

MARCH 2007 Volume 32, Number 3

ASCE | *The newspaper for members of the  
American Society of Civil Engineers*

# news

## CEFI Conference Charts Course Toward Innovation and Sustainability

By **Mark Fitzgerald**

Hosted by the Civil Engineering Forum for Innovation (CEFI) January 30—31 in Washington, D.C., at the U.S. Chamber of Commerce, the conference “The Challenges of Change” featured discussions of such topics as innovation, sustainability, partnerships, project financing, public policy advocacy, and risk and reliability. Numerous leaders from government, academia, and industry attended, among them Major General Don Riley, the director of civil works for the U.S. Army Corps of Engineers; David E. Daniel, Ph.D., the president of the University of Texas at Dallas and the chair of ASCE’s External Review Panel (ERP), which is peer-reviewing the work carried out by the group (Interagency Performance Evaluation Task Force, or IPET) set up by the Corps to evaluate the performance of the hurricane protection system in New Orleans and southeastern Louisiana; and John H. Sununu, Ph.D., a former governor of New Hampshire and a White House chief of staff under President George H.W. Bush.

ASCE established CEFI in January 2006 to expand the mission of the body it replaced, the Civil Engineering Research Foundation (CERF). CEFI seeks to advance engineering and to improve productivity, performance, and quality in the construction industry through collaboration and the rapid application of innovations.

“Engineers need to be more involved in public policy,” ASCE’s president, William F. Marcuson III, Ph.D., emphasized at the outset of the conference. “ASCE has gotten a fair amount of traction with its [infrastructure] report card, but we are certainly not where we ought to be. Engineers are good at solving problems, but we need to do a better job at identifying them and bridging the gap between what we know and where we want to go.”

Benedict Schwegler, Jr., Ph.D., a vice president and chief scientist at Walt Disney Imagineering, which is based in Glendale, California, called on the civil engineering community to develop strategies for improving the quality of the nation’s infrastructure and incorporating innovation and the principles of sustainable design into its projects. “The idea of sustainability is compelling, but we don’t yet have a solid basis for what sustainable engineering really means,” he remarked. “We need to bring our engineering sensibility to discussions about ecology, biology, and the environment. Engineers are often the most knowledgeable people on these topics and yet are reluctant sometimes to make sure that their voice is heard and to stand up and be counted in these public debates.”

Schwegler, the recipient of CERF’s Henry L. Michel Award for Industry Advancement of Research in 2002, also underscored the importance of partnerships and project financing. “One of the biggest challenges we face in dealing with our infrastructure is balancing public and private interests,” he observed. “We have to figure out how to bring these interests together with new models of finance and engineering analysis. We need to take a fundamental look at what we can do differently with financial models to integrate short-term business interests and long-term sustainability.”

Riley, who manages the army’s \$5-billion annual budget for civil works, discussed the Corps’s “12 Actions for Change,” a plan that was released in August 2006 to improve the safety of the nation’s water resources infrastructure. “We had to look very closely at what happened with Hurricane Katrina—at what went wrong with the engineering system and what got us to that point,” Riley said. “The actions we’ve outlined call for a change in policy and legislation, significant stakeholder participation, procedural change in federal agencies, and funding support to effect this change. We don’t see this strategy for change as merely patchwork. This plan will indeed take time to implement. But if we implement it as desired, it will not only effect some changes within

the Corps, but I also really see this as effecting a greater change in national engineering standards.”

Developed through a collaborative effort that included the IPET, ASCE, the National Science Foundation, and Louisiana State University, the Corps of Engineers measures come in response to the need for the Corps to comprehensively design, construct, maintain, and update systems so that they will be sufficiently robust and will benefit from full stakeholder participation. They also reflect the Corps’s resolve to pursue effective and transparent communication with the public and within its own ranks regarding risk and reliability and to advance public service professionalism.

“Our vision is to allow for a safe public and a public that is informed enough to take responsibility for its own safety,” Riley added. “But we also have to have a clear national policy and standards. We have to have a sustainable system. We’ve got to get accurate floodplain information to the public and identify flood hazards posed by our aging infrastructure. We have to improve public awareness of risk and integrate programs across federal, state, and local agencies with private support.”

The steps outlined in the Corps’s plan include adopting an integrated, comprehensive, and systems-based approach; applying risk-based concepts in planning, design, construction, operations, and major maintenance; and continuously reassessing and updating policy as it relates to program development, planning guidance, and design and construction standards. Moreover, the Corps intends to avail itself of the advantages conferred by dynamic independent review; to employ adaptive planning and engineering systems; to focus on sustainability; to review and inspect completed works; to assess and modify its organizational behavior; to effectively communicate risk and develop risk reduction strategies that involve the public; to manage and enhance technical expertise and professionalism; and to invest in research.

Daniel led a panel discussion that explored ways of addressing the nation’s infrastructure challenges in light of the lessons learned from Hurricane Katrina. “What went wrong in New Orleans?” he asked. “Unfortunately almost everything at every level. There was a lack of a sound, overall strategy. No amount of good engineering will compensate for poor management. The standard project hurricane, based on the hurricane of record, had no risk basis and no probabilistic foundation and was in our view seriously flawed. Very regrettably, there were some engineering designs and decisions that played

it too close to the margins of safety and led to failure. Some of the decisions made, in retrospect, were flawed. The decision not to update the benchmarks for survey data resulted in levees being built too low. Maintenance was not always what it should have been either. Trees were not supposed to grow on levees, but the levee boards didn't always keep trees off the levees. Land use choices were completely—and still are today—completely unintegrated with risk, levee design, and other things.”

ASCE convened the ERP in October 2005 at the behest of Lieutenant General Carl A. Strock, P.E., the Corps's commander and chief of engineers. Since then the panel has endeavored to provide an objective technical review of the IPET's findings. The work carried out by the ipet has included data collection associated with the condition of the hurricane protection systems before and after Hurricane Katrina; a review of project construction and maintenance; numerical modeling to characterize the storm surge; an analysis of floodwalls, pumping stations, and levee performance; an evaluation of the effects of economic decisions associated with hurricane protection systems; and an examination of the engineering and operational risk and reliability of the system. The work has been painstaking and is not yet complete.

“I really believe that there is a general complacency about extreme events,” added Daniel. “The levees themselves almost provided a false sense of security, and unquestionably there was a low-cost mentality towards their construction. The risk was poorly understood and poorly communicated, perhaps even within the engineering profession. I'm not sure anybody really understood the depth of the catastrophe and the loss of life that would occur, [and] if they did, that knowledge somehow did not factor into the decision making.”

Last August the ERP released *Hurricane Katrina: One Year Later. What Must We Do Next?*—a 12-page report that advocated 10 measures for addressing and correcting the deficiencies in the hurricane protection system in New Orleans and southeastern Louisiana. The hurricane protection system, the report said, was poorly planned and managed, as “evidenced by the fact that the system took decades to build and remains incomplete yet today.” Moreover, the city's system of levees and floodwalls “failed catastrophically at over 50 different locations,” and pump stations “were not designed to function in a major hurricane or mitigate flooding if the levees were overtopped or breached.” The ERP report also called attention to crucial problems with the protection

system and emphasized that solutions would require investments on multiple fronts. “There are flaws in the way the hurricane protection system was conceived, budgeted, funded, designed, constructed, managed, and operated,” it explained. “There is no quick fix for the complexity of problems. Overcoming the deficiencies in the New Orleans hurricane protection system—and instituting real change in its governance, management, and engineering—will require leadership, courage, conviction, and funding.”

The steps recommended in the report were seen as necessary to ensure shifts in thought and approach. They included understanding risk and embracing safety, reexamining and repairing the hurricane protection system, revamping its management, and demanding engineering quality. The report also called for keeping safety at the forefront of public priorities; quantifying the risks; communicating the risks to the public and deciding how much risk is acceptable; rethinking the overall system, including land use in New Orleans; correcting the deficiencies; putting someone in charge; improving interagency coordination; upgrading design procedures; bringing in independent experts; and placing safety first.

“We feel that you have to start with a good management structure—someone has to be in charge,” emphasized Daniel after citing the ERP’s report. “The appropriate design hurricane is just a huge issue. How safe do we want to try to make New Orleans? The Corps needs to focus on safety and peer review, and they’re already doing that. The whole system needs to be rethought, and the Corps is already significantly pursuing that. A risk-based approach is the only one that makes sense. But the big question is, do we really have the will to make such dramatic changes in business as usual?”

In his keynote address, Sununu shared insights from his work in public office and offered his views on innovation, technology, energy, public policy, and education. “I want to dissuade you as engineers [from believing] that you are living in a period of time when technology is developing quickly, when innovations are coming fast, and when we are making cutting-edge changes,” he said. “I hate to surprise you, but that is not the case. We are evolving; we are improving; we are making things better. But this is not the fastest period of technological change. This is important because we walk around talking to each other about how quickly things are happening, and I have to tell you that we are not making them happen quickly enough.”

Sununu, who in 2004 co-chaired a task force on nuclear energy set up by the Secretary of Energy Advisory Board, called attention to the nation's projected expansion of nuclear power capabilities. "Nuclear power is having a revival," he noted. "The nuclear industry is considering twenty-nine potential new nuclear power plants. But we have to take a look at why as a nation we allowed ourselves to go almost thirty years without a new plant being ordered and ... twenty-odd years without a new plant being completed. And frankly I believe it's because we as engineers didn't have the guts to stand up and fight the irrational arguments made by the opponents to this technology. We have to—as employers, colleagues, and members of society—make it easier for engineers to participate in the process of public policy and comment on issues that may be politically difficult for the corporation as an institution or for us as friends and colleagues to deal with. We've got to create a climate, at least among ourselves, that will allow engineers to participate in the process and put whatever pressure we have on the rest of the system to make participation proper and acceptable."

A visiting professor at Harvard University's John F. Kennedy School of Government during the 2003-04 academic year, Sununu concluded his address with comments on the current state of engineering education. "To me the crisis in engineering education is that we seem to be drawing fewer students from the United States," he said. "We are drawing a lot of students from overseas, but we are drawing fewer of our own students, and frankly they seem to be less excited about it and significantly fewer of them are going on to graduate degrees. I think that it is our fault. I think our wage scale in engineering has been allowed to be suppressed and I think the differential rewards for master's degrees and certainly the differential rewards for doctorate degrees are ludicrously low and that our students are making a smart decision and not making a bad bet."

Through such outreach programs as Zoom into Engineering, the Extraordinary Women Engineers Project, and its annual concrete canoe competition, ASCE actively encourages students to pursue careers in engineering. It has also been promoting actions aimed at improving the standards governing engineering education. In October 2004 the Board of Direction adopted Policy 465, which encourages education beyond the baccalaureate and emphasizes the attainment of "a body of knowledge for entry into the practice of civil engineering at the professional level." This initiative has seen some

positive results. Last September the National Council of Examiners for Engineering and Surveying voted in favor of a modification to section 130.10 of its model law that will provide guidance to states as they craft legislation pertaining to licensure. The change to the model law, which will take effect in 2015, calls for education beyond a bachelor of science and requires students to earn either a master's degree in engineering or acquire 30 additional credits by taking upper-level undergraduate or graduate courses.

“We are not rewarding technological innovation in the marketplace,” Sununu added. “There are dozens and dozens of examples out there where the best technology comes into companies after we reward them. So I think that if we want to get our best and brightest students into engineering and keep them in engineering and move them into master's and doctorate programs, then we have to get the private sector to cooperate and understand that a reward structure has to be out there that makes that a good bet for our best and brightest students.”