

## University at Buffalo SEESL

### Epicenter of Innovation

MTS helps a pioneering university lab pursue advanced civil structural testing and simulation.



Testing of added clamping system in 5-story structure

*"I'm not sure we would have gotten to where we are today without the presence and support of MTS. Our partnership with MTS has been excellent for the last three decades, and we hope it will be much longer."*

— Dr. Andrei Reinhorn

Clifford C. Furnas Professor of Structural Engineering  
 Founder, Structural Engineering and Earthquake  
 Simulation Laboratory (SEESL)  
 University at Buffalo, The State University of New York

*"I've appreciated my ability to directly access experts in earthquake simulation and static and dynamic testing, and MTS has always had talented engineering staff at the applications, systems engineering and facilities planning levels."*

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Technical Service Manager  
 Structural Engineering and Earthquake Simulation  
 Laboratory (SEESL)  
 University at Buffalo, The State University of New York

#### CUSTOMER CHALLENGE

Over the last three decades, the University at Buffalo (UB) Structural Engineering and Earthquake Simulation Laboratory (SEESL) has played a prominent role in the advancement of civil structural engineering. It has done so through a combination of superior-quality education, pioneering research, and helping various industries establish codes, standards and test methods.

SEESL currently supports a broad range of operations. The facility sets aside space for the Multidisciplinary Center for Earthquake Engineering and Research (MCEER) and the George E. Brown, Jr., Network for Earthquake Engineering Simulation (NEES). It also supports UB educational and research initiatives and serves external clients for commercial and research purposes. Areas of specialization include structural vibration testing, dynamic testing, material static tests, structural control testing and validation of nonstructural components, such as HVAC systems and suspended ceilings, as well as lifeline systems such as electrical substations.

"We have achieved a long list of industry firsts, but we are equally proud of the talent this facility has produced," said Dr. Andrei Reinhorn, a professor in the UB Civil, Structural and Environmental Engineering Department and founder of the SEESL facility. "In my 31 years here, I've seen more than 400 engineers graduate, many of whom have established advanced civil and seismic test labs of their own throughout the world."

SEESL constantly strives to provide more realistic simulations with the massive forces, displacements and specimen sizes involved. "Many of the structures we examine are bigger than our laboratory, which limits us in terms of the size of items we can test," Reinhorn said. "So, one of our ongoing challenges is finding better ways to provide the most accurate simulation in the test lab, while also containing costs."

#### MTS SOLUTION

Since 1983, MTS has provided SEESL with the configurable technology required to adapt quickly to new test requirements, along with the readily available testing expertise required to help SEESL test engineers explore new research methods. This longstanding partnership has empowered SEESL to continually identify new techniques for improving civil structural and seismic simulation accuracy.

SEESL completed a major upgrade in 2004, which tripled the facility's size and integrated a host of advanced new test equipment supplied by MTS: two 6DOF shake tables to complement an original 5DOF shake table; large-scale dynamic and static actuators; a geotechnical laminar box; and networked MTS FlexTest® controllers. The two MTS 6DOF shake tables can be combined to support tests of very large specimens, including full-sized bridge spans up to 40 meters in length. MTS and SEESL also jointly developed a unique

be certain.



Large-scale, shake table test of container crane



Shake table test of steel structure with advanced braces (zipper frames)

facility for nonstructural component simulation, composed of a two-story shake table with strokes of +/- one meter and velocities of up to three meters per second.

“The configurability of our shake tables has opened a new world of possibility for us in terms of testing and experimentation,” said Mark Pitman, Technical Service Manager at SEESL who has collaborated with MTS for 27 years.

According to Pitman, such innovation is made possible through both the versatility and precision of the MTS test equipment, as well as the readily available domain expertise of MTS field engineers.

“I’ve appreciated my ability to directly access experts in earthquake simulation and static and dynamic testing, and MTS has always had talented engineering staff at the applications, systems engineering and facilities planning levels,” Pitman said. “MTS has provided a level of technical support and field engineering that I consider second to none.”



#### MTS Systems

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#### ISO 9001 CERTIFIED QMS

An example of this support is SEESL’s collaboration with MTS in its early exploration of hybrid simulation technology, which simultaneously combines the mechanical testing of substructures with computer models of the remainder of the structure. This technique provides an effective means of understanding how seismic events will impact a civil structure, without having to invest in the lab space and test equipment necessary to test the entire structure.

“Hybrid simulation has proven essential for us to keep test specimen sizes manageable while more accurately characterizing the larger structure to which the specimen belongs,” Reinhorn said.

#### CUSTOMER BENEFITS

Reinhorn and Pitman agree that MTS has been essential to helping SEESL establish and maintain its strong global leadership position in civil structural engineering. The partnership has created a highly capable and configurable foundation on which SEESL engineers can confidently pursue new testing methods that support their educational, research and commercial testing objectives.

“The flexibility of the test equipment really frees us in terms of exploration, because it gives us ability to get creative and pursue

new innovations,” Pitman said. “We may be pioneers in research and experimentation, but that is due in large part to the fact that MTS has been such an excellent guide.”

“This lab flexibility also benefits us from an education and mentoring perspective, because it allows us to standardize our test software and hardware to simplify learning,” Dr. Reinhorn added. “Students can focus more on understanding experimental methods and less on trying to master the test equipment itself.”

In addition, SEESL receives Routine Maintenance from MTS, which Pitman cites as another critical element to the SEESL success story. “The uptime we experience due to the periodic regular maintenance, calibration and repairs has allowed us to keep our MTS equipment operational with minimal downtime,” he said. “We currently have five or six projects running in parallel every day of the week, each in a different stage of preparation.”

Dr. Reinhorn looks forward to further great results from SEESL and MTS in the future. “I’m not sure we would have gotten to where we are today without the presence and support of MTS. Our partnership with MTS has been excellent for the last three decades, and we hope it will be much longer.”