Project Abstracts

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I. Regional Research and Operations Support

**Data-Driven Simulation System for Training, Decision Support and Policy Evaluations (REALSIM)**
( Oak Ridge National Laboratory/Budhu Badari)

Local, state and regional officials need a capability to track material assets and key personnel; to evaluate the effectiveness of proposed and existing local, state and federal policies relating to preparedness and response to disasters; to improve training of personnel that must plan and respond to disasters; to improve investment strategies for dealing with planning and response; and to enhance response ability on real-time decisions by real-time situational awareness. This project will develop a system that will consist of a core modeling and simulation capability that will be able to determine the dynamic movement and tracking of material assets and people based on real-time data feeds to the system, simulate the dynamic movement and tracking of material assets and people based on simulated real-time data feeds to the system for the purposes of training, event planning, and policy evaluations, scale from local to state to regional to national needs, serve as dynamic information repository and as an archive of information, and provide a flexible range of user interfaces based on open standards to provide interoperability to existing and future applications and data systems.

**Law Enforcement Regional Technology Assessment and Gap Analysis**
(Salient Solutions Corp/Lee Reese)

The NPG’s approach to enhancing homeland security focuses efforts on identifying and developing critical capabilities from the Target Capabilities List (TCL). A significant amount of effort and resources have been devoted over the course of the past few years to achieving targeted capabilities. While much has been accomplished, there remain a number of potential gaps in specialized law enforcement capabilities to achieve the objectives outlined in the NPG. This effort will survey the conformity of selected Law Enforcement agencies throughout the Southeastern region of the United States with the technology aspects of the Department of Homeland Security Target Capabilities List, utilizing a nationally-recognized law enforcement professional, with the requisite law enforcement seniority and homeland security technology experience, to survey continuing law enforcement technology needs throughout the law enforcement community in the Southeastern United States.

**Cyber Security Projects: Wireless Authentication, Location, and Tracking System (WALTS) and Location and Tracking System (LTS)**
(Tennessee State University)

Cyber security remains a critical national vulnerability. At the local, state and regional level, products developed for the national security environment or the national homeland security
environments are not necessarily adaptable, usable or affordable. This project will develop two components:

**Wireless Authentication, Localization, and Tracking System Utilizing RFIDs (WALTS)**

Securing network hardware and/or software alone is insufficient to avoid exploiting the flaws in wireless networks. With this in mind, there exists a need to physically locate, track and authenticate users to identify offenders. The purpose of this research is to improve wireless network security by exploring the utilization of Radio Frequency Identifications (RFIDs) in the authentication scheme.

**Localization and Tracking of a Mobile Node Using Directional Antennae (LTS)**

The objective of this research is to develop a secure wireless sensor network by designing and implementing a network security capability that is able to localize and track a network client in a static wireless network. This is achieved through the deployment of an array of directional antennae along the perimeter of a given wireless network.

**Regional Emergency Planning Model for Continuous Disaster Mitigation Response**

(Western Carolina University/Laura Meyers)

Deficiencies in interagency communication remain a key obstacle to successfully developing and implementing emergency plans during times of disaster. The Institute for the Economy and the Future at Western Carolina University, under contract to SERRI, will develop a Regional Emergency Planning Model (REPM) that will enhance interagency communication by designing a framework for effective disaster response; devise an effective methodology for considering human behavior in emergency situations that can be adopted and implemented throughout our nation; identify important policy considerations and best practices that must be examined for effective disaster responses; and disseminate the information to relevant practitioners.

**Data-Sharing Middleware for Information Dissemination Among Heterogeneous Sources**

(Oak Ridge National Laboratory/Ham Hunter)

A key growing need is to provide derived knowledge for empirical real-time situational awareness systems that span wide-area deployments (such as E911 systems in a metro area). Sharing of information to various agencies to and from emergency response teams requires delivery and display of accurate, time-sensitive data for rapid coordination and efficient operations. This project will develop a data sharing “middleware” that is able to handle multiple distributed data sources and dynamically changing data items, to assist in real-time information dissemination across multiple agencies for homeland security purposes. This will be used as a mechanism that is able to “translate” data from different sources into a repository maintained with common templates so that data can be moved from originators to requestors in a generic manner.
Rule Set Automation in Support of Critical Infrastructure Protection (CIPRSA)

(Enterra Solutions/ORNL/Richard Hale)

Responses to attacks or damage to critical infrastructure are frequently suboptimal because the responders do not have critical information, do not understand the environment, are not aware of important plans and lack the tools to guide their initial decisions thereby relegating their responses to reacting to events rather than guiding and directing events along a logical and responsive pathway. Current progress in automated decision making processes and systems provide substantial promise to solve this problem. Working closely with ORNL, Enterra Solutions LLC (Enterra) will provide the design and deployment of a repeatable solution for Critical Infrastructure Protection associated with the management of radiological releases at Oak Ridge National Laboratory. Specifically, Enterra will make use of radiological field measurement data from the HFIR sensor suite, along with the emergency operations rules and requirements embedded within the Laboratory’s SBMS procedures for response to radiological emergencies.

Kentucky Operations Support – Collaboration Between SERRI and DNDO’s South East Transportation Corridor Pilot (SETCP)

(Kentucky Transportation Cabinet/University of Kentucky/David Jackson)

The Southeast Transportation Corridor Pilot (SETCP) program is a Domestic Nuclear Detection Office-sponsored technology pilot to develop and test the technologies and procedures for radiological detection on the Nation’s highways. As states in the southeast region participate in the pilot and the subsequent secure corridors that emerge from the pilot, the management of information that comes from the weigh stations and mobile systems that make up the secure transportation corridor and the task of making that information useful to all stakeholders is a significant problem. Beginning in the State Of Kentucky and working in collaboration with the DHS DNDO SETCP, SERRI will support the states of the southeast region in the development of business models to support the design and assessment of options for expanding the DNSO radiological focus to an “all-threat” countermeasures system.
II. Mississippi Research Initiative (listed by university)

University of Mississippi

Computational Tools for Water Security (Dr. S. Y. Wang)

The proposed research is to transfer the technology in the area of computational simulation of water infrastructures to DHS to strengthen its technological base for preventing, being prepared for, and planning to recover from major incidents on critical water infrastructures in general. The focus in the near-term, however, is on providing useful tools to the local homeland security personnel for them to make the best possible (compromised) decisions to meet the urgent need at the initial stages of major incidents of chemical spills in critical water infrastructures. The newly developed technologies can also be used to identify the optimal designs of new water infrastructures and/or the plans for the improvements of the existing critical water infrastructures, so that they can be less vulnerable to major hazardous incidents and better prepared for and recovered from the chemical spill incidents if they do happen.

Nano-Particle Reinforced Composites for Critical Infrastructure Protection (Dr. Alexander H.D. Cheng)

This project investigates the use of the recent advancement in material, structure, and building technologies for the protection of critical infrastructures, which include governmental buildings, emergency response system (police station, fire house, hospital), oil and gas pipelines, power and communication transmission towers, etc., against terrorist threats, as well as natural disasters. The new structural/building technologies developed from this research can be used to improve the survivability of these structures. The findings, recommendations, and tools derived can become a part of the decision support system for local, state, tribal and regional leaders and emergency responders for better preparedness.

Specification, Validation and Verification of Imagery Products for Disaster Management and Response (Dr. Greg Easson)

The goal of this proposed project is to create a reference key designed to increase the utility of imagery products for disaster response. This reference key will describe the technical specifications for remote sensing data acquisition systems that are necessary to produce data products that address the functional requirements of the first responder community and the FEMA Essential Elements of Information.

Mississippi Groundwater, Surface Water, and Dam Inventory and Vulnerability Assessment (Dr. Robert Holt)

Mississippi groundwater and surface water (GW/SW) resources, including shallow aquifers, streams, dams, and reservoirs, represent “key resources” and “key assets” as defined by the
Interim National Infrastructure Protection Plan (NIPP) of February 2005. We propose three interrelated tasks to 1) inventory Mississippi GW/SW resources and dams in a GIS spatial database which can be used for vulnerability assessment and to parameterize numerical GW/SW models for additional risk assessment and modeling and 2) assess the vulnerability of these resources to various threats, and 3) provide training to state agency end users of the GIS database and vulnerability assessment tools. The GIS databases and vulnerability assessments produced in this effort will be developed in coordination with and provided to sector specific agencies, including the Mississippi Department of Public Safety Office of Homeland Security, Mississippi Emergency Management Agency, and Mississippi Department of Environmental Quality (including the Dam Safety Division). Database and model training will be provided to end users of these products.

Simulation-Based Decision Support System for Water Infrastructural Security (Dr. Mustafa Altinakar)

Water infrastructures such as dams, levees, water control structures, etc. are critical infrastructures whose incapacitation/ destruction may have a serious negative impact on our nation’s security. We propose the development of a new “systems approach” for carrying out threat-risk vulnerability analysis of water resources and water-related infrastructures based on robust, state-of-the-art, realistic two-dimensional (2D) numerical simulations. The proposed approach yield spatial variability of solved variables and various criteria computed by 2D numerical models, and thus eliminates the deficiencies of the currently used one-dimensional approach, which is neither sufficiently reliable nor provides enough information for a detailed damage analysis. The present proposal also involves development of innovative spatial risk and uncertainty analysis methods and procedures making use of the rich level of spatial information provided by two-dimensional approach.

University of Southern Mississippi

A Simulation Environment for Planning, Training, and Assessment of Emergency Response and Evacuation Capabilities at High Consequence Sports Events (Dr. Lou Marciani)

Effective emergency security management of large-scale spectator sports events is vital nation wide because of the potential for mass causalities and detrimental economic impact. The objective of this project is to develop a robust evacuation simulation system to evaluate and support emergency response, stadium evacuation operations, and the subsequent traffic flow at high consequence sports events. At the completion of this project, the new evacuation simulation system will be accessible to universities, professional and amateur sports organizations nationwide. This project has been endorsed by the NCAA and NFL.

Real-time Detection of Chemicals and Biological Pathogens in Fluids (Dr. Gordon Cannon)
Our goal is to produce a simple-to-use, portable detector system that is able to sense in real time various pathogens and toxic chemicals that pose potential threats to both Mississippi and the nation as a result of acts of terrorism, accidental events, or acts of nature.

Alcorn State University

Development of an Integrated Sensor System for Real-time Monitoring of Metabolites of Organophosphorus Chemical Warfare Agents, Pesticides, and E. coli in Food and Water (Dr. Yolanda Jones)

The Department of Homeland Security (DHS) has assigned high priority to the deterrence and prevention of terrorist acts, which threaten the security of American citizens and critical infrastructure. The focus of this project is to address this critical need by developing technology for a low cost, robust sensor system which will be deployed for three critical environments for monitoring against biological and chemical agents.

Jackson State University

All Hazards Emergency Operations Management System
(Elizabeth J. Matlack)

A region must not only have the capacity to respond effectively in the short-term but must also have the ability to sustain coordination and control through the request for targeted ex-region response requirements, and to effectively transition to a joint response when ex-region and Federal response capabilities are brought to bear on plans; systems, skills and relationships must exist for local leaders to not only manage their own jurisdiction, but also to collaborate effectively regionally in incident management. This project focus on three specific areas: (1) automate All Hazards Incident Management System with GIS integration (2) applying remote sensing and geographic information systems technology to critical infrastructure protection (3) “Putting Mississippi on the map”; a homeland security community mapping.

Disaster Response Intelligent System (Dr. Gordon Skelton)

Information technology decision aids and data fusion systems are revolutionizing decision making in operational scenarios. The JSU team is proposing to leverage these advances by developing innovative decision support aids useful for converting and fusing data to useable knowledge for DHS emergency response. Specifically, the JSU team will transition an existing analysis and fusion system developed from an on-going DOD program into a Disaster Response Intelligent System (DRIS). The system is designed to be interoperable with the Jackson State
University proposal “All Hazards Emergency Operations Management System (ALLHAZ)” and/or any other open architecture system. The Disaster Response Intelligent System (DRIS) is designed to provide real-time analysis and decision support for the Department of Homeland Security and operational agencies in disaster response.

Mississippi State University

Real-Time Identification and Monitoring of Barge-Carried Hazardous Commodities (Dr. Mingzhou Jin)

In response to increased terrorist threats related to hazardous material movements on the U.S. inland waterway system, towing vessel operators and fleet area managers, at specified reporting points, are required to notify the U.S. Coast Guard’s Inland River Vessel Movement Center of the movement of barges loaded with Certain Dangerous Cargo (CDC). The current reporting process is manual and cannot identify and monitor CDC loaded barges in real-time. The objective of this proposal is to develop and field test a prototype system that provides more accurate, uniform, and timely data on hazardous movements by barges, especially those certified as CDC, and to identify and report barges with potential security threats. The proposed system is expected to automatically track and monitor barges with CDC and communicate the real-time information to a data server.

Real-Time Operations Support for Emergency Evacuations (Dr. Li Zhang)

Real-time traffic information gathering and management is one of the most important aspects of emergency evacuations operations, but one where scarce practical research has been conducted. This research proposes to improve the operations during a vehicular emergency evacuation by using newly developed real-time traffic information gathering technologies to assess traffic conditions and to detect incidents on the main evacuation routes. The ultimate goal is to create a system which emergency management agencies, and/or other public safety organizations, can rapidly deploy anywhere to help manage traffic operations during emergency evacuations.

Rapid Detection of Agriterrorism via Remote Sensing (Dr. Lori Bruce)

Interruption of the agricultural food supply could be accomplished by widespread application of airborne bio-chemical agents (ABAs) to agricultural crops. Terrorists could utilize plant pathogens or existing, commercially available herbicides and pesticides that may be safely used in some crops but which would have catastrophic effects on others. There exists a strong need for a means to rapidly and accurately detect such an event, or the lack thereof in the case of a hoax. This project includes the design, implementation, and validation of an automated target recognition (ATR) system for utilizing hyperspectral imaging (HSI) data to detect when an ABA has been applied to an agricultural crop.
Assured Strategic Communications During Natural and Willful Disasters  
(Dr. Lori Bruce)

The objective of this proposal is to develop a strategic plan for building, operating, and maintaining a robust, national emergency communications system that will assure reliable communications during disaster management operations, improve preparedness, and ensure interoperability. The proposed strategic plan will include risk and economic viability assessments, identification of critical systems and technologies, and development of operating principles that are necessary for assured communications during future national emergencies. This proposed research program will take advantage of the Office of Interoperability and Compatibility’s SAFECOM and RapidCom initiatives in devising strategies for a highly reliable communications (both public and private) infrastructure during disaster management. The technology will be developed taking into account the existing and emerging standards so as to provide ease of interoperability and upgradeability.

Capturing Hurricane Katrina Data for Analysis and Lessons-Learned Research (Dr. David R. Shaw)

Hurricane Katrina represents an unparalleled opportunity for homeland security research and study. During this event of national significance, the importance of geospatial data was demonstrated during the search, rescue and recovery efforts. The Mississippi Geographic Information System community volunteered countless hours in the weeks following Katrina, generating thousands of GIS, remote sensing and map products for use by local, state and federal agency personnel. However, the lack of a central archive for geospatial information presents a lost opportunity for understanding how these services could be improved for future events. For most major catastrophic incidents, the acquisition, management and archive of critical data does not occur in a coordinated, organized manner. Instead, various agencies that have operational responsibilities acquire and hold data that pertain to their mission without the mandate or funding to share those data to a central archive. Data held by individual agencies is maintained for varying lengths of time and is then either discarded or written out to a permanent storage media. Without a central archive to hold the entire collection of data from all agencies the full understanding of response efforts to any incident will be very difficult.

Semantics-Driven Knowledge Discovery System for Wide Area Monitoring of Electric Power Grid (Dr. Nicholas Younan)

A new innovation related to critical infrastructure protection and cybersecurity for electric power systems would be to provide a well engineered human-machine interface that allows knowledge discovery for comprehensive wide area monitoring across the State of Mississippi and the southeastern part of the United States. This would permit the integration of data and information between electric utilities before an incident - allowing for detection of terrorist threats, prevention of cascading failures through remedial actions, and innovative solutions for restoration efforts.

Southeast Region Critical Infrastructure Protection Center Initiative  
(Dr. Rayford Vaughn)
This proposal seeks to expand the current operational Center for Computer Security Research (CCSR) and its Department of Justice funded Forensics Training Center (FTC) with an end result of creating a Critical Infrastructure Protection Center (CIPC) at Mississippi State University. This proposal offers to expand current facilities to create a Southeast region Critical Infrastructure Protection Center which will provide training, awareness, testing, technical advisement, and emergency response capability. The CIPC will initially focus on cyber security, digital forensics, and biological agents during the first year of operation and will expand into a more comprehensive operation during years 2 and 3 which will address all critical infrastructure priorities as identified by PDD-63 and HSPD-7.

Analysis of WMD Materials in Waste and Storm Water Treatment Infrastructures in Southeastern US Cities (R. T. Jubin, joint with Oak Ridge National Laboratory)

This effort focuses on the development of estimation tools and the required supporting data to predict the distribution and fate of a dispersed Weapons of Mass Destruction (WMD) material (radiological, chemical, or biological agents) in wastewater and storm water treatment and handling systems of the State of Mississippi, specifically, and in general, for any Southeastern US urban environment in the 24 to 96-hour period immediately following a dispersal event.
III. Mississippi Operations Support Initiative

Education and Workforce Development Initiative  
(Elizabeth Matlack, Jackson State University)

The nation needs to improve its ability to rapidly deploy homeland security relevant science, technology, engineering and mathematics (STEM) knowledge to a wide range of stakeholders, from the leadership of national, state and local organizations to first and early responders, to the general citizenry and to the future workforce. This project will develop a hub and spoke model for Workforce Development among the colleges and universities in the DHS University Centers of Excellence (COE). COE universities would function as the ‘hubs’ of the homeland security related STEM (science, technology, engineering and mathematics) distribution network. This project will also produce an architecture and prototype for the rapid deployment of technology within the national K-12 thorough Post Graduate Education System infrastructure, and an architecture and prototype for implementation of the enabling technology at the Homeland Security Operational Unit level.

High Performance Agent-Based Topic Monitoring  
(Jim Treadwell, Oak Ridge National Laboratory)

The ability of policy makers to make effective decisions and take action in near real-time during a rapidly evolving disaster would be significantly enhanced if they could effectively monitor and correlate patterns and trends in communications across many media types and sources (TV, Internet News, Web logs, Messages, Call Center activity etc.). This remains a challenging problem because of the integration and processing requirements. ORNL, supported under contract by Psydex Incorporated, will develop and deploy a prototype system that demonstrates how multiple news data sources can be monitored, fused, correlated and analyzed in near real time for known and emerging threats to national security. Decision makers will be able to visualize threats with charts and geospatial views to identify patterns and trends in the subject matter contained in various unstructured information sources. The system will be developed and deployed to a High Performance Agent Based cluster at ORNL.

Southeast Region Technology Transfer Network  
(Alan Liby, Oak Ridge National Laboratory)

There is not currently a comprehensive, region-wide mechanism in place to ensure that non-commercial investments in homeland security-related research and development are expeditiously transitioned into the private sector when positive prospects for viable commercial marketing exist. This project will establish a network of research universities, homeland security-related businesses and economic development organizations to support SERRI’s
objective of developing and implementing technology-based tools to improve public safety, readiness and disaster response. The near-term objective is to create the SERRI-sponsored network in a small group of contiguous states (Mississippi, Alabama, Tennessee, South Carolina and Kentucky), that already share common interests in infrastructure, homeland security and technology-based economic development, taking advantage of established relationships and initiatives where possible.

**Mississippi Technology Alliance and Outreach Program (Alan Liby, Oak Ridge National Laboratory)**

A principal SERRI objective is to develop and implement technology transition strategies that will convert research results into useable products and put them into the hands of the Homeland Security community. The Mississippi Technology Alliance (MTA) is uniquely positioned to fulfill this objective. It is a non-profit organization whose mission is to champion innovation and technology-based economic development for the state of Mississippi. With SERRI support, MTA will use staff and consultants to perform assessment steps and then call upon its well-established relationships with Mississippi universities and businesses to manage and complete the Technology Transition process.