# Novel Projection Environments

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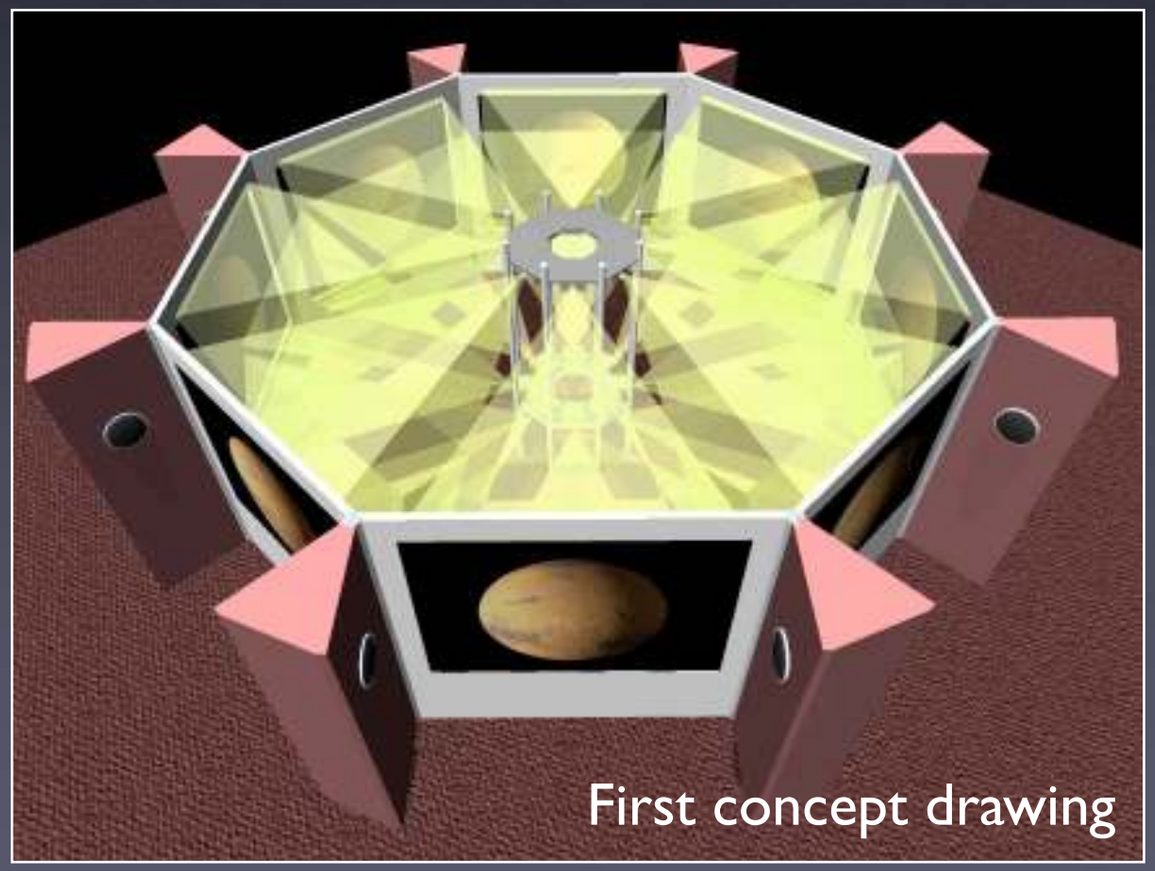
# Introduction

- VROOM (Virtual ROOM), Melbourne Museum
- AVIE (Advanced Visualisation and Interaction Environment), ICinema, UNSW
- Hemispherical displays, inflatables and fixed planetaria
- Wide angle projection using a spherical mirror
- iDome - Upright dome
- Cosmology Gallery, Gin Gin
- Future project: iSphere
- Current project: Navigable movies

## Application to visualisation

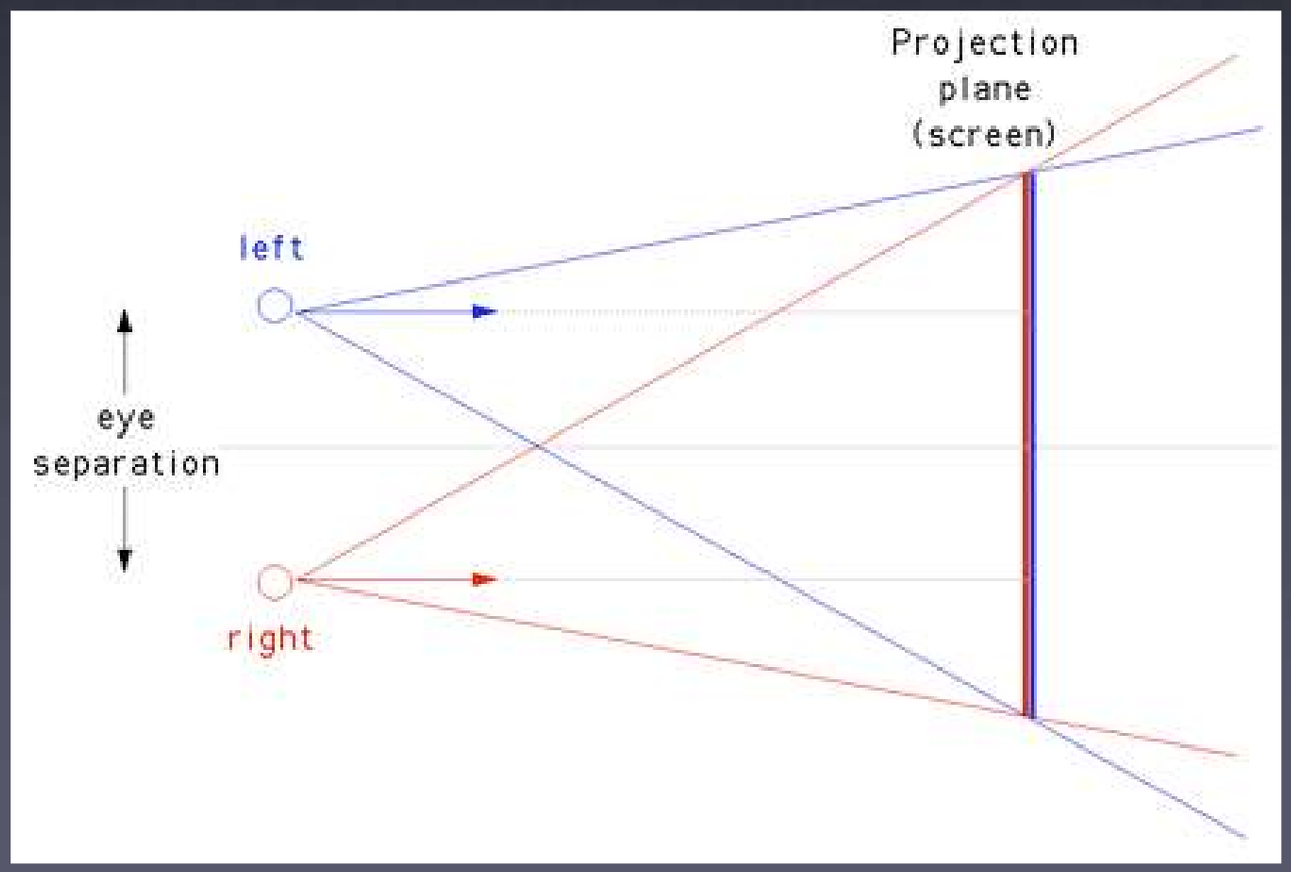
# VROOM: Virtual ROOM

- Conceived 2001 - Virtual Containment Vessel
- Inverted CAVE: Looking inward rather than outwards.
- Designed/built 2003.
- Ideal for museums, solves single person limitations.
- Currently operating at the Melbourne Museum.


First concept drawing

# Stereoscopic projection

- Ideally stereoscopic generation requires off-axis frustums, rarely supported. (Toe-in introduces vertical parallax).
- Crucial to create correct depth effect, achieved by modelling the exhibit and placing cameras at intended viewing positions.
- Rendering challenge: 1024 x 768 x 2 x 8 x 25fps
  [Show sample clip]





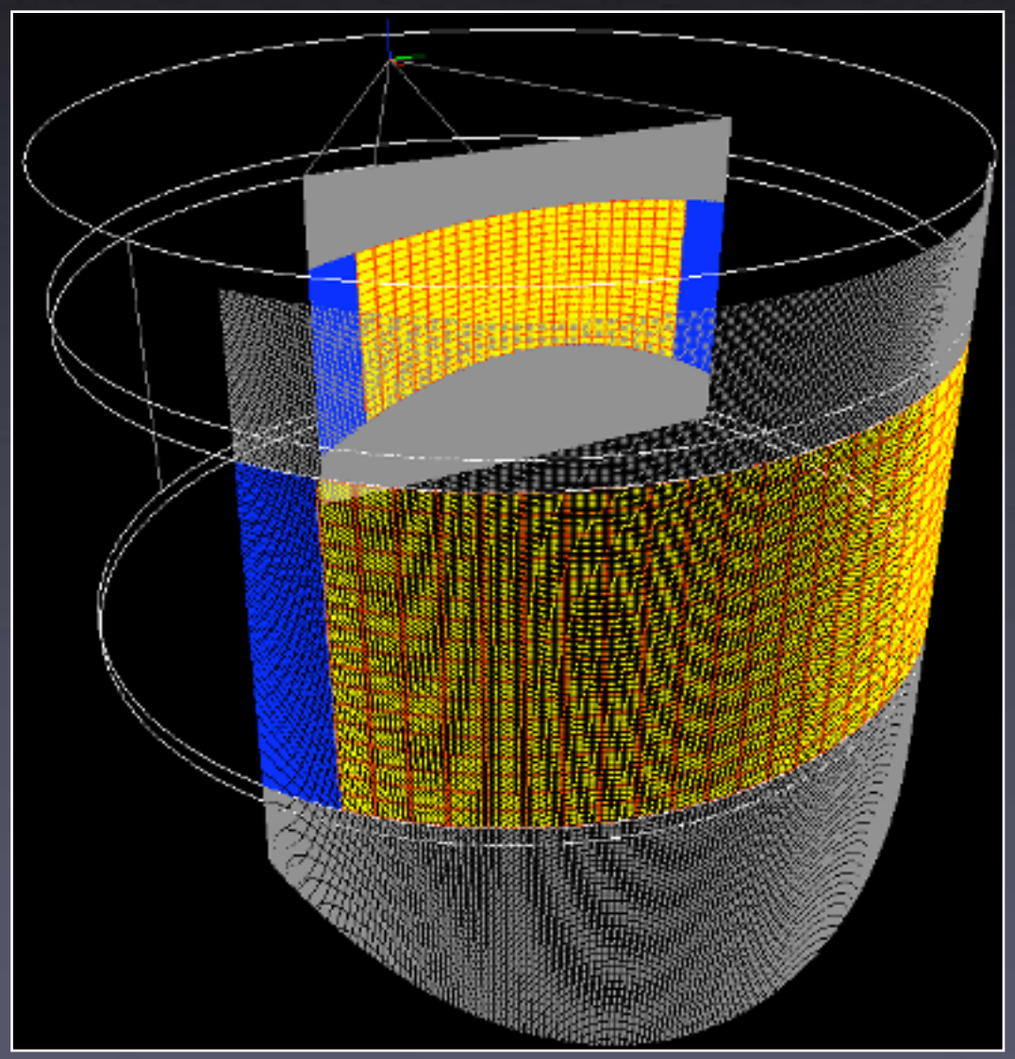
Initial installation

# AVIE
## (Advanced Visualisation and Interaction Environment)

- Full 360 degree stereoscopic cylindrical display.
- Built at the ICinema Scientia Facility, UNSW, Sydney
- Each projector SXGA+ (1400x1050), image capacity close to 8000 pixels around the cylinder.
- Phase 1: 4 projector pairs
- Phase 2: 6 projector pairs
- Genlocked imagery from 6 computers, one per pair.
- 10m diameter, 4m height

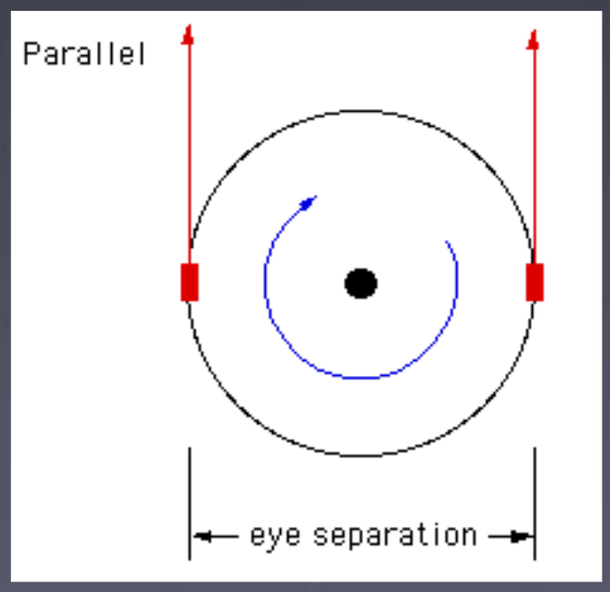
# Projection geometry

- Geometry correction onto cylindrical surface.
- Edge blending, in stereo .... 12 edge blend zones!
- Optimise # projectors and % of used pixels.
- Cylindrical panoramic images resolution: 8000 pixels wide.
- Development of an optical design tool to evaluate projectors and geometry variations.
- Development of a calibration tool.
- Content delivered with VirTools.



# Generating stereoscopic panoramic pairs

- Geometry for creating stereoscopic panoramic images
  - cannot use existing mono panoramic techniques!
- Challenge is capturing images at sufficient resolution.
- CG content generation. 8000 x 1000 pixels x 2 x 30fps.
- Current research involves live action capture.
- Development of panoramic alignment and blending across 0-360 degree interface.
- [Show sample]




Roundshot camera rig

# Hemispherical displays - domes

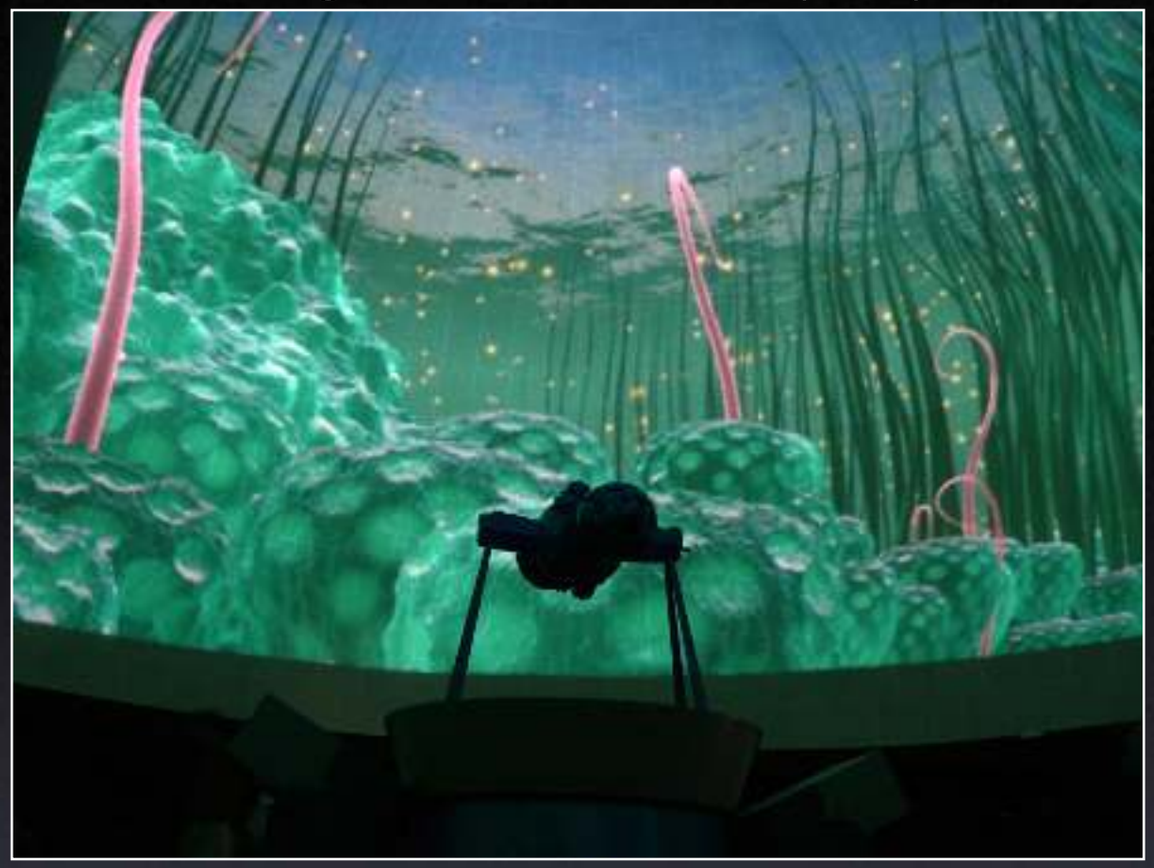
- Inflatable domes.
  Traditional star field generators: pin holes in mylar sheets/ cylinders and a really bright light source.
- Fixed planetarium domes.
  Traditionally use a Zeiss star projector.
- “Everyone” trying to move to full dome projection.
- Multiple projector installations: expensive, high cost of ownership .... out of the reach of many planetaria.
- Goal of multiprojector configurations is to reproduce star fields (very hard). Resolution not necessarily as important for full dome movie playback.

# Wide angle projection using a spherical mirror

- Wide angle projection options:
  - Multiple projectors (edge blending, synchronsation)
  - Fisheye lens and a single projector
  - Spherical mirror and a single projector
- Initial concept early 2004, tested late 2004 in the Wollongong planetarium.
- First used commercially in inflatable domes for school tours.
- Now recognised and used around the world as a low cost fulldome projection solution. With care the quality is not significantly different to fisheye but at a fraction of the cost.
- Trick: image warping.

Adelaide planetarium


Bangalore Planetarium (15m)

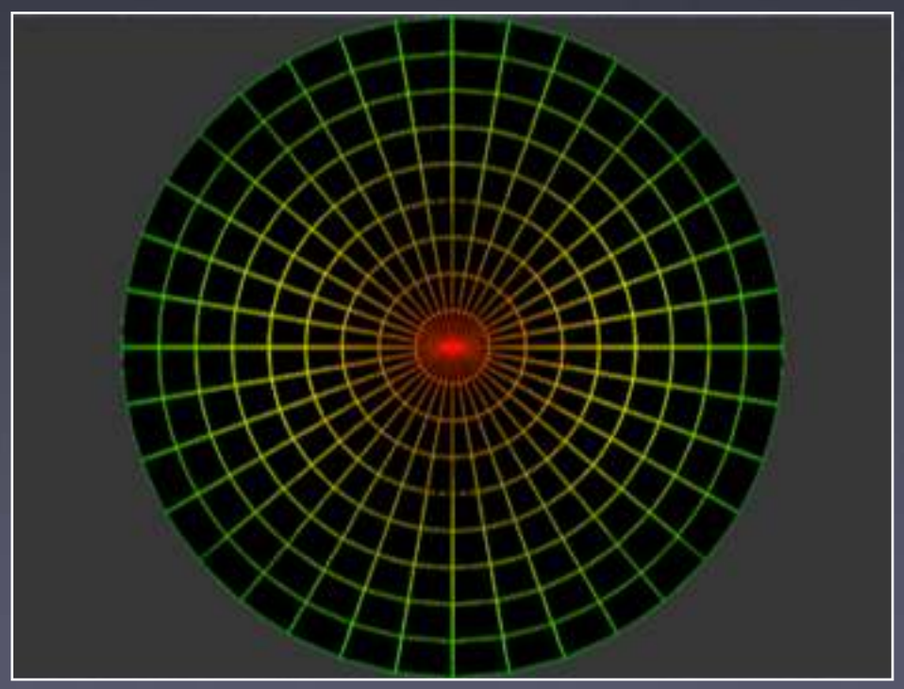


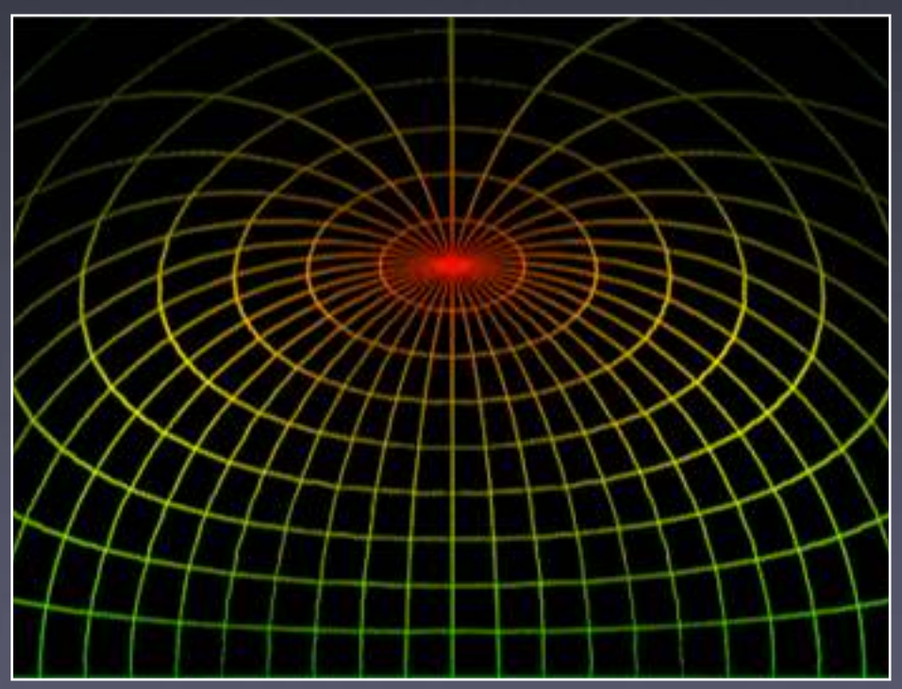

Mueller planetarium, Nebraska

Graphite (2005)

# Image warping

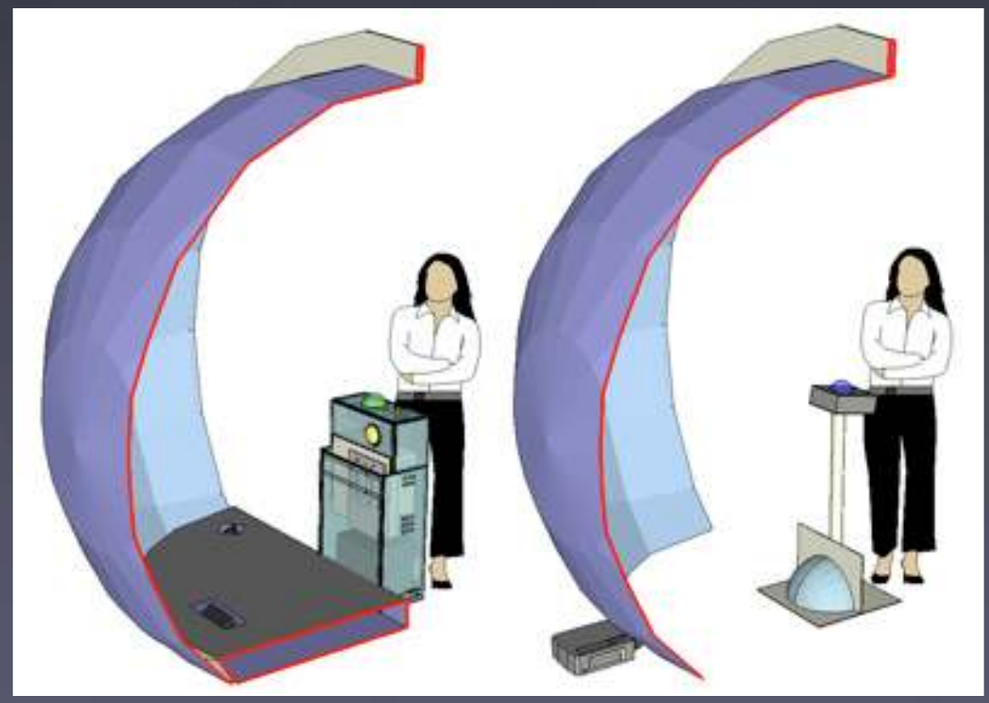
- Given an image projection that contains the required visual information (eg: fisheye), and a geometric description of the projection environment (eg: position of projector, mirror, dome, projector throw...), distort the input image so the result on the final projection surface looks normal.
- This can now readily be done on the fly, even for high resolution movies. Eg: 2Kx2K fisheyes can be interactively warped using a laptop. [Show example]



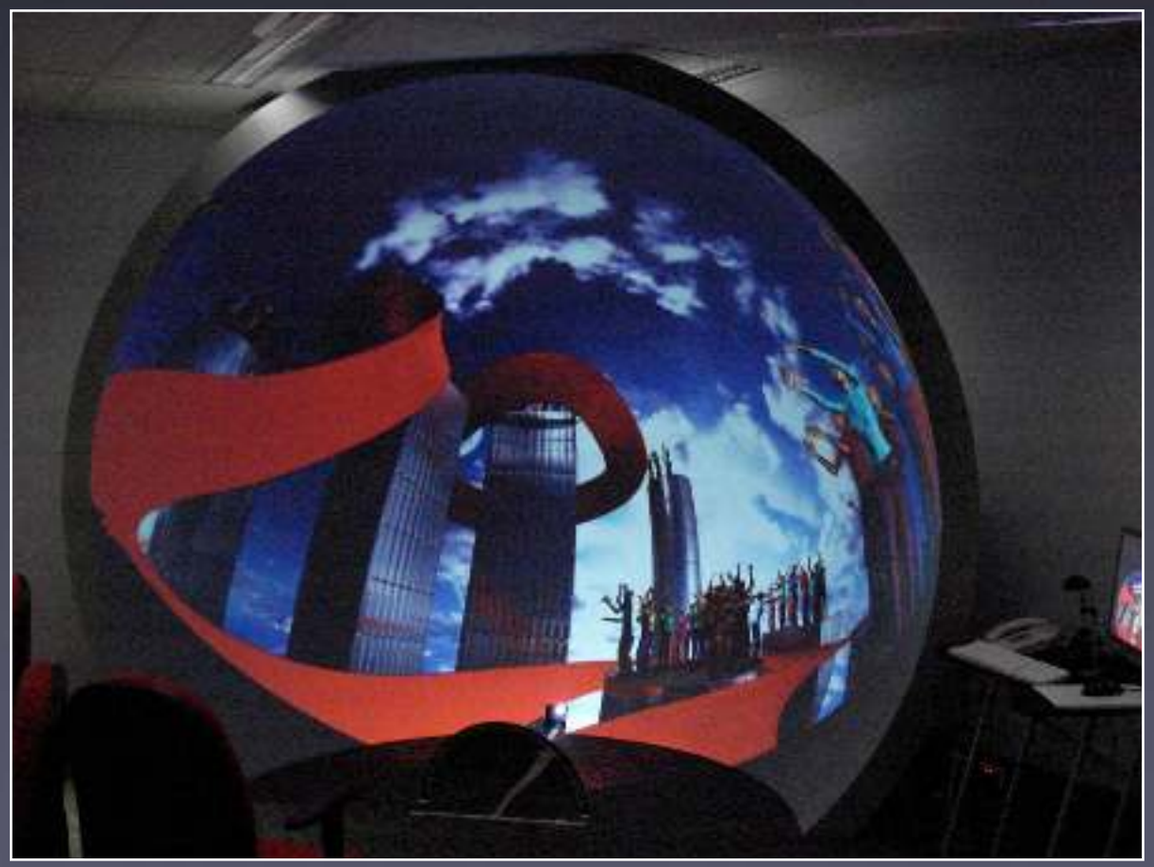


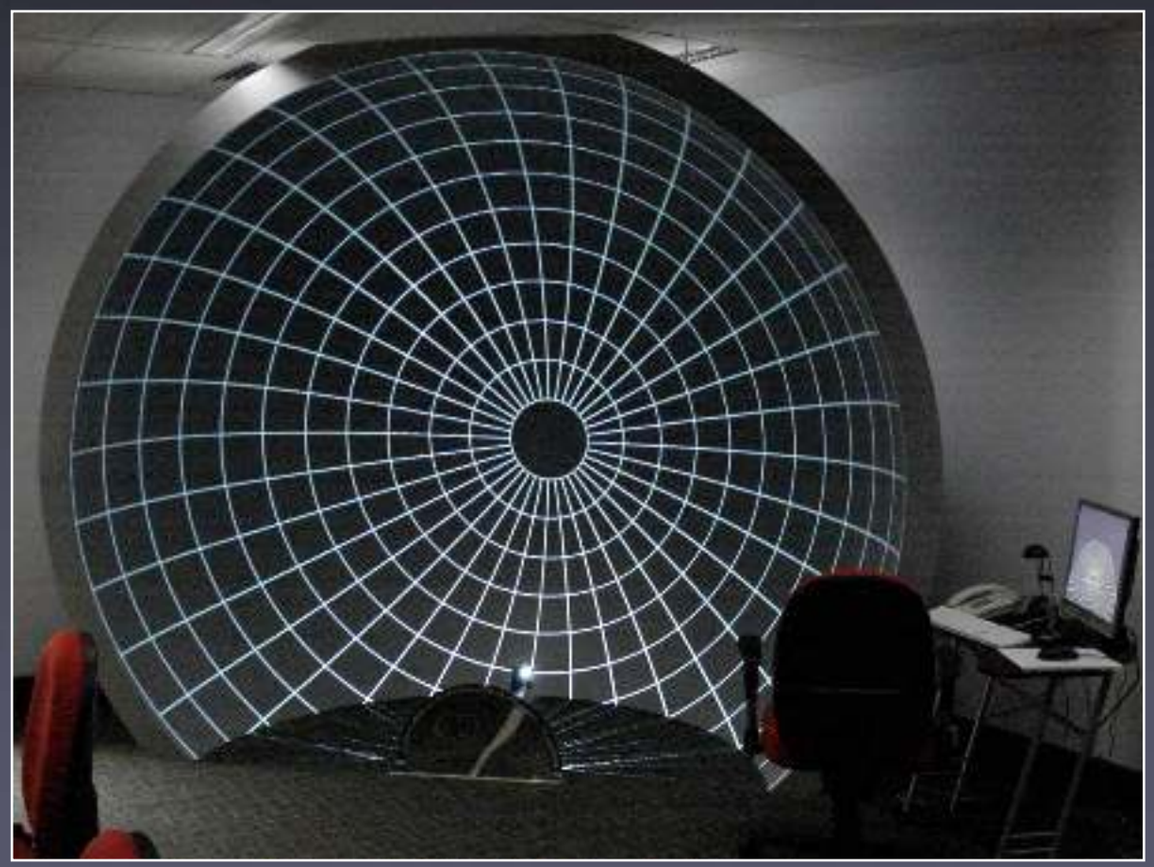
# iDome - more general immersive display

- Dome orientated 90 degree to standard planetarium dome.
- Intended for between 1 and 6 participants.
- Simulation and gaming applications.
- Visionstation was 1.5m diameter, local design is 3m diameter.
- Spherical mirror frees up the center of the dome (vs fisheye lens and projector).
- Separates the projector from optics.



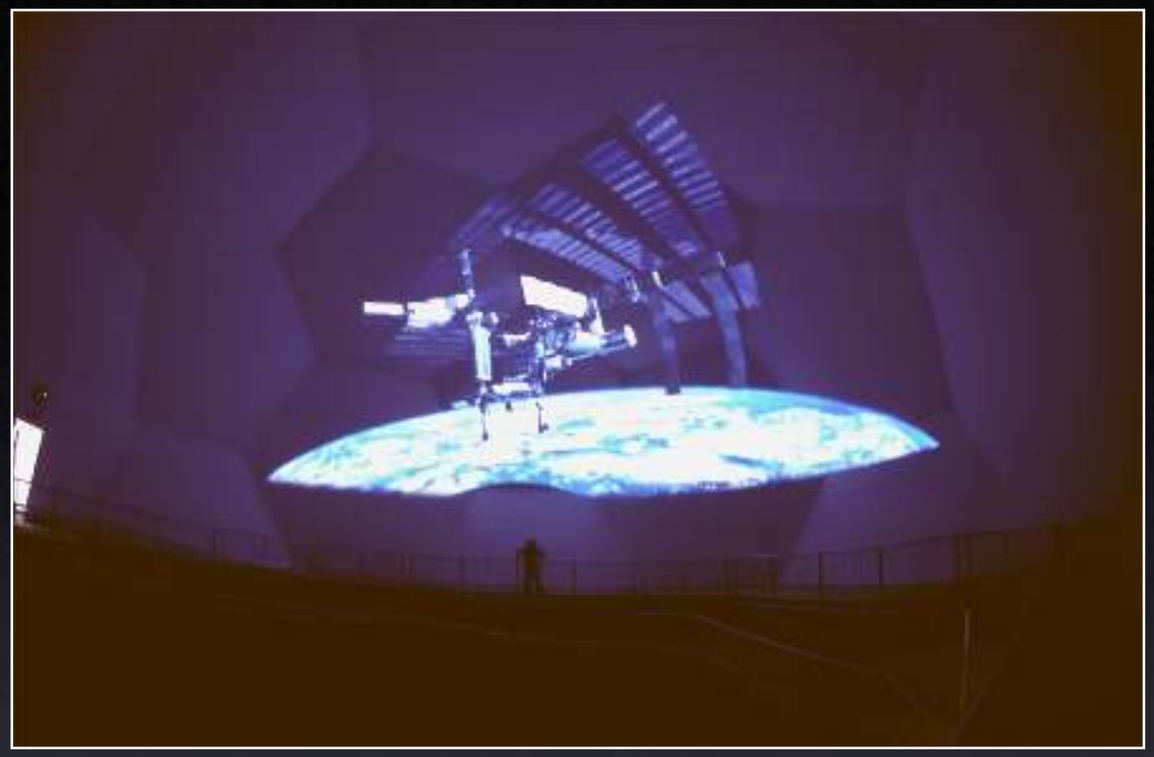
Courtesy iCinema

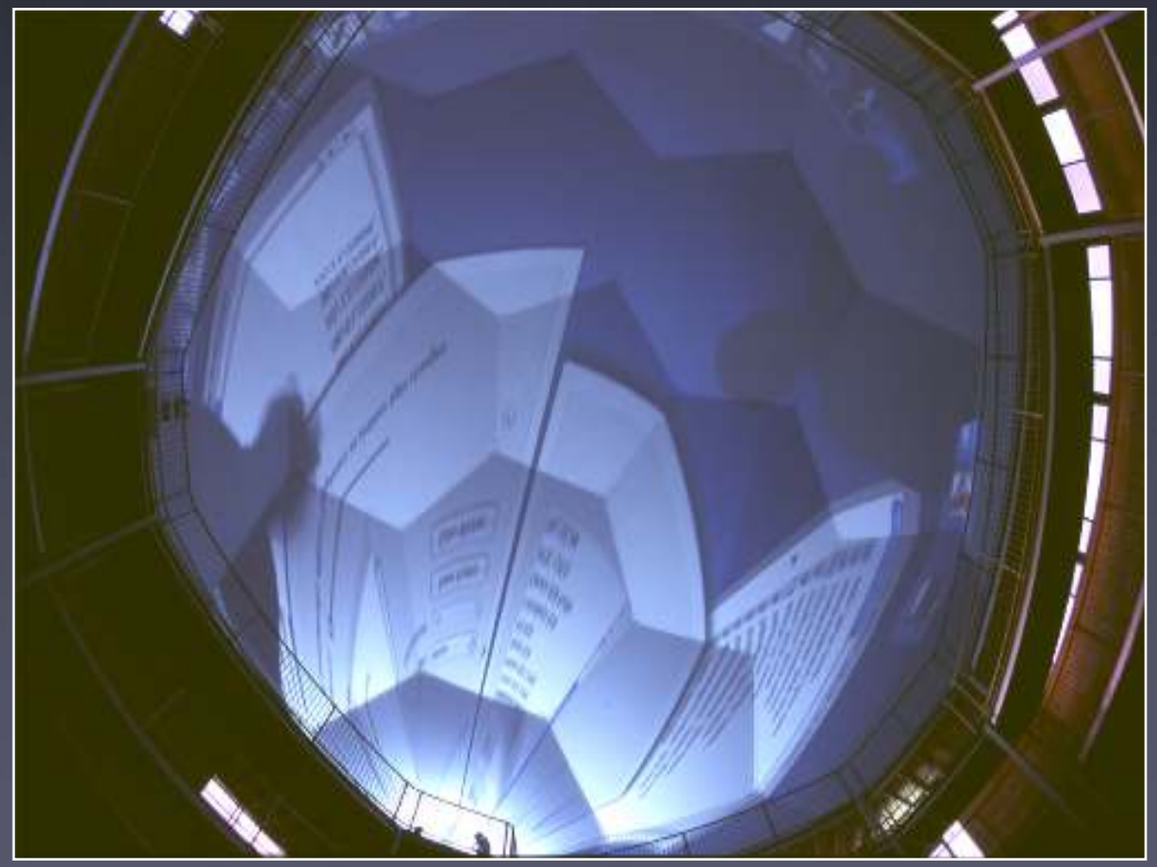




# Cosmology Gallery, Gin Gin, WA

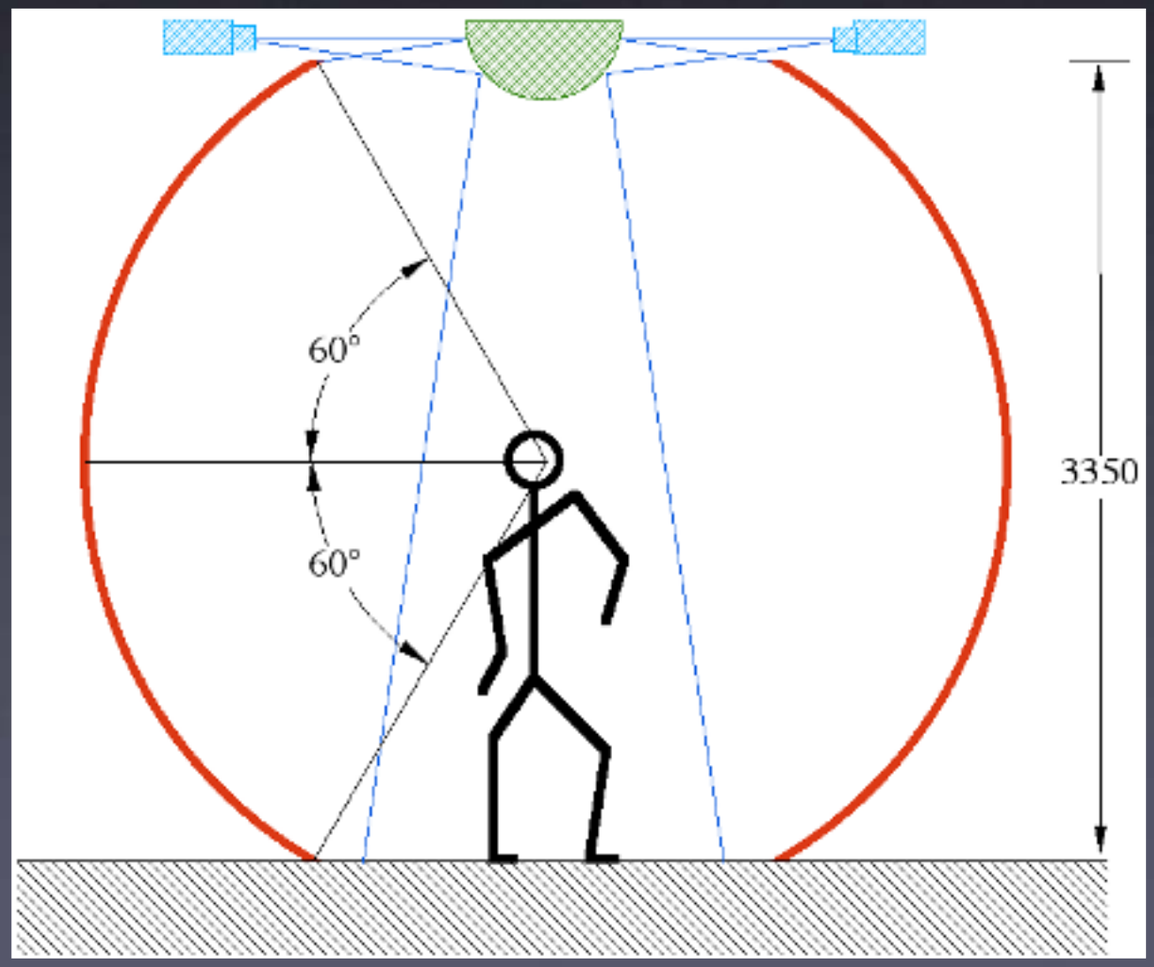
- Australias largest projectable dome is here in WA.
- 20m diameter, 2.5 storeys above the gallery floor.
- Bucky ball (Carbon 60) geometry.
- Part of the Gravitational Discovery Center (GDC), public science centre and gravity wave research laboratories.

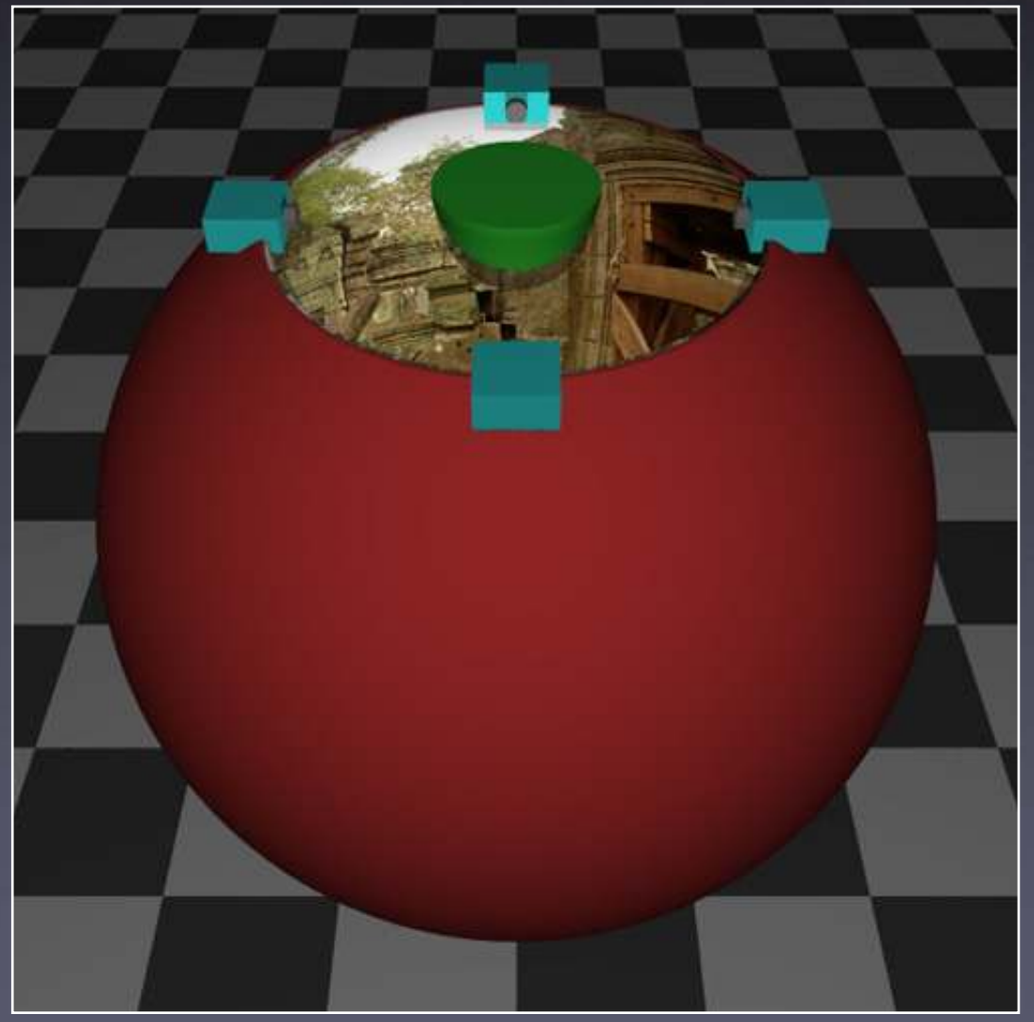




# iSphere

- Full visual field
  360 degrees of longitude
  120 degrees of latitude
- 4 x HD (1920x1080) projectors.



# iSphere Projection Example

# Current project: Navigable movies

- Imagine capturing the entire visual field about the viewer position (eg: spherical, cylindrical, or cubic map projections).
- May be CG animation or live capture.
- When watching this movie the viewer is free to choose his/her view direction. A different experience in each viewing!
- Moving away from "the frame" or window metaphor, interesting implications/opportunities for the traditional cinematic experience.
- [Show example]

# Questions?