Dome Projection using a Vertex Shader

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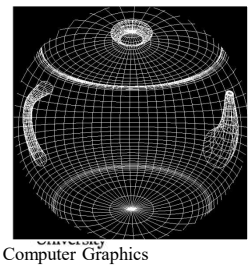
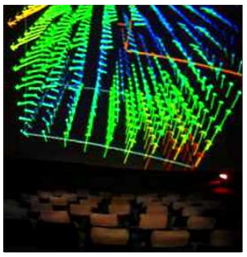
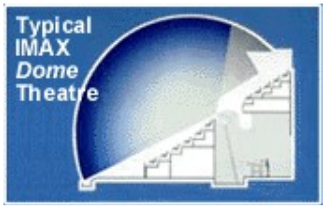
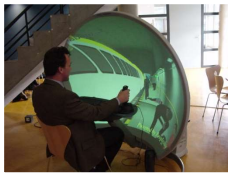




Dome Projection – Becoming more Common





I believe that it's only a matter of time until it becomes a routine visualization tool

Programming a Dome display is easier when only a single projector is used

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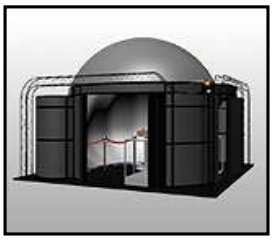
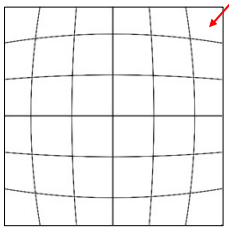
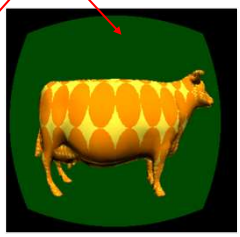


A fisheye lens in the projector distorts the image so that it spreads out across the dome.

The trick is pre-distorting the image in the other direction so that it looks correct after being projected.





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One Night at the Reuben H. Fleet Science Center in San Diego…

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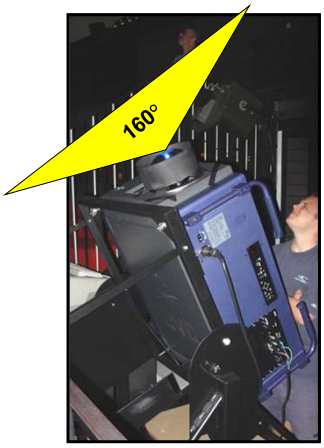

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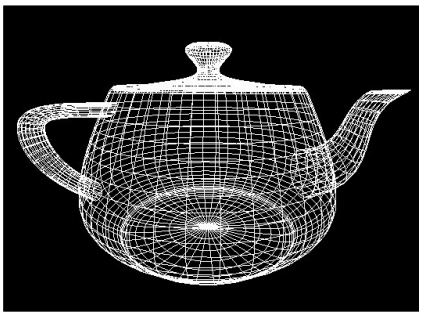
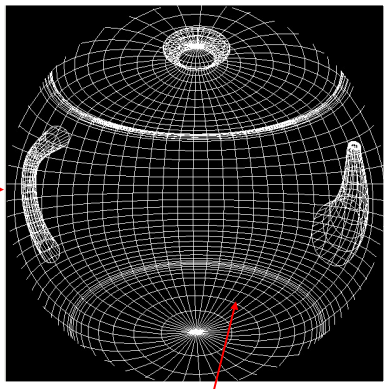
Dome Distortion

Move the teapot so it surrounds the audience

Undistorted



Distorted



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A fisheye lens in the projector distorts the image so that it spreads out across the dome.

The trick is pre-distorting the image in the other direction so that it looks correct after being projected.

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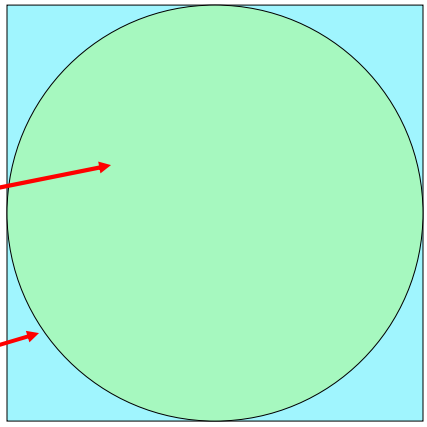
Dome Projection

Viewing Volume = (-1,-1) to (1,1)



The edge of the circle represents the edge of the dome projection = your left, right, bottom, top as you are sitting in the theater.

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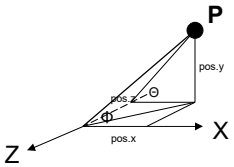
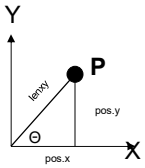
Dome Vertex Shader:

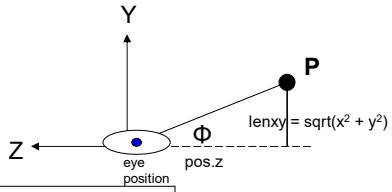
God's-eye View:



As the eye sees it:



From the side:

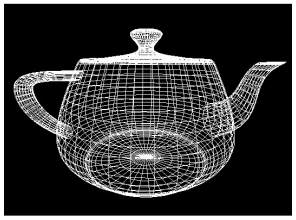



```
const float PI =  3.14159265;

void
main( )
{
        vec4 pos = gl_ModelViewMatrix * gl_Vertex;
        float lenxy = length( pos.xy );

        float phi = atan( lenxy , -pos.z );
        pos.xy = ( phi / (PI/2. ) )  *  ( pos.xy / lenxy );

        gl_Position = gl_ProjectionMatrix * pos;
}
```

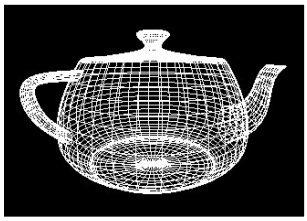
Note: (pos.xy / lenxy) = (cosΘ,sinΘ)

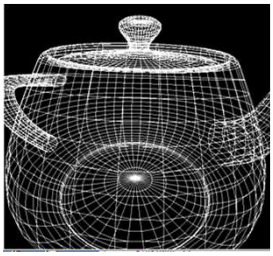
Dome Vertex Shader:

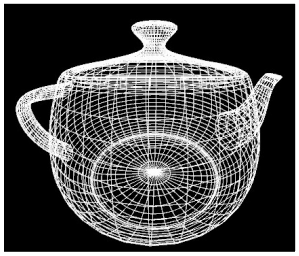
Undistorted



Distorted

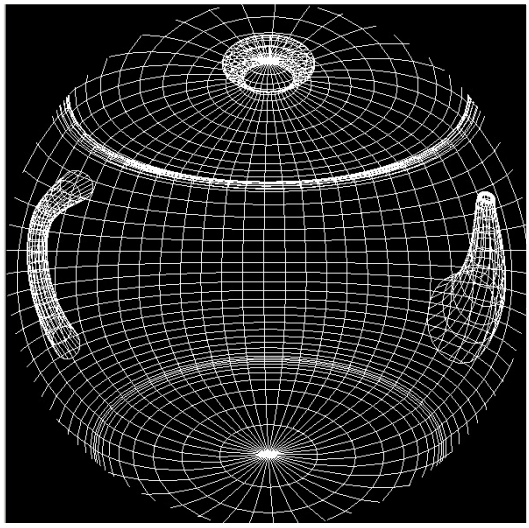






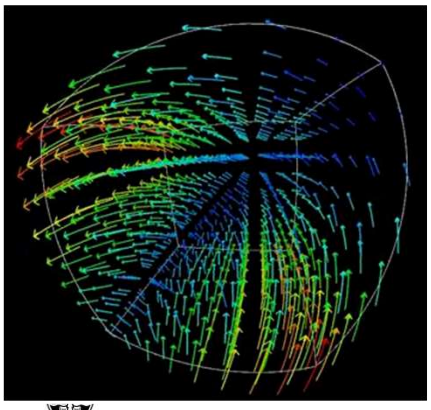
Dome Vertex Shader:

Distorted

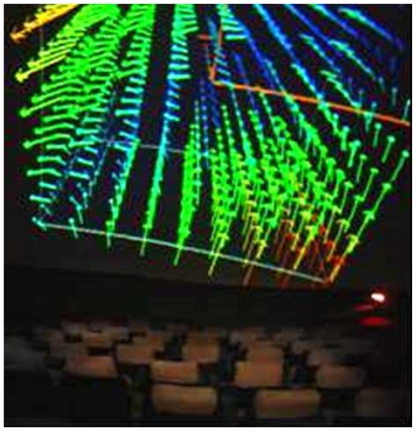


Flow Visualization in the Dome

Distorted

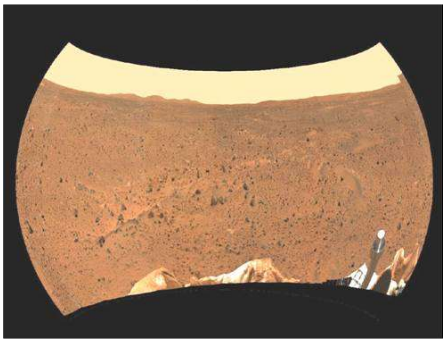


Projected



Mars Panoram in the Dome

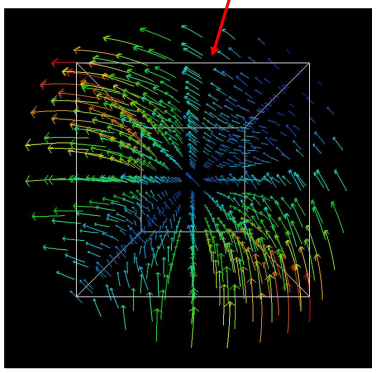
Projected



Projected

Large Lines and Polygons Need to be Tessellated

Note: This edge does not pass through the flow vectors!



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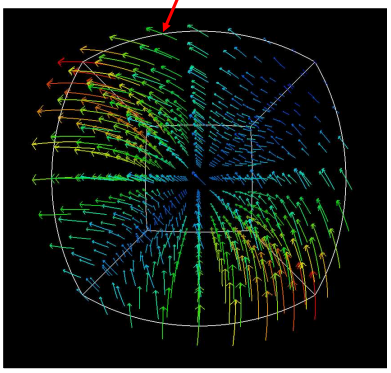

Bounding Box edges were *not* tessellated. Straight lines on the monitor produced curved lines on the dome.

Bounding Box edges were tessellated. Curved lines on the monitor produced straight lines on the dome.