Case Study

\Orchestrating a brighter world NEC

Starry Nights – and Schooldays:

NEC Projectors and LED Display Create Immersive Learning Environment for School Planetarium

Challenges:

- Transform an aging school planetarium's outdated technology while staying within budget

Solution:

- Three NP-PX602UL laser projectors, one NP35ZL lens, two NP34ZL lenses and one 65-inch V652 LED display.

Result:

- An immersive learning experience that allows K-12 students from 54 schools to interact with cosmic concepts firsthand.

School administrators and educators constantly hunt for new ways to get kids excited about learning, and one of the most successful tactics they've discovered is to create an immersive environment that makes abstract ideas concrete, allowing students to interact with concepts in ways that reading about them doesn't allow.

When an aging planetarium housed within a middle school in Bel Air, Maryland – created to bring the cosmos to life for students – was due for an upgrade, the Office of Science didn't want to simply replace the outdated overhead projectors with something newer. Instead, the department decided to explore other technologies that would create memorable experiences for students and facilitate core learning principles through a sensory explosion.

The Setting

Southampton Middle School – located in central Maryland and serving 1,229 students – and its planetarium were built in 1970, when it was not unusual for a school to have its own planetarium. According to NPR, at one time there were more than 350 planetariums in schools around the country, but as the infrastructure aged and budgets shrank, they became a "nice to have" versus a necessity, and many began to close.

But not all of them.

Harford County Public Schools (HCPS), the district in which Southampton resides, continues to place a high priority on its three planetariums, believing they reinforce learning concepts and bring space and science to life for students.

"The classroom teachers who stand before our students are the most critical part of our science program, and it is important to provide them with as many authentic learning scenarios as possible," said Andrew Renzulli, supervisor of HCPS' Office of Science. "The goal of the planetarium program is to afford students a highly immersive and authentic science experience that otherwise couldn't be replicated in a traditional classroom. This approach to teaching and learning adds a layer of excitement and fun for students, blending learning with multimedia sensory experiences."

The planetariums are used for data collection and modeling as well as multimedia presentations. Prior to upgrades, data collection was modelled on overhead projectors with red lighting gels – clear red cellophane similar to plastic wrap that would be cut to shape – over the stage to minimize the brightness. The standard office-grade LCD projector was a "poor performer," according to Jason Mills, planetarium director.

"Depending on the projector, the image was always either too bright or lacked contrast, and regardless of the projector, the image was always heavily keystoned and warped due to the geometry of the planetarium dome," he said. "Additionally, it produced a small image, and could not be geometrically corrected."

When it was time to start determining upgrades, Mills decided to create a traditional theater aspect in large format in Southampton, using a custom configuration of modern projectors to show rectangular, seemingly flat media in the planetarium as well as dome projection.

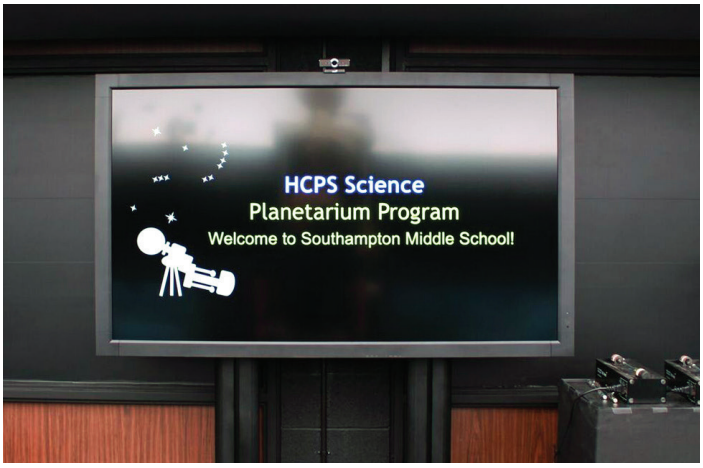
With the idea in place, it was time to find the technology.

The Tech Solution

When Mills and the technology department began investigating new projector options, their first thought was NEC Display Solutions, because the school has had an agreement with NEC for several years, and the technology department is an NEC-certified repair facility.

NEC product reps and solutions engineers met Mills at the planetarium to discuss the project goals and technology needs. Mills had attended a planetarium conference and was impressed by how cutting-edge digital projectors were able to incorporate video streaming into presentations. Although he knew that level of technology would never fit into a budget, he also realized that type of content was integral to future programming, and hoped for other commercial-grade projectors within budget that would yield the same results.

With a goal of creating a large-format video system that would allow science teachers to expand



presentation topics beyond astronomy, Mills had a number of qualifications he wanted in a projector. To project rectangular, "flat" media in the planetarium, projectors needed to have high contrast as well as save set geometric corrections. While lumens weren't a priority – because the planetarium gets so dark, even a 2,000-lumen projector would suffice – the ability to project black was critical. Mills also needed projectors with a wide throw to create a very large image.

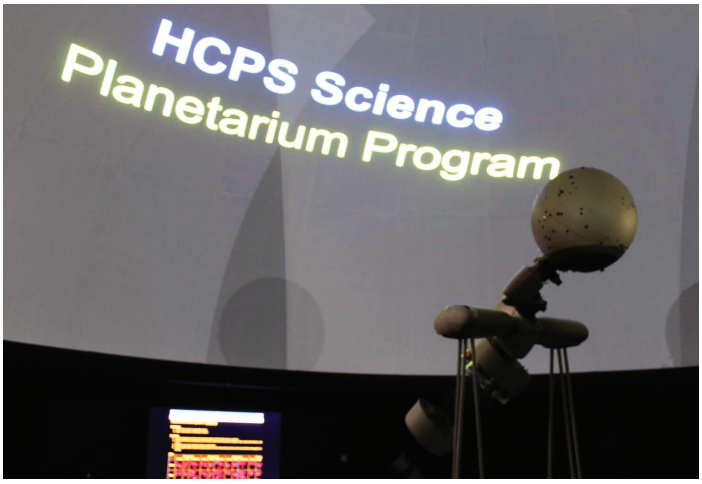
Mills also wanted a flat-panel display for the space that offered durability and contrast ratio.

"We needed a panel that allowed me to dim it to the point that it did not affect the audience's dark- adapted vision, but still was capable of showing colorful graphics with high contrast," he said.

NEC loaned Mills multiple projectors to demo in real lessons and test the geometric correction software and Multi-Screen tool, a camera-based system that allows users to edge-blend and stack multiple projectors together.

"Throughout my learning and testing process, NEC was very responsive to questions and problems," Mills said.

Mills ultimately selected and installed three NP-PX602UL laser projectors, one NP35ZL lens, two NP34ZL lenses and one 65-inch V652 LED display.



"Laser projectors have the contrast ratio necessary to get a true black in the completely dark planetarium," Mills said. "Granted, when color is projected from them, the true black turns gray, but, they are still dark enough that they do not light up the room and affect the audience's ability to see the dim stars when I shutter the projectors."

Mills added that three projectors were necessary to create the massive immersive environment they were looking for.

"We wanted a big enough image that you feel like you're immersed in the night sky," he said.

While a major focus was on the projectors, the display is also important to the atmosphere.

"It's changed the way we teach in the planetarium, because it doesn't wash out the dome," Mills said. "Before, we would have to turn on other lights and we would lose the star projection. Now, I can refer to material from the star projector while I'm teaching on the display."

The Installation

The installation took 18 months from start to finish, including transforming the space itself. A theater rigging company fabricated a rigging bar and custom mounts for the projectors, and a sound company installed a sound system. An electrician ran necessary wiring. The HCPS tech department helped Mills select a gaming computer, which would be powerful enough to run six connected monitors/projectors simultaneously.

Technology testing and selection took place over the winter and spring of 2016. Installation of the LED display occurred in the fall of 2016.

Projector installation was completed in January of 2017, with configuration testing occurring in the spring and fall of 2017.

"This was almost completely trial and error," Mills said. "I had a general idea of where the projectors should go, but until you use the Multi-Screen tool software and blend the image, you don't know for sure. I mounted the projectors above the rigging bar, below the rigging bar, in different orientations, and in different locations. Once I got an acceptable image, I'd use it for a few days. When it didn't work out, I'd figure out the problem, and then fix it and start over."

Mills added that a multitude of tiny details went into discovering the exact placement and settings that would yield the best image.

"Everything mattered – ambient lighting, camera resolution, camera placement, projector settings and so on," he said. "I felt like I took one step back for every step forward for a solid 18 months while working on this."

After a year and a half of countless miniscule changes and tweaks to every imaginable element of the system, Mills' hard work finally paid off – the final projector lens was installed in the fall of 2017, and the newly upgraded planetarium was ready to wow students.

The Results

The planetarium design is considered "classic," comprising a 40-foot-diameter circular room with a 30-foot-diameter spherical dome ceiling. An optical star projector creates the star field, while the projectors are stacked and tiled to create a large-format image on the dome in the front of theater. Geometric correction makes the projected image appear rectangular. The flat-panel display is installed at the front of the theater, below the dome, at ceiling height.

The projection system allows Mills to project content from his computer onto the dome in a large-format, easy-to-view image – the current image is approximately 19 feet tall and 34 feet wide. Mills uses the projectors to show video and PowerPoint as well as share data with students in a more meaningful way. The images are large enough to allow detailed analysis of the graphics and graphs.

The flat-panel display is also used for multimedia presentations, but primarily for PowerPoint and Word documents. The vast majority of what is displayed on the panel is streamed from an iPad Pro using an Apple TV.

"This isn't like most planetariums where you put on a show – we teach lessons," Mills said. "We do a lot of data collection in the planetarium, such as the altitude of the sun over a year, positions of the planets, angular distances, colors and brightness of stars. I try to incorporate data collection into as many presentations as possible to increase student inquiry and make them think."

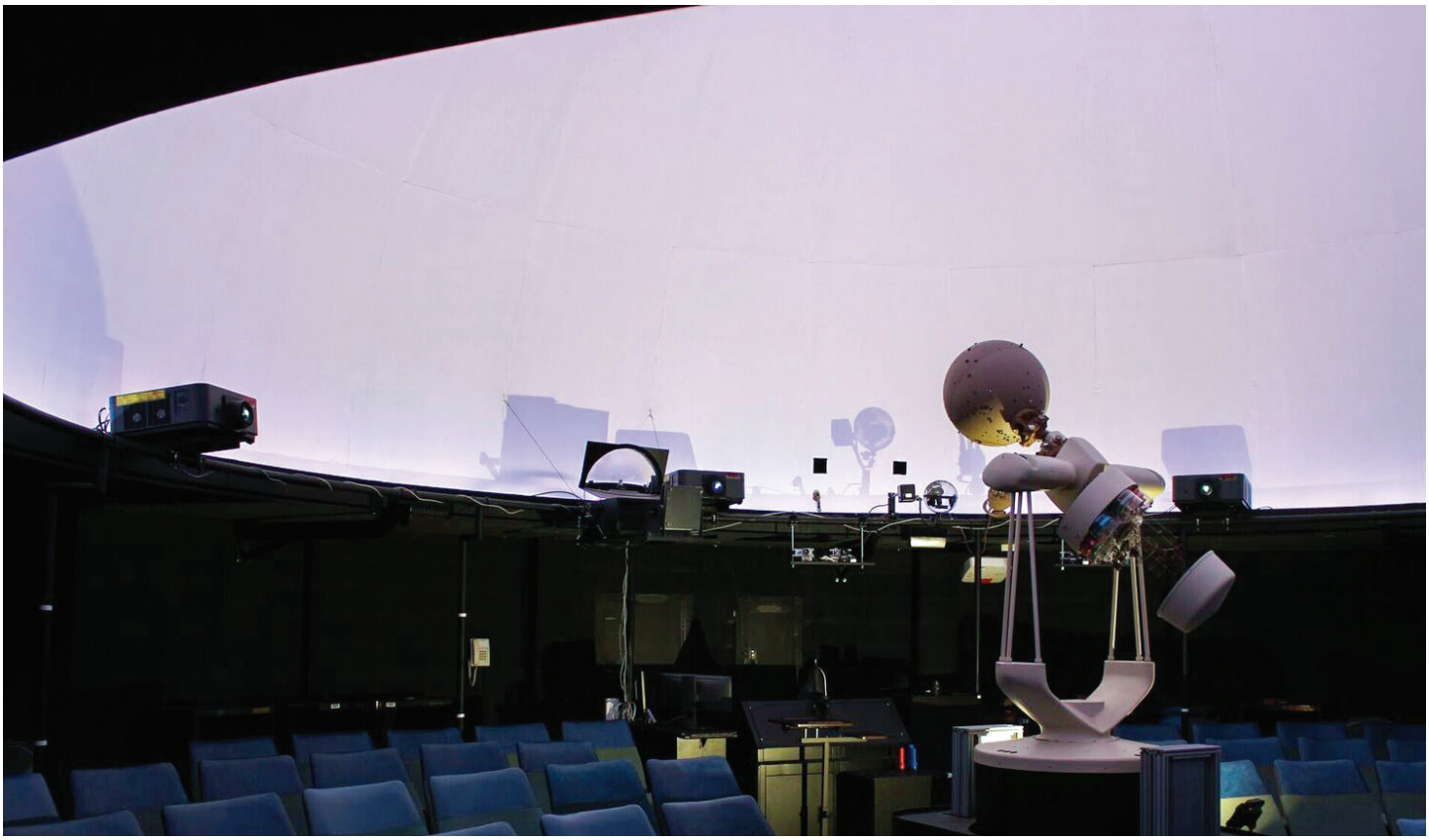
And it's working. Student response has been overwhelming, according to Mills.

"Every time I turn things on, the room fills with 'Ooh!,' 'Ahh!' and 'Wow!'" he said. "The planetarium program had become somewhat routine, and this has truly rejuvenated it, bringing back the 'wow' factor for kids and teachers alike. It's hard to put their reactions into words. It's huge."

Renzulli added that the planetarium gives students ownership of their learning through the immersive environment.

"This is a very different way of facilitating learning within a planetarium, which usually is presenter-focused," he said. "We're trying to get away from that by allowing students to control elements like the views of the night sky. It's incredibly valuable for them to be fully immersed like this."

The planetarium provides a multimedia learning environment all 54 district schools can enjoy, bringing students closer to understanding cosmic concepts such as rotation of the planets and the effect of plate tectonics on ocean currents, and the technology has been central to the experience. "We found a product that worked, and NEC was so supportive," he said. "I have no regrets."



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