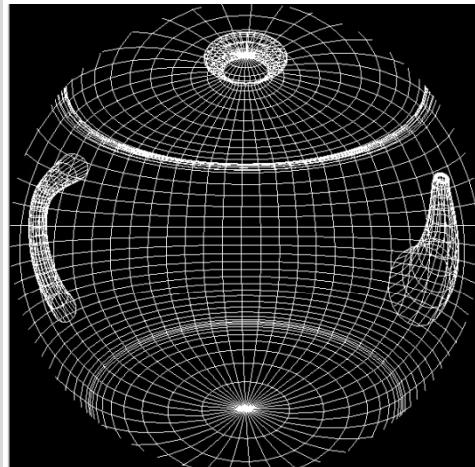


# Dome Projection using a Vertex Shader

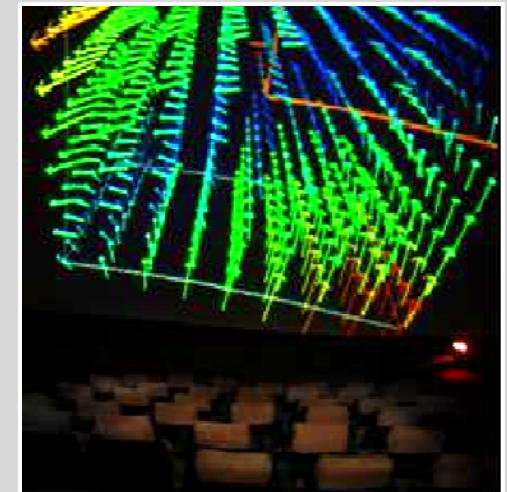
**Mike Bailey**

[mjb@cs.oregonstate.edu](mailto:mjb@cs.oregonstate.edu)

**Oregon State University**

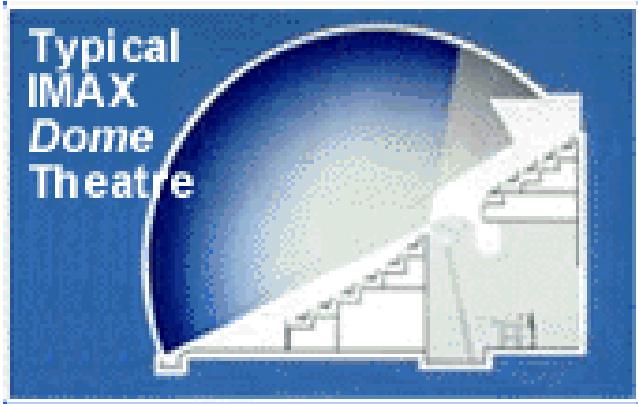


dome.pptx



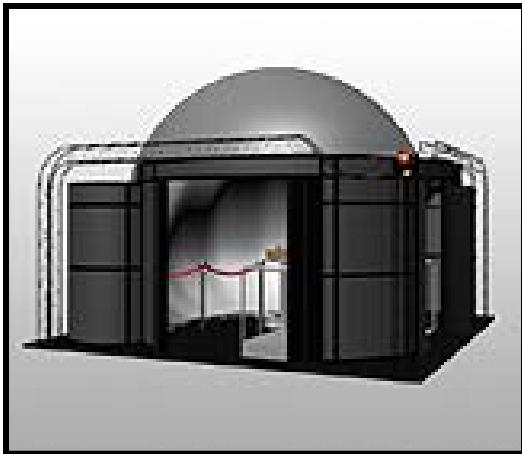
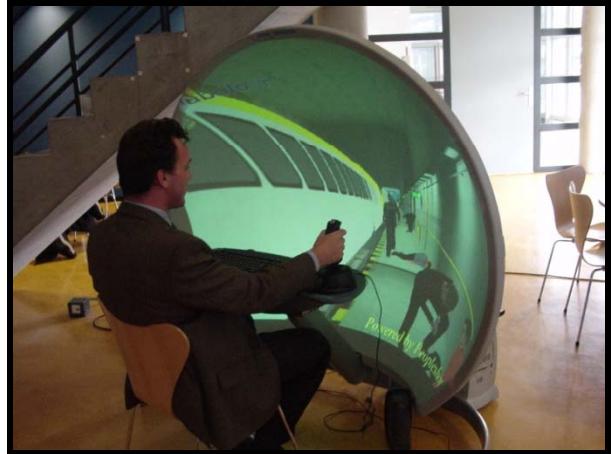
mjb – January 15, 2015

## Dome Projection – Becoming more Common



Only a matter of time until it becomes a routine visualization tool

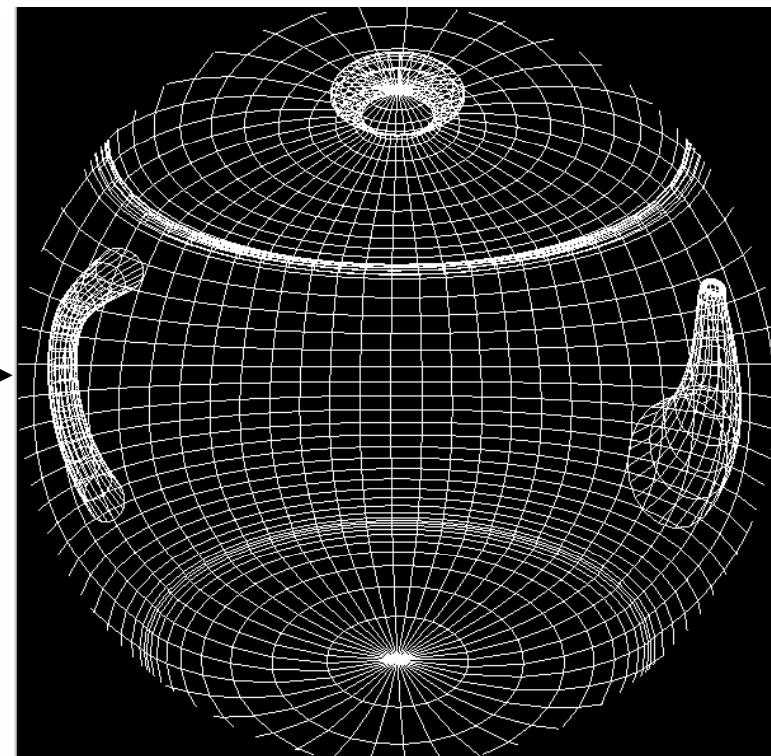
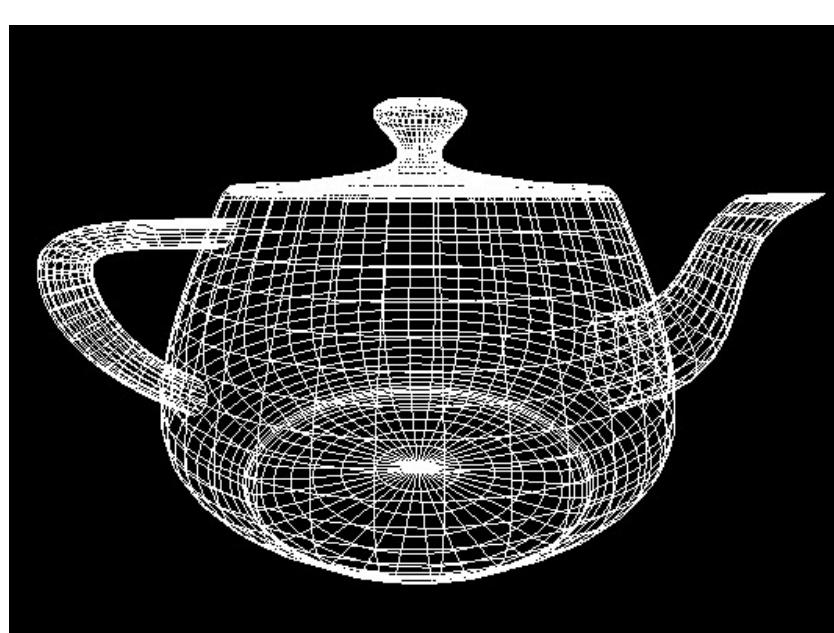
## Programming a Dome display is easier when only a single projector is used



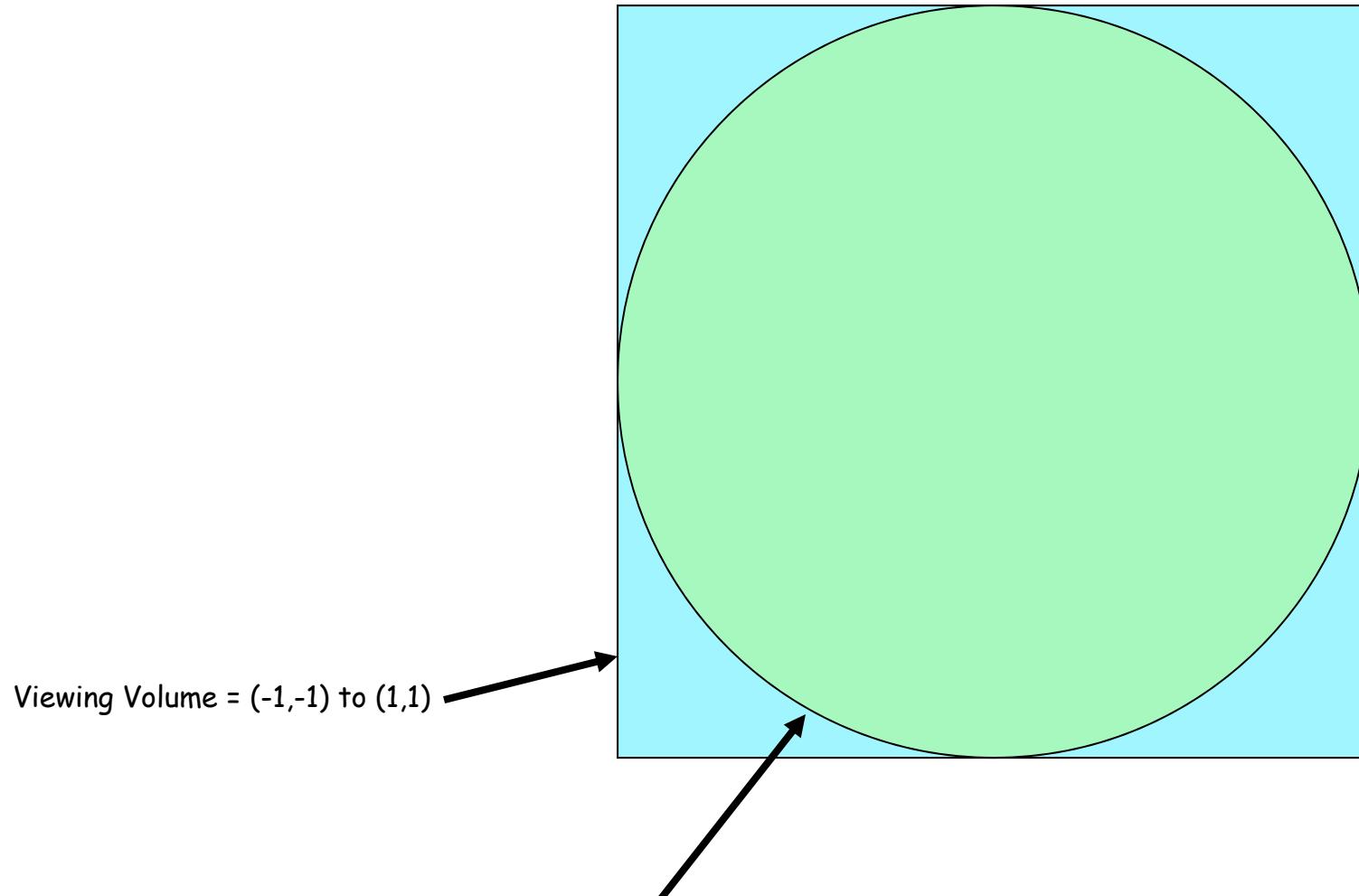
A fisheye lens distorts the image so that it spreads out across the dome. The trick is pre-distorting the image in the other direction so that it looks correct after being projected

## Dome Distortion

Move the teapot so it surrounds the audience



## Dome Projection:

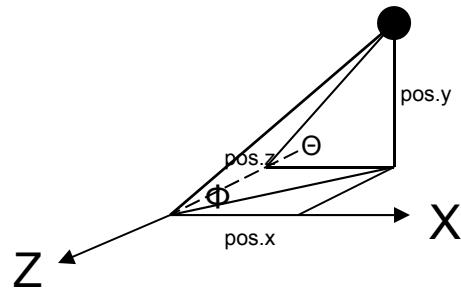


Viewing Volume = (-1,-1) to (1,1)

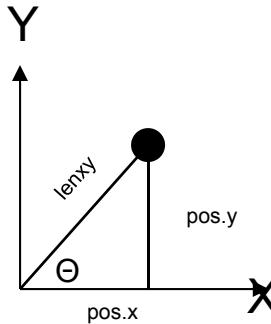
Edge of the circle represents the edge of the dome projection = your left, right, bottom, top as you are sitting in the theater.

## Dome Vertex Shader:

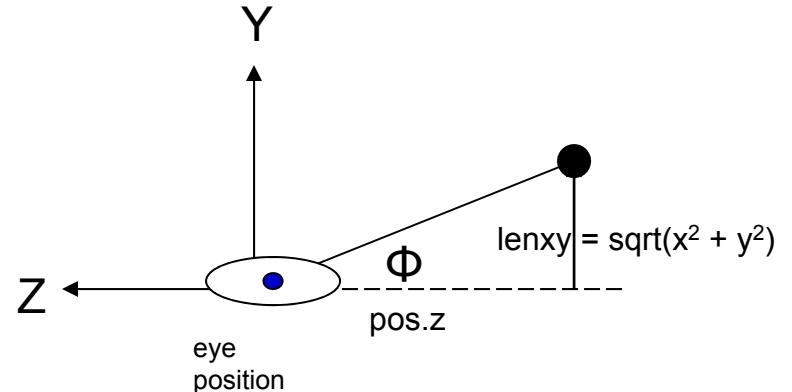
God's-eye View:



As the eye sees it:



From the side:



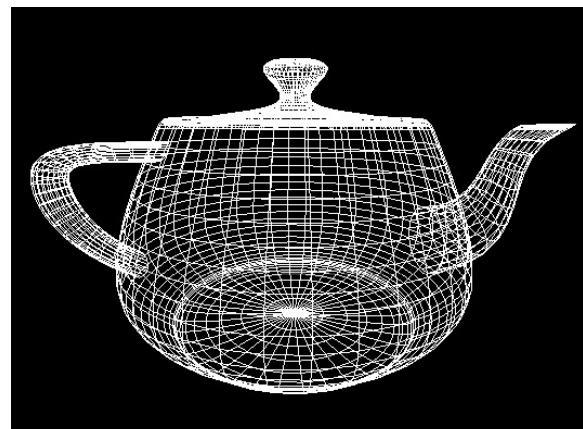
```
const float PI = 3.14159265;
```

```
void
main( )
{
    vec4 pos = uModelViewMatrix * aVertex;
    float lenxy = length( pos.xy );

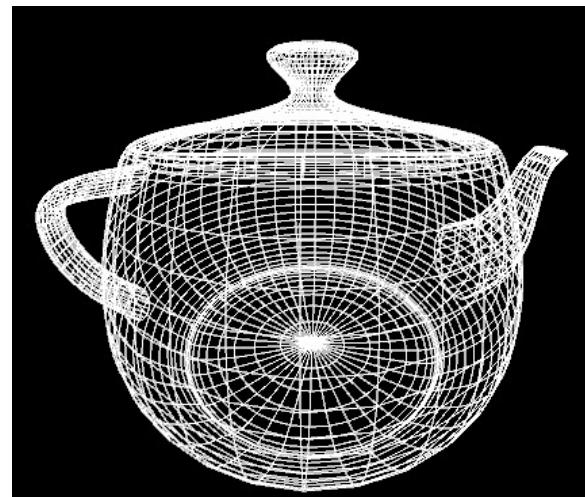
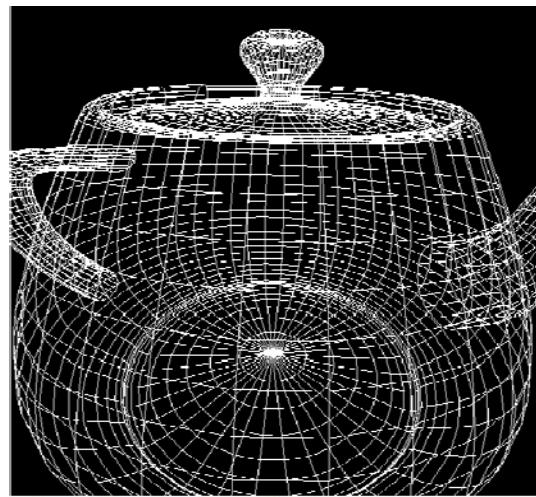
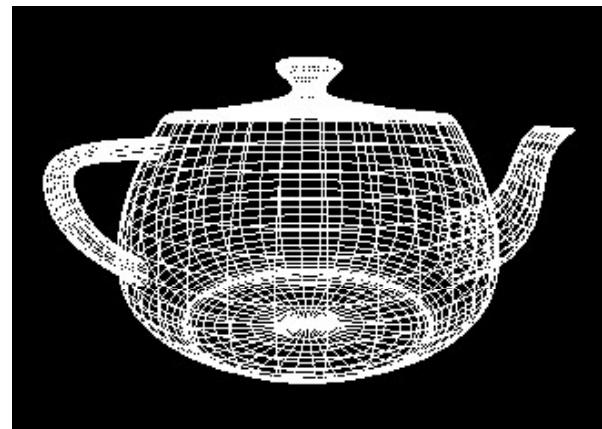
    float phi = atan( lenxy , -pos.z );
    pos.xy = ( phi / (PI/2. ) ) * ( pos.xy / lenxy );
    Note: ( pos.xy / lenxy ) = ( cosθ,sinθ )

    gl_Position = uProjectionMatrix * pos;
}
```

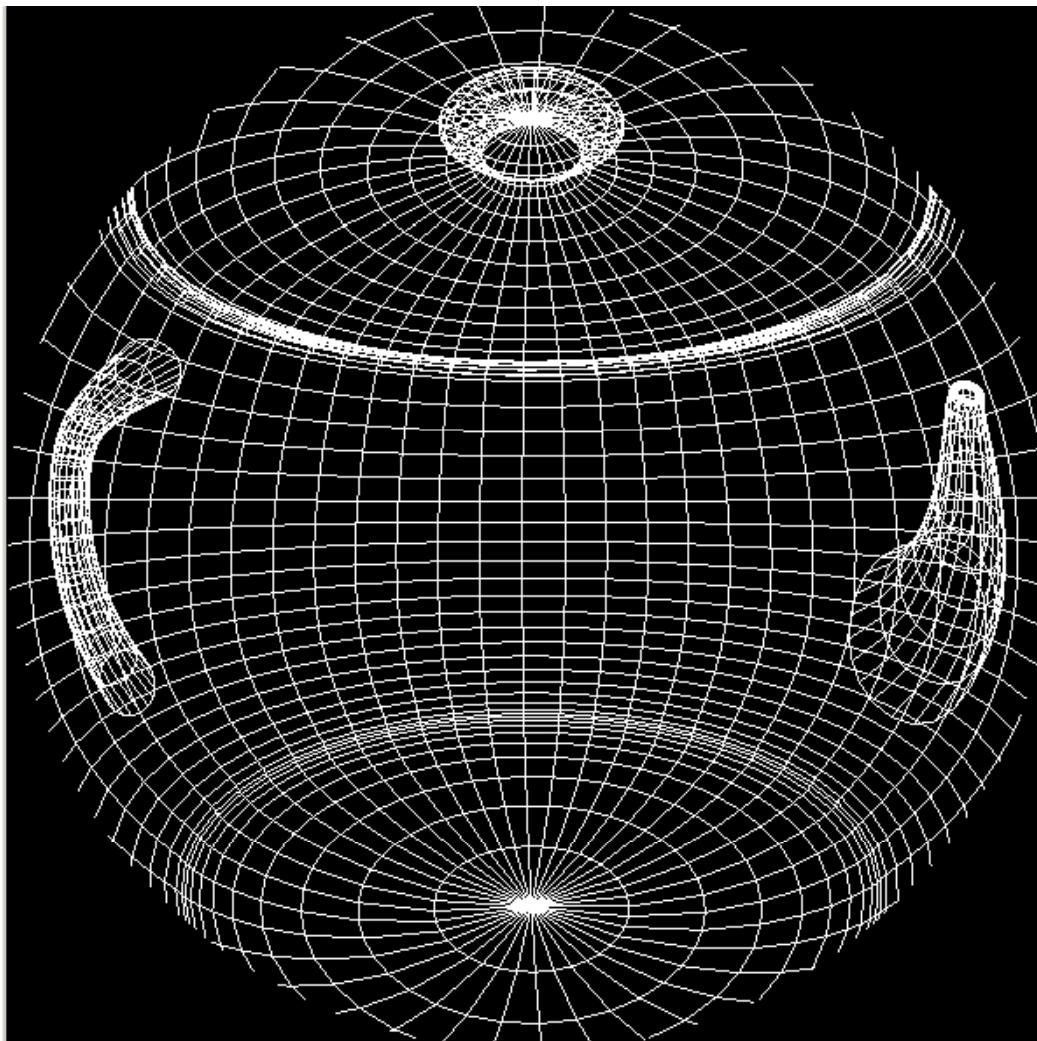
*Cartesian:*



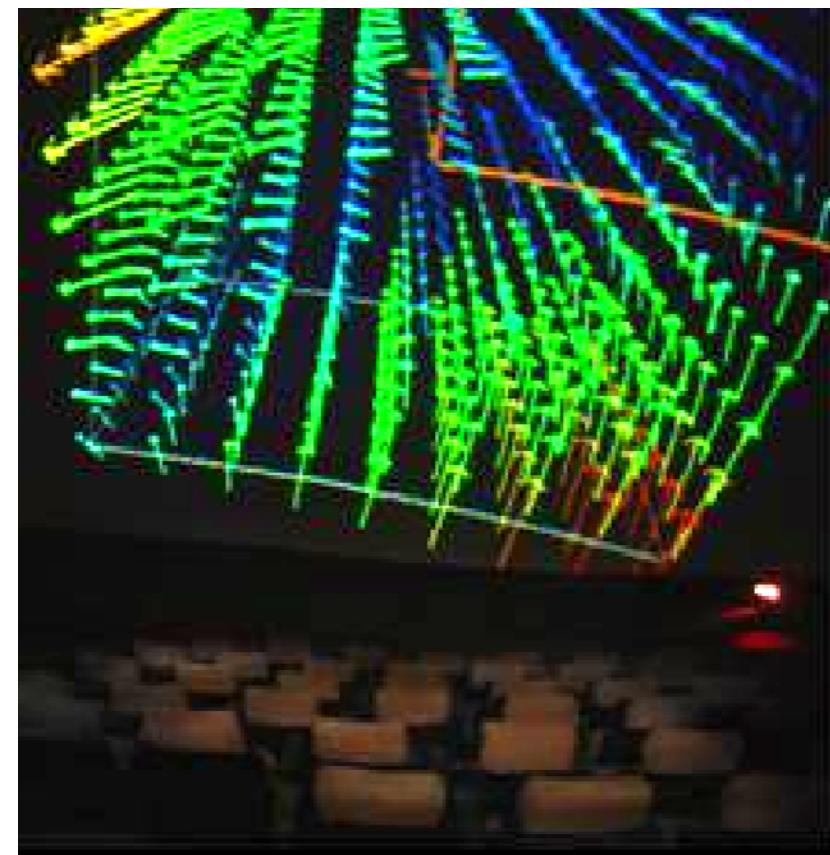
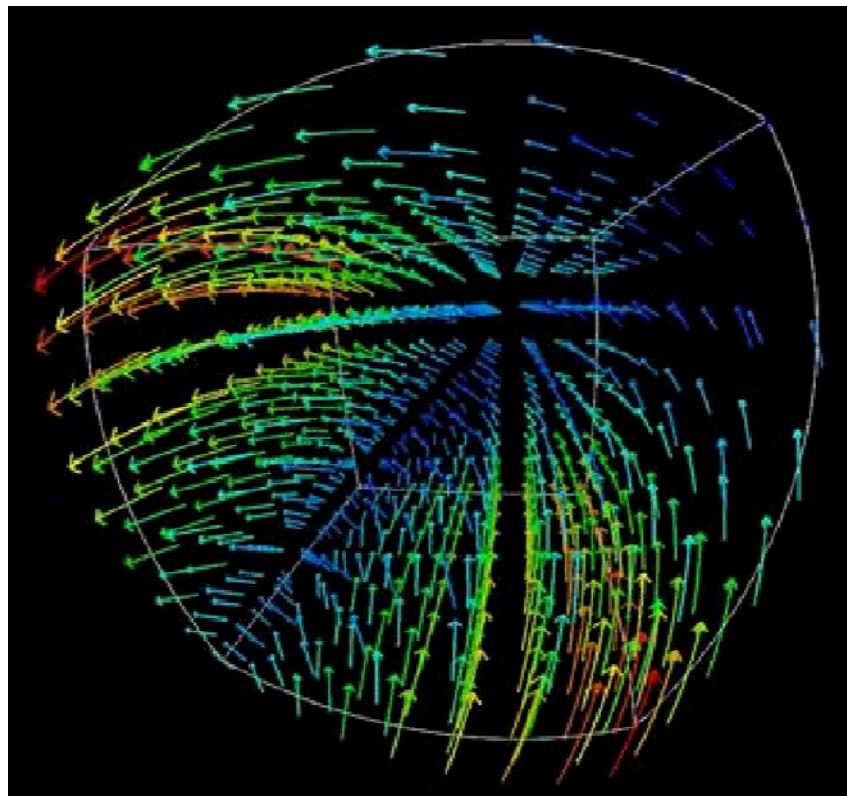
*Dome:*



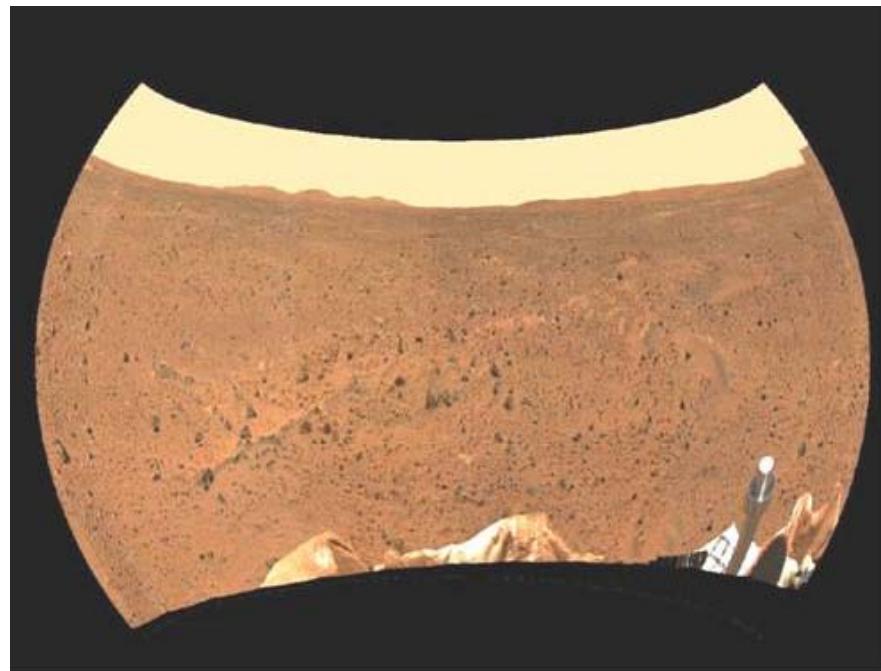
Dome:



## Flow Visualization in the Dome

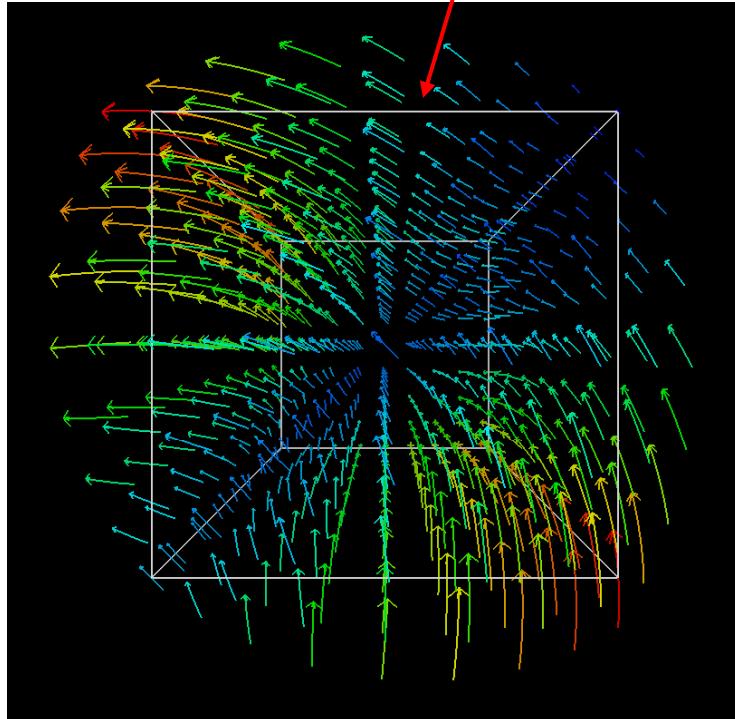


## Mars Panoram in the Dome

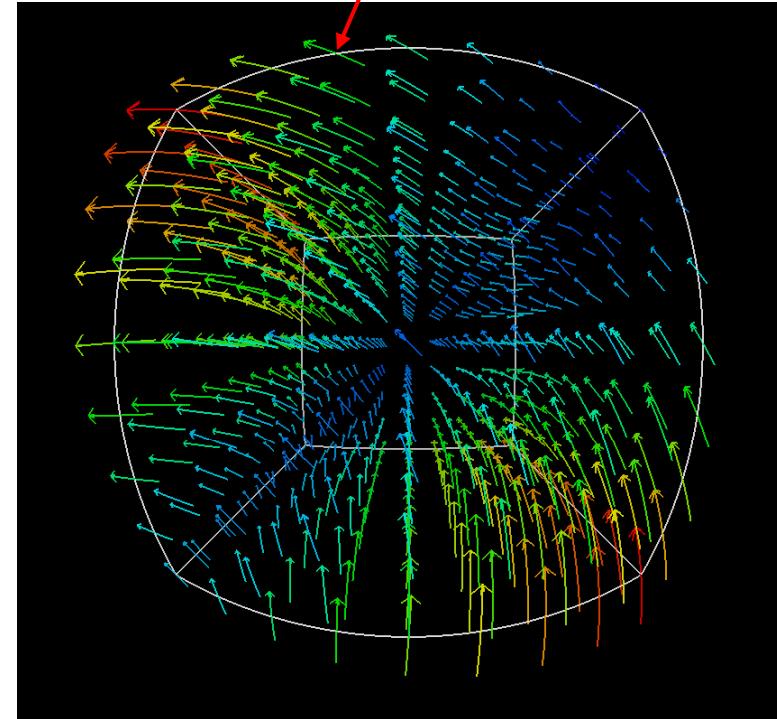


# Large Lines and Polygons Need to be Tessellated

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



Note: This edge does pass through the flow vectors!



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

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