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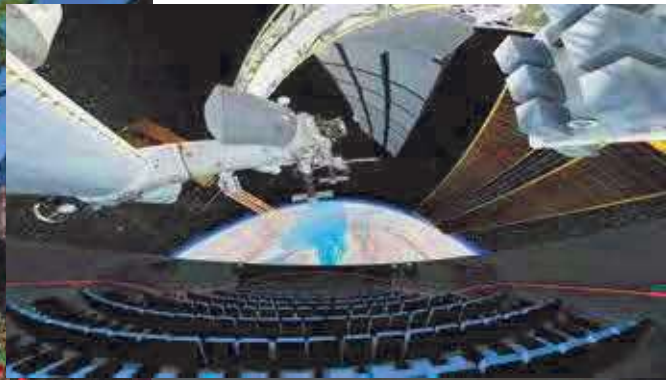
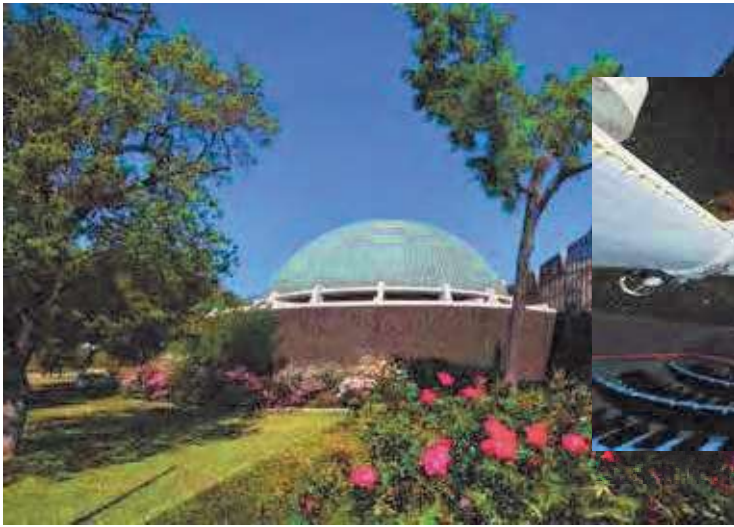
PLANETARIAN

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One Earth Message: Continuing the Legacy

Page 14



Above: The exterior of the Burke Baker Planetarium; a view of the ISS from the new Sky Boxes in the back of the planetarium; and the size of the Sony projectors. All photos provided by the author.



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The first true 8K planetarium: Houston reaches the stars

Astronomy knowledge is exploding at every wavelength, taking us closer to the edge of space and the beginning of time. Now planetarium projection technology can provide the computer processing, data storage, resolution, and brightness to deliver the farthest galaxy, newest exoplanet, and latest amazing discovery.

The Houston Museum of Natural Science decided that it was time for Space City to have a renovated Burke Baker Planetarium, displaying the richest starry night and creating the sharpest and most dramatic immersive adventures in 21st century astronomy.

We challenged Evans & Sutherland to design a projection system that would approach the limits of the human eye, giving visitors the best possible experience. An arc minute is about what the human eye can resolve. For the dome, that means a meridian of a little more than 10 thousand pixels (180° times 60).

With that in mind, consider an 8K dome master. Every meridian through the zenith has at least 8,000 pixels. Going from north to south along the horizon, an 8K dome master has over 12,500 pixels (circumference of the semi-circle). So, on average, an 8K dome master has enough pixels to approach the resolution of the human eye. The number of unique pixels in this dome master is the area of a cir-

cle 8,000 pixels in diameter, or just over 50 million pixels.

E&S accepted the challenge and provided a system that actually delivers 50,602,000 unique pixels to the dome at 60 frames a second. This True8K™ system requires five 4K projectors along the horizon and five 4K projectors to cover the rest of the dome, generating about 80 million pixels before edge blending. Existing 8K planetariums have four 4K projectors along the horizon and one or two projectors for the rest of the dome. With edge blending, these systems deliver about 30 million pixels, only 60% of those required for a True8K projection.

The night sky of West Texas

Planetariums began with giant opto-mechanical machines that replicated the starry night far from city lights, but kept audiences firmly on Earth. We wanted to recreate the dark night sky of West Texas and be able to travel anywhere our data could take us with all the contrast and color that the human eye can see. The new 4K Sony VPL-GTZ280 laser projector has a 20,000:1 contrast ratio that makes this possible, delivering a very black night sky with bright stars and a rich Milky Way. The extended color space of the projector's laser-generated light source also gives vis-

itors the rich color palette they see in movie theaters.

Years of animations produced by Digistar planetariums using the Digistar 3D starfield, with hundreds of models, have helped significantly in our production of new 8K content without months of rendering. Last fall we began downloading proven scripts stored on the E&S Cloud and adapting them to create exciting audience experiences and to meet the required learning goals of our students. We thank Evans & Sutherland for facilitating and encouraging this level of drag-and-drop sharing, so we could have live 8K experiences already prepared for our renovated theater opening.

Before we closed for renovation in December, we vetted these experiences with our partner educators at the Houston Independent School District and are now testing their effectiveness on student learning. Teresa Phillips, HISD Manager of Elementary Science, summarized our success:

"We are very excited about the renovations taking place in the Burke Baker Planetarium. For generations, fourth grade students from HISD have been able to experience the dark night sky and observe different objects in the sky in the planetarium. The incredible digi-

(Continues on page 46)

(8K, continued from page 44)

tal clarity of the new Digistar 5 system will allow our students to clearly visualize abstract concepts such as the phases of the moon and the rotation of the Earth through this immersive experience. We appreciate the ongoing collaboration between our two organizations and know that the renovated planetarium will provide an experience that our fourth graders will not soon forget."

This immersive view from the renovated planetarium's top platform "sky boxes" illustrates our production efforts in True8K. A NASA astronaut photograph taken with the museum's 8mm fisheye lens on the ISS is composited over an 8K Digistar starfield with the museum's 8K model of the International Space Station layered in front. When animated, this scene lets students discover where astronauts live in space now.

A new dome to open the sky

To accommodate the physical limitation of our iconic exterior dome, we chose a 50-ft (15.2-m) Spitz NanoSeam™ dome tilted at 20°, providing a seemingly boundless visual experience facilitated by the dome's forward tilt. The visually seamless dome also diminishes audience awareness of the dome's physical size. Our raked seating platforms with an elevator and "sky boxes" in the back can accommodate 187 visitors.

Our installation schedule allowed exactly 20 days to destroy our old theater, leaving a black dome cavern, and 60 days to install a new dome, new floor platforms, new interior walls, new seats, new lights, new sound, and those 10 new Sony 4K projectors with the 20 computers and fiber optic cables to support them.

We completed construction with centimeters to spare in every direction and reopened just in time for the crowds of spring break. This insane timeline required the combined efforts of all museum departments, E&S, Sony, Spitz, the Digistar Users Group, American Seating, Hudson Building Systems, the Johnson Space Center, and even Julius Caesar for giving us an additional day when we needed it most!

"World-class experiences"

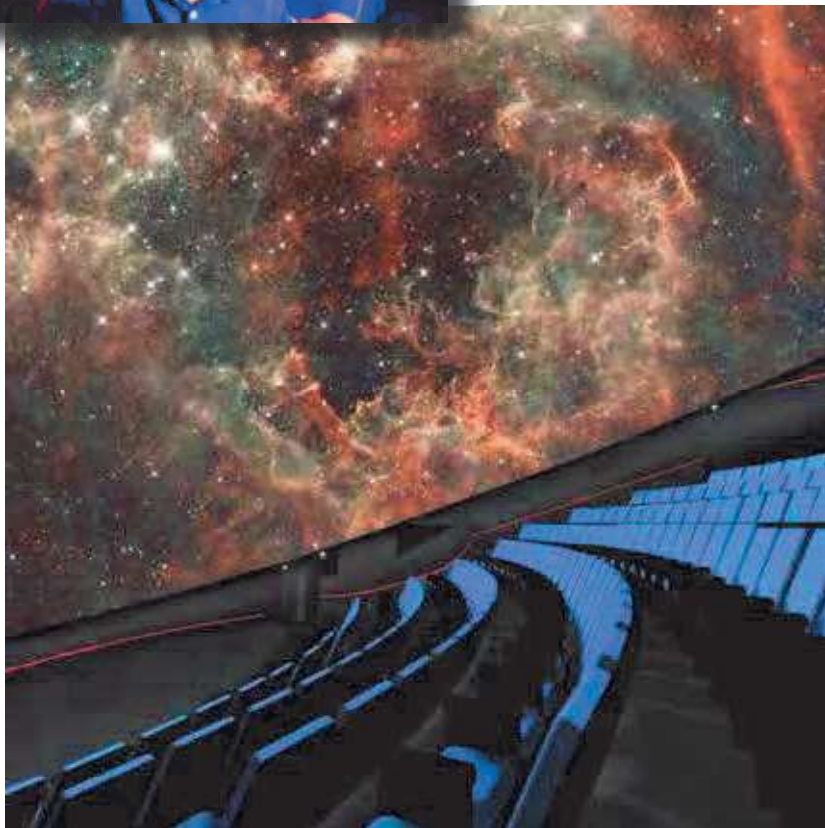
Museum President Joel Bartsch summarized the larger context of this ambitious renovation. "The Houston Museum of Natural Science strives to offer world-class experiences in its exhibits and theaters. With the world's first True8K planetarium, our starfield is now an immersive exhibit that more closely and

dramatically replicates reality than any other system currently known. Our full-dome experience now has the brightness, resolution, and vividness of the best theater screens, surrounding the audience in every direction. The Burke Baker Planetarium and its Friedkin Theater, the cornerstone of our institution when we opened in 1964, is now a crowning jewel in our 21st century museum."

If you are looking for the best possible dome experience, especially if you are limited by space, time, budget, dome size, and/or pixels, please come to Houston and see what we have done together with E&S. We are providing the first True8K planetarium with the quality experience that today's moviegoers expect and that every urban child deserves. ☆



Left: Students from the Houston Independent School District taking part in a planetarium program. Below: A side view of the planetarium's interior; the new projector allows the highest resolution Hubble images to be displayed in their full glory.



Dr. Carolyn Sumners is the Vice President for Astronomy and the Physical Sciences at the Houston Museum of Natural Science, an adjunct professor at Rice University and at the University of Houston and a museum educator for the Houston Independent School District. She directs the Museum's Burke Baker Planetarium, Expedition Center, and George Observatory. She opened the first full dome digital planetarium in the US in 1998 and has written and directed over 40 shows for local audiences and for national distribution in her 45 years at HMNS. She directed the development of the first Challenger Learning Center in 1988 and invented the portable digital video theater in 2003. She is currently overseeing the complete renovation of the Burke Baker Planetarium including installation of the world's first True 8K planetarium.