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Stars That Need Not Shun The Light.
Thanks To Zeiss Fiber Optics.

The stars, those apparent lords of the night sky, are terribly afraid of light. For millions of years, since the first seeing creatures populated the Earth, only the Sun was able to dim down its distant brothers into nothingness. Today, this is easily accomplished by street lamps, neon signs and car headlights.

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Planetarium Maintenance: Protecting Your Investment

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There are a lot of 10 to 40 year old planetarium star projectors presently in service. In fact, the majority of all planetarium projectors in use fall into that category. Some of those projectors have exceeded their useful operating lifetimes by performing at levels far below what the equipment was originally capable of doing. Many others will be approaching their useful operating lifetime point within the coming years, some sooner than others. Eventually, of course, every projector will face that situation. In many cases, the projectors do not need to be replaced, but simply repaired or perhaps refurbished. And, equally important, most projectors can be maintained within acceptable accuracy and reliability standards so as to postpone their replacement for many years.

To some extent, the operating lifetime is determined by factors beyond the control of the user. This may occur when a company goes out of business, when a particular model is no longer supported by a manufacturer, by a lack of critical parts, or by the lack of knowledgeable service personnel. In other situations, the operating lifetime is limited by user-caused or user-determined factors such as misuse and/or abuse, lack of maintenance, vandalism, or a number of other factors.

Often it is difficult to determine the point or condition at which a planetarium projector needs to be replaced. Refurbishment or corrective maintenance, perhaps extensive in nature, is sometimes a more practical solution than projector replacement. Also, keep in mind that many state-of-the-art control systems and enhanced operating features and capabilities can be installed on projectors that are several decades or more old.

No matter how well your projector may be performing right now, ongoing preventative maintenance is a very important consideration and investment. Each manufacturer has developed maintenance procedures to address the needs of their particular equipment. Unfortunately, some of the critical needs are dismissed as not important or worth the expense, and consequently go unaddressed.

The “electro-optical-mechanical” planetarium instrument has been the mainstay of planetarium theaters since their introduction in the 1920s. This basic design continues to dominate existing and new facilities and has particular maintenance needs. All too often, these needs are not adequately addressed resulting in impaired operating parameters and shortened projector lifetimes. This paper will provide a strong rationale for ongoing service, provide various tips that will allow planetarium staff to perform limited maintenance procedures, and furnish criteria to identify and remedy projector problems.

The following is a rough guideline dealing with a variety of technically oriented situations that face planetarium theaters. This is not intended as an all inclusive compendium on these matters. Indeed, I hope that it fosters a continuing effort towards further clarifying the procedures and situations expressed.

Problems

Equipment-imposed problems and limitations.

Know your planetarium design parameters/limitations. Is the projector capable of doing what you expect? Many “problems” are simply the projector being expected to do more than what is possible. For instance, the horizon cutoff height for the stars in most older Spitz projectors varies with the latitude setting of the projector.

capable of doing and a particular planetarium alignment cannot be presented any more accurately. Keep in mind as well that some tolerances will increase as the equipment ages. Knowing these distinctions will give you a much more informed perspective to deal with or avoid actual problems.

Typical human-induced problems and concerns:

poor/no training procedures showoff “gee whiz/impress member of opposite sex” operators I can fix anything type (staff, volunteer, friend) unauthorized users/abusers (custodians/maintenance personnel other staff contractors performing other work VIPs [museum director, board members, etc.] vandalism

What can you do?

If all else fails, read the directions! In the case of most planetarium projectors, it is

Vol. 28, No. 1, March 1999  
Planetarian

John Hare, has over 35 years of experience in the planetarium field having worked for Spitz, as Technical Director for Abrams Planetarium, as Director of Bishop Planetarium, and now as President of Ash Enterprises, a service-oriented, planetarium company.
A basic checklist of criteria for recognizing projector problems may include such items as:

- frayed wires - especially important near moving parts
- does equipment shift due to loose hardware?
- wires near gears/projector protrusions - is there adequate clearance?
- has focus or brightness changed on any image?
- Spitz star (arc) lamp users please note - The condition of the star lamp degrades slowly with use. Look for "fuzzy" and dimming stars near the zenith. Replace the lamp when this becomes pronounced.
- light leaks
  - star projector
  - auxiliary equipment
  - external - under doors, around ducts, etc.
- Do all controls function normally? are instrument readouts synchronized?
- are instrument motions smooth?
- unusual mechanical noises - identify location if possible
  - louder than normal
  - higher/lower pitch than normal
  - clicking/intermittent noises
- stains/discoloration from external or internal sources
- internal lubricant or other
- external:
  - drip from above
  - overspray
  - water in elevator pit
- electronics
  - odor
  - scorched components

In-house maintenance procedures should be formulated and carried out based on a number of factors. Sometimes technical staff will be able to provide most of the maintenance. In other cases, one person may be the only one available for the entire planetarium operation. In these situations it is important to recognize what can and cannot be done as well as what must be done. Maintenance deficiencies must be provided for in other ways such as periodic service by outside sources. In either case, the frequency and extent of instrument maintenance will vary from facility to facility based on such differences as type of equipment, amount of usage, amount of dust accumulation, amount of abuse, etc. Some procedures will need to be performed more or less often than others. Your checklist should specify the frequency of specific maintenance procedures.

Such procedures should include:
- periodic visual inspection based on previous criteria list
- dusting
- starball
- mirrors
- lenses
- geartrains/other
- cleaning mirrors
- cleaning lenses
- cleaning other surfaces
- lubricating projector components
- periodic replacing/aligning lamps

Some maintenance procedures that may fall beyond the scope of in-house staff:
- cleaning slip rings/replacing brushes
- cleaning first surface mirrors
- cleaning internal projector optics
- lubrication of projector components
- recalibration of electronics
- precise alignment of star projector optical systems setting of all projection systems including annual motion

Miscellaneous considerations:
- provide correct climate control
- install light in elevator pit to help with humidity maintain HVAC and/or humidity control
- provide adequate dust filtration
- provide adequate security
- surveillance of theater at all times when in use alarms when unoccupied
- safeguards from unauthorized use

Finally, regardless of who performs the maintenance on your planetarium instrument, you should maintain a log of all problems and fixes. This will be especially helpful in identifying systems or components that are prone to failure and can significantly reduce analysis time and repair of certain future problems. It can also help in rectifying ongoing problems that can only be fixed by a process of elimination. Additionally, if you contract for outside maintenance, a long-term record of problems and repairs can be a valuable reference for improved service.

Just like your automobile, the planetarium projector that is properly maintained from the day it is purchased, is very likely to be one that continues to function at a time when many other projectors of similar age are suffering worse fates. Whether you do it yourself, or contract with the factory or another qualified source, please, see that your projector gets the attention it needs and deserves. When you consider that a new planetarium projector usually costs from 2 to 10 times the cost of your existing one, the amount you need to commit to servicing will pay you back handsomely in the long run through more reliable and long-lived operation. You, your successors, and your audiences will enjoy the long-term dividends that will result from such an investment.

(Janes, continued from page 58)

progressed, he got the feeling that someone was looking at him. He even imagined that he could see an angel watching him from on high. He wondered if horrible things had happened to someone in his family and he was getting thought messages from a loved one about the tragedy.

Eric shook off the feeling and attributed his hallucination to the lateness of the hour. The next day, when he was talking to the director, he decided to mention his strange experience. The director laughed, took him under the dome, and showed him a switch near where Eric had been working, right next to the room light switch. When this switch is tripped, a cardboard angel, set behind the dome, is dimly lighted. The effect is of a hovering indistinct robed figure. As they both laughed, the director said, "You must have accidentally tripped it when you turned on the room light!".
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When some stars reach the last stages of their "lives" they blow off shells of material into space. In this installment, we'll explore a great way to simulate expanding planetary nebulae and supernova gas shells during your planetarium presentations.

The "expanding gas shell" effect (Figure 1) uses just a few simple parts, including: a flashlight reflector, a low-voltage lamp and a lamp socket, a transformer, a motor, a microswitch, and a few other bits of material and hardware. You may actually have some artificial appearance.) If you don't have a lantern flashlight, they're available from just about any auto parts, discount, or home improvement store for about $5 U.S.

We recommend substituting a #1129, 6-volt automotive lamp for the flashlight lamp as it is much brighter. Because this large lamp will bob up and down through the bottom of the reflector with the see-sawing motion of the lamp lever, the original lamp opening should be enlarged to accommodate it. This can be done easily using a small saw and a rat-tail file.

The reflector is sandwiched between two sections of similar-diameter, heavy cardboard tubing or PVC pipe, which is painted black. The short, upper length of tubing is mounted above the concave side of the reflector and is designed to help prevent stray light from the bulb from directly illuminating the dome. A longer, lower tube section is attached beneath reflector, and its opposite end is mounted to a plywood base. This tube has a narrow slot cut lengthwise down one side, which is designed to accommodate the pivoting lamp lever.

**Mechanical Details**

Parts of the motion mechanism — the lamp lever, connecting link, and mounting brackets for the lever, motor and microswitch — can be fabricated from thin aluminum bar and angle. A 1/2-to-1 RPM AC synchronous motor works well for this application — depending upon just how fast you want the effect. The cam can be made from a spur gear having suitable diameter and bore size whose teeth have been filed away. "Shoulder screws" (Figure 2) — available from specialty hardware suppliers, such as Small Parts, Inc. (P.O. Box 4650, Miami Lakes, FL 33014-0650, telephone 800-220-4242 or 305-557-8222) — work well for the pivot points on the lamp lever, connecting link, and cam. Otherwise, a serviceable pivot can be made by drilling a "clearance hole" through one of the parts, thread-tapping the other part, inserting a standard machine screw.
through the “clearance hole”, then screwing it into the threaded hole until just before the screw-head begins to tighten, and finally jamming a nut onto the screw up against the threaded part (Figure 3).

A single-contact lamp socket can be purchased from an auto parts store along with the #1129 lamp, and can be mounted to one end of the lamp lever using a pipe clamp, a short length of small-diameter PVC tubing (which will serve as an electrical insulator), and some epoxy. The lamp works best if it is shielded from spilling light directly onto the dome. An easy way to accomplish this is to paint the top of the bulb with high-temperature black spray formulated for automobile exhaust systems. (Painting a spare bulb ahead of time is advisable in the event of a future lamp burnout.) The lamp is powered through a 6-volt, 2-amp transformer whose primary can be connected to a dimmer circuit in the planetarium’s control system.

The actual placement of the various pivot points in the mechanism are determined by the motion of the lamp with respect to the reflector. The middle of the lamp filament’s up-and-down motion should be set at the “prime focus” of the reflector (i.e. — where the image on the dome is collapsed down to a “spot”), and the apex of the motion should place the filament a little above the reflector’s rim (where the image has expanded into a wide ring). A bit of experimentation determines pivot-point locations on the lamp lever, connecting link, and cam which will achieve this geometry.

After mounting the microswitch to ride along the edge of the rotating cam, a valley can be filed into the cam for the switch’s roller at a position corresponding to the lamp’s prime focus position. After it is wired up later, this valley and the microswitch together will determine the start/stop position for the mechanism.

Refinements

Of course, the projector as presented up until now would only project a white-light ring of light. A simple way to introduce color would be to add a sheet of colored gel over the top of the upper tubing section. To make things even more visually interesting, though, you can instead mount a disk of clear Plexiglas over the top tube, and adhere small bits of different colored gels to the Plexiglas with tiny droplets of glue. Taking the latter approach will introduce a metamorphosis of color into the light ring as it expands.

The projector as shown in Figure 1 would project the image vertically. Most folks will probably need to project the image across the dome from the cove, however. In this case, simply mount or prop the projector at a suitable angle. To simulate supernova explosions, this effect can be used in conjunction with a strobe mounted toward or behind the dome.

The gas shell projector is an effective and inexpensive way to simulate several stellar-related phenomena. It requires only modest mechanical skills to build, yet it is an impressive way to illustrate the death-throws of a moderate- to heavy-mass star in that new, or older, planetarium program.
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Congratulations

to Martin Ratcliffe (Director of Theaters & Media Services at Place, Wichita, Kansas), who has been elected as our next IPS President Elect. Martin and his wife also have a new baby daughter, Emma Catherine, who was born on November 9 at 8 lbs 13 oz. The baby is and is now feeding very well. She joins Martin’s other Victoria, and they are among the generation who might get to fly to Mars!

to Harold Van Schalk (former Director at the Garland ISD Planetarium in Texas), who is recuperating nicely from his stroke and is out of rehabilitation.

to Dave Maness (Director of Astronomy, Peninsula Planetarium, Museum, Planetarian Seasons” show ’99. The show was written by Jim Manning (Director, Taylor Planetarium, Bozeman, Montana), and will contain animation sequences in addition to slides. Bowen Production’s new hard disk video system, AstroFX, is in high demand … by the end of January, they had over 40 orders! Jeff says that Steve Savage (Sky-Skan) is discussing making drivers for the system to integrate it for spice users.

Did you know

Steve Tidy (editor of the Forum and Director of the Maryvale Schools Planetarium in Buffalo, New York) is editing an updated version of a 1984 GLPA Tips booklet on planetarium scriptwriting. Just this past January, Steve also reported that they had four feet of snow in seven days. He said, "I can now add expert snow shovel to my resume!"

Bill Gutsch (President, Great Ideas) reports that their show for Valencia, Spain, was at 96% capacity, and that the shows sold out on weekends up to two weeks in advance! The planetarium out-drew and out-earned the IMAX movies and IMAX movies in selected time slots. The second show is even stronger!

Middle Atlantic Planetarium Society is having an anniversary this year! The 1999 Conference of the Middle Atlantic Planetarium Society (MAPS) will be held in Pennsylvania Dutch Country from May 12 through 15, 1999. The very first MAPS Conference was held at the North Museum Planetarium in Lancaster, PA. The conference was only a single day, December 4, 1965, and registration was a mere $2 (including lunch!). The 1969 conference was also held in Lancaster, the year of the Apollo II mission to the Moon. So 1999 represents the 30th anniversary of both the first lunar landing and the last MAPS conference in Lancaster.

Dave Maness (Director of Astronomy, Peninsula Planetarium, Virginia Living Museum, Newport News, Virginia) reports that they are undergoing a capital campaign. They hope to have a new building, new exhibits (including astronomy exhibits), new planetarium theater, etc. They’re very excited about all of the possibilities!

Jeff Bowen (Bowen Productions) reports that 1998 was an exciting year, with terrific opportunities to work on unique shows in Mandarin Chinese, etc., as well as being allowed to introduce new presentation system ideas. Their new "Mystery of the Missing Seasons" show is scheduled to ship April 1999. The show was written by Jim Manning (Director, Taylor Planetarium, Bozeman, Montana), and will contain animation sequences in addition to slides. Bowen Production's new hard disk video system, AstroFX, is in high demand … by the end of January, they had over 40 orders! Jeff says that Steve Savage (Sky-Skan) is discussing making drivers for the system to integrate it for spice users.

People on the Move:

Joyce Towne Huggins (formerly at the Fels Planetarium/Franklin Institute in Philadelphia) has left to accept a new position in sales and marketing at Spitz Inc. She reports that she's looking forward to helping more theaters succeed and change to meet the needs of the next century in new ways.

John Stokes (previously with Sky-Skan) has taken on a new position at the Space Telescope Science Institute. We look forward to seeing his efforts in the outpouring of new astronomical information at Space Telescope. Paul Tetu is the new sales contact at Sky-Skan.

Bill Buckingham (formerly at Lowell Observatory in Flagstaff) is now Director of the Flandrau Science Center, in Tucson, Arizona.

Our Condolences

to SEPA’s ’98 conference host, Gary Close, (Director, Hopkins Planetarium in Roanoke Virginia), who has been diagnosed with lung cancer. He is having difficulty speaking because one vocal cord is paralyzed. Currently, he is recuperating from pneumonia and receiving radiation treatment. Dave Godman is helping to fill in at the planetarium during his illness.

to the friends and family of Jean Henry, who passed away at her residence in Odessa on Monday, Nov. 30th. She was Planetarium Director at Highland Park in Dallas, Texas before Donna Pierce. She later moved to California and worked at parks concentrating on bats and their behavior. She also was interested in photography and won several contests.

to Donna Pierce (Director, Highland Park ISD Planetarium, Dallas, Texas) who had a wreck during a car pile-up and totaled her car. Thankfully, no one was hurt!

Did you know

Steve Tidy (editor of the Forum and Director of the Maryvale Schools Planetarium in Buffalo, New York) is editing an updated version of a 1984 GLPA Tips booklet on planetarium scriptwriting. Just this past January, Steve also reported that they had four feet of snow in seven days. He said, "I can now add expert snow shovel to my resume!"

Bill Gutsch (President, Great Ideas) reports that their opening show for Valencia, Spain, was at 96% capacity, and that the shows sold out on weekends up to two weeks in advance! The planetarium out-drew and out-earned the IMAX movies and IMAX movies in selected time slots. The second show is even stronger!

Middle Atlantic Planetarium Society is having an anniversary this year! The 1999 Conference of the Middle Atlantic Planetarium Society (MAPS) will be held in Pennsylvania Dutch Country from May 12 through 15, 1999. The very first MAPS Conference was held at the North Museum Planetarium in Lancaster, PA. The conference was only a single day, December 4, 1965, and registration was a mere $2 (including lunch!). The 1969 conference was also held in Lancaster, the year of the Apollo II mission to the Moon. So 1999 represents the 30th anniversary of both the first lunar landing and the last MAPS conference in Lancaster.

Dave Maness (Director of Astronomy, Peninsula Planetarium, Virginia Living Museum, Newport News, Virginia) reports that they are undergoing a capital campaign. They hope to have a new building, new exhibits (including astronomy exhibits), new planetarium theater, etc. They’re very excited about all of the possibilities!

Jeff Bowen (Bowen Productions) reports that 1998 was an exciting year, with terrific opportunities to work on unique shows in Mandarin Chinese, etc., as well as being allowed to introduce new presentation system ideas. Their new "Mystery of the Missing Seasons" show is scheduled to ship April 1999. The show was written by Jim Manning (Director, Taylor Planetarium, Bozeman, Montana), and will contain animation sequences in addition to slides. Bowen Production’s new hard disk video system, AstroFX, is in high demand … by the end of January, they had over 40 orders! Jeff says that Steve Savage (Sky-Skan) is discussing making drivers for the system to integrate it for spice users.

Did you see the Leonids? Many of us did not have excellent views, although I did see about a dozen here in Phoenix in a quarter of an hour. Australia seems to have had a great view … Launceston Planetarium staff Martin George (Curator) and Peter Daalder observed from 16:20 to 18:00 UT on November 16 (locally, the morning of November 17). They reported that despite a little hazy cloud here and there, they observed 14 Leonids, mostly brighter than magnitude zero — the shower was very rich in bright meteors. They were especially impressed with the number as the radiant for them was very low. Many trains, and several meteors were an obvious yellow color.

Loch Ness Productions was inundated with phone calls this fall; unfortunately, many were wrong numbers. Mark Petersen reports that many people who were trying to call "meridia" were misspelling it and calling 1-888-4-MERRIDIA, which gets them the Loch Ness toll-free number: 1-888-4-NESSIE. They were getting 35-40 calls a day (which they had to pay for). Mark says that if you call Loch Ness Productions, please don't hang up — leave a message when the answering machine comes on; and maybe the next time you mention the meridian in your planetarium show, you could spell it for people ...

Martin Ratcliffe also had some troubles this winter. In November Wichita experienced major rainfall, resulting in very high water at the site of the new Exploration Place. Fortunately no damage was done - just a few days delay waiting for the ground to dry out - and it also provided a good test of the building which was designed and built

(See Gibbous on page 18)
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Spring/Autumn greetings.
It's always concerned me that the average member of the public only visits a planetarium perhaps a couple of times in their whole lifetime. Thinking about this brought to mind the topic for this issue’s column, so here it is:

Ever since the first public planetarium opened over 70 years ago, planetariums have been faced with the problem of how to persuade people to visit their local facility more than a couple of times in their whole lives (once when they are a child, and again, later in life, when they have their own child). To what degree could it be argued we are, perhaps, in part, the unwitting architects of this conundrum? After all, many public shows are packed to the gills with so much astronomy data, the general public, walking out at the end of the performance, may be entitled to think they've just seen and heard it all, so anxious were the show's producers to cram in every last picture in yet another tour of the Universe in 40 minutes. So, is a more focused approach to planetarium scripting-writing the answer, concentrating on fewer topics but in greater depth, so the public know they will have a structured education by re-visitng their local domes to catch up on new, stand alone topics on a periodic basis?

Darryl Davis is fired up and ready to go, so let’s hear his wise words.

I have some strong feelings on this topic. I first agree that most visitors that I've experienced where I work have not been to a planetarium since they were a kid. We did a survey and found that a lot of folks thought that once you have seen one show, you have seen what a planetarium is about. The next visit is with their kids to share the experience. I feel this is in part due to the misconception that when you go to a planetarium, you just see stars and planets. That is a quote I hear often.

How this perception is changed is dependant on your particular venue. Each town is different and people have different expectations, depending on where they live. A venue may be in a town where a star show is just fine. On the opposite end of the spectrum, you may be in a town where movies-OMNI/IMAX shows - and other entertainment has you competing for an audience. In this case, you need a show which is first compelling, topical and also entertaining. It does not have to be overloaded with information, but with just enough for visitors to understand the topic and get the point. Building in drama is a must, too. High and low points, placed properly, make for an entertaining program.

Folks know that if something astronomical is happening in the news, they will find something about it in one of our programs.

My personal feeling is that we must be current. Where I work we have done many kinds of programming from the very light-hearted attempt at humor to the extreme of explaining the technology astronomers use. By far the best accepted programs that we have produced are the ones dealing with 'in the news' current topics. This has been a good formula for two years now.

The response to our programs have been very positive, and we do get locals coming back for the new programming. Folks know that if something astronomical is happening in the news, they will find something about it in one of our programs. Visitors are not disappointed that they could not see an OMNI show, and in some cases like the planetarium better than OMNI.

Being current is the key. I believe that this works in any venue, no matter how many theatrical toys you have or don't have. In a big city, however, lots of video and other such devices do help.

If you would like more information on the style of our programming, feel free to email or call me.

The public's impression about what they may see when visiting the planetarium can be influenced by many things. They may have visited a planetarium when they were in elementary school. They may, therefore, have a vague memory of a dark room where the constellations were pointed out. They may revisit as an adult and see a program where constellations are pointed out. Thus they conclude that the only program the planetarium ever shows is one where constellations are pointed out. And so they do not need to revisit, because they have already seen the show.

We present programs that have a great variety of topics and age levels at our theater. Of course, one of our standbys is a live tour of the current night sky. But we also have programs that are geared to our younger visitors (Larry Cat in Space) and programs that are chock full of facts and special effects (Through the Eyes of Hubble).

What I find, more often than not, is that the public does not get the concept the we change programs from time to time. After running a children's program for a few months, we might show one for adults. Inevitably, we will get a few comments along the lines of, ’That was way over my kid's heads. I thought you ran shows for kids. When are you going to bring back that cute cat show? Or, at the other end, I enjoyed that program about that space microscope. Lots of really cool pictures. All this show was, was a talking cat.'

I am of the impression that the reason for this is that we are not doing a good enough job of impressing on the public that we are much like a movie theater. The programs change! We also have to appeal to a wide audience. Thus we have lots of different types of programs in a given year. If we didn't present lots of different program types, we would not be serving some part of our potential visitors.

What I find, more often than not, is that the public does not get the concept the we change programs from time to time.

I have found that if a visitor knows what the program is about, they are more favorable to seeing different types of programs. Adults have enjoyed seeing kids programs, when they knew before the program that it was geared to children. And vice versa. We always tell visitors that the programs change, and if they wish to see a constellation program, stop back when that is showing (which is year-round).

I do not think that doing only one type of
program to the exclusion of others is the solution. Inform your visitors that things change, and soon something they are more interested in seeing will be showing. When the public gets used to the changing schedule, they will look forward to upcoming programs and will revisit. Find out what they would like to see. And if possible, do a show on that topic. Visitors with children enjoy kids shows, adults enjoy shows that are crammed with info (and pretty pictures), adults and kids both enjoy stargazing programs. It is our job to inform them that all these different programs are available. And if they keep checking back, they will find something new. Even the movie theaters can’t just show Star Wars forever, and neither can we.

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Museum of Science and History
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Centuries ago, the orrery was developed as an educational device to represent the solar system. In the early part of this century, the Atwood Sphere represented one way to show students and others the night sky from an artificial environment. Finally, in 1919, Walther Bauersfeld of Carl Zeiss Optics developed the first optical projection planetarium system.

The first planetarium presentations were nothing more than astronomical lectures. And the persons giving those lectures were, for the most part, professors. The popularity of the first presentations relied heavily upon the awe factor of seeing a fabulous sky, and marveling at the new equipment. Other aspects of popular interest included the personality of the presenter himself. Some speakers were dull and uninteresting, and some were quite good. But the favorite planetarium presentations included some sort of story, something that the audience could humanly relate to.

As time went on, technology advanced, and more gadgets were added to the planetarium theater. Still, as late as the 1970s, planetarium shows had limited special effects, and the two best assets that a theater had were the night sky and the presenter.

I recall seeing shows, and giving shows, to huge crowds, often sell-outs, at Los Angeles’ Griffith Observatory, in the early 1970s. And those shows had nothing more than the night sky, two or three visuals, and four or five pieces of music, of which one was for sunset, another was for sunrise, and two more were for walking in and walking out.

The key to the success of many of those shows was not so much the gadgetry, but the personal warmth of the presenter, and his style of delivery. Two good friends of mine, whom I learned a great deal from, were Paul Roques and Ron Smith. Both were lecturers and master storytellers at the Griffith Observatory at the time I joined the staff. Both emphasized stories, and limiting what we would try to convey, or teach, our audiences. Not a dozen or more new things to tell the audience, but only three. And never get too deep on any of those three. If the audience liked what they saw and heard, they would ask questions, or they would come back again and again.

By giving the audience too little, they hungered and thirsted for more. I fear today we often try to engulf our visitors with so much information, they feel no need to come back for ten more years. Both Ron and Paul also peppered their stories with humor, anecdotes, and personal experiences. These can only add to the enjoyment of the show.

While all these technical, electronic, and visual effects are pleasing and interesting, the best part of any show is still the stories we share, the feeling we impart to our visitors.

The key to the success of many of those shows was not so much the gadgetry, but the personal warmth of the presenter, and his style of delivery. ... While all these technical, electronic, and visual effects are pleasing and interesting, the best part of any show is still the stories we share, the feeling we impart to our visitors.

It appears to me that we need to take responsibility for the lack of return visitors, but for reasons beyond those suggested.

First, all of astronomy cannot fit into a 40 minute survey-style program will confuse audiences who are unfamiliar with astronomy or perhaps leave them with the impression that they now know everything, while audiences who do know some astronomy leave bored, with the sense that they’ve learned nothing new. It appears to me that any attempt to provide such a broad informative background in a single show is self-defeating.

More importantly, we should never miss the opportunity to encourage people to return to the planetarium. We must not forget to mention the shows currently in production to our audiences. We need to inform captive audiences of the other features currently showing. We should invite audiences to return for our live shows which have the newest, latest information on any particular subject.

It appears to me that the biggest obstacle to return visitors is the way in which we market the planetarium. Do the ads, schedules, and posters emphasize the subject of our shows, or simply the existence of a planetarium show? Unless the subject itself catches attention, the public may simply hear the term planetarium and block out everything else. Many planetariums out there are showing presentations that focus on a single topic. Unfortunately, many people won’t realize how the show differs from their past experiences. For many individuals, the planetarium is an experience, like looking through a telescope or riding a roller coaster. We need to communicate that the planetarium offers constantly changing programs — more like a theater than an amusement park ride.

Perhaps we can learn from the marketing of other places with the same problem. Zoos and aquariums suffer from the same tendency toward infrequent visits. They schedule special events, such as the arrival of a new animal, a birth, unique tours, etc. Perhaps marketing our shows as new opportunities for the public to see something unique might work.
Ultimately, each of our presentations should be a unique experience, which our audiences will want to repeat. We just have to let them know it.

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Of course it would be great to get more of the general public so excited about planetarium programs that they would attend frequently, but I’m not convinced that the answer lies in fine tuning the content of our shows.

It is my belief (and my experience) that in a field where the number of die-hard fans is so small, our marketing efforts are better rewarded when we concentrate on attracting new visitors and drawing in people making their first visit to a planetarium.

The Russell C. Davis Planetarium is a major planetarium in a relatively minor urban center. Like most planetariums I know much about, it has a small number of die-hard fans. We see them at any special events we offer, and when we promote a season ticket (membership) option, we can expect them to buy in at well above the average value of the attendance benefits associated with the program. Even so, these folks don’t attend all the programs we offer - or even a majority of them. They come once or twice a year. Their decision to attend seems to be either as a response to a special offer, or because the show is getting a lot of publicity. Specific show content has little to do with it.

Interestingly enough, these die-hards are responding to exactly the same things we offer to try to attract the first time visitors - special events, limited opportunities, and special promotions.

I know the marketing dictum that one should build from one’s base, but that dictum assumes that a significant base exists. It is my belief (and my experience) that in a field where the number of die-hard fans is so small, our marketing efforts are better rewarded when we concentrate on attract-
nents on the mind. So where is the disconnect between the hunger and the satiating?

It's the planetarium, stupid: There is an irony in the Forum asking if we are unwitting architects of this conundrum. For indeed, part of the legacy of living in the Industrial Age is a conforming of expectations to a norm, and planetariums are unique. And this may factor into the public's failure to perceive us a dollar-sum worth of other leisure attractions. Neither movie theater nor theater stage, we have diverse dome sizes, tilts, horizon lines, seating arrangements, projection galleries, equipment, automation, lighting and sound. This results in greatly different presentations, even if two planetaria were to purchase the same program from a distributor. But then, there is no law stipulating all planetariums must present the same program. Our programming varies widely, with some having live narration, others pre-recorded, some having dissolve slides, others having video and movies, some with special effects, other with lighting effects, and so on.

We ought to foster a better understanding that the planetarium is a multi-media, audio-visual facility, and that many different programs are presented there. I have had many children approach me at the end of the hour and say, sadly, that I did a different show than last year. Although I'm pleased some programs have staying power (at least, anecdotally), I'm alarmed visitors come with the expectation that they would see the same show, regardless of the passage of time. For every child that wants to see the same show, how many other children and adults are dreading the thought of having to see the same show?

As illogical as it sounds, our shows are probably the biggest obstacles to our success. Even as our audience has evolved over 70 years, the nature of the planetarium program has adapted and adjusted. Find a presentation for the Viking landing on Mars in 1976, and ask Would it do for a Mars Polar Lander show today? Almost certainly not. Has this change been for the better? Read Dumb and Dumber in the fall, 1997 issue of Phenomena by Spitz, Inc, where George Reed says, "Since adults are reluctant to part with money to feel dumb, you must keep their minds off the most important part of the program and distract them with inappropriate visual effects." Read A Lesson From Hollywood in the October, 1997 issue of Astronomy magazine, where Bob Bernab discusses critical program guidelines that have little to do with science but everything to do with successful presentations. Read the Focal Point's Bring Back the Planetarium in the January, 1991 edition of Sky & Telescope magazine, in which M. Leon Knott decrues the funeral parlor ambiance of the huge automated planetarium. They and many other publications indicate the largest failing in the modern planetarium is the writing and presenting style.

The rule has always been: whatever pleases, teaches more effectively. It doesn't matter whether it is a storytelling night sky show, or a whiz-bang multi-media show. It must be done to fit the audience, and it must be done well!

The Forum question is posited to condemn yet another tour of the Universe, and to be sure the Seven Wonders of the Solar System/Galaxy/Universe is visually appealing, yet thematically disjointed. However, the focused approach... concentrating on fewer topics but in greater depth has its pitfalls as well. Too many times have I been confronted, accusingly, that my live star talk didn't mention the inquisitor's favorite topic, be it black holes, binary stars, the Big Bang or the Big Dipper. The key lies in the expression stand alone topics. Why must our presentations stand alone? Television depends on long-running series to fill their line-ups. The motion picture industry seeks to repeat success with sequels. Why should the planetarium field be any different?

It seems to have been a taboo to create multi-part spectacles that can be viewed independently or watched collectively. I have seen many excellent shows at other installations that should retain the format and presenters, but could change content to become outstanding vehicles for continued exploration, entertainment and education. As an example, Hansen Planetarium has never rescued Professor Photon from oblivion with continued Adventures Along the Spectrum, nor offered modular updates to the computer in Cosmic Catastrophes.

Fortunately, this reluctance is beginning to be overcome. Sudekum Planetarium has recurring roles of Sam Snork and Ursula Major in their Planet Patrol programs. Loch Ness Productions has promised another installment of Larry, Cat In Space. And to combat the stand-alone nature of programs, the staff of the Aldrin Planetarium is currently developing an on-going series titled, The Celestial Six. These comic-book champions clash each episode with different villains, such as light pollution zombies, The Cannibal Galaxy and his herald, the Golden Globular, Disasteroid, Chromatic aberration, and Entropy the III. The format of good against evil is familiar enough that little time needs to be spent introducing and re-introducing our heavenly heroes. But they serve as a continuing cast in the stellar serial, while the audience is presented with unfamiliar powerful forces that shape our universe, inasmuch as the characteristics of the subject matter are manifested as personality traits. The times challenge us to create shows that have life beyond the fire-and-forget mode.

My other suggestion is the International Planetarium Society exercise their prerogative to publish submitted copies of any and/or all entries to the Eugenides Foundation script contest in the Planetarian far more often. If our shows are so bad they are keeping people away for decades at a time, then more meritorious work appearing in more facilities ensures we will get better. Visitors may come more often when the caliber of presentations in planetariums is literally award-winning.

One final thought. There is a truism of commerce that 80% of the business is generated by 20% of the customers. Perhaps we should reconsider: what we perceive to be a problem with our repeat customers may in reality be a market-wide occurrence.

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The public's lowered attendance may be due, in part, because astronomy has suffered from a public relations struggle that is innocent, benign, and—for planetaria—may eventually be fatal financially. Astronomy is fun for kids; a source of entertainment; a distraction. That is one extreme of public perception. The other is that astronomy—the serious stuff—is intimidating. This combination of situations is growing more acute. The public either sees astronomy as child-like entertainment, or as inaccessible and irrelevant to daily life. As planetaria simplify programming—some may call it 'dumbing down'—the public expects less education, less substance and more entertainment. A vicious circle.

The result? Kids go with parents, then the kids grow up and, in turn, take their kids. Typically, there is a period of non-attendance in the lives of people in between these almost ceremonial visits. In desperation, planetaria respond by jamming quantities of astronomical information as a sort of smorgasbord, in the interest of wowing the public audiences by day, and injecting the younger—teenage through twenties audiences with loud music and laser eyewash by night. Well, that's what they want, right?. Hmmm...

So, how does one get beyond this state of affairs successfully? Why maintain planetaria at all?

Probably everyone on the staff and administrations of planetaria likes astronomy, they see the value to the public's appreciation of it and wish to partake in the act of transferring knowledge to others. These are noble motivations. Though, perhaps quixotically, we are propping up these early-twentieth century institutions which were a source of great public enlightenment from a time before television, before computers, before quality stereo systems, before fast cars, computers, discos, the Internet or the Web. The later two, after all, are able to provide most of what planetaria have always prided themselves on possessing: information, and the ability to illustrate the unimaginable.

We have before us two choices: go on, or not. If the answer is the latter, then let me know. As an architect, I have many a developer contact who would just love to turn these places into rock and roll discos, get liquor licenses and make a killing on the ageless adolescent mating ritual.

We'll use the stars on the dome as a backdrop. Before presuming I'm making fun, keep in mind that that's not too tough an outcome to imagine. After all, that is what most planetaria are heading towards already. While I haven't the statistics at my side, I would surely not be surprised if many planetaria derive most of their income from astronomy related activities. So, in the end, I give planetaria maybe 25 years. Some, far less - that is, unless something happens to them that secures their value in the eyes of the public once more. Perhaps something that resurrects their original purpose, but in a contemporary manner. That brings us to the other option: to go on. But planetaria that survive — even thrive — may need to rethink their methods in order to have a chance at staying in the game.

But planetaria that survive — even thrive — may need to rethink their methods in order to have a chance at staying in the game. There are three parts to a suggested remedy:

1. Clarity of purpose.
2. Internal functions: clear, inspiring, attractive, hierarchical educational structure.
3. External functions: Media relations, community involvement.

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3. External functions: Media relations, community involvement.

This is not a theme unique to planetaria. As an architect, I have worked on hotels, restaurants, and schools and they all have something in common with you: the more they work with their community, the better, in the long run, they do. They become an organ in the body of the surrounding community. They sponsor community activities, hold awards banquets, press conferences, youth programs, etc. The bottom line? The community of people, who in the end make anything function successfully, views these places as beneficial to their well being. In turn, the people support the institutions. If your planetarium's motive is to benefit the community, it will reciprocate.

Internal functions. One approach to the improvement of the internal structure of a planetarium may be to look at similar organizations that benefit public education, and have done so with success: colleges and universities. A passing glance at their most fundamental structure may enlighten us. They move their students from the simple to the complex; the reinforcing to the challenging; the familiar to the exploratory. Applying this approach, one can see that jamming most, or all, of astronomy into one dome session is a bit like making students take all their courses for their entire academic career in just one semester.

Solutions? For one, make it clear to the public that they can enter at any knowledge level. Like taking an elevator, they can push whatever entry button they wish. The planetarium should have, always, an entry level that is not child-like, but simple, that is not about entertainment and lasers and titillation, but about the value, poetic beauty and excitement of the subject itself. In fact, the argument could be made for entry-level programs being small. That is, where one, capable, individual works with a seminar of maybe five or ten people at most, and in an unintimidating setting.

The personal approach reinforces an intellectual intimacy enjoyed by university graduate students with their professors. Thus the planetarium can secure a public image less like that of a movie house and more of a community center, or neighborhood library, even a sort of club, minus the cigars, perhaps. But that's up to you. Whether this is done as a general public dome session, in the traditional sense, followed by a break up into smaller groups afterwards or if the groups start off small is up to the planetarium education directors.

By the way, that may be the key calling card of the future planetarium if it is to duck mortars of obsolescence lobbed by the Web. On the Web, anyone can secure information about astronomy in an intimidating manner alone, not from planetarium volunteers, but from writings and seminars from the likes of Stephen Hawking.

However, there are two things you can't do on the Web, yet. One, is to do. You can't yet do anything on the Net. You can manipulate a telescope on the other side of the globe, and secure lovely CCD images from it. But you can't stand there and look through the glass yourself - a very different experience.

The other thing yet to be transmittable by the Internet is the enjoyment, vigor and inspiration of a presentation by a master of oratory. Overly romantic, you say? Have
you ever seen a good storyteller magnetize the riveted attention of a crowd? It is a powerful sight to behold. I will put such rare and wonderful individuals up against any laser show any day. I know a couple. But you likely have them in your community, too. And it is far easier to educate a good orator in the ways of astronomy, than to teach good oration to an astronomer.

External functions. Another approach is a pre-emptive one. A planetarium will have considerable lead-time knowledge about most astronomical events, except supernovae, perhaps. That's one nice thing about astronomy: its predictive nature. Setting up seminars as a lander mission approaches, discussing anticipated landing sites and planned experiments, data gathering methods and possible results will amplify the appreciation and enjoyment of the mission in participant's eyes. Some such seminars should be offered free of charge as magnets to leverage media popularization, and get people to discover what your planetarium offers besides the seminar and dome thingy.

Star parties are becoming almost epidemic in their popularity. Planetaria should surely be able to attract some of this fever for mutual benefit. Add a structured twist. Whether it's a casual, *Who can find the most double stars in one hour*, or holding telescope resolution, light-gathering, or craftsmanship competitions. Or more structured: a Drawing In Astronomy seminar. Or how to time an occultation (there are quite a few of these visible per year). The results of all these can then be published in the local paper. Mix the star party with a preliminary lecture, or midnight coffee discussion.

The International Dark Sky Association (IDA) is gaining momentum and appreciation from architects such as myself, engineers and politicians. Be a conduit for them in helping reduce light pollution, decrease municipal taxes for energy consumption, and provide information for land- and homeowners in reducing their energy expenditures without compromising perceived security. Ask the IDA for more information. They are wonderful in helping you out with the necessary flyers and backup information. You want to be noticed by the local community? Believe me, that will do it. (Shortly before this article was written, an Arizona community, with the help of the IDA, defeated a huge land development proposal that threatened to obliterate the night skies near the Mount Hopkins observatories.)

Be available as the local authority for the papers, radio and television. Select a good spokesman and prepare standard one- and two-line descriptions (remember, we're dealing with the media) of typical stuff. But make yourself available when a star blows up or a comet is about to wipe out Manhattan, as has happened a few times already in the last year.

Perhaps due to politics or other salient reasons, I have discovered over the years that many planetaria make little or no use of local astronomy groups. The Hayden Planetarium here in New York did start doing that in earnest with the AAA just a couple of years ago. The relationship seems to be flourishing. Both groups can work together in countless ways by sharing the public communication effort, and by bringing in greater membership to both entities.

The other opportunity along these lines is in association with other educational institutions. Do students need help in the sciences, math? Can the planetarium help develop an astronomy course in local public schools? Find the science teachers and amateur astronomers who are able to speak well to the public, and invite them in for special presentations.

All these are opportunities to inspire far more than two visits per lifetime. They need not all be executed by one planetarium or at the same time, of course. Further, I describe the above more as casual examples to illustrate an attitude rather than a measured, strict policy. If your motive is to serve the public in every way you are capable of, and you work towards long relationships, the financial stability will be a casual concern, not the purpose of your institution's existence.

People are overjoyed when they perceive they have learned something that fundamentally improves the perspective of their lives. Astronomy has maintained a relatively untarnished reputation in that regard. Professional astronomers may be the foot soldiers and cavalry, but you -- the planetarians -- are the ones who bear the flag. Hold it high in the wind. 

Claudio Veliz
Architect, New York
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Here's the topic for the next column:

**Direct audience involvement in shows has grown markedly in the 1990s. Electronic interactive handsets are revolutionizing the way planetarians deliver astronomy information to audiences. Given its present limitations and drawbacks, but tremendous potential, how would you like to see this technology develop over the next five to ten years?**
Most Frequently Asked Questions:

**Question:** What is the most frequently asked question about 'Star Gazer'?

**Answer:** That's easy. Everybody asks about our theme song which is the classic 'Arabesque #1' by Claude Debussy performed by Tomita on the still available "Snowflakes Are Dancing" album (RCA).

**Question:** At what times and days of the week can I see 'Star Gazer'?  

**Answer:** Most TV stations air 'Star Gazer' just before nightly sign-off. However, due to 'Star Gazer's' enormous popularity a number of stations find the show's 5-minute format can fit anywhere during the broadcast day and air the show more frequently. Local TV listings seldom include 5-minute shows, so it's best to call the station for the broadcast schedule.

**Question:** If I can't find 'Star Gazer' on my hometown PBS station, how can I see it where I live?

**Answer:** 'Star Gazer' is provided free of charge by WPBT, Miami to all PBS stations. If you can't find it, write or call your local PBS station and ask if they will air it and remind them that it is available free of charge.

**Question:** Is it necessary to get special permission to use 'Star Gazer' for astronomy club meetings, teaching in the classroom, science museum or planetarium use?

**Answer:** No. In fact, many astronomy clubs, teachers, science museums and planetariums have been taping 'Star Gazer' off the air and using it regularly as a way to reach their public.

**Question:** Is there any way I can get 'Star Gazer' other than my local PBS station?

**Answer:** Yes. A month's worth of 'Star Gazer' episodes are fed monthly to a satellite from which all PBS stations take it for their local programming. Anyone with a satellite dish is welcome to the satellite feed. Again, no permission is required. For satellite feed dates and times call Monday through Friday (Eastern time) 305-854-4244. Ask for Ms. Harper or Mr. Dishong.

**Question:** I am a teacher planning my curriculum and would like several 'Star Gazer' episodes in advance, but I do not have access to a satellite dish. Is there any other way I can obtain 'Star Gazer'?

**Answer:** Any teacher anywhere around the world can obtain 'Star Gazer' episodes in advance through their NASA C.O.R.E. Teachers' Resource Center. For details write:NASA C.O.R.E., Lorain County Joint Vocational School; 13181 Route 58 South; Oberlin, OH. 44074. Or visit our website: www.jackstargazer.com

**Question:** Why does 'Star Gazer' always say "Keep Looking Up!" at the end of each show?

**Answer:** Have you ever tried star gazing looking down?
International News

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The column of the first 1999 Planetarian issue starts with a nice Fruit Cake Recipe, provided by Thomas Kraupe, who just has become IPS Past President:

You'll need the following: a cup of water, a cup of sugar, four large eggs, two cups of dried fruit, a teaspoon of baking soda, a teaspoon of salt, a cup of brown sugar, lemon juice, nuts, and a bottle of whisky. Sample the whisky to check for quality. Take a large bowl. Check the whisky again. To be sure it is the highest quality, pour one level cup and drink. Repeat. Turn on the electric mixer, beat one cup of butter in a large fluffy bowl. Add one teaspoon of sugar and beat again. Make sure the whisky is still okay. Cry another tup. Turn off the mixer. Break two legs and add to the bowl and chuck in the cup of dried fruit. Mix on the turner. If the fried druit gets stuck in the beaters pry it loose with a drawerwrench.

Sample the whisky to check for tonsisticaity. Next, sift two cups of salt. Or something. Who cares? Check the whisky. Now sift the lemon juice and strain your nuts. Add one table. Spoon. Of sugar or something. Whatever you can find. Grease the oven. Turn the cake tin to 350 degrees. Don’t forget to beat off the turner. Throw the bowl out of the window, check the whisky again and go to bed.

The International News column depends entirely on contributions that I receive from IPS Affiliate Associations all over the world. Please continue to contribute as you have done before. In order to be sure that your text will make it into the column, please send it to I have it at the first day of the Planetarian deadline month, preferably by e-mail — send only regular text, please! The deadlines for contributions to No. 2/99 is thus 1 April, and for No. 3/99 1 July.

Thanks to Bart Benjamin, Tom Clarke, Kevin Conod, Jon Elvert, Jean-Michel Faidit, John Hare, Donna Pierce, Loris Ramponi, and Christine Shupla, for your contributions to International News. You are welcome back with new reports, and I look forward to reports from other Associations as well. Please remember that a short note is also appreciated!

Association of French-Speaking Planetariums

Among the latest news from France, the Planetarium de Bretagne in Pleumeur-Bodou that opened in 1988 has completed its renovation and is now equipped with a Digistar II projector. Planetarium manager Claude Ganter has developed a special all sky projection system with 10 Barco 12095 video projectors covering the 21 meter dome. It is the first all sky video planetarium in France, producing its shows with soft ware developed by the staff. More information is available from saem0694@eurobretagne.fr.

A new French Planetarium will open in La Hague, near Cherbourg, with a 11 meter dome and a Zeiss ZKP III instrument in time for the total solar eclipse on 11 August. The project leader is D. Boust.

The annual meeting of APLF will be held during the spring in Strasbourg. This year, France welcomes the European meeting of small and portable planetariums. For registration contact Planetarium de Strasbourg at fax No. +33 388 212045. An APLF directory is now in preparation for being included in the 1999 edition of the French Planetariums magazine. Please contact Dr Jean-Michel Faidit before 31 March (Planetarium de Montpellier, BP 1088 34007 Montpellier Fax +33 467 611008, e-mail info@lepluggin.com.

Canadian Council of Science Centers

For some months now the Royal Ontario Museum has been referring to the McLaughlin Planetarium as the “McLaughlin Facility” and playing with “McLaughlin Centre”. On 2 December 1998, the large metal letters declaring the “McLaughlin Planetarium” were removed from the building to be replaced by a large banner designating the Children’s Own Museum COM. This comes neatly sandwiched between two 3 year anniversaries: the last public programs on 5 November and last school programs on 15 December 1995. COM has rented the first two levels for about three years and made considerable renovations to these floors. The star theatre remains the storage area of last resort for the museum and repository of all the planetarium gear which will go for disposal over the next few months.

Although the Museum has begun contemplating other uses for the third floor star the-
The Cernan Earth and Space Center at Triton College in River Grove and Wau-bonsee Valley High School Planetarium hosted the Near and Far Sciences teacher's workshop on 29-30 January. Dinosaur expert Dr. Paul Sereno will speak to Cernan Center members in March. The William M. Staerkel Planetarium at Parkland College in Champaign hosted same workshop on 26-27 February.

Lakeview Museum Planetarium has a new All-Sky system, courtesy of a grant from the Ruby Warner Charitable Trust. The Near and Far Sciences teacher's workshop was presented for the Illinois State Board of Education on 29-30 January. The staff of the ISU Planetarium in Normal has updated and improved their webpage. The result is seen at http://www.phy.ilstu.edu/planet.html. Many maintenance upgrade have occurred, including new smoke detectors and fire alarms.

Indiana news. Thanks to Dan Goins, director of the Martinsville Planetarium, for a great annual GLPA Conference last October in a beautiful location.

The Koch Planetarium in Evansville has a great new web page, which can be found at http://www.emuseum.org. It was designed and is maintained by the science and planetarium department. Ball State University Planetarium has added three more projection screens for a total of six screens. Once again, Ron Kaitchuck's summer planetarium workshop was a success with 28 people taking the course. Muncie Community Schools' Planetarium has added an Automated Rear Screen Projection.

The Merrillville Community Planetarium moved back into his renovated office area the last week of October. Work in the theater was completed at the end of November. The Spitz S12 projector is still at the factory being refurbished and repainted and is scheduled for installation in late-February or March. The Bedford's Lawrence North Planetarium gives teachers the choice of about four programs per class level. Lawrence North students in science, math, and social studies, art, and special education are the most faithful in using the planetarium. The planetarium is currently averaging 17,000 students per year.

The Wayne High School Planetarium in Fort Wayne recently welcomed astronaut Gary Gardner, who appeared with the National Theater Group in a motivational program for the Fort Wayne area schools at Wayne High School. Amera Platt and a group of planetarium students attended and had an opportunity to meet with Mr. Gardner.

Ohio news. The crisp skies of autumn inspired a variety of planetarium programs and activities around Ohio last fall. At Garfield Heights High School, Bob Sledz ran outdoor observing programs in late October using the Cleveland Mobile Observatory and featuring telescope views and slides of Jupiter and its satellites and other celestial sights. At the Westlake Schools Planetarium, Jeanne Bishop brought the celestial sights inside with a pair of October evening programs showing the constellations and sharing the stories behind them. Also in the Cleveland area, Dan Mott and Laurel Odeal at the Strongsville High School Planetarium ran a seasonal constellation series "Stars of the Night Sky" which coupled a presentation in the planetarium with outdoor sky-watching.

The Cleveland Museum of Natural History completed its annual astronomy lecture series. One of the fall's speakers was Dr. George Preston of the Carnegie Institute who spoke on What I Have Always Wanted to Know about the Universe and was Afraid to Ask. Across town, NASA's Lewis Research Center ran an open house on the second weekend in October. Bob Sledz hosted the October CRAP meeting at Garfield Heights and Rod Thompson hosted the November meeting at Mentor. Caryl D. Phillips Space Theater in Dayton has among other programs shown Stars of jade (from Sudekum) accompanying an exhibit of Chinese terra cotta soldiers elsewhere in the museum.

Wisconsin/Minnesota news. The Minneapolis Planetarium has produced two new original programs, Once in a Blue Moon and the renamed The Magical Millennium Tour. Minneapolis also staged its annual Solstice Celebration complete with fireworks and all sorts of family activities.

Italian Planetaria's Friends Association

The XIII Annual Conference of Italian Planetaria's Friends Association was held in Milan last October. Among the participants from the north to the south of Italy was Thomas Kraupe, the first I.P.S. president attending a National Meeting of Italian Planetaria. Next yearly Meeting will be in October 1999 in the small village of San Giovanni in Persiceto, near the city of Bologna, whose planetarium has a 9 meter diameter dome.

The programs of the 1999 Day of Planetaria, that will be held on 21 March, are available at the Internet address www.cityline.it on the pages about science. IPFA likes to each year to specially mention the first foreign planetarium that communicates its program. This year, it was Geospace Observatoire D'Aniane (Montpellier, France). Thank you Bernard Pellequer! Thanks also to the other colleagues that communicated their programs and in particular to Patricia Lipovska, Presov Planetarium, Slovakia www.ta3.sk /hvezdarne/general, the main reference point in the Eastern European countries for the Day.

Each year Serafino Zani Astronomical Observatory organizes A week in Italy for an American planetarian in collaboration with Learning Technology Inc. During the week, secondary students follow a lesson in English under a Starlab dome that is held by a U.S. teacher selected among several candidates. Last October, Dee Wanger from Discovery Center Science Museum of Fort Collins, Colorado came to Italy. Colleagues interested in participating in the 1999 Week can send their entries to Susan Reynolds sreyhold@ocmvm.cnycrit.org or to Serafino Zani Astronomical Observatory caelum @lumetel.lumetel.it.

Middle Atlantic Planetarium Society

The very first conference of the Middle Atlantic Planetarium Society was held at the North Museum Planetarium in Lancaster, Pennsylvania. The conference was only a single day, 4 December 1965, and registration was a mere $2 (including the luncheon). The master behind that original conference was John Gavaughn, whose memory is today honored by having his name affixed to Polaris, the North Star, on the planetarium constellation mural. The 1969 conference was also held in Lancaster, the year of the Apollo 11 adventure. So returning in 1999 to Lancaster represents the 30th anniversary of both the first lunar landing and the latest MAPS conference there.

Dr. Dana Bachman, on the team which discovered the dusty disk around star HR4796 last April using the Keck II telescope in Hawaii, will be a major speaker at the conference. The discovery was an important link in our understanding of the formation of planetary systems. Dr. Michael Seeds, the well-respected author of Horizons and other popular astronomy texts, will offer a workshop for hands-on activities and lead a tour of Franklin and Marshall College's rooftop CCD observatory. Dr. James Kaler, Professor of Astronomy at the University of Illinois, will be back by popular demand to speak to the conference about the developments of astronomy during the past year and Pete Connors will deliver the Margaret Noble Address following the MAPS banquet.

A variety of planetarium programs will be presented to delegates in the museum's 41 foot dome, including Sudekum's new program Lunar Odyssey and Adler's In Search of New Worlds. Beyond the variety of programs, papers, workshops, the exchange of inspira-
tion and ideas, and in the shadow of the fellowship and laughter, the 1999 MAPS conference will also attempt to stimulate its delegates with a variety of intellectual challenges. The conference is expected to include a constellation identification contest, a story-telling competition, and also the ultimate astronomy crossword puzzle. MAPS 99 Host is Skeeter Eliason, North Museum Planetarium, North Museum of Natural History & Science, 400 College Avenue, P.O. Box 3003, Lancaster, PA 17604, USA, phone +1 717 291 4315, e-mail nmastro@ptd.net and john_eliaso@mail.mtwp.k12.pa.us.

Nordic Planetarium Association

A number of NPA Members plan to join the solar eclipse expedition to Romania, which is arranged by Göteborg's Astronomic Club. The expedition starts from Göteborg and Copenhagen by air on 7 August to Bucharest where both the Geological Museum (with many meteorites) and the Astronomical Observatory will be visited. On 10 August, the trip continues to the observation site by the Black Sea. The eclipse will take place on 11 August at 11:12 UT and have a duration of 2m 22s. The probability of clear sky is 70%. The planetarium in Constanta will be visited 12 August, and the expedition will return to Scandinavia on 14 August. More information is available from expedition leader Erik Andersson erikaw@ebox.tinet.se.

Teknoteket Science Center in Oslo, Norway — home of St. Exupery Planetarium — hosts the Dalarna University course Science Center Education 6-7 March. Planetarians interested in joining this course 99-00 should contact course secretary Gunilla Andersson, gan@du.se, for a Program and Application form. This is a so-called distance course and students meet only 2-3 times per semester. Deadline for application is 15 April (but late registrants will usually be admitted as well) and tuition is free.

Falun Science Center, Sweden — home of Stella Nova Planetarium — has received a substantial grant from the Ljungberg Fund, which has permitted the Center to invite all school classes in Falun to a visit during 1999 free of charge. The staff has therefore been expanded with Göran Back, who will work full-time during 1999. Also Broman Planetarium in Göteborg, Sweden has expanded its staff, since Per Broman, who previously was part-time teacher at Rudehåks Junior College, has decided to work full-time with his company from January 1999. Good luck to both of you!

Back numbers of the NPA electronic newsletter NPEN are now available at www.dalnet.se/~stella/npen/. There you will find, among other material, several papers presented by Nordic planetarians at IPS'98.

Jessica Christensen joined the Stockholm Cosmonova staff in November. Besides assisting Tom Callen in the production of planetarium shows, she will also work with economy and administrative items, as well as oversee the translation of Omnimax films into Swedish. Marketing representative Maria Skoog has returned to work from maternity leave. Cosmonova recently had its lower projection gallery modified and made larger to accommodate a new type of reel unit for its Omnimax films. This will allow the projectionists to keep four films ready to project at any one time, which will save a lot of physical strain. Also in the works are changing over the original Digital Disk Player (or DDP) to the newer DDP II version. This unit plays four compact disks simultaneously, providing the sound for the Omnimax films and has also been used for the soundtrack in several recent planetarium shows.

Pacific Planetarium Association

Alan Gould, new Director of the Lawrence Hall of Science, is collaborating with NASA’s Sun-Earth Connection Education Forum to produce a new addition to their Planetarium Activities for Student Success (PASS) series of audience-participation planetarium shows. The new show, Northern Lights, is about seasons and light above the Arctic Circle and Aurora Borealis. More info on the Sun-Earth connection is at http://sunearth.ssl.berkeley.edu/. LHS is also putting together a hands-on universe, http://hou.lbl.gov/, curriculum for middle schools which, similar to its high school counterpart, puts telescope images and computer image processing tools in the hands of teachers and students to make learning astronomical concepts come alive.

The October '98 LA's Quadruple Conjunction in Van Nuys, California, was attended by 125 members of the PPA, GPPA, RMAP and SWAP associations. Over 30 papers were presented and 19 vendors exhibited. Tours included the JPL and the Mt. Wilson Observatory. Next year's Quadruple Conjunction will be held in Phoenix, Arizona.

The Planetarium at the Community College of Southern Nevada has undergone a major remodeling, replacing all their seating to increase capacity from 63 to 71. Plans are also for a new facility in 2000 to include a 60 foot dome with a Digistar projector.

The Lane ESD Planetarium produced "special event" demos for business/corporate and educators in order to demonstrate the planetarium's edutainment capabilities. These high energy, visually immersed presentations have had very positive results in attracting the support of the business community, which would otherwise not know the Planetarium exists.

Rocky Mountain Planetarium Association

The Rocky Mountain Planetarium Association's joint meeting last October with PPA, SWAP, and GPPA was very successful — many thanks to host David Falk! By the time you read this, the Proceedings from the conference should be published and distributed — our gratitude to Alan Gould and all of the others involved in this endeavor.

President Mike Murray has finished The Planetarium Primer. Members will have received it by now, along with the winter High Altitude Observer issue. In thanks for his hard work, Mike was presented with an award and our gratitude by RMPA members during the Los Angeles conference. New work will be done on the RMPA slide bank, which includes an archaeology slide set. The slides will be sent to Dorrance Planetarium, which will scan them in and have high-resolution versions available to members.

The Primer is available for free to all RMPA members but is also available for $25 to non-members. The slide bank service is for RMPA members only. Membership is only $15 a year, and RMPA is always happy to greet new members. Those interested in becoming RMPA members or in just purchasing a copy of the Primer should send their check (payable to RMPA) and name and address to Nello Williams, RMPA Secretary-Treasurer, Campbell Co. SD Planetarium, Sage Valley Jr. High School, 1000 Lakeway Dr., Gillette, Wyoming, 82716, USA, phone (307) 682-4307, e-mail nwilliams@ccsd.k12.wy.us.

In the January issue, the RMPA Newsletter High Altitude Observer will include a set of submission deadlines for every HAO. All members are encouraged to participate by sending articles to Editor Cory Stone, 76613.2301@compuserve.com.

According to Geoff Skelton, Programs Supervisor at the Fiske Planetarium in Boulder, Colorado, they have their hands full this year. They recently received approval for a NASA IDEA grant to develop a solar system tour for early elementary grades that is tailored to the National Science Content Standards. Fiske Planetarium also has a number of physical changes due to come about in 1999. The University is renovating the facade of their building. They plan to improve the seats this year as well. The leakiness of their geodesic roof should be improved this summer when all of the joints will be recaulked and sealed. Inside the dome, the insulation will be replaced by this summer.
Dorrance Planetarium in Phoenix has recently completed a new show, entitled *Light/Speed*. Narrated by Hugh Downs, it highlights the mystery and illusion of light to recreate a universe beyond our reach. Planetarium Manager Ryan Wyatt has created many Digistar sequences for the new show, and hopes to have some available for members of the Digistar Users Group. The show also includes many original animations created by staff member Mike George.

The Dorrance Planetarium staff is already busy with preparations for the conferences they will be hosting in October: the Digistar Users Group will be meeting at the Arizona Science Center 8-11 October, and the Desert Skies Conference (including RMPA, PPA, SWAP, and GPPA) will be 13-16 October. Additional trips will be available on 12-13 and 17 October.

**Southeastern Planetarium Association**

The new SEPA web site address is [http://www.sepadomes.org/](http://www.sepadomes.org/).

SEPA will hold its next annual conference 22-26 June 1999. The host facility is the Alexander Brest Planetarium at the Museum of Science and History (MOSH) in Jacksonville, Florida. The conference paper sessions and the vendor area will be based at the Omni Hotel on the Saint John's River in downtown Jacksonville. The Omni is just across the river from the planetarium and has a variety of amenities including great views.

Planetarium programs and workshops will be held at MOSH and the Brest Planetarium. Planetarium facilities include 210 unidirectional seats under an 18.3 meter dome, a wide array of special effects, and a video projection system. A conference trip is being planned to NASA's Kennedy Space Center. For more information and registration contact Patrick McQuillan, Museum of Science and History, 1025 Museum Circle, Jacksonville, Florida 32207, USA, voicemail (+1) 904 396 7062, e-mail patastro@aol.com.

**Southwestern Association of Planetariums**

LA's Quadruple Conjunction Conference

*Where the Stars Meet the Stars* was held last October. Jet Propulsion Laboratory tours and speakers on the themes of NASA and the upcoming robotic missions were enjoyed as were the visits to Griffith Observatory and Mount Wilson. At the regional meeting the following SWAP Officers elected: as President Barbara Baber, Abilene; as Vice-president Charles Hemann, Little Rock; as Secretary/Treasurer Jim Rusk, Mesquite; as Newsletter Editor Wilgus Burton, Garland; as Members of the Board Jan Wallace, Andrews and Ann Seely, Richardson; and as IPS Representative Mark Sonntag, San Angelo.

Life long SWAP member Jean Henry passed away last November in Odessa, Texas. Jean was planetarium director for Highland Park I.S.D. in Dallas, Odessa College and Shasta Community College in Redding. Jean also was a well known photographer exhibiting her works in Texas as well as a seasonal National Park Ranger for Carlsbad Caverns and Kings Canyon National Park. Survivors include daughter Elizabeth Henry of Austin and brother Dr. Richard Gilvert of Santa Rosa. Jean will be missed by all her many friends in the planetarium community.

The Local Group were joined by Barbara Baber from Abilene and Jane and Mark Wallace from Andrews for the SWAP 2000 Conference Planning Session for a week-end last November at Donna Pierce's home in Dallas. John French treated the group to the new facilities at Cook Science Center in Corsicana on Sunday. His behind-the-scenes tour and planetarium presentations were enjoyed by a dozen Texas planetarians. Hopefully all planetarians will look forward to "Texas 2000"!

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**Mount Wilson Summer Program for Undergraduates**

The Consortium for Undergraduate Research and Education in Astronomy (CUREA) will offer for the tenth time its summer program in astrophysics, June 16 through 29, 1999. Undergraduate physics and astronomy majors, with junior or senior standing, who are considering a career in science or science teaching are encouraged to apply.

Staff members and students will live and work on Mount Wilson, in the San Gabriel Mountains above Los Angeles. This site, renowned for its superb atmospheric conditions, is home to the historic 100-inch Hooker Telescope, still being used in frontier astronomical research, as well as several smaller instruments. In addition, a state-of-the-art multiple-telescope interferometer is being built there.

The program will center around a short course in astronomy and astrophysics with a major hands-on component. The course will emphasize how our present understanding of the Sun has been achieved and how it relates to the astrophysics of all stars. Students will make intensive daytime use of the Snow Horizontal Solar Telescope (24-inch aperture and 60-foot focal length), with its associated powerful grating spectrograph and unique atomic-beam solar-oscillation spectrometer; make both daytime and nighttime observations of a wide variety of celestial objects using a 7-inch diffraction-limited refractor and a 24-inch reflector equipped with a CCD detector; and also observe with the historic 60-inch telescope! Introductions to celestial photography and darkroom work will be included.

Additional activities will include: short presentations on important contemporary and historical astronomical topics; special lectures by distinguished astronomers; tours of research facilities on the mountain; field trips to JPL, Cal Tech and Palomar.

The application deadline is April 15, 1999. The tuition fee is $1550. This covers all expenses during the two-week program. Students are responsible for the cost of their transportation to Burbank, California. See the CUREA website at: [http://www.astro.wisc.edu/~faison/curea/curea.html](http://www.astro.wisc.edu/~faison/curea/curea.html)

and also *Sky & Telescope* magazine, April 1990, page 360, and February 1991, page 206. For further information and application materials, contact:

Prof. Joseph L. Snider, CUREA Director  
Dept. of Physics  
Oberlin College  
110 North Professor St.  
Oberlin OH 44074 USA  
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Email: info@goto.co.jp
Full-Dome Video Systems

Kevin Scott
IPS Technical Committee Chair
The Renaissance Center
Dickson, Tennessee, USA

Richard McColman
Morehead Planetarium
Chapel Hill, North Carolina, USA

There are several companies that provide full-dome video systems in a variety of formats. Some of the major vendors include:
- ElectricSky™ – Spitz, Inc.
- Virtuarium – GOTO Optical Mfg., Co.
- V-Dome - Trimension, Inc.
- VisionDome™ - Alternate Realities Co.
- StarRider™ - Evans & Sutherland
- SkyVision – Sky-Skan, Inc.

The actual physical system varies from system to system, although there are some similarities. Most of the options use multiple video projectors and some form of edge-blending technology to create a seamless video image over the entire surface of a planetarium dome. Only Alternate Realities offers a single-lens system for smaller theaters. To generate images, some systems use a graphics super computer and others use off-theshelf hardware and software solutions. Finally, there is a wide range of control and automation mechanisms, audience response sub-systems, and production philosophies.

There are two primary architectures in all-dome video systems: real-time and offline (also known as "pre-rendered"). Real-time systems use massive amounts of processing power to generate every image "on-the-fly." Offline systems render video out to a storage medium (hard disk, tape, laserdisc) and then play back as needed. Each architecture has its own merits, but the larger question of which type of system a theater might choose is probably more philosophical or financial in nature, rather than technical.

Real-time architectures have their roots in high-end flight simulator displays. Historically, these Image Generators (IGs) were specifically designed to recreate out-of-cockpit views for pilots, ground warfare, and other military training scenarios. Modern IGs provide a more general-purpose approach to graphics and can now reproduce wider range of content.

Production with real-time systems involves creating 3D graphics models for every object in your "show." These models are then given texture and color, and are placed in a three-dimensional space – the "world." Over time, objects can move from one place to another, change in size and shape, and fly in and out of the audience's view. In the spirit of flight simulators, the audience's viewpoint can also change over time, allowing for tremendous production freedom and graphic realism.

Real-time systems can produce images as fast as they can – hopefully producing images at more than 30 frames-per-second (fps). Depending on the complexity of the show sequence, real-time frame rates may vary, resulting in motion that can be very smooth in some places and jerky in others. With careful production, though, these systems can produce consistent, smooth motion.

Since real-time architectures generate images on-the-fly, they work very well in interactive environments. For example, with StarRider™ from Evans & Sutherland, it is possible to "fly" the theater with a single joystick, much like one would fly a flight-simulator. Another important feature of real-time image generation is the ability to manipulate program content on the dome without having to refer to some sort of "preview" or having to wait for animation sequences to render on a separate computer. On the other hand, real-time systems are somewhat limited in the complexity of the scenes that they can produce, and they require very technically skilled modelers to create objects that will be shown in a program. Further discussion of the merits and challenges of various systems will be addressed within individual product evaluations.

Offline (pre-rendered) architectures stem from recent advancements in digital video production and non-linear editing systems. Desktop video production and animation has become very popular in the last several years. Today's systems can provide full professional level capability at a fraction of the cost of yesterday's studio gear. Witness television programs like Star Trek and Babylon 5, along with blockbuster movies like Armageddon and Independence Day; each of these productions used PC-based animation and video editing systems to create visual effects.

Production with offline systems is similar to real-time. Objects are modeled and textures are applied. One tremendous difference, however, is the complexity of the models that can be used, at the expense of time. An offline model can be as detailed as you like, but you have to wait for the computer to render each image. One advantage is that slow-time animation systems tend to be more advanced (both in terms of interface and features) than the current crop of real-time production software.

After selecting models and designing the animated sequences that will make up your program, an additional step must be employed to generate images for the dome. In a multi-projector situation, frames of animation must be divided up, directed to the appropriate projector, and synchronized with all of the other content. This process is handled differently in each of the primarily offline solutions evaluated here.

Near-real-time is another term that may be applied to some pre-rendered systems. Given that all of your show content is prepared and placed in random access storage (e.g. hard disk or laserdisc), it is then considered to be online content. From there, indi-
vidual frames can be displayed at will, or in sequence, at almost any frame rate. In this sense, pre-rendered content can mimic some of the functionality of a real-time system.

Finally, there is a need to address standards between systems. Currently, each vendor has a unique projector configuration, development platform and imaging hardware. Some vendors support industry standard tools like 3D Studio Max for modeling and animation, and After Effects for compositing, although the final media format is different for each system. That is, content created for one system can’t easily be used by another. This is especially true when moving from real-time to offline or vice versa.

Perhaps a first step is to encourage vendors to agree on a common projector configuration. Then we can concentrate on common media formats and production standards. One example of vendors working together was demonstrated at the most recent IPS conference in London where Sky-Skan and Evans & Sutherland used the same projectors to showcase SkyVision and StarRider. While each vendor’s content was very different, at least they were somewhat compatible at the projector level. This kind of cooperation is beneficial to both vendors and planetariums by expanding the library of available content that can be presented in a theater.

Once there is a potential for projection compatibility it is necessary to address the source material and production differences between real-time and pre-rendered systems. As an example, we’ll work through a prototypical visual sequence and highlight a few of the production considerations for both architectures. Our storyboard snippet begins with the planet Saturn appearing on the limb of our dome and zooming up to rest at front and center. After pausing for a moment, we move towards the planet, dip through its rings and fly on to Titan.

In a real-time environment, one would start by creating a sphere to represent the planet Saturn and a disk for its rings. This combination would probably be modeled several times, each with a different level of detail (LOD). Because real-time systems are limited in the amount of detail that can be displayed in any one channel, (one channel = one projector) it is often necessary to create simplified models to represent the object when viewed from a distance. While zooming in towards the planet, we’d start with the simplest model and transition between the others as it got closer. The key is to develop models with the minimum number of polygons necessary to achieve the desired effect.

Texturing the planet’s surface isn’t much of a challenge - one can find very accurate texture maps that will work nicely. The rings are a bit more difficult. Designing a 2D texture for the rings as viewed at a distance is not trivial, but designing a series of textures to make the rings three-dimensional when we move through them is downright hard. Unfortunately, a real-time system could not possibly handle a model of every individual clump of material in the rings - and most real-time systems don’t support particle animation (an algorithmic method for generating lots of tiny objects without having to explicitly model every single one). In this case you’ll most likely use a collection of flat polygons with custom texture and transparency maps.

Once all the models are complete and textured, they must be translated into the desired image generator format and downloaded to the IG and a show-control workstation. Once everything is “installed”, then comes the task of positioning models and preparing flight paths for both the objects and/or the view camera. Those details are very system-specific and are beyond the scope of this article. In any case, once everything is roughly positioned and timed, you’re ready to finalize the sequence and move on.

To replicate this same scene in an offline environment, you again start with basic models and textures. This time you don’t have to worry about level-of-detail models and polygon counts (though these techniques can save you some rendering time). There are also a number of “special effects” that you can add in the offline system not currently available with real-time. For example, you might develop a complex particle system to represent the rings where all of the individual particles are moving independently and realistically with the proper gravitational effects. You might also add layering effects to the planetary surface to simulate cloud layers. All these effects add rendering time, but they also add a stunning amount of realism to the finished sequence. Finally, the tools for creating object paths and camera paths are far superior to most real-time show production software. Furthermore, in most cases you can do all of your modeling, animation, and rendering in one software package, on one computer. Real-time often requires you to work with separate modeling, animation, and control packages, and several different computer systems.

As you read through the following product reviews, keep in mind that the technological issues of all-dome video are just one small part of the equation.

Regardless of which system you may prefer from a technical standpoint, there may be larger, more difficult questions to pose:

- Can I afford it?
- Will it help further the goals of my planetarium?
- Will it help me reach my audience more effectively?

You should also consider the time and money you’ll spend on maintenance and production. Another important consideration is whether you have the creative and technical talent on your staff to effectively use the system, or if you prefer to use external production houses and private consultants. Any full-dome video system will more than likely require at least two, perhaps three full-time employees with very specific skill sets. The potential for these systems is great, but they require a significant resource commitment.

**SkyVision Product Review**

This review does not constitute a recommendation nor endorsement for any product or company.

**SkyVision**

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Evaluation Setup:
Cabletron, a large hardware vendor in the networking business, hired Sky-Skan, through a series of subcontractors, to produce and operate a demonstration program for Cabletron at the recent Networld & Interop show in Atlanta, Georgia USA. The program was given in a small 27-ft (8.2m) vacuum dome produced by ProDome (Antti Jannes & Co. in Finland). In addition, there was a Digistar II instrument, several moving-mirror incandescent fixtures, and an infrared sound system. As an aside, the seats were from an automobile manufacturer and were very comfortable! Sky-Skan also demonstrates SkyVision in their 30-ft (9.1m) dome in Nashua.

SkyVision currently consists of six Barco video projectors (with outboard line quadraplers) for imaging on the dome. Five projectors form a continuous horizon image, and the sixth projector forms a “cap” that fills in the zenith. Each projector was mounted underneath the springline of the dome. SkyVision, as assembled in Atlanta, used Barco 801s projectors running at approximately 80% brightness. Sky-Skan also offers a high definition system called SkyVision HR. Using the same configuration, this system makes use of six Barco 1209s projectors. The digital video workstations that feed the projectors have an initial on-line video playback capacity of approximately 25 minutes and the native resolution for each frame of video is 1726 x 1296 pixels. This yields an image resolution approaching that of an IMAX frame across the dome.

All of the projectors are accessed through the SPICE automation system and each can function as a stand-alone unit along with providing SkyVision output. This makes the system extremely flexible when it comes time to incorporate more traditional video sources (e.g. laserdisc, DVD, and tape formats) into a program.

Producing the images were six PC compatible computers, each with a compressed
video output card. In addition, the "zenith" computer also had a SMPTE timecode generator, and an additional card that delivered eight channels of digital audio for the show's soundtrack. Each machine also had a removable storage unit with a 9GB hard disk.

SPICE automation controls the SkyVision system, allowing programmers to search for and play from individual frames of video, and to play segments by name. The six-computer configuration is fairly flexible, and may change in subsequent revisions of the system. One advantage of keeping all six computers is that when it comes time to render new footage, you can have six processors working on the job.

In its current configuration, SkyVision supports two hours of online storage. That's two hours of full-dome imagery without changing disk drives. There are other storage options that can provide up to eight hours of online video if needed. Since the system uses removable technology, it is just as easy to swap in a new set of drives for additional content. In any case, SkyVision content storage is very flexible.

SkyVision supports interactivity through Sky-Skan's proprietary hardware/software combination, along with some creative pre-production. Since all of the content is pre-rendered and stored to hard disk, multi-path programs (where the audience chooses various topical segments during the course of the show) are quite simple to execute. In fact, when compared to laserdisc, hard disk based video can offer faster search times and more flexible control over playback. More advanced forms of interactivity are also possible, though it may require some extra effort during pre-production to assemble all the content in a meaningful way.

The production process for SkyVision is relatively straightforward: the magic is in the software. Sky-Skan has produced a clever production tool that can take a computer image file and dice it up such that it can be displayed as a whole by the SkyVision projectors. You can use almost any image, though to achieve full-dome video you will probably use a fish-eye lens (either real or virtual) to generate an appropriate hemispherical representation of the subject.

Perhaps the two most common ways of producing SkyVision images are via animation and compositing. When creating animated sequences, the renderer is set up with a virtual camera that mimics a fish-eye lens. This compensates for the distortion that occurs when projecting onto a hemispherical screen. The detail of an animated sequence is limited only by time and the sophistication of your rendering software. It is also possible to use video and film footage shot in more familiar rectangular formats.

Using a compositing tool (e.g. Adobe After Effects) one can stretch and position footage for use with SkyVision. Note that since the date of this review, Sky-Skan has made progress on streamlining the SkyVision production process and has integrated additional content development tools.

**SkyVision Strengths & Criticisms**

Probably the most important technical considerations to address are image quality, content production, and maintenance. The full-dome image generated by SkyVision is surprisingly good, but varies with content. With proper alignment, the seams between projectors are nearly invisible. Depending on the image being projected, sometimes the seams are not detectable at all. Projector alignment will drift with time, though, and will likely require regular adjustments to maintain the best image. High-detail, natural footage such as Earth-bound panoramas seem to be more forgiving than some animated sequences when it comes to detecting misalignments. Edge blending between the five horizon projectors is excellent. Edge blending inconsistencies between the zenith projector and the others is much more noticeable. As with any multi-projector system, the "soccer ball" effect is unavoidable when viewing large, bright, low-detail areas such as a daytime summer sky. (Keep in mind that this review was conducted in an inflatable dome, and it is nearly impossible to accurately align multiple projectors in such an environment — actual installations provide much better results.) Given a bit more time, the engineers at Sky-Skan say they can tune the image blending algorithms to minimize the visual impact. Content is perhaps the largest factor in evaluating image quality. Some material looks absolutely wonderful on SkyVision, while other sources highlight its weaknesses. Our guess is that this effect has as much to do with psychology and the human visual system as it does with the technical aspects of multi-image projection.

Some planetarians who have used large format video projectors may feel a bit underwhelmed by the brightness offered by CRT based systems, especially in larger domes. Thankfully, this isn't so much of a problem when using an all-dome video system by itself. That is, when the eye can't compare between a smaller, brighter projector and a larger, more dim image, the perceived contrast ratio is very high and the image appears to be quite acceptable. For mission critical applications, the image brightness issue can be overcome by doubling the number of projectors, effectively having two projectors per frame and having an instant backup for the theater.

It may occur that while producing an animated sequence for SkyVision, you spend all night rendering only to put the result up on the dome and find that it's not acceptable, for whatever reason. Careful planning and pre-production can minimize these troubles, but it's still a fact of life. To help alleviate this problem, one might do some production work in the dome itself, using one of the SkyVision projectors as a preview monitor. Then it is possible to adjust colors, intensity, detail, alignment, etc. such that it looks best when viewed on the dome, rather than on a computer screen.

Perhaps the greatest strength of SkyVision is the ability to produce detailed, Hollywood-style imagery with well known tools. Granted, the time required to render complex scenes is substantial, but it's the realism that modern audiences demand. Another strength of SkyVision is that it takes a software approach to solving projection geometry and overlap issues. This lowers the cost to the end user because software is easy to reproduce and upgrade and does not rely on more expensive proprietary "black box" hardware.

SkyVision is offered in full and partial dome configurations.

The first SkyVision installation was unveiled at the Houston Museum of Natural History's Burke Baker Planetarium on December 11, 1998.

**StarRider Product Review**

This review does not constitute a recommendation nor endorsement for any product or company.

**StarRider**

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**Evaluation setup**

The Evans & Sutherland Digital Theater division has constructed a demonstration and development theater at their headquarters in Salt Lake City, Utah. This theater features a 36-ft (11m) variable tilt Astro-Tech dome, Sky-Skan automation and sound reinforcement, a Digistar II digital planetarium, and a full dome StarRider projection system.

StarRider is currently based on the ESIG (Evans & Sutherland Image Generator) and the PRODAS display system from SEOS. PRODAS consists of six specially modified Barco CRT video projectors and a proprietary edge blending system to create a seamless dome
The projectors are arrayed in a five-segment panorama with a sixth projector filling in at the zenith. (This configuration is very similar to SkyVision, with some differences in projector placement.) StarRider projectors normally reside in a cove space or projection gallery such that the front lenses sit just beneath the dome springline. PRO-DAS comes with a rather elaborate remote control panel that is used to administer all aspects of projector setup and operation. Unfortunately, the unit is not immediately compatible with any automation system; that functionality may arrive shortly.

With the addition of a video source switcher, StarRider can accommodate other input sources (e.g., laserdisc, DVD, SkyVision, and tape formats). Using these alternate sources and some creative animation techniques, it is theoretically possible to create non-real-time content for playback on StarRider. It is also possible to turn off the edge-blending hardware. In effect, this makes each projector behave as a "normal" Barco and provides six discreet channels of video.

The graphics muscle behind StarRider is the Evans & Sutherland line of image generators. As previously mentioned, the current version of StarRider ships with the ESIG — a proven technology that is used extensively in other E&S simulator product lines. StarRider is also available with the new Harmony and Ensemble image generators, both from E&S. Ensemble will come in at the lowest price point, using custom PC-based graphics technology. Harmony will offer the highest performance and image quality. Harmony uses several proprietary graphics engines to generate the six simultaneous video streams that drive StarRider. The IG is based on a number of custom chip designs and runs under a specially designed real-time operating system which results in unmatched performance. Harmony supports a number of breakthrough graphics technologies such as texture sharpening, real-time Phong shading, and a multisample depth buffer. Suffice it to say that Harmony is a very complex piece of engineering that is still in its infancy. I strongly recommend that you explore the E&S website if you're interested in these and other technical details of Harmony.

FuseBox is the software product that controls the Harmony IG and integrates the entire StarRider system. FuseBox is a show production and show control tool that brings together models, textures, and other assets, into a visual scripting environment. Show elements respond to system and user definable events (e.g., time cues), and "paths" help define object motion. In addition, FuseBox is the hub of StarRider's interactive capabilities. StarRider uses flight sticks and an armrest keypad for audience participation. FuseBox is a rapidly evolving tool that is being tuned to the program development needs of StarRider. Its learning curve is steep, but therein lies its power.

StarRider audio is handled by SawPro which is a commercial multitrack audio editor and playback system. SawPro can support up to 32 tracks of simultaneous audio playback provided that you have enough sound cards in your host computer (a Pentium class system with at least 128Mb RAM). SawPro is the SMPTE show source for StarRider and is triggered by FuseBox via MIDI. In case you're wondering, a 20 minute show with six audio channels requires about 650Mb of disk space if the material is stored at CD quality (44.1KHz sample rate, 16 bit resolution). As with most hard disk based audio systems, there is no wait for tape rewinding and the system can instantaneously jump to any place in the soundtrack — quite a boon during production.
The production process for StarRider is somewhat complex. Each task, in and of itself, is not overly difficult, but each has its own separate challenges. To begin, all of the visuals in a show must be modeled and textured. The modeling process can be done with tools like 3dStudio Max and MultiGen. The challenge is to create models that will work well in a real-time architecture. Perhaps the most important point is that models should have low polygon counts. In the process of creating textures, one must consider how colors will change when viewed on a large screen display, the effects of transparency, along with the physical size and image complexity of the texture. There are substantial differences when modeling for offline or real-time systems.

Once all the assets are generated, the next step is to begin organizing and developing the show in FuseBox. Models are positioned and oriented in the virtual world, given flight paths and other attributes, and events are timed to match appropriate script and score cues. During the course of production, one must keep in mind the capabilities of the real-time IG. In order to maintain image frame rates, a limited amount of detail may be present in each of StarRider’s six video channels.

**StarRider Strengths & Criticisms**

StarRider shares most of the basic technical challenges found in multi-projector all-dome video systems; image quality, content production, and maintenance. StarRider’s image quality is a function of content, production technique, and projector tuning. Visuals must be well modeled, strategically placed, and motion must be scripted with care. Harmony and the other E&S IGs are relatively forgiving technologies, but they do have limits when it comes to the complexity and placement of StarRider visuals. Specifically, there is a limit on the amount of detail that can be displayed in any one channel of the IG (recall that StarRider is a six-channel system—one channel per projector). Furthermore, aligning and color matching the StarRider projectors is a challenging process. In order to maintain the best image, the projectors will most likely require bi-weekly adjustments. It is important to note that when the system is properly tuned, the resulting image is seamless and very pleasing to the eye.

Developing StarRider content requires a staff of creative and skilled professionals. The terminology and technical challenges of real-time are daunting. There’s also a steep learning curve when it comes to the highly specialized software used to create and control models. Thankfully, one can use popular software like 3D Studio Max to create models, but one must use FuseBox to manipulate them within the context of a show. Still, the very best StarRider shows will be produced by those who have a firm grasp of real-time modeling concepts.

Perhaps StarRider’s greatest technical achievement is truly interactive production and presentation. Interactively placing and moving visual elements on the dome is a relatively new production model and one that offers a tremendous amount of creative freedom. Furthermore, the real-time processing of StarRider allows one to develop audience interfaces that are unique and robust.

StarRider is normally sold as a complete package with dome, projectors, Digistar II digital planetarium, sound system, interactive hardware, effects, automation, and software. StarRider and Digistar II work well together on the dome, but they are wholly separate development environments. E&S currently offers full and partial dome StarRider systems.

The first StarRider installation was unveiled at Chicago’s Adler Planetarium on December 4, 1998.

**ElectricSky Product Review**

This review does not constitute a recommendation nor endorsement for any product or company.

**ElectricSky™**

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**Evaluation Setup**

Spitz has several demonstration domes at its headquarters in Chadds Ford, Pennsylvania. ElectricSky™ is currently housed in their 40-ft (12.2m) dome (10 degree tilt). The theater also showcases a Spitz planetarium instrument, Spitz’s new ATM-4 automation system, and a full complement of all-sky and special effects projectors. ElectricSky is offered in several configurations. To be more correct, ElectricSky is a member of a family of products called ImmersaVision™, an immersive multimedia theater system developed by Spitz. All-dome (immersive) video is just one aspect of ImmersaVision. Currently, the most extensively supported suite of products include ElectricHorizon and ElectricSky. For this review, we are taking a look at ElectricSky as configured with three projectors providing a 200 x 60 degree field-of-view. Spitz also offers a four-projector system (panorama with top-cap) and a seven projector full-dome array. ElectricSky uses newly-developed Electrohome dome projectors with advanced geometry correction and edge blending technologies from Panoram.

The entire system is integrated within the ATM-4 automation software, allowing random video source selection, routing, and output format. ElectricSky provides support for CRV, laserdisc, DVD, tape, digital disk recorders, and workstation source material. ATM-4 also automates the edge blending hardware such that blended and non-blended source can be displayed within the same program.

Spitz developed a 10 minute demonstration program to showcase the ImmersaVision format. The first performance was delivered from a trio of CRV discs, and the second from DVDs. Without a side-by-side comparison, it’s difficult to see any differences between the two source formats; both were of excellent quality. Spitz is also exploring hard disk based storage options with an eye toward an integrated media server. Recording source material to a CRV disk is relatively simple, but the disks hold less than a half hour of video per side. On the other hand, DVDs hold much more content but are currently somewhat expensive to create. Keep in mind that almost any video playback format can be used and the folks at Spitz seem to be generally flexible in supporting customer-preferred equipment.

Audio can originate directly from the playback devices or from a separate digital tape or disk recorder. ElectricSky uses the S.1 surround sound standard from either encoded source or discreet channels. The ElectricSky specification outlines a complete theater treatment for sound reproduction, including speaker types, placement, and reinforcement hardware.

ATM-4 automation controls all aspects of ElectricSky through a new Windows interface. ImmersaVision content is treated as a single playback system with a standard set of control options. In addition, ATM-4 supports interactivity via proprietary hardware (audience responders) and integrated software control. Like any other pre-rendered architecture, interactive and multi-path programs require a bit of pre-production effort. Any time the audience is given a choice, two or more separate bits of content must be generated and stored for real-time retrieval during the program.

The production process for the ImmersaVision format is greatly simplified through the use of a number of custom utilities and plug-ins that work with off-the-shelf production tools like AfterEffects, and Photoshop. In addition, Spitz has developed a special plug-in for the popular program 3D Studio
Max, called ImmersaMax, used to generate CG content for ImmersaVision. ImmersaVision content can originate from a number of different source material formats including film, video (HD and NTSC), panoramic and hemispherical video and film, computer graphics, and still images. In each case, a producer can choose the form of spherical correction, if any, that needs to be applied to the source material to ensure that it is displayed correctly on the dome. Spitz is the only manufacturer that offers the ability to set an eyepoint when correcting materials for display on a dome. That is, every other system assumes that the viewer is seated in the very center of the theater, which is usually the location of the planetarium instrument. With Spitz's utilities, you can create a view that is better suited to your particular theater layout.

Because ElectricSky uses hardware edge blending there are a number of other image sources that can be considered. For example, you can connect a desktop PC/Macintosh to the system, displaying the computer desktop across three full projectors. ElectricSky can also be driven by multi-channel visualization systems (from Silicon Graphics, Intergraph, HP, etc.), and other real-time image sources. This is a tremendous advantage during production because you can test source material without having to split it up into three separate frames and then apply soft edges for display. In the case of ElectricSky, just open a window containing an image with the correct aspect ratio and you're done! One might also imagine playing video games on this enormous display, or perhaps seeing every cell in a large spreadsheet. The possibilities are quite exciting.

ElectricSky Strengths & Criticisms

Spitz's video panorama and ImmersaVision projection format are more than a collection of software and hardware. In developing these technologies, Spitz spent a great deal of time researching large-format immersive displays. What they've come up with is an extremely flexible system that can accommodate a diverse range of source material and a production and presentation philosophy that is based on the science of visualization. Of all the systems reviewed thus far, Spitz has demonstrated the greatest amount of technical flexibility and product forethought.

Spitz blends their video projectors with a 25% overlap, which is a bit more than the other manufacturers use. This larger overlap seems to have a positive effect on the resulting image, giving the very best color blending, and absolutely seamless geometry blending. Spitz also uses a circular top-cap, reducing the edge-blend artifacts that can be quite harsh in a pentagonal cap (a la SkyVision and StarRider).

Like SkyVision, ElectricSky production uses mostly off-the-shelf tools and popular software packages for the manipulation and generation of content. Spitz, however, has developed additional custom utilities that allow an illustrator or animator to use virtually any software package for content creation, even if that software doesn't support spherical rendering or custom image warping! The other tremendous advantage to ElectricSky is the ability to preview content on the dome without having to split images...
and pre-blend. In fact, you can use Electric-Sky as a working desktop and produce images right on the dome.

Spitz is currently focused on the three-projector ImmersaVision format, with a sound philosophy and research to back up their development efforts. They are working to build more support for their full-dome video product, though Spitz did not demonstrate full-dome capability during the review. There's no doubt that a tremendous amount of content can be effectively displayed within the ImmersaVision format. A planetarium, though, implies a complete hemisphere and sometimes it's necessary to exploit the full dome for maximum effect. Bear in mind that full-dome configurations can be much more expensive, and they require more complex production techniques. There is a clear trade-off and a planetarium's choice may depend on cost, support, production and maintenance issues. Formats like ImmersaVision provide a cleaner, more uniform image than full-dome, are easier to maintain and operate, and provide a very dramatic effect when used well. It's not an easy decision.

The first ElectricSky theater was unveiled at the Northern Lights Centre in April of 1997. The Northern Lights Centre is located in Watson Lake, Yukon Territory, Canada.

VisionDome Product Overview

This overview does not constitute a recommendation nor endorsement for any product or company.

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VisionDome is a system for projecting full-color, full-motion graphics, created and manipulated in a 3-D computer environment. The technology is most similar to that of StarRider, but instead of using several video projectors to cover the dome, VisionDome uses a single projector and fish-eye lens to achieve a full-dome image. VisionDome is a real-time architecture that shares many of StarRider's strengths and content development challenges.

Alternate Realities Corporation is located in North Carolina's Research Triangle Park, nestled between the cities of Raleigh, Durham, and Chapel Hill. Morehead Planetarium proved to be a convenient, yet challenging test for their system in an actual, working planetarium theater. (Until that time they had limited their activities to using the technology in a small, demonstration dome as a stand-alone system.) Besides the challenges of positioning the projector off-center, such a demonstration would test the ability of the system to project images over a much greater distance. Both the VisionDome and Morehead staffs were initially skeptical about how well the system's images would hold up projecting onto a 20.7-meter (68-foot) dome, but felt, nonetheless, that the challenge would be informative in evaluating VisionDome's capabilities and limitations.

After a couple of preliminary visits to evaluate the Morehead theater environment, and to arrange for an adequate electrical power feed, the VisionDome team arrived to conduct their test. Their equipment included a 3-D graphics workstation and image processor; a high-intensity, high-resolution video graphics projector; a specially-designed optical assembly for the 180-degree projection; and a large, makeshift wooden stand for the projector.

On "test day", equipment setup was completed within only a couple of hours of arrival. The large projector had been placed on its stand, the long optical pipe — complete with integral fisheye lens — was mated and aligned to the projector, and the graphics workstation and processor was up and running. A few moments later, the first
VisionDome images were being drawn. A variety of different images were displayed during the test, including fractal-style images, a graphical Space Shuttle launch, and a DNA double helix, among others.

The initial results were encouraging with a number of images that showed a surprising degree of sharpness and clarity. Motion of the manipulated “objects” was relatively smooth, with very little jerkiness evident. Objects were projected with a variety of background colors, but the best results were obtained when objects were placed against a black background.

Of course, it was assumed that there would be difficulties associated with the Morehead test. Some of the images displayed during the test were quite “soft” in appearance. The VisionDome people said this was because they were testing image-sequences of a variety of resolutions. It was obvious that only the higher-resolution images would be applicable for all-dome use. There was some distortion visible in the images, taking the form of the image appearing to rest atop a curved void of black extending about 75 degrees in azimuth and about 10-15 degrees in altitude at the void’s apex. The VisionDome folks attributed this effect to an incorrect mechanical and design adjustment between the projector and the lens pipe. They explained that this would be easily correctable by re-machining the shim-plates between the two components. However, the good news was that the distortion that would normally be encountered by projecting images off-center is easily corrected by loading a computer algorithm into the graphics processor.

The main limitation seen during the test was Morehead’s large dome-size, which lowered the brightness, contrast, and overall color-saturation of the images. In addition, Morehead’s white, high-reflectance dome further reduced the overall contrast of many images — particularly those incorporating non-black backgrounds — because of “cross-bounce”. (This is a phenomenon familiar to all-dome film people, and is why such theaters have gray domes to reduce the overall reflectance, and thus, the cross-bounce effect.) Both the VisionDome and Morehead personnel suspected that lowered brightness, contrast, and color would be negative factors in the test, but were, nonetheless, pleasantly surprised that the images “held up” as well as they did. However, because of these limitations, VisionDome, as currently configured, is not optimized for large-dome applications. And given the need for lowered dome reflectance, the system is probably best suited for domes roughly 12-meters (40-feet), and smaller.

VisionDome Strengths & Criticisms

As with most of the systems under review, content for VisionDome is a primary concern. VisionDome’s graphics workstation and application software appeared to be quite functional. However, since there is currently little in the way of appropriate ready-to-go graphical sequences for the system — particularly those which are astronomical in nature — the burden appears to rest primarily on the shoulders of the end-user. Facilities considering VisionDome or any other similar graphical system for the planetarium must consider the issue of content availability. With a trend toward smaller staffs in planetariums these days, many facilities may be hard-pressed to create original images for use in programs, given the staff-time and expertise needed to generate even the simplest 3-D objects and manipulated sequences. To that end, Mr. Galluppi and the engineers at ARC are interested in approaching the planetarium community as a potential market and looking for artists/designers to develop visual content.

The Morehead demonstration should be looked at as a worst-case scenario. Not only was the dome extremely large, but the system was tested with an older generation of video projector. Newer projectors from the same manufacturer can produce brighter, sharper images at higher resolutions. The greatest potential for VisionDome is in smaller theaters where the image can be most effectively used.

Alignment and color balancing with VisionDome is greatly simplified since there is only one projector and one lens. There are no bright spots, overlap areas, or other alignment headaches to deal with. While the system is not maintenance-free, it is much less expensive to own and operate.

An ideal partnership would probably be to install a VisionDome system into a college or university planetarium where staff and students could make use of it as a visualization platform and showcase for student graphics work. VisionDome is available in a number of configurations and price-points.

Questions and comments regarding these reviews should be made directly to the respective vendor or to the IPS Technical Committee.

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kevin@rccenter.org

Spitz will offer a day-long workshop on immersive video and computer graphics production for dome theaters. This free workshop will be held on May 12th, (the day before the M.A.P.S. conference begins), from 10 a.m. to 4 p.m. The purpose of the session is to introduce colleagues to Spitz’s ImmersaVision format, production techniques, hardware, software and how it can benefit a planetarium.

Topics will include: compatibility among different video systems; ElectricSky theaters as flexible, multi-purpose theaters; 3-D and 2-D graphics production, and the integration of immersive video with all-skies. We will also address questions and topics you bring along, and show you our newest demo clips. The workshop is limited to 15 participants. Lunch is provided by Spitz.

Call or write Joyce Towne to reserve a spot (610-459-5200, jtowne@spitzinc.com). Spitz is located in Chadds Ford, Pennsylvania, USA.

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Web Links

System Vendors
Trimension: www.trimension-inc.com/visual/domes.html
Sky-Skan: www.skyskan.com
Evans & Sutherland: www.es.com/Products/Edutain/starrider.html
Goto: www.goto.co.jp/product/virtuarium-e.html
Spitz: www.spitzinc.com/VR.htm
Alternate Realities: www.virtual-reality.com/products.html

Production Software
3D Studio Max: www.ktx.com
Electric Image Animation System: www.electricimage.com
Lightwave: www.newtek.com
MultiGen real-time modeling tool: www.multigen.com

Other Hardware
Electrohome: www.electrohome.com
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Planetarian

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Happy equinox, fellow star-farers. This issue brings you reviews of volumes for anyone's reading list: a scholarly look at comets and how we've perceived them, the reprint of a classic reference, a celebration for Pluto achieving "farthest planet" status this month, a feast of astronomical appetizers, and one for the young aspiring astronaut crowd.

Many thanks to our loyal reviewers: Bob Bonadurer, Chris De Pree, Francine Jackson, and Robert Hicks.


Reviewed by Robert D. Hicks, University of Exeter, Exeter, England.

In 1997, 39 members of the Higher Source, a millenarian religious group, committed suicide in the belief that by shedding their mortal bodies they could achieve a higher consciousness and thereby rendezvous with a UFO which followed Comet Hale-Bopp. The apparition of the comet signified that the time had arrived to begin their celestial journey. Clearly, comets continue to occupy a place in popular culture despite our self-proclaimed scientific sophistication. Science depicts comets as dirty snowballs racing through the solar system, dispensing primordial matter in colorful meteor displays. The following statement, then, seems more New Age than scientific:

"For as the seas are absolutely necessary to the constitution of the earth... so for the conservation of the seas, and fluids of the planets, comets seem to be required, that, from their exhalations and vapors condensed, the wastes of the planetary fluids spent upon vegetation... may be continually supplied."

This statement was written by Isaac Newton. The received wisdom about Newton and the other geniuses of early modern science concentrates on their brilliant insights or rigorous methods of analysis and relegates the odd outburst of mysticism or irrationality to personal idiosyncrasy. Sara Schechner Genuth, however, argues that to ignore these odd outbursts is to misunderstand how science evolves. Did the scientific revolution mean the abandonment of cometary lore and attendant superstitions? Not only did popular beliefs continue, but Newton, Edmund Halley, and other theoreticians in astronomy "embraced... and used (popular ideas) creatively in the development of their cosmological theories."

Further, the new astronomical rationalism defined a new role for comets as agents of world renewal or reform, becoming "a cornerstone of eighteenth-century cosmogonic theories."

"If there is a message here, it is that we should widen our gaze and reconsider the boundaries between popular culture and modern science."

Schechner Genuth, former curator of the history of astronomy, Adler Planetarium and Astronomy Museum in Chicago, lately scholar-in-residence, American Institute of Physics, and research fellow, National Museum of American History, has explored a new dimension in understanding the origins of the scientific rationalism in Europe. Rather than reinforce the conventional gulf between superstition and modern astrophysics, Schechner Genuth seeks to break down intellectual fences among historians. Her argument posits a common cultural milieu, initially shared by the lower orders and the elite, which by the late sixteenth century figured comets either as causing or as signs of the rebirth of the Messiah, the downfall of the wicked, the reformation of the church, the last battle with the Antichrist, crop failures, war, or sickness.

In her well-illustrated analysis, Schechner Genuth states that although both high and low culture shared this popular discourse about comets, in the early seventeenth century the elite withdrew from this common view and began to rail against superstitions and popular ignorance of science. Nevertheless, she shows that Newton and Halley reinvented popular beliefs about comets into natural philosophy (self-identification as a "scientist" was still two centuries away). To Newton, an understanding of the true role of comets in creation would enrich religious faith by deepening an appreciation for how God achieves His design, using comets as cosmic watering cans to engender renewal on earth and to refuel the sun.

After Newton, subsequent thinkers such as Herschel, Laplace, and Kant considered the role of comets, transmuting them from the monstrous omens of popular culture to natural causes. Hume and Laplace, though, finally refuted Newton's argument from design by pointing out that God did not need to intervene through comets to keep the solar system going; mechanical principles alone sufficed. But the rare and dramatic appearances of comets had and still have their effect: "Along with an appreciation of comets' destructive and restorative functions came a recognition of the possibility of both catastrophic change and progressive transformation of the earth and heavenly bodies over vast periods of time. The study of these natural changes was to become a distinguishing feature of modern cosmological thought." If anyone doubts this contention, he should examine the current question of the extinction of dinosaurs through cometary impact.

Schechner Genuth's work is a welcome and provocative study which has opened a new window in the history of ideas. Her work joins the small but growing number of social histories that embrace an entire cultural milieu of thought rather than artificially isolate and celebrate early science because it best resembles our twentieth-century endeavors.

Schechner Genuth's analysis involves wide-ranging excursions into religious thought, political writings, ephemera such as broadsheets and almanacs, and art to examine changing perceptions about comets and the continuity of comet lore. She has shown that a study of scientific ideas must examine the influence of popular culture to include what we disdainfully disregard as superstitious. She concludes: "If there is a message here, it is that we should widen our gaze and reconsider the boundaries between popular culture and modern science." Planetariums interested in exploring popular views of comets and their influence on science will find this book stimulating.


Reviewed by Bob Bonadurer, Minneapolis Planetarium, Minneapolis, Minnesota, USA.
gateway to the stars. Often we can simply project the stars up on the dome and people will come. But sometimes we need an angle to sell the stars. Coffee and stars? An astronomy cafe? Ok, I'll buy that.

Sten Odenwald's book *The Astronomy Cafe* gives off a definite aroma. Like Chet Raymo's *365 Starry Nights*, he uses the Earth's orbit in days as his framework. Answers to 365 questions from all corners of the universe are served up in a meat and potatoes fashion. And the style is both rare and well done.

"sometimes we need an angle to sell the stars."

Odenwald is the straightforward astronomy waiter who can tell a good joke. He's a Ph.D. who can give the hard science and then surprises you with some playful banter. For example, after citing five solar system mnemonics, Odenwald offers five of his own. My favorite? "Mr. Vega Enjoys Many Jewel-like Stars Under Nightly Promenades." For the 5/5/2000 conjunction, he writes, "the only effects will be those caused by mass hysteria - a far more powerful force than gravity."

This book grew out of his Astronomy Cafe web site, www2.arl.net/home/odenwald/cafe.html, where he has answered over 3,000 questions about astronomy. For each answer in the book, he gives a number reference for more information on his web site.

Odenwald is aware of the book's shortcomings as he notes in his introduction. The answers at times can leave you hanging — saying to yourself, "That's it?"

For the question about how astronomers can figure out the immense distances in the universe, we get a chart with the various methods but no real explanation. At other times you find new terms within the answers that seem to pop out of nowhere and you think, "What's that?" An example comes from an answer to a big bang question. We start to hear about "scalar fields" without any idea about what they are.

So is this book fun? Well, I'll answer the same way Odenwald answers question number 349 - Is Astronomy Fun? "Sometimes, but sometimes it is just hard work." Overall the book is a great resource, especially for planetarium educators. There are accurate, flavorful, and heartfelt answers to the major astronomical questions. You may want more, but as Odenwald reminds us, astronomy doesn't have all the answers and "that's life."

P.S. You don't have to be a coffee lover to like this book, but it helps!

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Reviewed by Christopher G. De Pree, Department of Physics & Astronomy, Agnes Scott College Decatur, Georgia, USA.

Dover Publications is probably most well known for producing inexpensive copies of out-of-print, classic texts. Now Wiley-Interscience is in the same business, publishing its Wiley Classics Library. These inexpensive, paperback reprints of classic science texts will be a welcome addition to many personal libraries. Lyman Spitzer's *Physical Processes in the Interstellar Medium* is an acknowledged classic, a fundamental text and reference. As a graduate student, I referred to the text so often that I had one of the few copies in the library constantly checked out.

"(The book) covers the basic astrophysics of the interstellar medium (ISM) in a concise and readable manner."

Spitzer covers the basic astrophysics of the interstellar medium (ISM) in a concise and readable manner. The text begins with a thorough, qualitative overview of the main components of the ISM: neutral gas, photo-ionized gas, and collision-ionized gas. Spitzer then moves on to the topics of kinetic equilibrium, radiative processes and excitation, two chapters of physics of HII regions, and three chapters dedicated to the properties and physics of grains. The final part of the text covers basic gas dynamics, equilibrium and non-equilibrium environments, and gravitational motion.

The text is most appropriate for students at the advanced undergraduate or graduate level, and serves as an excellent reference for professionals in the field. Spitzer dedicates the book "To the younger generation, from whom I have learned so much." Thanks to this reprinting of Spitzer's text, another generation will have its own copies of his book.

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Reviewed by Francine Jackson, University of Rhode Island Planetarium, Bryant College, Smithfield, Rhode Island, USA.

What is Pluto? This tiny object, which at one time defined the edge of the solar system, is in the midst of such controversy that it will take a spacecraft to sort out many of the continuing questions attached to it. I was brought up with Pluto rounding out the planets in our neighborhood; now, its size, motion, and companion satellite are combining to remove it from the routine chart of the planets and relegate it to the membership of large, new objects skirting the ecliptic plane.

Stern and Mitton, in *Pluto and Charon*, have done their best to introduce our normally farthest planet and its moon. They follow the growth of our solar system, from clearly-visible Saturn, to the telescopic Uranus and Neptune, to the photographic artistry of a bouncing, tiny Pluto.

As Pluto became accepted as a viable planet, and more and more scientists began to wonder as to its real physical properties. When I was a kid, it was second in size to Mercury; suddenly my adulthood saw this become a smaller-than-satellite-sized body with a marginal atmosphere and, thanks to the Hubble Space Telescope, actual surface differences and a photogenic companion.

Stern and Mitton, in addition to introducing us to Pluto, show us the human side of the planet, the many self-described Pluto-philosopher who have sometimes worked all their lives to learn about it: from Percival Lowell, disgraced by his Martian canals, but at whose observatory the discovery was made; Clyde Tombaugh, who for months blinked the sky looking for the distinct bounce of a solar system edged planet; James Christy, discoverer of Charon (however you want to pronounce it); and many others - Buie, Tholen, Young, Millis, Elliott et al. - who added substance to Pluto. And, with the (still funded) future launch of Pluto Express, the two craft destined to give us our only on-hand views for the next two decades, we will finally be able to really see for ourselves our little neighbor.

"Stern and Mitton, in addition to introducing us to Pluto, show us the human side of the planet."

This book was nicely readable; it was written for the general audience. Of course, a few errors always seem to leak into books these days - Robert Millis lists several in his review in the June '98 *Sky & Telescope*, which I won't retell, and of course your eyes may cross at
I've been recommending Franklyn Branley's books to science teachers and libraries for years. His latest offering is another excellent book for primary school age children. In these days of increasing cries for "interdisciplinary materials" (not just a "science" book, but one that lets kids practice their reading and math skills as they learn science), HarperCollins' titles stand out. There are plenty of colorful, 30 page children's books about space out there. Many of them are full of colorful pictures and diagrams, but short on information. Floating in Space has delightful illustrations and substantial information as well.

After a brief discussion of gravity, the reader is introduced to life aboard the space shuttle, and what it's like for astronauts who work while floating in space. Food, space suits, a day of construction work, sleep and re-entry details are all clearly explained and well illustrated. If you're looking for a good quality volume for libraries, gift shops, or that parent who calls for birthday present ideas, I recommend Floating in Space.

---

**Euler's Disk**

Conducted by Barbara Baber  
Morgan Jones Planetarium  
700 N. Mockingbird St.  
Abilene, Texas 79603

For the Committee on Astronomical Accuracy/Astrology

Euler's Disk is named after the famous Swiss Mathematician Leonhard Euler. Euler began publishing his applied mathematical proofs in 1726, when he was only nineteen years old, and for the next fifty-seven years published over eight hundred sixty books and articles.

Euler had two invaluable traits as a mathematician: he had a prodigious memory and he could make complex calculations mentally. Newton once said that the only problem that made his head hurt was the calculation of the moon's motions. Euler tackled the problem and did the complicated analysis in his head.

In mechanics, Euler revolutionized the field with his analytical methods. In particular, he studied rigid dynamics, which is probably why the toy is named for him.

Euler's Disk is a tabletop holographic display which is used and enjoyed by all ages. To start, you place the mirror base on a hard, flat surface. Place the disk on the mirror at a slight angle, smooth side down, give it a twist, and the disk immediately begins to put on a hypnotic display that does not slow down. In fact, it actually speeds up. Hundreds of years ago someone might have thought it was witchcraft.

What are the physics that are involved? Euler's Disk is spun on its base by placing the smooth rounded edge of the disk on the mirror, with the disk oriented so that the normal vector $n$ is slightly displaced from the horizontal. The disk is spun about the vertical axis $v$ and released. As the disk rolls, energy is lost in friction and vibration, causing the angle $a$ to eventually go to zero. As the disk loses energy, the soaring pitch produced by the rolling edge increases toward infinity, as the inverse of the square root of the angle $a$.

Start Euler's disk spinning and everyone will watch as the laws of gravity and conservation of energy put on a private little war. Eventually gravity wins out.

I sent Euler's disk to Jim Rusk, Director of Russell Planetarium in Mesquite, Texas. Jim used the disk with a physics class. He said although the class was clearly impressed, the physics of Euler's disk was a little outside what is normally studied by students in high school. Although rigid dynamics can be very technical, in this case the math was not too difficult for the high school class. He said contrary to his students expectations, the disk actually speeded up. That's the physics demonstration. The "3-D holographic effect" was secondary to the sound and speed of the disk.

Euler's disk can be purchased from Tangent Toy Company (P. O. Box 436, Sausalito, CA 94966). The company sells the kit for about $34 plus a shipping/handling fee. The kit contains one mirror base and a disk. The mirror is not easily damaged or scarred, but the disk is heavy and if dropped will get nicks or chips on it that will affect the way it spins. The disk needs to be free of dirt or nicks and the mirror base needs to be kept clean. You can polish the disk with superfine grade sandpaper to maintain a superior spinning surface.

Is Euler's disk worth the price? A positive aspect of this device is the holographic display in which physics becomes fun. Euler's disk could be used to introduce gravity to a physics class or show a planetarium class a holographic display. I would probably not purchase the disk for planetarium use, but for classroom use Euler's disk might be appropriate and fun.

One drawback for Euler's disk is that it needs a dark room for the holographic display to be effective. Another drawback as far as safety goes is the weight of the disk. If dropped, the disk could damage a student's foot. Also, the mirror, if shattered, might cut a finger or hand. On the positive side, the mirror would be hard to break if dropped accidentally. Neither the disk nor mirror has any sharp edges or corners.

In conclusion, I would not recommend this disk for middle school or high school students. As a demonstration for high school physics, Euler's disk would be an interesting display but as Jim Rusk stated, the concept is not taught in physics. College students that study rigid dynamics might benefit from the toy's display of the physics principle.
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European Meeting for Itinerant and Small Planetaria:
The next meeting will take place on May 10-12, 1999 in conjunction with the Association of French-Speaking Planetariums meeting in Strasbourg, France. We will meet in the Salle de Paris at the European Council Building. During this time there will be space for portable planetarium demonstrations for one day and there will be two days of simultaneous translation for French, English and German. We certainly hope to meet many mobile and small planetarium users for a time of intense sharing. If you have not received information about this meeting yet please contact Agnes Acker (11, rue de l'Universite, 67000-Strasbourg, France; phone: 33-3-88-15-07-24, fax: 33-3-88-15-07-40, e-mail: acker@cdsx6.u-strasbg.fr).

American in Italy 1998 Report:
Dee Wanger (Starlab Coordinator, Discovery Center Science Museum, 703 East Prospect Rd, Fort Collins, CO 80525, USA; phone: 970-472-3993, fax: 970-472-3997) wrote the following article describing her trip to Italy in 1998. Dee won this trip as a result of the annual contest for an American portable planetarium presenter in Italy. (For more information about this contest contact Susan Reynolds at the address above.)

Starry, Starry Nights
By Dee Wanger

There's a comfort in knowing that they will always be there. They accompany me everywhere in the Northern Hemisphere. They don't require ticket or suitcase. They are my friends—the stars!
The stars greeted my daughters, Darcy and Renee, and me in Italy at four o'clock in the morning when jet lag woke us. We ventured onto a cliff-hanging balcony overlooking the Ligurian Sea and glanced at the sky. The North Star confidently held its place and Orion stood masterfully in the sky. So began the trip to Italy.
The primary purpose of the trip was to give Starlab Planetarium presentations to Brescia high school students who were learning English. I also had an opportunity to present to the public and regional teachers. I gave 12 presentations at two different high schools in Brescia, and a permanent planetarium in a nearby town, and one presentation each to the public and teachers.
While I shared general astronomy information, the audiences were most fascinated with the Native American lore. I was impressed with the students' abilities with our language. This aspect of the experience gave me a "small world" feeling of our global society. After all, I was sharing information about our common sky.
Just outside Brescia under a dark sky stands a new observatory. The fine company, Serafino Zani, built it in honor of its late founder. Zani was an astronomy enthusiast, so such a monument was fitting. It was an important gift to the region, which, due to city lights, has lost much of its ability to see the night sky.
While in Italy, I met many welcoming people who helped build a bridge with Discovery Center. We shared many ideas about successful programming that I am eager to share with Discovery Center members and visitors in 1999.

American in Italy Contest 1999:
A week in the north of Italy: Each year Serafino Zani Astronomical Observatory (Lumezzane/Brescia), in collaboration with the IPS Mobile Planetarium Committee and with the support of Learning Inc., will host an American Planetarium Operator who presents lessons in English with the itinerant planetarium Starlab to high school students of English. Transportation from the United States will be provided, along with bed and some meals from Monday to Sunday. If you would like more details and/or an application write or call: Susan Reynolds, OCM BOCES Planetarium, PO Box 4754, Syracuse, NY 13221; phone: 315-433-2671, fax: 315-432-4523, e-mail: sreynold@cnyric.org.

SEPA Portable Planetarium Meeting 1998 Organized by Sharon Mendonsa:

Sharon Mendonsa (Sudekum Planetarium, Cumberland Science Museum, 800 Fort Negley Boulevard, Nashville, TN 37203-4899 USA Phone: 615-401-5078, e-mail: mendonsa@worldnet.att.net) wrote to tell me about a second very successful PIPS (Powerful Interactive Planetarium Systems) meeting at the SEPA Conference where 29 people shared techniques, lesson ideas, and special effects to be used in portable planetaria. Aside from me, Sharon is the only person I know of, so far, who has run a PIPS meeting on her own! She has been successful in increasing interest and attendance for this meeting during the last year and is planning ahead for next year. She sent the minutes of the meeting, some detailed directions for making an auxiliary lighting system by Robert Rodriguez, a list of techniques that seem to work in Starlab by Sharon Mendonsa, a list called "Enhancements to My Planetarium Life" by Adam J. Thanz, a set of space postcard templates for use on Astronomy Day, and plans for modifying a clipboard (by mounting a light on it) designed by Dave Hostetter. (Dave uses this clipboard for teaching constellations. It is another way students can see the constellation outline and then look for it in the sky, without ruining the night sky projection.)
Sharon also sent some possible suggestions she got from the meeting participants about how to create a workshop session that would be as useful as the meeting in which they share needs and problems:
1) taking the SEPA audience through a 30-minute live presentation just like we do in Starlab for school groups. For example, pretend you are a group of first graders and I am the presenter (or how about George Hastings?). The subject is day and night, or seasons, or Native American sky stories, etc.
2) going through the process to prepare the audience for a Starlab or dome visits, how to discipline, how to seat, all the logistics involved, etc. Many of you have a lot of experience at this and I bet we all can come up with some tricks each of us uses to control the audience, to make them laugh and to make concepts unforgettable. This can easily apply to permanent domes as well.
3) a make and take workshop for a special effect or for activities.
4) a workshop covering a topic (seasons, constellations, scale) and everyone bring one idea written up or provide directions and materials to make something.
Thank you Sharon for your continued efforts to network portable planetarium users in your region. Hopefully the other regions will be inspired by you and also by some of the workshop suggestions.

**Project ASTRO Hits Central New Jersey with a BANG!!!**

The material for the following article was provided by Jerry Vinski. Thanks for letting us in on the good news Jerry!

Raritan Valley Community College (RVCC) conducted its first annual Project ASTRO NOVA Summer Workshop. Project ASTRO is a National Science Foundation funded program that matches teachers in grades 4-9 with a volunteer professional or qualified amateur astronomer who makes regular classroom visits. The project emphasizes a hands-on, activity-based approach to maintain the natural excitement students have for astronomy and help teach them the process of science. “When people think of astronomy they usually picture constellations and the planets in their minds. But, astronomy is actually filled with all of the other sciences. That's why I became interested in it as a teenager,” said Jerry Vinski, Director of the Planetarium at Raritan Valley. “Astronomy is the study of the universe and astronomers use math, physics, chemistry, biology, computers, geology and even meteorology when studying the heavens.”

Project ASTRO was started 3 years ago by the non-profit Astronomical Society of the Pacific which is located in San Francisco, California. It has since expanded to eight other sites nationwide. RVCC, along with the University of Central Florida, was awarded this year's grant. No other community college in the country has been selected. Only universities and one major science center have started programs. Although New Jersey's expansion site is being lead by the Planetarium at Raritan Valley, it has strong support from other local institutions. The project coalition group is composed of astronomers and educators from Rutgers University, Columbia University, Kean University, United Astronomy Clubs of New Jersey, Amateur Astronomers Incorporated, The Business and Education Partnership, Somerset County 4-H, Rolling Hills Girl Scout Council, Hayden Planetarium, Merck Institute for Science Education, Somerville School District and Edison School District.

“There has been an overwhelming amount of interest in this new program,” Vinski said. “Originally only 10 astronomers and 15 teachers were to be part of the Raritan Valley expansion site. Instead, 28 volunteer astronomers have agreed to visit 38 teachers from 30 different school districts.” They will visit their partner teacher's school at least four times during the school year. Both the teacher and astronomer work closely to define goals, plan their program and fit visits

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into the curriculum. Astronomers might help lead hands-on activities, serve as a resource for the teacher and class, present auditorium programs, arrange field trips, or assist with science fair projects or evening star watch programs.

Dr. Wil van der Veen, Project Coordinator, notes that, "This program has the potential to match professional and qualified amateur astronomers with several hundreds of teachers over the next several years throughout the metropolitan area affecting how science is taught to thousands of children."

The selected teachers and astronomers attended a two-day training workshop on August 28-29, 1998 at RVCC where they received a copy of the 813 page *The Universe at Your Fingertips, an Astronomy Activity and Resource Notebook*, and other useful resource materials. Participants became part of a growing local and national network of Project ASTRa partners and has the opportunity to join in school year workshops and activities.

To learn more information about the success of this project call or write the Planetarium Department at Raritan Valley Community College (Lamington Road and Route 28, PO Box 3300, Somerville, NJ 08876 USA; phone: 908-231-8805, fax: 908-526-7938, or e-mail: astro@rvcc.raritanval.edu)

**Other Correspondence:**

Robin Symonds (121 Maple Street, Easthampton, MA 01027 USA, phone: 413-527-3963) called to let me know that she is making some major changes in her life. She left the Springfield Science Museum and bought a Starlab! She plans to start a business with her Starlab and called “Northstar Education.” To augment her income she will also work at the Bassett Planetarium in Amherst College as a part time employee. Good luck Robin and have fun!

I received three requests for materials from the public domain files (two from Georgia and one from Florida), one request for information about the GLPA Tips #18 Booklet (from Greece) and a letter from a new user in Israel. Dr. N. V. Vidal (The institute for Teaching Sciences and Technology, 81 Bayit Vagan Street, Jerusalem 96426 Israel; phone: 972-2-6424254; fax: 972-2-6430040), has purchased a portable planetarium from Albert Pla (Sphaera System) and is eager to learn as much as he can about programming and instrumentation. Contact him if you are near and can help. Meanwhile I will invite him to the meeting in May.

**Signing Off:**

I hope the New Year is being good to you and yours. Keep in touch!
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Innovative Controls for Planetariums and Laser Displays
I stood atop the Fort at Nagarkot and watched the Sun rise over the roof of the world Nagarkot is a village tucked away in central Nepal. The Fort is a brick tourist lodge that caps a small ridge just east of the village. The roof of the world is of course the Himalayas. They spread out before you in a sawtooth range of jagged snow-capped peaks to the east and north of the Fort. Alone with my thoughts, my camera, and the mountains in the primeval light before dawn, I tried to imagine how we were all moving. Eastward, as the Earth rotated, speeding along at 900 miles an hour (1450 mk/hr), though of course I couldn't feel it at all. Northward, at least the Fort and Nepal and I were moving northward, but creeping only a few micrometers an hour as the Indian crustal plate pressed north into Asia. And upward, the mountains were moving upward, slowly, perhaps a micrometer an hour on the average, as India and Asia squeezed together and twisted up a mountain range along the collision front. Imagination had to suffice as I pictured these motions, but the landscape before me was a visible demonstration of the crust of our planet transformed by the inexorable march of forces generated in the mantle beneath.

As the Earth's rotation carried the Fort and the mountains eastward, the first rays of the morning Sun found the world's tallest summits. The day before, I had seen the tallest of these peaks - Sagarmatha as it may be called in Nepal - through an airplane window and camera lens, but now the summit also called Everest was lost in the cluster of peaks to my east. Gradually, as we all swept eastward, the light crept down the mountain flanks to the valleys beneath, and morning mists and pinks gave way to the full light of a new day.

An hour earlier, while the Sun was still a time zone to the east and the local sky was still dark, my eye had crept around the starfield. I was halfway around the world from home, but the sky was filled with familiar friends: the Dippers, Arcturus, Mars, Spica, and Leo - yes, they were there, but so was Scorpius. Scorpius? in January? and not in a planetarium? But it was 5:30 in the morning, and the summer stars glowed in the nip of a winter's dawn. Then there were the less familiar friends I hadn't seen since my last time South: Centaurus, and just barely visible above the south point, the stars of the Southern Cross. I knew that our colleagues in Australia and New Zealand would already be up, and far enough away that they wouldn't be able to tell me I had the seasons wrong.

But they, and their neighbors to the north in China and Japan, would be arriving at their planetariums soon and would open their domes to the world for another day. I thought too that back home in North America, it was already evening, planetarians in schools had already taught their classes for the day while I'd slept, and evening shows would be in progress across the American time zones on a pair of continents. Observatory domes would be opening too in anticipation of another night of wrestling out the secrets of starlight, and some of this newfound knowledge would in time come to us, and we would interpret and share that knowledge in the programs and classes in our domes, the domes that bring the wonders of the cosmos down to Earth.

As the hours slipped by, I might have to shuffle the continents around in my thoughts, but whatever the hour, I could be sure that a planetarium program was running somewhere, and bringing the wonders of the cosmos down to Earth.

A few hours earlier, a cluster of us had gathered atop the Fort to stargaze under one of the best skies I had ever seen. Andromeda, Praesepe, h and chi Persei - those fragile sights lost in the light-polluted skies most of us see from home - leapt out. You almost couldn't miss them. All of the Little Dipper was there too, and was so easy to see. Stars glistened all the way down to the horizon in the thin clear air at two thousand meters (7000 feet). From the valleys below, a handful of the faintest lights twinkled up, just enough to tie the sky above to the Earth beneath, and to lift the vault of the starfield even higher, at least to my eye. In the distance, unseen in the blackness, the tallest mountains on Earth sat small under the looming white arch of the Milky Way and a celestial hemisphere filled with a host of stars.

We looked at the bright stars, we looked at the faint stars, we peered at the clusters, we saw the Earth turn as the stars rose, we contemplated the two-million-year-old light from another galaxy, we saw the temperatures of the stars, we saw the neonatal stars in Orion. We passed the binoculars from the astronomer to the neonatal doctor, from Doris to Ved to Anne to Om to Maribeth, from American tourist to Nepali host, from the denizen of one crustal plate to the citizen of another. At last, as the chill of the winter night began to seep inside us, we watched that most distant outpost of Earth-stuff, the Moon, climb out from behind the jagged peaks.

To this astronomer turned planetarian, it was all a fresh reminder of just why we are in this planetarium business in the first place. We have this incredible heritage, the sky, that we share across the continents and across the generations. We bring this starry sky inside within our domes to teach and to inspire. We interpret the cosmos near and far to the people who come to visit us. The sky and its wealth of wonders are the heart and soul and anchor of all we do in all our grand diversity.

As our van curled its way down the mountain road the next morning, I thought of Martin Ratcliffe, the new president-elect of IPS. If that oncoming driver didn't give us enough room and our van had to veer much farther to the left - well, this road had no guardrails, the dropoff could probably swallow a few more tourists for lunch, and Martin's term as president might begin a couple years early. But we did make it safely down to the Kathmandu Valley, and a few hours later, Venus guarded the evening twilight as our plane descended into Delhi to connect with an overnight flight to Europe and home.

Saints together on a small island

A synodic period of Venus earlier, I had flown into the small Arctic island of St. George, the smaller of the two inhabited Pribilof Islands in the middle of the Bering
Sea southwest of mainland Alaska. St. George is home to fewer than two hundred people, and all of them live in a single village anchored above the cliffs that form the island’s north shore. Some of us could seat all the Saint Georgians under our dome in one sitting. I’d come here directly from an IPS officers meeting (well, with connections in Minneapolis and Anchorage). Our small plane tumbled to a stop on the new gravel runway, and I made my way to the little lodge in the village and met its three other guests. I’d come here for the remoteness, to catch the sight of seabirds in one of the world’s premier rookeries, and to walk the island’s tundra in the late spring winds of May.

It was my second attempt to get there; a flight the previous August had been kept aloft by thick weather and had returned to Anchorage without even seeing the island. A pair of St. George teachers on that flight had advised me to try again the next spring when the weather was better, and they were right. As I walked around the village, dodging a succession of sun, wind, rain, and snow, I spied the school, and two days later found myself inside one of its classrooms giving a volunteer talk about astronomy. There were just three other classrooms, a gymnasium/basketball court, and offices. No, there is no planetarium in St. George, but they do have a telescope, and in what has to be some of the world’s most frustrating observing weather, they had seen Comet Hale-Bopp a few weeks earlier.

Feeling rather self-conscious, though visitors to the island are encouraged to come to the school, and also feeling somewhat adrift without a star, slide, or video projector at hand, I talked about our place in the universe, building up the hierarchy of structure with the same words you would probably have used: our small planet orbits the Sun, an ordinary star in an arm of the Way, and we peer out into space from the surface of this one tiny planet we live on. Who among us has not given this little talk in one way or another?

I had tried to think of an analogy that would build a connection between this remote universe of ours and the students’ isolated island where there’s a fifty-fifty chance the scheduled flight can’t land for the weather. I drew a mental picture of their village with its less than fifty houses on an island whose length you can walk in two hours on a calm day. Fifty miles (80 km) away there’s another inhabited island, but there’s no predictable air service between them, and then there’s nothing for hundreds of miles. A tiny island set alone in a vast space of sea, and that sea beset by some of the world’s worst weather. The rest of the world is far away, and at times, beyond reach. You of course have already seen the analogy I went on to draw with the Earth set alone in space. In their isolated home, the villagers of St. George inevitably turn to each other to carry on their lives.

So too, we as planetarians inevitably turn to each other to carry on with our work. Ours is a global profession, but it is a small one, and we must work together to share our insights, our skills, and our enthusiasms. The goal of IPS is to help us work together to become better planetarians and, in all the diverse ways that we do our jobs, to become better interpreters of the cosmos to our neighbors who live with us on the moving crustal plates of planet Earth.

The officers’ table

A few days before Earth passes perihelion in odd-numbered years, IPS rotates its officers. So in this odd-numbered (and prime-numbered and penultimate millennium) year, we changed some seats at the officers’ table and began our new terms. Each president finds that his or her two-year term is a remarkably short time, a mere hundred weeks. Many projects require much longer than that to complete, and each president and team of officers continue and build on the work of those whose who came before. Our structure of a presidential team with each of us serving successively as president-elect, president, and past president helps foster this continuity, and so does the remarkable level of cooperation we have forged among the five officers.

As Thomas Kraupe becomes past president and I become president, we will both greatly miss the wise counsel of Jim Manning, whose term as past-president ended with the close of 1998. IPS experienced a remarkable growth during the six years that Jim was part of the officer team. The first-ever IPS conference in Asia convened during Jim’s presidency when we met in Osaka, Japan in 1996. The distribution (by subscription) of slides from the Hubble Space Telescope and JPL to planetarians was negotiated by Jim during his term as president. More recently, the establishment of Astronomy Link — the roster of research astronomers who will field our questions — was largely Jim’s handiwork. These have been some of the visible results you have all seen. But Jim has also done so much quiet work behind the scenes and has been a wise and steady voice of insight in the almost daily email discussions among the officers. Somehow through all this, Jim still found the time to keep telling us What’s New each quarter in the Planetarian, and we look forward to many more turns of this column even as he takes a well-earned rest from his six years’ term on the officer team. Jim once remarked to me with, I think, an ever-so-slight and always diplomatic clench of the teeth, “I wish I knew who nominated me to run for IPS president.” To that unknown person, thanks — you done good!

Then came the two remarkable years of Thomas Kraupe’s term in the president’s chair. So much was accomplished during his term, and you’ve only seen a part of the results so far, such as the wonderful new web site, new resource and planetarium directories, or the technical survey of the world’s planetariums. If you haven’t already read his December President’s Message in its entirety, go back and take a look at it, and you will see many projects in progress that will form much of the foundation for what we hope to do in the coming years — extending our media distribution service beyond slides to also include video; placing publication of directories on a firm, regular schedule; encouraging creation of regional affiliates in geographic areas not now served; exploring the new possibilities of electronic publishing; and more, as we’ll talk about in the coming months.

Thomas has served IPS with style and energy and a joie-de-vivre that you’ve seen at conferences and in his president’s messages. Behind the scenes we’ve seen his inspiring flow of ideas, dedication, and sheer hard work. We know that we can count on many more contributions as he continues on the officer team as past-president, and I look forward to our continuing work together in the next two years.

We welcome Martin Ratcliffe aboard as the new president-elect. While the Americans may think he is still British and the British may think he has become American, we know that whatever passport he carries, Martin brings an impressive record of accomplishments and array of talents, and we are very excited to have him as part of the leadership team.

Martin emerged the winner in the recent election over three other outstanding candidates. John Dickenson, John Petersen, and Asuncion Sanchez Justel are all inspiring planetarians with distinguished records of service to the planetarium and science education fields. Thanks to each of you for running, and while you may have escaped (for now) the six-year commitment of the president’s stream, I do hope you’ll continue to serve the planetarium community as faithfully in the future as you have in the years past.

Lee Ann Hennig and Shawn Laatsch will return for fresh terms as Executive Secretary and Treasurer/Membership Chair, respectively, and will continue their work as such inte-
The Stars, A Man, and his Parrot: A True Story

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In the field of planetarium programming, where the audience consists of the general public who buys a ticket at the door to attend the star show, interesting or amusing situations can develop because of the diverse nature of the audience.

At one of my presentations at the Chabot Observatory and Planetarium in Oakland, California, a man showed up with a live parrot on his shoulder, bought a ticket, and then he and his parrot sat down among the audience to listen to my presentation. Although I expected amusing disruptions by a vocally active parrot, the man and his parrot sat for the entire presentation and neither said anything. After my short presentation, which was held in the planetarium's classroom, everyone got up, lined up, and proceeded to file into the planetarium theater. So did the man and his parrot. In the planetarium the lights went out and the stars appeared. I proceeded to show the constellations and explain the nature of the stars. Again, the parrot said nothing as he and his owner gazed at the stars in the darkened planetarium. When the planetarium show ended, after 30 minutes of star facts and lore, everyone applauded and then filed out of the planetarium theater to go to the observatory to view celestial objects through the large telescopes. After closing the planetarium, I walked over to the observatory to chat with the visitors as they waited to look through the telescopes. At the 8-inch refractor telescope dome, there were several people lined up to look through the telescope at the planet Jupiter. The man and his parrot were in line. When his turn came, the man looked through the telescope and said nothing. Then, he took the parrot off his shoulder and held its eye to the eyepiece of the telescope. The parrot looked at Jupiter and squawked! This was the only sound uttered by the man and his parrot during that memorable Saturday evening in the month of September in 1997.
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And so the flurry of new little spaceships continues ... A baby space station now orbits over our heads every ninety minutes ... Deep Space 1 chugs its ion engine ... two new invaders are on their way to Mars ... and if all has gone well, little Stardust, the comet dustpan, will have launched in early February on its mission to sample and return.

It reminds me that there are neat little video mission profiles to sample ourselves—and to remind the reader of that in this column's first item.

Mission Videos

In the June 1998 column, I reviewed an excellent seven-and-a-half minute videotape, produced by Engineered Multimedia, Inc. (800 Old Roswell Lakes Parkway, Suite 100, Roswell, Georgia 30076 USA, telephone: +1-770-993-8384, fax: +1-770-993-8352, e-mail: info@engmm.com, web site http://www.engmm.com) for the Jet Propulsion Laboratory in Pasadena, California which outlines the Stardust mission using first-rate computer animation and narrative. It's handy video to have now that the mission should be underway.

Check with your regional NASA Educator Resource Center to see if they have a copy. If not, or if you don't have access to such, you can obtain a copy of the videotape from NASA CORE (Central Operation of Resources for Educators), Lorain County JVS, 15181 Route 58 South, Oberlin, Ohio 44074 USA, telephone: +1-440-774-1051 extension 235 or 249, fax: +1-440-774-2144, e-mail: nasaco@leeca.esu.k12.oh.us, web site: http://spacelink.nasa.gov/CORE. The cost $10 U.S.—and well worth it.

By the way, NASA CORE offers a good variety of slide sets, videotapes, computer software, and memorabilia. You can obtain a free catalog by writing to the above-given address, or you may order one on-line via the CORE web site.

I didn't see that CORE had available the "Mars Surveyor '98" video which I reviewed in the September 1997 column—a similarly excellent mission profile of the Mars Climate Orbiter and Polar Lander prepared by the same parties. But I believe that copies were distributed to regional affiliates as part of the materials distribution arrangement that IPS has with JPL. So check with your regional affiliate or with one of the IPS officers to inquire about obtaining a copy. Again, it's well worth having as these missions unfold.

Winds of Mars

While we're thinking Mars, you might check out a new musical album entitled Winds of Mars, produced by Music Crest Productions, P.O. Box 2945, Minneapolis, Minnesota 55402 USA, telephone: +1 612 338 5461, fax: +1-612-338-4769, e-mail: windsofmars@premiergallery.com, web site: http://www.windsofmars.com.

The album features classic works of Johann Sebastian Bach performed by pianist Roderick Kettlewell, underscored with the sounds of Martian winds as digitized from data obtained from Pathfinder's wind sensor on Day 25 of its historic 1997 mission. The seventeen Bach selections (from two to five minutes each) are divided into four "scenes," with the winds varying on each track. I listened to the CD, and it's relaxing—Bach's music played simply and elegantly on piano, Mars whispering and blustering in the background, the winds coming up to fill the spaces in between each piece. The music varies from the classic "Air on the G String," "Jesu, Joy of Man's Desiring," and "Sleepers Awake," to several selections from The Well-tempered Clavier and the Anna Magdalena Notebook, to lesser-known pieces, played sparsely to echo the lonely sounds of winds wafting over the rocks and ancient washes of the Red Planet.

For fans of Bach and Mars, this is a good choice; I'm a fan of both, and I found the
album an enjoyable listen. Wholesale educational institution rates are $14.39 U.S. for ten CD's or less, with the price going down for larger quantities, and $10.39 U.S. for ten cassettes or less, again with lesser prices for larger numbers. Suggested retail price is $17.99 for CD and $12.99 for cassette. Contact the company for more information and perhaps a sample copy to consider for your gift shop.

Custom All-Skies

Last fall, at the conference of western American planetarium affiliates in Los Angeles, Laura Misajet of LM Images, P.O. Box 948, Narberth, Pennsylvania 19072 USA, telephone/fax: +1 610-664-0308, e-mail: lmimages@aol.com made a presentation in which she described her work of providing planetarium all-sky and panorama slide sets for use in all-sky projectors, using DigiDome software to customize the slides to match dome diameter and projector configurations with built-in soft-edge masking.

Laura showed some of the imagery available from her company, ranging from clouds and Pathfinder pans to fractal designs. It was beautiful, interesting stuff, all nicely applicable to planetariums in a variety of ways. In addition to the sets she offers, she can scan most any image or artwork customers supply to create new all-sky sets.

LM Images offers standard all-sky sets at $250 U.S. per set, $200 apiece when more than one set is ordered. Custom creations cost an average of $300-$350 per set depending on the job. For more information, contact Laura as given above, or check out her brand new web site at http://members.home.net/misajet/lmimages.htm.

Millennium Star Atlas

We could argue all day, I suppose, about when the new millennium starts, and who cares anyway beyond a bunch of computer programmers. Regardless, here's something you don't have to wait until the new millennium to use: a new star atlas by Roger Sinnott and Michael Perryman published by Sky Publishing, Inc. and produced in collaboration with the European Space Agency (ESA).

The Millennium Star Atlas is advertised as the first atlas based on the stellar positions, brightnesses and distances measured by ESA's Hipparcos satellite. It's a hefty tome indeed, consisting of three oversized, hardcover volumes (about nine by 13 inches — 23 by 33 cm) in a protective slipcase presenting the entire celestial sphere in 1,548 individual charts measuring 5.4" by 7.4" in size. The maps offer crisp black star images on a white background—some 1,058,000 of them down to visual magnitude 11, including 22,000 multiple stars plus more than 10,000 nonstellar objects.

I've had the privilege of examining a copy and it's an impressive effort indeed. The first volume includes an introduction, a reference and bibliography section, and an overview of the Hipparcos mission. Each of the volumes includes a chapter on how to use the atlas, an index to names of celestial objects, and chart keys showing where each chart fits on the section of sky featured in the volume. The coordinate grids are positioned for Epoch 2000, but the star positions are plotted for early 1991, centered on the three-and-a-half-year Hipparcos mission when the data was gathered. (The resulting shift is undetectable at the scale of the atlas [100 arcseconds per millimeter] for all but the fastest-moving stars, the authors assure.) The star charts themselves are presented using conic projection.

I found the charts to be nicely functional, using fairly standard symbolic designations for variable stars (some 8,000 of them) and deep sky objects. Variables are surrounded with either solid, dashed, or dotted lines, depending on the magnitude of variability. The brighter stars with names and/or Bayer or Flamsteed designations are labeled a such, variables are likewise labeled according to their convention, and deep sky objects retain their catalog numbers and common names. Double star pairs closer together than 30 arcseconds are indicated by a "tick," a line extending to one side which indicates the amount of separation (in exaggerated form) and the orientation of secondary to primary at the catalogue epoch (1991.25). (Double star components with larger separations are plotted individually with overlapping disks.) In especially nice touches, some 10,000 stars closer than 200 light years are labeled with their Hipparcos-derived distances, and stars with proper motions faster than 0.2 arcseconds per year are shown with small arrows indicating the direction of travel and the angular distance covered in 1,000 years.

You can also learn some interesting esoteric facts. For example, Hydra is the constellation with the biggest sky area. But which constellation has the most naked-eye stars (down to magnitude 6.5) within its borders? (Centaurus.) Which has the fewest? (Equuleus.) Which has the most stars down to magnitude 11? (Cygnus.) Which has the greatest density of stars? (Crux — the smallest constellation in the sky, but located in a very star-rich area.) Which has the least? (Coma Berenices; the queen's locks are thin, so far from the band of the Milky Way — all the better to see galaxies beyond!)

To aid in the use of the atlas, a set of transparent acetate overlays can be purchased in addition. The first includes a variety of useful references: finer subdivisions of stellar magnitudes, sets of double star separation ticks and proper motion arrows to gauge distances, a 360° protractor for measuring orientations, a ruler for measuring angular distances between objects, and a Telrad 1X finder pattern at the chart scale to aid in telescope pointing. The second offers a series of circles with diameters ranging from one-quarter degree to three degrees to help visualize fields of view for different-sized eyepieces and finder scopes, a 35-mm film frame for visualizing photographs taken with an 8-inch (20 cm) f/10 telescope, and circles representing the diameter of the moon at perigee and apogee, to help plan for occultation observing. The remaining four overlays contain finely subdivided coordinate grids which can be used to determine accurate coordinates for plotted objects, or for accu-
rately locating non-plotted objects such as asteroids, comets, novas, or faint galaxies.

This is a fine atlas indeed for the serious amateur or professional—serious because it ain't cheap at $249.95 U.S. (The overlay set costs a modest $19.95.) But it is a reference that can serve a serious stargazer for a lifetime, representing the best data that can be had at the present time. And it's the only way I know of to hold a million stars in your hands!

You can find the *Millennium Star Atlas* in the 1999 Sky Publishing catalog, along with a plethora of other astronomy-related products—slides, posters, books, computer software, globes, and other items—many old favorites, and many new entries. For a catalog or to place an order, contact *Sky & Telescope*, 49 Bay State Road, Cambridge, Massachusetts 02138 USA, telephone 800-253-0245 (international orders telephone: +1-617-864-7360), fax: +1-617-864-6117, e-mail: orders@skypub.com, web site: http://www.skypub.com. Customer service contact information is as follows—U.S. and Canadian calls: 800-253-0245, international calls: +1-617-864-7360. Note that members of astronomy clubs (world-wide) who subscribe to *Sky & Telescope* through the S&T club subscription plan (and whose clubs include at least four others who do this) are eligible for a 10% discount on astronomy books and products. (If you qualify, you've just knocked $25 off the cost of the *Millennium Star Atlas*.)

**Precessional Planisphere**

Learning Technologies, Inc., 40 Cameron Avenue, Somerville, Massachusetts 02144 USA, telephone: 800-537-8703 or +1-617-628-1459, fax: +1-617-628-8606, e-mail: starlab@starlab.com, web site: http://www.starlab.com, has announced an ingenious product that offers a new twist on an old concept: a planisphere that can precess.

Created by Milton D. Heifetz, the three-layer planisphere, ten inches (26 cm) in diameter and made of sturdy plastic, quite literally allows you to set the sky for any date and time thousands of years past or future—through the entire 26,000-year cycle of the precession of the equinoxes. The base plate contains the standard Northern Hemisphere starfield (black stars and constellation figure lines on a white background, with a gray Milky Way) and the ecliptic; the central rivet is positioned at the North Ecliptic Pole. The transparent middle plate (attached to the base at the North Ecliptic Pole rivet) contains the Celestial Equator and markers for the solstices and equinoxes (as well as the perimeter calendar of dates). The transparent upper plate is inscribed with the horizon oval and the perimeter scale for time, and is attached to the middle plate by a second rivet marking the position of the North Celestial Pole.

To use it, you set the middle plate for the year desired according to the 26,000-year scale around the perimeter of the base plate (marked off in 250-year increments); this sets the position of the North Celestial Pole in proper relation to the North Ecliptic Pole for that year. You can then manipulate the upper plate as you would for any regular planisphere, and can see what stars were visible above the horizon at any particular date and time—as well as where the solstices and equinoxes were located along the ecliptic. You can set the device for the current year and use it as a normal planisphere. Or you can set the date to 5000 years in the past and see how the sky pivoted around the star Thuban when the pyramids were being built. Or you can set the date to 10,000 years in the future and see how the sky looks with Vega as the nearly North Star. It's cool, and the nearest thing yet that I've seen to a flat planetarium!

On the back of the base plate is a brief, cogent explanation of precession with step-by-step instructions for using this slightly more complicated version of the handy starfinding device we've employed (and sold) for many years. For those who may want to start the uninitiated off on something less complicated, Learning Technologies also offers a second standard two-plate planisphere of similar style to the first, 8.5 inches (22 cm) in diameter, also created by Heifetz. This one has the pleasing feature of showing undistorted constellation patterns along the periphery—in other words, Scorpius and Sagittarius aren't squashed. I like planispheres with this feature, especially for novice stargazers for whom undistorted patterns is more important than slightly out-of-whack relative positions.

My only real quibble is that the "historical planisphere" (as the precessing version is called) is only offered in a 30° North Latitude configuration. I understand from John Mosley (who offered input on the precessional design aspect, incidentally) that this is because the planisphere was originally designed to assist those researching early Near East astronomy in visualizing the sky in the last thousand years B.C. It thus makes sense that the planisphere is configured for the sky of Babylon. But as a product for wider dissemination in the Northern Hemisphere, I think this is too southerly to serve as a good "catch-all" for Northern Temperature regions (40° North Latitude is the customary choice if a company offers but one Northern Hemisphere planisphere, and that works better notably for central North America, south/central Europe, and central Asia). It's perhaps not as much a problem for the familiar contemporary sky as it is for the sky past and future, when the sky shifts to an unfamiliar setting and offsets may not be as easy to estimate. I hope that the distributors will consider an additional more northerly latitude configuration for the future; when you're offset by 15° or more (as in my case), loss of accuracy starts to become significant. The standard version planisphere (again offered in one latitude "flavor") does a little better, set as it is for 35° North.

Latitude comments aside, I think the Heifetz "historical planisphere" is wonderful—a true innovation in planisphere design, and one that teaches new concepts in the process of use. You'll certainly want one for yourself—more for your classes, and some for your gift shop (for those of your public who won't be intimidated by the extra layer of astronomy presented, and assuming your latitude offset is within a reasonable tolerance). And the price is right: the precessing version sells for $12.95 U.S., the regular version, for $9.95. Wholesale quantities for resale are offered at a cost of $9.66 U.S. per unit for the historical version for a minimum order of two dozen ($6.50 per unit for the standard version, for the same two-dozen minimum order).

Get it. You'll be glad you did!

**From Stargazers to Starships**

If you ever wanted a good, basic astronomy primer with on-line access for students, teachers, and planetarians alike, then bookmark this web site: http://www-spsf.gsfc.nasa.gov/stargaze/Sintro.htm. Here you will find a book-sized collection of linked documents written by NASA scientist David P. Stern from the Laboratory for Extraterrestrial Physics, Code 695, Goddard Space Flight Center, Greenbelt, Maryland 20771 USA, telephone: +1-301-286-8292, e-mail: usdps@lepvax.gsfc.nasa.gov.

This impressive compilation is designed, according to the author, to offer an introduction to three areas: 1) the night sky and what it tells us, 2) Newtonian mechanics, and 3) space flight and spacecraft. And it does. What you'll find is the stuff of an astronomy course—maybe two—written at the high school level, with some 35 main sections and almost as many subsidiary ones to explore. I did some exploring part of one afternoon, and all I can say is take along a sandwich; you could spend some time in here!

The sections are generous on text, as would be expected, but also include many simple diagrams and black-and-white and color pictures. The sections include mathematics in appropriate places, and there is a...
math refresher section to help. Topics cover
the gamut, from concepts of the celestial
sphere and sundials, through seasons, preces­
sion, the calendar, past Kepler's law's, on to
Newton's laws and frames of reference, to
the principles and history of rocketry and
space flight — with lots of historical and
anecdotal stops along the way. There is a
glossary of terms, an astronomical timeline,
hints on using the site, and links to the NASA
and Goddard Space Flight Center home
pages.

There's a lot of stuff here — historical, con­
cceptual, contemporary, mathematical — and
it's well worth checking out and adding to
your resource list. The author also welcomes
comments and suggestions, and can be
reached at the e-mail address given above.

Astronomy Day Alert

It's not too early to be thinking about
Astronomy Day, a date “set aside each year
for astronomy related organizations to host
special events related to astronomy for the
general public,” according to a news release I
received from Gary Tomlinson of the Chaffee Planetarium at the Public Museum
of Grand Rapids in Grand Rapids, Michigan
— the “Astronomy Day Headquarters” for the
event, which is coordinated by the Astro­
nomical League. The event is international
in scope and is co-sponsored by fifteen
organizations including IPS.

Gary reported in his news release that
institutions and people organizing events for
the day can now list their events on the
Astronomical League web site at http://
www.astroleague.org. This will also give
browsers an opportunity to see what events
may be occurring in their areas.

So plan an event in celebration of astro­
nomy — and let people know by listing it with
the Astronomical League.

New Officer on Deck

Congratulations to Martin Ratcliffe of Ex­
ploration Place, Wichita, Kansas USA (for­
terly of the Buhl Planetarium at the Carnegie Science Center in Pittsburgh, Penn­sylvania USA and the Armagh Planetarium
in Armagh, Northern Ireland), who assumed
the office of IPS President-Elect on January 1.
Those of us who know Martin know that he
will be an excellent representative of our
profession for the next six years. So long as
he avoids those elk. (Long story.)

Astronomy Products

Star Globe. Several recent astronomy-relat­
ed additions to my museum's store have
captured my eye; this is the first of them. It's
another new wrinkle on the standard plani­sphere called the “Star Globe.” Reminiscent
of a little navy-blue Saturn, it consists of a
3.5-inch (9 cm) wide celestial sphere imprinted
with white stars and constellations on the
dark blue background, surrounded by a flat
ring an inch (2.5 cm) wide which represents
the horizon. The unusual bit is that the
sphere does not show the constellations
reversed as in a true outside-the-celestial­
sphere view, but shows them as we would
see them from our inside view.

You can set the sphere for any latitude
north or south and can set the desired date
and time (during nighttime hours) by
manipulating a ring girdling the celestial
equator. You then see the which lies
above your horizon at that moment. There's
a tiny compass embedded in the horizon
ring to help you find the cardinal directions
outside, and you match the real the
little hemispherical sky by facing the
direction you desire and then turning the con­
traption until the corresponding direction
indicated on the horizon ring is facing you.

STARLAB Planetarium . . .
The Portable Universe

Many of you, in planetariums worldwide, already know how easy
it is to incorporate a STARLAB into your existing planetarium
programs. Because of its versatility, portability, ease-of-use, and
cost-effectiveness, the STARLAB is considered an invaluable and
exciting multicultural tool for education. STARLAB can be used
in conjunction with a fixed planetarium for:

- school outreach
- training programs
- multicultural education
- workshops
- special events
- community outreach
- hands-on education
- public relations
- teacher training
- fundraising

Visit our web page at <www.starlab.com>
or contact us for free information about
the STARLAB Portable Planetarium.
You can look at it face-on or can hold it above your head to get a better sense of the whole sky. The device comes with a small key ring flashlight to help you use the device at night, as well as a small stand for displaying it when you’re not.

It’s clever and cute, but I find it unnatural to be looking on the outside surface of a hemisphere to find my way around a sky which appears as an inside surface of a hemisphere. Foreshortening effects around the “limb,” for example, are significant and distracting. It makes a nice desk decoration and conversation piece, but there are better tools if you’re actually trying to find constellations, in my opinion. And you lose interesting bits of the sky—Orion’s midsection, for example—with the day and time scales expropriating the celestial equator region. But as a little, inexpensive bit of functional astronomy art, I like it. And it functions equally well for Northern or Southern Hemisphere.

Star Globe is made in France by Sculptures-Jeux in Paris, and is distributed in the U.S. by Sarut, 107 Horatio Street, New York, New York 10014, telephone: +1-212-691-9453, fax: +1-212-691-1077. Wholesale price is about $19 U.S. Contact the company for more information.

Celestial Mobile. While we’re on astronomical art, our store carries several astronomical mobiles, my favorite being the one called the Celestial Mobile made of handcrafted wooden elements—artistic representations of stars, the moon, Saturn, and a meteor, painted in gold and dark blue. I think it’s quite attractive as mobiles go, and includes a printed sheet giving basic information on the objects represented. (The information is quite reasonably accurate, too, aside from the small transgression of referring to the sun as being yellow-orange.)


Dear Diary. Looking for an appropriate receptacle for your inmost thoughts (and observing notes) while stargazing? Then consider The Nature Company’s Naturalist’s Journal entitled Skywatching. This bound volume (slightly under six by nine inches—15 by 23 cm) is filled with blank pages, ruled and unruled, awaiting your choicest scribblings. The manila-colored pages inspire with full-color thumbnail drawings of planets, constellation figures, spacecraft, skygazers and astronauts stuck into corners and around the edges, as well as snatches of poems and sayings. In the very back are listed some astronomy milestones of the twentieth century. Attractively bound with a blue cover decorated with tiny, tasteful planet images, with a dark blue bookmark ribbon to help you find your place, it’s almost too pretty to write in. You’ll want to use your best penmanship.


It’s also inspired me to wrap things up using the words of Alexander Pope quoted in its pages—a little something from his “An Essay on Man” that could almost serve as an astronomer’s (or planetary’s) credo:

He who through vast immensity can piece,
See worlds comprise our universe,
Observe how system into system runs,
What other planets circle other suns, ...  
May tell us why Heaven has made us as we are.

With that thought in mind, and until next time... what’s new?
ElectricSky™ is a proven, multi-use digital dome theater powered by award-winning desktop graphics and video production tools like 3D Studio Max®, Adobe Photoshop® and Adobe After Effects®.

The heart of ElectricSky is ImmersaVision™—a panoramic, digital video display system developed by Spitz especially for planetaria. Compatible with 2D and 3D computer graphics, film, HD video, still art, photographic images and more, ImmersaVision gives you the freedom to create original, wide-format video content from a variety of source media.

Add the planetarium standards — star projection, hemispheric multi-image, surround sound, laser graphics and our new ATM-4 show controller — and the result is a complete, flexible environment for group education, entertainment and training. Open-architecture design, high audience impact and affordable price make ElectricSky the immersive theater for the next millennium.
This time we have a guest in the Computer Corner, Keith Johnson of the Fleischmann Planetarium. Take it away, Keith!

Stars in Your Palm!
Keith Johnson
Fleischmann Planetarium
University of Nevada
Reno, Nevada 89557-0010
keithj@equinox.unr.edu

Most of us have been using desktop computers to aid us in our astronomical endeavors for quite a while. But when we're out in the field, at a star party for instance, we generally don't have that resource available. Even laptop computers are a bit much to lug around when you're also trying to carry a telescope and mount.

But now there are computers smaller than laptops that can provide a surprising amount of information and still fit into a pocket. The most popular of these is the PalmPilot. I got one of these a few months ago, and found it to be an amazing gadget.

*The Palm and/or Pilot.* It started as the Pilot, and was (and still is) mainly intended to be a portable digital assistant. After a major upgrade, and a buyout by U.S. Robotics (I think I've got this right!), it became the PalmPilot; the latest version, now under the 3Com umbrella, is the Palm III. By the time this article appears, the next version, code-named Razor, may be available (and who knows what company will be it, or what it will be called).

But they all contain the Big Four: a datebook, an address book, a To-Do list, and a memo pad. All of these are well-done, by the way. The later versions have more bells and whistles: a calculator, built-in telecommunications software, and expense accounts.

But wait! There's more! With one or two meg of RAM, and with the tight coding limits imposed on the programmers, there is a lot of memory left over. You can actually install new applications of your choice.

*Astro-apps.* At first, most of these were understandably business-oriented. Soon, however, programmers discovered a market for a vast range of other types of programs. Astronomy was late out of the gate, but several programmers are working hard to catch up. Let's look at a few of the astronomy programs available at press time. By the time you read this, there will surely be more.

J-Moons! Yes, the exclamation mark is part of the name. Ed Wilborne has created several useful utilities; he uses the bang in all of his program names, and we'll look at several of his productions.

**J-Moons!** is one I could have used in times past when observing Jupiter at the telescope. A few knowledgeable public types actually recognize the names of the Jovian satellites, and ask me which one is which in the telescope. Now I can haul out my Pilot and show them a graph of the four Galilean satellites with labels. If my telescope displays a reversed field, I just touch a button with my stylus, and the Pilot picture reverses the image. If it's dark, I just turn on the backlight. This item is $5 shareware. Wilborne's software is available at http://www3.gamedwood.net/mew3/pilot, and at other places on the Web such as PalmPilotGear.

**Sun!** Here is current information about the Sun: rise, set, and transit times. There is a table of the start and end of all three sorts of twilight times.

Perhaps the cleverest feature is a compass. The Pilot draws a circle with the four principal compass directions, plus an additional radial alignment marker. You line up this marker with the Sun, and the four other lines point to the four directions. If you don't feel this is accurate enough, touch a button, and the display flips to accommodate a shadow. Hold your stylus in a vertical position, line up its shadow with the marker line, and read off directions. Sun! has a shareware fee of $5.

**Moon!** Similar to Sun!, Moon! provides rise, transit, and set times for the Moon. It takes a few seconds, as the PalmPilot isn't equipped with high-power math functions in ROM. As in all of Wilborne's programs, you can change the date and time, or move to a different location, and save your favorite locations in a data base. It's similar to Sun!, but because the Moon requires more computation than the Sun, it costs $10.

**Moon Phase.** Wilborne's Moon utility says nothing about the phase, but this program by Steven Kienle fills that void. You get phase and age info, and a nice little graphic illustrating the Moon's appearance for the chosen date. It's freeware, and can be found at www.eurocool.com.

**StarPilot.** This is perhaps the most impressive of them all. I never thought a star-chart program could work on the Pilot, but StarPilot does a pretty good job. The Pilot screen is small, so the stars are too large (but that's true to a lesser extent for any star chart), and the magnitude intervals are too large. One nice function: you can adjust the magnitude limits, both at the top and the bottom end. There are even two buttons labeled "Rural" and "City" that adjust the display for those two conditions (the latter takes less time to redraw than the former).

One useful feature for sky-watchers is planets: they are displayed in their proper positions, with alphabetical symbols. You can zoom in on a selected section. Finally, you can click on any object, and if it's a star, you'll discover its name, its color, and its distance in a small text box. If it's a planet, you'll get its distance. Now, if they could only do that for Messier objects...

**StarPilot** is available at the Web site for Star-Pilot Technologies, www.star-pilot.com; it runs $30. You can also get a combo package of Star-Pilot, Sun!, Moon!, and J-Moons! for $44.95.

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Vol. 28, No. 1, March 1999

*Planetarian* 53
Planetarium. Here's an alternate and useful presentation of current planet information. There are two views offered. One is a star chart view of a portion of the sky, showing stars and planets with the horizon showing.

The more interesting display is "Compass" view. One circle plots the solar-system bodies in azimuth. A side benefit of this display: you can use either the Sun or Moon, or maybe even a bright planet, to align the chart and make into a simple compass.

Another half-circle plots them in elevation. One body is selected, and for it numerical data is shown, including RA/Dec, ecliptic longitude/latitude, azimuth/elevation, and distance. The current appearance of the Moon and the phase fraction is also provided.

Planetarium has another feature usually found only on desktop programs. You can step forward and backward in time by pressing the up and down hardware buttons on the Pilot; time increments are selectable. The author even includes sidereal increments. It takes a couple seconds to update the display, so it's not quite like a movie, but you can use this to search for conjunctions and eclipses, and view retrograde loops, quite nicely. You can even activate an automatic update, so the display redraws itself every minute. Planetarium is written by Andreas Hofer, and is available from PilotGear (www.pilotgear.com) for $16.

E-text. If you have a text file of information — Bible passages, this year's schedule for the Chicago Cubs, the latest Spider Robinson novel — on your desktop computer, you can convert it to E-text format, store it in your Pilot, and use one of several text readers to peruse it while waiting for the bus.

There are several astronomy-related files of this sort that have been created by Pilot users. I carry a list of information about the planets: semi-major axis, period, density, surface temperature, everywhere I go. I mean, you never know when someone will walk up to you in the street and ask you "What is the surface gravity of Neptune, anyway?" There are also E-text files of the Messier list, information about Apollo flights, and many more.

A good place to start for E-text, and for Pilot shareware and freeware in general, is www.memoware.com.

Other stuff. There is a host of other applications that are astronomical, or almost astronomical. A German programmer has done a very nice navigation aid. Another user has created a data-base (yes, there are data-base applications for the Pilot) of the Messier objects. Tide Tool will give you information about tides for many years in the past and into the future. Unfortunately, there is a horoscope program for the Pilot. You can attach a GPS receiver to one of the newer Pilots and find out where you are. DeLorme has a utility that will download street maps into your Pilot from its atlas CD-ROMs.

In fact, there is one program called SoftGPS that emulates a GPS receiver entirely in software. It will tell you exactly where you are when you run it. For details, see the accompanying diagram. There are other humorous programs that most planetarians will probably find a use for. One of my favorites is Tricorder, which converts your Pilot into a miniature Star Trek scanning tricorder, with animated graphics and blinking lights (and hilarious readouts). And, of course, the Pilot will play Mine Hunt, and solitaire, and something like Pac-Man, and a surprisingly good game of chess, hard as that may be to believe.

I haven't room here to describe more about the PalmPilot — how you input data with the stylus, how to synchronize/backup the Pilot to your desktop computer, how to surf the Web using your Pilot (yes, really! I've done it!), etc. — but if you're interested, you might check out the numerous Pilot Web sites. A good starting point for basic information is www.palmpower.com, a free on-line magazine. To see what kinds of software and other products are available, try www.pilotgear.com (a commercial site) and www.eurocool.com (mostly shareware, and tons of it). The company's PalmPilot page is at palm pilot.3com.com, though that's typically commercial glossy.

To me, the Pilot phenomenon has the same flavor that the Maccintosh had at its inception. It's fun to play with, it does a lot of very useful things, and it's created an active community of dedicated users and programmers... but you can get one for under $400!

A note about the figures accompanying this tome: they may appear blocky in print, but when seen on the PalmPilot itself, they look quite acceptable and usable, if a bit on the small side.

... The demonstration that no possible combination of known substances, known forms of machinery and known forms of force, can be united in a practical machine by which man shall fly long distances through the air, seems to the writer as complete as it is possible for the demonstration of any physical fact to be.

— Simon Newcomb
Sidelights on Astronomy, 1906

This foolish idea of shooting at the Moon is an example of the absurd length to which vicious specialization will carry scientists. To escape the Earth's gravitation a projectile needs a velocity of 7 miles per second. The thermal energy at this speed is 15,180 calories. Hence the proposition appears to be basically impossible.

— A. W. Bickerton, 1926
Building or retrofitting a planetarium? Call Sky-Skan.
We make the finest, most reliable multimedia systems for domed theaters on the planet. Our integrated systems offer:

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Meteors
At 3 a.m. on Wednesday, November 17 with a fuzzy blanket and pillow on a chaise lounge on patio, I watched the Leonid meteor shower. A bolide streaked across the southeastern sky as I plopped down my low. Several meteors streaked here and there as I settled down and fought sleep. Then a thought stirred me away from slumber. I smiled as I thought of an earlier meteor watch.
During the mid-fifties there was briefly mentioned in Current Science and Aviation a more comfortable way to watch meteors. However, the textbook of my junior high school science class, Adventures in Science, showed an illustration and presented a list of simple things to aid the comfort.
To bring the demonstration to life for my classes of students, I procured a folding chaise lounge, warm jacket, hat and gloves, blanket, flashlight in a brown paper bag, clipboard, pen, portable radio and a few other things of my own design.
The Demonstration.
To demonstrate, I set the stage for the need by explaining that all one has to do see meteors is to go outside, look at a dark sky, and usually the observer or a companion will see a meteor or more likely, the person's companion will see the first one behind the observer's back. However, there some additional things can make the observing much more comfortable.
From a hidden spot in the classroom, I disclosed the old folding chaise lounge and splayed it on the demonstration table. Produced a blanket. Changed costume by donning an old jacket, scarf, hat and gloves. Plugged in an electric cord leading from a black box. Tuned the radio to some classical music station, climbed atop the demonstration table and settled onto the chaise lounge.
As the students giggled and tittered, I pretended to see meteors flitting across the classroom ceiling and I reached for the black box. From under the black box came a drinking mug followed by a hot pot steaming with cocoa mix and water. Thereupon, I poured a mug of hot chocolate and settled back to watch meteors with class.
The High School Astronomy Class Demonstration.
Later, I taught high school astronomy and the demonstration was repeated with an added bit of sophistication in addition to a newer chaise lounge, clothing, radio and black box. However, the students were aghast when the high school principal walked in the door of the classroom just as I took my place on the chaise lounge. Their laughter changed to groans as I sipped the hot chocolate and smacked my lips. Their groans changed to sighs of contentment when I pulled from a hiding place the half pints of chocolate milk that the principal and I procured from the school cafeteria.
A Planetarium Show.
Still later, at the Planetarium of St. Petersburg Junior College, the demonstration was modified to become a Friday evening public show.
The trapezoidal podium on which I stood to make the usual introductory remarks was adapted with 2 inch by 4 inch lumber to support the folding chaise lounge and to clamp it in place. The usual black box with hot pot was plugged into a switchable outlet. The old jacket, scarf and hat were hung from a demonstration skeleton support stand so it could be easily wheeled into place.
A fireball meteor projected from a Talent Meteor Projector streaked across the newly introduced darkened starfield to set the stage. A meteor shower projected from an overhead projector with a dimmable lamp circuit lead to an explanation of meteors and to the problem of How to Watch Meteors with Class. A switch was tripped to start the pot heating under the black box as a spotlight supported by the star projector was dimmed up to reveal some items that would be needed: chaise lounge that was clamped into place, clothing items, red lensed flashlight and radio.
The audience members probably left the planetarium wishing they could grab a cup of hot chocolate on the way up the stairs to the observatory. A gentleman told me years later that the lesson on How to Watch Meteors with Class was the one he remembered the most.
Epilogue.
It was 4 a.m. when I fell asleep for a few moments, woke, abandoned the chaise lounge on the patio, grabbed my blanket and pillow and went to bed.
During the next early morning of the meteor shower, my blanket, pillow and I went out at 4 a.m. and at 407 the sky clouded over as a fog rolled in and the blanket, pillow and I went back to bed.

Planetarium Memories
How to Watch Meteors with Class
Kenneth E. Perkins
6624 12th Avenue North
St. Petersburg, Florida
33710
perkink@mail.firm.edu

One hour of Leonid Meteors and a Memory.
At 3 a.m. on Wednesday, November 17 with a fuzzy blanket and pillow on a chaise lounge on patio, I watched the Leonid meteor shower. A bolide streaked across the southeastern sky as I plopped down my pillow. Several meteors streaked here and there as I settled down and fought sleep. Then a thought stirred me away from slumber.
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Universe in Your Classroom
A workshop on the teaching of space and astronomy in grades 3 - 12
University of Toronto, July 2 - 4, 1999

A workshop for elementary and secondary school teachers (and those who work with them) is being offered by the non-profit Astronomical Society of the Pacific as part of our 111th Annual Meeting. There will be a review of current research on how students learn astronomy most effectively followed by a wide variety of sessions and mini-workshops on hands-on activities, and useful resources. The focus of the first two days will consist of practical strategies for teaching astronomy in the US as well as for the new science curricula in Canada. There will be separate streams for beginning (elementary-level) and more experienced (secondary-level) teachers. Everyone will receive a thick package of activity handouts and resource materials. The third day will feature non-technical talks by noted astronomers on topics relevant to the new curricula as part of a general astronomy expo, called Universe 99.
Registration is limited and is available on a first-come, first-served basis. Early registration fees are $59 US for ASP members or $65 for nonmembers. After May 14, add $20 US. Request a registration brochure by writing: Laurie Keechler, ASP Annual meeting, 390 Ashton Avenue, San Francisco, CA 94112, or go to website www.aspsky.org.
A planetarium is a spectacle, an event, but above all a tool which provides amusement in the service of knowledge. To meet all these needs, RS AUTOMATION INDUSTRIE, thanks to its specialization in automation, has developed a complete range of planetariums, all designed to provide a specific and immediately operational solution.

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E-mail : rs.automation@wanadoo.fr
I'm wearing my "Starlady" hat today. I could be speaking of a figurative hat: a reference, perhaps, to some role I'm assuming today that exploits my planetarian expertise. But no, I'm speaking of a real hat, a baseball cap, with the word "Starlady" and a comet picture sewn on the front. I just feel like wearing it today; I love it. It was a gift, one of many planetarian-related items I have acquired through the years from friends and relatives. It goes like this: you must get a gift for someone for an upcoming special occasion. It might be a birthday or Christmas gift. You want it to be unique. Does the intended gift receiver like dogs? How about a kitchen wall clock with recordings of a different breed of dog barking at each hour? Does he or she collect...clowns, glass figurines, movie Memorabilia? Here it is in this shopping mall store, pushcart display! A perfect gift for my planetarian.

I've been a planetarian for a long time now (never mind how long!), and have received many presents. These presents can usually be grouped into categories. The most obvious category to interest a shopper for a gift for a planetarian: books! I have received lots. A representative sample is a fabulous coffee table book of earth-from-space photos called *Looking at Earth*. My favorite book came during the Comet Halley era of 1985-86. It's a child's pop-up book about comets. As you turn each of the 15 pages, parts of a scene pop up from the surface of the page. The scenes are related to space themes, with an emphasis on comets.

The second most obvious category for gifts is you guessed it: *sweatshirts or T-shirts*! I sometimes wear my "Solar System", "Earth's Moon", or "Good planets are hard to find [Earth picture]" sweatshirt to class, correlating with the day's topic. My favorite planetarian sweatshirt designs are homemade: one with a 10-inch circle on front with a sequin-sewn constellation star map inside the circle, and one with cut-out cloth SLOs (Spacey Looking Objects) glued on a plain sweatshirt.

I have a sweatsuit also, black with cut-out cloth SLOs glued on the pants and top. I have a "H-R diagram" T-shirt that I wear when I teach astronomy, but the students aren't as interested in it as I am. My favorite T-shirts are homemade: one which says, "Planetarians sing 'Ah Capella" (a reference to my choral-singing hobby), and another whose letters spell out "Planetarians don't do it. They just planet.

My husband George, who is a Starlab (portable) planetarian, gets these types of presents too. He has received two watches. One is a Casio model which not only displays the time, but also the present position of the planets and a list of past and future solar eclipses. He also has a watch which shows a floating astronaut rotating around a pin in his stomach (ouch!) on the face of the watch.

Next category: *constellations*! Do you have the umbrella with star figures drawn on the cloth inside, and Polaris located where the tip of the umbrella is thrust through the fabric? When you twirl the umbrella, the "sky" moves around Polaris. I do! It's a wonderful item to keep handy in case the electricity goes off in your planetarium in the middle of a "Star Identification" show or an "Earth Rotates" lesson and you have a flashlight handy.

Also in the constellation category of "Gifts for Planetarians" is a rubbery bowl-shaped thing in which you change the constellation scene by rolling the rubbery part over the circular ring which delineates the circle shape. I, of course, have a "Home Planetarium" which is a round plastic box about 5 inches deep. The top is pierced with star-pattern holes, a light is inside. Note pad cubes seem to be the rage these days. My notepad cube has labeled constellation patterns on each of the four 3-inch square sides: 4 different ones, one for each season! I had a wonderful eleven-inch diameter wall clock whose hands kept time on top of a background of a constellation star map. It disappeared from my office over the summer. And now a description of my favorite in the constellation category: this is a set of colored pencils in a transparent box. The twelve pencils are not round; they are four-sided, so they fit snugly next to each other in one layer in this clear box. The black surface of the up-turned side is imprinted with a portion of a constellation "scene". Each portion of the scene continues to the portion seen on the next pencil so that a whole star map picture emerges across all 12 surfaces. Where do they find these things?

This will be continued in a future column. After all, we still have to hit the jewelry, ceramics, candles, photographs, artwork, suncatchers, and "so unusual that it doesn't fit into any category" categories!

I know you've received some unusual gifts. Please e-mail me. The topic is "The most unusual planetarian-related gift(s) I ever received is (are)..."

**Report: "Day the Planetarium Repairman Came..."**

-Thanks, Dave Menke of Buehler Planetarium at Broward Community College in Davie, Florida, USA, for sending your "The Day-The-Planetarium-Repairman-Came" story. In May of 1998, Dave's planetarium closed for about 6 weeks for minor repairs, major cleaning and to replace seats. While it was closed, it seemed like a good idea to also have the duct work cleaned: a 2-week, 16-hour a day process to replace a 30-year build-up of stale air with fresh air.

While the duct engineers were in the Zeiss theatre, up behind the dome, they spilled the white paint they use for the inside of the ducts, which hit the dome and oozed through the holes onto the seating area, console, and floor. It's a good thing the seats were gone and the console covered! The carpet needed cleaning, though.

I guess the duct engineers had never come across a solid surface that wasn't solid before. The duct people worked so hard at removing the spilled pure white paint from the off-white dome that they removed the existing dome finish as well!

Perhaps that's why the duct people worked 16 hours a day, to escape this worrisome job where everything seemed to go wrong. But they weren't through. When the ducsters started painting the outside of the ducts with flat black paint...the paint dropped onto the dome, oozed through the holes, etc! As the project neared completion, Dave reported "The white paint and black paint have been removed, and the finish has been matched well enough that only we and the duct engineers know where the spots, streaks, and marks are (or were). Whew!"

-The next "planetarium repairman" story from Sidney Frohman Planetarium in Sandusky, Ohio doesn't come from its director, Richard Speir, but from the planetarium repairman himself. Eric Mellenbrink, planetarian at the Science Museum of Virginia, and part-time planetarium repairman for Ash Enterprises, was hired to do some work at this facility. Planetarium repairpeople often work at night, after the facility closes, to eliminate down-time for the facility. Sometimes the director stays with the repairman, sometimes not. On this particular evening, Eric was working alone, late at night, in the 73-seat Spitz A3P chamber. "It was spooky", Eric reported. As the evening

(See please Jane's on page 6)
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