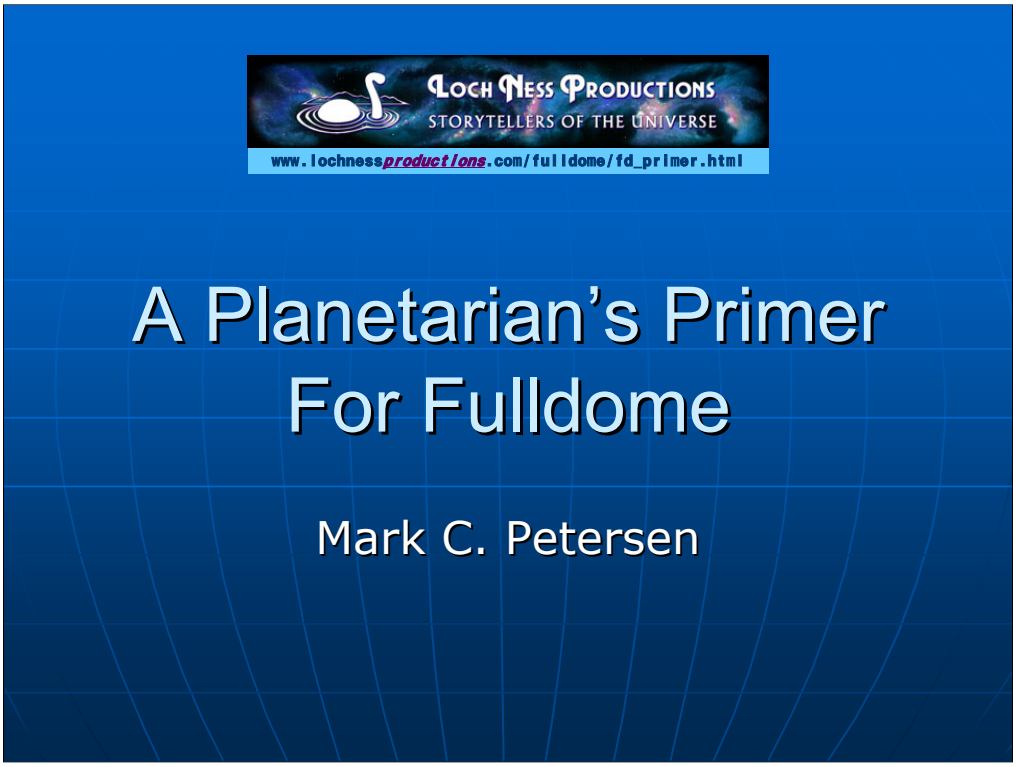
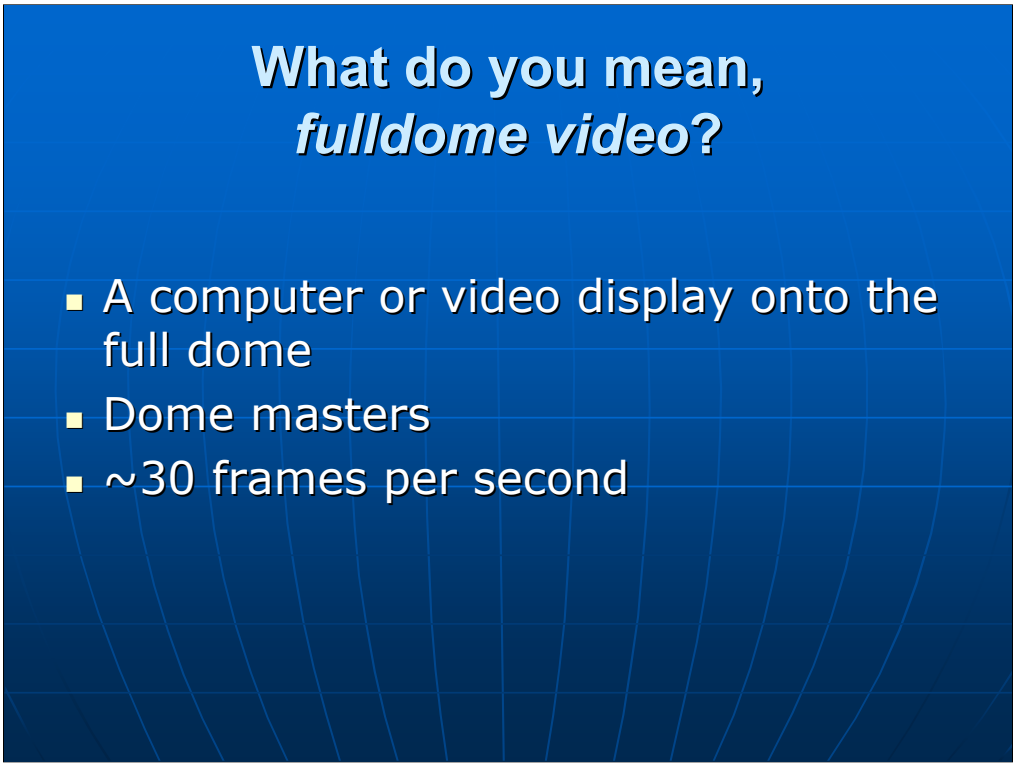
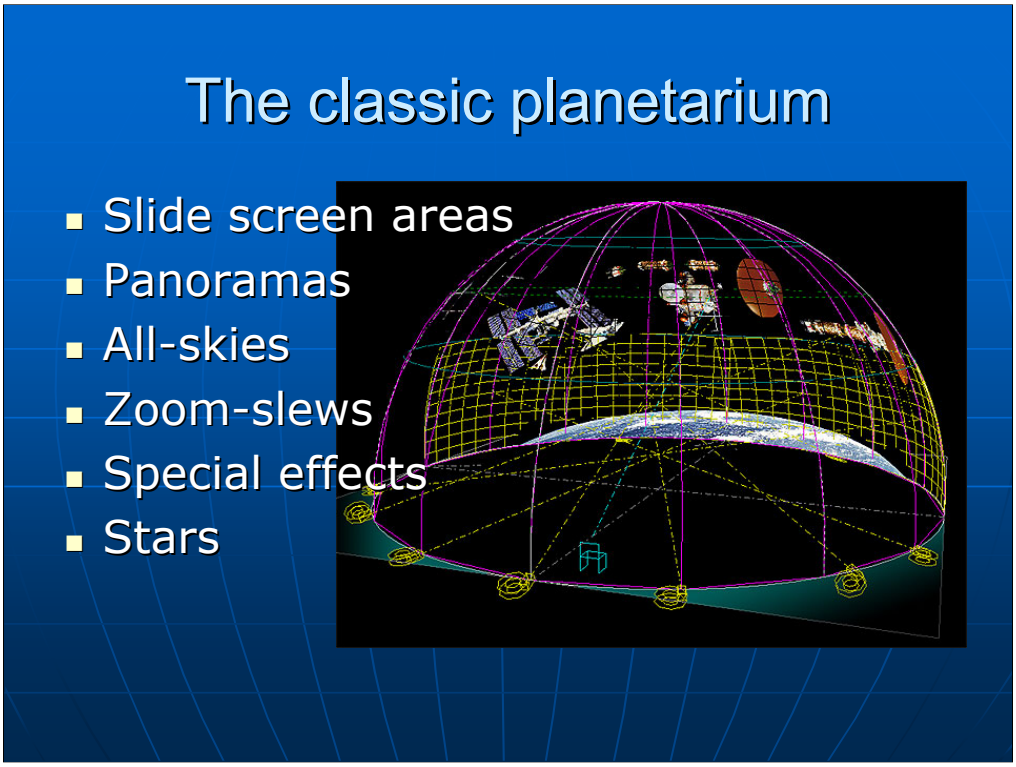


This talk is basically a summary of information we've put on our Web site. That's the URL. You may be used to going to lochness.com, or you may have bookmarks or links to us. We're changing our domain name to match our company name, so please update your links to us and your e-mail address books by inserting the word PRODUCTIONS into the lochness.com. Anyway, you should be able to find this page easily enough on our Web site. It's where we answer many of the questions we often receive about this medium.

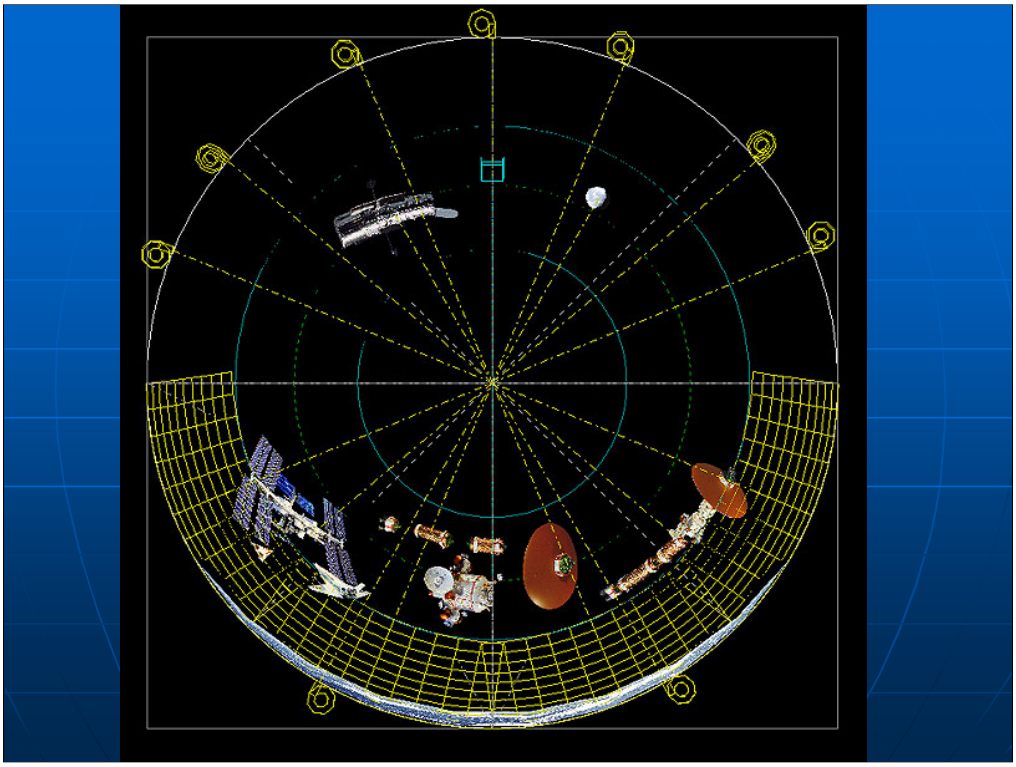
At Loch Ness Productions, we don't sell hardware; we're show producers. We've been producing classic planetarium shows more than 30 years, so many people know us from that. So we have a classic planetarian's perspective when it comes to fulldome, and we provide that perspective when we get calls and emails from our colleagues. They ask all kinds of questions, most of which don't involve our shows, but do pertain to the projectors and the technology in general… and they ask our recommendations. I will say we try to be "vendor neutral" and play nice with everyone. Anyway, let's get to some of the questions.



Basically, projecting a **computer or video display** onto the full surface of a planetarium dome. The images being projected are called **dome masters**, and they're shown at the usual **30 frames per second** (or thereabouts).



Imagine the presentation of a traditional multi-media planetarium show in a classic, slide projector-based theater. You'll see imagery appearing on an array of **"screen areas"** where banks of slide projectors are pointed. Some are stacked 2- and 3-deep to make lap-dissolve screens for crossfading animations. Some are trained on the horizon to make **panoramas;** others are fitted wide-angle lenses to project **all-skies**. Some have motorized **zoom** lenses, trained on motorized mirrors to make images "fly" in and around the dome. There are **special effect projectors** to create clouds and snow, ripples of water, flashes of lightning, rotating galaxies, and more. And, of course, you'll see **stars** overhead.

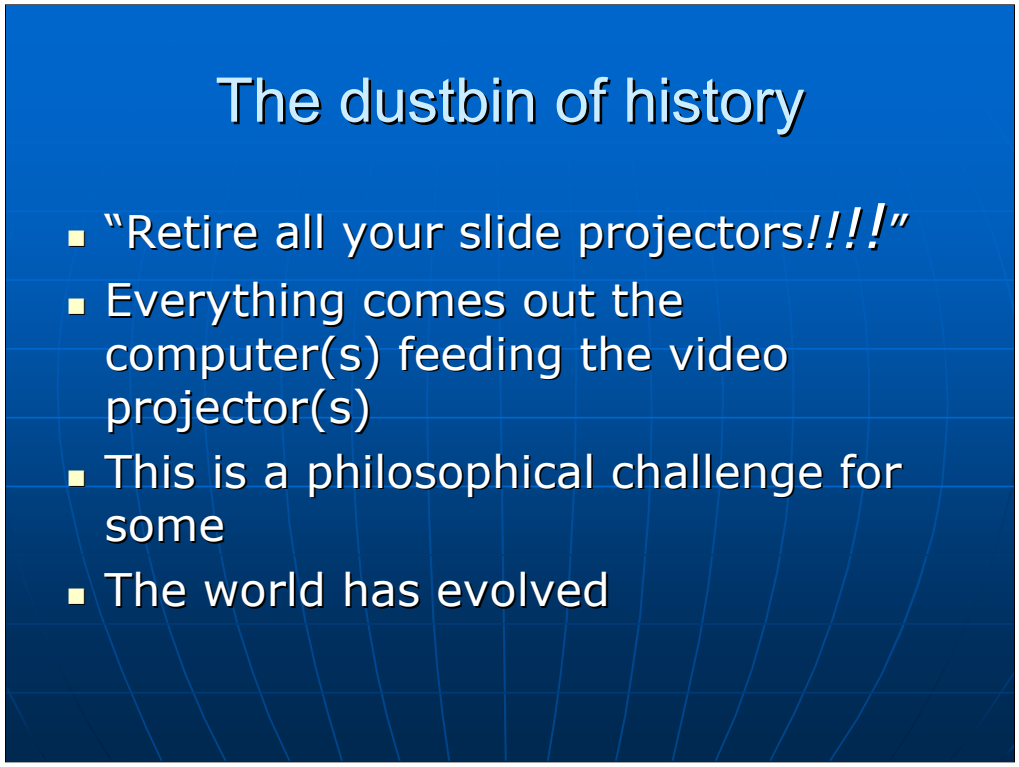


Now imagine *you're* at the center of the room instead of the star projector. You're looking up straight up, with the entire dome filling your peripheral vision while the planetarium show is playing. If you had a camcorder with you, and it had a wide enough lens on it to pick up the entire dome in its field of view, you could record everything that went on in the theater. The image in your camera would look like a circle, with the zenith at the center, and the horizon around the circumference of the circle.

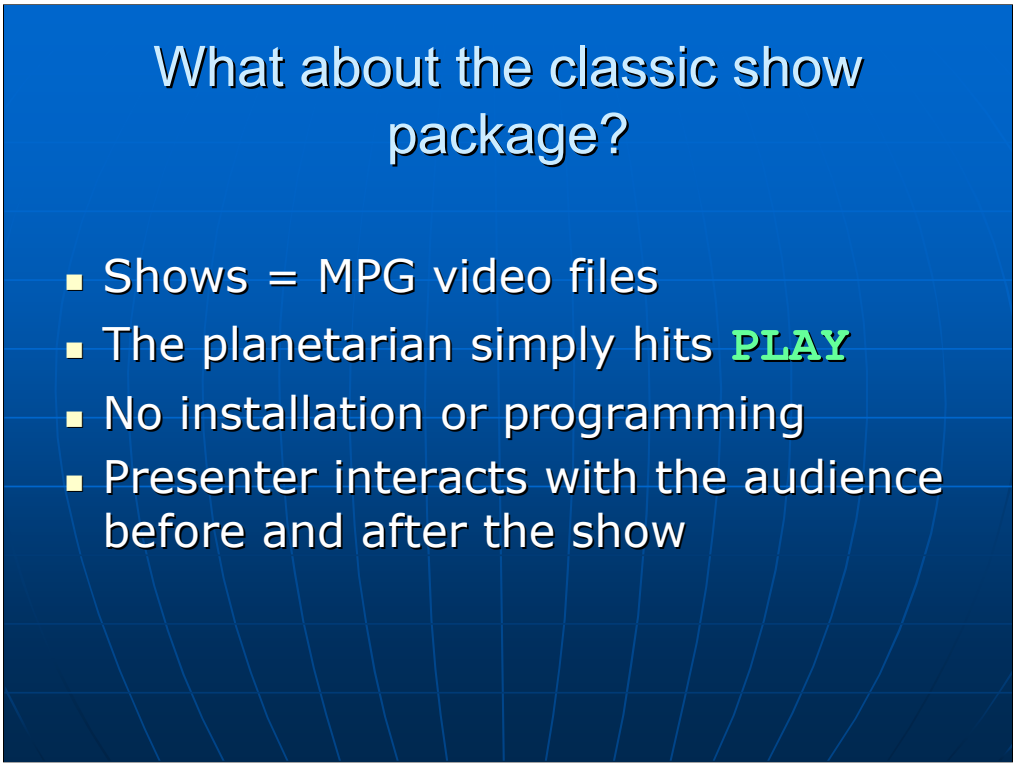
If you played the video you made, it would look like this.

That's basically the concept of fulldome video: projecting a full dome's worth of imagery — circles called dome masters — through video projectors onto the dome. No floating rectangles from single video projectors, just a big video all-sky, usually shown through a fisheye lens (or several).

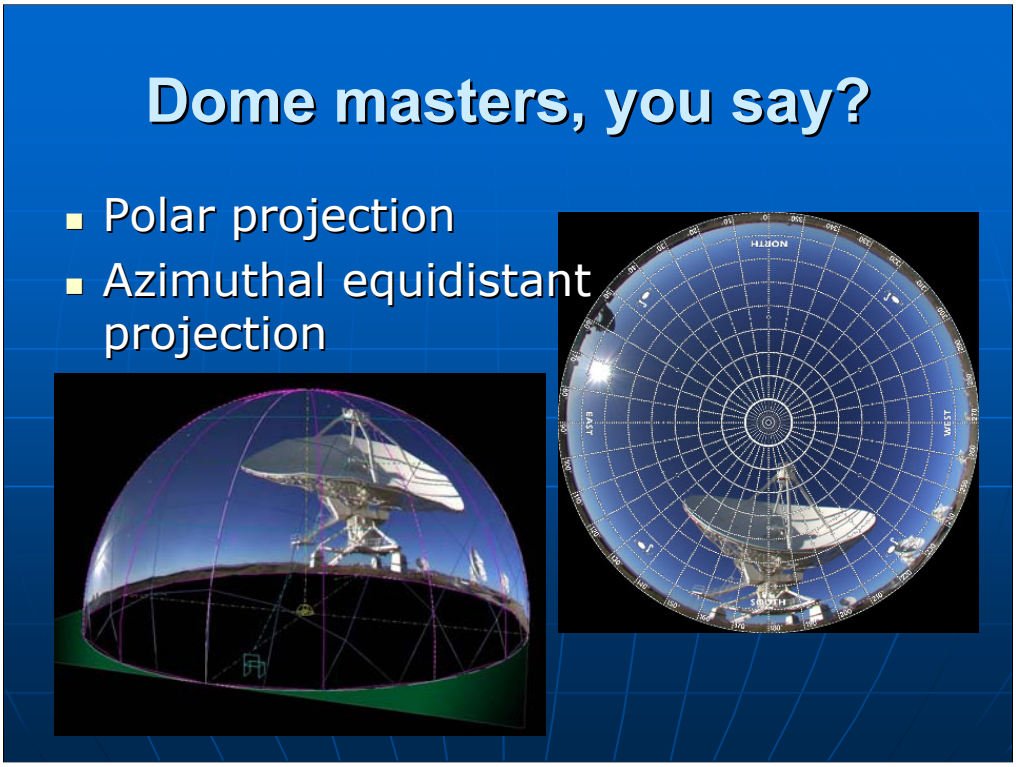
While we say *video* projectors, we're really talking about *computer graphics displays*. The definition of video is not limited to what you see on television; they're called video cards in your computer, after all.



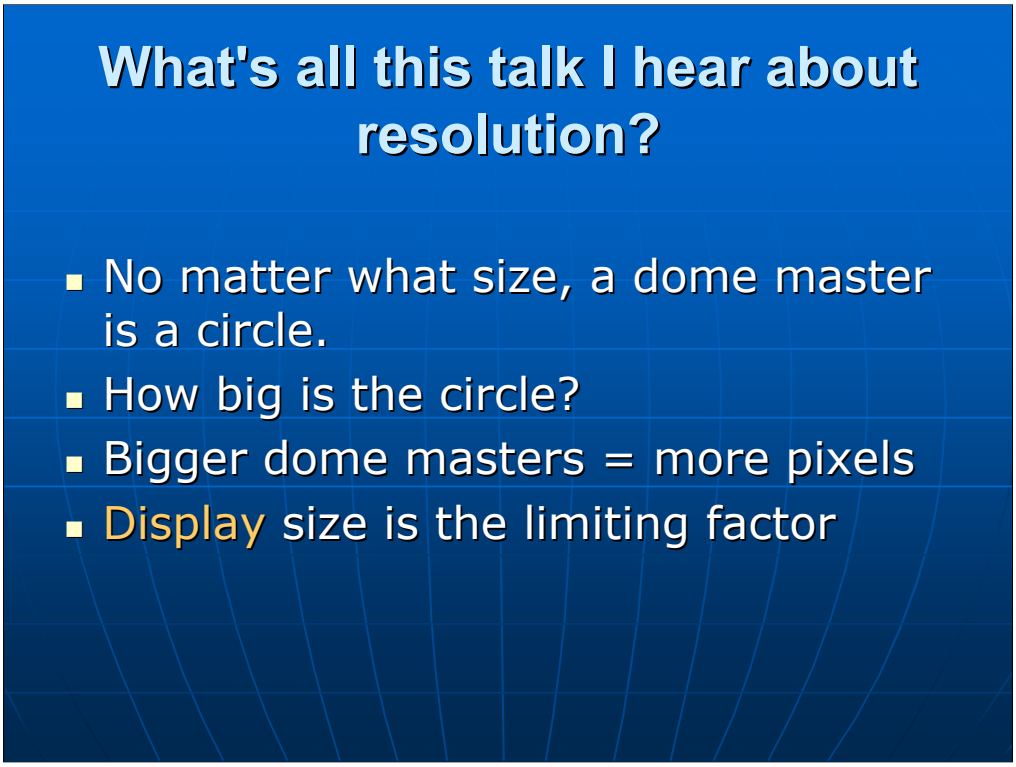
So, by having the capability to project anything everywhere, from one source, you can **retire** all your finicky, noisy, prone-to-malfunction slide projectors, motorized zoom-slews, challenge-to-synchronize laser discs, videotapes, tape decks, remote controls, all that. **Everything** comes out the computer(s) feeding the video projector(s) — the visuals, the audio... and the stars. Yikes! That means you're basically pitching into the dustbin of history all the training, investment, time and effort and equipment you and your predecessors have expended over the preceding years. **This is a philosophical challenge** for some. But yes, you can leave much of the hardware behind. **The world has evolved.** We're moving on.



The concept of *planetarium show* has evolved too. **Shows are now MPG video files**, like on DVDs; they're just circles instead of TV rectangles. **The planetarian simply hits the "Play" button**, and everyone watches and hears the movie. **Installation** is as easy as copying the file from the distribution DVD to the computer's hard drive. No more long hours programming automation systems, running around changing slide trays in the dark, and hoping everything stays in sync. All the show creation effort goes into making the video. Now, we do the pointing out of constellations when the script calls for it, we roll the stars; it's all in the video. The only things that are really required of the presenter are hitting that "Play" button, maybe fading the house lights, and **interacting with the audience** before and after that part of the presentation. Again, this can be a philosophical challenge for some.

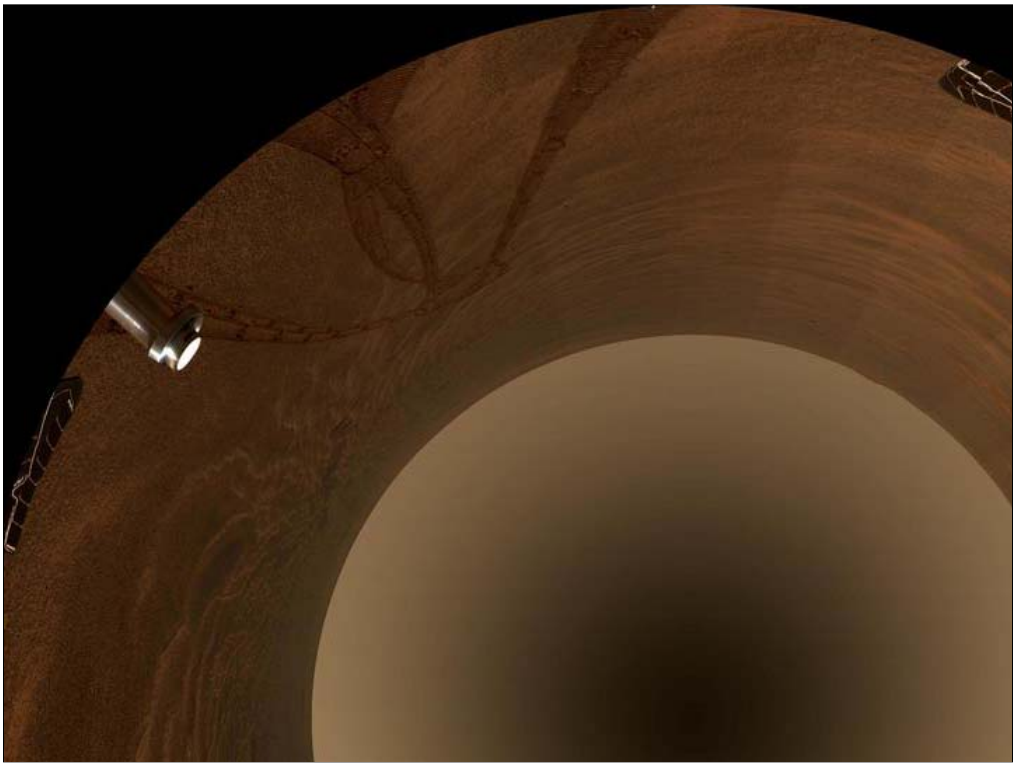


A dome master is a "fisheye" image of a circle in a square or rectangular frame. The circle contains the image you want to project, curvature corrected for proper display on the planetarium dome. This is often called **polar projection**, or more technically, an **azimuthal equidistant** projection. The center of the circle is the zenith point; the circumference is the horizon. 0° North is at the top, 180° South is at the bottom (the direction your audience is facing), east is left, west is right.



A circle is a circle; a dome master is always going to be that shape. How many pixels are used to make the dome master image is what's significant for the purposes of this discussion. Put simply, **how big is the circle**? As in much of life, bigger is usually better. The higher the resolution (meaning, the more pixels you have to represent the scene), the sharper the image is likely to look. **Bigger dome masters means more pixels.**

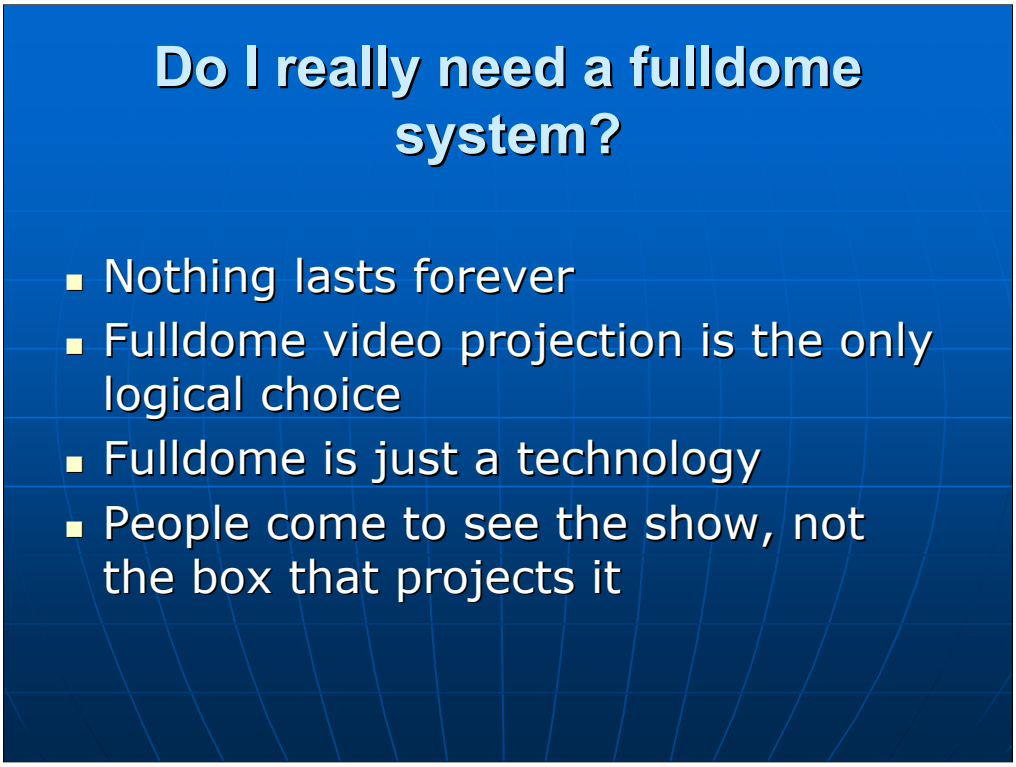
However, we have to match our need and greed for pixels with the projector's ability to display them. Its **display size is the limiting factor**.



It does you no good to have images bigger than the projector's display can handle. You have to **scale down images to fit**, and the resulting display looks blurrier as a result, because you end up throwing away pixels. A one-to-one image size to projection size ratio is the ideal. In other words, you don't want to be rescaling your images up or down; you want to show them at 100 percent size.

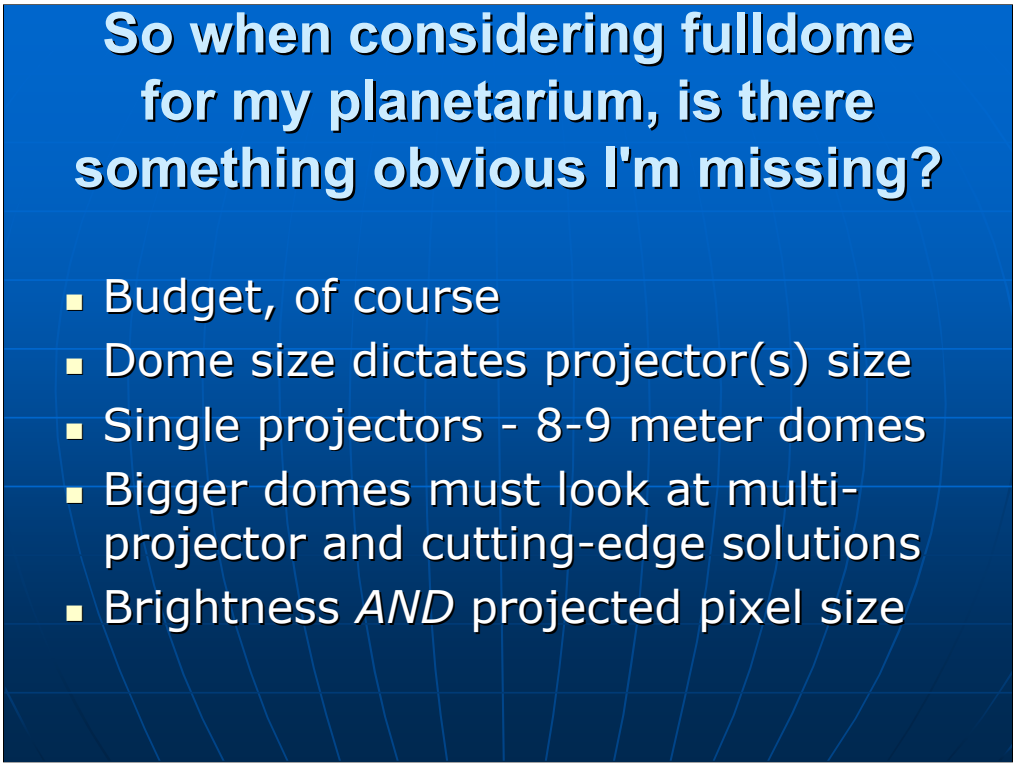
Here's a slide I stole from our vendor PowerPoint presentation. I'm showing it not to sell you anything, but I think it's illuminating. It's a list of systems we've created fulldome videos for in the last year. The ones in white are actual sales we've made, the yellow ones we've produced for, but haven't made an actual sale to the end-user yet.

What I want to say is this: like galaxies and snowflakes, no two are exactly alike. They're ALL different; they all have something that is unique to that particular system, whether it be image size, video codec required, audio format, a file-naming convention that must be observed, a play script that has to be written… there's a "gotcha" with each one. We end up spending a ton of time trans-coding our content to fit the needs of each system. The more we at Loch Ness Productions get into this, the more "gotchas" we run into, which makes life much more difficult than it ought to be.
We shall have to see how the upcoming talk about "standards" will address this.



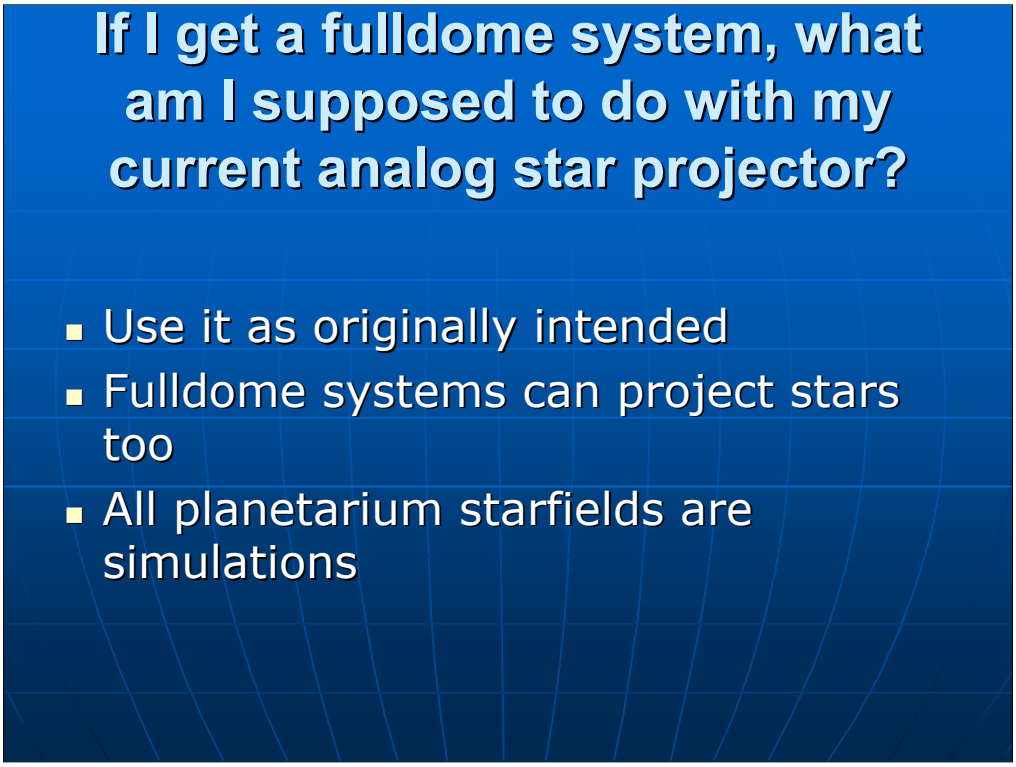
Nothing lasts forever, so at some point, the analog planetarium equipment in the field is going to reach the end of its useful life. When it comes time to retire it — whether from catastrophic failure or resigned recognition that "you can't keep nursing the old stuff along forever" — **fulldome video projection is likely going to be the only logical choice.**

Fulldome is just a technology, one of many in the planetarian's toolkit. What you do with it in the theater is what's important. **People come to see the show, not the box that projects it.**



While your **budget** may be your determining factor — the bigger the displays, the costlier they are — there is another, more practical concern here, too. The **size of your dome** will pretty much dictate the size of the projector(s) that go in it.

Most single projectors will work well in domes up to, say, 8-9 meters diameter. Beyond that, those precious few 1000 pixels start looking like big blobs, and dim too. So **if your dome is bigger**, you simply must look at the multiple-projector and cutting-edge technology solutions. Keep in mind it's not only **brightness** you have to deal with, but also the size of the pixels when projected across the radius or diameter of the dome.



Of course, you can continue to **use your existing projector** as originally intended, for pointing out constellations and doing backyard astronomy from an Earth-based viewpoint. It should be just as useful and inspirational for that purpose as it always has been. In theory, you could have "the best of both worlds.“

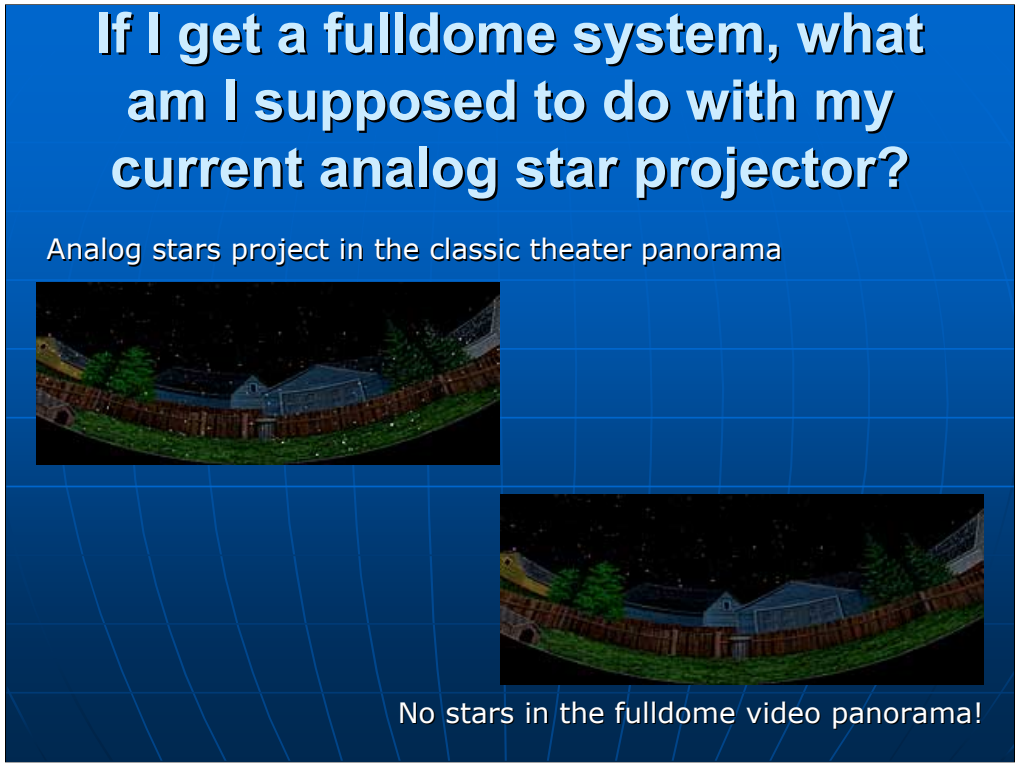
But **fulldome systems can project stars too**. Now debates about the quality of the skies produced by all planetarium projectors have been raging for as long as they've existed, and will undoubtedly continue for decades to come.

Our take: **all planetarium starfields are simulations**. They're depictions of the placement of stars in space. Those depictions are created by projectors. Once you've decided what you want to do with the planetarium, you can determine how well the equipment does it, and at what price point.

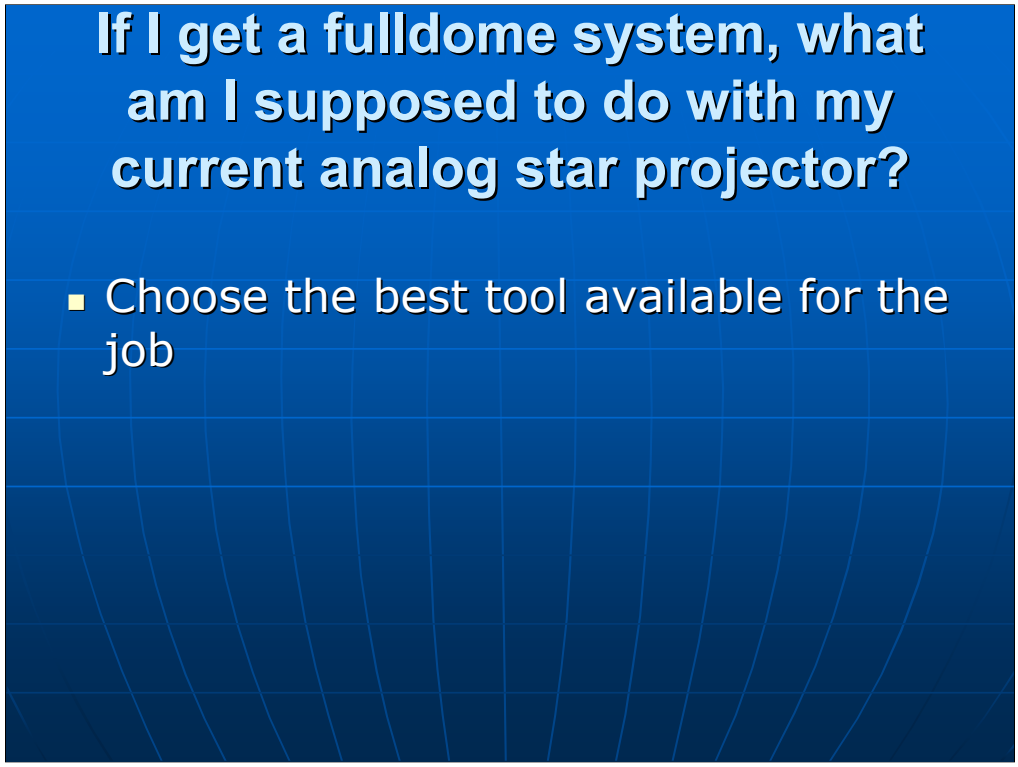
If I get a fulldome system, what am I supposed to do with my current analog star projector?

- The big mechanical machine is going to be in the way
- The multi-projector-from-the-pit approach can work around this

In practical terms, when it comes to projecting fulldome video, it's likely that the big **mechanical machine is going to be in the way**. The **multiple-video-projector**-from-the-pit approach can work around this, although both systems will be competing for space at the center of the dome.



Besides, you won't be using the analog star projector during fulldome video playback, because you'd see stars through the video, just as you do now when you see stars through slide projections.



And when it comes time to take your audiences away from Earth and fly through the galaxy, the big mechanical ant won't be of much use. You'll be using a different visualization tool. When the planetarium projector was first invented, space travel was just a dream; now it's a reality. Today planetarians have a range of tools to visualize the new reality. **Choose the best tool available** for the job at hand.

Again, all this information is on our Web site at lochnessPRODUCTIONS.com.
Thank you.