

DEEP SPACE ADVENTURE

A REVOLUTIONARY WAY TO EXPLORE THE UNIVERSE LAUNCHED AT ADLER PLANETARIUM, CHICAGO IN JULY. KATHLEEN WHYMAN VENTURES INTO SPACE WITH THE TOP TEAM

PAUL KNAPPENBERGER
president



What was the inspiration for the project?

Adler Planetarium in Chicago, US was the first planetarium in the western hemisphere to open outside of Europe. Five years ago we celebrated its 75th anniversary. Rather than saying, "wow, look at all the stuff we've done in the last 75 years," we took the occasion to ask, "what should we be doing in the next 75 years to better serve the audiences that come to visit us?"

We thought it was time to significantly transform Adler back into the leading theatre in the world, which it was when it opened in the 1930s, and inspire people to want to explore space for themselves.

The result is the \$14m (£9m, €10.30m), 40-minute gallery and planetarium experience Deep Space Adventure.

What is Deep Space Adventure?

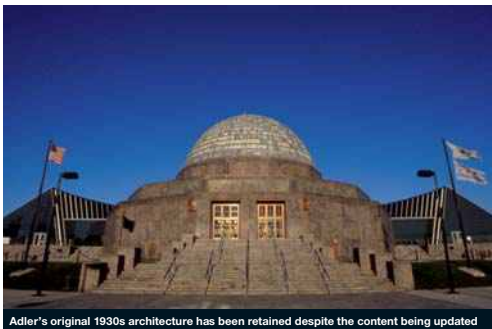
If anyone wants the experience of flying out to space, this is the only place in the world at the moment where you can see this.

The centrepiece is the Grainger Sky Theater, which presents a journey through the universe. Designed to resemble the observation deck of a star ship, visitors fly through space and visit unimaginably beautiful and strange things that are going on out there in the universe.

What's the Welcome gallery?

The Welcome Gallery is intended to get people to stop thinking about the traffic they had to encounter in the parking lot, and everything else that's in our day-to-day world, and begin to think about the vastness and mysteriousness of space.

There are no right angles in the gallery – all surfaces are curved. Embedded in



Adler's original 1930s architecture has been retained despite the content being updated

DESIGNED TO RESEMBLE THE OBSERVATION DECK OF A STAR SHIP, VISITORS FLY THROUGH SPACE AND VISIT UNIMAGINABLY BEAUTIFUL AND STRANGE THINGS THAT ARE OUT THERE IN THE UNIVERSE

those surfaces are four interactives, which offer ways of exploring space. We don't anticipate people being in there for more than 10 minutes before the gallery morphs into a pre-show experience. This causes a transformation within the room with lighting and video displays.

We have a very innovative way of moving people from the gallery into the theatre. They enter through a black hole – a space portal – and go down a long tunnel with pulsing lights. When they pop out at the other end they're in the new, huge theatre.

What's the content?

The Welcome Gallery's interactives help set the stage for how to explore space. In the theatre we selected some of the most

dramatic, celestial environments that we know about in space and fly people to them, so they can observe them.

We see a collision between two huge galaxies and watch the black hole that is the centre of our galaxy – the Milky Way – shred a star that's falling into it. Another we chose was a binary star where two stars orbit each other. One is a Red Giant, which is a huge, very bloated star and the other is a compact White Dwarf. Gas from the Red Giant streams out onto the surface of the White Dwarf and accumulates as fuel onto its surface. At a certain point, there's so much fuel that the White Dwarf explodes.

These are all very dramatic events that are going on in space. The visualisation for our dome is based on real data – these



(Main picture and left) the planetarium's film uses data-driven visualisation and is projected at the highest resolution ever attempted; (right) a tantalising glimpse into the futuristic Welcome Gallery



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aren't from artists' imaginations. We're using the world's largest super computer to create visualisations of data that scientists from NASA's Am Research Centre in California and the University of Illinois have collected from their studies. It's the closest to being in space you can get.

Has NASA's last shuttle flight had an impact?

It's really sad that the last shuttle flight's taken place and that America doesn't have another rocket that's capable of taking astronauts into space right now. NASA is working with the private sector to develop a variety of rockets that can take humans into space, but we're several years away from that being a reality. But when there's

only so much money available, do you keep spending it on the old technology [the shuttle] or do you start investing in the development of new technology? At some point you have to make that decision, and we're at that point. NASA has selected Adler to get one of the shuttle simulators from the last flight into space, so we're going to be installing that in the next year.

How have you kept the building's character while updating it?

We were very sensitive to the architecture of the original building. Adler sits at the end of a peninsula that juts out into Lake Michigan. It has the most spectacular view of the Chicago city skyline. It's a 12-sided building with the dome on top, so is very

distinctive. A new wing we built a few years ago is a light, glass structure that wraps halfway around the building. It's lower than the base of the dome, so it doesn't interfere with the original architecture.

What are the future plans for Adler?

We're working on how to display the space shuttle from NASA so visitors can experience a simulated space flight mission.

We're also considering building another wing. We have a very large collection of historical astronomical instruments, such as telescopes, sundials, and astrolights. It's the third largest collection in the world. We only have about 10 per cent of our collection on display so would like a larger facility to get more out on display. ▶



DOUG ROBERTS
chief technology officer



The Welcome Gallery's curved architecture has been designed to look otherworldly

What is the theatre's layout?

We want to give people the experience that they're on the deck of an intergalactic space ship and can see as much of space around them as is possible.

We had to stay within the existing architecture. Because the floor's flat the dome could only go so high because we had some interior infrastructure.

We've arranged the seats in a general curving arc in one direction, facing forward. Stadium seating is fine, but it disconnects guests from each other. On a flat surface you're always aware of people around you, as you have to look over their heads – that's what it's like watching the stars with a group of friends in your back yard. If we'd had more freedom, we may not have come to this solution, but it's fantastic.

The original theatre had an optical mechanical projector made by Zeiss, which had been designed in the 1920s. It gave the illusion of looking up through a well at the night sky. We've brought the dome to the floor, raised the floor and taken out the big projector in the centre of the room, so when you're in your chair facing forward, it really feels as though you're on the deck of a ship looking out to space – there's nothing in your way.

There's space for 220 chairs, but when we're not busy we'll take out some seats so only the best 120 centre seats are left.

What were the challenges?

A big part of the experience is the visual and the technology, which we had to create. We explored the option of motion floor or motion seats. Given our building's age, it wasn't clear how we'd get the hydraulics in, plus it would have cost a lot to reinforce the floor. We decided instead to use audio and have the best visuals of any theatre in the world. Anyone can have high resolution by getting together enough projectors and adding up enough pixels to be the biggest in the world. But it needs to be done in a way where it feels like one seamless image, and you want to produce the night sky as accurately as possible.

If you have projectors that aren't true black, you start having edge overlaps. If you've got 20 projectors, then the entire dome is edge overlaps with twice the brightness on the overlap parts. The way you fix that is by increasing the brightness on the non-overlap parts. Then you've basically taken a black sky and turned it grey to make things uniform. That's a compromise that breaks the illusion of outer space.

We use 20 projectors called Zorros. They're expensive, but are designed to be run 24/7, so are very reliable and configurable and really make true blacks. Those 20 projectors are outside of the dome and project through portholes up onto the dome. The computers stitch the edges of

those images together so it appears as though a single image is being projected.

The illusion is much stronger than any other planetarium that any of our team has ever seen before – it really does feel as though you're in a space.

What film is shown?

The film is *The Searcher*. It's the most ambitious planetarium show that's ever been created because it's being done at the highest resolution.

Running for 23 minutes, it tells the story of an alien that's billions of years old. It leaves its home galaxy to travel, but when it returns, its home has been combined with another galaxy. Its people have gone, so it has to find out where they are.

It sounds simple, but it's a very complicated presentation as it uses a tremendous number of data-driven visualisation. Artists and scientists have worked together to turn that data set into something on screen that looks like, for example, two galaxies fighting. We have a tremendous number of sequences that are using these data sets. We have to render them all out at 8K resolution, which is four times more than the traditional 4K system. Until recently a 4K system was considered ambitious, so going four higher is a pretty big deal.

We'll update the film every 18 months. The show is meant to be an engaging, inspiring experience. We're not making it so factual it goes over the heads of kids or too basic that it bores adults. We aim to inspire people so they then go on to other areas of the planetarium to learn more. ▶

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(Top left and main picture) the Welcome Gallery and the wormhole that leads visitors into the Grainger Sky Theater; (inset) *The Searchers*

MARK WEBB theaters manager



What are the dimensions?

The Grainger Sky Theater is a 70ft (21m) diameter dome space. It's 190 degrees, so a little more than a hemisphere. The floor is raised and there are 400 LED lights embedded in the floor underneath that shine up through little plastic lenses, so we can do lighting effects on the floor as well as on the dome as people enter.

At the edge of the floor, between the audience area and the dome screen, there's a 3ft (1m)-high barrier wall that acts as an artificial horizon and takes away some of the depth clues of how far away the screen is once the movie starts.

The projection system's single image is created from projectors which are running at 1,500 x 2,000 resolution.

How have you used light and sound?

Behind the horizon wall that goes around the perimeter there are 40 LED Philips colour burst fixtures that are programmable to create a dome wash effect. We can also use the projection system to create

effects as people enter the theatre. A fibre optic system goes around the base of the perimeter wall. During the course of the show it's kept on at an extremely low level so people can see where the aisle is in the dark in case they need to leave. It's on at full brightness when they enter and adds to the general atmosphere.

A spherical space is a hard environment to deal with acoustically. We've got 16 channels of audio that completely envelop the space, designed by Meyers Sound.

How does the dome screen work?

Designed and manufactured by Spitz in Pennsylvania, it's called a nano screen. The panels of the dome screen are fitted by hand next to each other, so under projection conditions it's absolutely seamless. There's no interruption of the image by the screen itself, which is new for planetariums. Before, whenever you'd put a bright scene up, the seams of the dome would become immediately apparent. But with this one, they're truly invisible.

I'm just blown away by the quality of the image we're achieving here. It's the first time I've ever seen one of these systems and every time I see new material on it I'm amazed again by how spectacular it looks.

ALAN CASKEY director for the Americas, Global Immersion



What work did you do?

As the technology vendor, we worked with the key stakeholders at Adler to build a consensus of what the visitor experience should be, which fitted in with their vision, and then turned that vision into reality.

We designed and installed the hardware and software throughout the dome. Partners we worked with include: Rockwell Collins for the Zorro projectors; SCISS for the Uniview – science and astronomy visualisation software; and Spitz for the screen.

How does it work?

In the theatre, the screen orientation, projector array and content combine to give the feeling of flying through the (digital) universe. This is achieved by combining the image output of ultra-high resolution Zorro projectors to create an astonishing 64 megapixel video display. The unique 'hyper array' configuration features custom-built lenses and puts out enough contrast and resolution to compete with the

"COMBINED WITH THE DIFFERENT LEVELS OF BRIGHTNESS, SIZE AND SPEED OF OBJECTS, IT MAKES YOU BELIEVE YOU'RE SEEING 3D STEREO"



The theatre's dome has been brought down to below floor level so visitors have a clear view ahead of them into the depths of space

contrast and clarity of a starball, while benefiting from the advantages of being digital. We call it the world's first digital starball.

All these projectors are wired up to our media server solution which feeds the dome with real-time and playback media. It features 46 separate computers that, when combined, have a storage capacity of over 260 terabytes. This back end system configuration uses 42 NVIDIA Quadro FX4800 graphics cards, which produce unprecedented graphics processing power.

In between, we programmed iPads, control desks, PCs, lighting, audio, projector blending technology and a whole lot more.

These theatres constitute some of the most hi-tech places in the world, but most visitors don't see or realise the level of hardware that goes on behind the scenes. It's all invisible!

How can visitors get a 3D experience without glasses?

The black background of the night sky and the ultra high contrast means that space objects, including stars, appear very well defined and jump out of the black sky.

Combined with the different levels of brightness, size and speed of objects, it makes you believe you're seeing 3D stereo.

THOMAS ROSZAK architect



What's the design?

The gallery is designed to represent slices of time and space. Using double and single layers of fabric we created a curving canvas for the displays, which turn and twist, just like space does in real life.

We used an aluminum structure and pulled fabric tightly over it to create soft, curvilinear shapes. I hid the structure everywhere apart from the wormhole where I let the bones show so it's the opposite of the rest of the gallery.

We created some ellipsoids and cut them into shapes that people can walk through. I wanted them to be otherworldly.

The lighting changes constantly. There are literally a million variations of this and it adjusts very subtly, so visitors don't really notice it changing.

What fabric did you use?

The fabric had to be translucent to allow the LED lights behind it to glow through. It also had to reflect light because media educational content is displayed onto

certain walls. There are infrared sensor displays behind the fabric so when someone comes up to the wall the content changes.

What were the challenges?

Most people are used to building with plaster, steel, concrete and glass. Here the materials were very different - most people haven't worked with aluminum. Plus, the fabric was vast, it was almost like sewing an enormous dress. There were dozens of seamstresses working on it, initially in the factory but then on site doing final fittings.

How can the gallery be developed?

The media content can be changed and different things displayed from the same projectors, so the operators can easily update the show. They didn't want to be tied into something that needed hard construction and a lot of money to update. This way they can spend the money on the media content and education. ●