critical infrastructure and essential facilities in advance of storms and immediately after to predict and reduce vulnerability in the short-term and long-term; and
- ♦ Develop improved engineering standards, smarter transportation systems, more resilient critical infrastructure and essential facilities in addition to cost-effective technology to ensure that these facilities maintain robust operations during severe winter weather.

■ Short-term action ● Medium-term action ♦ Long-term effort

NOTES
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