So You Want to Build a Planetarium

CONTENTS

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INTRODUCTION

The words "planetarium" and "space theater" conjure up many different images to many different people. Much of this is due to the wide variety of facilities that call themselves planetariums and space theaters and to the almost equally wide variety in the operating modes of those entities. Individual perceptions of what a planetarium is also vary with the time of first encounter. This is largely due to the considerable evolution that planetariums have undergone since the first modern ones were invented in the 1920's.

Often the initial decision to establish a new planetarium and how to go about it rests with a key individual (e.g. an administrator, museum director, school superintendent, etc.). This booklet is designed to help such a person get off to a good start on such an important project.

In what follows you will find: a brief overview of what planetariums are; some reasons why they are established; what some of the key decisions are in planning a new planetarium; who can help you in the planning process; and, where to go for more information.

This booklet was produced by a small committee of the International Planetarium Society (IPS), the only world-wide group of professionals working with planetariums. We hope that our many years of experience will be of help to those considering the construction or renovating of a planetarium. A more detailed guide is being planned, which will be designed to help individuals with direct supervisory involvement with the design and construction of a new planetarium, but in the mean time, Checklists and Questions to Ask may act as a summary to its contents.

WHAT IS A PLANETARIUM?

Today the word planetarium can refer to several things. It can mean a special projection device designed to recreate indoors the appearance of the stars and planets. It can also apply to the room housing such a device or the building containing that room.

Modern planetarium projectors date back to the 1920's when the first such device was designed by Dr. Walther Bauersfeld and constructed by the Carl Zeiss company for the Deutsches Museum in Munich. In the 1930's planetariums started to appear in the major cities of the world, nearly all of them using projectors made in Germany. Most planetarium programs were little - more than lecture-demonstrations by an astronomer in the planetarium chamber.

By the 1950's and 60's new planetariums boomed. Many of the smaller facilities became possible due to lower priced planetarium projectors made, by the American company, Spitz. Spurred on by the space program, the 'Rate of new planetarium creation peaked in the late 60's and early 70's, but has continued vigorously through the 1980's and early 90's.

In recent years the design of new planetariums has been marked by sweeping changes and improvements in planetarium technology. Now most programs in larger planetariums are totally automated, require banks of special effect projectors, and feature a variety of state-of-the-art audiovisual equipment. The opportunity for new and innovative planetarium design has never been greater.

Just as the technology has changed, so has the potential for new and imaginative programs. Though most planetariums devote their energies primarily to astronomical shows, it is now possible to present programs on nearly any topic from the inside of atoms to the pyramids of Egypt.

One hundred years ago the frontier of human exploration was at the poles of our earth. Today, the new frontiers of human exploration lie far beyond the earth, extend through our solar system, across interstellar space, and reach out to galaxies billions of light years away. We can still experience adventures in this realm with old technologies like the printed word. Unlike a hundred years ago, however, we can now simulate these distant environments and let people see what it's really like to be there. Modern planetariums can be simulated space ships, staffed with knowledgeable tour guides so that the ordinary citizen can explore the wonders of the universe.

WHY BUILD A PLANETARIUM?

Planetariums have been established for a variety of reasons; some of them not always stated. A few have been built solely as useful tools for teaching celestial navigation. Some came about primarily as memorials to rich and/or famous people. Others were designed as unique attractions to draw visitors to a museum. Still others were intended from their inceptions to serve as multimedia theaters for a wide variety of educational and entertaining programs.

Perhaps the best primary reason to establish a planetarium is to provide a community a place where people can enjoy a guided journey of exploration through the vast cosmos to which we all belong. Never before have humans known as much about the universe as we do today. Never before have we acquired new information about the universe as quickly as we do now. Yet, at the same time, never has the general public been so ignorant about even the basic facts of celestial science.

Hence the need for planetariums as front line artillery in the battle for science literacy has never been greater. The educational role of the planetarium is enhanced by the ability of the stimulating planetarium environment to inspire enthusiasm for science; awe at the marvels of the universe; and new perspectives on our world and civilization. In this sense a planetarium is of no less cultural importance than a library or museum.

Perhaps the poorest reason to build a planetarium is to make money. Very few, if any, planetariums generate more money than they cost, when all the direct and indirect costs are taken into account. Neither do most libraries nor museums. The point is that these educational and cultural institutions are not, by nature, for-profit businesses - at least not in the monetary sense. The 'profits' that they generate are more enlightened citizens who live more enriched lives. To their credit, however, many planetariums can and do recover large portions of their operating expenses from ticket sales, facility rentals, gift shop sales, and financial grants.

WHAT KIND OF PLANETARIUM?

Never before has there been such a wide range of options in planning a planetarium. At one end are portable planetariums costing less than US$ 10,000 (1992) and staffed by one person. At the other extreme are multimedia theaters seating several hundred people; staffed by a dozen or more highly trained specialists; and costing several million dollars to build.

Between the two ends of the planetarium spectrum lies a wide range of possibilities.

How do you decide what you need, what you want, and what you can afford? To begin with, if you're not very familiar with present day planetariums, this would be a good time to visit several planetariums to see first hand how they function. If you have no idea of what kind of planetarium you'd like to build, visit a wide variety. At the very least try to visit one each of the following:

- A portable planetarium with an inflatable dome.
- A school based planetarium.
- A medium size (dome diameter 30-50 feet) public planetarium.
- A large public planetarium (dome diameter greater than 50 feet).

Talk with the directors and staff of the planetariums you visit. Most are quite friendly and willing to help. Please keep in mind that these people are often very busy. It's best to call in advance and make an appointment. If you need more than a half hour, offer to compensate them as consultants and schedule to meet outside of normal work hours. The more facilities you visit at this stage and the more questions you ask of experienced planetarium professionals, the easier and better informed will be your key decisions. If you already have some idea of the kind of planetarium you would like to build, visit those which are similar in size, location etc. There you will find ideas you hadn't thought of for making your new planetarium better. Equally important, you will learn of important pitfalls and dead ends to avoid. The IPS maintains a directory of planetariums all over the world. We highly recommend that you obtain a copy of this to aid you in seeking out the right planetariums to visit.

Once you have a good idea of why and what you're going to build, it's time to find answers to some important questions:

- Who is your target audience? Is it college students, senior citizens, girl scouts, tourists, families, or some combination of all of these?
- What geographical area will your new planetarium primarily serve?
- How will it serve your target audience (e.g., small group live shows or large general audience shows, etc.)?
- Will the planetarium space be used solely for astronomy education, or will other multimedia programs also use the space and equipment?
- Will the facility be in a fixed location or will it travel to its audience?

- How many people will the planetarium serve at any one time and in the course of a year?
- How will the planetarium be staffed and maintained?
- How will the operating expenses of the planetarium be funded over the years?
- What sources of funding are available for initial construction?

It is far better to address the above questions early on in the planning stages than to wait until they become problems later. The sooner you can arrive at answers, even just provisional ones, the sooner you can start to make detailed plans for construction.

WHO WILL HELP IN PLANNING?

As with any project of this magnitude, there are many sources of advice and information. Architects, lawyers, financial planners, and so forth, immediately come to mind. There are two other sources, however, that need particular mention.

There are consultants with various backgrounds and experience who will, usually for a fee, provide advice on building a new planetarium. They can be a vital resource if carefully chosen and utilized.

Beware of consultants who also sell or are associated with companies who sell planetariums, especially in the very early planning stages. If you have independently decided to purchase products or services from a vendor, then, by all means, consult with them as to how to plan for, use and maintain their products. But don't be pressurized into purchasing things you don't need or want.

Non-vendor consultants, on the other hand, work for you alone. The best ones will take the time to get to know your unique goals, needs and resources. If you decide to use such a consultant, make sure that he or she has recent experience of, or is currently working with, the kind of planetarium you have in mind.

Perhaps the best source of advice is the person who will be supervising the day-to-day operations of your new planetarium once it is completed. If you know for certain that you are going to build a new planetarium, find the funding to hire that person in advance. He or she will have a vested interest in seeing that the new planetarium is the best that it can be for the funding available. The experiences of the members of the International Planetarium Society have shown that many costly oversights, shortcomings and outright mistakes in new planetariums could have been averted if an experienced planetarium director had been hired early enough in the planning stages.

In addition to visiting established planetariums and talking with their staffs, the Professional Planetarium Organizations listed at the end of this document will advise you of regional and international planetarium meetings. Some of them will also have Resource Lists to help you further, and many publish journals and special reports. The International Planetarium Society directory gives addresses and technical statistics of planetariums all over the world. This will be useful in finding a contact nearby.

QUESTIONS TO ASK BEFORE MAKING DECISIONS

The intention of this list is to raise important questions to be answered and to note key decisions to be made in designing and building a new planetarium or renovating an existing planetarium.

CHOOSING A DOME

- What size interior dome?
- Will it be a tilted or level dome?
- What material will the dome be made of (solid plaster, perforated metal)?
- What reflectivity will be the dome surface?
- How high will the springline of the dome be above the theater floor?
- How much clearance and access will there be behind the dome? Ladders, catwalks or what?
- Will you have live actors, puppets and/or tableaux behind the dome?
- Will the dome have a surrounding cove space for special effects projectors?
- Will you have a projection booth or booths for special effects, slide projectors, movie projectors, video projectors, etc.?
- Will you want to use the planetarium for things other than planetarium shows (e.g. concerts, live drama, classes, conferences, etc.)?

SEATING

- How many seats will your theater have?
- How will those seats be arranged?
- What makes for a good planetarium seat?
- Will the seats be 'wired' for sound or audience response?

WHICH PLANETARIUM INSTRUMENT? (Star Projector)

- What instrument is proper for your dome size & reflectivity?
- What features are available and which are desirable?
- How reliable can you or should you expect the instrument to be?
- How much time, money and labor will it cost to maintain the instrument?
- How available are spare parts and at what costs?
- How easily can the instrument be upgraded?
- Should you consider a used instrument?
- How do you find out about the track records of various instruments and their manufacturers?
- What should you keep in mind when negotiating the purchase?
- Does the instrument need an elevator and, if so, what are the concerns and requirements of such an elevator?

AUXILIARY & SPECIAL EFFECTS PROJECTORS

- How extensively will you be using special effects projectors in your planetarium?
- Will you be purchasing all, some or none of these projectors from an outside vendor?
- Will you have cove, pit and/or projection booth space for your special effects?
- Will your effects be bright enough for the size and reflectivity of your dome?
- What are the electrical requirements, codes, space needs, cooling needs, service access needs, etc. for your potential special effects usage?
- What are the standard special effects that are common to many, if not most, planetariums?
- Will you have video projection equipment in your planetarium? If so, what equipment do you need, where will it go and how will it be controlled?
- Will you have a projection pit area in the center of your planetarium? if so, how large will it be and what functions will it serve?
- What sort of projection gallery or booth will you have? How accessible will it be and how can it be designed to most effectively house your auxiliary projectors?

CONTROL & AUTOMATION SYSTEMS

- What are the control needs of the devices in your planetarium?
- Will you want automation capabilities for your control system?
- What do you look for in a good automation system?
- How flexible is the automation system?
- How user-friendly is the automation system?
- How well documented is the automation system?
- How reliable is the automation system?
- How available are spare parts and service for your automation system?
- How compatible is your automation system with other planetariums with which you might wish to exchange programs?

SOUND SYSTEMS

- What will the sources of audio in your planetarium be (e.g., live voice, tape, film, CD, live music, etc.)?
- What qualities should you look for in loudspeakers?
- How many loudspeakers do you need?
- Where should the loudspeakers be placed?
- What do you look for in an audio amplifier?
- How much audio production will you do in-house? (i.e. what do you need in the way of a sound studio?)
- Will you be doing live concerts or theater in your planetarium?
- Will you be showing movies in your planetarium?
- What are the maintenance concerns of a planetarium audio system?
- Should the sound system be automated?
- Will your shows be done live, on tape, or a mixture of both?
- What pieces of audio equipment are vital, desirable or unnecessary?
- Will your audio be digital, analog, or both?
- What are the special electrical grounding needs of a planetarium sound system?
- Where should microphone jacks be placed?
- Will you have monitor speakers connected to the planetarium sound system and placed in planetarium offices and work areas?
- Will the planetarium offices/exhibit areas have a P.A. system?
- Which audio equipment will need to be remotely controlled?

LIGHTING

- How will you light your planetarium dome for shows?
- How will you light it for cleaning & maintenance?
- How will you control that lighting?
- Which lighting systems are more cost effective than others?
- How will you light 'exit' signs without spoiling the planetarium shows?
- Should you have aisle lighting?

DETERMINING ELECTRICAL NEEDS

- How much electrical Power should you have for your planetarium including house lighting, projectors, sound system, computers, etc.?
- How many different circuits should you have?
- Where should the circuits be run? Where will the conduits and/or raceways go? Room for expansion?
- Should the planetarium circuits be separate from the rest of the parent institution?
- How 'clean' does the power need to be?
- How do electrical codes affect your plans?
- Where should the electrical panel boxes be located?

THE PLANETARIUM ENVIRONMENT

- What are light locks and why do you need them?
- What are the soundproofing needs of the planetarium? Or the HVAC system?
- How much electrical shielding does the Planetarium sound system need?
- What are the air conditioning (HVAC) needs of the planetarium, including the added heat loads of audience, projection and electronic equipment? Should you have a manual override?
- What colors and materials will you use inside and behind the dome to minimize light and sound reflection?

SPECIFYING SUPPORT AREA NEEDS

- What kinds of support areas does the planetarium need?
- Where should they be located?
- What support services can be shared with other institutional departments?
- How much floor space should be allocated to the various support functions of the planetarium?
- What sort of equipment will you need in the planetarium support areas?
- How do you allow for future growth of staff and storage needs?
- What kinds of storage space are needed?

DETERMINING STAFFING NEEDS

- Based on the goals, methods, magnitude, etc. of the projected planetarium operation, what sort of staff will you need to operate it?
- What are the various 'typical' planetarium staff positions and the qualifications needed for them?
- Where do you find planetarium staff members?
- How much have you budgeted for planetarium staff positions? How will their salaries compare with those of similar positions elsewhere in the planetarium field and/or community?
- How will existing institutional staff members (if any) assist with planetarium operations?
- What other responsibilities (if any) will the planetarium director have other than planetarium direction?

WIDE ANGLE FILM SYSTEMS

- Why consider a wide angle film system?
- What types are currently available?
- How does a wide angle film system affect the planetarium design?
- What are the maintenance concerns of a wide angle film system?
- What films are available for the system and how much do they cost?
- Will the system be manually controlled or automated?

LASER PROJECTION SYSTEMS

- Why consider laser projection?
- What is the range of laser equipment available at the moment and what can it do?
- How does the inclusion of laser equipment affect the design of the planetarium?
- Will it be manually controlled or automated?

RENOVATING AN OLDER PLANETARIUM

- How do you decide whether to renovate an older planetarium or to build a new one?
- How extensive should a renovation be? How do you decide whether or not to renovate the planetarium instrument or to replace it?
- How do you dispose of old equipment?
- How long will a renovation take?
- What unexpected pitfalls should you watch for in renovation?

CONTRACTORS & ARCHITECTS

- How do you select a contractor and/or architect?
- How much/far should you trust a contractor/architect?
- What work should a contractor do and what should you do 'in-house'?
- How do You communicate effectively with a contractor/architect?

PROGRAM PRODUCTION

- Will you produce most of your planetarium shows 'in-house' or will they be purchased from another source?
- What 'in-house' capabilities do you need to produce your own shows?
- What 'in-house' capabilities do you need to produce 'out-soured' shows?
- What program topics and approaches would effectively address the characteristics and needs of your potential and/or targeted audiences?
- What blend of live, recorded, and interactive programming will you strive to achieve? How will this blend affect facility design and construction?
- What staff and equipment will you require to produce or install your programs? How will you present them?

PLANNING THE PROJECT

- How have you defined the planetarium's mission? How does that mission support and depend upon the institutional mission?
- What long-range goals will help the Planetarium operation embody this mission?
- What objectives will enable realistic progress towards attaining these goals?
- What strategies will you implement to accomplish these objectives?
- Have you conducted a valid feasibility study for a planetarium? How will you implement its recommendations?
- Why should you build a planetarium? What factors might hinder its construction and operation? How will you overcome them?

CONSTRUCTION & OPERATING COSTS

- How much do you expect to spend on constructing operating the facility?
- What provisions have you made for cost overruns?
- How will you fund construction (or renovation)? How will you fund ongoing operations?
- How much of your institutional budget can you allocate to building costs? To operating costs?
- What granting agencies might help fund building costs? Operating costs?
- How can the planetarium earn income to offset its operating costs? Will the planetarium retain this income or will it become part of general operating revenue?
- What admission categories can you offer? At what rates?
- What membership categories can you offer? At what rates? What level of services and benefits will you provide?
- Can you furnish, supply, and operate a gift shop? What items will you plan to offer for sale?

SAFETY AND SECURITY PROVISIONS

- What kinds of access should be allowed?
- What needs to be kept from prying hands?
- What backup systems are needed to get your audience safely out of a dark environment?
- What fire protection equipment will you have and what will it damage if activated?
- Sprinklers? Hand extinguishers? Halon?
- Will you have a 'trouble' alarm system from the theater console and/or ticket booth to staff offices and work areas?
- Where will you place phones and/or intercom stations?
- Do you need fire doors and/or automatic door closers to the planetarium?
- Will you have alarm bells/lights in the planetarium theater itself?
- How will you evacuate the planetarium in the event of an emergency?

- Will you have controlled public access to the planetarium separate from the parent institution? Do you want to be able to close the school or museum and just open the planetarium for a special or evening function?

CHECKLIST 1
GENERAL PLANNING

SITE SELECTION

Transportation
- Walk
- Bus
- Subway or train
- Automobile

Basement desirable
- Utilities
- Storage
- Workshop

Telescopes needed
- Clear horizon
- Light pollution
- Portable telescopes
- Roof top use

Solar energy considered
- Consult local installations

PLANETARIUM & AUXILIARY PROJECTORS

Types
- Lens projection
- Non-lens projection
- Precision

Star image location

Automation

Azimuthal projectors in "Package"
- Pointer
- Sun
- Moon
- Planet
- Celestial equator
- Ecliptic
- Meridian
- Coordinate grids
- Precession circle
- North celestial pole - Zenith
- Twilight
- Sunrise
- Sunset
- Constellation outline - Others

Other important auxiliary projectors
- Panorama
- Solar system orrery

- Cardinal points
- Geocentric earth
- Meteor
- Comet
- Aurora
- Eclipses
- Binary star
- Cepheid variable star
- Constellation outlines
- Star clusters
- Galaxies
- Astronomical triangle

2 X 2 Slide projectors
- Remote control
- Dimable

Overhead projector
- Dimable

Film projectors
- 16 mm
- 8 mm
- Film loops

Other lens
- Zoom
- Image rotation
- Video projectors

PLANETARIUM CHAMBER

Entry
- Light trap
- Eliminate noise
- Proper width for equipment

Dome
- Perforated aluminum
- Plaster
- Standard or tilted
- Inflatable
- Space behind

Adequate

Catwalk/ladders

Lighted

Secure from "visitors"

Control console placement
- See sky that audience sees
- Install 1 -inch, 2-inch & 3-inch (25mm 50mm & 75mm) conduits

Electric circuits
- Star projector
- Auxiliary projectors
- Cove sectors
Lighting
- During programs
Daylight control
Light at seats
- During non-program times
Separate circuit
High-level lighting
Emergency system
Elevator for projector
Chamber used as classroom
Auxiliary projectors
- Noise control
- Accessible
- Ventilation
- Adjustable mounts
- Placement: Booth, Cove, Behind dome, Other
Heating/Air conditioning
- Philosophy of facility use
- Independent control
- Noise control
- Humidity control
Dust control
Sounds in chamber
- Unwanted from
Projectors
Heating & air conditioning
From the hall
From bells
Sound system
- Specifications needed
- Microphone
- Multi-channel amplifier & mixer
- Speakers - at least 4
- Multi-channel tape deck - All components to be free of operational noise
Walls
- Light reflection
- Black walls depressing
- Sound reflection
- Easier to 'deaden' than 'enliven'
Floor
- Flat
- Tiered

- Slanted
- Carpeting preferred

Seating
- Unidirectional
- Circular
- Sturdy & quiet
- Solve "tired neck" problem

Other considerations
- Demonstration area
- Stage area

ENTRY AND WAITING AREA

Cloakroom
- Adequate space

Water fountains

Restrooms
- Locate away from chamber wall

Display space

Permanent

Changing

Keep glare off glass

Controlled lighting

Floor covering

Door size adequate
- Large displays
- AV carts
- Piano?

STORAGE SPACE

Adequate and orderly

Slides / Films

Tapes / records

Replacement parts

Classroom materials

Props & special effects

STAFF WORK AREA

Office
- Desk / Table
- Working storage
- Phone
- Computer
- Typewriter

Workshop
- "Clean"
- "Dirty"
- Tools -

Basic hand tools
- Specialized tools for equipment
- Storage for spare parts

Photographic
- "Clean"

Tools
Camera body
Lens
Copy stand
Floodlights
Slide copier
Darkroom
Tape preparation
Soundproof room
Auxiliary classroom(s)

STAFF

Student Assistants
Script preparation
Technical skills
Printing/Graphic Arts
Photography
Electronic
Audio Visual
Radio / TV

CHECKLIST 2 - RUNNING COSTS

TRANSPORTATION

Students to facility
Staff to schools

MAINTENANCE OF EQUIPMENT

Annual
Periodic
Emergency

SUPPLIES

For special effects
Gears
Motors
Bulbs
Lens
Mirrors
Wire
Metal
Wood
Clear plastic sheets
Plugs & Connectors
Electronic parts
Photographic supplies
Fresh film
Fresh chemicals
35mm lithographic film
Slide mounts
Opaquing fluids
Art materials
Paints & inks
Brushes & pens
Transfer letters
Templates
Illustration board
Paper materials
Cloth materials
Music supplies
Records

Tapes
Music service
Splicing tape
Leader tape
Magazine subscriptions
Reference books
Office supplies
Staples
Paper (computer, printer & copier)
Computer disks
Printer ribbons
Paper clips
Adhesive tape & Glue
Pens & pencils
Stationery
Printer ribbons
Postage

UTILITIES

Water
Electricity
Heating/Cooling
Telephone

SHOW PRODUCTION

- Fees
Scriptwriter
Narrator
AV consultants
- Studio
Audio
Video
- Show kit production

CONFERENCE COSTS

- Staff
- Printing
- Hire of rooms/equipment

GLOSSARY

Compiled by Sharon Parker

ALLSKY PROJECTION SYSTEM
An all-sky projection system creates a seamless hemispheric image covering the entire dome surface. These are used to create large scale, high impact environmental scenes or to create backgrounds on which other images are projected. All-skies are typically created by using six different slide projectors with matched lenses. They are positioned beneath the dome springline at 60' intervals and project directly across the dome. The seamless effect is achieved through the use of specialized photographic masks, which allow each projected image to cover only 1/6th of the dome and blend the edges of adjacent slides. All-sky images can also be created using one projector with a large fisheye lens located at the center of the room. The latter method is non-standard and rarely used except for specialized applications.

AUTOMATION SYSTEM
A combination of electronic projector control devices and a device (usually a computer with specialized software) that is capable of recording and playing back manually programmed "cues" which automatically activate and control the electronic projector control devices.

BRUTE FORCE PROJECTOR
A projector using light, but not lenses, to create an effect on the dome.

CATWALK
Permanently fixed walkway located behind the dome, which allows staff to access the rear of the screen. Catwalks are usually placed at or near the dome springline and usually extend a full 3600 around the back of the dome. Some catwalks are multi-tiered, or spiral upward to improve access to upper portions of the dome. Revolving, behind-the-dome ladders can achieve the same effect. Catwalks and ladders are optional but should be strongly considered if much rear dome access is anticipated.

CHEVRON SEATING
Planetarium seating arranged in straight rows, where the seating pattern, viewed from overhead, resembles a chevron.

CLOCKTRACK
Timing or program synchronization signal similar to a SMPTE timing signal.

CONCENTRIC SEATING
Planetarium seating arranged in a circular format where all seats face toward the center of the room and the center of the circle formed by the chairs coincides with the center of the planetarium.

CONSOLE or CONTROL CONSOLE
The structure inside the planetarium theater that holds the manual control panels for the star projector, sound system, slide and special effects.

CONTROL ROOM
The place where sound playback equipment, patch panels, and computer automation control hardware is kept. This area is usually located very close to the control console for quick access by show operators.

COPY STAND
A stand designed to hold copy camera and lights at positions that can be adjusted. They are used to photograph artwork and illustrations for shows.

COVE
The shelf or space beneath, behind, or in front of the springline where most projectors are located.

DISSOLVE SET
Two or more slide projectors that are aimed at the same place on the screen. Multiple slide projector sets make it possible to smoothly fade one slide into another and to "animate" slide sequences for greater visual interest in shows.

FLAT DOME
A dome that is not tilted.

EPICONCENTRIC SEATING
Seating arranged in a circular format where chairs face one area of the dome, and the center of the circle lies outside the planetarium theater.

GOW
Grain of wheat lamp. A small incandescent lamp often attached to a planetarium dome to create the effect of an intense, point-like star.

HEMISPHERIC DOME
A dome that is consists of exactly half of a sphere. Hemispheric domes may be flat or tilted.

HVAC SYSTEM
Heating, Ventilation, and Air Conditioning system. Specialized needs for planetarium theaters include positive air pressure to keep dust out of the theater, increased air filtration to take dust out of the air so projection beams won't be seen, and oversized ducts for silent air flow. Air should also be introduced high and behind the dome, and should be pulled into a return air plenum" low.

HYPERHEMISHPERIC DOME
A flat hemispheric dome with an additional sector of the sphere added in front of the audience to permit the projection of foreground imagery.

HYPOHEMISPHERIC DOME
A dome that is less than a true hemisphere and usually tilted.

HYPOSPHERE
A tilted dome that extends beyond a hemisphere.

KEYSTONING
When a rectangular slide image is projected on a curved surface, or when a slide image is not projected directly across the dome, the shape of the resulting slide image will appear slightly distorted. This is called "keystoning".

LIGHT TRAP
A hallway, tunnel or room with a double set of doors through which all audience members enter and exit the planetarium theater without letting light into the darkened theater.

LUMIA
A special effect that produces a large, slowly mixing, diffuse, wispy and colorful cloud-like effect.

MATCHED LENSES
A set of projection lenses that share matching focal lengths. It is important that panorama, all-sky, and dissolve projection systems each use sets of matched lenses.

OEM
Original Equipment Manufacturer.

ORRERY
Refers to either - 1) a hand held model of the solar system, or 2) a projected model of the solar system showing the positions and movement of the planets.

PAN
See **PANORAMA** PROJECTION SYSTEM.
PANORAMA PROJECTION SYSTEM (a.k.a. SKYLINE or HORIZON SYSTEM)
A panorama projection system ("pan") creates seamless, low profile scenes projected at the dome springline. Pans are used to create surface views of other worlds, historical or environmental scenes, or local horizons. Panoramic scenes may cover as little as 30' or as much as 360' of the planetarium's horizon. Most commonly, pans are created using 6 or 12 different slide projectors (with matched lenses) positioned beneath the dome springline at 60' or 30' intervals respectively.

PATCH PANEL (a.k.a. PATCH BAY)
A junction point for wires carrying audio signals or projector control signals. Audio patch bays allow audio output signals from any source to be connected to audio inputs of any source and vice-versa. Projector control patch bays allow projector controls to be assigned to specific manual or automation controls.

PHOTOGRAPHIC JIG
A custom designed device used to conform artwork and illustrations to a curve that matches the projection dome. The curved artwork is placed under a copy camera and photographed.

PIN REGISTERED SLIDE
A type of slide that accurately positions the slide in the slide mount. They are necessary to create precise slide animation and dissolve sequences.

PIN REGISTERED CAMERA
A specially modified camera that accurately and reliably positions film during exposures. Pin registered cameras simplify the creation of precision slide animation and dissolve sequences.

PLANETARIUM
Refers to any of the following, non-interchangeable definitions: 1) The physical building in which the star theater is located, 2) The star theater in which presentations are given, 3) The star projector which recreates the appearance and motions of the heavens, 4) a hand held model of the Earth, Sun, and Moon which is commonly used to demonstrate seasons and lunar phases.

PORTABLE PLANETARIUM
Commonly referred to as an inflatable planetarium. The 'dome', made of an opaque, lightweight, and durable fabric, is inflated with a fan; a simplified star projector is set up inside it.

PORT HOLE
A small, usually circular, hole in the projection dome, through which images are projected.

PROJECTION DOME
Refers to the projection surface of the planetarium. Today, most projection domes are made of perforated aluminum panels riveted to a rigid framework which is then attached to permanent structure. Perforated metal domes allow sound transmission through the dome, improve theater acoustics, and contribute to improved air circulation. Perforated metal domes are preferable to other types.

PROJECTION GALLERY
The access/service area located immediately behind the projection cove. It is preferable for galleries to have continuous, 360° access.

PROJECTION PORT See PORTHOLE

PROJECTION WINDOW

Any large glass surface through which images are projected. If not installed properly, projection windows can introduce unwanted light and sound reflections.

PROJECTOR BLIMP

A soundproof and light tight enclosure for slide projectors. Desirable if the theater does not have an enclosed projection cove.

RAKED SEATING

Any seating configuration requiring ramps or steps to reach back rows.

RECORDING BOOTH

A sound-proof room designed for recording voices, sound effects, and live musical performances.

REVEALER See UNVEILER

RIPPLE WHEEL (a.k.a. DIMPLE DISK)

Disk of distorted clear glass or plastic rotated through the optical path of a special effects projector in order to distort or animate an image.

ROTATOR

A special effects device that fits into the focal plane of a projector and causes a slide image to rotate. Used for rotating planets, space stations, asteroids, etc.

SLEW

A device, usually a motorized mirror, which moves an image across the dome.

SMPTE

Abbreviation for Society of Motion Picture and Television Engineers. However, in common use **SMPTE** (pronounced simp-TEE") refers to a timing or synchronization signal which is recorded on a dedicated channel of the show soundtrack and is played back through an automation system. The automation system "reads" the **SMPTE** timing signal and uses it to trigger pre-programmed projector control cues at specific times. **SMPTE** has become the industry standard for audio/visual timing signals.

SOUND STUDIO

A dedicated room with sound recording, mixing, and editing capability. Sound studios often include recording booths.

SOUND REINFORCEMENT See SOUND SYSTEM. .

SOUND SYSTEM
Any combination of speakers, amplifiers, subwoofers, mixers, tape decks, CD players, patch panels, microphones, or other sound equipment that is used to produce or reproduce music, sounds and/or narration for programs.

SPECIAL EFFECT
Projection device that is built or modified for a specific purpose. Examples: projectors for comets, quasars, rotating planets, rotating space stations, zooming UFO's, strobes, simulated clouds, special lighting effects, etc.

SPRINGLINE
The lowest point of the dome screen, sometimes erroneously referred to as the dome's horizon, or horizon line. Low springlines help audiences feel that the planetarium experience is around them, while high springlines give audiences the feeling that the experience is above them. The term springline is used in reference to non-tilted, hemispheric domes.

STAGE
Any raised platform in a directional planetarium theater.

STAR PROJECTOR
Opto-mechanical or video graphics projection system capable of simulating the appearance and motion of the night sky.

SUB-WOOFER
Speaker designed to reproduce low frequency sounds such as rocket launches or enhance bass tones in music.

UNIDIRECTIONAL SEATING
Planetarium seating arranged on a curve such that every seat faces the same part of the dome.

UNVEIER
A special effects device that fits into the focal plane of a projector and causes an image to be gradually revealed or covered up.

YLEM
A special effect that produces seething, turbulent, multi-colored swirling clouds.

ZOOM
A special effects device capable of making a projected image grow larger or smaller.

ZOOM/SLEW

A special effects device capable of simultaneously making an image move across the dome and change its size.

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