Written Testimony to the Senate Committee on Commerce, Science and Transportation Concerning Senate Bill 1485, The National Hurricane Research Initiative Act of 2009

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Thank you, Mr. Chairman, and members of the Committee for the opportunity to talk with you today.

My name is Gordon Wells. I serve as program manager at the University of Texas at Austin's Center for Space Research. During major disasters, my team and I work in the State Operations Center of the Governor's Division of Emergency Management, where we use the results from a variety of forecast models to assist decision makers, including the State's elected leadership, to make decisions in response to a crisis, such as the landfall of a hurricane.

The bill under consideration today to enact The National Hurricane Research Initiative receives my complete support and my request for your urgent consideration. In the two years since the National Science Board issued the report that serves as the intellectual foundation for Senate Bill 1485, Texas has experienced Hurricane Dolly, the second costliest hurricane to strike the U.S. coast in the month of July, and Hurricane Ike, which at $30 billion is the third all-time most damaging hurricane in U.S. history. By all available evidence, the problems to be addressed by the scientific enterprise enabled by Senate Bill 1485 are steadily escalating.

Improvements to forecast modeling and simulation covered by the bill are particularly important. Let me tell you why.

If Jack Colley, the Chief of the Texas Division of Emergency Management, were here today, he would emphasize that Texas mobilizes to respond to an emergency based upon threat and does not wait for a presidential declaration or other assurances of federal support before taking action. When a hurricane threatens the Texas Gulf Coast, thousands of local and state first responders perform tasks for which they have trained and exercised according to guidance issued by the Division of Emergency Management. The only way to prepare appropriate guidance to orchestrate such a widespread, multi-faceted effort is with reference to the results of model forecasts. For instance, in preparation for a hurricane, one of my first responsibilities in working with Chief Colley is to create the countdown clock for the contingency time line used by the state to synchronize response operations. For a Cape Verdes storm crossing the Atlantic, that clock is calculated by analyzing results from a series of long-range forecast models to estimate the timing that would potentially bring the storm to Texas. We might track a system for several days before triggering the 120-hour countdown for operations in response to a storm crossing the eastern Caribbean or entering the Gulf of Mexico.

If the storm does indeed intensify to become a tropical cyclone and follows a track toward the coast of Texas, forecast models are used to define the impact region that will likely be subjected to high winds, storm surge and inland flooding. Based on the projections, the state positions assets to meet the needs for evacuation, search-and-rescue and re-entry into the damaged area as well as the communications and logistical support necessary to maintain the continuity of local government.

Because storm surge is by far the most lethal danger accompanying a hurricane, the state places special emphasis on the results from hydrodynamic models, especially the Sea, Lake and Overland Surge from Hurricanes (SLOSH) model run by the National Hurricane Center and the Advanced Circulation (ADCIRC) model that we run on the NSF-funded Ranger supercomputer at the Texas Advanced Computing Center at the University of Texas. The ADCIRC model is the creation of a national team of modelers, including Rick Luettich of the University of North Carolina, Joannes Westerink of the University of Notre Dame, who originated the code for ADCIRC, Randall Kolar of the University of Oklahoma and Clint Dawson of the University of Texas at Austin, who has led the algorithm development for ADCIRC. While the National Hurricane Center's SLOSH model predicts the regional risk of storm surge, the high spatial resolution and additional physical parameters computed by ADCIRC permit more specific forecasts to be made of the magnitude and extent of coastal inundation.

ADCIRC is run in three different modes. First, in forecast mode, it leverages the more than 60,000 processors available on the Ranger supercomputer to complete a high resolution run in just over an hour, allowing the impact forecast to be updated with each advisory issued by the National Hurricane Center. During Hurricane Ike, the ADCIRC model correctly predicted the magnitude of the storm surge that struck Galveston Island, the Bolivar Peninsula and inland areas of Chambers and Jefferson counties. With the forecasts made by ADCIRC and SLOSH, the state targeted search-and-clear operations in the predicted impact region. The teams led by Texas Task Force One rescued 634 individuals who could not self-evacuate before Hurricane Ike made landfall. Many would likely have died without the assistance of the U.S. Coast Guard, Texas Task Force One, Texas Military Forces and allied search-and-rescue teams.

ADCIRC is also run in forensic mode. Although it is difficult to find any positive outcome in the aftermath of a large hurricane, the evidence left behind by destructive storms can be used to calibrate and improve the performance of future models. Most of the high-resolution hindcasts of hurricanes Katrina, Rita and Ike have been produced using the ADCIRC model. Better physical descriptions of the hydrodynamic processes of large landfalling storms have resulted from these forensic investigations.

Finally, ADCIRC is run in a mode that facilitates the design and planning of future protective coastal infrastructure. In the wake of recent destructive hurricanes, both "soft" options, such as wetlands restoration and restrictions on land use practices, and "hard" options, such as the construction of seawalls and giant storm gates, have been proposed. One current idea is the Ike Dike conceived by William Merrill of Texas A&M University at Galveston. The Ike Dike would shield a sixty-mile section of the Upper Texas Gulf Coast, including Galveston Island, Galveston Bay and the Houston Ship Channel. To assess the concept, Clint Dawson and Jennifer Proft of the University of Texas at Austin have run ADCIRC simulations for Hurricane Ike with and without the proposed dike and for a "Mighty Ike" Category 4 version of the hurricane with and without the dike. These are the first of many computer simulations that can be used to test the effectiveness of different kinds of protective infrastructure. The results will allow the selection of the best combination of design elements capable of withstanding a multitude of different hurricane landfall scenarios.

In support of The National Hurricane Research Initiative, I would amplify two subjects that are contained in Senate Bill 1485 with additional emphasis based on my own experience.

First, the bill authorizes the development of a National Infrastructure Database to characterize the physical, social and natural infrastructure of coastal regions. Although the language mentions social factors, their importance is not highlighted to the same extent as the physical factors. As a major hurricane approaches the coast, the "threat geography" is not defined solely in terms of the magnitude and distribution of the physical impact to the region, where high winds, storm surge and inland flooding will occur. Beyond the physical risks, it is equally important to know the character and geographic distribution of vulnerable populations in the impact area. The concentration of certain portions of the coastal population, including elderly, fixed-income residents living in older housing stock, individuals who are homebound with medical special needs, low-income, single-parent families and those who do not speak English as their primary language among many other social factors need fully documentation. The intersection of these societal vulnerabilities with the physical risks, where the geographic distributions of the physical and social components overlap, defines the threat geography of the disaster. First responders need to know more than simply where the worst physical impacts are predicted to occur. They need to know who will be affected and where they live.

Second, while the bill discusses many requirements to improve our scientific knowledge of hurricanes and our ability to model and forecast their dangers, it contains little specific language describing how that knowledge needs to be communicated to the public. The greatest problem facing our coastal population is the failure of individuals to understand their personal risk to a natural disaster. Victims of events are often heard to comment that indeed they knew that the hurricane was going to be bad, perhaps as bad as or worse than one they had lived through, but they did not believe that the storm would be so bad in their part of town, in their neighborhood or in their home. Greater emphasis must be placed on communicating the results of forecast modeling and simulation to the public in ways that enable the comprehension of personal risk. Advances in the visualization of model results, particularly in the production of photorealistic, three-dimensional portrayals of inundation and wind damage at the neighborhood level, offer new techniques to inform the public. Studies should be conducted with a cross-section of coastal residents to determine what methods of communication are most effective in leading citizens to make accurate judgments of their level of personal risk and then take effective measures to ensure their own safety.

Having summarized these areas deserving additional emphasis, I close by reasserting my support for the measures contained in The National Hurricane Research Initiative and once again call for its urgent consideration and rapid approval by the Congress.

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