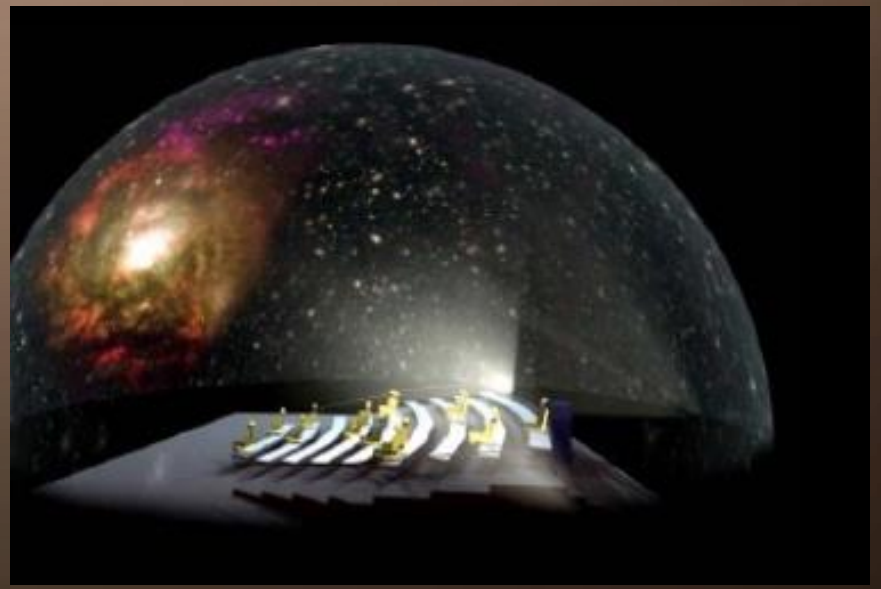
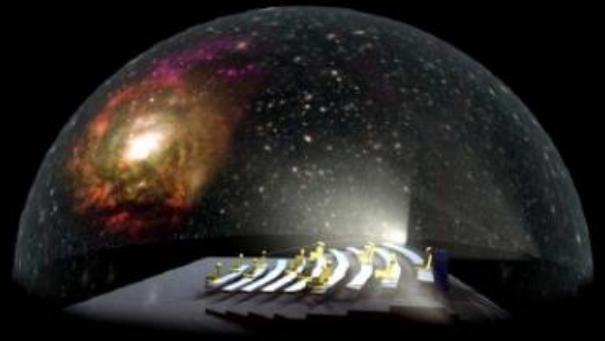
DIGITÁLNÍ ÉRA, „FULLDOME“ PROJEKCE



Fulldome 101:
Part 1 - Introduction to Fulldome Theaters



Ed Lantz

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Vortex Immersion Media, Inc.

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Chadds Ford, PA 19317

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www.vorteximmersion.com

www.visualbandwidth.com

VISUAL BANDWIDTH

VORTEX IMMERSION MEDIA

Digital Dome or "Fulldome" Theatre

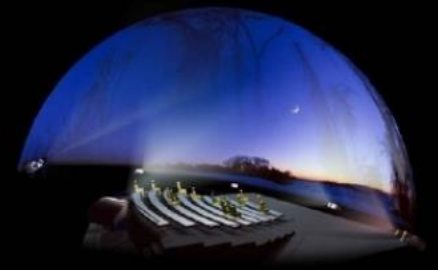
Large-scale, real-time interactive group immersive environments

- Large-format immersive cinema
- Real-time digital planetarium & visualization
- Multi-use auditorium and performance space

Image courtesy Spitz, Inc.

Fulldome Theaters

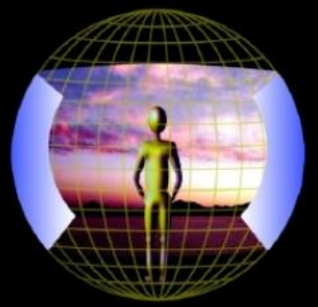
- Science Centers, Planetariums, Theme Parks
- Real-time interactive storytelling
- Group interactivity, interactive performances
- Used to convey a scientific world view
  - Cosmology & our place in the universe
  - Earth science and climate change
- SciArt
  - Sense of beauty, awe
  - "Overview Effect"



A New Medium!

- It's Video, Not Film
  - End-to-end 4k x 4k digital productions
- Relatively Affordable Productions are Possible
  - Live action 4k solutions emerging!
  - Animation with desktop tools
  - Spherical compositing tools available
  - Real-time interactive navigation
- Independent Productions
  - Experimentation by students
- "Cinema of the Future"

Immersive Display

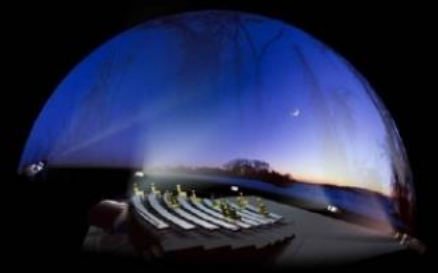


Visual Display with Simultaneous High Resolution and Wide Field-of- View

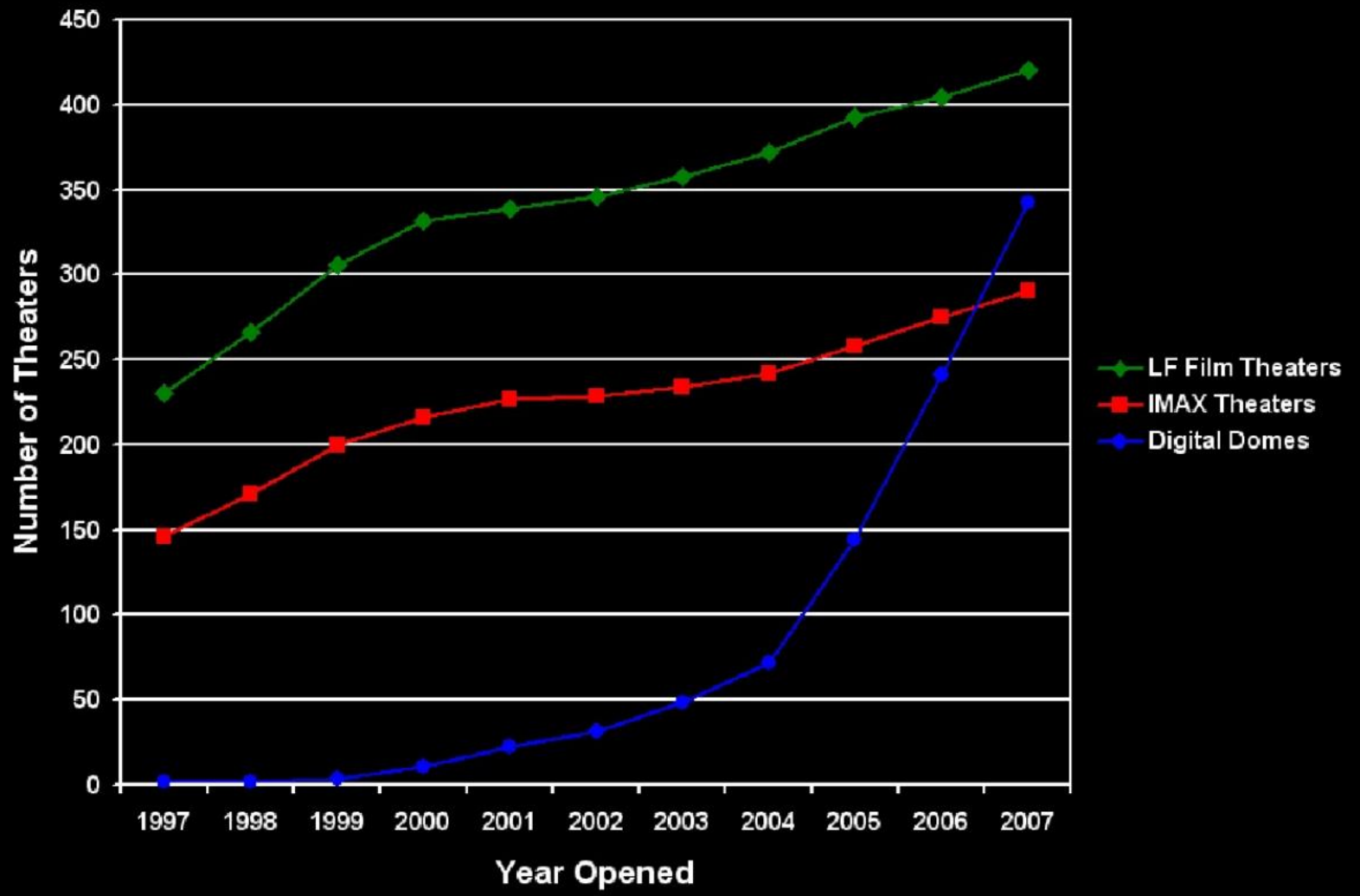
- Excites Nearly the Entire Retina
- Strong Sense of Presence
- Invokes Opto-Vestibular Response in Brain
  - Thrill-ride or cybersickness possible
- Horizontal FOV >140°, Vertical FOV >40°

Fulldome Theater Breakdown

- 385 Theaters Worldwide
  - Half in U.S.
  - 32% are in Museums & Science Centers (US)
  - 22% are in School Districts (US)
  - 15+ million annual attendance
- 54% are Single-Lens Fisheye Systems
- Over 3000 Planetariums Worldwide
  - 110 million annual attendance
- Over 80 Show Titles



Fulldome Theaters Worldwide



Advanced Fulldome Theater

Real-Time Live-Action
- Telecasting, Telepresence
- Virtual Sets
- Live Performance
- Networked Video Feeds

Real-Time 3D
- Games
- Virtual Sets
- Virtual Characters & Worlds
- Dataset Visualization & GIS

Pre-Rendered
- 3D Animation
- Live Action

Aux Video
- PowerPoint
- User Feeds

Live Spherical
Mixing
Compositing
Keying
SFX

Display
Processing

Pre-Rendered Workflow

Narration
Music & Audio

Digital Live-Action
Recording

Pre-Rendered
3D Animation

Stock Video
2D Content

Spherical Editing,
Compositing & SFX

Colour Correction
Audio & Dome
Mastering

Distribution

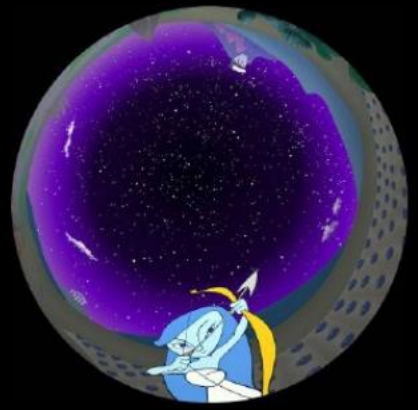
Theatre FX
Automation

Playback
Server

Multi-Projector
Splitting &
Compression

Pre-Rendered Fulldome Productions

Stars of the Pharaohs
Evans & Sutherland



Legends of the Night Sky: Orion
AVI/Spitz

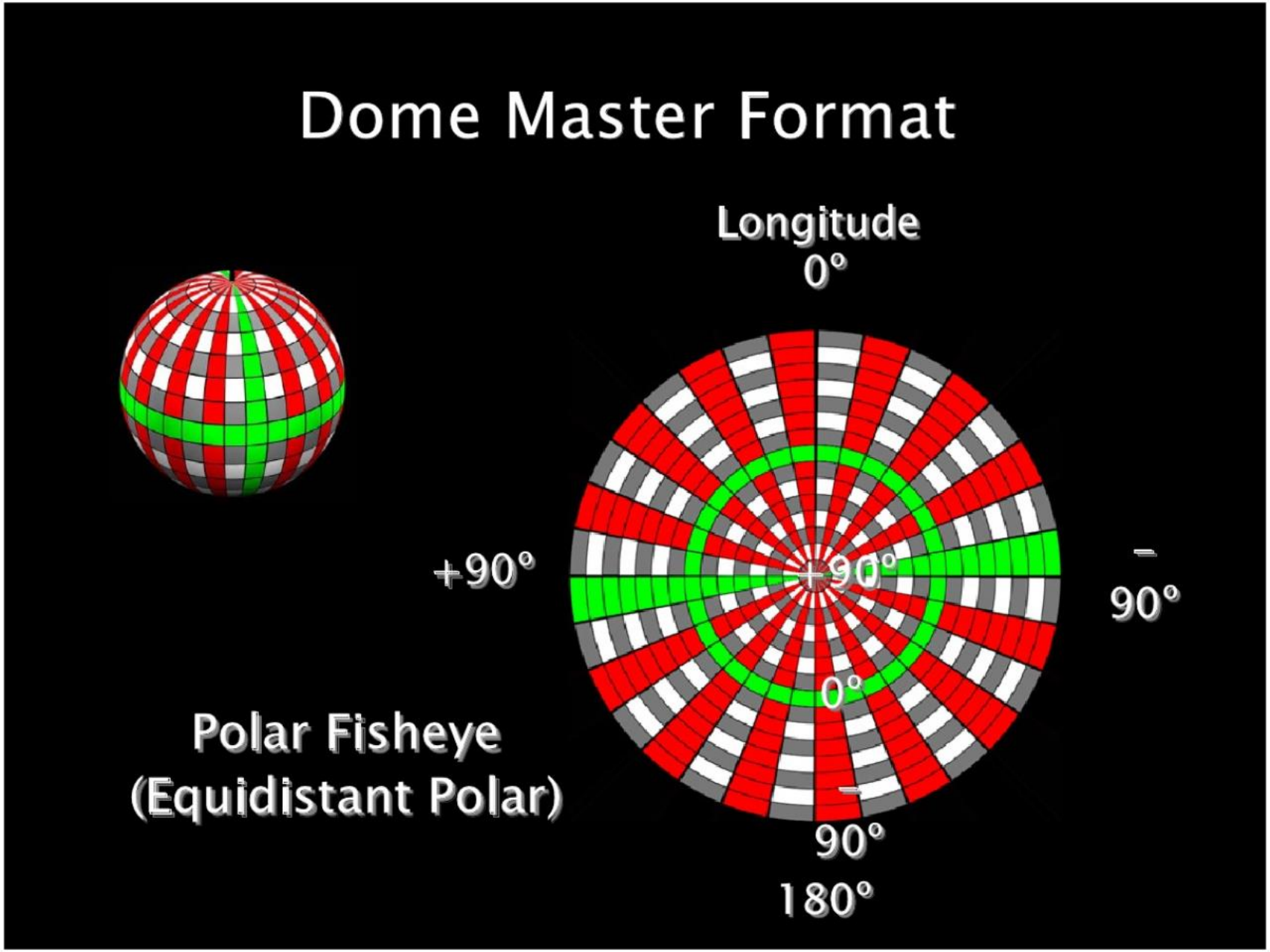
Sonic Vision
AMNH

Brain Flame
GRONK/UNM

Kaluoka'Hina
Softmachine

Major Fulldome Programmers

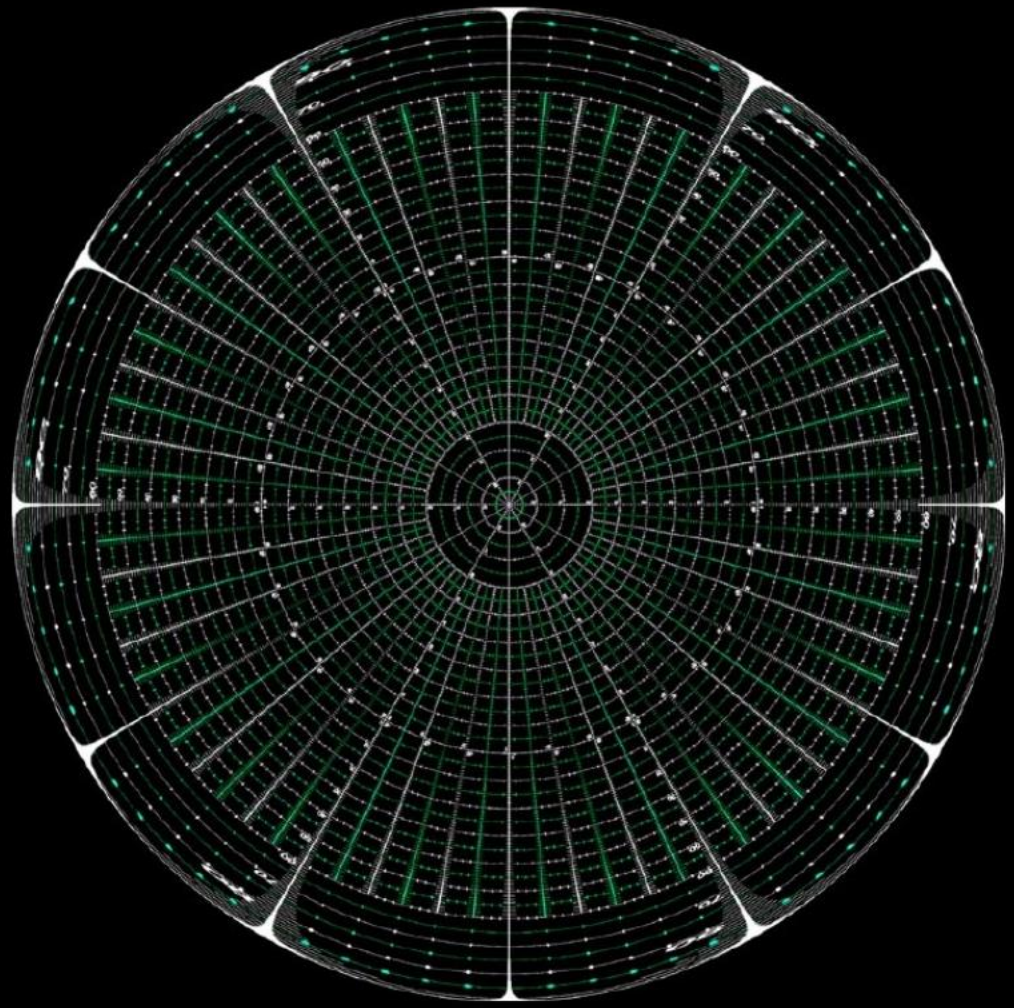
- American Museum of Natural History – New York, NY, USA
- Audio Visual Imagineering – Orlando, Florida, USA
- Clark Planetarium – Salt Lake city, Utah, USA
- Denver Museum of Nature and Science – Denver, Colorado, USA
- Evans & Sutherland – Salt Lake City, Utah, USA
- Home Run Pictures – USA
- Houston Museum of Natural Science – Houston, Texas, USA
- LivinGlobe – Germany
- Loch Ness Productions – Massachusetts, USA
- Lucas Productions – USA
- Mirage3D – Netherlands
- Nanotoons – New York, USA
- National Space Centre – Leicester, UK
- SCISS AB – Sweden
- Softmachine – Germany
- Sky-Skan – Nashua, New Hampshire, USA
- Spitz, Inc. – Chadds Ford, Pennsylvania, USA


Dome Master Format
Longitude
0°
+90°
90°
0°
90°
180°
Polar Fisheye
(Equidistant Polar)

Clip slide

Dome Master Format

Entire Outside Edge Maps to Single Pixel at South Pole



Polar Image Fills 78.5% of Square Frame

Spherical Photography & Live Action

Dan Slater's Spherecam

www.nearfield.com/~dan/photo/wide/sphere/

Panoscan Digital Panoramic Camera

www.panoscan.com

Nikon Coolpix w/Fisheye

www.nikonusa.com

4k Digital Cinema (i.e. RED)

www.red.com

Immersive Media's Dodecahedral Video Camera

www.immersivemedia.com

Real-Time 3D Workflow

Music & Audio FX

3D Content & Datasets

2D Content

Animations & Simulations

Real-Time Authoring

Real-Time Engine Optimization

Distribution

Plug-In or Application Installation

Real-Time Engine

Theatre Interactive UI

Realtime Image Generation

PC/Linux Clusters with Commodity Graphics Cards

Images Courtesy E&S - www.es.com

- Low Cost
- Most Popular Approach
- Open GL or Direct X
- Digital Planetarium
- Linear Playback
- 3rd Party Plug-Ins

Clip slide

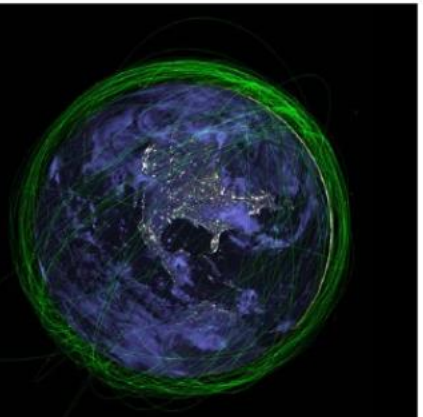
Realtime Interactivity

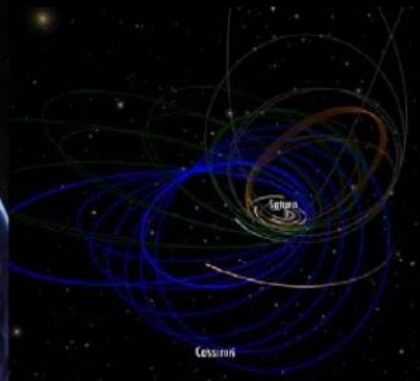
- Group Interactive
  - Computer facilitated group interaction
- Operator Interactive
  - Operator is navigator – takes audience on journey

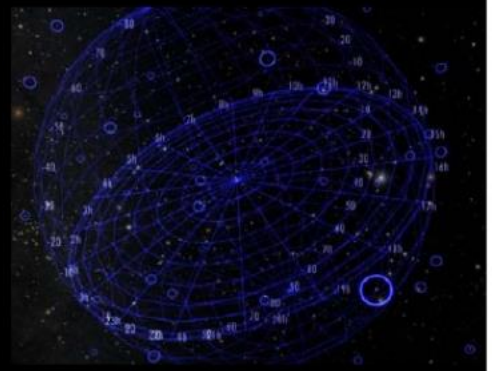
Images Courtesy de pinxi & Spitz, Inc.

Digital Planetariums

Real-Time Navigable, Scientifically Accurate Model of the Known Universe

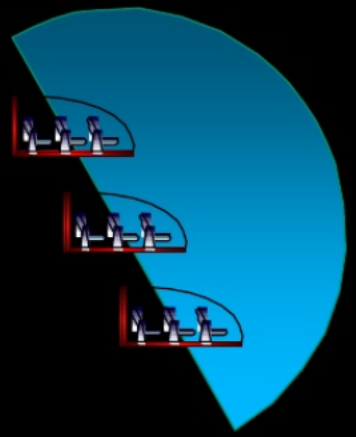






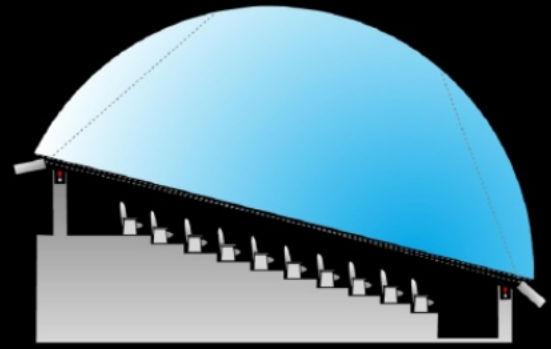
Images Courtesy SCISS AB www.scalingtheuniverse.com

Fulldome Display Applications

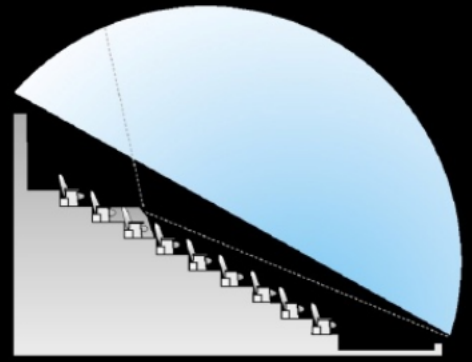


Simulator Rides

Digital Planetariums



Digital Domes



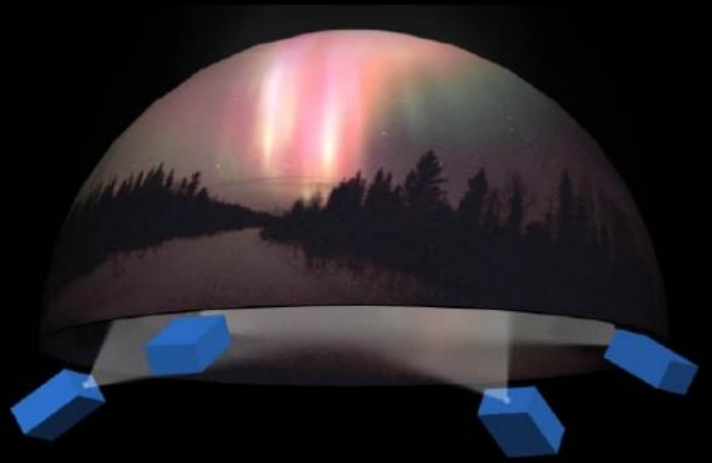
Large-Format
Digital Cinema

Major Fulldome System Providers

- Barco – Kuurne, Belgium
- Carl Zeiss Jena GmbH – Jena, Germany
- Digitalis – Bremerton, Washington, USA
- The Elumenati, LLC – Minneapolis, Minnesota, USA
- e-Planetarium – Methuen, Massachusetts, USA
- Evans & Sutherland – Salt Lake City, Utah, USA
- Global Immersion – Haywards Heath, UK
- GOTO Inc. – Tokyo, Japan
- Konica Minolta – Osaka, Japan
- Learning Technologies, Inc. – Massachusetts, USA
- Obscura Digital – San Francisco, California, USA
- R.S.A. Cosmos – Sorbiers, France
- Sky-Skan – Nashua, New Hampshire, USA
- Spitz, Inc. – Chadds Ford, Pennsylvania, USA
- Swinburne Space Works – Victoria, Australia

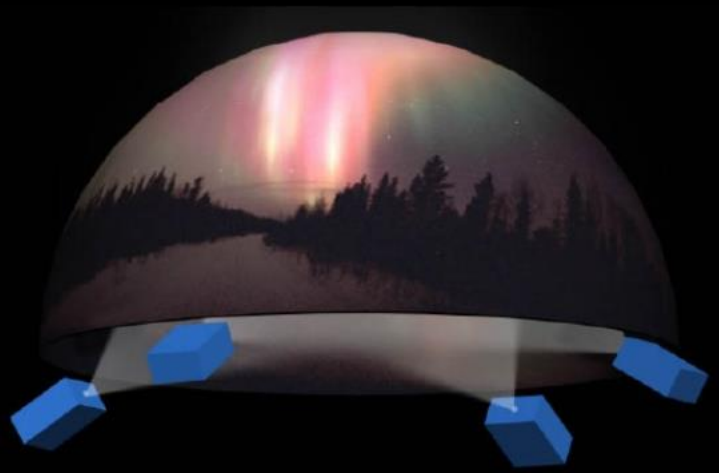
Spherical Projection Formats

Single Projector
(Fisheye)

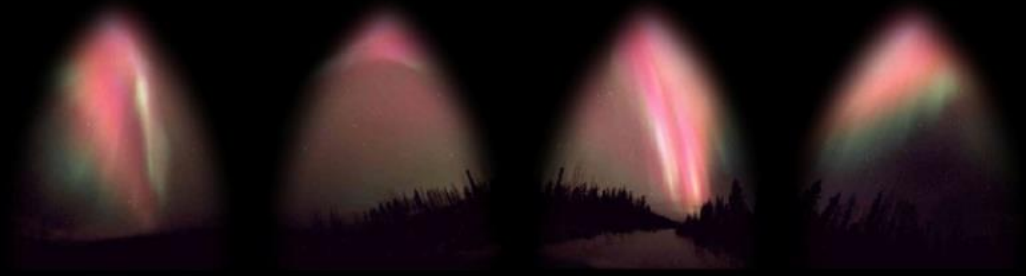


Multi-Projector
Edge Blended

Edge-Blended Projection



Dome Master



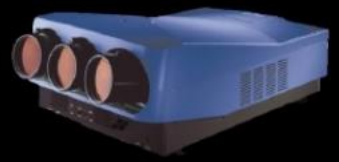
Sub Frame 1 Sub Frame 2 Sub Frame 3 Sub Frame 4

Video Projector Technologies

- DLP – Digital Light Processor

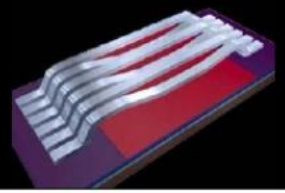
- LCoS – Liquid Crystal on Silicon

- CRT – Cathode Ray Tube

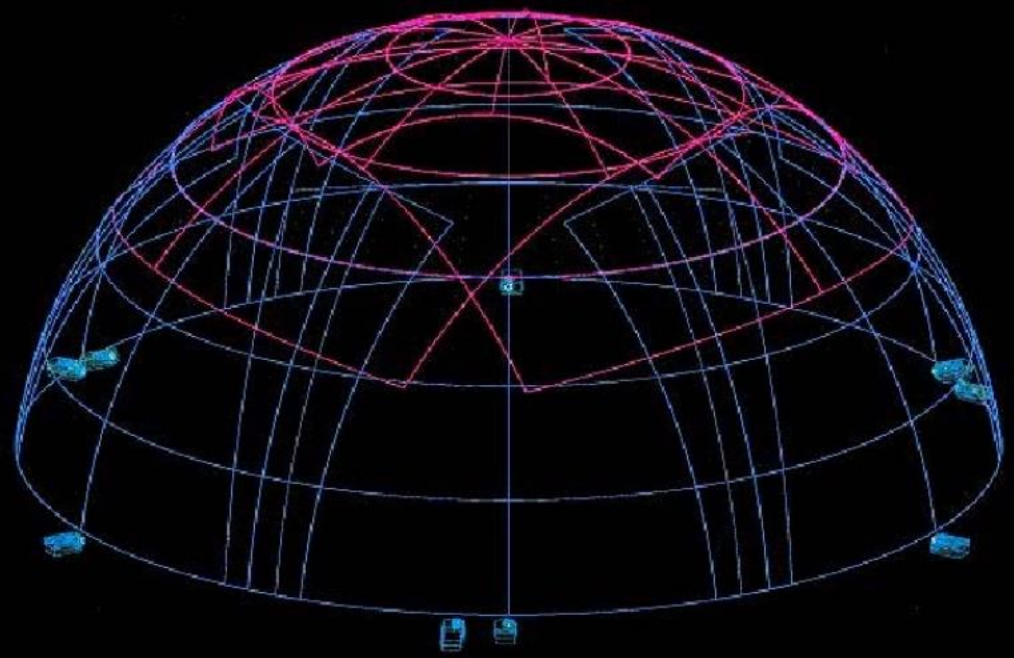


- Scanned Laser Projection

- Grating Light Valve



A Sampling of Fulldome Displays

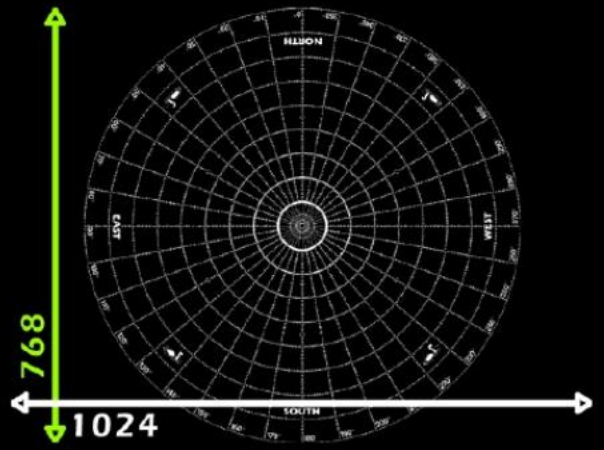


From small fisheyes to 4k stereoscopic theaters…

Adapted from: *A Planetarian's Primer For Fulldome*
Loch Ness Productions (www.lochnessproductions.com)

Hemispheric Fisheye

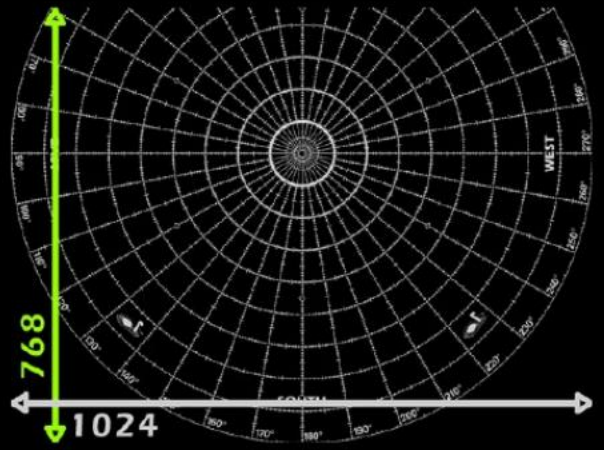
XGA Fisheye System



768 x 768 Dome Master
0.46M pixels on dome
4.3 pixels/degree
1950 lumens on dome
>900:1 contrast
1 projector (DLP)
1 channel @ 1024x768

Truncated Hemisphere

XGA Fisheye System

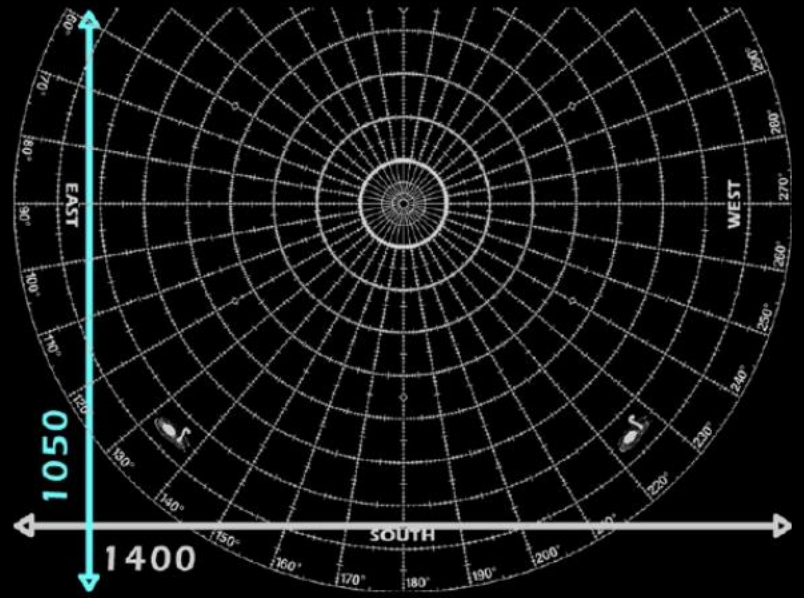


1024 x 1024 Dome Master (t)
0.66M pixels on dome
5.7 pixels/degree
2100 lumens on dome
>900:1 contrast
1 projector (DLP)
1 channel @ 1024x768

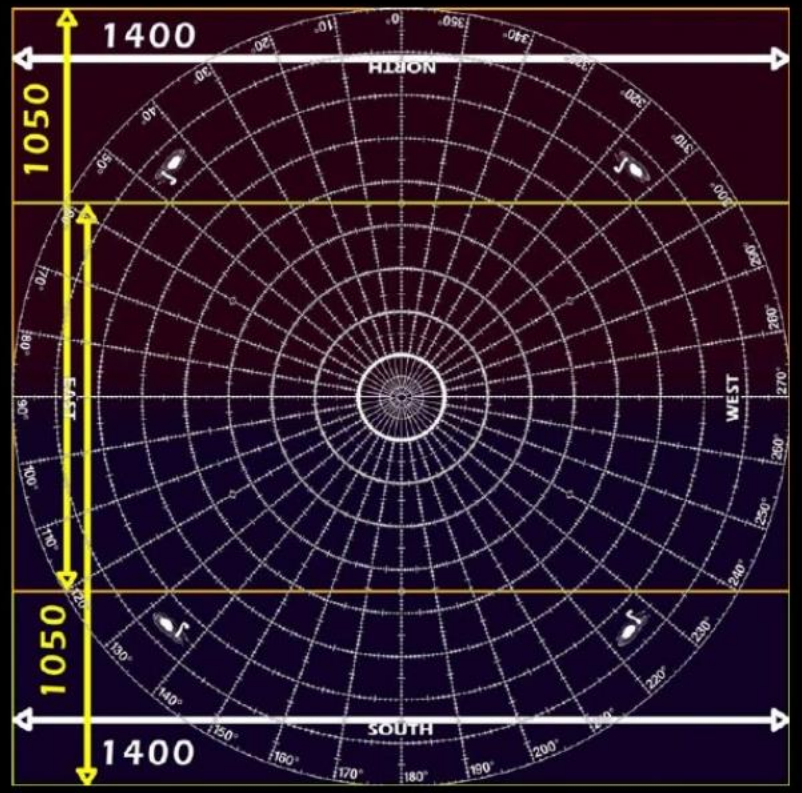
Truncated Hemisphere

SXGA+
Fisheye System

1400 x 1400 Dome Master (t)
1.2M pixels on dome
7.8 pixels/degree
Up tp 16,800 lumens
>1500:1 contrast
1 projector (DLP)
1 channel @ 1400 x 1050



Dual Fisheye with Edge-Blend



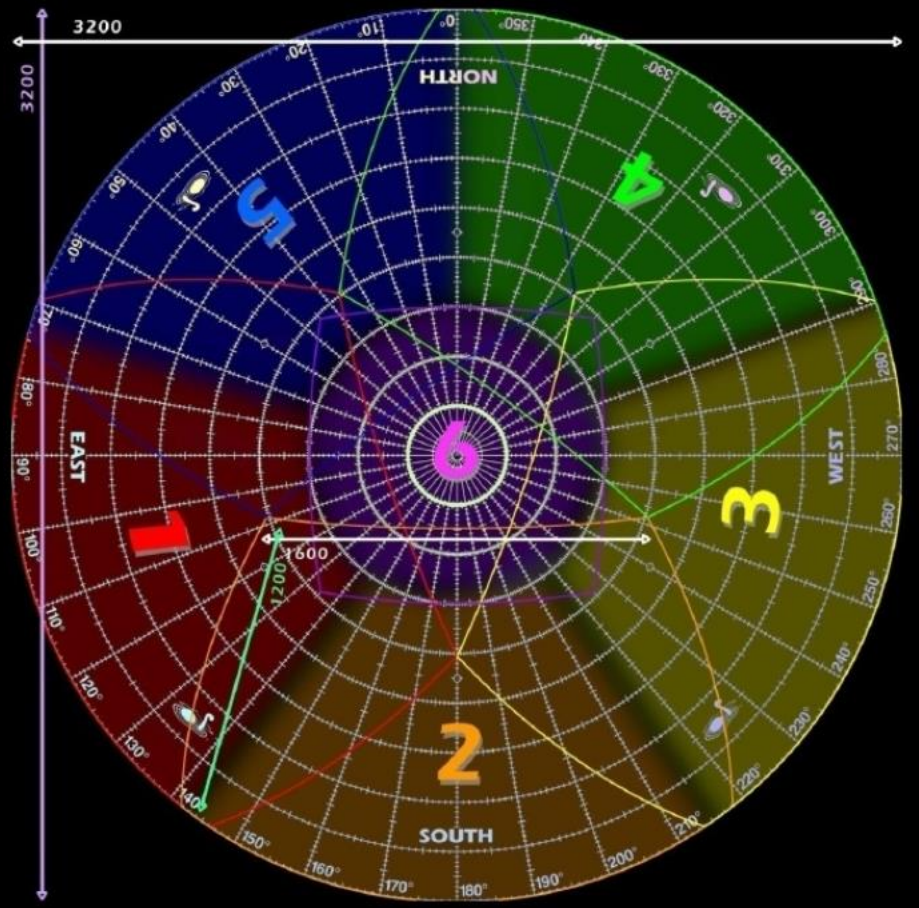
Dual SXGA+
Fisheye System

1400 x 1400 Dome Master
1.5M pixels on dome
7.8 pixels/degree
Up tp 21,000 lumens
>1500:1 contrast
2 projectors (DLP)
2 channels @ 1400 x 1050

DLP Projector Edge-Blend

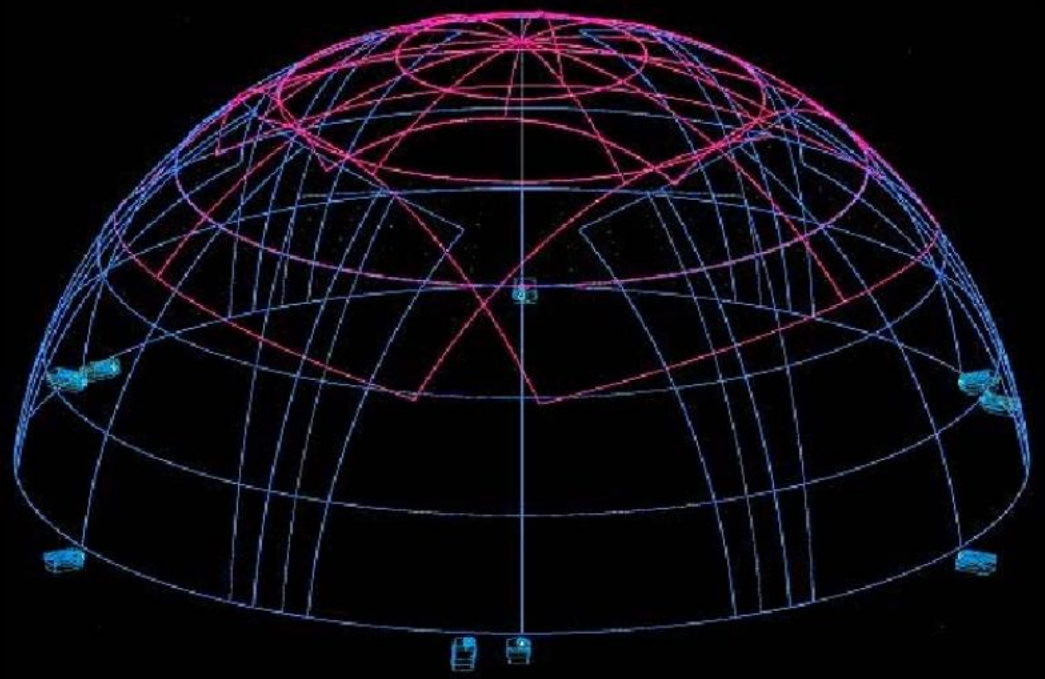
6-Projector Edge-Blend (DLP)

2880 x 2880 Dome Master
6.5M pixels on dome
16 pixels/degree
29,250 lumens
>1800:1 contrast
6 projectors (DLP)
6 channels @ 1400 x 1050



DLP Projector Edge-Blend

9-Projector Edge-Blend (DLP)

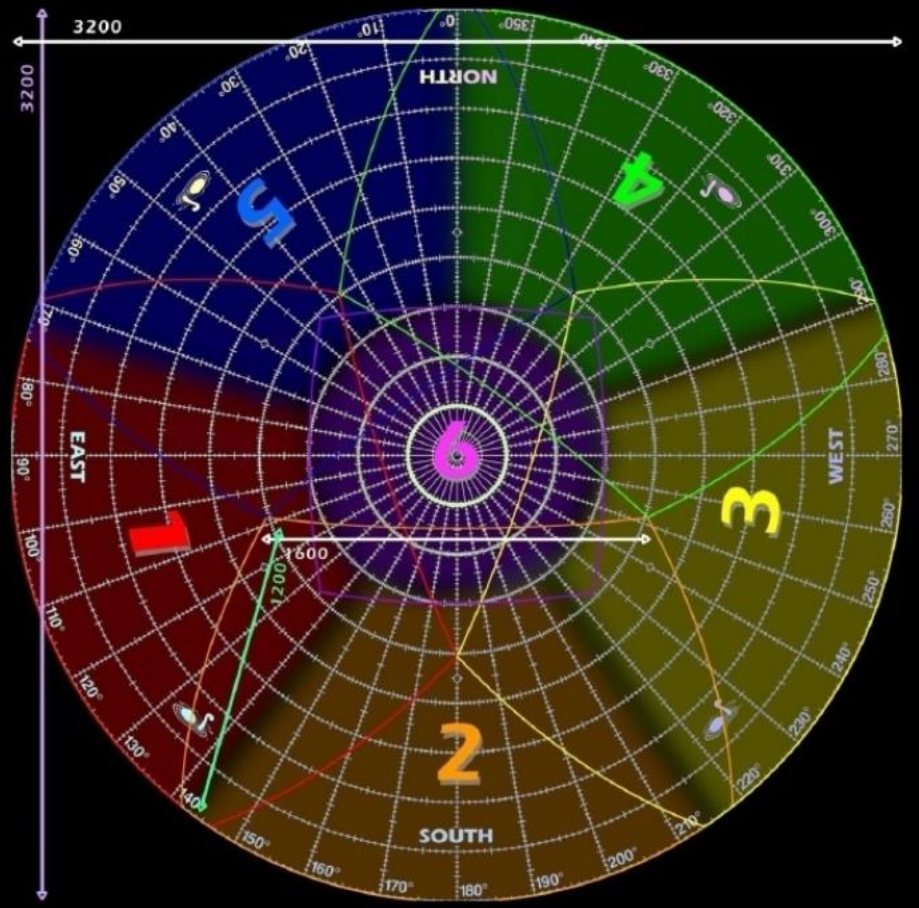


3070 x 3070 Dome Master
7.4M pixels on dome
17.1 pixels/degree
27,000 lumens
1800:1 contrast
6 projectors (DLP)
6 channels @ 1280 x 1024

CRT Projector Edge-Blend

6-Projector Edge-Blend (CRT)

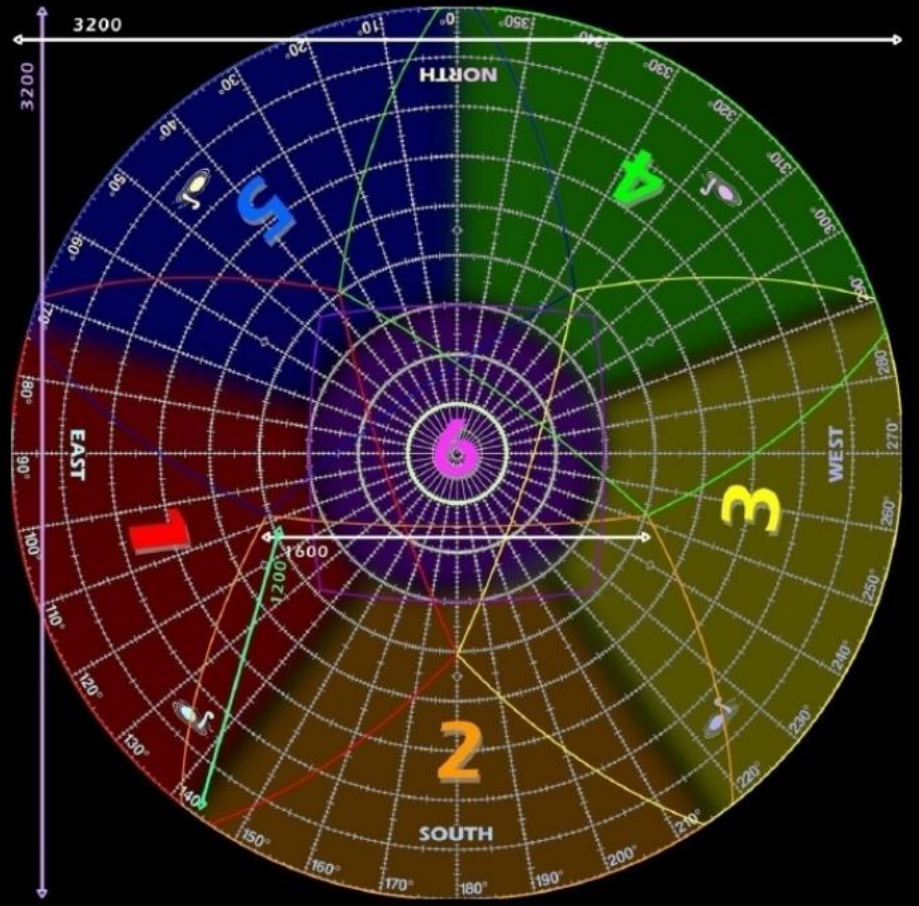
3420 x 3420 Dome Master
9.2M pixels on dome
19 pixels/degree
1,260 lumens
10^6:1 contrast
6 projectors (CRT)
6 channels @ 1600 x 1200



Laser Projector Edge-Blend

6-Projector Edge-Blend (Scanned Laser)

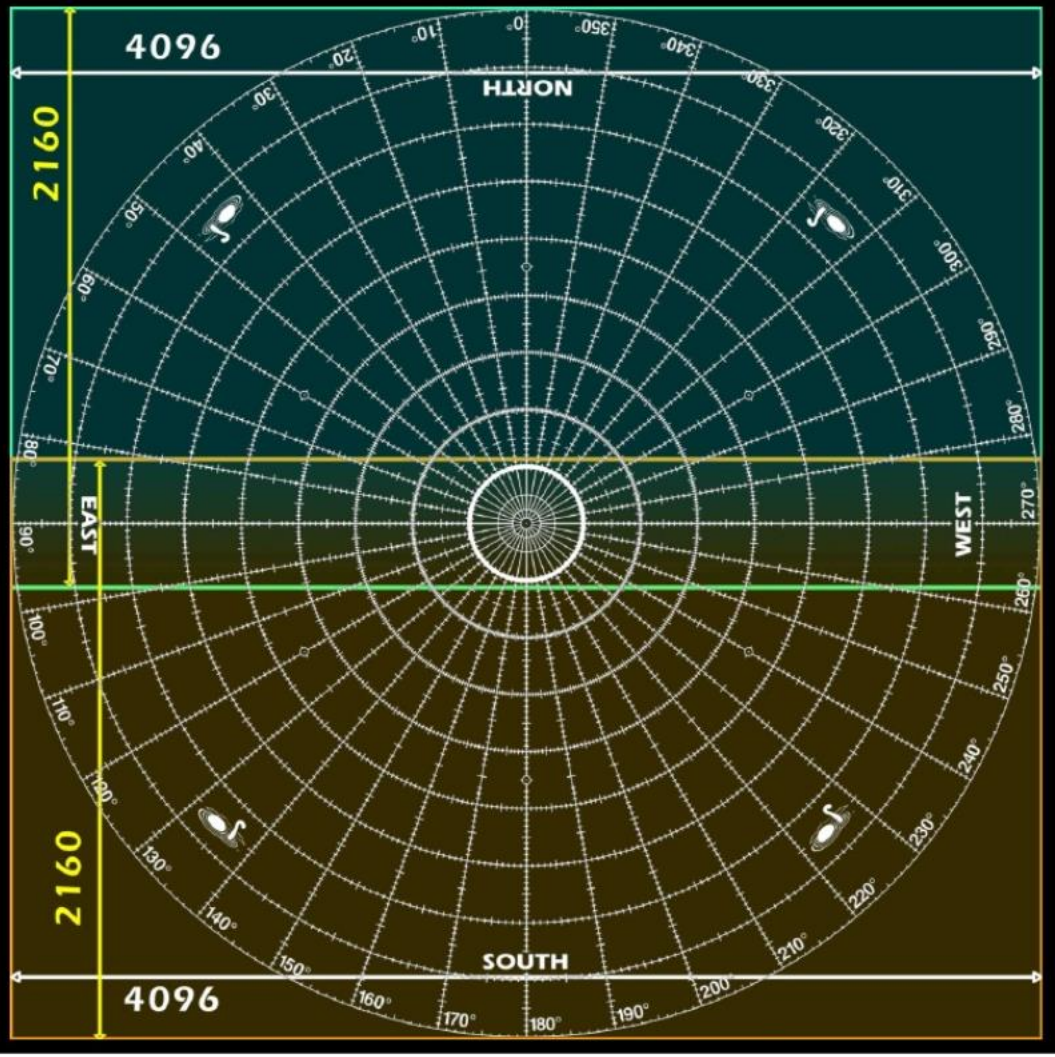
3420 x 3420 Dome Master
9.2M pixels on dome
19 pixels/degree
13,500 lumens
30,000:1 contrast
6 projectors (Laser)
6 channels @ 1600 x 1200



Dual 4k Fisheye with Edge-Blend

Dual Fisheye System

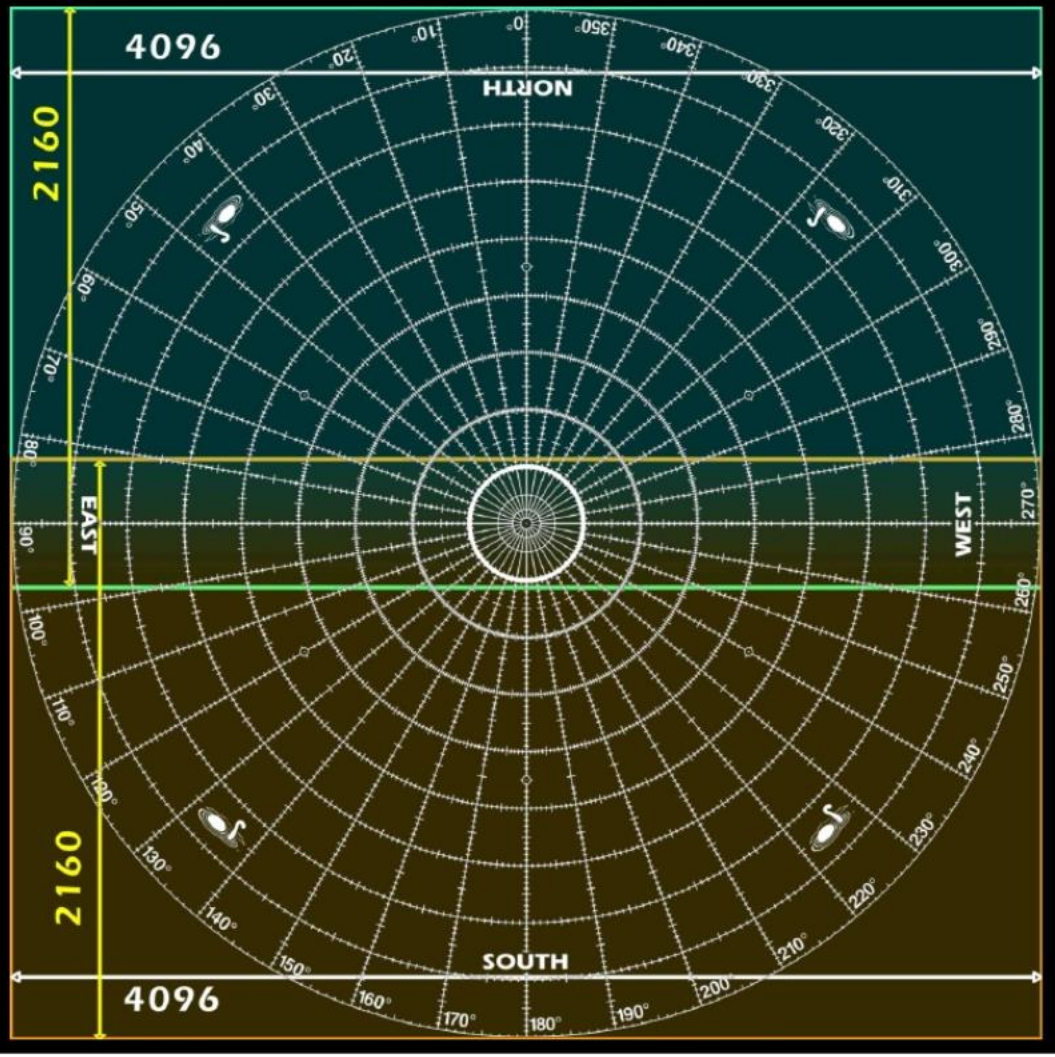
4096 x 4096 Dome Master
13M pixels on dome
22.7 pixels/degree
14,900 lumens
1800:1 contrast
2 projectors (Sony SXRD 4k)
8 channels @ 2k x 1k



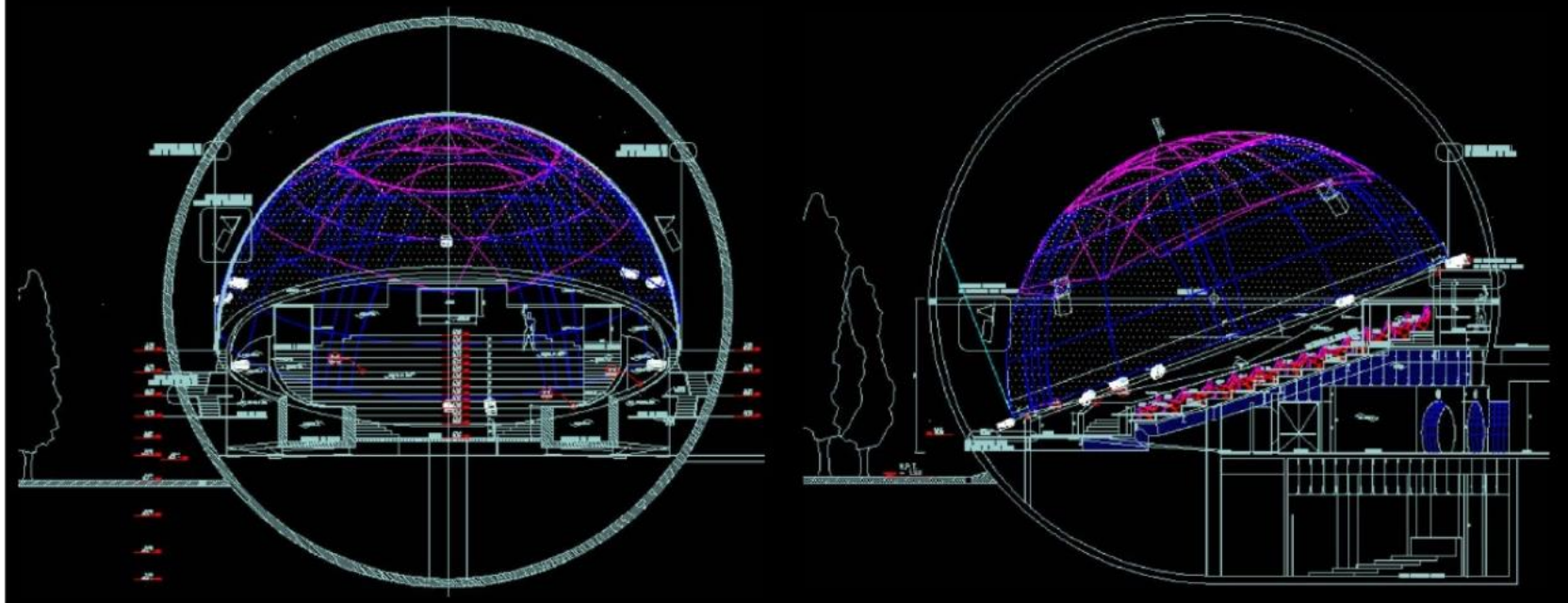
Stereoscopic 4k Dual Fisheye

Dual Fisheye System

4096 x 4096 Dome Master
13M pixels on dome
22.7 pixels/degree
4,500 lumens
1800:1 contrast
4 projectors (Sony SXRD 4k)
16 channels @ 2k x 1k



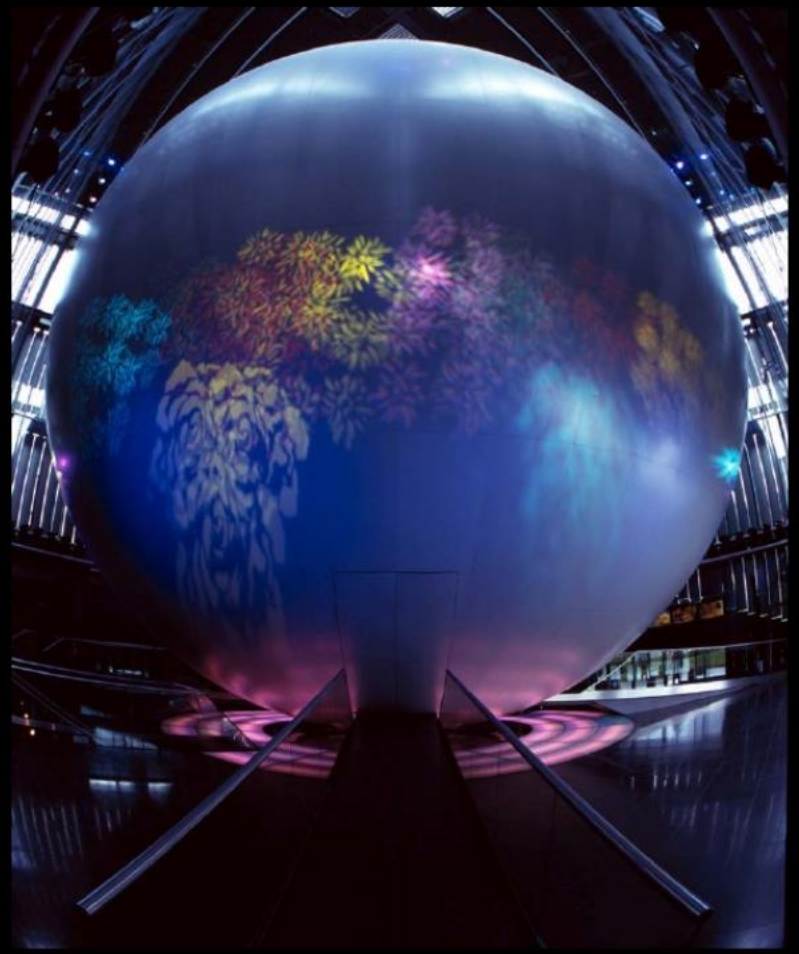
A Sampling of Fulldome Theaters...



Images Courtesy Spitz, Inc.

Volkswagen Autostadt

Wolfsburg, Germany

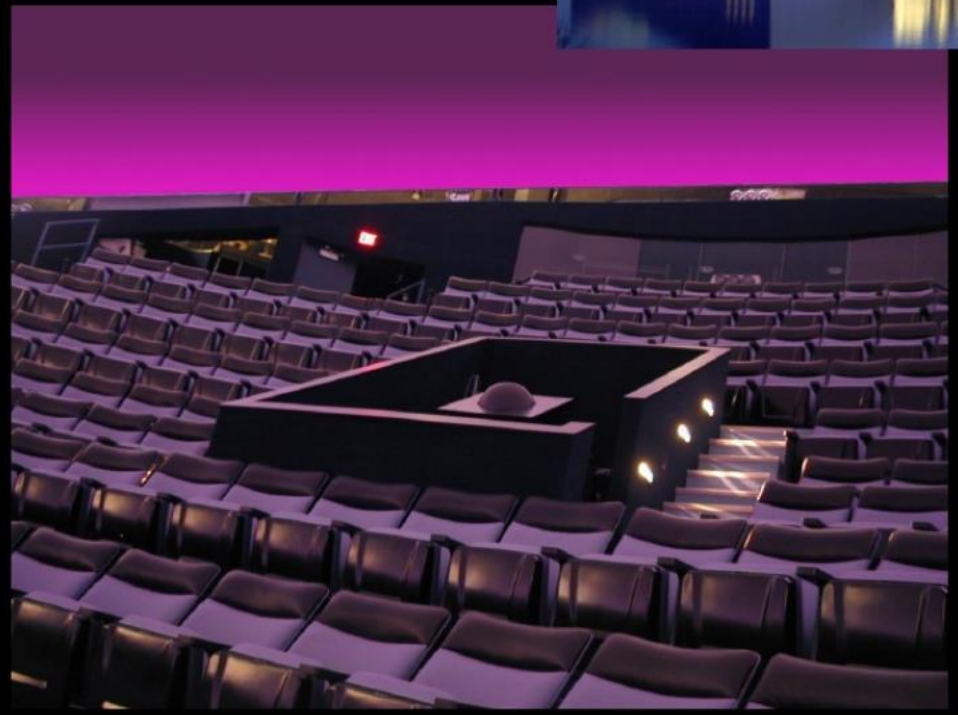


- Opened 2000
- Fulldome video
- 14.7m dome screen
- 4x Barco DLP's
- Spitz & Furneaux Stewart

Images Courtesy Spitz, Inc.

Boeing CyberDome Theater

Exploration Place
Wichita, Kansas



- Opened 2000
- Fulldome video
- 18.3m dome screen
- 6x 9" CRT's
- Real-time 3D
- 170 Interactive seats
- 5.1 sound
- Integrator: E&S

Hayden Planetarium

Rose Center for Earth and Space
American Museum of Natural History
New York, NY

- Opened 2000
- Fulldome video
- 7-pipe SGI Onyx
- 21m dome screen
- 7x 12″ CRT's
- Spatialized sound
- Integrators: SGI, Trimension, AMNH

Photos Copyright D.Finnin/AMNH

Clip slide

Bibliotheca Alexandrina

Alexandria, Egypt

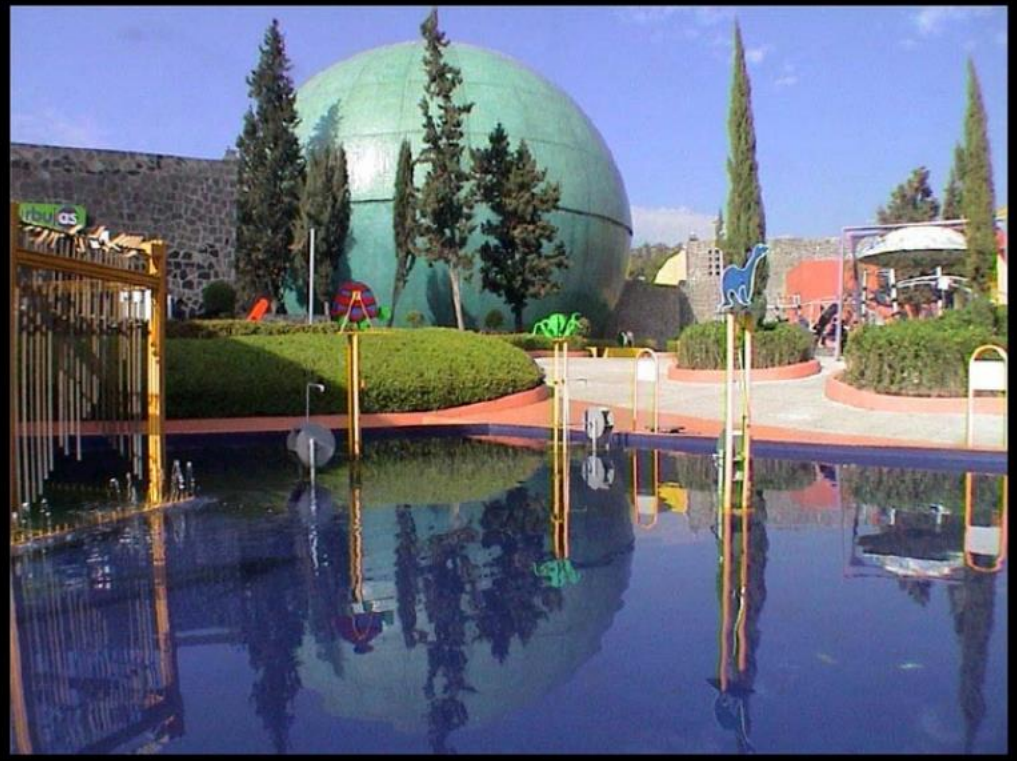
BIBLIOTHECA ALEXANDRINA

Image Courtesy Spitz, Inc.

- Opened 2001
- Panoramic video
- 14m dome screen
- 3x 9" CRT's
- 8/70 film projector
- Spitz star projector
- 5.1 sound
- Integrator: Spitz

Papalote Museo del Niño

Mexico City



- Opened 2004
- Fulldome video
- 23m dome screen
- 9x Barco DLP's
- Over 9M pixels
- 24,000 lumens
- 5.1 sound
- 283 seats
- Integrator: Spitz

Image Courtesy Ed Lantz

Chabot Space & Science Center

Oakland, California, USA

- Opened 4Q 2004
- Fulldome video
- 21.3m dome
- 6x PD F3 DLP's
- Over 6M pixels
- 20,000 lumens
- 5.1 sound
- 240 seats
- Integrator: SEOS

Image Courtesy Chabot Space & Science Center

LodeStar Astronomy Center

New Mexico Muesum of Natural History and Science
Albuquerque, NM

- Opened 2000
- Fulldome video
- 16.8m dome screen
- 6x 9″ CRT's
- Digistar II projector
- 5.1 sound
- 140 seats
- Integrator: SkySkan

Stereoscopic 3D Digital Domes

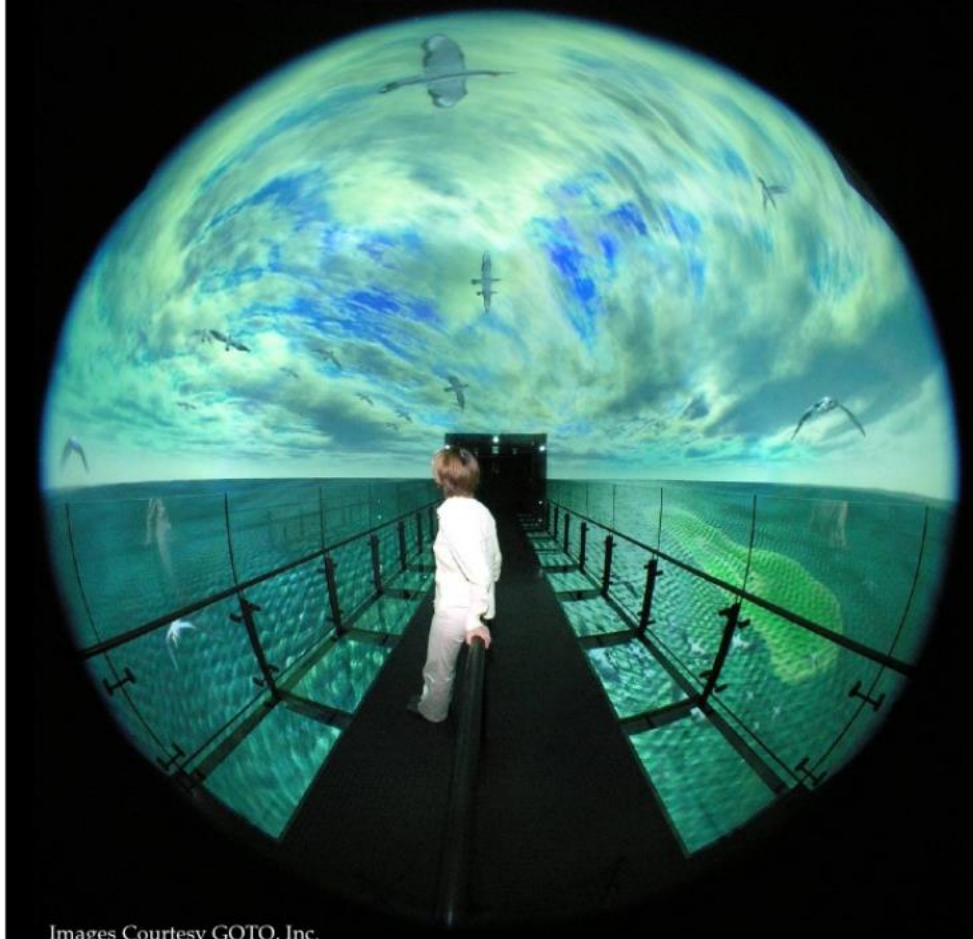
Images Courtesy Sky-Skan

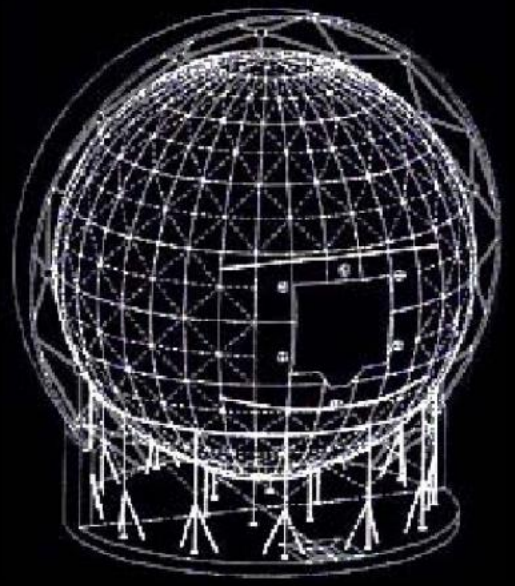
- ‘Imiloa Astronomy Center: Hilo, Hawai’i
- Infitec 3D Stereo
- Opened Jan. 2008
- Integrated by Sky-Skan

- Foundation for the Hellenic World: Athens, Greece
- Infitec 3D Stereo
- Opened 2007
- Integrated by SEOS

THEATER 360

National Museum of Nature and Science, Japan





12.8m, 360° spherical display
(Courtesy GOTO, Inc.)

Images Courtesy GOTO, Inc.

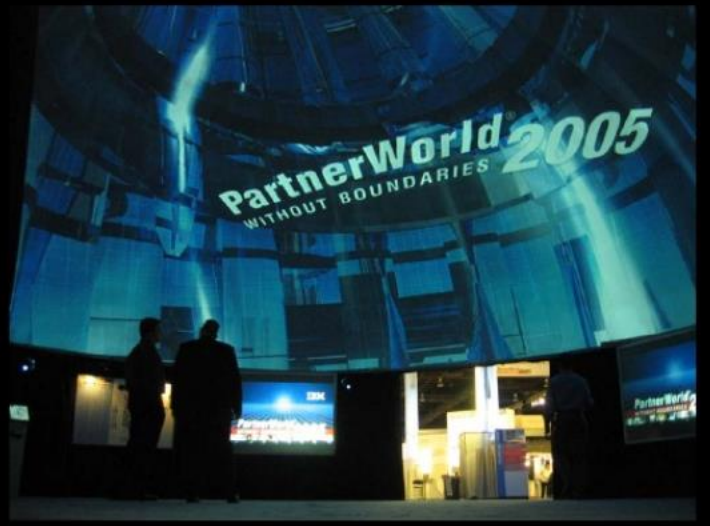
Portable Displays

VisionStation™

SciDome™

- Dome Production Monitors
- Educational Planetariums, Portables, Art Exhibits
- Tradeshows, Nightclubs, Special Venues

Other Fulldome Applications

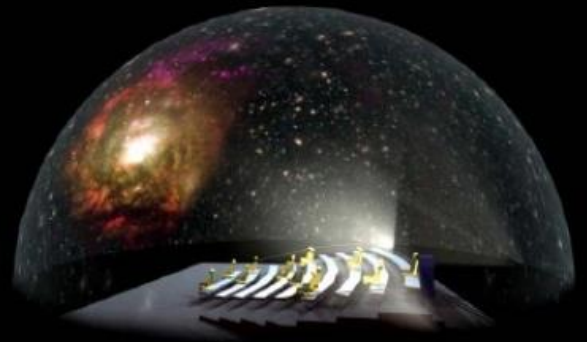


Images Courtesy Vortex Immersion Media

Images Courtesy Obscura Digital

- Tradeshows
- Nightclubs
- Concerts
- Dance Parties
- Restaurants
- Spas
- Corporate

End of Part 1



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VISUAL BANDWIDTH

VORTEX IMMERSION MEDIA

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Dan Slater
de pinxi
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Goto, Inc.
Immersive Media
Loch Ness Productions
LodeStar Astronomy Center
Nikon
Obscura Digital
Panoscan
Red
SCISS AB
Sky-Skan
Spitz, Inc.
Vortex Immersion Media

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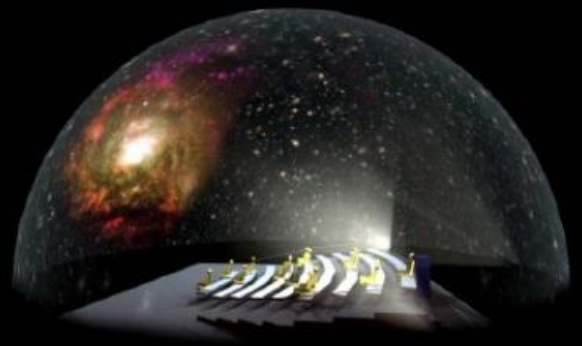
Fulldome 101:
Part 2 - The Future of Fulldome
Pioneering a New Medium



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VISUAL BANDWIDTH

VORTEX IMMERSION MEDIA

Digital Dome or “Fulldome” Theatres

Cinema of the Future?

- Most immersive of all cinema formats
- All digital workflow and real- time interactivity
- Group “reality- portals” into real and virtual worlds

How can digital domes thrive in the future media environment?

1. Deliver powerful yet meaningful out- of-home media experiences.
2. Strive for excellence in theater design, programming and operations.
3. Leverage collective power of stakeholders to promote and advance immersive media.
4. Converge with games, VR and LF cinema.

1. Deliver powerful yet meaningful media experiences.

- Identify and validate unique characteristics and advantages of group immersive environments.
- Align ourselves with meaningful social needs with an existing or emerging demand.
- Make a science out of meeting these needs by applying the unique strengths of fulldome.

Unique Characteristics of Group Immersive Environments (we think)

- Greater spatial understanding
  - Large- scale geometry, i.e. solar system
  - Geospatial awareness
- Data visualization
  - Data visualized as 3D spatial relationships
- Provide more deeply moving, compelling experiences (affective goals)
  - WOW factor
  - Journeys, stories, connections
  - Emotional connection
  - Transformative media

Meaningful social needs with an existing or emerging demand

- Earth Science and Environmental Responsibility
  - Earth is finite – we can alter the biosphere
  - Powerful tools of STEM must be used responsibly (STEM = Science, Technology, Engineering & Math)
- Cultural Heritage
  - Multicultural history, world heritage sites
- Building Bridges of Understanding
  - Fostering global, multicultural perspective
- Our Place in the Universe
  - What we know about our universe (data)
  - Meaning of the universe (stories)
- Art and Culture, Entertainment & SciArt

The Importance of Storytelling

Storytelling can open our perspectives to more brilliant possibilities.

- Susan O'Halloran

Stories are bridges from one mind to another.

- Martha Holloway

An enemy is one whose story we have not heard.

- Ms. Gene Knudsen Hoffman

Storytelling can change a room. It can change lives. It can change the world.

- Gwenda LedBetter

People become the stories they hear and the stories they tell.

- Elie Wiesel

The universe is made of stories, not of atoms.

- Muriel Rukeyser

The Importance of Music and Art

"Music has well established psychological effects, including the induction and modification of cognitive states, moods and emotions."
- Dr. Norman M. Weinberger, MuSICA Research Notes, vIV #2, F97

Art and religion first; then philosophy; lastly science. That is the order of the great subjects of life, that's their order of importance.
- Muriel Spark

Art does not reproduce what we see; rather, it makes us see.
- Paul Klee

Art is the objectification of feeling, and the subjectification of nature.
- Susanne K. Langer

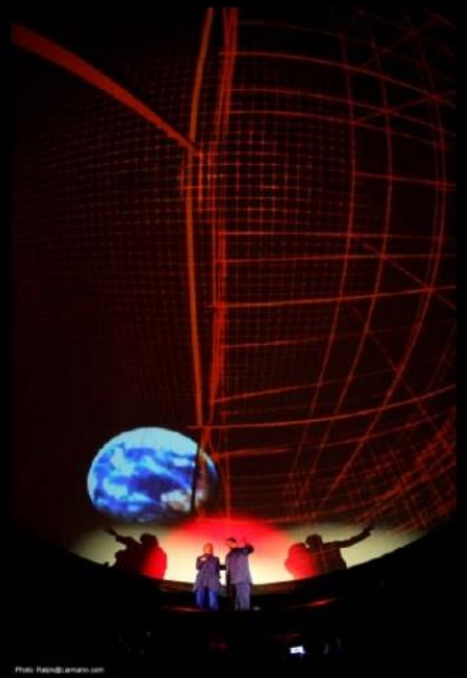
Art is the most intense mode of invidualism that the world has known.
- Oscar Wilde

Art is the science of inducing unique neural states.
- Ed Lantz

Fulldome SciArt Productions

Prof. Tom Duscher's ICH2
live interactive performance
Kiel Planetarium, Germany

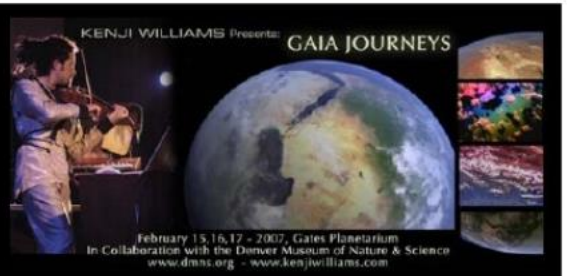
J.Walt Adamczyk
Real-Time 3D
Visual Music Performance



c-the speed of light
phase7
Berlin, Germany

Gaia Journeys
Kenji Williams
& Dr. Kachun Yu
Denver Museum
of Nature & Science

Real-Time Interactive
SciArt Performances



Gaia Journeys

Real- Time SciArt Collaboration

- Classically trained violinist, Kenji Williams
- Denver Museum of Nature & Science Astronomer Ka Chun Yu
- Earth- based panoramas by Greg Downing
- Earth and space visualization by UNIVIEW
- Sold out 4 performances

DENVER MUSEUM OF NATURE&SCIENCE

SCISS

REMEDY ARTS™
Audio Visual Remedies

UNIVIEW
SCALING THE UNIVERSE

Harmony
CHANNEL

Bella Gaia (next gen.)

A Narrative SciArt Experience

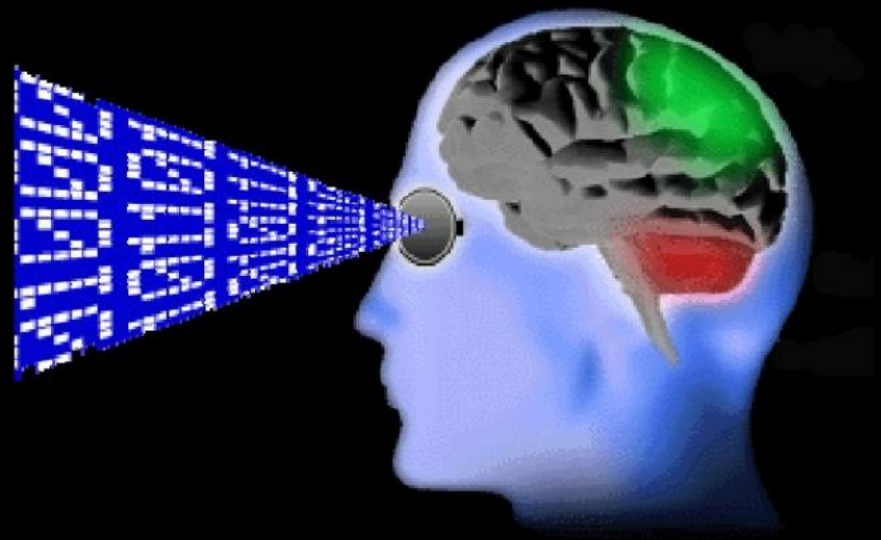
- A Tour of the World via ISS
  - Planetarium show, live concerts, DVDs
- Cognitive goals include understanding of:
  - Power of STEM tools to change the earth and improve lives
  - The many world cultures and their geography
  - The power of space science to better understand the world
  - The need to preserve world heritage sites
- Affective goals include appreciation of
  - The Earth itself as a heritage site
  - Global culture, music and environment
  - Geoscience and space technologies
  - Inspiration to use STEM tools wisely for benefit of humanity
- Seeking support from NASA, UNESCO, Smithsonian

Science of Fulldome Storytelling

- Leverage Existing Storytelling Knowledge
- Extend Cinematic Language for Fulldome
- Cognitive Research (need more)
- Neuroaesthetics – the science of art
- Refine Storytelling Techniques
  - Measure effectiveness
  - Peer review/ critique
  - Experiment with new modalities
- Pioneer Transformative Media

Pioneering Transformative Media

The Eyes and Ears as a Wideband Interface to the Brain



Immersive Experiences are Powerful Tools for Transformative Programming

Transformative Experience

An experience that substantially alters a person's "possibility space" or life path

- Discovering new facts, cultures, connections
- Epiphany, realization, revelation
- Spiritual, numinous, or "unity" experience
- Awakening to empathy, compassion, love
- Often triggered by new friends, social circles
- Trauma, loss, fear, etc. can also be transformative

transformed individuals = transformed world

Neural Plasticity

"You create your brain from the input you get"

– Dr. Paula Tallal

You also create your brain from your beliefs and expectations (or world view):

"Visual neurons in the brain's primary visual cortex -- long thought to conduct purely sensory, value-free visual information -- can also modulate their response as a function of expected reward. In a clever study that sharply revises the view of the fundamentals of how we see, Marshall Shuler and Mark Bear show that visual neurons once considered to be mere feature detectors are affected by complex cognitive influences such as reward expectancy. Even at the most fundamental level, it seems, our expectations influence how and even what we see."

From Scientific American regarding:

Shuler and Bear, "Reward Timing in the Primary Visual Cortex" Science, 17 March 2006: 1606-1609

Immersive Environments for Transformative Experiences...

30,000 B.C.E.
Chauvet Caves

1,500 B.C.E.
Temple of
Amon, Egypt

16th Century
Sistine Chapel

1788
Barker's Panoramas

1826 Daguerre's
Panoramas

1895
Lumière Cinématographe

Transformative Media

Intentional use of digital media to:

Open the Mind
Information, education,
Empowering truths bring new understanding

Shift the Heart
Empathy, compassion, understanding, fun
Emotional shift towards love, respect, joy, happiness

Activate the Spirit
Sense of awe, mystery, ecstasy, bliss, unity
Elevated quality of consciousness

Soothe the Beast
Invoke positive moods, relaxation, regeneration, "digital spa"

Awaken the Senses
Arouse passions, sensuality, sexual ecstasy

Transformative Media

Transformative media modalities

- Cognitive
  - Intellectual realization
  - Transmitted through thoughts, facts, language
- Affective
  - Emotional or mood shift
  - Transmitted through storytelling, drama, music
- Many Unique States of Consciousness
  - Shift in “quality of consciousness,” perception, flow
  - Transmitted through beauty, awe-inspiring music and visuals, contemplation and reflection

Future Transformative Modalities

Experimental and proven biometric techniques that may some day find application in domes...

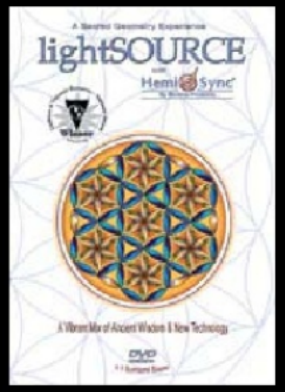
BrainPaint™

Hemi Sync®
By Monroe Products

Brain Entrainment

Brain Entrainment (Brainwave Synchronization)

- **Relaxation**
- **Improved performance**



Brain Machines (Mind Machines)

Entrainment through flashing lights and sound

www.mindmachine.com

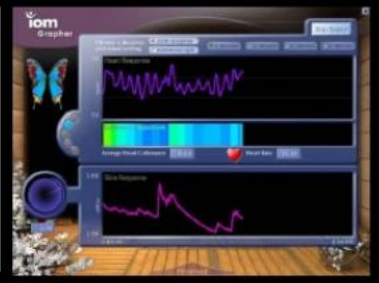
Hemi-Sync Products

Monroe Institute

Binaural Beat Frequency induces brainwave synchronization effect

www.hemi-sync.com

Neurofeedback Games & Experiences

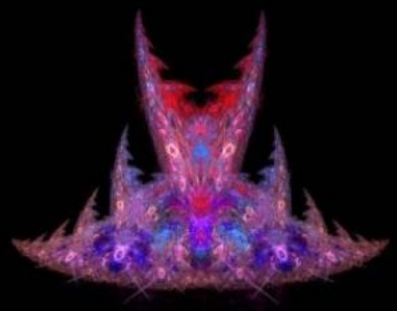


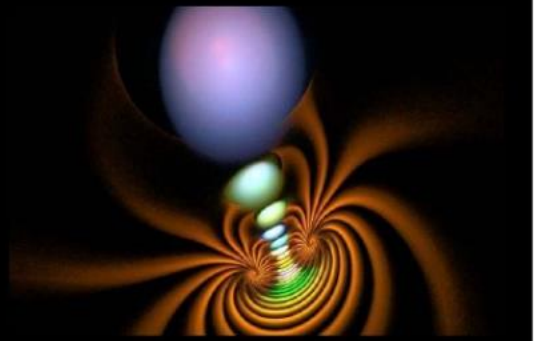
Wild Divine & Healing Rhythms
www.WildDivine.com

Emotiv Systems
www.emotiv.com

Epoc can differentiate between thoughts such as lifting an object or rotating it; detect and mimic a user's expressions such as a smile or wink; and respond to emotions such as excitement or calmness.

Neurofeedback Art





Neuroimaging EEG biofeedback therapy by Dr. William Scott

www.brainpaint.com

2. Strive for Excellence in our Theater Design, Programming and Operations

- Create and adopt industry standards & guidelines for fulldome displays, theater design, distribution
- Industry awards encourage quality programming
- Guidelines for theater design, programming standards, etc.
- Continued technology advancements

Fulldome Summit 2008

- First Fulldome Summit Held in Valencia in 2004
  - Special session of IPS 2004
  - 13 papers presented and published on fulldome standards
  - Standards roundtable
- Second Fulldome Summit in Chicago on July 3rd, 2008
  - Special session of IPS 2008
  - 14 Papers, 2 panels, 2 roundtables and one Keynote
  - Launch of IMERSA (Immersive Media Entertainment, Research, Science and Arts)
  - Standards roundtable
  - Integrated with DomeFest 2008
  - www.ips2008.org/fulldome

Fulldome Technology Needs

- 4k x 4k Digital Fisheye Film Camera
- Need “Killer App” for Group Interactivity
- Real-Time VJ and Graphic Manipulation Software
- Better Auto-Alignment Systems for Tiling
  - Needs to be adopted by vendors
- Open Source Framework for 3D Datasets
  - “Model of the known universe” project collaborators
  - Also need framework for integrating simulations

3. Leverage our collective power to advance our profession and our perceived value.

- Work through professional organizations:
  - IPS, ASTC, GSCA, TEA, SIGGRAPH, IMERSA
- Adopt “official” fulldome standards and guidelines (IMERSA for domes, GSCA for LF film)
- Publish, communicate, network
- Consortia, teaming on grants, etc.
- Public relations for fulldome (IMERSA)
- Networked domes

IMERSA

Immersive Media Entertainment, Research, Science and Art Association

- IMERSA serves as a collective authority in immersive media by establishing and disseminating industry standards, guidelines and recommended practices.
- IMERSA advances the industry through fund and program development for research, arts, show production consortia and other programs serving common industry interests.
- IMERSA fosters professional development of its members by providing educational resources and programs, certifications, and recognition of outstanding achievements.
- IMERSA is a nexus for professional communication and collaboration, uniting venue operators with creative communities, researchers and manufacturers through events, online networking and an annual conference.
- IMERSA promotes industry research, including the collection of market and industry statistics, historical records, original research and product evaluations.
- IMERSA provides outreach to the media, the public and other trade organizations to raise awareness of and promote the immersive medium and its wide spectrum of venues, formats and functions.

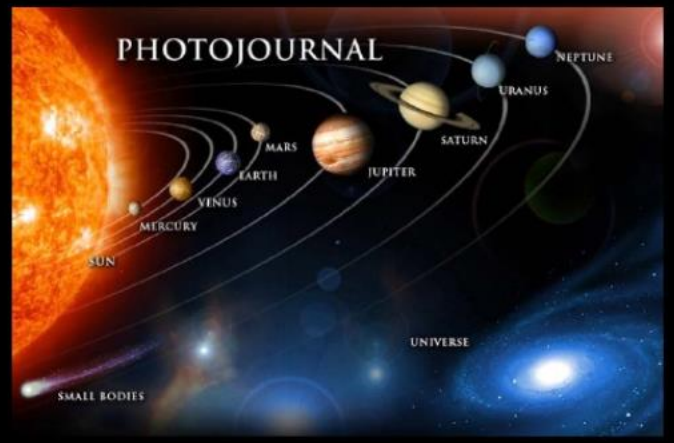
Feeding the Dome: Democratizing the Universe

- The Universe is Too Big to Experience Firsthand
- The Universe can be Virtually Experienced through Datasets and Models
- Scientists have a Need and Responsibility to Make Scientific Data and Models Accessible to the Public so that They Too can Experience the Knowable Universe
  - Science, in this sense, is expanding the knowable universe, not just for scientists, but for all humanity
  - Non- scientists will add immeasurably to this knowledge base, providing meaning, context and “heart”

The universe is made of stories, not of atoms.
- Muriel Rukeyser

Turning Raw Data into Visualization

- Spatial and Temporal Continuity
  - Missing data must be extrapolated, interpolated, or guessed
  - Motions must be smooth with inertia
- Aesthetics, Understanding Trump Accuracy
  - Exaggeration, distortion, artistic license
  - Ordinarily coupled variables are separated



NASA Website

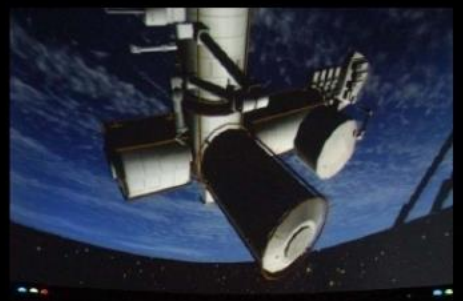
Will Wright's SPORE

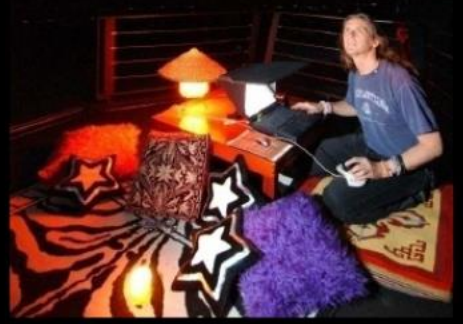
AMNH's Digital Universe Atlas

- Started in 1998 with NASA Funding
  - Originally the Digital Galaxy Project
- Curated Package of 3D Astrophysical Datasets
  - Nearby Stars (Hipparcos/Tycho star catalogs)
  - Milky way galaxy
    - star clusters, nebulae, extrasolar planets
  - Extragalactic galaxies, quasars, etc.
    - Tully Galaxy Catalog
    - Sloan Digital Sky Survey and others…
    - Multispectral Sky, WMAP, etc.
- Used by Multiple Digital Planetarium Vendors
  - Uniview
  - E&S's D3
  - Sky-Skan's DigitalSky

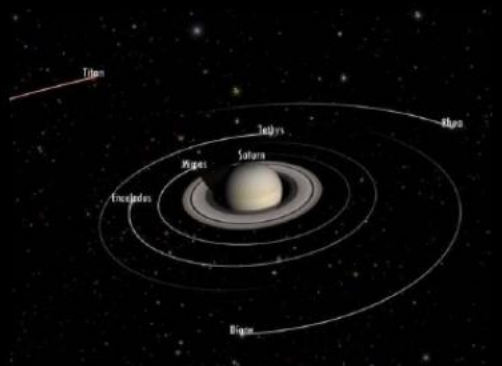
AMNH's Digital Universe Atlas

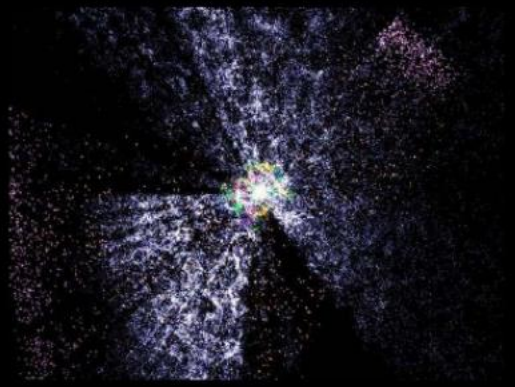
Curated datasets for 3rd- party digital planetariums





Carter Emmart, Director of Astrovisualization at the American Museum of Natural History's Rose Center for Earth and Space





Images Courtesy SCISS AB www.scalingtheuniverse.com

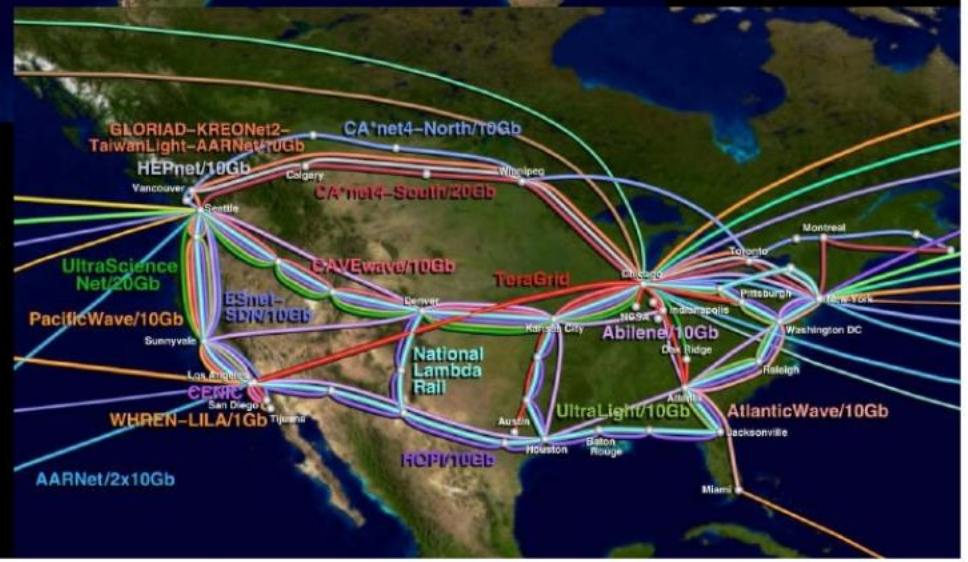
Model of the Known Universe (MotKU)

- Proposed Collaboration of Leading Institutions
  - Universities, science centers, programs
  - Multi- agency funding: NASA, NSF, UNESCO, ESA, etc.
- Curation of Scientific Datasets and Simulations
  - Geospatial, planetary, galactic, extragalactic
  - Biological, biomedical
  - Microscopic, particle/ quantum physics
  - World heritage sites
  - Participation could be mandated by funding agencies
- Standard Licensing Templates
- Dissemination through Vendor Partners, i.e.
  - Web: Google, Second Life
  - Digital Domes: E&S, Spitz, Sky- Skan, Uniview
  - Academia: OptIPortals
  - Television and Cinema: Film studios

Networked Domes: The DomeGrid

- Uniview's Octopus
  - Collaborative Tour of Satellite Databases
    - Demonstrated at DomeFest 2007: Albuquerque, New York, Sweden
    - Remote control of client rendered data
- CineGrid™ - www.CineGrid.org
  - "Interdisciplinary community focused on the research, development, and demonstration of networked collaborative tools to enable the production, use and exchange of very-high- quality digital media over photonic networks."
  - Demonstrated real- time 4k x 2k simulcasting
  - Seeking to interconnect digital domes as CineGrid nodes
  - First project: July 2009 Eclipse in China (GOTO)

Networked Domes



The Global Lambda Integrated Facility

Visualization by Robert Patterson, NCSA/University of Illinois at Urbana-Champaign
Compilation by Maxine Brown, University of Illinois
Earth Texture, visibleearth.nasa.gov

Networked Domes: Telepresence

CMU's Nomad Robot Tested by NASA Ames in Atacama Desert... Live Audience Telepresence

http://www.cs.cmu.edu/afs/cs/project/lri-13/www/atacama-trek/

Spaceborne Telepresence

- Permanent Fisheye/Immersive Camera on the ISS
  - Exterior view of ISS against Earth
  - HD Downlink
- Public Web Access (public participation in space)
  - Virtual camera with pan/tilt
- Full Fisheye Compatible with Fulldome Theaters

Immersive Media's
Dodecahedral Video Camera

www.immersivemedia.com

4. Converge with games, VR and LF cinema.

- Serious and fun game applications for domes
- Leverage VR programming and assets
- Joint standards for LF digital cinema & fulldome

Video Game Education Systems

- **A single video game can reach 10x more people than are graduated annually by the entire US higher-education system in science and engineering.**
- **Students already play games 5-8 hours a day in their spare time.**
- **Video games stimulate substantial dopamine release in the brain that promotes learning.**
- **Initial studies show typically 30% or more improvement of teaching effectiveness for video games over lecture.**
- **Video games employ effective learning paradigms in order to be compelling:**
  - **Experiential learning –** "If you do it, you learn it"
  - **Inquiry-based learning** – "What happens if I do this?"
  - **Self-efficacy** – In games, points, levels, or magic swords are awarded at positive decision points, encouraging players to keep going.
  - **Goal setting –** "You learn more if you work towards a well-defined goal."
  - **Cooperation** – Cooperative or team learning results in a 50% improvement over either solo or competitive learning.
  - **Continuous Feedback, tailored instruction, cognitive modelling** – Tutor-type software can increase TIMSS scores by 30%.

Merrilea J. Maya, "Games for Science and Engineering Education," Communications of the ACM, July 2007, Vol. 50, No. 7

Video Game Tournaments

- Dome Video Game Tournaments
  - Regional, national, international
- Audience as Players
  - Group interactivity using wands, joysticks, etc.
- Audience as Spectators
  - Economic model similar to sports with skilled teams
  - Audiences collaborate to support their team

Images Courtesy de pinxi – www.depinxi.com

Fulldome Theatres and Virtual Reality

Virtual Reality for the Masses…

Virtual Reality Definition

Virtual Reality = Media technologies that immerse the senses sufficiently to replace perception of the ordinary world with a sense of presence in an intentionally manipulated virtual, artificial, or enhanced environment

- Augmented reality and projected information overlays
- Large- format displays and wrap- around screens
- Computer games and interactive spaces

Flavors of Virtual Reality...

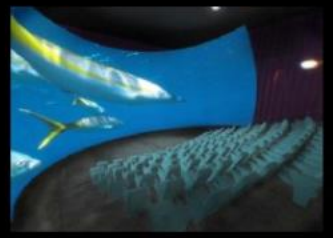
Reality-Virtuality (RV) Continuum

P. Milgram, H. Takemura, A. Utsumi, F. Kishino, "Augmented Reality: A class of displays on the reality-virtuality continuum," SPIE Vol. 2351, Telemanipulator and Telepresence Technologies (1994)

Flavors of Virtual Reality...

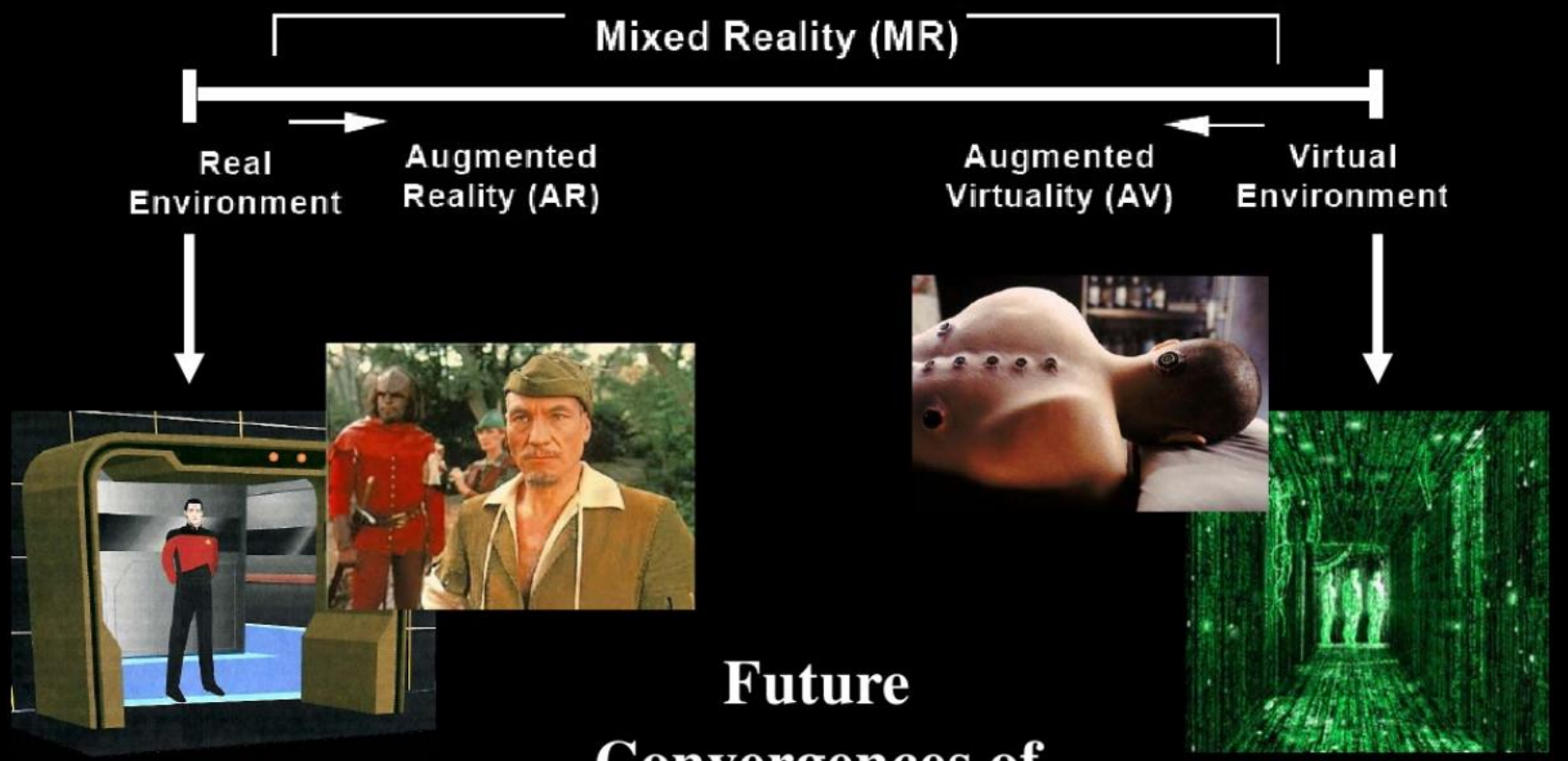
"Classic" Virtual Reality

Spatial Immersive Displays



Spatial Augmented Reality

Flavors of Virtual Reality...

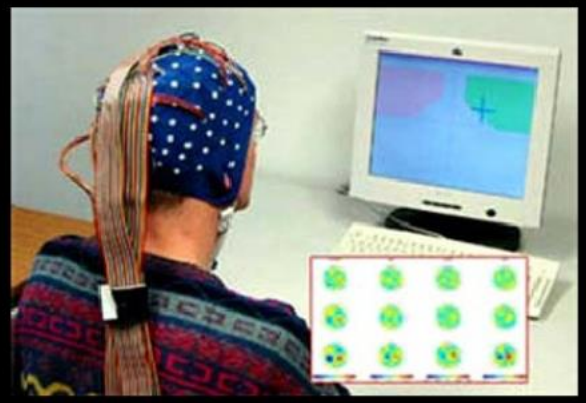


Virtual Reality

Courtesy NASA

Courtesy VirtuSphere Corp.

Courtesy Immersion Corp.



Virtual Reality

- Override external sensory inputs
  - Physically isolating, digitally immersive
- User Interfaces Expensive and Encumbering
  - Opaques Out “Real- World”
    - Users oblivious to telephones and other real-world demands
    - Physically isolating yet digitally highly immersive & interactive
  - Long- term usage issues for 3D stereoscopy
  - Low throughput (for entertainment applications)
  - Hygiene issues (for entertainment applications)
- Low adoption rates in real- world applications

Virtual Reality Art

Tree Pond from Osmose
Char Davies
Immersence.com

"Immersants" reported:

- Being in another place
- Losing track of time
- Unable to speak rationally
- Euphoria
- Spiritual experience

Summer Stream from *Ephémère*

Char Davies

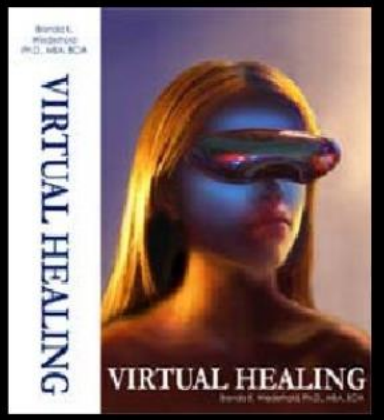
"*Ephémère* can be viewed as an attempt to reaffirm our limitations, our mortality, our dependency on aging bodies and an earth which will, for those of us now living, absorb our bones, dreams of cyber immortality notwithstanding."

Virtual Reality Healing

- Pain Management
- Phobia Treatment
- Technology-enabled conflict negotiation
- PTSD treatment
- Anxiety disorders
- Addictions
- Eating disorders
- ADHD treatment

Cybertherapy Conference
interactivemediainstitute.com/index_conf.html

Virtual Healing (book)
Brenda K. Wiederhold, Ph.D., MBA, BCIA
vrphobia.com



The degree of immersion in an interactive VR experience seems to improve its efficacy in medical treatments for phobias and pain, performing better than 2D video games, for instance. - Hunter G. Hoffman, Sci. American, August 2004

Spatially Augmented Reality

Virtual Reflectance

Virtual Illumination

Virtual Motion

UNC & Ramesh Raskar's Shader Lamps

Virtual Interaction

Spatially Augmented Reality

- Normal Operation of Sensory Inputs
  - Physically collaborative yet immersive
- Completely Unencumbered
  - Enhances the “real- world”
    - Requires spatial “props” for projection or emissive surfaces
    - limited flexibility, reconfigurability - not “general use”
  - No long- term fatigue issues
  - High throughput (by entertainment standards)
  - No hygiene issues (entertainment applications)
- Potentially high adoption rates in real- world applications

Spatially Immersive Displays

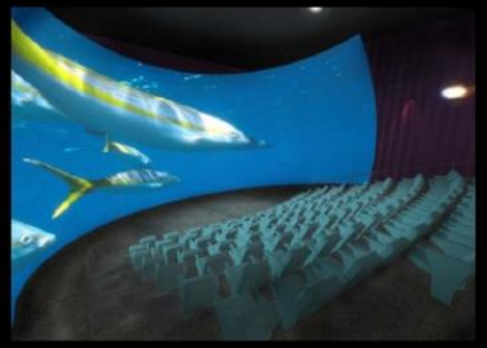
CAVE

Reality Centers

Fulldome Theaters

Domes

Mega-Walls



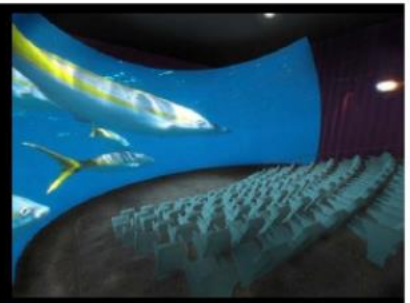
Wrap-Around Screens

Personal
Small-Scale

◀ ..... ▶

Group
Large-Scale

Spatially Immersive Displays



- Walk-In Immersive Spaces
  - Physically collaborative
- Completely Unencumbered
  - General use immersive projections
  - No long-term fatigue issues
  - High throughput (by entertainment standards)
  - No hygiene issues (entertainment applications)
- Demonstrated high adoption rates in real-world applications

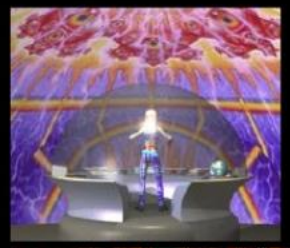
Other Immersive Display Applications

- Theme Parks
- Tradeshows
- Nightclubs
- Concerts
- Dance Parties
- Restaraunts
- Spas

Images Courtesy Obscura Digital

Vortex Immersion Media

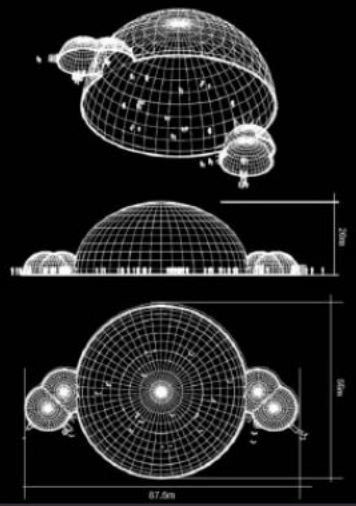
Advanced Immersive Media Applications



VR Nightclub

Digital Theming

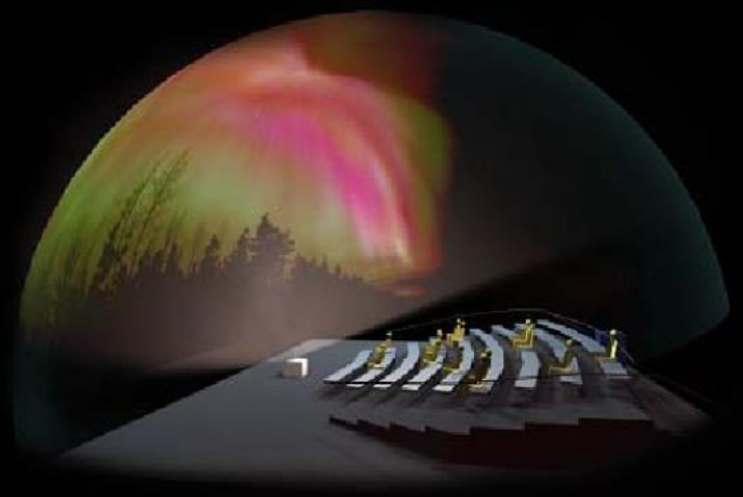
Inflatable Domes



Convergence of Fulldome and Large- Format Film

- Imax Corp. recently sold 180 digital screens
- White Oak Foundation is applying for NSF funding to hold a LF Digital Standards Colloquium
- IMERSA is considering DCI specifications for both fulldome and LF Film specifications
- LF Digital Cinema is basically already compatible with digital planetarium systems
- Fulldome adds real- time interactivity

Digital Dome Theaters



More than a planetarium…
More than a movie theater…
It's a portal into cyberspace,
virtual environments
and the new world of
electronic information.

As an artistic medium,
digital domes are the closest thing to
being inside the artist's head.

Find out more at:

http://en.wikipedia.org/wiki/Fulldome

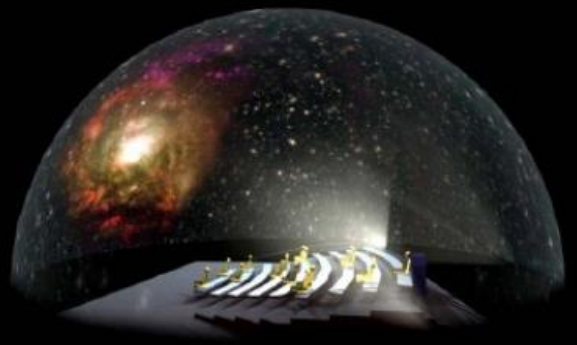
http://extranet.spitzinc.com/reference

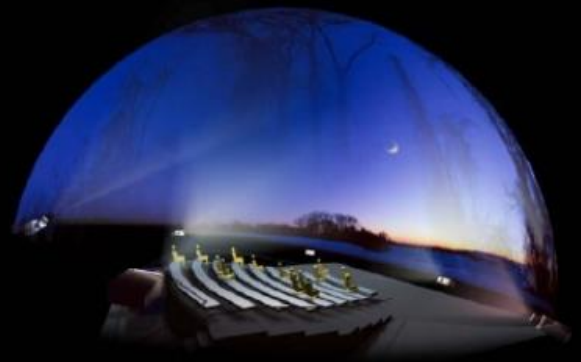
www.lochnessproductions.com

www.ips-planetarium.org/fulldome

http://groups.yahoo.com/group/fulldome/

Thank You





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Clip slide

About the Author...

Ed Lantz is a media and entertainment engineer, inventor, scientist, artist and entrepreneur. He is internationally recognized as a pioneer and leading authority in large-format digital cinema and immersive experiences for mass audiences. Other areas of interest include virtual reality, interactive place-based entertainment, real-time video/music performance, independent films with socially conscious themes, fine art visual music, neuroaesthetics, transformative media and entertainment, celebratory event design and wellness applications exploiting the psychophysical effects of interactive digital media.

Mr. Lantz has a background in hardware and software engineering, quantum physics and electromagnetics. He spent seven years leading photonic signal processing R&D at Harris Corp. in Melbourne, Florida, five years at the Astronaut Memorial Planetarium in Cocoa, Florida leading the development of advanced laser, video and astronomical projectors, and eight years with Spitz, Inc. where he built a team that transformed old-style planetariums into immersive visualization environments. Mr. Lantz founded Harmony Channel in 2004, a cable and broadband television network delivering mood-elevating digital media that has been described as "MTV for the Soul." He most recently founded Vortex Immersion Media, a new venture bringing virtual reality experiences to the Las Vegas nightclub environment.

Mr. Lantz has published and presented numerous papers on VR and entertainment technologies, and is a regular contributor to ACM SIGGRAPH papers, panels and courses. He founded the International Planetarium Society's Fulldome Video Committee and the first Fulldome Standards Summit held in Valencia, Spain in 2004, co-organized the first Immersive Cinema Workshop in Espinho, Portugal in 2005, and was Keynote Speaker at Immersive Vision 2008 in Plymouth, UK. He received an MS in Electrical Engineering from Tennessee Tech University (1984), serves on the board of the Center for Visual Music, and holds two US Patents on immersive video-based theater technology.

LITERATURA:

- http://www.zeiss.de
- http://www.ips-planetarium.org
- http://www.lochness.com
- http://www.fddb.org/
- https://blooloop.com/museum/news/experimenta-science-dome-kraftwerk-living-technologies/

… A TO JE VŠE, LIDIČKY !