

Spring 2003

# Civil & Coastal Engineering



Renovated Weil Hall

## Message from the Chair



Dr. Joseph W. Tedesco

*It is once again my pleasure to update you on new developments in the Department of Civil and Coastal Engineering. Let me begin with our move back to Weil Hall. As much as we love the "SWAMP", we are happy to be out of Yon Hall and back to the familiar confines of the dramatically improved and revitalized Weil Hall. I extend a warm invitation to all our loyal alumni and friends to visit us in our old "new" home...it's spectacular.*

*Civil and Coastal Engineering faculty continue to excel in the research arena. CCE Department research expenditures for the 2001-2002 academic year totaled \$16.3 million, a 20% increase over the previous year. This ranked the Civil and Coastal Engineering Department first in the College of Engineering, and once again in the top ten nationally for all civil engineering programs. The most impressive aspect of this research total is our diverse base of research sponsors. Approximately 45% (\$7.3m) of the total expenditures are attributed to federal research sponsors such as the National Science Foundation, NASA, the Federal Highway Administration, USDA, USGS, the U.S. Army, the Office of Naval Research, the U.S. Department of Defense (DOD), and the U.S. Department of Energy (DOE). Another 35% (\$5.7m) of the total expenditures are attributed to state agencies such as the Florida Department of Transportation, the Florida Department of Environmental Protection, the Department of Community Affairs and several Water Management Districts around the state. The remaining 20% (\$3.3m) of the total is attributed to private business and industry...GO GATORS*

*On the educational front, the University has recently sanctioned a 30hr., courses only, Masters Degree. The CCE Department is taking advantage of this academic milestone to satisfy industry demands for premier engineering courses and graduate degrees. Starting in the Fall 2003 semester, the CCE Department will begin offering a comprehensive menu of civil and coastal engineering courses through distance learning, via the Florida Engineering Education Delivery System (FEEDS). I am proud to be in the position to offer one of the nation's finest civil engineering educational programs to practicing engineers and technical managers throughout the great State of Florida. For more information about this exciting educational opportunity please visit the FEEDS web site <http://oeeep.eng.ufl.edu>.*

*In closing, I want to express my sincere appreciation to our many alumni and friends for their generous financial support of our program, especially in this difficult economic period. And as always, I am so very proud to proclaim...It's great to be a Florida Gator!*

Dr. Joseph W. Tedesco

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## CCE Faculty Activities

**Drs. Gary R. Consolazio, Michael McVay,** and G. Benjamin Lehr were nominated for the K.B. Woods Award at the 2003 Annual TRB Meeting for Foundations and Other Structures "Dynamic Finite Element Analysis Of Vessel-Pier-Soil Interaction During Barge Impact Events."

**Dr. Frank Townsend,** elected ASCE fellow, made a keynote presentation at the "II Panameric Conference on the Teaching and Learning Processes of Geotechnical Engineering" Nov 28, 2002, Guayaquil, Ecuador entitled, "Challenges for Geotechnical Engineering Graduate Education"



**Dr. Robert Dean** has been notified that his book "Beach Nourishment: Theory and Practice" has been published by World Scientific. This book is intended for both the student and practitioner of beach nourishment technology.



**William M. Sampson,** McTrans Center Director, was appointed to the Transportation Research Board (TRB) Committee on Highway Capacity and Quality of Service (HCQS) and Chair of the User Liaison Subcommittee.



**Dr. Rey Roque** was appointed Associated Editor of the International Journal of Road Materials and Pavement Design. He was also appointed to Committee A2D04 on Characteristics of Bituminous Mixtures

to Meet Structural Requirements of the Transportation Research Board, National Research Council, after having completed 6 years as committee chair.



**Dr. Byron Ruth** was awarded the status of Honorary Member of the Association of Asphalt Paving Technologists. This is the highest honor that can be bestowed by the Association to one of its members.

**Dr. Gary Long,** Associate Professor, received two "Best Paper" awards at the 82nd Annual Meeting of the Transportation Research Board

for a paper in the area of traffic signal systems, and for a paper for last year's meeting in the area of operational effects of geometrics.

**Dr. Robert Thieke** was awarded the 2003 Excellence in Civil Engineering Education (ExCEED) Career Award for Excellence in Teaching. He will be honored at ASCE's 2003 Annual Conference and Exposition held in Nashville, TN in October.



The Department of Civil & Coastal Engineering is pleased to announce the promotion with tenure of **Dr. Kurt Gurley** to the rank of associate professor. Dr. Gurley is a member of the department's Structures Group and is currently

involved in damage mitigation research to structures caused by hurricanes. Dr. Gurley received his Ph.D. in Civil Engineering from the University of Notre Dame in 1997.



## Announcing The Powell Family Structures Research Laboratory

This year the College has made an important breakthrough toward the construction of a structures and materials laboratory that will allow our faculty and students to perform research that is not presently possible with our limited facilities.

The Department of Civil and Coastal Engineering is in the process of defining new areas of research and adding new faculty members who will bring cutting edge research to the College of Engineering. Until recently, our ability to implement these key programs in the College's strategy for an increased research program has been impeded because of inadequate facilities. A key research laboratory for Civil Engineering has been contemplated for ten years, but has not been built due to a lack of funding.

Through the generous gift from the Robert O. Powell Family, and the anticipated state matching funds, the College will be able to fund the design, construction and equipping of this important new building. This commitment, in combination with anticipated commitments from building suppliers for at-cost materials, will enable the College to construct a 6,000 square foot facility with a 36' crane hook height. Construction of the new building is anticipated to begin in the latter part of 2003. The Department plans to site the building at the Waldo Road Florida Department of Transportation and Materials Research facility, which will be vacated by the FDOT and transferred to the University. With the firm commitment to construct this long-needed research facility, the Department of Civil Engineering plans to recruit nationally known research faculty who will greatly enhance the research program.

In recognition of the Powell family's generosity in designating this gift for the construction of this critical research laboratory, the University of Florida will name the new building the Powell Family Structures Research Laboratory, which will stand as a permanent tribute to their support of excellence in academics and research at the University of Florida.

## Recently Awarded Research Contract Highlights

Research Title	Agency	Value	Principal Investigator
"Pedestrian Safety Engineering and Intelligent Transportation System-Based Countermeasures Program for Reducing Pedestrian Fatalities, Injuries, Conflicts and other Surrogate Measures"	Federal Highway Administration	\$785, 000	Ralph Ellis
"Hurricane Loss Reduction Consortium: Wind and Structural Engineering Initiative"	Clemson University	\$184,787	Kurtis Gurley
"Career: Advancing Nearshore Circulation Modeling"	National Science Foundation	\$454,068	Donald Slinn
"State-Wide Coastal Monitoring Using Airborne Laser Swath Mapping"	Florida Department of Environmental Protection	\$130,000	Ramesh Shrestha
"Napa Valley Channel and Surface Reconstruction Using Airborne Laser Swath Mapping"	State of California	\$273,942	Ramesh Shrestha

## CCE Faculty Plan for M.I.T. Conference

Several CCE faculty have been actively involved in the planning and organization of the Second M.I.T. Conference on Computational Fluid and Solid Mechanics. Dr. Joseph Tedesco resides on the Scientific Advisory Board for the Conference, and CCE faculty Drs. Bjorn Birgisson, Gary Consolazio, Ashish Mehta and Peter Sheng have organized specialty technical sessions. The objective of the Conference is to bring together researchers and practitioners from around the world to assess the latest frontiers of high performance computing and to set important directions for further research and development. The focus of the conference will be on computational fluid dynamics, computational solid and structural mechanics, and in particular on the interdisciplinary areas of multi-physics phenomena. The conference will be hosted on the M.I.T. campus June 17-20, 2003. For detailed information on the conference please visit the web site <http://www.secondmitconference.org>



The Department of Civil and Coastal Engineering held its first Transportation Research Board Reception at the 2003 TRB Annual Meeting in Washington DC this last January. The reception was deemed a success as transportation professionals, faculty, students and department friends stopped by the reception to get reacquainted and discuss their research activities. The department hopes to make the reception an annual event.



# A BRIGHT IDEA:

## Roadside Beacons Warn Motorist of Impending Danger

Fog-related pileups such as last year's 71-car collision in Texas could become a thing of the past with roadside "smart beacons" that use the latest wireless technology to sense wrecks and warn motorists of danger ahead.

So say three University of Florida engineering researchers who this month applied for a patent on the concept for the beacons, which would be placed at regular intervals on roadside rights-of-way, and flash red or yellow lights to indicate a hazard ahead. Projected to be roughly the size and shape of highway reflectors, the ground-level smart beacons also could be used to designate evacuation routes during hurricanes and other emergencies, urge lane clearing for oncoming rescue vehicles -- even help motorists avoid traffic jams by directing them to less clogged alternative routes.

"The sensors will automatically determine if a crash has occurred," said Dave Bloomquist, a UF associate professor of civil engineering. "They'll then transmit that information to sensors a mile or two up the road, warning vehicles that haven't yet reached the crash site."

Although the researchers have not yet built a prototype, they say the beacons likely will draw on the same wireless technology -- ultra-wideband radar and communication -- now being developed for collision-avoidance systems in cars and trucks.

Ultra-wideband, or UWB, broadcasts extremely rapid pulses of radio energy. By measuring the amount of time required for the pulses to return, the system can be used as radar, thereby precisely determining the location of nearby objects as well as their speed.

UWB-based on-board new vehicles now being built and tested are intended to help motorists avoid collisions by warning the

driver of nearby cars or obstacles. Such systems also sense impending collisions, then tighten seat belts and deploy airbags at the proper pressure, thereby reducing injury to occupants.

Longer-range radar systems based on a different technology already are being used in so-called adaptive cruise-control systems, which gauge the speed of nearby traffic and adjust a car's speed to flow with the traffic. Adaptive cruise control is now available in some Jaguars, BMWs and other high-end luxury vehicles.

### SMARTREFLECTOR

Bloomquist said adaptive cruise control, onboard navigation systems, UWB radar and other technologies are the first components of an emerging "intelligent" transportation system expected to make driving far safer and more efficient.

The smart-beacon system fits into this trend. Bloomquist, Mike McVay, a professor of Civil & Coastal Engineering and Erik Larsson, a UF Assistant Professor of Electrical & Computer Engineering, say the beacons will consist of solar cells for electricity; batteries; green, red and yellow lights; UWB radar and wireless communication electronics -- all in a self-contained package the size of a deck of cards.

Placed at 100-foot intervals along a road, the beacons would monitor traffic flow continuously. When they sensed stopped or dramatically slowed vehicles, they would send that information to beacons down the road, which would warn motorists of trouble ahead using flashing colored lights.

The automatic system would require no human intervention, although law enforcement and rescue personnel could control it remotely, or shut it on or off from

the roadside. Officials also could use it to program evacuation routes during hurricanes or alternative detour routes around accidents or traffic jams.

The highway patrol can say, "Look, down the road there's a toxic spill, so let's change the color of the lights and re-route the traffic away from the incident."

It's even possible the beacons could be used to customize timing of traffic lights. For example, the beacons would monitor the number of vehicles stopped in each direction and adjust the duration of green and red lights based on the longest lines.

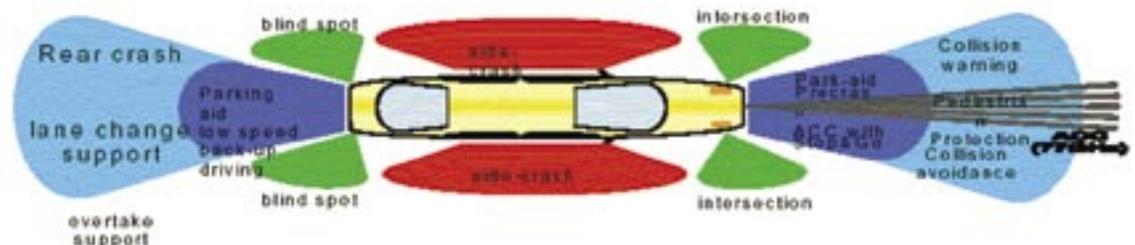
Hoping to acquire funding support for development and testing of a prototype beacon and the deployment of a test beacon system, the researchers are scheduled to present their idea to Florida Department of Transportation officials. The technology to build the sensors is available now, but moving from the concept to reality will take time.

"The chip sets are already out there," McVay said. "What has to be done is to adapt the technology to this particular application."

Price depends on production but if made in large quantities, the beacons probably would cost around \$30 each. It costs about \$20 million to build one mile of interstate highway, so installation of the reflectors would represent only a small additional cost. Nationwide, motor vehicle crashes resulted in 37,795 fatalities and over two million injuries in 2001, according to the U.S. Department of Transportation National Highway Traffic Safety Administration. The agency estimated the economic cost of crashes at \$230.6 billion in 2001.

### Short range Radar functions:

- 1) Collision warning;
- 2) Precrash sensing;
- 3) Firing of restraints, Airbags;
- 4) Recognition of all Traffic members;
- 5) Blind spot detection;
- 6) Parking aid;
- 7) Pedestrian recognition.



# Next Generation Modeling

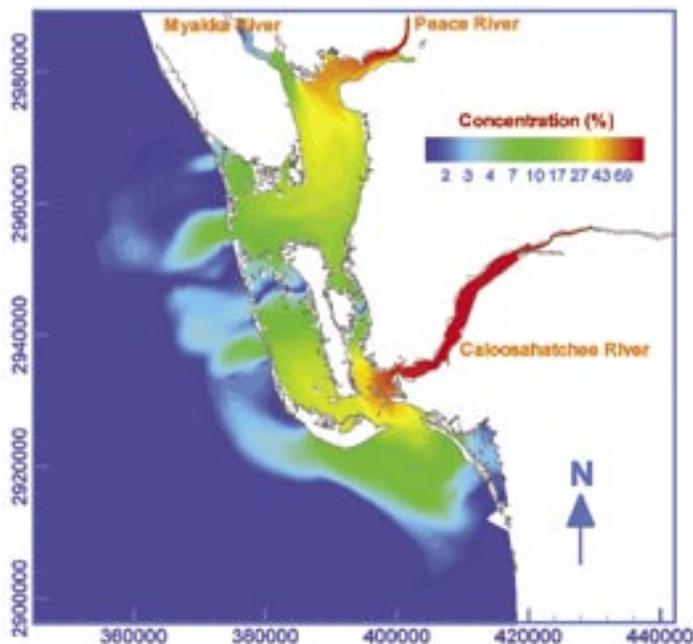
Dr. Peter Sheng and his research team, consisting of eight Ph.D. students and a postdoctoral associate, are conducting interdisciplinary studies and developing mathematical models that can be used to solve many important problems in Florida and the nation, e.g., the restoration and management of estuarine and coastal ecosystems, the production of more accurate flood insurance maps, as well as the tracking of the space shuttle Columbia debris in the Atlantic Ocean. Model simulations are being conducted on high performance computers including a 16-cpu SGI Origin3400 system and a 20-cpu Beowulf cluster.

Between 50% to 75% of the nation's population live near estuaries. The protection of water quality and habitat in Florida estuaries and the coastal waters of the Gulf of Mexico and the Atlantic is of utmost importance to the sustainability of Florida's and the nation's economy. To reverse the damages to estuarine and coastal ecosystems caused by population and agricultural growth, environmental managers (USEPA, FDEP, and Florida Water Management Districts) are developing scientifically based loading limits (TMDL, PLRG, and MFL) to reduce the amount of pollutants entering into estuaries. These efforts are now benefiting directly from one of Dr. Sheng's research areas - the development of integrated modeling system for restoration and management of estuarine and coastal ecosystems.

Dr. Sheng's research in environmental fluid dynamics and pollutant transport in aquatic ecosystems started in the 1970's when he did his Ph.D. and postdoctoral work at Case Western Reserve University, and continued through his tenure at Aeronautical Research Associates of Princeton, where he conducted research in turbulence modeling and estuarine and atmospheric processes, and developed the CH3D (Curvilinear Grid 3-D) model for coastal and estuarine circulation. Since joining UF in 1986, Dr. Sheng and his research team conducted numerous interdisciplinary research projects, collaborating with researchers in Soil and Water Science, Fishery and Aquatic Science, Statistics, and Computer and Information Science and Engineering. They further developed the CH3D model and have expanded it into an integrated modeling system, CH3D-IMS, which includes fully integrated

models of circulation, wave, sediment transport, water quality dynamics, light attenuation, and seagrass dynamics. The CH3D model is widely used, and has been applied to almost every major estuary and lake in Florida. It is the cornerstone of the Chesapeake Bay model. Dr. Sheng led the 1.8 million dollar Indian River Lagoon study and validated the CH3D-IMS with IRL data. The Indian River Lagoon Pollutant Load Reduction (IRLPLR) model, is now being used by the St. Johns River Water Management District to develop pollutant load reduction goals (PLRG's) of nutrients and suspended solids for various IRL watersheds. To protect the Charlotte Harbor estuarine system from irreversible damage caused by reduced freshwater from rivers, SWFWMD and SFWMD are relying on Dr. Sheng's CH3D model to develop MFL criterion for the Peace River and Caloosahatchee River, respectively. As shown by the distribution of a tracer in the Charlotte Harbor estuarine system one month after its initial release inside the Peace and the Caloosahatchee (Figure 1), there is significant interaction between the tracers released from the two rivers, as well as significant interaction between the estuary and the Gulf of Mexico.

Dr. Sheng's group is also involved in the development of an integrated storm surge and coastal flooding model, and its application to develop flood insurance rate maps for the largest coastal county in Florida - Pinellas County. Hurricanes are the most devastating and damaging natural hazard impacting the United States, and especially Florida. The damage associated with the direct hit of a single hurricane like Andrew can easily amount to \$60-\$80 billion; comparable to the damage caused at the World Trade Center disaster. Insurance industry data show that 65% of all insured losses from natural hazards in the US



over the past 50 years are due to hurricanes, with major damages caused by storm surge and coastal flooding. Dr. Sheng's group has developed an integrated modeling system that combines the CH3D model with two robust wave models: REF/DIF and SWAN. Nonlinear interactions among surge, wave, tide, and wind are being incorporated into the integrated modeling system. In addition, Dr. Sheng used the high-resolution topography data of the Pinellas County obtained by the Airborne Laser Swath Mapping (ALSM) system of the CCE Department. The multi-dimensional modeling approach in combination with the high resolution ALSM data proved to be much more accurate and robust than the FEMA method. Figure 2 shows an example flood map for the Tarpon Springs area of the Pinellas County, indicating significant difference between the FEMA and UF results. Upon final approval by FEMA, Dr. Sheng's method could become the foundation of the next generation FEMA storm surge and coastal flooding model.



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### CCE Needs Your Support

In this time of receding support from the State Government, we need the help of our loyal alumni and friends. Any donations you can make to the Department will help to sustain the vitality and quality of our education programs. Thank you in advance.

Joseph Tedesco

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