Developing Innovative Research for Improving U.S. Levees and Dams

Science and Technology

THE RISKS OF THE AGING WATER INFRASTRUCTURE IN THE U.S.

Water infrastructure, such as dams and levees, provide many crucial services: protecting the water supply, creating recreation areas, providing water for livestock and irrigation, and generating energy. While the services this infrastructure provides is often taken for granted, the failure of these key structures would be catastrophic. Their failures can result in cataclysmic floods, leading to loss of life, urban and agricultural property damage, environmental degradation, and cascading failures in other critical sectors. Current engineering practices leave room for major errors when assessing flood events and their consequences. These possibly life-threatening inaccuracies coupled with the structural components of our nation's aging navigation locks and dams having far exceeded their design life, generate a need for innovative water infrastructure failure and material research.

ADDRESSING NATIONAL WATER INFRASTRUCTURE NEEDS

The U.S. Army Corps of Engineers (USACE) Engineer Research and Development Center (ERDC) is the lead Army research and development (R&D) organization for civil works research, development, and technology. USACE-ERDC provides innovative sustainable solutions to the nation's water resource challenges. This, along with a partnership with the Department of Homeland Security (DHS), Science and Technology Directorate (S&T), places USACE-ERDC in the optimal position to address the challenges regarding national water infrastructure. To meet these challenges, their research will involve assessing impacts and consequences of water infrastructure failure through simulation tools and models and materials science. The research will focus on increasing computational performance and capabilities of modeling tools to predict failure modes and composite materials and applications to improve the physical performance of concrete dams and levee structures.

THE RESEARCH APPROACH

Over a three-year period, USACE-ERDC is developing research to assess communities' vulnerabilities to flood hazards, to increase community resilience by improved emergency response planning, and simulating different types of failures to different components of flood infrastructure systems. This will be accomplished by providing multi-level simulations that can model a range of failures, from the collapse of a single dam or levee to complex cascading failures.

The research process will be facilitated through tasks and milestones conducted in part at the University of Mississippi and the University of Kansas:

- R&D to improve the computational performance of dam/levee system modeling tools and prediction of failure modes
- Optimize the performance of levee systems aided by computational/artificial neural network approach
- Utilize physical scale modeling to optimize output and evaluate material development
- Composite materials and applications to improve the performance on concrete dams and levee structures

THE IMPACT

This innovative research for improving national water infrastructure will enable DHS S&T to better protect the public against the catastrophic impacts a water infrastructure failure would cause. Not only is it likely that the computational tools utilized during this research process can be employed in other sectors, but the materials research also has the potential to revolutionize national infrastructure resilience.