William McGuire enjoys a reputation as a true visionary

Looking Ahead

By Sommer Brokaw

While structural engineers usually concentrate on quantifiable solutions to specific problems, William McGuire, professor emeritus at Cornell University, has long been recognized as a visionary. In addition to his skills as an educator, McGuire has the reputation for looking at how technology may advance in the future and how engineers and society can prepare for it. This foresight won him the Norman Medal in 1962 for an atomic power plan containment design. It led him to write one of the most widely respected textbooks on steel design, Steel Structures, in 1968. And it led to innovative and groundbreaking work in computer graphics.

According to Robert F. Lorenz, AISC's retired Director of Education: "Bill McGuire could always see the whole. Everybody is a specialist and fewer people are broad enough to see the bigger picture."

He feeds his knowledge to the next generation through his lectureships in Tokyo, New Zealand, and Australia and as a professor at Cornell University. While at Cornell University he became one the planners for one of the worlds largest radar telescopes in Arecibo, Puerto Rico. In the mid-1970s he foresaw the ability of computers to simulate more completely the behavior of structures. Almost two decades later in 1992 this foresight was rewarded with the T.R. Higgins Lectureship Award for his application of computer graphics to the structural engineering industry.

McGuire's most recent honor came in February, when he received the Geerhard Haaijer Educator Award during the North American Steel Construction Conference for the impact his research and teaching has had on advancing the use of structural steel framing in the construction industry. The Geerhard Haaijer Educator Award, named for one of AISC's most respected Vice Presidents/Technology and Research, is given in special recognition to individuals who have had a profound and lasting impact in developing a unique application for engineering practice or in the mentoring of future technical leaders. This prestigious award honors those who, through their research and teaching, have had an outstanding impact on advancing the use of structural steel framing in the construction industry. McGuire is the second recipient of the award, which was previously presented to Theodore Galambos of the University of Minnesota.

"It's a real honor because I knew Dr. Haaijer very well. I was pleased because it was in Jerry's name," McGuire said.

His colleague, Gregory Deierlein, who worked with him for 10 years at Cornell University, sees him as a visionary for his ability to recognize the potential impact of interactive computer graphics on structural engineering in the mid-1970s. "He started that work before the Macintosh, so the ideas of point and click, he was one of the pioneers in that area," Deierlein said.

Director of Civil Engineering at Cornell University John F. Abel said: "This advance was fruitful in that it transformed an already sucessful research career into a new direction, and as a result the next generation of PhD students were eager to work with him."

"He started before computers were powerful enough and engineering models were adequately developed to use computation for nonlinear simulations. He worked with his students in antici-

McGuire (right) received the Geerhard Haaijer Educator Award from AISC at this year's North American Steel Construction Conference in February. Presenting the award is Terry Peshia, president of Garbe Iron Works and Vice Chairman of AISC.

pation of the computer being able to do it and now it can," he added.

McGuire's work with interactive computer graphics has advanced the understanding of structural engineering. "He's been influential in how much we can learn about full range behavior of structures when we improve the quality and completeness of computer models of those structures," Abel said.

Viewing the broader image allowed McGuire to see how things optimize so he didn't waste anything. Robert F. Lorenz, AISC's retired Director of Education, said that this set him apart. "Other researchers could get really good at bits and pieces. Bill McGuire could always see the whole. Everybody is a specialist and fewer people are broad enough to see the bigger picture.

"Before the application of computer simulation made more effective by computer graphics we still built buildings but with less use of mathematics and more ingenuity. Now we can really calculate it better. We can try different scenarios by putting the buildings through various computer tests, to see how the buildings perform at virtually no cost," Lorenz added.

Specifically, McGuire worked with the nonlinear behavior of structures, Abel of Cornell University said: "His work with interactive computing increased how the understanding of nonlinear behavior can be accounted for in design."

"Linear behavior means that deflections would double when the forces would double. Real structures don't behave that way. We didn't have the tools and approach to predict that behavior. However, interactive computing helped us to better understand and predict that behavior by providing more complete simulations that can be appreciated both visually and numerically," he added.In 1984, McGuire gave the keynote address at AISC to illustrate the potential of the computer interactive graphics medium at that time.

McGuire won the T.R. Higgins Lectureship Award in 1992 for his application of computer graphics to the structural steel industry and his reputation as a lecturer.

"In the past, the jury felt he had been overlooked because he was more out there with the students than active in the field," Lorenz said. "We don't want engineers to be just technologists; we want them to be balanced people. McGuire has been a leader in balancing engineering with leadership."

McGuire is modest about his success. "I wouldn't hold myself up as a role model," he said. "People should be independent and do their own thinking rather than just following and copying after me," he added.

"I think it was stubbornness, just hanging in there; no brilliance just interest in the field and sticking to it," McGuire said.

McGuire gained his enthusiasm for structural analysis while an undergraduate at Bucknell University. A professor, D.M. Griffith, inspired him because he was "a strong teacher who explained things very well, had a clear interest in structural engineering himself, and was just a fine gentleman."

After graduating Magna Cum Laude in 1942 with a bachelor's degree in engineering, McGuire got a commission to serve in WWII as a maintenance officer on an aircraft carrier in the Pacific Fleet of the U.S. Navy. When he returned to the U.S., he earned his master's degree at Cornell University, using the GI Bill.

"Having been an officer in the Navy and having endured combat matured him, made him have a serious commitment to his work," said his former colleague at Cornell University Deierlein.

McGuire views the opportunity to go to graduate school as a key element in engineering education. He thinks that the academy should do more than it has in furthering the cause of making the Master's the entry-level degree for the practice of technical engineering in any of its forms.

"The technology that's out there now has really added to

the information we need to know. The methods of education in the past are not enough. The information is so deep we need more time to absorb it, graduate school gives us more time," Lorenz noted.

After earning his Masters in Civil Engineering (M.C.E.) in 1947 he was engaged by Jackson & Moreland engineers in Boston, Mass., for two years as a structural engineer in on the design of power plants and atomic energy projects. He worked for nine months on the ground floor on a nuclear energy project. But it never came to fruition. "A lot of us involved in that project are sorry that nuclear power hasn't been the main source of power in America today," McGuire said.

In 1949, he came back to Cornell University, this time as a member of the faculty. He worked his way up from associate professor in 1952, to professor in 1960, to director of the school of engineering from 1966 to 1968. During that time he also was a visiting faculty member at the Asian Institute of Technology, the University of Canterbury, the University of Western Australia, the University of Tokyo, the University of the Liege, and Strathlycyde University. In 1979, he won the Outstanding Teacher of the Year Award from the Cornell Chapter of Chi Epilson.

McGuire had a longtime involvement on behalf of Cornell in the planning, design, upgrading and maintenance of the world's largest radio telescope structure of the National Astronomy and Ionosphere Center, Arecibo, Puerto Rico.

At the National Convention of the American Society of Civil Engineering (ASCE) in 1992 he became an honorary member. " The ASCE is the basic professional organization that has been around 150 years. To be an honorary member is to me the greatest honor a civil engineer could get," McGuire said.

McGuire also received the Norman Medal at the convention for a paper on atomic power plant containment he wrote with G.P. Fisher. "Gordon Fisher and I took the design and did an analysis of its resistance to hypothetical blasts," McGuire said.

McGuire became a consultant for some of the National Bureau of Standards (NBS) investigations in the late 70s to early 80s, including the Hyatt Regency walkway collapse, the East Chicago ramp collapse, the U.S. Olympic Ice Arena in Lake Placid, New York, and the L'Ambiance Plaza collapse.

For the Hyatt Regency Walkway collapse, McGuire was a consultant to the NBS on the issues of the strength of the welds of the hanger rod box beam connection and the vibration characteristic of the walkways, said Co-Principal Investigator Glenn R. Bell. McGuire was called in for his expertise on the behavior of steel structures, and for his thoroughness, objectivity, and clarity of thinking, said John L. Gross, who is the leader of a structural systems design group at the National Institute of Science and Technology (NIST), formerly named NBS.

McGuire was also a consultant in 1987 on the investigation of the L' Ambiance Plaza in Bridgeport, Conn., which he said was harder to look into because there were a number of suspect qualities. The L'Ambiance Plaza was a 16-story building under construction using lift-slab technology when it collapsed, killing 28 construction workers. Although the investigation came to no definitive resolution, a settlement provided relatives of the victims with $24 million.

The investigation revealed four major structural deficiencies and at least five other design conditions that may have diminished the building's ability to withstand structural trauma. At least one of the wedges had been installed but not yet tack-welded, McGuire suspects this inadequate connection triggered the collapse.

McGuire doesn't describe any of the work he's done as a problem. "I enjoyed doing the work and going about it," he said.

"Personally I find him delightful to talk to; he has a sense of humor, and he's well-read not only in his field but also in history and literature," said Deierlein, his former colleague at Cornell University.

After a long teaching career at Cornell University, McGuire became Professor Emeritus in 1989. "It was time to retire but I still keep my hand in writing and occasional research," McGuire said. For example, he recently published the second edition of his textbook, *Matrix Structural Analysis* (jointly authored with Richard Gallagher and Ronald Ziemian). He is working with some of his former students now on a technical paper related to the instability of framed structures.

He lives in Ithaca, NY, with his wife Barbara Weld McGuire and his two children, Robert and Thomas, who he said have always been a support and inspiration to him.

Although McGuire has been in the business for more than a half-century, his enthusiasm for the advance of technology is as strong as ever.

"Engineering is a continuously evolving field," he said. "In many ways we are just getting started, awful lot still to be done."

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