

Theater Configuration

by Kevin Scott

There's a story of a planetarian who was trying to decide what particular star projector he wanted for his theater. He considered various models of traditional star projectors and the alternative computer generated versions. In the end, his decision came down to the following question: Who am I purchasing this equipment for? Me? or my Audience?

Domes

Choosing a projection dome means choosing a dome manufacturer. You can find dome manufacturers all over the world; the two most widely used are produced by Astro-Tec and Spitz. Both will claim to have the superior product though it's probably best to evaluate examples of each in terms of your particular needs and budget. Once selected, the dome maker and building architects will work together to layout the basics of your theater. In some planetaria, the entire exterior structure is built around the interior dome, highlighting its shape and uniqueness.

The primary goal of a planetarium projection dome is a seamless surface upon which to display a representation of the starfield. To that end, each manufacturer has a unique approach to fabrication and installation. Spitz domes consist of pre-coated panels that are said to be quite durable and very uniform in color. Astro-Tec paints their domes on-site in an effort to reduce the visibility of seams. Again, your eye and budget will have to be the judge as to which you prefer.

Most modern domes are constructed of perforated aluminum panels. Normally the perforations amount to approximately 22% void area. This allows speakers and HVAC ducts to be mounted behind the dome screen, and reduces internal echoes. Domes also come in different reflectivities – that is, they are painted or coated with materials that reflect different amounts of light. Imax dome theaters normally have very low reflectivities – usually in the low 30% range. This is said to reduce cross-bounce; the effect of illuminating one side of the screen and having reflected light show up on the other side of the screen, reducing the overall contrast of the image. Planetaria tend to use a higher reflectivity (50% or more) to obtain brighter star fields. While there is no standard for dome reflectivity, fiber-optic star projectors and all-dome video may prompt a reevaluation of our collective wisdom.

Your production philosophy will most likely dictate whether or not your dome is to be tilted. The argument goes something like this. Flat domes preserve the sense of horizon and can maximize seating capacity. Tilt domes allow the audience to be closer to the action and provide a greater sense of immersion. If you decide to tilt, the next question will be how much? Larger tilts in the 35°-45° range create substantial seating difficulties and can greatly reduce potential seating capacities. More modest tilts still benefit from increased

immersion, and are generally kinder to the audience in terms of stairways and foot space. It's also instructive to note that hemispherical domes aren't the only options. Some planetaria have non-spherical dome shapes, as well as domes that are slightly more or less than hemispheric. One might also consider domes that offer adjustable tilt, or more novel approaches like the Spitz RoDo – a cantilevered structure that rotates a projection dome into position around the audience.

Your dome configuration will dictate installation options. For example, it is very difficult to suspend highly tilted domes. Suspended domes feature a clear and unobstructed cove but require appropriate support structures above. Domes supported from the ground up should be designed such that support columns do not interfere with major projection systems. You might also consider a cutout in the rear of the dome to accommodate banks of projectors or an entire projection gallery.

The Theater Chamber

As with the dome, we try to minimize sound and light reflections in the theater chamber. Careful selection of wall treatments and built-in architectural features can help make the chamber disappear in favor of the adventure taking place on screen. It's not necessary to have black as the only color in your decorating palette. In fact, any muted color will tend to visually recede under dim planetarium lighting. Carpet and wall fabrics can help absorb unwanted sound. Irregular or perforated wall materials may also be acoustically appropriate. When selecting floor and wall coverings, keep in mind the durability of these treatments and the overall look of the theater.

Projection Gallery & Cove Spaces

Whether you have a projection gallery, cove, or both, it's important to consider various ways to isolate projector noise and stray light. An enclosed projection gallery is certainly an excellent way to reduce unwanted noise pollution, but be sure the space has adequate ventilation to keep projectors and other devices within their operating temperatures. The same goes for projectors that are enclosed in cabinets around a cove. There is a special brand of glass that should be used for galleries and other enclosures. It's called StarFire and is specially formulated for projection and is used in most cinemas. StarFire glass will not shift the colors of a projected image and is ultra-transparent so as not to reduce brightness. Note that projectors in a gallery may still require shielding to reduce light spills. Some planetaria utilize matte black theatrical foil to create "caps" for slide projectors, or simply paint the inside of slide projector covers.

A continuously accessible cove is essential in traditional planetaria. There's nothing worse than standing atop a ladder in a dark theater, cantilevering oneself over walls and other barriers to reach projectors for slide installation or adjustment. Ideally, a cove will have a standing height shelf that runs all the way around the perimeter of the theater to accommodate projectors and special effects devices. This shelf should be installed such that it is a constant distance from the springline of the dome, and such that it is a comfortable distance from

the floor. A consistent cove will aid greatly when installing matched projectors like all-sky and panorama systems. Accessibility is also essential when the theater is in operation. Make sure all cove areas are free of obstacles so that staff may address technical issues during a program without disturbing the audience. Here's a hint: if the dome is installed before the chamber wall and cove, contractors can build a construction jig that will ensure a regular and dependable relation between the springline and the cove shelf.

Service Areas

Spacious service areas are often difficult to fit in. In a tight budget situation, so called "extra" space is often the first to be cut. While continuously accessible and spacious coves are a planetarian's best friend, they are hard to come by. Pit size is also a consideration. You'll inevitably need access to the one projector that is in the most awkward location. Vendors often have special requirements for their particular piece of equipment and that can help define what's necessary and what's superfluous.

Light reflections and light leaks are always something to watch for when addressing behind-the-scenes areas. Before a projection dome is installed, every visible surface – from HVAC ducts, sprinkler pipes, beams and other structures – should be painted flat black.

Central Projection Pit

At some point in the future we may be able to build a pitless planetarium. For now, we still need to reserve prime audience viewing areas for the star projector and other equipment.

While it may not actually be a physical pit, the location of your particular star projector is critical. You and your architects should carefully read any site preparation guides from your instrument manufacturer to be sure that every installation issue is addressed. Pay particular attention to:

- Placement and construction of enclosing structures not provided by the manufacturer
- Data and electrical needs for the star projector and other devices
- Additional HVAC ducts
- Elevators or lifts for the star projector and other equipment
- Service access and lighting for repairs and upgrades
- Room for future growth

At some point during the design phase, it's probably best to gather all the major equipment vendors that intend to install equipment into your pit. Let them work together with you and your architect to prioritize the available space.

Depending on your overall design, you may need to be concerned about the possibility of visitors falling into a projection pit, or at the very least, reaching in and disturbing the equipment. Never underestimate the mischievous mind of a teenager.

Seating

Planetarium seating will probably be the most contentious issue during the design of your theater with the primary tradeoff involving seating capacity. The following choices will affect seating capacity: dome tilt, row spacing, staggered layouts, seat back angle, and width of seat. Normally, your seating layout will correspond to the dome with a raked (sloped,) stepped, or flat floor. The two most popular seating configurations are concentric and unidirectional. According to Loch Ness Productions surveys, unidirectional seating arrangements are more common by a margin of 2:1. In the end, it all comes down to available space vs. number of seats vs. potential income – or in the words of past-president Bill Gutsch, “fannies in seats.”

Seating manufacturers abound. Probably the best wisdom that can be given is to find one with a local representative. You might ask other planetaria to see whom they contacted for seating. In any case, always get a sample of the chair you’re interested in and have a closer look. Some things to consider when auditioning a seat for your theater:

- How wide should the seat cushion be? Who is your primary audience?
- Do the seats provide a headrest? What size guest is the headrest built for?
- What sorts of options are available? Tablet arms, reading lights, reclining or adjustable tilt seatbacks, etc.
- Will you be installing special seats for larger guests, or seats with flip-up side arms to accommodate guests transferring from a wheel chair?
- Do you want to install a transducer in the seat for low frequency sound effects?
- Are rows of cushioned bench seats (no arms) an attractive option?
- How much flexibility do you want in theater space use—are removable, portable, or even no seats an option to consider?

When laying out seating in your theater, keep in mind that several manufacturers provide seat backs that are adjustable. That is, people towards the front lean back more than the folks toward the back of your theater in a unidirectional seating arrangement. You’ll also need to have the architect work closely with the seating manufacturer so that you can accurately place the seats in the theater such that the seat backs are close enough to the riser behind them such that feet and small children don’t fall into a gap. The seating manufacturer is usually responsible for creating drawings that define your seating layout. Check their drawing to be sure that they’ve used the most recent base drawing from your architect and that there haven’t been major design changes.

If you are planning to install interactive responders of some sort, make sure the seating manufacturer, the responder maker, and your architect are all “on the same page.” Also, be cognizant of the possibility that young hooligans will try to deface, tamper with, or destroy the responder devices. Some manufacturers have made design and construction changes that help prevent these sorts of problems. Ask the seating vendor about the construction of their uprights and the potential for color matched conduits between seats to hide and protect the wiring for interactive responders.

Seats adjacent to the projection pit may allow patrons to eclipse various projectors during the show or possibly reach into the pit and harm projectors. Similarly, patrons should have an unobstructed view if they sit near the pit.

Isles/stairs

Cinemas have long used discreet floor lighting to help patrons find their way in the dark. For the safety of your patrons, research lighting options for isles and stairways. Step lighting is only useful if it's visible for patrons going both up and down the stairs. Some light molding designed for steps is shielded such that it's only visible from one direction, and is normally installed in high end cinemas that want to help you get into the theater, but not distract you once you're there.

Try to find step lighting that will integrate into the structure of the step. There are versions that are designed to interface with carpeting, but they have a thickness that is often twice as great as the carpeting and may be a trip hazard. If you don't have lighting built into your steps, it's still important to ask your architect to research floor covering options to reduce the possibility of guests stumbling on the edge of the step.

IMAX theaters have long known that it is much safer for an audience to enter at the bottom of a theater and walk up steps if necessary. The same is true for planetaria. When entering the theater, most visitors will look up in wonder at the unusual surroundings. Any obstructions, pathways, isles or steps will immediately be ignored. It cannot be stressed enough that those planetaria with raked or stepped seating use a bottom-up exit path.

Finally, it's important to not overlook the obvious questions of handrails, and the proportional size of isles to the entry and exit areas. While space is at a premium in most planetaria, generous isles will speed seating and egress times, increasing the overall throughput of the theater.

Console

Some planetaria like to showcase their console as an expression of the technical sophistication of the room, while others believe that the console should not be part of the visitor's experience. This basic philosophy, coupled with your production needs and presentation style, will guide the size and placement of your theater's console. It seems every theater is unique when it comes to the console. Some tuck the console up under the springline and out of the chamber, while others configure it as a lecturing podium. There are even planetaria where the console is wholly removed from the theater and where dome is visible only through a tiny porthole. When choosing the location of your console, you might ask some of these questions:

- Will the console be used for live presentations where the planetarium teacher will need to interact with the audience and operate any control systems?
- Can an operator easily reach the chamber to interact with the audience?
- Will the console be useful during production? Is it necessary to see the entire dome during production?

- Will the console be safe from visitor fingers?

The physical size of your console will also play a role in its configuration and placement. One rule of thumb is that console space is like a closet – you will fill all available space in time and wish you had more.

Today's consoles need to cleanly organize the myriad wires and cables from computers, projector and manual control panels, and audio controls among other devices. One of the best console designs is to have one where technicians can access the back of computer systems and other equipment for servicing and installation. This sort of modular rear access can save time and possibly reduce the number of occasions where a piece of equipment needs to be removed entirely for service. Your console should also be equipped with appropriately sized raceways and cable trays to keep things neat and orderly. In every case, control wiring should be separate from electrical power.

Remember that computer and equipment fans must have ample air supply for cooling. If computers are mounted on or under the console, they should be dressed to prevent substantial light leaks and noise.

Performance Space

Many planetaria enjoy having a stage, or other performance space in their theater for live presentations. Be it lectures, traditional theatre, or live concerts, these areas add flexibility and functionality to your theater. When designing a stage area, it is important to consider how many people will be able to comfortably work there and whether they can safely maneuver in dark lighting conditions. You might provide extra audio/video tie lines, microphone connections, and electricity for podium lamps, props, and any additional on-stage lighting. Finally, you should plan on having some sort of off-stage access for your actors/actresses from their dressing rooms or green room with appropriate light locks.

Equipment room

An equipment room forms the hub of any modern planetarium. All of your audio and video equipment, automation system electronics, lighting dimmers, and electrical panels can be co-located for convenient wiring and production access. An equipment room can be a showcase of sorts as is done in many IMAX and IMAX-DOME theaters.

Entry/Exitways

Most countries have laws that dictate many aspects of entry and exit from public spaces. In addition, your architect may need to abide by local building codes that further define door type and placement, stairways and ramps, handrail placement, etc.

Before actually entering the theater, you'll probably want to design some sort of queuing space or waiting area. Since our eyes naturally take time to adjust to low light levels, it's appropriate that these waiting areas also have subdued lighting. While the audience is gathering, you might have video monitors or posters to advertise upcoming programs or special events in the

night sky. Exit ways can also be somewhat subdued to be kind to the dark-adapted eye as it leaves the planetarium.

The transition into the theater should be free of obstructions and provide enough space to quickly seat your audience. Along the way, you'll need to provide a light lock. Light locks are usually just a pair of light-tight doors that allow entry or exit while the program is in progress without flooding the theater with outside light. Your light lock doors will be fully open during seating and egress, but provide a safety during the program to avoid interruptions. Entry and exit doors should also have silent locks. Finally, make sure you can reach the lighting controls for your light locks from the operator's console. It's also a nice feature to have the lighting tied into your automation system with a manual backup.

Where the audience enters/exits is a function of the entire theater design. If you have stairs, it's best that people walk up stairs when entering, rather than down. This is especially true in planetaria where light levels are low. When a person is coming into a planetarium for the first time, hopefully they'll encounter a sense of wonder at the space. This is automatically distracting them from where they're walking. A drop-off is more dangerous than a step up when visiting a theater for the first time. You will most likely be required to accommodate wheelchairs in the planetarium. Your architect will be the best source of information when providing for disabled visitors.

Watch out for the simple things. For example, don't install double doors that have a stationary locking post between them. If you hang an exit sign above the door, guests will probably head for the exit sign, push one of the doors open, and walk right into the post. Finally, if your theater part of a larger institution, will the planetarium operate after hours when the rest of the facility will be closed? Are there separate publicly accessible entries and exits? For example, how does the public leave after the 10pm laser show when the rest of your museum or science center is closed?

Architectural effects

After your planetarium design needs are satisfied, take a look again to see how you can make your facility special. No doubt you and your architect will come up with plenty of ideas.

- Cove lighting systems with chasing and/or flashing effects
- Equipment and production rooms as a showcase
- Colored lighting in entry/exit vestibules, or fiber optic star fields.
- Single shot slide projectors creating images on floors or walls in queue spaces.
- Blacklight paintings or murals
- Dome Tour lighting and special effects
- Trap-door or other hidden entries for presenters
- Theatrical fog machines

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