

SOUTHEAST REGION RESEARCH INITIATIVE – COMBINING SCIENCE AND TECHNOLOGY FOR PROTECTION AGAINST NATURAL DISASTERS

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Abstract

This briefing is a programmatic overview of the Southeast Region Research Initiative (SERRI) and of some of its activities related to the development of tools and technologies that help local, state, and federal agencies develop protection mechanisms against natural disasters -- in particular hurricanes, tornadoes and floods. This briefing will also address SERRI activities that impact resilience for communities, for families, and for the workforce of the next generation of homeland/national security professionals.

1. Background

SERRI is a ground breaking program managed by the Department of Energy's (DOE) Oak Ridge National Laboratory (ORNL) for the Department of Homeland Security (DHS). ORNL is the Department of Energy's largest science and energy laboratory and is managed by a partnership between the University of Tennessee and the Battelle Corporation. Since being established in 1943, the mission of ORNL has evolved from the secret Manhattan Project to pioneer the methods for enriching uranium and producing and separating plutonium; to becoming an international center for the study of nuclear energy and related research in the physical and life sciences; to energy technologies and strategies; and to supporting the nation with a peacetime science and technology mission that is just as important as, but very different from, its role during the Manhattan Project. ORNL has a staff of more than 4,600 people and annually hosts over 3,000 guest researchers. With a budget of around \$1.5 billion annually, ORNL is an international leader in a range of scientific areas including six major research areas – neutron science, energy, high-performance computing, systems biology, materials science at the nanoscale, and national/homeland security. One of the missions given the Laboratory by the DOE is to provide world-class research support to DHS. As part of that support, DHS established the SERRI Program in 2006 at ORNL with the intent that ORNL would manage and implement the Program through strategic partnerships of federal laboratories, regional research universities and private industry to solve validated research challenges for DHS.

2. Objective

The key objective of the SERRI Program is to strengthen the region's (and the nation's) ability to address disasters, emergencies, and terrorist events. The Program will assist DHS in developing core competencies in emergency/incident management, disaster logistics, hazard mitigation, and integrated preparedness. These competencies will be developed by combining science and technology with validated operational approaches which address regionally relevant requirements, and which may result in the development of regional solutions that have national implications. These efforts must also be validated in a representative operational environment that will yield effective contributions to the preparedness and response capabilities of the test

bed's region; and contribute significant lessons-learned, plans, policies, procedures and interoperable systems to (or with) other regions of the country.

The intent of the SERRI Program is to provide a methodology for leveraging the nation's science and technology assets in the southeast region in order to enhance regional preparedness, protection and mitigation, response, recovery and resilience to the impacts of natural disasters and man-made incidents (or terrorists events). In particular, SERRI activities are expected to address regional issues related to: infrastructure protection from natural or man-made disasters; preparation of critical infrastructures to mitigate the effects of natural and man-made disasters; and social, economic and infrastructure resilience from the effects of natural or man-made disasters with a special emphasis on preparation for long-term recovery.

3. Discussion

A broad range of homeland security challenges faces the southeast region. These challenges include natural hazards such as storms, hurricanes, tornadoes, floods, earthquakes, and a multitude of threats and cascading consequences impacting critical infrastructures and key resources. This presentation includes an examination of three natural disasters which are prevalent to the southeast region and to the nation as a whole. These disasters include hurricanes, tornadoes, and floods. Each year these disasters have a major impact on communities and the nation and result in high economic and social losses while causing devastations to families and human life.

Hurricane Katrina is being recorded as the costliest natural disaster to touch American soil and one of the five deadliest in the history of America. Katrina provides a powerful image of how horrifying the level of destruction a hurricane can cause. The extreme wind speed and storm surge of Hurricane Katrina resulted in economic losses of more than \$80 billion dollars; left nearly a million homes damaged or destroyed; caused the death of more than 1800 people; and left many, many more people jobless, homeless, distressed, and separated from their families. To address the many issues related to hurricanes, the SERRI program is focused on modeling and simulation of storm surge, incident management and training for emergency operations, and technologies to strengthen critical infrastructure. SERRI partners are exploring innovative ways to help emergency operations and first responders at the local and state level better prepare for, respond to and recover from the perils of hurricanes.

The US has more tornadoes each year (approximately 1000 on average) than any other country in the world. Spawned from powerful thunderstorms, tornadoes can cause fatalities and devastate a neighborhood in seconds. The economic and social impacts from these storms are also quite significant. Devastating tornado outbreaks resulted in insured losses of \$1 billion in 2008. On average, approximately 70 fatalities and about 1500 injuries result from tornado damages each year. SERRI is focused on the development of tools which support situational awareness and incident management for emergency operations and response. In addition, SERRI partners are investigating ways to improve home safety through better roofing structures as well as ways to help reduce the loss of life through awareness by homeowners and homebuilders of safety shelters and tornado safe rooms.

Flooding is the most common and most frequent natural disaster affecting every region of the nation. As much as 90% of the damage related to all natural disasters (excluding droughts) is caused by floods and associated debris. From 1988 – 1997, floods cost the US nearly \$4 billion dollars annually. Flash flooding is the leading cause of weather-related deaths in America causing approximately 200 deaths per year. Coastal states (TX, LA, and FL) are among the top three payouts for flood insurance losses in the US. Floods are typically associated with extreme weather events such as hurricanes, tornadoes, and heavy rain. Floods also result when water control systems, such as dams and levees, are breached. Flood management and protection is a critical area of research within the SERRI program. Research activities span the range of modeling/simulation of dams and levee breach; to the development of new techniques to screen, assess, and repair levee systems; and to understanding new techniques homeowners may use to remediate mold and other contaminants caused by floods. Products resulting from SERRI flood research activities can be used to study the impacts of floods, to update flood zones, and to design response and recovery plans and mitigation strategies to reduce the impacts and minimize the consequences of this water related threat.

4. Conclusions

SERRI activities support local, state, and federal agencies in developing solutions to help them plan for, prevent, prepare for, respond to, and recover from natural disasters. The technologies being developed by SERRI projects can play an extremely important role in infrastructure protection and human safety from hurricanes, tornados, floods and other natural disasters.

Currently SERRI has funded over 80 research projects located in 8 southeastern states. These projects involve nearly 40 universities and 6 federal laboratories. These projects include tasks in flood management, mitigation and restoration; critical infrastructure protection; incident management; information sharing and management; cargo security, cyber security and regional resilience. To date the program has produced about 100 technical papers; 50 technical reports; 75 formal scientific presentations; and 4 book chapters. (SERRI publications can be found at www.serri.org) The program has identified one national level Computer Emergency Readiness Team (CERT) vulnerability (VU#310355) and has 3 large-scale computational models that have been accepted in beta version by a number of federal and local government agencies. Products resulting from SERRI activities have supported recent natural disasters such as the tornado that struck Yazoo County, MS on April 24, 2010. SERRI researchers are also involved in studying social and economic aspects of the BP Deepwater Horizon Oil Spill in the Gulf Coast. As an added benefit to the Program, SERRI research is having a significant impact on Science, Technology, Engineering and Mathematics (STEM) education. SERRI student research associates have won honors in international and national competitions. The program has been the catalyst for a number of bachelors, masters and doctoral degrees and has provided opportunities for students to gain practical work experience through on-campus research involvement, and through summer internships at ORNL and other federal facilities.

5. Acknowledgement

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