SPACE SHUTTLE ATLANTIS EXPERIENCE

Kennedy Space Center's latest immersive attraction.

BY DAN DALEY

Through their 134 flights, the five orbiters of NASA's space shuttle program logged a staggering 537,114,016 miles over 1320 days in space. However, since the program was officially closed in 2011, the remaining three space-flown shuttles (two others were lost to accidents) are in the process of making their final journeys, which in some ways can be as complex as their sojourns into orbit, and remain a trip that's still in progress.

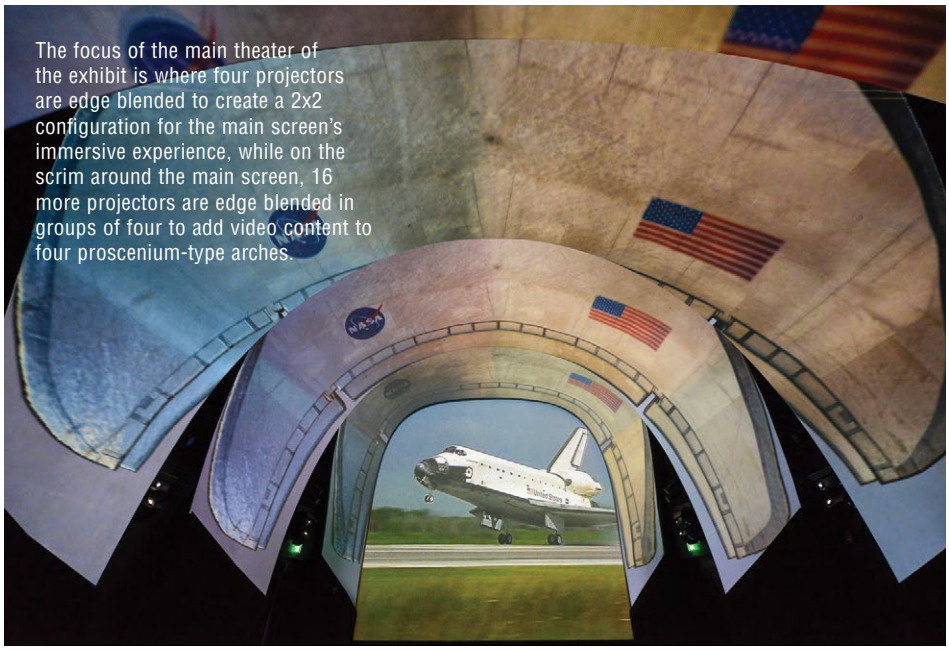
Last Trip

Shuttle Discovery is now ensconced at the National Air and Space Museum in Chantilly VA; Shuttle Endeavour is slated to be installed in a new addition to the California Science Center in Los Angeles, with a planned 2017 opening. Shuttle Atlantis is now finally settled into its new home at the Kennedy Space Center Visitor Complex near Orlando FL, with some finishing touches applied last year in the form of firmware updates to several MultiTouch MultiTaction 55-inch interactive screens. (Shuttle Enterprise, which was built as a test platform and never flew in space, is aboard the aircraft carrier Intrepid on Manhattan's West Side.)

Atlantis' new home, though, is perhaps the most ambitious of them all, just as the ship itself was unique: Its STS-135 mission was the final flight of the entire shuttle program, and in its 33 lifetime missions, it was the first to dock with the Russian Mir space station; it delivered

This is the scene that greets visitors when the last film ends. The 110'x20' videowall behind Atlantis, fabricated by Delta Displays using about 800 8mm pitch LED tiles, makes the shuttle seem to sail over the Earth as the sun rises to greet it.

All photos: Delaware North Companies



The focus of the main theater of the exhibit is where four projectors are edge blended to create a 2x2 configuration for the main screen's immersive experience, while on the scrim around the main screen, 16 more projectors are edge blended in groups of four to add video content to four proscenium-type arches.

the International Space Station's Destiny laboratory, Columbus laboratory and Quest airlock, and it was also the last flight to service the Hubble Space Telescope. It ended its career with 120,650,907 miles clocked on its odometer, after 293 days, 18 hours, 29 minutes in space.

Planning The Final Voyage

Those accomplishments were very much on the mind of Tom Owen, Vice President and Senior Planner and Designer at PGAV Destinations (pgavdestinations.com), a St. Louis firm that specializes in designs for museums, aquariums and zoos, and large-scale themed attractions. "This wasn't long after the end of the shuttle program, and people were thinking that NASA was going out of business," recalled Owen, who was the creative lead on PGAV's successful bid for the Atlantis project. "On one hand, you wanted to celebrate what was, but at the same time, you wanted to communicate that the shuttles were one more step on a much longer journey. We wanted Atlantis to be able to inspire the next generation of space explorers."

On a more pragmatic note, though, Owen also reminded *Sound & Communications* that historically, space exploration has been a finicky proposition for the average American, who was enthralled by Neil Armstrong's first step on the moon in 1969 but was barely aware that astronauts were still going there three years later. "The space business moves slowly and it's challenging to keep the public interested over the long term," he said.

At the same time, this is the only shuttle that would also reside on a NASA property and be situated close to its working home, the launch pad at the Kennedy Space Center. "We knew we also had to please the insiders, the people who lived and worked around Kennedy, for whom the shuttles had been part of their lives for 30 years," said Owen. "It couldn't be a theme park ride." All of that would form the context for Atlantis' final mission: inform, engage, amaze, but most of all, keep it real.

Owen's background is in theater arts, as are those of about half of PGAV's designers (the rest tend toward architectural arts), so he laid out a narrative design in three distinct acts. Visitors approach the 90,000-square-foot installation via a wide, windowed ramp designed to hold several hundred people at a time, taking about 400 feet to come to the events stage about 20 feet above the ground. It not only helps pace their approach to the prize inside, letting the crowd find its own dimensions rather than squeezing them through enforced lines, but it also helps create a sense of anticipation.

"You don't want to walk through a door and bang, there it is in front of you," Owen explained. "First you want to know what the shuttle meant, why it means something to stand next to a spacecraft. It's a theatrical approach: It builds on emotion."

Inside Act 1

Inside Act 1 (aka the batching area, where the visitors form up in groups of up to 250 people each, counted automatically by sensors connected to the Medialon SCM-MNG V5 Pro show controllers), a narrative film depicts the shuttle's engineering and mission evolution dating back to sketches from the 1960s, some of which were closer in feel to something out of The Jetsons than to the elegant but decidedly utilitarian shape of the shuttles. These are interspersed with several transitional scripted scenes that tie together the archive material into a narrative. Its sound, also culled from NASA archives and mixed with music, comes pouring out through eight JBL Control 47HC narrow-beam high-ceiling speakers and 16 QSC AD series ceiling and surface-mount speakers.

This space gives way to Act 2, the pre-

The Docking Station Simulator video consists of 12 separate kiosks, each with 24 32-inch and four 19-inch displays, all linked to their respective media services via fiber.

show area, where four Barco F35 2560x1600 projectors are edge-blended in a 2x2 configuration for the main screen's immersive experience on a 20'x12½' screen. On the scrim around the main screen, 16 Barco F32 1400x1050 projectors, edge-blended in groups of four, add video content to four proscenium-type arches, inspired, Owen said, by the sinuous curves of the shuttles themselves. These add to the sense of theatricality while also providing a texture of projection surfaces, synchronized through 7th Sense Delta media servers.

The media content in this "standing theater" area, as with that in the rest of the exhibit, was created by production house Mousetrappe (mousetrappe.com). The content in Act 2 is a heroic paean to the shuttle, complete with a score that evokes John Williams, which takes visitors through launches, recoveries, turnarounds, re-launches and views from the shuttle of space, the Earth and related items such as the International Space Station.

Owen noted that the video content spans not only a lengthy period of history, but also a range of video formats, resulting in often-disparate levels of resolution between images. That low resolution lends authenticity to the experience but, he added, "It can be painful for the modern viewer to watch." To counter that effect, it was directed onto the sides of the arches, present but not demanding of attention.

"There's a lot to see on all of the projection surfaces, but we kept the story focused on the main screen because we're really reinforcing how this was taking us to the edge of a new era in space travel," said Owen. "This was the first time a manned reusable launch vehicle was going up. There was a lot of apprehension and uncertainly around it. We wanted the environment to reflect that."

Careful Calibration

Yiannis Cabolis, Chief Engineer at Electrosonic, the AV systems integrator on the project, said that the lighting and projection in the first two rooms are carefully calibrated to allow ambient light to fade progressively, replaced by illumination mainly from the projection. That's for safety reasons, as well as another way to transition visitors from the reality of the Kennedy Space Center's campus to the hyper-reality of experiencing Atlantis. "Plus, there is a lot of rich media before you even see the shuttle, so we wanted to have eyes adjusted gradually," he explained,

As the narrative film reaches its finale, the last image seen is that of Atlantis head on, turned slightly on its side, cargo bay doors open and its robotic arm deployed. Just at the moment the film fades, the semitransparent main screen rolls upward quickly, at four feet per second, and doors behind it swing open, to reveal the real Atlantis. The shuttle is cocked at precisely the same 43.21° angle as it was last seen in the film, doors fully open and arm deployed.

The effect is kinetic enough by itself: Cabolis said it tends to make the crowds move quickly toward the next room, something the show's schedule counts on. It's made more so by a huge 110'x20' video-wall behind Atlantis, fabricated by Delta Displays using about 800 8mm-pitch LED tiles, from which the shuttle seems to sail over the Earth as the sun rises to greet it. Images fed from a 7th Sense Design Delta media server and LED lighting changing hues over the shuttle's fuselage mimic the sun's rays moving over it. It's dramatic, and guests don't notice the huge hangar door closing behind them, as one of the two Medialon SCM-MNG V5 Pro show controllers in the installation resets Acts 1 and 2 for the next group of visitors downstairs.

The LED wall behind Atlantis was conceived originally as a projection screen, which would have allowed it to be even larger and more immersive. However, several concerns changed that, most notably an aversion to putting anything directly above the shuttle itself in such a way that gravity might cause them to interact. "The shuttle's come through the heat of re-entry numerous times, protected by the heat shield tiles on the bottom, but its upper surface is actu-

ally quite fragile," Owen explained. "The shuttle is an historic object, so it has to be protected." Projection would also have exposed Atlantis' skin to near-constant UV light, which could have a deleterious long-term effect on it.

Audio

Perhaps it's true that, in space, no one can hear you scream, but audio is definitely used to enhance the Atlantis experience. QSC speakers and DSP form the backbone for the show's sound. However, although visually, the goal was a theatrical type of experience, the environment wasn't conducive to a typical multichannel surround-sound array.

Cabolis said that the specifications for a Dolby or DTS 7.1 system couldn't have been met in either of the main video rooms because of their scale and the constant movement of visitors. Instead, a point-source automated mix is done onsite through 24 QSC speakers placed every 20 feet above the crowd, time-aligned to arrive as the group moves through each of the three spaces. This is accomplished with an Out Board TiMax processor, which used a 3D map of the space to properly identify locations and objects in the TiMax processing GUI environment to enhance the experience by widening the acoustical sweet spot.

And no rocket launch would be complete—or certainly believable—without subwoofers. Four QSC KSUB dual-12-inch subs provide the LFE needed to make liftoff credible, placed above the screens in a center cluster in the middle space. Those subs complicated the design initially, however. "We didn't want to give the reveal away to visitors who were in the previous room, who would be able to hear the sound of the boosters igniting," said Cabolis. Acoustician Gary W. Siebein of Siebein Associates (siebeinacoustic.com) was brought in to apply treatments to keep the LFE contained within the Act 2 stage.

Act 3

Act 3 also features two additional theaters designed by Electrosonic. The Hubble Close-up Movie Wall uses two Barco F35 projectors to display images from the telescope. The International Space Station Micro Gravity Theater uses seven MultiTouch MultiTaction 55-inch touchscreens to access views of astronauts aboard the ISS, as well as a Laser Magic 5'x30' TransScreen translucent membrane as the projection surface for a pair of Christie 13,500 lumen projectors that create a holograph of the ISS.

There are several interactive stations in the Act 3 area, including the Crew Module AR and the Aft Fuselage AR, which consist of multi-axis movable pods with Itech 26-inch touchscreens, Innovox small USB-powered line array speakers, webcams and rotary encoders to feed position information to a PC. Electrosonic designed the EVA, or spacewalk, interactive, which features three Samsung 65-inch LCD screens with GestureTek Maestro 3D depth-sensing systems and an ASUS motion-sensing camera allowing visitors to trigger media.

Simulators provide visitors more interactive opportunities: Landing the Orbiter simulators comprise nine kiosks fitted with Samsung 40-inch displays, and Robotic Arm and Docking Station simulators consist of 12 separate kiosks each with a total of 24 Samsung 32-inch and four Viewsonic 19-inch displays. All of these additional displays are linked to their respective media services via fiber, due to the long run

Equipment

- 4 3M C2254PW multi-touch 22" touchscreens
- 8 7th Sense Delta HD AV servers
- 1 7th Sense Nano HD digital signage player
- 3 ASUS XTION PRO LIVE motion sensing cameras
- 1 ATS AE46S-354s 6 digit 4" LED Time clock w/serial control
- 16 Barco F32 1400x1050 DLP projectors
- 1 Barco F32 1920x1080 DLP projectors w/lens
- 6 Barco F35 WQXGA 6500 lumen DLP projectors
- 2 Behringer FBQ2496 audio DSP feedback suppressors
- 1 BSI AFL-08B 8" touchscreen
- 1 BSI- AFL-W15A 15" PC/monitor
- 1 Chief CMA105 4" ceiling plate
- 1 Chief CMS006S 6" extension column
- 1 Chief FHS110B flatpanel ceiling mount
- 1 Chief RPA091 mount
- 3 Christie WU12K-M 13,500 lumen 1920x1200 DLP projectors
- 12 Dell Precision T5600 high spec PCs
- 12 Dell T5600 medium spec PCs
- 8 Delta video distributors
- 1 Draper Onyx 20'x12½' front projection screen
- 6 ELO 1537I 15" touchscreen monitors
- 3 Extron Fox T UWP 302 AV input panels
- 1 Extron HAE-100 HDMI audio de-embedder
- 1 Extron MTP/HDMI UR twisted pair video receiver
- 2 Extron SW2 HDMI LC HDMI switches
- 1 Gefen EXT-AUD-1000 stereo audio balun extender
- 1 GestureTek GroundFX Interactive floor system 22'x16' w/server
- 3 GestureTek Maestro 3D 3D depth sensing for application manipulation w/source PCs
- 1 Gigaport HD+ USB multichannel audio card
- 3 Guitimer Buttkicker-Concert tactile transducers
- 22 Happ 95-0800-30K Joystick control interfaces
- 1 HP 1905-24 network switch
- 7 HP 2510-24G 24 port network switch
- 13 Icron USB 2.0 Ranger 2224 4-port multimode fiber 500m extenders
- 3 Imaging Source DFK 24BUC03 USB cameras
- 2 Innovox FP-V2 monitor mount line array speaker system
- 5 Innovox MLA-16 24" Microline arrays, 16 drivers
- 7 Innovox MLA-8 12" Microline array, 8 drivers, w/custom hardware for 6x1 array
- 38 Innovox MLA-8-USB self powered speakers
- 9 Innovox SL-2.1R custom rev. of SL2.1 low profile speaker w/mount
- 4 Innovox SLA-4.1-Slim custom array, 4x3½" wfr, 1x ribbon HF, 24"x4"x2"
- 8 I-Tech WOPW2600A2-TSAW 26" touchscreens w/DVI/USB, mount
- 8 JBL Control 47HC narrow-beam high ceiling speakers
- 3 JBL Control 47HC recessed speakers, 2-way
- 6 JBL Control 67 6½" pendant speakers

distances involved, Cabolis said. "We also wanted to use fiber to provide the ability to increase frame rate and resolution in the near future," he added. "There are some areas where Cat-class cables were used, but they were mostly for local area network demands, and in the under-300-foot range."

Just In Case

If Act 3 seems busy, it's on purpose, in the event it ever needs to become the only part of the exhibit available, if systems in the theaters were to fail. Cabolis pointed out that NASA and Delaware North, the hospitality company that manages the Atlantis exhibit, put a lot of faith in PGAV's and Electrosonic's designs, which he said are on a par with those found in the high-end theme parks that are less than an hour's drive away near Orlando rather than museums. That increased complexity puts an especially high premium on maintenance. If, for instance, any of the divider doors or screens between the anterooms were to fail, visitors would have to enter through the exhibit's gift shop, missing the carefully planned and executed emotional rich-media prelude.

"It wouldn't be the same experience," he said. "So, the equipment and design decisions required a very high degree of care and thought." It was an exhausting project but one that reaped its own rewards, earning the American Alliance of Museums' top Muse Award in the Multimedia Installations category, as well as Creativity International's Silver Award for Outstanding Creative Design, and the International Academy of Visual Arts' Communicator Award of Excellence. As they once used to say often over the intercom at nearby Cape Canaveral, "Mission accomplished." ■

Even before its background screen was installed, the shuttle Atlantis looks majestic.

4 K-array KT-20 speakers
1 Laser Magic TransScreen 5'x30' Holographic screen material
2 Level Mount ELDM tabletop mount LCD monitor mounts
2 Medialon SCM-MNG V5 Pro show controllers
9 Metalmaster mounts for projectors
3 Microsoft LifeCam USB cameras
1 Moxa ICF-1150 Series serial to fiber converters
33 Moxa IMC-101-M-C 10/100BaseT Ethernet MMF transceivers, standalone
22 Moxa IOLOGIKE 1211 USB to I/O interfaces
13 MultiTouch MultiTaction 55" displays
1 MultiTouch MultiTaction PC for up to 8 displays
8 Opticis M1-201DA RX fiber receivers
8 Opticis MT-201DA fiber receivers
1 Out Board TiMax processor
8 QSC AD-C42T 4" in-ceiling speakers
6 QSC AD-CI52ST recessed speaker, 2-way (1x5¼")
3 QSC AD-S282TH-BK surface-mount 2-way (2x8") speakers w/mount
12 QSC AD-S52 5¼" surface mount speakers
8 QSC AD-S52T 5¼" surface-mount speakers
13 QSC AD-S82 8" surface mounted 2 way speakers
4 QSC K12 2-way active 12" loudspeakers
10 QSC K8 2-way active 8" loudspeakers
4 QSC KSUB active dual 12" subwoofers
2 QSC PS-800H 8 button paging stations
2 Rane MLM42S mic/line mixers
1 RDL EZ-MX4L stereo audio mixer
48 Samsung 320MP-3 32" LCD display
2 Samsung 320TSn-3 32" LCD touch displays
1 Samsung 400TS-3 40" LCD single touch display
3 Samsung 650FP-2 65" 1080P LCD screens
2 Samsung BDP Blu-ray players
2 Samsung MD32C 32" LED monitors
12 Samsung ME40A 40" LCD/LED displays, 1080p
1 Samsung ME55A 55" LCD/LED display, 1080p
2 Sennheiser ew322 G3 wireless lav setup for presentation and field speech
1 SenSource Crowd Sensor system package (including PC)
2 Shuttle PC x350v3 mini PCs
24 SmartAVI FDX-3000 fiber receivers
16 SmartAVI FDX-3000R fiber receivers
11 Spinetix HMP200 HD digital signage players
5 Stewart Audio AV25-2 stereo power amps
1 Tapeswitch Safety Mat 12" round safety mat
14 US Digital CA-FC5-SH-MIC3-5 adapter cables
14 US Digital MA3 shaft encoders
14 US Digital QSB-S single-ended quadrature encoder interfaces
1 Videology 24C7.38USB USB cameras
3 Videology webcams
12 Viewsonic VA1931WM 19" LED monitors

List is edited from information supplied by Electrosonic.