New Saudi University's Stunning Visualization Facilities Prototyped at UC San Diego

Display and VR Systems Developed at Calit2 Get High Marks

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Doug Ramsey

In inaugural ceremonies webcast around the world, Saudi Arabia inaugurated the King Abdullah University of Science and Technology (KAUST) on Sept. 23. The campus on the Red Sea was built in just 24 months, and its world-class facilities and programs are funded by the King's $10 billion endowment -- one of the largest in the world, and enough to fund the university for years to come.

Those facilities include Shaheen, the region's fastest supercomputer, as well as what is being billed as the world's most advanced facilities for scientific visualization.

The display systems for the Visualization Laboratory Showcase were developed and fully prototyped earlier this year in the KAUST-funded VirtuLab at the California Institute for Telecommunications and Information Technology (Calit2) at the University of California, San Diego and the Electronic Visualization Laboratory (EVL) at the University of Illinois at Chicago. A 10-person team from Calit2 and EVL spent much of the last two months in Saudi Arabia working with the KAUST visualization team as the facilities were constructed, tested and finally displayed to the media and guests this week.

Some 3,500 guests - from Saudi royalty and foreign heads of state to technology reporters and academics from around the globe - attended the festivities. UC President Mark Yudof, UC San Diego Chancellor Marye Anne Fox and her Vice Chancellor for Research, Art Ellis, were on hand. So was Calit2 UCSD Division Director Ramesh Rao, who led a Calit2 delegation that included Calit2 Director of Visualization Tom DeFanti, and UCSD archaeologist Tom Levy, who is Associate Director of Calit2's Center of Interdisciplinary Science for Art, Architecture and Archaeology (CISA3). Also on hand to participate Thursday in KAUST's inaugural symposium: Tony Haymet, Director of UCSD's Scripps Institution of Oceanography.

With KAUST flying in reporters from around the world, Calit2's and KAUST's visualization teams were kept busy showing off the impressive facilities in the Geometric Modeling and Scientific Visualization Center, all first prototyped at Calit2 and EVL.

CORNEA is a 10-ft. cube of screens forming a 6-sided virtual-reality environment derived from the CAVE invented by EVL, with an all-new audio system designed by Calit2 and constructed for KAUST by Mechdyne and Meyer Sound. CORNEA has the world's highest resolution (100 million pixels) and brightest (10,000 lumens/ projector) visualization environment. It features 24 4K projectors, with native resolution of 4096x2160 pixels each (roughly four times the resolution of HD-TV). The Calit2/Meyer spatial/surround sound audio system makes it possible to play multi-channel audio and add directional sound cues to visual images - making this the most advanced virtual-reality research center of this type in the world.

Technology reporter Scott Merrill spent time with Calit2's Tom DeFanti, and went away impressed with CORNEA. He reported that two things set KAUST's CAVE apart from all the rest. "First, it has the world's highest

resolution at 100 million pixels," Merrill wrote in his *CrunchGear* blog, "and second, it has a phenomenal audio system inside the room. Tiny microphones placed in the room pick up sounds and project them back in any of a number of programmable acoustic configurations. So if you're walking through a visualization of an actual cave, your voice will echo and reverberate. This is actually amazingly hard to describe in text, and even harder to capture on video... When the audio is on, you really do feel like you're in a larger space. Then when the audio is muted, you feel like you're in any other room in the world. It's very impressive what a dramatic effect sound has on our sense of sight."

Archaeologist Tom Levy demonstrated how he can use CORNEA and Calit2's StarCAVE to explore a 3,000-year-old dig site in southern Jordan, complete with sound effects that imitate the actual sound of descending deep into an excavated shaft where the archaeologist found artifacts (represented in CORNEA at the precise geographic locations and depths where they were excavated). As Steve Sechrist, senior analyst at Connecticut-based Insight Media, reported in his *Display Daily* blog, "As we continued to go lower, our voices began to echo adding a whole new dimension (audio) to the experience." The audio system was jointly developed by Calit2 and industry partner Meyer Sound. "A world class research institution needs world class tools," said UCSD music professor Peter Otto, who leads Calit2's Sonic Arts group. "We were inspired by KAUST to complement the best visualization facilities in the world with unprecedented capabilities in the auditory domain. Meyer Sound, Mechdyne and the UCSD Sonic Arts group teamed up to deliver the best imaginable, beyond state-of-the-art, 3D sound systems, and we are extremely proud of the results."

Calit2's Kai-Uwe Doerr and Andrew Prudhomme and KAUST's Steve Cutchin demonstrated the other visualization facilities developed for KAUST, including the 21-tile NexCAVE scalable, modular 3D environment; REVE (which stands for "Rapidly Expandable Virtual Environment"), which uses passive 3D technology to present limited "autostereoscopic" images to the viewer without the use of special glasses; the 40-tile AESOP, which features a new generation of computer displays with extremely narrow bezel edges - eliminating one of the major drawbacks of tiled display systems; and two 3x4-tile OptIPortals (made of 52" displays).

Roughly 400 graduate students make up KAUST's inaugural class, and 15 percent of them are women, in a country where co-ed higher education has not existed until now. Some 70 faculty members have been recruited in a worldwide search led by KAUST's President, Choon Fong Shih, former president of the National University of Singapore.

The inauguration coincided with Saudi Arabia's National Day holiday in an indication to the world and that the King sees research and education as critical to the country's and the region's future. Saudi Aramco, the oil giant with U.S. roots, was contracted to build the modern KAUST campus to compete globally for top talent. Only about 15 percent of new students are Saudi citizens, with Chinese, Mexican and U.S. students the next largest contingents (all on fully-paid scholarships).

Media Contact: Doug Ramsey, 858-822-5825 or dramsey@ucsd.edu


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