Computer Graphics for Large-Scale Immersive Theaters

Fulldome Showcase

Course # 25
Fulldome Production Showcase

We are proud to present, for the first time ever, the SIGGRAPH Fulldome Video Production Showcase. We have invited a sampling of the world’s best and most interesting digital dome artists and students to present and discuss their work at the Reuben H. Fleet Science Center’s IMAX® Dome Theater. The theater has been fitted with a temporary fulldome video display system provided by Spitz, Inc. and participating vendors (DVS Digital Video, Elumens Corp., and JVC Americas Corp.). It is our hope that this event, in time, becomes an annual SIGGRAPH tradition.

This year not only celebrates the 30th annual SIGGRAPH conference, but also commemorates the 30th anniversary of the first Omnimax® theater (now called IMAX Dome). The Reuben H. Fleet Science Center was actually the birthplace of the first large-format domed theater [1]. This first Omnimax project was complemented by a new theater design featuring the first tilted hypo-hemispheric dome screen. It also included a Spitz STS star projector, requiring a large projection pit in the center of the room. This pit made the placement of our fulldome projection system possible.

It is synchronistic that the Fulldome Production Showcase debuts the birth of a new medium to the SIGGRAPH community on this 30th anniversary of Omnimax – in the very theater where Omnimax was created – led by Spitz, a company that was integral to the unique San Diego theater design, and that manufactured and installed the original projection screen. We take this as a good omen for the future of this exciting new fulldome medium.

Unlike large-format film, digital dome theaters are a highly accessible medium. While 70mm film costs around $2000/minute simply to develop, fulldome productions can be produced on a desktop computer by anyone with animation know-how and a little patience for rendering large frames. Never before has such a powerful medium been accessible to such a broad user base.

We also recognize that this is the 20th anniversary of Nelson Max’s Call for Omnimax Films at SIGGRAPH ’83 [2]. Max developed and published the mathematical foundations for rendering to the Omnimax format while working at Lawrence Livermore National Labs. The following year featured animations produced by the SIGGRAPH community at the Science Museum of Minnesota in St. Paul. This ambitious project featured twenty sequences edited into a film called The Magic Egg [3].

Interestingly, the present fulldome projection system employs the highest resolution video projectors in the world, with 2048x1536 native resolution. Yet this scantly exceeds
The Magic Egg’s original 1732x1280 resolution – produced using 1984 technology! Of course, ultra high-end fulldome theaters are now pumping 4000x4000 pixel frames onto the dome screen using multi-projector edge-blended displays. The complexity of such systems unfortunately prohibits their use in a temporary installation such as this. Please keep in mind that many of these fulldome productions are being screened at less than 4 times their originally intended viewing resolution.

All Fulldome Showcase productions were produced using a 1536x1536 pixel polar fisheye frame called a dome master. These frames are played back uncompressed from a hard drive player and are fed to the QXGA resolution projector. Dual playback and projection systems are employed to achieve sufficient brightness for the Fleet’s 23 meter dome screen. Even with a dual projection system, the image brightness cannot compete with the Omnimax medium, which outshines even the brightest multi-projector digital dome systems. Video projection must advance yet another generation before it begins to compete with the full image quality of large-format film.

Our presentations are also complemented by the Fleet’s original 6.1 audio system. This configuration is similar to standard 5.1 audio with the addition of an overhead “zenith” channel.

We believe that the creativity and expertise of our fulldome producers shines brightly despite any technical limitations of our medium when compared to film. As a new medium, fulldome video is ripe for exploration. We invite you to explore with us as we pioneer new storytelling devices, special effects, artistic environments and more.

In the following pages we present a brief overview of the presenters, their productions, and their production teams. Additional material submitted by producers can be found in the appendix section entitled Fulldome Producers. Enjoy.


LodeStar Astronomy Center, Univ. of New Mexico - David Beining

LodeStar’s theater presentation will include sights and sounds created through various programs of fulldome experimentation and exploitation, including:

1. **Sequences created through UNM courses and personal efforts from students such as:**
   - Aaron Romero
   - Marcos Baca
   - Marty Martinez
   - Mark Nava
   - Keith Baca
   - Rudy Martinez

2. **Faculty leadership and instruction provided by:**
   - Ed Angel, Computer Science & Arts Technology Center
   - Bryan Konefsky, Media Arts
   - Mary Tsongias, Media Arts
   - Danae Falliers, Arts Technology Center

3. **Experimental art will be presented by such artists as:**
   - LA-based artist Gronk, with Hue Walker – through the Arts Technology artist-in-residence program
   - UC-Berkeley faculty Greg Neimeyer & Stanford University’s Chris Chafe – also through the Arts Technology artist-in-residence program
   - Santa Fe-based composer Michael Stearns (Earth Turtle Studio) and light sculptor Gregg Stephens (Gregg Stephens Design) – independent works

The demo will also include the first work by GRONK, with Hue Walker and music by Joseph Julian Gonzales. Their work [a detail is left] is also part of the ATC residency program. GRONK is widely known for a thought provoking body of expressionistic work, which includes painting, performance, photography, video and installations. GRONK is probably best known for his large scale, on-site mural pieces that he paints in front of an audience. The process of painting the mural therefore becomes a performance where the audience gets to watch the process involved in its creation. GRONK’s already moved on to new expressions for the dome which we eagerly await.
4. Personal and show-based productions by UNM instructors such as:

- Hue Walker, Media Arts, Computer Science & Digital Pueblo Project
- Sheryl Hurley, Computer Science & High Performance Computing Research & Education Center
- Chris Jordan, Computer Science & High Performance Computing Research & Education Center

A domemaster from Hue’s art for the dome. Her demo will be accompanied by a Michael Stearns.

A domemaster from a 8-minute sequence created by UNM animation instructors Sheryl Hurley, Chris Jordan, and Hue Walker. They created the 2/3D animation entirely on their own time and initiative. Their reward? Many thanks and some pizza and beer from the under-funded L*. score.

Work by theater manager Laurel Ladwig featuring the planet Jupiter.
LodeStar Astronomy Center, Univ. of New Mexico - David Beining

5. Work for-and-by LodeStar’s mission and shows by Planetarium Manager Laurel Ladwig.

6. Digital Pueblo Project: First work of the community-training program for fulldome production

Funded by the National Science Foundation, the Digital Pueblo Project is an economic development initiative provide digital arts training to community members from all walks of life. Through a mentorship program, participants learn by working on real-world projects, including television and big screen movies and, of course, the giant screens of fulldome theaters. The LodeStar demo will include the first voyage into fulldome production by the first group of Digital Pueblo participants.
Spitz Creative Media - Brad Thompson and Mike Bruno

The Spitz Creative Media team consists of four full-time animators and producers who create programs and custom animations for the dome screen. The team also distributes third-party shows, and partners with outside producers on joint projects. Spitz’s Creative Media team specializes in creative storytelling in immersive format. Spitz is proud to present this sampling of their latest work.

**DarkStar Adventure** is a sci-fi story with an educational twist for kids of all ages. After spending three years at her father’s astronomy research station on a dusty, dying planet, Subrah, a teenager with a penchant for mischief, is excited about going home – and not a moment too soon. The planet’s sun is about to explode and it’s time to evacuate. When a technical glitch causes the family’s escape pod to launch without her, excitement turns to despair and Subrah is faced with the biggest challenge of her life – making her own getaway and returning safely home again. Join Subrah, and her robot helper Sweeps, on an unforgettable voyage of discovery. You’ll witness the awesome power of a supernova, explore the heart of a gaseous nebula, visit exotic pulsars and feel the death-grip of a massive black hole!

**Oasis In Space** takes you on a startling and beautiful journey through our Solar System and beyond in search of water and water worlds like Earth. Incorporating the latest results of astronomical research and exploration, including recent data from robot explorers, **Oasis In Space** offers a new perspective on a substance of obvious importance to our planet. **Oasis In Space** is the first in a series of immersive video programs for Spitz’s ElectricSky® theaters to be entirely produced using original 3D computer animation. With a proven, audience-tested story, visually immersive imagery and an original surround-sound musical score, **Oasis In Space** will inform, delight and entertain viewers of all ages.
Spitz Creative Media - Brad Thompson and Mike Bruno

Subrah is left behind in *Dark Star Adventure*

**Scenes from *Oasis in Space***:

- Asteroid Belt
- Nebula
There are stories in the stars, and there are those destined to become legends. *Legends of the Night Sky: Orion* takes a light-hearted and imaginative look at the myths and stories associated with the constellation *Orion*, the great hunter of the winter sky. Produced in high-resolution, fulldome immersive video format, *Orion* breaks new creative ground through the fusion of traditional 2D cel-animated characters and 3D computer graphic environments. *Orion* was produced in partnership with Audio Visual Imagineering. Narrated by Aesop the owl and Socrates the mouse, two wonderful characters who enliven the tale with humor and wit, and set to an original surround-sound musical score, *Orion* will delight anyone who enjoys cartoons and a good story.
Houston Museum of Natural Science – Carolyn Sumners

The Houston Museum of Natural Science opened a large format digital theater in its Burke Baker Planetarium in December, 1998. In over four and a half years of operation, the planetarium has seen a dramatic increase in visitors to accompany the increased educational and entertainment value of planetarium programs. This presentation illustrates new storytelling imagery developed with 3D Studio Max and futuristic spacecraft created in LightWave. For exploring alien worlds, Bryce artists paint the dome in glowing colors. The presenter will also show how this immersive imagery has unique and measurable educational value.

Scenes Rendered for Titanic:

Radio Room

Night Bridge
Houston Museum of Natural Science – Carolyn Sumners

Scenes from *Alien Oceans: Dharmok's Gate*
Home Run Pictures - Tom Casey

Home Run Pictures has been involved in creating content for over 10 years to varied clients worldwide. This demo is a collection of various all-dome content we have produced over the past several years. Some sequences are shown as complete scenes while others are clips from longer works.

TITLE: "Titanic"
PRODUCTION COMPANY: Home Run Pictures
PRODUCED FOR: Houston Museum of Natural History
PRODUCER: Carolyn Sumners
DIRECTOR: Tom Casey
ANIMATION: Tom Nypaver, Desiree Roy, Gerry Wagner

DESCRIPTION: "The Night of the Titanic" is an immersive presentation employing a fulldome projection format... utilizing multiple video projectors to completely fill a planetarium style dome with seamless imagery... the audience is treated to a "you are there" style drama, just as if they were one of the survivors in the Titanic's few lifeboats... the immersive all-dome view no longer limits the viewer to looking at a traditional screen's "framed" view, but enables you to look left, right, up... all around at the imagery created by the dome's 360x180 degree surface. In one scene, the audience is transported two miles down to the bottom of the ocean where the wreck of the Titanic now sits... the viewer is immersed in the cold, secluded underwater environment... only the handful of people who have gone down in the few submersibles that can dive this deep have had the experience of seeing the Titanic were she now rests... in a fulldome theater, it's just like you are there... as the popular story is retold, the audience is given panoramic views of the last two hours of the famous liner's life... just as if they were one of the few survivors seeing it from one of those lifeboats.

TITLE: "Microcosm: The Adventure Within"
PRODUCTION COMPANY: Home Run Pictures
PRODUCED FOR: Evans & Sutherland Digital Theater
COPRODUCERS: Michael Daut (E&S), Tom Casey (Home Run)
DIRECTOR: Tom Casey
ANIMATION: Tom Nypaver, Desiree Roy, Gerry Wagner
DESCRIPTION: "Microcosm: The Adventure Within" is an immersive presentation employing a full-dome projection format utilizing multiple video projectors to completely fill a planetarium style dome with imagery... resulting in the audience being immersed in our sci-fi styled story where a miniaturized sub, Alpha, is injected into a patient to seek out a stubborn infection and combat the nasty virus. The format allows the audience to go with the sub's crew and its humorous artificial intelligent-ROV, Scout, into the human body like never before... no longer looking at a traditional screen's "framed" view, but able to look left, right, up... all around as if they were actually sitting in the environment created by the dome's surface... imagine the excitement of riding along on the trip... the imagery projected on a 60+ foot 360x180 degree screen complete with surround sound audio effects.

**Title:** "Big Bang"
**Production Company:** Home Run Pictures
**Produced For:** Houston Museum of Natural Science
**Producer:** Carolyn Sumners
**Director:** Tom Casey
**Animation:** Tom Nypaver, Desiree Roy, Gerry Wagner

DESCRIPTION: As part of their new Galileo's Legacy show, the Houston Museum of Natural Science's Burke Baker Planetarium asked Home Run Pictures to create a two minute sequence of the history of the universe from the Big Bang to present time. Nobel laureate Steven Weinberg was the consulting expert for the scientific theory. The sequence is in the new fulldome format where multiple HD video projectors are used to completely fill the dome and give the audience the feel of actually being in the scene... able to look right, left, forward, even behind for a truly immersive experience.
TITLE: "Wild Ride – Canyon/Thunderstorm"

PRODUCTION COMPANY: Home Run Pictures

PRODUCED FOR: Houston Museum of Natural Science

PRODUCER: Carolyn Sumners

DIRECTOR: Tom Casey

ANIMATION: Tom Nypaver, Gerry Wagner

DESCRIPTION: The final closing sequence in the HMNS Burke Baker Planetarium show "Earth's Wild Ride" is a fast roller coaster ride down a canyon during a torrential thunderstorm. If you would like to experience the need to grab onto your chair during an immersive fulldome show, this one's for you. The motion is designed to give the audience the thrill of flying down a canyon with a rapidly moving river just inches below their view. Near misses of lightning, falling trees, landslides, diving through tunnels, full 360 pitches and eventually a plummet over a waterfall all are part of this sequence.
TITLE: "Dinosaurs"
PRODUCTION COMPANY: Home Run Pictures
PRODUCED FOR: Houston Museum of Natural Science
PRODUCER: Carolyn Sumners
DIRECTOR: Tom Casey
ANIMATION: Desiree Roy, Gerry Wagner

DESCRIPTION: The Earth long ago was ruled by giant creatures... the fulldome format allows the audience to experience these animals close up and life sized Eke never before. "Imagine standing just under the belly of a stalking Tyrannosaurus as he hides just out of sight of a herd of Hadrosaurs and then bursts out to attack. Or walking with a herd of saurapods, their long necks towering high above your view. Or moving rapidly through the low lying plant life with a small group of Velociraptors chasing a Gallimimus. Or experiencing the hatching of a baby Maisaura from inside its egg..."
DESCRIPTION: The Ice Age... early men created paintings of these large mammals... our story begins in a cave where the artists depicted scenes form their daily lives and morphs into a herd of mammoths in a blinding snowstorm during a colder time in the Earth's history. The scenes required massive amounts of render horsepower to faithfully depict the "Furry" creatures in the fulldome format.
E&S Productions – Kevin Scott

Evans & Sutherland offers the largest library of complete immersive theater programs in the world. These programs have been produced in conjunction with some of the most talented artists and designers in the field. Our presentation consists of a short series of trailers and a preview of upcoming programs.

- Digistar 3 Introduction and Titles

- Evans & Sutherland Show Trailers – Now Available
  - Wonders of the Universe
    - Produced by Evans & Sutherland
    - Visuals by Donald R. Davis
  - New Horizons
    - Produced by Evans & Sutherland
    - Visuals by Donald R. Davis
  - Microcosm
    - Produced by Evans & Sutherland
    - Visuals by Home Run Pictures
  - Cosmic Safari
    - Produced by Evans & Sutherland
    - Visuals by Donald R. Davis

- Evans & Sutherland Show Trailers – Coming Soon
  - Universe
    - Produced by Evans & Sutherland
    - Visuals by Donald R. Davis
  - Force 5
    - Produced by the Houston Museum of Natural Science
    - Visuals by Sybilmedia
  - Titanic – The Science of the Sinking
    - Produced by the Houston Museum of Natural Science
    - Visuals by HMNS and Home Run Pictures

- Special Preview of Evans & Sutherland’s Latest Show
  - Stars of the Pharaohs
    - Produced by Evans & Sutherland
    - Visuals by Evans & Sutherland and Donald R. Davis

- Digistar 3 Closing Titles
Don Davis is an astronomical artist who got his start working on some of the first modern lunar maps with the United States Geological Survey. His attention to detail is recognized by his fellow artists. He has also contributed to books and films, including the PBS series Cosmos. Recently the Minor Planet Center of the International Astronomical Union named an asteroid after Mr. Davis for his contribution to the field of astronomical visualization.
Scene from *Stars of the Pharaohs*
Drexel University and amalgamation house, Inc. - Ted Artz

Motion Graphics for Single-Projection Full-Dome Immersive Theaters

Director-Animator: Theo. A. Artz
Co-director-Animators: Max Callahan, Christopher P. Redmann
Student Animators: John A. Wasong, Jasper Zhineng Zhang, David Abrams
Original Music Composition: John Avarese

Our collective submissions to this course are an eclectic assemblage of computer-generated visuals; vignettes representative of our experimental investigations of the nascent forms of Full Dome immersive storytelling. Within our assemblage are varied levels of production fulfillment and visual refinement. It may be worthy to note (as part of the “experimental” side of things): our intention here is to “play” with full-dome projection’s unique features, whilst “pushing about” an emerging set of spatial/motion/environment concerns and visual/perceptual effects intrinsically appropriate to this burgeoning medium. As creative content producers we are exploring these new visual domains in hopes of helping to define full-dome’s theatrically expanded ranges of audience engagement, communication, and enjoyment.
Drexel University and amalgamation house, Inc. - Ted Artz
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Theo. A. Artz, Assistant Professor
Drexel University
College of Media Arts and Design
Philadelphia, PA, USA

Theo. A. Artz has been designing and producing visual effects and animations for film and broadcast video since 1979. In 1984, he founded a Philadelphia-based production facility, amalgamation house, Inc., and has been involved in the development and application of several emergent media technologies (CD-Interactive, desktop paint and image processing software, Spitz, Inc.’s ElectricSky®, and SciDome™). In 2000, Artz was recruited into an Assistant Professorship on the faculty of Drexel University’s College of Media Arts and Design, where he leads courses in computer animation, visual effects, and media theory. Currently, his time is split between teaching and continuing production of “Piggy’s Predicament” – a suite of speculative fiction media properties based on a logic-looped story that interweaves movie-making and game development with state-of-the-art visual effects.

Christopher Redmann, Instructor
Drexel University
College of Media Arts and Design
Philadelphia, PA, USA

Christopher Redmann is a faculty member of the Department of Media Arts at Drexel University, in the Digital Media Program. Christopher teaches undergraduate courses in 3-D modeling and animation, as well as digital compositing. He has completed several multimedia exhibits including elements for the "Out of the Ordinary" retrospective at the Philadelphia Museum of Art. Further avenues of study include graphical datascapes for real-time medical imaging and physically interactive animation. Christopher completed his undergraduate education at the University of Virginia and pursued his graduate studies at the University of Pennsylvania, where his thesis focused on the possibilities of using real-time animation as a tool for architectural design.

Max Callahan, Lead Character Animator
amalgamation house, Inc.
Philadelphia, PA, USA

Max Callahan has worked in various capacities in both the live-action and computer-generated film industries. After earning a degree in art and film at Penn State University, Max began his career in Los Angeles as an art director and storyboard artist for independent films, music videos and commercials. Currently, he works as the character designer at amalgamation house, inc. in Philadelphia, and as an instructor at Drexel University’s College of Media Arts and Design, where he teaches courses in 3D character animation, storyboarding and figure drawing.
Clark Planetarium, Salt Lake City - Mike Murray

The Sheila M. Clark Planetarium opened in April 2003 with a 55 ft. diameter dome theater and the world’s first “pitless” Evans & Sutherland Digistar 3 planetarium projection system. The Clark Planetarium is a relocation of the former Hansen planetarium, which had a long history of planetarium programming excellence. We continue this tradition with all new full dome video productions.

**Secret of the Cardboard Rocket.** The most popular program we've ever presented is completely re-produced for our new digital theater. Two children build a rocket out of a refrigerator box and take a fantastic journey through the solar system with the help of a magical book and vivid imaginations.

**Ultimate Universe.** The first Feature Show to open in the new star theatre of the Clark Planetarium will utilize Digistar 3 to take audiences on a tour of the universe with unprecedented detail and realism. “The Ultimate Universe” is a totally immersive 3-dimensional voyage through space and time witnessing some of the most provocative wonders of the cosmos.

**Cosmic Light Shows.** The latest in computer animation technology hits the dome in this immersive thrill ride set to the hits of
Sky-Skan Productions - Steve Savage, Jack White and David Miller

Compositing many forms of multimedia into a fulldome playback production, presenters discuss the need for tools, and Sky-Skan’s solutions. Presenters discuss the future of real-time presentations and how these multimedia shows can be assembled in real-time.

Sky-Skan, Inc. and the National Air and Space Museum, have combined efforts to create a 20-minute immersive experience for the fulldome SkyVision system, elegantly narrated by actor Laurence Fishburne (“The Matrix”).

*Infinity Express* takes the audience on an exciting journey of discovery, from the search of the solar system to the mapping of the Universe. Some of the best space visualization agencies from around the world including, the Space Telescope Science Institute and the Centre for Astrophysics and Supercomputing at Swinburne University of Technology, contributed to the production, interpreting the script developed between the writer and experts from the Smithsonian Institutions, National Air and Space Museum.

*Infinity Express* is currently playing in Planetaria worldwide, including Museum of Transportation and Communication, Lucerne, Switzerland; Galileo Planetarium, Montpellier, France; Lodestar Astronomy Center, Albuquerque, USA; Challenger Science Center, Florida, USA; the Burke-Baker Planetarium, Texas, USA; and soon to be cruising over the Atlantic Ocean on the Queen Mary 2, Cunard Line, the Most Famous Ocean Liners in the World.

**Images from Infinity Express:**

- Shuttle Launch
- Data Storm
Sky-Skan Productions - Steve Savage, Jack White and David Miller

**Ancient Astronomy from *Infinity Express***

Images from Production Demos:

- **Stonehenge**
- **International Space Station**
Sky-Skan Productions - Steve Savage, Jack White and David Miller

Steven T. Savage – Executive Producer: Steven T. Savage is President and Owner of Sky-Skan, Inc. His company is a leading designer and worldwide supplier of audio and video projection, automation and control systems, special effects, and interactive audience response systems for planetaria and domed theaters in museums, theme parks, universities, schools and EXPO's.

Steve received his Bachelor's in Electrical Engineering Technology from Northeastern University in 1977, and has over 30 years of experience in the planetarium field. He began his work in the planetarium field while still in high school at the Strasenburgh Planetarium in Rochester, New York. He continued to gain experience and knowledge about planetaria during college through work at the Hayden Planetarium in Boston, and after college at the Davis Planetarium in Baltimore, Maryland.

Since assuming his position as President of Sky-Skan in 1985, his company has grown from three employees to over thirty. Sky-Skan has expanded from its origins as a manufacturer of optical special effects projectors to become a leading provider of audio, show control, and turnkey multimedia performance systems for domed theaters. Sky-Skan has pioneered the use of video and computer graphics in hemispheric theaters. The SkyVision All-Dome Video System, which debuted at the International Planetarium Conference in London in 1998, has been a defining factor in the development of full dome video production, and SkyVision systems are now installed in 17 locations around the globe.

Jack White – Producer / Director: Jack White came to planetarium production at a critical time. After 15 years producing and directing documentaries for television, Full-Dome video was emerging and Jack was presented with an amazing opportunity - motion picture was coming to the dome theatres on a grand scale. Jack’s recent work includes Infinity Express for the Smithsonian and currently is completing a surround sound mix in Germany for a US fulldome production. Jack is the former Director of the Melbourne Planetarium and recipient of many international awards for his work in television.

David Miller – Animator: While studying engineering at the University of Maryland, David decided to take a different direction with his life. An about face into the world of art. This decision took him to study at the Art Institute of Pittsburgh where he received both traditional and digital art training and obtained a Associates Degree in Computer Animation. Whilst studying at the Art Institute, David was brought in to work on the "Brain Project" where he was exposed to the world of full dome production. After graduating from the Art Institute in the summer of 2000, David joined the Graphics Production Department at Sky-Skan as Lead Graphic Artist. David has been pivotal in the development of 3D DigitalSky and Sky-Skan’s SkySuite production tools.