Articles

6 Astronomy Education: A Global Perspective .................. John Percy
8 Planetarians and the Art of Communication .................... Steve Tidey
10 Home, Dome on the Range ........................................ Gary Likert
12 Dark and Light Matters: Dance and the Planetarium .... Jenefer Davies
15 Invitation to IPS '96 Conference in Osaka .................. Tadao Nakano

Features

19 Opening the Dome: Host a Radio Astronomy Show ............ Jon U. Bell
22 Focus on Education: Constructing Simple Telescopes ...... Stu Chapman
25 Book Reviews ................................................................. April S. Whitt
31 What's New ............................................................................ Jim Manning
35 Gibbous Gazette ............................................................... Christine Brunello
37 All-Sky Circle: Southern Extragalactic Sky ........ D. Judith & E. Bartha/
................................................................................................. A.P. Fairall, W.R. Paverd, & H. Mair
39 Mobile News Network ......................................................... Sue Reynolds
42 Sound Advice: Computer Digital Audio Workstations .... Jeff Bowen
45 Forum: Preparing for 21st Century ................................. Steve Tidey
53 Regional Roundup ............................................................ Steven Mitch
56 Computer Review: Earthwatch ......................................... Ken Wilson
58 President's Message ....................................................... Jim Manning
66 Jane's Corner .................................................................... Jane Hastings
Zeiss introduces its newest star, the Starmaster. Small in dimension, but versatile in performance, the Starmaster features the latest in Carl Zeiss Jena technology.

For over 70 years, Zeiss has been a trusted leader in the planetarium industry. More than 500 planetariums all over the world testify to the quality, durability and performance of Zeiss planetaria for simulation, education and entertainment.

If you are interested in planning a new facility, or replacing your star projector, give us a call. Seiler can assist you in coordinating your entire Zeiss planetarium package from dome size to seating arrangements, auxiliary projectors, computer software and lighting.

Explore the possibilities. You never know what you might discover.

The Starmaster
Model ZMP

Small in dimension, versatile in performance.

Featuring the latest innovations in Carl Zeiss Jena technology:
- A fiber optic system for the fixed star projection, portable control panel and a 2 in 1 starball design that integrates into existing tilted or horizontal dome sizes of 33 to 59 feet.
- A special version will be available for domes diameters of 59 to 75 feet.

Call your Seiler Instrument representative for details.
INDEX OF ADVERTISERS

Bowen Productions .............................................. 54 & 55
Commercial Electronics Ltd. ................................. 41
Davis Planetarium .............................................. 21
DSC Laboratories .............................................. 40
East Coast Control Systems .................................... 24
Evans & Sutherland ........................................... back cover
Goto Manufacturing Co. ......................................... 44
Joe Hopkins Engineering ....................................... 57
Laser Images, Inc. ............................................... 38
Miami Space Transit Planetarium ............................ 34
Minolta Corporation ............................................ 36
NEOS Technologies ........................................... inside back cover
Planisphere Productions ....................................... 46
RS Automation Industrie ........................................ 18
Seiler Instruments ............................................ inside front cover
Sky-Skan, Inc. .................................................... 17
Spitz, Inc. .......................................................... 30

Associate Editors

Jon U. Bell
Opening the Dome

Jeffrey H. Bowen
Sound Advice

Christine Brunello
Gibbous Gazette

Stu Chapman
Focus on Education

Deborah Judith & Ervin Bartha
All-Sky Circle

Alan Davenport
Scriptorium

Jane G. Hastings
Jane's Corner

Richard McColman
Planetechnica

Jim Manning
What's New

Steven Mitch
Regional Roundup

Sue Reynolds
Mobile News Network

Steve Tidey
Forum

Ken Wilson
Computer Reviews

April Whitt
Book Reviews

Vol. 24, No. 3, September 1995
I. P. S. Officers

President
Jim Manning
Taylor Planetarium
Museum of the Rockies
Bozeman Montana 59717 USA
406-994-6874
406-994-2682 fax
ammjn@gemini.oscs.montana.edu

Executive Secretary
Lee Ann Hennig, Planetarium
Thomas Jefferson High School
6560 Braddock Road
Alexandria, Virginia 22312 USA
703-750-8380
703-750-5010 fax

Treasurer and Membership Chairman
Kelt Johnson
Fleischmann Planetarium
University of Nevada
Reno, Nevada 89557 USA
702-784-4812
702-784-4822 fax
kelthj@equinox.unr.edu

1996 Conference Chairman
July 13-18, 1996
Dr. Tadao Nakano, Director
The Science Museum of Osaka
Nakanoshima, Kita-Ku
Osaka 530, Japan

Great Lakes Planetarium Assoc.
Dayle Brown, Pegasus Productions
713 Cushing
South Bend, Indiana 46616 USA
219-282-1885

Great Plains Planetarium Assoc.
April Whitten, Business Mgr.
Mallory Kountze Planetarium
60th & Dodge Streets
Omaha, Nebraska 68182 USA
402-554-2510
awhitten@csis.unomaha.edu

Italian Planetarium’s Friends Assoc.
Loris Rampa, National Archive of Planetaria
via Bosca 24, C.P. 104
25066 Lumezzane (Brescia), Italy
30-871861
30-872545 fax

Japan Planetarium Society
Dr. Tadao Nakano, Director
The Science Museum of Osaka
Nakanoshima, Kita-Ku
Osaka 530, Japan

Middle Atlantic Planetarium Society
Fred Stutz
302 Beechgrove Court
Millersville, Maryland 21108 USA

Nordic Planetarium Association
Lars Broman
Broman Planetarium
Fjöllaharvsg 67
S-424 06 Göteborg-Angered
Sweden
+46-2310 177
+46-2310 137 (fax)

Pacific Planetarium Association
Lynn Baker
Astronomical Society of the Pacific
390 Ashton Avenue
San Francisco, Calif. 94112 USA
415-337-1100
415-337-5205 fax

Planetarium Assoc. of Canada
Ian D. Cameron
Lockhart Planetarium
500 Dyer Road
Winnipeg, Manitoba R3T 2N2
Canada
204-474-0785
204-261-0021 fax
iacamter@ccu.umanitoba.ca

Rocky Mountain Planetarium Association
Bess Amural
Robert H. Goddard Planetarium
Roswell Museum & Arts Center
11th and N. Main
Roswell, New Mexico 88201 USA
505-624-6744
505-626-6785 fax
schriff@technet.nm.org

Elections Committee Chairman
Thomas Stec
Central Bucks East H.S.
Hollington and Anderson Roads
Buckingham, PA 18912 USA
215-774-7481

Awards Committee Chair
Phyllis Pitluga
The Adler Planetarium
1300 S. Lake Shore Drive
Chicago, Illinois 60605 USA
312-322-0319

Permanent Mailing Address
International Planetarium Society
c/o Hansen Planetarium
15 South State Street
Salt Lake City, Utah 84111 USA

Please notify the Editor of changes of IPS officers and affiliate representatives.

I. P. S. Affiliate Representatives

Association of French-Speaking Planetariums
Agnes Acker
Planétarium Strasbourg
Université Louis Pasteur
Rue de l’observatoire
67000 Strasbourg, France
88-36-12-51

Assoc. of Mexican Planetariums
Ignacio Castro Pinal
Museo Tecnológico C.F.E.
Apartado Postal 18-816
CP 11870 Mexico City, D.F., Mexico
277-5779

British Assoc. of Planetariums
Undine Concannon
London Planetarium
Marybone Road
London NW1 5LR, England
(44) 071-486-1121
(44) 071-465-0862 fax

Assoc. of French-Speaking Planetariums
Agnes Acker
Planétarium Strasbourg
Université Louis Pasteur
Rue de l’observatoire
67000 Strasbourg, France
88-36-12-51

Council of German Planetariums
Dr. Hans Metzl
Zeiss Planetarium
der Ernst-Abbe-Stiftung
Am Planetarium 5
D-07743 Jena
Germany
49-3641-27315
49-3641-24632 fax

European/Mediterranean Planetarium Association
Dennis Simopoulos
Eugenides Planetarium
Syngrou Avenue—Amfitheia
Athens, Greece
94-111-81

Russian Planetariums Association
Zinaida P. Sitkova
Nizhny Novgorod Planetarium
Pokljušnjak s’Yezel 5-A
Nizhny Novgorod, 603 001
Russia
34-21-66

Southeastern Planetarium Assoc. John Hare
Bishop Planetarium
201-10th Street West
Bradenton, Florida 34205 USA
813-746-4132

Southwestern Association of Planetariums
Donna Pierce
Highland Park ISD
School District
4220 Emerson
Dallas, Texas 75205 USA
214-523-1836 planetarium office
214-520-6917 fax

Ukrainian Planetariums Association
Dr. Alexander P. Lenin
Republic Planetarium
57/3 Krasnoanneiskaia Street
Kiev 252 005
Ukraine
044-227-51-66
044-227-51-66 fax

Produced at the Griffith Observatory, Los Angeles, California
From the Editor

I had the opportunity to attend the Astronomical Society of the Pacific Symposium on Astronomy Education in June. Like planetarium conferences everywhere, it was a mixture of talks and focused group discussions, but unlike planetarium conferences I have attended it also included a poster session. This was my first experience with a poster session, and I'd like to report on what I learned.

Posters are summaries of projects or programs in a form that can be posted for display. Each presenter was allotted a 4 by 4 foot square (1/4 meter square) cork board, and he or she stapled or thumb-tacked to it the elements of the display.

I had imagined that the displays would be a mixture of text, drawings, and photographs, but I saw anything that could be pinned to a vertical surface. This included plastic astrolabes, spectrosopes, an orrery, and three-dimensional folded paper items. Most papers were mounted to cardboard, and there was lots of color. Some people put larger items, including laptop computers, on a chair or small table in front of their posters, along with samples and other give-away items.

All presenters were asked to bring a stack of a double-sided single sheet handouts that summarized the poster. This way people took home handouts that let them immediately do any follow-up work without having to wait as long as a year for information to appear in a published proceedings.

Presenters divided their time between standing beside and explaining their own posters and visiting the others.

As a general rule, we learn more when we participate than when we are listen passively (this was one theme of the symposium). The most enjoyable activity in a planetarium conference seems to be informal conversations between people who seek each other out to talk. Often this happens between (and even during and in spite of) scheduled activities. Posters are a good way to encourage such informal one-on-one meetings to take place, and it gives them a focus.

A poster session has other benefits. There were approximately 80 posters at the ASP symposium. That many ten-minute talks would have consumed two full days of formal presentations, and most people would not have been interested in most talks. As posters, visitors can pick and choose and allocate their time according to their interests. Four hours is probably adequate to see 80 posters, although people will fill more time by just visiting. I would have liked to have had more time to stand beside my posters to talk to people who stopped to read it.

The handouts became a published record of one important part of the symposium. Eighty two-page handouts fill 160 pages of a proceedings volume. And—as an important bonus for the organizer—the papers are brought to the conference as handouts. If presenters follow formatting guidelines, the handouts can be published without further editing. No more badgering people for overdue write-ups!

Posters do require both work and space. Someone has to procure for and arrange a very large number of cork boards—a commodity that might be in short supply in a conference hotel. And they take up a lot of space. A typical classroom could hold a maximum of eight double-sided 8 by 4 foot boards; at four per board this is 32 posters per crowded room. Someone has to set them up, number them, and distribute a list directing presenters where to set up (at the ASP symposium they were arranged alphabetically by the presenter's last name). Posters can be set up and left for several days for people to revisit during coffee breaks.

I like the idea, and suggest that organizers of planetarium conferences consider adding poster sessions to the agenda and cut down on the number of talks.

Letters

Dear Editor:

In the June 93 issue of The Planetarian, the paper by J. Tucciarone "Perspective and the Crescent Moon" (p19) deals with the lack of a full 180° extension of the thin crescent moon. The same topic has been addressed in deeper detail by E. Schafer in the Quarterly Journal of the Royal Astronomical Society (QJRAS), vol. 32, p.265 (1991).

The main conclusion of Schafer is that the perspective and roughness of the lunar surface are negligible factors, while the delectability of the moon's horn against the twilight background are the main factors leading to such an effect. The distribution of light coming from the Moon is treated in a detailed way. It is true, in fact, that if the Sun is directly above the lunar equator, the sunlight on the moon will depend upon the cosine of the lunar latitude (being at 80° of latitude, following the example given by Tucciarone, one sixth of the equatorial one) but also the amount of light reflected towards the Earth will depend upon the

Janet Mattei of the American Association of Variable Star Observers demonstrates software on a laptop computer in front of her poster. A colorful poster from Project CLEA lies on the left half of the bulletin board.

(Please see Letters on page 64)
Astronomy Education: A Global Perspective

John Percy
Division of Sciences
University of Toronto
Mississauga, Ontario, Canada
percy@astro.utoronto.ca

Planetarians are part of a worldwide network of astronomy educators—"kindred spirits" in the communication of astronomy. This network includes planetarians in other countries, and also educators and astronomers (both professional and amateur) working in other settings but sharing the same goals. This article is written from my perspective as president of the International Astronomical Union (IAU) Commission on the Teaching of Astronomy.

Introduction

Astronomers are concerned about astronomy education because it affects the recruitment and training of future astronomers. It also affects the awareness, understanding and appreciation of astronomy by the taxpayers who support us. Astronomy has a wider educational and cultural significance, however, and most professional astronomers understand and support this. Astronomy is deeply rooted in almost every culture by virtue of its practical applications and its philosophical implications. It shows us a universe which is vast, varied and beautiful; it shows our place in time and space, and gives us a "cosmic perspective." It harnesses curiosity, imagination, and a sense of shared exploration and intellectual excitement. It shows "how small our bodies, how large our minds" (Henri Poincaré). It helps to advance physics and the other sciences by providing a cosmic laboratory with extreme environments (black holes). In its own right, it is one of the most rapidly-moving sciences of our day. For all of these reasons, astronomy has the potential to increase public interest in science, and to attract young people to study science and engineering. It provides an enjoyable hobby for millions of people.

Why, then, is astronomy so often the "poor cousin" in the school science curriculum? The same problems and issues seem to occur all over the world: (i) few teachers, especially at the elementary level, have any training in astronomy; (ii) teachers think that astronomy must be technical and mathematical, and requires elaborate teaching equipment; (iii) simple, inexpensive, "hands-on" activities are needed—preferably ones which get around the problem that "the stars come out at night, the students don't; (iv) inappropriate teaching techniques fail to overcome students' ingrained misconceptions about physical and astronomical phenomena; (v) many students (especially girls) are turned off science at an early age; (vi) scientific illiteracy is widespread among students and the public.

Current Developments in the US

In the US, much is being done to tackle these problems, thanks to the education budget of the National Science Foundation—over half a billion dollars annually. The "flagship" astronomy education project was STAR: Science Teaching through its Astronomical Roots, based at the Harvard-Smithsonian Center for Astrophysics (CfA). After careful research on students' learning processes and misconceptions, STAR developed a jargon-free curriculum and simple, hands-on activities and equipment. These were tested and refined by expert teachers, then disseminated to teacher-agents across the country in a series of workshops. Similar curriculum projects, based on the same model, are being developed for students from kindergarten to college level, at CfA and elsewhere. In addition, there are projects to: (i) link teachers and students with professional and amateur astronomers; (ii) provide astronomical images and data, along with necessary software for classroom activities and research; (iii) develop other modern lab activities and research opportunities for high school and college; (iv) provide telescopes, instruments, and faculty grants to facilitate undergraduate research; (v) upgrade instructors' skills at all levels, especially through summer workshops; (vi) produce resource materials and disseminate them widely.

The results of these efforts will soon be available to astronomy educators around the world. In order to facilitate this process, to co-ordinate the next phase of development of astronomy education, and to ensure that present efforts meet the needs of all students, the Astronomical Society of the Pacific is holding a major symposium on astronomy education on June 24-25, 1995 at the University of Maryland. The proceedings of this conference should be the definitive guide to astronomy education in the US.

Astronomy Beyond the US

In contrast with the US system of education, the "European" system (which has been adopted in many other countries) tends to be built around a national curriculum, often with standardized exams which select students for elite high schools and/or universities. The other students receive appropriate vocational education. In this system, astronomy is often taught as a rigorous science in high school, by teachers who take at least one astronomy course in their undergraduate or teacher training program. Astronomy is almost never taught in university as a "science option" for non-science students, as it is to hundreds of thousands of US college students each year. Nevertheless, European astronomy educators are concerned about getting more and better astronomy in their schools and universities, and this led in 1994 to a major conference in Munich, and to the formation of the European Association of Astronomy Educators.

Education Programs of the IAU

The IAU, the world organization of professional astronomers, is a non-governmental union founded in 1922 to "promote and safeguard astronomy, and to develop it through international co-operation." The IAU currently has 60 member countries (up from 51 in 1988 due to political reorganization in Europe) and 7839 individual members (up from 6711 in 1988, presumably due to a real growth in astronomy over the last decade or two). The IAU is administratively "lean," most of its funds go to the development of astronomy. It is funded by its member countries, according to the number of individual members in the country, and its ability to pay. There is no individual membership fee, but there are qualifications: normally a Ph.D. in astronomy, and a few years of experience as a professional astronomer. Since very few planetarians qualify for IAU membership, is there any reason or possibility for liaison between the IAU and the IPS? I think so.

The IAU's education programs are carried out through the one of its 40 "commissions" or interest groups which is devoted to education: Commission 46, on the Teaching of Astronomy (CTA). CTA exists "to further the development and improvement of astro-
nomical education at all levels, throughout the world." Among its 150 members are national representatives from each country; Jay Pasachoff (Williams College) is the US representative. Its Executive Committee is a "task group" of individuals concerned with specific programs or projects, or specific areas of the world. Years ago, the IPS had a representative on that committee; I propose that we restore that arrangement.

The CTA's programs include a Newsletter, with triennial national reports; meetings associated with IAU General Assemblies and Regional Meetings, including a one-day workshop for local teachers at each General Assembly; IAU Colloquium #105 (The Teaching of Astronomy) held in Williams-town USA in 1988, the Visiting Lecturers' Program, which sends experienced astronomer-educators into "target" countries (most recently, Paraguay and Peru) for up to several months to give courses and develop collaborations; the International Schools for Young Astronomers (co-sponsored by UNESCO)—intensive three-week schools held every year or two for advanced students and young astronomers and teachers in different parts of the developing world (currently India (1994), Egypt (1994) and Brazil (1995)); the Traveling Telescope, a Celestron-8 telescope and research-grade instruments to be used in countries (currently Paraguay) where astronomical research is in a developing stage. The national representatives play an important role in coordinating astronomy education in their countries, and in providing a two-way communication channel with the IAU.

Note that most (but not all) of these activities are designed for developing countries. The IAU also has a Working Group on the Worldwide Development of Astronomy, and Commission 38 (Exchange of Astronomers), which also promote and facilitate the development of astronomy.

We should not forget the needs of the developing countries. There are almost a hundred countries worldwide with some form of astronomical activity. Only 60 are members of the IAU, and only about half of these could be called fully-developed. Knowing that this includes the US, with all of its educational challenges, there is obviously much to be done.

Astronomers and astronomy educators in the developing countries need opportunities to be visited and to visit abroad; they need books, journals and equipment which fit their needs and their culture. A common phenomenon in the developing countries is the "lone astronomer"—one individual (or at most a small group) who is responsible for all astronomy education at all levels—school, university and the public.

Many of CTA's activities are relevant and accessible to planetarians. Its semi-annual newsletter is now available electronically (from Armando Arellano Ferro: armando @astrosclunam.mx). The proceedings of the Williams-town meeting (The Teaching of Astronomy, edited by J.M. Pasachoff and J.R. Percy, published by Cambridge University Press, 1990) is still the best overview of astronomy education worldwide. The next IAU CTA-supported meeting will be in London UK, July 8-12, 1996; planetarians are cordially invited. The one-day teachers' workshops held at IAU General Assemblies, Regional Meetings, and some specialized meetings, almost always involve local planetarium staff. Planetariums are often an important facility (sometimes the only facility) in developing countries—in India, for instance, where they have helped to promote public and government interest in the development of astronomy.

Astronomy Education Around the World

When I give talks on the topic of this article, I show slides of astronomy education activities from a variety of countries:

- simple, inexpensive children's astronomy textbooks from Mexico; the same approach is now being taken to reach the disadvantaged schools in South Africa.
- "sleepovers" under the planetarium sky in New Zealand, and "Pipehenge"—an astronomical "jungle gym" from the same country.
- hands-on science centres built in former observatories (Australia) and railway stations (New Zealand), and a planetarium built in a former gasworks (Poland).
- scale models of the solar system in parks (Switzerland), towns (Poland) and in a whole province (Spain).
- public observatories—a rarity in North America, but a tradition in Europe, and now a popular facility in Japan.
- simple, hands-on activities for high school students in Uruguay (not just the US).
- summer institutes for teachers; a regular and well-developed program in France, years before they became common in the US.
- journals and newsletters on astronomy education: long-standing in France and Germany; still lacking in the US.
- undergraduate research opportunities, pioneered at the Maria Mitchell Observatory, Nantucket, USA.
- distance education: The Open University (UK), with more students in one astronomy course than in all other astronomy courses in the UK combined!
- the role of amateur astronomers, exemplified by Astronomy Day programs in the US and elsewhere.
- astronomy in the media: Patrick Moore (UK) has the longest-running program on British TV, and has published over 100 books!

How Astronomy Educators Can Help

Astronomy education worldwide will be most successful if everyone pitches in to help—amateur and professional astronomers; teachers, planetarium and science centre staff; publishers and the media; scientific and educational societies; government, school boards and industry.

- make education a part of your institution, association or club; appoint an education co-ordinator; include an education column in your newsletter, and education talks at your meetings.
- be aware of developments in education: research on learning, and changes in the local school science curriculum; form coalitions on astronomy education in your area; bring the members together for meetings occasionally.
- seek more funds for science education.
- do your "bit" for astronomy education: give (or arrange) a public lecture; write a popular article; pass on your knowledge and enthusiasm to teachers and students (especially from under-served groups); support your local schools and teachers; publicize the practical and cultural benefits of astronomy.
- get more and better education in: day and night schools; museums, science centres and planetariums; parks and conservation areas; libraries.
- help improve astronomy in books and the media: speak out against pseudo-science; work with the news media; help your local library choose better astronomy books; review and improve school science textbooks.
- lobby for, and help develop a planetarium, science centre or public observatory.
- support astronomy education internationally, especially in the developing countries learn more about these topics; support programs to send surplus books and journals to developing countries; communicate with, visit, or otherwise help the "lone astronomers;" support the work of the IAU.

(Please see Education on page 9)
Planetarians and the Art of Communication

Steve Tidey
58 Prince Avenue
Southend-on-Sea
Essex, England
stidey@zeroth.demon.co.uk

Planetarians are a rare breed; we like speaking in public! It is somewhat surprising, then, that whilst in recent years a lot of attention has been paid to ways by which the information about the universe imparted to an audience is put over in an entertaining manner—making it more likely that patrons will hold on to the facts for more than a few hours or days—there has been little, if any, attention given to the importance of the vocal quality of the presentation. Anybody who has made a conscious effort to use the basic skills of public speaking, will have found that their ‘live’ presentations are more effective. It sharpens your professionalism, generates more feedback from audiences and also increases your overall satisfaction with presenting astronomy to the public.

Acquiring these skills will have a knock-on effect in your one-to-one social conversations, too, because good public speakers command extra attention and respect, making them more capable of communicating successfully on a personal level. Many of us are probably self-taught as public speakers, and have therefore unwittingly picked up bad habits over the years which nobody has thought to comment upon. You may think this doesn’t include you, but I would encourage everybody to seek feedback from their colleagues. Learn from each other. It’s easy to assume you’re doing fine, until somebody sits down to consciously test your performance. Even experienced politicians, who live on the power of words (not true!), find that they have room for improvement in some departments when they start to appear on television, and irritating mannerisms suddenly become magnified. What I want to do, then, is to look at the qualities that set expert public speakers apart from the indifferent. This is by no means a comprehensive outline, but I hope that you can put some of the tips to good use.

What I want to do, then, is to look at the qualities that set expert public speakers apart from the indifferent. This is by no means a comprehensive outline, but I hope that you can put some of the tips to good use.

Your delivery must be measured, so it is vital to use pace and pause. Adopt a steady flow of speech which is neither so fast that people are straining to keep up with you, nor so slow that it irritates your audience. Pause slightly between sentences and enunciate the words clearly. To assist with this, it would be useful to record a short sample presentation on audio tape and play it back to yourself, listening for pace and pause, emphasis on key words, voice projection, persuasion of an argument, clarity of thought and breathing in the right places. Also watch for occasions when your vocal energy dips, as it does for many people at the end of a sentence. Or voice drog, in which words are unnecessarily drawn out. You should also be wary of putting on a posh speaking voice or acting out of character, as your audience must feel that you are being genuine with them. Be yourself. Convince them that you are worth listening to.

Another important consideration is: value the quality of the words you use. When your subject is the entire universe, past, present and future, and the topics you can touch on are black holes, supernovae, nebulae and constellation mythology, to name but a few, there is clearly plenty of scope for using colorful, active verbs which take full advantage of the richness of language. So try expanding your vocabulary (but avoid using fancy words that may lay you open to accusations of showing off and allow your audience’s imagination to run free. We are educators, but we don’t have to explain everything in detail.

Thought should also be given to the quantity of words you use. For example, don’t use ten words where perhaps five would be sufficient to describe a phenomena. Try to avoid being too clever in your speaking, as you will want people to grasp your point as quickly as possible. Francis Bacon once wrote, “The ill and unfit choice of words wonderfully obstructs the understanding.” Brevity is one of the keys to putting over an effective argument, or a simple explanation, so think ahead and cut out any surplus words which do nothing but get in the way of putting over your message. This should increase the impact of the words you do use. (John Arlott, a famous BBC TV cricket commentator of the past, once remarked that the secret of good commentary was to say as little as possible. In other words, leave room for thought and conjecture in the audience).

Deal with just one thought or idea at a time, otherwise people will become confused. Learn to deliver your information in small individual packets. Avoid using clichés. Take the time to think of a fresh way of putting over your point. This one is difficult, I know, but try not to use too many superlatives. They become wearing after a short while, and will make an audience skeptical when you describe something as extraordinary/enormous etc. Remember to keep a sense of proportion.

A related issue to the above is the use of numbers. It can be difficult for a lay audience to grasp the meaning of the sort of numbers we are used to dealing with in astronomy, so whenever possible avoid placing too much emphasis on them. If you have to quote some numbers, round them off and simplify them for clarity.

You may think the next point is trivial,
but a public speaker must pay attention to the clothes worn for a presentation. Clashing colors or an untidy appearance will distract the audience’s attention from your well-prepared words about the cosmos. To bring home this point, remember that a survey has shown that 55% of a presentation’s impact comes from the speaker’s appearance and his or her physical actions. People who pay smile—but not too often, otherwise they’ll mistake you for a politician running for office!

Also, don’t patronize your audience. You have to show respect for them in order to get it back.

Another tip: don’t be afraid to learn from your mistakes. All speakers have their failures, but the good ones aren’t daunted by them.

Many of us are probably self-taught as public speakers, and have therefore unwittingly picked up bad habits over the years which nobody has thought to comment upon. You may think this doesn’t include you, but I would encourage everybody to seek feedback from their colleagues. Learn from each other.

attention to their appearance will be thought of as more authoritative than those who do not.

You can say as much with your body language as you can with your words, and so it is important to adopt a proper, confident posture which tells an audience that you are comfortable being the center of attention. Don’t slouch, rock on your heels or put both hands in your pockets. Look relaxed and don’t fidget. Stay in one spot as long as possible, because continuous movement will quickly irritate your audience. Every significant hand gesture should add something to the power of your words.

We must show genuine enthusiasm for our subject. Your line of argument and persuasion has to come from the head, but try to show people that your words come straight from the heart, because if they don’t perceive any sense of the excitement that we feel for the study of the universe they may justifiably ask themselves, “Why should I bother to study it?” Planetarians have a genuine love of their work, more so than in most occupations I could name (after all, you aren’t in it for the money) so enthusiasm shouldn’t be hard to come by. Harry Ford, at the Caird Planetarium in Greenwich, England, infuses his audiences in a marvelous way with his deep love of, and enthusiasm for the night sky, so much so that Dr. George Reed believes Harry is probably the best planetarium lecturer he’s ever seen.

But of course when it comes to sheer enthusiasm, impact of presentation and presence, even the most experienced planetarian can learn a thing or two from the venerable Dr. Patrick Moore. As an example of his professionalism, on one occasion a fly glided into his mouth as he spoke to camera on The Sky At Night, but he simply swallowed it and carried on speaking without missing a beat!

An audience will need to see evidence that you are enjoying speaking to them, so After a presentation, think back over it as critically as you can and list any weaknesses. Personally, I think one of the worst things a public speaker can do is to go through a talk in auto-pilot, as it were, with no thought given to its effectiveness. After all, if you aren’t continually improving your presentational skills, then you let down both yourself and your audience.

A public talk on any subject will benefit from the inclusion of humor. This is one element which cannot be rehearsed, as humor requires an audience for feedback, so try the humor on friends and colleagues first to see how it goes down. During a presentation, get some of the jokes in early, as this will relax both yourself and the audience. They are on your side, after all, and want you to succeed and entertain them. If you have a proven rib-tickler, try to save it for the end of the presentation, so you can go out on a high.

In the hands of a skilled planetarian, the night sky can be discussed in an exciting, vibrant way with touches of humor. For example, I once saw the limonite that gives the Martian surface it’s distinctive red color described as “designer rust!” You could also follow the example of the astronomical laterial thinking used by Douglas Adams in The Hitchhiker’s Guide To The Galaxy. Then again, there are a treasure trove of humorous anecdotes in two of Patrick Moore’s books, Armchair Astronomy and Fireside Astronomy. Who could forget the tale of the Spanish TV producer who asked Patrick if he could move the track of totality during a solar eclipse, because it would just miss his town?

In a classroom environment, remember that eye contact with your audience is an important personal touch, especially in the first few minutes of a presentation. Think of it as a visual handshake. Select people from around the room and, as you speak, make eye contact for just a second or two to make that person feel you’re speaking to them as an individual. But avoid intimidating long stares; a friendly glance will be sufficient. This establishes a rapport with your audience, and ensures they will listen more closely to your well-chosen words.

To sustain a lengthy delivery, you should learn how to breathe from the diaphragm, using the maximum capacity of your lungs. Breathing control overcomes nerves, and makes your voice both reliable and powerful. It will also allow you to control the volume of your voice without shouting.

A good public speaker and planetarian should also know when to stop. The best presentations are those that don’t last as long as the audience expects. This should leave them wanting to come back for more. We all want a captive audience, but there is a point beyond which the brain turns off, so always be conscious of this. And wherever possible, try to link the end with the introduction, as this neatly bookends the presentation.

To sum up, then, for a more professional presentational style you should:

- use pace and pause in your delivery
- value the quality of words
- exercise brevity
- deal with one thought or idea at a time
- avoid using clichés
- limit the number of superlatives you use
- be conscious of your appearance
- maintain good energy in your voice and avoid word drag
- adopt a confident posture
- smile—but not too often
- show genuine enthusiasm
- learn from your mistakes
- inject humor into your delivery
- make occasional eye contact with your audience
- breathe from the diaphragm
- know when to stop.

OK, now knock ‘em dead!

(For reference, continued from page 7)

References

In addition to The Teaching of Astronomy and the electronic newsletter of IAU Commission 46 mentioned earlier, the best and most convenient sources of information on astronomy education are the articles appearing regularly in Mercury, the popular journal of the Astronomical Society of the Pacific, 390 Ashton Avenue, San Francisco CA 94112-1787.

If you want more information or advice on astronomy education worldwide, please feel free to contact me.

Vol. 24, No. 3, September 1995

The Planetarian

9
Home, Dome on the Range

Gary Likert
1203 Highway 25
Gallatin, Tennessee 37066

The exotic projectors wheel and turn beneath the darkening dome as a thunderstorm hangs over the glowing western horizon. Now the stars are coming out one by one, and the lecturer begins his guided tour through the night skies. While this certainly is a scene we're all familiar with, the locale perhaps is not. We're in Bob Myler's basement in suburban St. Louis, Missouri, witnessing a home planetarium theater in action!

Bob is a charter member of the one year old Home Planetarium Association, a group of dedicated if slightly crazy people that build and operate their own home planetaria. Going far beyond those 'toy' projectors...

... Home Planetarium Association, a group of dedicated if slightly crazy people that build and operate their own home planetaria.

... there are some surprisingly imaginative and sophisticated home facilities popping up across the U.S. and abroad.

... a commercial celestial globe has the advantage of preplotted stars. Complicating the process of plotting your own stars for later drilling on a globe is the need for working backwards —some sort of template is usually employed. Scales of magnitudes must be carefully worked out and drill bits or pins selected accordingly. Opinions on light sources vary. Although conventional wisdom says filament size should be minimized (since it will be projected by the pinholes), filament location can also be key. Filaments mounted too low in the bulb often cause secondary reflections as opposed to those high up. Suitable bulbs can be found at your neighborhood Radio Shack outlet however. Filters may be employed to introduce realistic star colors to your re-created sky. Naked eye objects such as the Andromeda Galaxy and Great Orion Nebula may be simulated with diffusing tape, and the Pleiades can be recreated by carefully pinholing a piece of masking tape that covers a larger hole. Simple lenses may be employed for brighter stars, and it is possible to portray the Milky Way and lunar phases through special (sometimes masked) projection holes. An 'access door,' usually at the south pole, must be cut to allow for mounting and central light placement.

Mountings for home planetaria run the gamut, varying from simple pipe affairs to complex geared motor drives. Like an equatorially mounted telescope, the starball must be tilted to approximate the latitude depicted, and of course must be hand or motor rotatable east to west. A wide variety of small motors and gears are available to the hobbyist. Horizon cutoff mechanisms can be achieved either by providing a floating, gim-baled shield around the light source or with a physical half 'box' around the star globe itself. Many home units employ a second, smaller projector mounted in tandem with the main starball, a popular choice being the clear plastic 'Star Theater' by Super Science Ltd. for constellation outline projection with the lights on. Other accessories are limited only by the imagination of the builder and include lensed planet projectors, diffuse and dimmable 'house light' sources, and home built or commercially available handheld laser arrow pointers. From simple hand turned pipe mounts to electronic consoles, people are doing it all.

Home dome construction lends itself to rather ingenious solutions, with projection surfaces ranging from PVC pipe-supported fabric structures to solid vaulks adapted from cylindrical tanks or other unlikely sources.

Obviously, the 'portable vs. permanent' question is key here. Small commercial projection domes are now a viable option for those less-handy with curved surfaces. One of the tricks in any dome arrangement is hiding the seams and providing a highly reflective projection surface. Silo domes look like good candidates for a projection dome, but their corrugated construction necessitates some sort of inner subsurface. Dome size depends upon the projector and image quality. Dome locations are endless, and have been built in garages, barns, basements, and suspended from the ceilings of classrooms. The author
Two views of Bob Myler's basement home planetarium.

once constructed a white posterboard dome in the walk-in closet of his first apartment—it was necessary to lie flat on your back with your head underneath to see the recreated sky, but it was quiet convincing! One HPA member (reportedly) has a small dome suspended over his kitchen table. Taking the 'portable' approach to the extreme, the educational value of simply using the ceiling and walls of a darkened room cannot be underestimated, especially for children. I have managed to teach my four-year-old son constellation shapes and motions using a simple handheld projector and the walls and floor of our darkened bathroom shower stall. The sky really is the limit if you use your imagination.

Beyond the basics, special effects are where the fun in a home planetarium can really begin. Custom horizon silhouettes are virtually unlimited, traversing both space and time. I have plans to recreate my boyhood home and recapture some rich astronomical memories. Detailed instructions on how to achieve a photographic horizon from anywhere are available. Horizons can even integrate other, three-dimensional items such as model buildings or railroads, incorporating several hobbies in the home setting. Bob Myler's downtown St. Louis horizon even includes a tiny red LED high atop the Gateway Arch. Other areas where HPA members have run wild include composing and recording their own soundtracks. This is a whole subset of the hobby, as there are many instrumentalists who put out 'space music' and other works suitable for the planetarium environment. Digital audio is now a reality in the home studio. Auxiliary projectors are yet another whole area of endless possibilities. We have seen homemade projectors to simulate sunrise/sunsets, the Northern Lights, and even that thunderstorm mentioned earlier (achieved with an oil lamp chimney, rubbing alcohol and a magic marker). People have created very accurate constellation outline slides and hand projectors to house them. With the advent of home movie theaters, incredible sound/video systems are now available. Special effects put the icing on the home planetarium cake, and no one can say just what will come out of a home workshop next.

To summarize, one of the best things about a home planetarium facility is that you can spend what you want to spend. Since you are the director, creative consultant, and projector operator all rolled into one, it's practical to start extremely small and build over the years. Consider bringing this passion into your own home if you haven't. You may find that even the humblest effort will somehow bring a darkened room alive. Imagine the look on your child's face when the universe suddenly turns on at home, almost close enough to touch.

Home Planetarium Association membership costs just $10 per year for the quarterly newsletter and mailing list. Please contact Gary Likert for details.

Vol. 24, No. 3, September 1995 The Planetarian 11
Dark and Light Matters: Dance and the Planetarium

Jenefer Davies and Michael Mansfield
P.O. Box 9595
Hollins, Virginia 24020

As a child, I was always interested in star shows and planetariums. The dark eerie coldness that encapsulated me and carried me to a new world of brightly lit stars and constellations was like a carnival ride that scared, yet captivated me. Recalling the power of this enchantment, I regretfully realized that I had now shed the naïveté necessary for magical transportation. While visiting Hopkins planetarium two years ago, the benefits of wisdom became apparent. Maturity enabled me to see beyond the limitations of childhood. My adult understanding and appreciation of technological advancement and innovative engineering created an entirely new fascination with how the show was produced and directed. The magical experience was still alive. The creative learning devices were amusing and entertaining, yet effective. The variety of resources and their ability to conform to and enhance specific themes appealed to my sense of choreographic melody. My senses and my artistic instincts were aroused.

As a performance artist and choreographer, the many versatile computerized graphics and multimedia capabilities stimulated my interest in a collaborative performance event involving a media specialist and the planetarium staff. The aspect of the planetarium that solidified my direction for the next two years, was the dome. Designed by Don Lunetta, it has a 40-foot (12 meter) diameter, a 20-foot (6 meter) depth and is tilted horizontally toward the audience 40 degrees. Its three-dimensionality creates the illusion of suspension in a shell-like cocoon, warmly cradling and inviting the audience to participate. The console controls are hidden in a pit in front of the audience. Separating the dome from the pit is a semicircular 30-foot by 7-foot (9 x 2 meter) stage. The theater contains 125 unidirectional seats. I felt that this space, with assistance from the planetarium staff, could provide nearly ideal support for a multi-media performance concert.

My thematic interest is light. For two years I have been researching, experientially, the ways the human body can interact with light to produce desired or random patterns and intensities of shadow. I first made a limited study of light in order to discover how it behaves in its natural environment. I began to understand light by mimicking, on a small scale, the patterns the planets make around the sun and noting the shape and intensity of the shadows produced. I then reproduced, in a performance arena in Washington D.C., planetary movements using dancers as interectors and flashlights as the light source. The natural movement of the human body produced a limitless vocabulary of shadow shape and form as the interacting forces attempted to envelop and evade each other.

At this point I began making correlations between my findings and those of 15th century artist/inventor/astronomer Leonardo da Vinci. While trying to understand shadow in his development of a more realistic painting technique, da Vinci explained that "...shadow is a mingling of darkness with light, and it will be of greater or lesser density as the light with which it is mingled is of greater or lesser strength." Between light and dark there is no qualitative break, only transitions of saturation. He further stated, "It is inherent in the nature of a shadow that it is neither pure light nor absolute darkness but a product, a blending of the two." It is these naturalistic observations that prompted da Vinci to question the variations of luminosity (sources) and how they affect the subject. In his later manuscripts he formalized his views on light and shadow and categorized the resulting types of light. These categories of light, which I was pleased to see correlated with my findings, included universal, specific, reflected/absorbed and translucent light. Using these definitions, I integrated new movements into my choreography and focused my thematic goal. I titled the concert, "Chiaroscuro: a movement painting of light," after the painting technique of the same name brought to its full potential, arguably, by Leonardo da Vinci and made famous by Rembrandt.

I decided to investigate how the subject/performer can affect the light source. My first realization was that, in addition to the random and choreographed use of flashlights, the source could be influenced using special effects and multi-media sources. This was not financially feasible in Washington D.C. Borrowing or renting slide projectors, video projectors and camcorders wherever I went and attempting the projection of video in a black, thrust stage theater.

Moving into the planetarium resolved my predicament. The standard features within the facility exceeded my needs. Due to its vast array of instrumentation, new sections of dance were added that used special effects and graphics I had not previously known existed. The cloud-effects computer program became shadow dances as performers used the light ball's frontal projection for depth manipulation. Depending on where and how they moved, the dancer's shadows varied from filling the entire dome to as small as their natural height. The Lumina computer program, a surrealistic floating aura of white light, was initially projected alone and later imitated by dancers with flashlights. The planetarium, initially appropriate for the theme of the concert, became essential to its existence. As rehearsals progressed, variations to the theme were added and the planetarium became part of the performance. The concert grew into a site specific work.

New movement was added to the dance, imitating the architecture of the planetarium. The stairs descending into the arena were choreographed into the movement. Dancers moved behind the dome, lighting it and the catwalks with flashlights. This pro-

For two years I have been researching, experientially, the ways the human body can interact with light to produce desired or random patterns and intensities of shadow.

Jenefer Davies has recently completed her masters of fine arts coursework in dance and theater arts at The George Washington University in Washington D.C. She has danced and choreographed professionally for theaters and is the executive director of Acute Angles Dance Theater.

The Planetarian Vol. 24, No.3, September 1995
duced a contorted search light appearance as the beams of light attempted to conform to the curves and structure of the dome. Britt Rossi, planetarium director, wrote that “one section that really left an impression was one performer climbing up a 30 foot [9 meter] catwalk using a simple flashlight shining up from below. She appeared to have ascended to the stars and then vanished in the heavens above.”

As multimedia collaborator for “Chiaroscuro,” Michael Mansfield was responsible for the coordination of all visual effects that would enhance and clarify the thematic statement of the performance piece. This involved adapting the original visual design to take advantage of the effect generators already present in the planetarium. Planetarium lighting effects that were incorporated into the performance piece were the Spitz 512ATM2 star projector, AVI controlled special effects, Lumina effects generator, and two slide projectors. Hollins College, a woman’s liberal arts college in Roanoke, Virginia, also supported this program by providing all video projection and recording equipment.

The slides used in the performance were taken during the rehearsal period by Maria-Christina B. Pierson, using dancers moving with flashlights and Christmas lights. The shutter of the camera was held open from 30 seconds to 2 minutes depending on the intensity of the light source. In this way, as the dancer moved, her image and the path of the light was burned onto the film. These slides were choreographed and projected from extreme left and right remote controlled consoles in the planetarium. Using this placement, the slide projection covered a 6 by 8 foot (1.8 by 2.4 meter) area beginning at the base of the stage and reaching onto the dome. During this section, dancers moved through the projection, interacting with the image and the light paths of the slides.

In addition to the special lighting and slide effects, we used video projection of both live and prerecorded video throughout the performance. As the audience entered the planetarium they passed through a video projection of earlier incarnations of “Chiaroscuro.” We hoped this effect would initiate the audience into the piece by bathing them in projected light, in very much the same way as the performers would be lighted. Additional connection with the performance was provided by flashlights which were located throughout the planetarium and which were used by the audience to explore the arena before the formal part of the performance began.

We projected an original video created by Michael Mansfield on the dome using an LCD panel and a high output overhead projector. The video formally introduced the audience to the piece and the space by exploring the textural aspects of the planetarium in relation to those of the performers. We intercut images of different parts of the planetarium with images of the performers. The hard angularities of the planetarium’s architecture were contrasted with different parts of the human form. Various lighting effects were used so that we displayed both the planetarium and the performers in differing schemes of light and shadow. One particularly effective part of the video had the performers positioned about the star projector as it exited its enclosure and was turned on. The general lighting in the planetarium was lowered as the ball emerged, producing an effect in which the star field moved in and out of view depending on the placement of the dancers.

One of our desires was to incorporate live video into “Chiaroscuro” so that the technology of light projection interacted with the live performance. We hoped this would provide a clear expression of how simple effects, dependent on technology, can enhance the artistic expression of a performance piece. We accomplished this goal by turning a line of sight problem to our advantage. The relative placement of the stage, in regard to the planetarium’s seating, made it difficult for the audience to see a particular

Timed release shutter slide of dancer walking with Christmas lights. Photographer M. Pierson.

Vol. 24, No. 3, September 1995

The Planetarian

13
solo performed on the floor of the stage. This situation allowed us to interact with the performer and to project live video onto the dome above and behind the dancer. This effect was one of the most haunting and evocative of "Chiaroscuro" and allowed us to display different nuances of light and shadow that we had not explored.

We had a great deal of difficulty devising an ending for "Chiaroscuro" that reflected our thematic interests and incorporated the elements of performance, planetarium lighting effects, and live video footage that we felt were essential to the resolution of the piece. After a great deal of experimentation we created an ending that satisfied our goals. After a dramatic shadow dance section, which was generated using a cloud effects program, one dancer left the stage and began tracing a path out of the planetarium using a single light source. The performer's path was followed by the videographer, who moved to take her place on stage. The image of the performer was projected onto the dome until she reached the back of the planetarium. At that point the image faded to black and the piece ended.

The result of this concert was very beneficial for the planetarium. It exercised Hopkins' desire for more educational, entertaining programming. The concert brought a new audience to the facility who may return to view new exhibits of star shows, thus providing financial benefits. Due to the concert's wide publicity, new groups have requested the use of the planetarium, expanding its marketing area. As the full potential of the auditorium is realized, specific performances could be organized to reach out to different cultural or ethnic groups, providing enriching productions and hopefully serving as a vehicle for enlightenment. Each new group allowed to use the space will find ways to manipulate the instrumentation to create new effects, serving as a resource for the planetarium's own shows. This exchange of ideas would help keep the planetarium's programming exciting and innovative.

As with all collaborative events, difficulties arose and were dealt with. To produce such a large concert, many long hours and frequent rehearsals were held. Due to the piece's site-specific nature, rehearsals were held in the planetarium auditorium. Console operators were a time and financial investment for the planetarium. Therefore, a strict time line of rehearsals was necessary. No further expenses were incurred as rehearsals were held in the frequent down time of the facility. On the few occasions when groups had previously requested the planetarium, rehearsals were held in the Hollins College dance studio. We recreated the planetarium in the dance studio by taping out its stage measurements on the floor. Finally, the dance group was taught by console operator, Mark Catron, to correctly and carefully use the equipment belonging to the planetarium. At the end of each rehearsal we realigned slide and special effects generators for the next day's star shows.

A multi-media concert, or even a strictly theater or dance event, can be trimmed down and used within or during regular planetarium shows. In my experience at Hopkins, working with the planetarium staff gave me a new perspective and expanded my creative goals. Mark Catron became very interested in and involved in my artistic theory. His enthusiasm and daily presence at rehearsals integrated him into the cast and provided me with a creative, willing, special effects collaborator. In much the same way, teaming science with the arts makes a complimentary learning environment. Scientific information is made more approachable with entertaining learning tools. Also, students are exposed to the arts in a new way. Mr. Rossie is hoping to expound on these techniques with a spin-off interactive starshow that will include both the arts and sciences. In addition, it gives artists new, inexpensive performance arenas with built in multimedia capabilities and a world of thematic choices.
Invitation to IPS '96 Conference in Osaka

Tadao Nakano
Chairman of IPS '96 Conference
Director, Science Museum of Osaka

Introduction

The '96 IPS (International Planetarium Society) Conference will be the first such Conference to be held in Japan, or in Asia. We, the organizers of the Conference in Japan, feel greatly honored to be chosen as the hosts for this memorable event.

Japan has more than 300 planetariums; only the U.S. has more planetariums than Japan. About 80 planetariums in Japan have created the Japan Planetarium Society (JPS), which is working toward the development of planetariums in the country. Since 1993, JPS has been affiliated with IPS. Organizations of planetariums other than JPS have also been established in Japan; it is expected that all these organizations will cooperate with JPS in preparing for the IPS Conference.

The IPS Conferences have been attended by enthusiastic participants from various countries. We hope that not only previous participants, but many new participants, particularly those from Asian countries, will attend the Conference, furthering friendly exchange between "planetarians" from all over the world, and helping develop planetariums throughout the world.

1. Schedule of the IPS '96 Conference

Through discussion with the present and the past president, we have decided to hold the IPS '96 Conference from July 12 to 16, 1996. In addition, we are also planning pre-conference trips on July 11 and 12, and a post-conference tour from July 17 to 20.

During the previous IPS Conference in Florida, it was announced that the '96 Conference would be held from July 14 to 18, 1996. Subsequently, however, the Conference date has been advanced by two days, after consideration of air fare and other factors.

Those who have already made plans based on the earlier announcement are requested to kindly modify their arrangements, so as to correspond with the Conference schedule.

The Conference will begin with a reception on the evening of July 12, and end with a farewell party on the evening of July 16. (See the table below for details of the Conference schedule.)

Paper sessions and workshops constitute the most important part of the Conference. A call will be made for papers to the sessions and workshops to all members. We hope that many people will make enjoyable and worthwhile presentations at these events.

As for a speech to be made by an astronomer during the Conference, we have asked Professor Takeo Kosugi of the National Astronomical Observatory, Japan, to speak. Professor Kosugi, a specialist in solar physics, has played a central role in the satellite "Yohkoh" Project, which has produced splendid results. Many of those interested in the IPS Conference are sure to have seen the exciting picture showing a corona that was taken by "Yohkoh." With regard to the theme of his speech, we have requested Professor Kosugi to discuss the results and prospects of solar observation, particularly that in outer space, by Japanese researchers.

2. Participation Fee

The registration fee for the '96 Conference is 20,000 yen (approx. $230 at the current exchange rate). This fee covers the costs of materials, reception, cultural events, excursions and farewell party. In addition, participants in the Conference will be responsible for their own hotel, transportation and dining expenses. ("Dining expenses" refers to some expenses for breakfast and lunch.)

If you want to participate in pre- and post-conference tours, an additional payment is required. (The fee for pre- and post-conference tours are 15,000 yen (approx. $175) and 30,000 yen (approx. $350), respectively.)

3. Venue

Most events of the '96 Conference will be held at the International House, Osaka (known as I-house). I-house is a building designed for international conferences which was opened in February 1987. Its features include a large hall accommodating 1,000 people, and all necessary equipment for

Vol. 24, No. 3, September 1995 The Planetarian

Conference Schedule
(Preliminary)

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wednesday, July 10</td>
<td>9:00-12:00</td>
<td>Council meeting</td>
</tr>
<tr>
<td></td>
<td>13:00-19:30</td>
<td>Registration for Pre-conference tour</td>
</tr>
<tr>
<td>Thursday, July 11</td>
<td>9:00-19:00</td>
<td>Pre-conference tour (Kyoto)</td>
</tr>
<tr>
<td>Friday, July 12</td>
<td>9:00-17:00</td>
<td>Pre-conference tour (Nara)</td>
</tr>
<tr>
<td></td>
<td>12:00-19:30</td>
<td>Registration</td>
</tr>
<tr>
<td></td>
<td>19:00-21:00</td>
<td>Evening reception</td>
</tr>
<tr>
<td>Saturday, July 13</td>
<td>7:00-8:30</td>
<td>Breakfast on your own</td>
</tr>
<tr>
<td></td>
<td>9:00-9:30</td>
<td>Welcome ceremony</td>
</tr>
<tr>
<td></td>
<td>9:45-11:45</td>
<td>Paper session 1</td>
</tr>
<tr>
<td></td>
<td>12:00-13:00</td>
<td>Lunch provided</td>
</tr>
<tr>
<td></td>
<td>13:30-18:00</td>
<td>Business meeting</td>
</tr>
<tr>
<td></td>
<td>18:30-19:30</td>
<td>Buffet dinner provided</td>
</tr>
<tr>
<td></td>
<td>19:30-20:30</td>
<td>Cultural event</td>
</tr>
<tr>
<td>Sunday, July 14</td>
<td>9:00-10:00</td>
<td>Breakfast provided</td>
</tr>
<tr>
<td></td>
<td>10:30-13:00</td>
<td>Paper session 2</td>
</tr>
<tr>
<td></td>
<td>12:00-13:00</td>
<td>Lunch on your own</td>
</tr>
<tr>
<td></td>
<td>14:00-17:30</td>
<td>Excursion</td>
</tr>
<tr>
<td></td>
<td>18:00-21:00</td>
<td>Vendor time</td>
</tr>
<tr>
<td>Monday, July 15</td>
<td>7:00-8:30</td>
<td>Breakfast on your own</td>
</tr>
<tr>
<td></td>
<td>9:00-10:30</td>
<td>Paper session 3</td>
</tr>
<tr>
<td></td>
<td>10:30-12:00</td>
<td>Affiliate meeting</td>
</tr>
<tr>
<td></td>
<td>12:00-13:00</td>
<td>Lunch on your own</td>
</tr>
<tr>
<td></td>
<td>13:30-18:00</td>
<td>Vendor time, Workshop 1</td>
</tr>
<tr>
<td>Tuesday, July 16</td>
<td>7:00-8:30</td>
<td>Breakfast on your own</td>
</tr>
<tr>
<td></td>
<td>9:00-10:00</td>
<td>Panel discussion</td>
</tr>
<tr>
<td></td>
<td>10:00-11:30</td>
<td>Workshop 2</td>
</tr>
<tr>
<td></td>
<td>12:00-13:00</td>
<td>Lunch provided</td>
</tr>
<tr>
<td></td>
<td>13:30-16:00</td>
<td>Visit Science Museum of Osaka</td>
</tr>
<tr>
<td></td>
<td>16:00-17:30</td>
<td>Council meeting</td>
</tr>
<tr>
<td></td>
<td>18:00-21:00</td>
<td>Farewell Party</td>
</tr>
<tr>
<td>Wednesday, July 17 - Saturday, July 20</td>
<td></td>
<td>Post-conference tour</td>
</tr>
</tbody>
</table>
international conferences.

For the first time, both Japanese and English will be used as the official languages of the '96 Conference. Simultaneous or successive interpretation service will be provided at all Conference sessions.

Also, a trade show will be held at I-house, probably for about two days.

4. Host Planetarium

The Science Museum of Osaka will serve as the host planetarium for the '96 Conference. The Museum, opened in October 1989, is relatively new. Its predecessor, the Osaka Electric-Science Museum, was known as the site of Asia's first planetarium, which was installed there in 1937. Visitors to the new Museum can see the original planetarium, a grand Zeiss II, though it will not be operated.

The planetarium presently used at the Science Museum of Osaka is a Minolta Infinium Alpha. It is operated in a dome with a diameter of 26.5 m and a floor inclination of 20 degrees. An Omnimax is also installed in the Museum.

In addition, the Museum has an exhibition space of approx. 3,000 square meters, used for exhibition in such fields as astronomy, physics, chemistry and engineering.

5. Hotel

Only a small number of hotels are located near the Conference venue. Therefore, not all participants will be able to go to or from the venue by foot. Compared with other countries, hotels in Japan are relatively expensive: an overnight stay in a single room, furnished with a bed, a bathroom, a small table, a chair and a TV set, costs at least 7,000 yen (approximately $80 at the current exchange rate). The per-capita cost of staying in a twin room is not significantly lower than the cost of staying in a single room.

We have reserved about 300 hotel rooms, from which participants can reach the venue within 30 minutes. The prices of these rooms range from 7,000 to 13,000 yen (approx. $80 to $150) per person. An extra fee (approx. 1,000 yen, or $12) is charged for breakfast. For many participants, public transportation will prove useful in going to or from the venue. Incidentally, subways in Japan (especially in Osaka) are safer than their counterparts in any other country.

We are investigating accommodation and transportation possibilities to allow for the greatest convenience for those participants who are new visitors to Japan.

6. Pre-conference Tour

A two-day trip from Osaka is planned as a pre-conference event. The destinations are Kyoto and Nara, world-famous ancient cities of Japan, where participants will be able to see ancient temples, beautiful gardens, and more. How about spending some time in these cities before the Conference?

The visit to Kyoto will take place on July 11. Participants in the trip will depart Osaka early in the morning and arrive in Kyoto after an approximately 90-minute bus ride. In Kyoto, participants will visit Nijo Castle (built by a shogun) and Kinkakuji Temple, and other sites. They will also call at Kyoto Handicraft Center, where they will be able to observe demonstrations of traditional Japanese handicraft, and shop around for souvenirs. Participants will conveniently return to their hotels in Osaka in the evening.

The visit to Nara is scheduled for July 12. It takes approximately one hour to go from Osaka to Nara by bus. On this day, the participants will visit the Daibutsuden building of Todaiji Temple, the world's largest wooden building, as well as Kasuga Taisha Shrine, with its more than 1,000 garden lanterns. Since an official event will be held in the evening of this day, however, this trip will be shorter than the trip to Kyoto.

Since July coincides with the rainy season in Japan, the weather for these trips is likely to be rainy. Even so, participants should have no reason to regret such weather, since rain enhances the original atmosphere of Kyoto and Nara as ancient cities. You need only a small umbrella to enjoy this atmosphere.

7. Post-conference Tour

A trip along the former Tokaido and Nakasendo Highways (ancient highways which no longer exist) will be held as the post-conference tour. This tour features visits to the research institutes of two major Japanese planetarium manufacturers. Accordingly, the tour will undoubtedly prove interesting for planetarians.

Participants in this tour will board a Shinkansen train (bullet train) in Osaka on the morning of July 17. Their first destination will be Minolta's research institute in Toyokawa, Aichi Prefecture. After visiting the institute, participants will reverse their course to Nagoya, a metropolis in central Japan. Nagoya City Science Museum, one of the most active museums in Japan with regard to planetarium-related programs, is located in this city. Arriving at the museum in the evening, the participants will enjoy a planetarium show featuring computer music, and attend a "star party" using a reflecting telescope with a diameter of 60 cm. On this night, they will stay at a hotel in Nagoya.

On the 18th, the participants will visit Nobeyama Radio Observatory, operated by the National Astronomical Observatory, Japan. Nobeyama is an approx. 1,300 m-high plateau in southeastern Nagano Prefecture. The Nobeyama observatory is equipped with an interferometer, and a millimeter wave radio telescope with a diameter of 45 m. Using this equipment, researchers are engaged in the observation and study of interstellar molecules, producing results that are among the best in the world. If the schedule permits, participants will be able to observe the use of the solar radio heliograph.

For this night, we are looking for an appropriate Japanese-style hotel. Some spas are located near Nobeyama; a severe problem with these spas is that hotels there are rather expensive. We are working hard to ensure that the participants will enjoy the original atmosphere of a Japanese-style hotel without exceeding budgetary limits.

The participants will move to Tokyo on the 19th. First, they will visit Goto Optical Mfg. Co. in Fuchu, Tokyo Prefecture. Then they will divide into small groups which will be led by planetarians in Tokyo to planetarium halls, temples, shrines or shopping centers, according to group members' wishes. Probably a party will be held for the participants in the evening. We wish that everyone will fully enjoy their last evening in Japan.

On the 20th, the participants will travel individually to the airport according to their respective flight schedules. Note that it takes about two hours to go from Tokyo to New Tokyo International Airport by bus.

8. Schedule from Now and Address for Inquiries

Schedule from Now:
September, 1995
January, 1996
March 31, 1996
July 12-16, 1996

Address for Inquiries:
Secretariat of IPS'96 Office
3-7-3 Nakatsu, Kita-ku
Osaka 531, Japan
phone: +81-6-372-9345
fax: +81-6-372-6127
To planetarians who say:

"I'd control my theater with SPICE Automation if it cost less,"

Sky-Skan says:

"OK!"

The best media control system money can buy now costs less money. A lot less.

Take our new THYME II Data/Time Interface. It costs over 60% less than its predecessor. Our new NUTMEG utility cards make automated dimming and switching functions dramatically less expensive. New pricing on existing SPICE Automation hardware delivers even more savings.

If you're planning a new or revitalized theater, call us for a quote. The best is within reach.
SN 88® II PLANETARIUM, AN INFINITY OF POSSIBILITIES PLUS ...YOUR SKILL!

Based on its experience as automation specialist, RS Automation offers an innovating planetarium concept: the SN 88® II. The ease with which the most advanced functions are used will allow you to show existing productions or create your own with minimum difficulty. Amongst other advantages, you shall appreciate in particular:

Centralised piloting: all productions tools (planetary device, diascopes, video projectors, surround effect sound and lighting...) are operated by one powerful calculator, using a specific program: the Integral software. All can thus be controlled, automatically or manually, from the console.

Speed and flexibility: in only a few seconds, you can pass from an observation point and an observation date, to other coordinates, even to those located in totally different periods or regions, and this even from another planet. You just enter the coordinates and the calculator repositions itself immediately, silently and with maximum precision.

User-friendliness: no need to be a computer specialist to operate this system which uses a PC compatible computer as interface between the user and the calculator, associated to the Integral software developed on Windows.
You can therefore develop your own productions, simply using the trackball, the action menus and configuring the timing for each tool. You may also purchase existing productions, which are easy to implement, develop or modify.

RS Automation manufactures planetariums from 9 to 15 meters diameter, horizontal or inclined, and will, following your request, undertake overall implementation of a complete planetarium (including a spherical screen, floor and wall covering, seats, electricity, air conditioning...). Specific developments are also possible, such as planetary device elevating systems associated to a trap-door mechanism allowing use of the room for other purposes.
Opening the Dome

conducted by Jon U. Bell
Planetarium Director
Hallstrom Planetarium
Indian River Com. College
Fort Pierce, Florida

"Opening the Dome" addresses strategies and logistics for conducting active, aggressive real sky observation programs as adjuncts to planetarium shows.

How to Host a Radio Astronomy Show

I've just returned from the June, 1995 South Eastern Planetarium Association conference held in Macon, Georgia, hosted by the staff of the Mark Smith Planetarium/Museum of Arts and Sciences. A workshop was presented there by Dave Maness, Astronomy Director at Virginia Living Museum in Newport News, George Fleenor, Staff Astronomer at Bishop Planetarium in Bradenton, Florida, and me.

Dave had called up a few weeks earlier, and told me he'd wanted to put on a workshop about radio astronomy. Since neither Dave nor I would know a transmitter from a matter-antimatter phase inducer, I knew that the kind of radio he meant was broadcast radio—y'know, am-fm stuff. So Dave and I talked about what it takes to put together a radio show, and George Fleenor rounded things out by showing how he could make even a TV weatherman sound like he actually knew something about astronomy. (We'll talk about George's exciting experience in a later column.)

I first got involved with a service like this when working as an intern at Hayden Planetarium in the late '70s. No radio show there, but like many other major planetariums, they had a telephone message unit called "The Sky Reporter" that we changed once a week. (When Skylab came down in the summer of '79, we provided daily updates on its decaying orbit and last chances to see it in the sky before it hit Australia.)

When I moved to Virginia, I was approached by a public radio station to put on a "What's Up?" radio show—a once-a-week show on astronomy topics and sky events. This ran for a year. By this time, Dave Maness had joined the staff, and we switched to a classical radio station where we presented "Almagest," with a similar style, for about three years until that station was sold and they went from classical to adult rock format, whatever that is. Then we went back to the PBS station with a new feature, "The Sky Report," which consists of a live telephone conversation with the station's program director/announcer once a week.

And, since January, I've been hosting "Skywatch," a one-minute daily update on the sky, on the college's public radio station.

So—you've decided that you should offer an astronomy show on a local radio station. Or maybe you haven't. If that's the case, then read on, as we detail, in exciting outline form, all the things you might think about in setting up just such a service.

First of all,

I. Why would I want to do this?
A. It will establish a connection between you and the public.
1. It will help to raise your facility's visibility, and increase public awareness of your planetarium's existence.
2. It will make it possible for lots more people to hear you, whether you're talking about things going on in the sky, what telescope is best to use, and so on.
B. It will establish a connection between you and the media.
1. Most media folk, especially in the broadcast arena, are always searching for an area expert who can put the local spin on things. This could be you.
2. Making these connections will establish a professional reputation for you and your facility in the media, who monitor each other to see what the competition is up to.
3. When you have something newsworthy to announce, it will make it easier to get them to listen to you. After a while, they'll be calling you.
C. It will provide an outlet for giving out sky information, astronomy education
D. It will boost planetarium attendance. You may not see an immediate jump in numbers (unless there's some special sky event or specific planetarium program that you're plugging). But an upward attendance trend should appear over the long term of months and years, as this kind of program lends itself well to word-of-mouth publicity.
E. You can plug specific shows, programs, workshops, etc.
F. You are effectively carrying out your museum's or planetarium's mission statement.
G. You may enhance your status with your supervisor.

II. OK, you've sold me. Now, who should host the show?
A. This is just too easy. You, of course. Alternatively,
B. A syndicated service, like Starni~.'~e.
C. Whoever on your staff is the best astronomy expert (probably you, especially if you're a one-person operation.) Otherwise you can share the workload with qualified staff.
D. The person on your staff who has the best communication skills/speaking voice/persona, although the human ear can forgive a lot of voice imperfections if.
E. The person is very enthusiastic and "sky-wise".

III. Which radio station should I approach to offer this service?
A. It's best if they approach you. That way, they think it's their idea, and are generally more cooperative and enthusiastic about the show. Otherwise, you're apt to run into a lot of apathy out there.
B. A classical or fine arts station is usually best, because classical music listeners are also the same people who like to go to planetarium shows or look up at the night sky.
C. If you haven't got one of those, then you might try a public radio station. Same audience, but the NPR folk are sometimes less appreciative of your work; so if you can handle that, go with them—just don't expect to be thanked.

D. Talk radio; Easy Listening; Country/West-
E. Museum activities, workshops, excursions, etc.
F. Light pollution, space program, other related social topics.
G. How science and astronomy work.

VI. Are there any special problems I'll run into?

Good Heavens, yes. One special problem: what do you do if you're sick, out for the day, on vacation? What if you miss a deadline? It's good to have backup plans in place. For instance, I'm on a ten-month contract with my college, and while I'm away for a couple of months, I don't want to be worrying about sending in my spots. So the week before I left, I set aside a couple of days and recorded about thirty generic spots (how to buy a telescope, what are black holes, how can I see the Milky Way, etc.). The station will run each spot, Monday through Friday, for 30 weekdays, and then repeat them once more until I get back to make fresh, timely reports.

On occasion, the station will bump your program, forget to run it, whatever. Don't get angry about it—they just don't have the same priorities as you. Save everything you write, and reuse it if given an opportunity—I've already done this a couple of times in the past month.

Never forget why you're doing the program. If other opportunities come up in the print, television or computer medium, you may be able to accommodate these opportunities while still hanging on to the radio show. But it's always good to evaluate your situation from time to time.

VII. What resources will I need?

B. Mercury, Published by the Astronomical Society of the Pacific, 390 Ashton Ave., San

(Please see Opening Dome on page 46)
PARTNER * SHIP * EARTH
Our planet provides everything needed to support a large variety of life. Earth seems alive itself, caring for and nurturing its occupants. In this 25 minute program you will explore our fantastic planet from its violent birth to today and see how its composition, structure and wealth of resources make life possible. Find out what we can do to better enjoy and preserve the future of our world.
- 250 slides

LIFE BEYOND EARTH
This 31 minute program investigates the possibility of extraterrestrial life. The show explores the number of stars in our galaxy, the places where planets may have evolved, the chances of life on other worlds and our search for intelligent life in the Universe. A science fiction story about future contact with an alien civilization weaves through the program.
- 368 slides

DESTINATION: UNIVERSE, OUR FUTURE IN SPACE
We dream of flight among the stars, but a trip to the nearest star will require a mastery of technologies we can barely imagine today. This 38 minute program takes you on a journey of the imagination from America’s Space Station Freedom, to planetary engineering projects ten thousand years hence.
- 321 slides

WORLDS OF WONDER
"Worlds of Wonder" explores exciting discoveries about the planets, moons and other worlds in our Solar System made during the last two decades with spacecraft like Viking and Voyager and other probes. Beyond the familiar nine planets, at least sixty moons, thousands of asteroids and billions of comets add mystery and adventure to our continuing investigation. Explore these fascinating "Worlds of Wonder" in this 25 minute program.
- 314 slides

Also available: First Light: The Space Telescope Story
- $200 while limited supplies last

Production kit includes:
- Production Book with annotated script, visual list and educational materials
- Soundtrack on cassette
- Slides
$350 (unless listed otherwise)

Please send order to:
Distribution Davis Planetarium
Maryland Science Center
601 Light Street
Baltimore, Maryland 21230
410-685-2370
FAX 410-837-8840

Make check or purchase order payable to the Maryland Science Center

Preferred Audio Noise Reduction:
- Dolby B
- Dolby C
- dbx

MARYLAND SCIENCE CENTER

NEW! “Don’t Duck, Look Up” Preschool Show Coming Fall ’95
Introduction: In this participatory planetarium activity, students are given an assortment of plastic or glass hand lenses. Then, in the darkened environment of the planetarium they are expected to search until they discover how a refracting telescope is made.

Class Time: One fifty minute planetarium lesson plus one or two additional class periods after the planetarium visit.

Science Thinking Skills: constructing, distinguishing, interpreting, simulating, inferring, and predicting

Procedure: After the students have been seated in their cooperative groups, ask the attending teacher to aid in the distribution of materials and worksheets. Then, turn on the bright light in front of the room. Ask the attending teacher to stand behind the light and become the illuminated “object”. Darken the room, except for the illuminated teacher in front. Ask students to experiment with the lenses to produce a real image of the “illuminated teacher” on the back of their index cards. You may need to demonstrate this procedure to the class. Most students will be astonished to see that an image is actually formed, and that it will be inverted. Students will quickly discover that each lens is capable of focusing an image on the index card except for one—the divergent one. Each cooperative group should then use the centimeter ruler or measuring tape to measure the distance from the lens to the image distance for the other three lenses. You could also have each group measure the “object distance” as well for use in the lens formula later in the classroom. If you decide to do so, ask the attending teacher to hold one end of a 25-foot (8 meter) tape while you stretch it across the room to each lens, while the students record the measurement. We omit this because of time restraints. From the data collected on each lenses image distance, the lenses are labeled as short focus convergent, medium focus convergent, or long focus convergent (SFC, MFC, or LFC).

Now, darken the room with the stars and crescent moon on. Explain to students that they will now be using two lenses together instead of just one to attempt to produce a simple telescope. You will have to demonstrate to them that one of the lenses, the eyepiece, will have to be held right next to the eye for their telescope to work. Start out by placing both lenses adjacent to the eye. Then, keeping one lens close to the eye, move the other away and in the direction of the moon while carefully observing with the "eyepiece" eye. It might take a few tries—but eventually they will see a magnified image. This step is likely to be very noisy and will require a great deal of trial and error. Once they have been successful in this part, have them answer the questions on their worksheet. Check to make sure that each member of each cooperative group actually sees the image.

If students are given enough time to explore, with a little encouragement they will discover that a refracting telescope is really a combination of a long focus convergent lens for an objective and a short focus convergent lens for an eyepiece. They will be able to discover that the low-power eyepieces produce smaller, but more easily resolved images. If they are observant, the effect of chromatic aberration (red and blue tinges of color) around the lunar image will be easily seen.

Comparison: Use your slide projector to project an image of Jupiter with its Galilean satellites or a small Saturn on the dome. Encourage students to look at them through their “telescopes” Saturn’s ring plane should easily look inverted. Then, ask them to try to find the Pleiades through their “telescope”. Explain how a real telescope in the night sky would reveal many more stars than are visible to the naked eye. To demonstrate this, show them a slide of the Pleiades as they would look through a small telescope. Repeat this procedure with other selected objects such as the Beehive, the Andromeda galaxy, or a visual binary like Albireo.

POST PLANETARIUM ACTIVITY: The success of the lesson from this point on depends on the determination of the classroom teacher. Many find this a good opening or introductory exercise on a light or optics unit. In the classroom, they can build optical benches, find focal lengths by various methods, produce simple microscopes, etc. They then draw ray diagrams, identify real and virtual images, learn about light gathering power, f–ratios, filters, etc. This would be an excellent opportunity for the classroom teacher to invite a local amateur astronomer to the class with his or her own telescope to explain some of the details about telescopes such as mounts, projection methods, etc. Try to get an amateur with an H-alpha filter so the class can see the sun if the weather is good! Also, the classroom visit could be planned to coincide with a first or last quarter moon so that it could be observed also.

22 The Planetarian Vol. 24, No. 3, September 1995
Planetarium Lab Worksheet

Lenses and Telescopes

1. Use each of your lenses to form an image of the light source in the front of the room onto your index card.
   a. Which lens does not produce an image? (the divergent)
   b. Describe each of the three images formed. (Each image was inverted and reduced. Some were more easily resolved than others.)

2. Use the measuring tape or centimeter ruler to measure the distance from the lens to the image of the light source on the index card. Identify the four lenses as short focus convergent (SFC), medium focus convergent (MFC), long focus convergent (LFC), and divergent.
   (The SFC has the shortest image distance and is the hardest to resolve clearly up to the LFC which has the longest image distance and is the easiest to resolve clearly. The divergent lens does not produce a real image.)

3. Using the lenses provided, experiment until you discover the best combination to form a simple telescope. The "object" will be the moon in the planetarium sky.
   a. Which lens is the best one for the objective (LFC)
   b. The other two lenses (excluding the divergent) are the eyepieces. In this experiment, which one would be considered the low power eyepiece? (the MFC) Which one would be considered the high power eyepiece? (the SFC)

4. In space provided, sketch the moon it appears through both eyepieces of your crude telescope. Identify each as "low power" or "high power".
   (Illustrations should show the "inverted" crescent moon of slightly different magnifications.)

5. Describe the how the telescope image differs with differing eyepieces. Be sure to use the terms magnification, resolution, and chromatic aberration in your answer.
   (As the focal length of the eyepiece decreases, the magnification and chromatic aberration increase while the resolution decreases)
East Coast Control Systems

Manufacture • Install • Service • Maintain

ALSO AVAILABLE: Slide Projectors • Projector Racks • Special Effects • Laser Equipment • Video Equipment • Audio Equipment
Theater Upgrades and Maintenance • Technical Support • Hardware and Software Development • On-Site Consulting Services

East Coast Control Systems
(407) 631-9799
Book Reviews

April S. Whitt
Fernbank Science Center
156 Heaton Park Drive NE
Atlanta, Georgia 30307

It's another equinox, book lovers. Here are some star-gazing books for adults and some great stories and information for children. Celebrate with some of the volumes reviewed below. Or if you've read a good book lately, send me a description and see your name in print!

This issue's kind reviewers include Edward Albin, Edna DeVore, John Flynn, David Leake, Patrick McQuillan, Georgia Neff, Jose Olivarez, Mike Reynolds, Jon Welte and Gregg Williams.


Reviewed by: Edna DeVore, SETI Institute
2035 Landings Drive, Mountain View, CA 94043. email: edna_devore@seti-institute.edu

Exploring Planetary Worlds is a well-written tour of our solar system by the current Chief of Space Science Division at NASA Ames Research Center. Morrison's storytelling style and clear prose offer a brief introduction to astronomy and the solar system for the non-technical reader. Even though Exploring Planetary Worlds is non-mathematical, it is a book which requires some scientific literacy. Morrison brings together physics, geology, chemistry, astronomy, atmospheric sciences, history and politics to tell the story of the solar system.

Starting from "Where are we?" and "What can we see?" the reader journeys through both time and space with Morrison as he presents a primer of comparative planetology to "reveal the planets as places, worlds just as varied as our Earth." Exploring Planetary Worlds is not a "My Very Earnest Mother Just Sent Us Nine Pizzas" march through the planets. Beginning with historic astronomy which emphasizes the motions of the planets, he brings the reader to the modern study of the properties of planets and the processes which reveal the origin and evolution of the solar system. Throughout the book he compares the Earth with the other planets to show how we learn about our home from studying other worlds.

During his tenure at the University of Hawaii, Morrison was a very popular lecturer, and his skill as a teacher shines through the text. He describes the visual appearance of the planets to lure the reader out to look at the sky. Then the naked-eye view is compared with the view through the eye of the telescope and spacecraft. There are occasional humorous asides such as the comment that when stars explode, they "enrich (or pollute, depending on your perspective) the interstellar gas and dust ..." Clever analogies bring numbers to life. For example, "If the Jovian magnetosphere were a visible entity, it would appear, "seen" from Earth, the size of our Moon. The total mass of the ions and electrons in this magnetosphere, however, is less than the mass of the Great Pyramid of Giza in Egypt." (page 48) Or his comment that if Venus is the result of a run-away greenhouse effect, Mars is the result of a run-away refrigerator effect.

Color photographs and well-done graphics illustrate almost every page of the text from stone circles to the latest Magellan and Galileo images. The illustrations fit well with the text, and the captions often provide additional technical information. I appreciated the clear identification of color-enhanced versus true color photographs. Although few in number, charts of planetary data and space missions appear at appropriate places in the text, making the information much more accessible than if they were buried in footnotes or an appendix. Russian and American space exploration are treated evenly. Graphic, cut-away diagrams of planets and moons allow for easy comparison of these bodies. Exploring Planetary Worlds is like taking a colorful tour with an enthusiastic guide who seems at home anywhere in the solar system.

Morrison is outspoken about the interaction of politics and space exploration: "For a few glorious years, it seemed that humanity had broken the bonds of Earth and truly begun a new space age. But at the peak of its success, Apollo lost its political appeal, and the program was abruptly terminated... Leftover Apollo spacecraft, built at costs of hundreds of millions of dollars, take the place of honor in museums instead of resting, as intended, on the lunar surface. No science-fiction writer had predicted that humans, having once attained the Moon, would so quickly abandon it." (page 55) Later, he discusses the potential consequences of global warming and the ozone hole in warning tones. Although most comparative planetary science books conclude with the origin and evolution of the solar system, Morrison concludes with an extended epilogue on cosmic impacts on Earth. For the planetarium director, this epilogue is a good resource for programs on "Cosmic Collisions." Morrison has prepared reports and testified before Congress about the disastrous consequences of asteroids and comets colliding with Earth and what we might do to detect these objects and protect our planet. The epilogue presents Morrison's argument clearly. To date, no nation is funding his proposed global network of telescopes to seek the near-Earth asteroids. But the impact of Comet Shoemaker Levy 9 into Jupiter has renewed political interest in the problem of cosmic collisions.

Exploring Planetary Worlds includes a good bibliography of non-technical books for those who wish to explore in greater depth, and an adequate index. (Note: Morrison is also the author of an annotated set of 100 slides, The Planetary System, which is a natural partner to this book and a great resource for the planetarium director and astronomy educator. This set is available for copying at some NASA Teacher Resource Centers and for purchase as a slide set or an electronic picture book for the Mac through the Astronomical Society of the Pacific, 390 Ashton Ave., San Francisco, CA 94112, (415) 337-2624 or NASA CORE, Lorain County JVS, 1518 Rt. 58 South, Oberlin, OH 44074, (216) 774-1051 ext. 293. You may also download The Planetary System (and other titles) as an electronic picture book from the Space Telescope Science Institute at http://www.stsci.edu/exined-html/exined-home.html)


Reviewed by Dr. Mike D. Reynolds, Chabot Observatory and Science Center, Oakland, California, USA.

The Case for Mars III is the third in a series of presentations made at the Case for Mars Conference held at the University of Colorado, Boulder, Colorado on 18-22 July 1987. These are volumes 74 and 75 of the American Astronomical Society series. Earlier Case for Mars Conferences were held in 1981 and 1984, and each is detailed in a volume of this series.
These two volumes do not necessarily live up to their General Interest and Technical subtitles. I did not find the Technical that technical; many of the contributed papers were quite interesting. It appears as if the General Interest volume would have been too large, and papers had to be shifted from one volume to another. If you cannot afford both (they are not inexpensive: list price for General Interest is $55 and $50 for Technical) or have no interest in the "Technical" aspects, then only acquire General Interest and Overview.

Both volumes have excellent divisions in the Table of Contents. This leads the reader to his or her topic of interest, as well as specific papers/presentations about each topic. The abstracts that precede the papers nearly always provide the reader with an excellent overview. I also found the reference section following many of the papers excellent and quite in-depth; it would indeed provide additional resources as required by the reader.

Topics in the General Interest and Overview include vehicles for launching cargoes to Mars and propulsion systems that are both effective and economical, human physiology during such flights, and the politics of funding such missions. The explosion of the Space Shuttle Challenger, 1 1/2 years prior to the Boulder conference, figured prominently in several of the papers. For example, Radford Byerly, in "Decisions on Space Initiatives", discusses at length the short- and long-term effects of the Challenger accident. It was interesting to me as a reader to look back at recommendations made in 1987 and see how many have been implemented to date.

The reader will indeed find a plethora of topics on the subject, including why not to go to Mars. I found this discussion most enlightening, as I'm sure Conference attendees did.

The push for education is an occasional theme, especially in the General Interest and Overview. Ideas presented are those familiar to planetarians world-wide.

Many of the figures and photographs are quite useful, although some are of poor quality. The papers were apparently published from originals submitted by the authors/presenters.

Overall I would highly recommend the Case for Mars III: General Interest and Overview. It is a little expensive, although you might be able to pick up a copy in a used book store, (where you might even be able to get both volumes for the price of one, or less.) The Case for Mars III provides excellent information and background for those planetarians who have a passing interest in space exploration or who might be developing a planetarium program about the exploration of the fourth planet.

Reviewed by Jon Welte, Science Adventures, Huntington Beach, California, USA.

Intended as "the most up-to-date and comprehensive distillation of collective wisdom available to the amateur astronomer," Sky Watcher's Handbook succeeds in assembling in one volume a treasure-trove of technically sophisticated observing techniques for amateurs seeking to contribute to professional astronomy.

Sky Watcher's Handbook contains chapters on most areas of astronomical observation to which amateurs are currently making important contributions. Each chapter is written by a leading amateur observer in the field and typically includes a background on the type of object being observed, a brief overview of the equipment required and the observational techniques which produce the best results, and a survey of the research programs in the field to which more attention is needed.

The use of many authors results in a widely differing style from chapter to chapter. Perhaps nowhere is this more noticeable than in the often-repeated discussion of what constitutes an "adequate" instrument for "serious" observation. One author might express a requirement aperture in terms which make the more modestly-equipped observer balk in dismay, while another stresses the importance of enthusiasm and dedication in observing, no matter what size instrument is used—noting both the most commonly-used apertures and important results achieved with smaller telescopes.

There is a decidedly British flavor to many of the articles, which may be somewhat of a disadvantage to observers in different latitudes and different climates. Ironically enough, editor James Muirden adds a note at the end of David Levy's chapter on comet hunting in the southwest USA about the different techniques required for comet-hunting from England and northwest Europe. A reader observing from those southwestern United States will wish for a similar regional translation in some other chapters.

Definitely not for beginners, the information contained in Sky Watcher's Handbook makes it an indispensable guide for an amateur seeking to move on from casual stargazing to a systematic program of astronomical observation.

Reviewed by Jose Olivarez, Wichita Omnisphere and Science Center, Wichita, Kansas, USA.


The "story behind the story" of lunar landings is eloquently described in this definitive account of how we came to understand the geological history of the Moon. Dr. Wilhelms was a member of a scientific team responsible for assembling an overall picture of the Moon's structure and history during the Apollo flights to the Moon, to recommend where on the lunar surface field work should be conducted and samples collected by the astronauts. In this book, he relates the site-selection process in detail and draws in concomitant events concerning mission operations to show how the events affected the course of the scientific program. Dr. Wilhelms discusses all six landing sites in detail and tells the behind-the-scenes story of telescope and spacecraft investigations of the Moon before, during and after the manned lunar landings.

Intended for anyone interested in the space program, the history of science, or the application of geology to planetology, To A Rocky Moon leaves the reader with a better understanding of how the Apollo landing sites were chosen and a better idea of what the Moon is really like. The book is also replete with revealing statements about what has made the Moon what it is today. This reader learned, for example, that the Moon's famous Alpine Valley is a "graben" (a sunken channel); that if there is a volcanic caldera on the Moon, the crater Vitello ought to be it; and that the youngest prominent crater on the Moon is probably Tycho, at 109 million years of age. There are also profound statements about the Moon including Dr. Wilhelms' views that "the moon is not a primordial object but an evolving one," that "the moon is neither cosmic erotica nor a little earth," and that "cosmic impacts rule the Moon."

To A Rocky Moon contains 47 small black and white photographs, but it would benefit from many more. Also, a second edition of this book would be greatly enhanced by the inclusion of a larger version (perhaps a folding plate) of the ACIC photomosaic of the lunar near side. This map appears as a frontispiece of the current edition, but is too small to serve as an adequate guide to the location of the many lunar sites discussed in the book. Two good companion books to To A Rocky Moon are Sky Watcher's Handbook, edited by James Muirden, W. H. Freeman and Company, 41 Madison Avenue, New York, New York, 10010, USA, 1993, ISBN 0-7167-4501-X.

The Planetarian Vol. 24, No.3, September 1995

All planetarians planning a script on the geology of the Moon or on the Apollo landings must include To A Rocky Moon in their list of essential readings. The book is both fascinating and easy to read.


Reviewed by David Leake, William M. Staerkel Planetarium, Parkland College, Champaign, Illinois, USA.

At some time in their lives, every stargazer read one book that made the universe a bit more knowable; a book where everything just seemed to “click.” I can recall reading Herbert Friedman's Amazing Universe many years ago when the sequence of stellar evolution just seemed to make sense. Reading Roy Gallant's Private Lives of the Stars gave me flashbacks to a time when "the light bulb turned on."

In his unique, fatherly style, Roy Gallant takes the reader through stellar evolution at about the middle school level. Major topics include where stars come from, why they shine, why they come in different colors, and their eventual fate. All the bases are covered and it doesn't read like the Astrophysical Journal.

Mr. Gallant begins with an ancient view of the universe, through the gods and goddesses of our ancestors and the rise of the constellations and the lore that accompanies them. I particularly appreciate the author challenging the reader's beliefs in a rotating and revolving Earth. We often take for granted what is printed in our textbooks and fail to ask for proof. Throughout Private Lives of the Stars, the proof is given in layman's terms.

Chapters two and three focus on the Sun and our struggles to determine its distance and size. The reader is taken on an imaginary journey to the center of the Sun, through the corona, chromosphere, and photosphere, to the core. The discussion of the Sun's fusion powerhouse is excellent!

My favorite sections of the book are chapters five through nine. They introduce the reader to the different types of stars that inhabit our galaxy. Gallant does not speak in general terms, however. He acquaints us by discussing specific stars we can easily see in the sky. We learn about Rigel, Deneb, and Sirius as examples of blue and white giant stars. Then come the red giants in the form of Betelgeuse, Antares and Aldebaran. Each star comes with a "portrait" displaying some of the star's vital characteristics and full-page charts are included to show where to find these stars in the sky.

White dwarfs are introduced as the probable end state of our Sun, followed by a discussion of planetary nebulae and novae. The book concludes with chapters on variable stars that "can't make up their mind," and the anomalies of the galaxy, namely supernovae, neutron stars, pulsars, black holes, and "gnoblins," or mini-black holes.

My only criticism of the book is chapter four on the "big bang" and galaxy formation, which could probably be omitted and not disrupt the flow of the manuscript. The short section on star formation could have been situated elsewhere.

I would recommend this book to any high school, middle school, or planetarium that has a library. It would be the perfect gift for that young astronomer who has learned a few constellations and now desires further knowledge of how the universe works. It is full of black & white photographs and has a glossary at the end. The real treasure of this book, however, is Roy Gallant's writing style. It is as if he is talking to you as you read.


Reviewed by Edward Albin, Cherry Planetarium, Fernbank Science Center, 156 Heaton Park Drive, Atlanta, GA 30307

This book serves the planetarian as a much needed current reference on the planet Jupiter. Presented in a compact 250 page volume, I found the book to be very informative and concisely written by an expert in the field. Reta Beebe served on the Voyager team and utilized the HST to observe comet Shoemaker-Levy 9 when it collided with Jupiter.

After a brief historical overview, all aspects of Jovian planetary science are considered by the author. Of particular interest are the chapters dealing with Jupiter's atmosphere, interior, and natural satellites. The section describing Jovian moons is somewhat brief, and a detailed account of these fascinating miniature worlds can be better found in other recent books. In any event, the book is an excellent pre-Galileo look at the largest planet in our Solar System. Jupiter the Giant Planet is written in a "popular" style that makes it accessible to the layman, and it may be an item to stock in your gift shop this December (just in time for the Galileo-Jupiter encounter).


Reviewed by Gregg L. Williams, Merrillville Community Planetarium, Merrillville, Indiana

Skywatching is a beginner's guide to observing the night sky. The author, David H. Levy, is perhaps the most famous amateur astronomer of today. His fame comes from being one of the co-discoverers of Comet Shoemaker-Levy 9, which crashed into Jupiter in July, 1994. But Levy is also an experienced author, including eight previous books and a regular column for Sky & Telescope magazine.

Levy succeeds in writing an interesting and easily understood guide to astronomy and the night sky. The scope is broad and the contents are up-to-date. The text is accompanied by numerous photos, diagrams, and illustrations.

Skywatching starts with a brief history of astronomy. Next, Levy presents a primer on stars and galaxies. Chapter three is titled "Skywatching Tools and Techniques." The fourth chapter covers the fundamentals of naked-eye astronomy.

The heart of the book—and about half of its pages—is found in chapter five, "A Guide to the Sky." The chapter contains twelve sky charts and 85 constellation charts drawn by sky cartographer Wil Tirion. The constellation charts contain a wealth of information about each constellation including a guide to pronouncing the constellation name and a "visibility grading"—a ranking on a scale of 1 to 4 of how easily the constellation can be seen. In the text accompanying each constellation chart, Levy provides a little background about the constellation. A description of interesting objects visible to the naked eye, binoculars, and amateur telescopes is also included.

Chapter six is a summary of information about the various bodies in our solar system. The last chapter touches on the subjects of cosmology, space exploration, and life in space. The book also contains a directory of
resources.

Skywatching is a terrific introduction to astronomy and the night sky. It also makes a handy reference for those working in planetariums and astronomy education.


Reviewed by Patrick McQuillan, Virginia Living Museum Planetarium Newport News Virginia, USA.

Where Does The Moon Go? follows the Moon through its twenty-eight-day trip around the Earth. Along the way it identifies what causes the different phases of the Moon. This book is written for budding astronomers who want to learn more about the barren craters of the Moon. This book is written for budding young astronomers who want to learn more about the barren craters world this is our closest neighbor.

It is one of a series of books written by Sidney Rosen and illustrated by Dean Lindberg. It is important to mention both author and illustrator, for without both this book would not be one tenth as enjoyable. The illustrations really make this book one that kids will pick up and read again and again.

Sometimes we see a round moon like a fifty-cent piece.

sometimes a half-moon like a slice of melon.

And sometimes the moon looks like the top of a thumbnail. What are all these shapes?

The book is written in a question and answer format that starts with “Will the Moon be up tonight?” This starts the young reader thinking about the Moon and the sky. The narration proceeds to answer questions about the Moon’s environment and phases. By the end, these and many other topics are unraveled in easy-to-understand terms.

Lots of colorful cartoon drawings are overlaid on real photos of rocket launches or the night sky. And there’s an excellent glossary. Any big word (like planetarium, constellation or astronomer) is highlighted in bold print and defined at the back of the book.

Probably the best part of the book (and the part that shows my bias) is the question, “How can I spot a planet in the night sky?” Part of the answer is, “Your local planetarium can tell you where to look for planets.” It never hurts to have kids read a book and then bug their parents to take them to the planetarium.


Reviewed by Patrick McQuillan, Virginia Living Museum Planetarium Newport News Virginia, USA.

Can You Find a Planet is yet another in the series of questions and answer books written by Sidney Rosen and illustrated by Dean Lindberg. And once again they have created a wonderful mix of cartoon drawings and actual photos. This book’s topic focuses on planets.

Through the course of the book, readers are taken on a fast rocket tour of the planets. The book begins by looking at the night sky from our vantage point on Earth. It explains the difference between planets and stars, how we can see more with telescopes and space probes, and then looks at each planet up close.

One particularly good feature of all of Rosen’s books is the pictures. Some pages have cartoon drawings that help to explain the topic or infuse some offbeat humor. The characters in the book include the questioner (a boy with a backpack), a companion (a dog who is also wearing a backpack) and the source of answers (an owl with binoculars).

The boy and his dog are back asking questions again, but this time the answers are given by a woman (an astronaut maybe). She pilots the rocket that zips the characters around the solar system. (She has to. Everyone knows that owls can’t pilot rocket ships ...) My only complaint is that the boy and his dog are never named in any of the books. (I guess Mickey and Pluto would be too much of a cliché.)

If you want a fun book to use as a reading activity for a second or third grade workshop, this one will catch the children’s interest. It may even catch your interest. Doesn’t everyone like a book with lots of pictures and cartoon characters? I know I do.


Reviewed by John Flynn, Armagh Planetarium, Armagh, Northern Ireland, United Kingdom.

This delightful little book is intended for the 9 to 11 year old child, which would be years Primary 6 or 7 here in the UK. It deals, as the title suggests, with the distances to the stars, but soon progresses to such important questions as, “What is a star?” “What is a solar system?” and a bit of simple stellar evolution.

Two things struck me immediately upon reading this book. Firstly, the language is very appropriate for the intended age range, an impression that was confirmed for me by several teachers and many pupils in the schools I visit as part of my job. Often an American book will be difficult for European children to understand due to certain words (i.e. “fries” in America are “chips” in Britain).

This does not occur in this book, apart from one very minor exception. We are told to let the Earth be a ball “the size of a very small pea or a BB”. Kids in Northern Ireland (even 38 year old kids) do not know what a BB is! The meaning is still crystal clear, so this does not even matter.

Secondly, the illustrations by Dean Lindberg mix cartoon characters with real pictures of stars and nebulae. I had my reservations about this at first, but it does work remarkably well. Our little cartoon teacher
who guides us does indeed warn people about looking directly at the Sun, something I insist on in almost any work on astronomy for children.

I also like the practice of certain key words in the text being in bold type, which are then included in a glossary. If only more educational texts did this I would be a happier man!

Even though by the end of the book we're talking about black holes and red giants, this is done in a simple way and did not appear to upset any of the children that I tried this book on.

Should your school or astronomy club have a few spare pounds (whoops! so sorry, dollars) then I think this book would be a good investment for your library. I suppose I could have reviewed this volume in six words: "Language and contents, very appropriate. Illustrations, excellent!"

---

**Which Way to the Milky Way?**

Reviewed by John Flynn, Armagh Planetarium, Armagh, Northern Ireland, United Kingdom.

Having reviewed a companion volume *How Far is a Star?* by the same author, I approached this review expecting great things of this book. I am very glad to say that my expectations were in every sense fulfilled.

The subject of the Milky Way galaxy and beyond is daunting for 10-11 year olds, but Sidney Rosen approaches it in a very basic way and leads children on a journey through the Universe by means of asking those oh-so-simple questions that are the most difficult to answer. "If the solar system is moving around the galaxy, why don't we feel dizzy?"

The author asks the reader to think of a housefly flying around in the back of a car which is moving along the road. I'm sure you get the idea.

Having learned that the galaxy is a huge collection of stars, we find out what shape it is and where we are in that group. The kids find out that because things are so big, miles and other earthly measurements are not very useful for measuring distance and sizes, so we need something else—light years.

Having touched (briefly) on the problem of time lag when looking at objects whose light takes so long to reach us, we finish by seeing some spectacular views of distant galaxies.

Throughout the text the author uses the excellent device of putting certain key words (telescope, solar system, galaxy) in bold type, and then defining those words in the glossary. This idea is important for children. As adults, we often forget ourselves and take things for granted when using technical terms. Ideas like this and the content of the text show that while Dr. Rosen is a professor of astronomy in Illinois, he is no stranger to writing for young children.

This book successfully conveys some very difficult ideas to young readers, and I have no intention of finishing this review without mentioning the illustrator, Dean Lindberg. His light-hearted cartoons help keep the reader's attention and lead on to the next idea/concept. He has worked with Sidney Rosen before, and this is obviously a marriage made in heaven. They enhance each other's work, with an end result that is both entertaining and informative.

This book is part of a series, and I must state that I eagerly look forward to seeing the others, *Where Does the Moon Go*? and *Can You Find a Planet?* If they are anything like this one and *How Far is a Star?*, the whole series belongs in every school library and every home with young children.

---


Reviewed by Georgia Neff, Lakeview Museum Planetarium, Peoria, Illinois, USA.

Elinda is an Estonian maiden of marriageable age, courted by the Sun, the Moon and the North Star. She chooses, however, Prince Borealis of the Aurora. As she waits for him to return for their wedding day, she weaves her wedding veil, the Milky Way. She waits only so long before taking matters into her own hands.

Colorfully illustrated by artist Veg Reisburg, this tale is charmingly retold by storyteller Lynn Moroney. As such, it lends itself especially well to retelling under the dome. The book's format, with a short narration and multiple illustrations also make it an excellent choice for reading aloud.
What’s New

Jim Manning
Taylor Planetarium
Museum of the Rockies
Montana State University
Bozeman, Montana USA

Well, did you see Mir/Atlantis at the end of June/beginning of July, moving like a bright star across the evening sky? I did, not so long ago as I write. And one of the things that strikes me as newsworthy about it is that it took so long to do it again—nearly 20 years after Apollo Soyuz.

But now, cooperation is the key to a future is space, and it seems an encouraging development in the saga of a space station where encouraging developments have been rare.

Another thing that strikes me—after the flurry of articles in my local newspaper precisely when and where to see Mir/Atlantis pass by—is that Mir by itself has been nicely visible on regular passes for years, for those who took the trouble to find out. Same for the shuttle (at least for missions of high orbital inclination) and any number of orbiting satellites. Goodness, Roger Mansfield at Astronomical Data Service has been doing this forever. Which brings me, coincidentally, to the first topic this time out.

Tracking Satellites

For some years Roger Mansfield at Astronomical Data Service, P.O. Box 26180, Colorado Springs, Colorado 80936 USA, telephone 719-597-4068, offered a computer program called "Space Birds" for predicting the appearance of satellites from one's earthly location. More recently, he's offering a program called "WeatherBirds Utilities," a PC-compatible program for predicting the passes of up to 30 polar-orbiting weather satellites from various countries over one's local space.

The idea is that if you know when particular satellites (such as the American NOAA and Russian Meteor satellites) will pass by above your horizon, you can receive and process their signals to get your own weather satellite images.

The program is pretty nifty; Roger sent me one set up for my spot on the globe with 21 weather satellites already in the listing. He also included a seven-page set of instructions and advice on how to set up a ground receiving station with VHF radio equipment and your PC-compatible computer, including sources and suppliers of equipment and a reference reading list. He says you can set up such a ground station for as little as $500 U.S. not including your computer hardware.

What great educational possibilities exist here! You could set up a hands-on weather station for students that includes more than instruments for measuring temperature, atmosphere pressure, and wind speed. With this program and the necessary equipment, you could have students produce their own weather images—teaching them about computers, satellites, orbits, and weather all at the same time.

We haven't attempted setting up a weather bureau yet, but—prompted by the recent Mir/Atlantis tryst—we did experiment with the program to see if we could use it to predict the passages of other objects—like space stations and shuttles. My clever, net-surfing technician David Binnewies tapped into the public access site "NASA Spacelink," noting around for Mir's current orbital elements. The link produced a list of two-line Keplerian elements for a number of orbiting objects, including Mir.

David loaded the data into the program, modified the satellite list to include Mir, and came up with pass predictions whose times and trajectories compared very nicely with several memorable Mir/Atlantis passes that we had observed from Bozeman the previous week. A check of the upcoming week didn't indicate any passes of Mir (once again solo) readily observable in a dark sky, but the retroactive predictions satisfied us that we could use this program to keep track of Mir if we choose—so long as we get updates of its orbital elements from time to time.

Our Spacelink connection also indicated that there are orbit-tracking programs available either free or as shareware for both Macintosh and IBM compatible computers. No more excuses for having satellites catch us unaware! You can access NASA Spacelink on the World Wide Web at http://spacelink.msc.nasa.gov/.

"WeatherBirds Utilities" sells for $45 U.S., with diskettes available in 3.5-inch or 5.25-inch sizes. The order blank indicates that for overseas orders, add 25% for postage and handling. Incidentally, Roger sent a new version of the program to all WeatherBirds users in early June to accommodate two changes made in the two-line elements (TLE) format for satellites by NASA Goddard Space Flight Center. The new version accepts both old and new TLE's for satellite orbits—just in case the new format isn't permanent.

Astronomical Data Service also sells a number of other useful sky-related products, including the "Skywatcher's Almanac," a reference for the sun, moon, planets, and constellations including the daily times for the rising and setting of sun and moon computed for your location; the "Local Planet Visibility Report" providing planetary data again for your location; the "Skywatchers Guide Kit" with materials for making a planetsphere; and one that I've used for several years: the "Photographer's Almanac of the Sun and Moon," which provides daily information on morning and evening twilight, the rising and setting of sun and moon, the time of local noon and the height of the sun during the day, and the illumination percentage of the moon at rising—all for your specific location. The costs of these and other products range between $10 and $20 U.S., for the most part. For a catalog or more information, contact Roger as given above.

Tracking Satellite Data

Speaking of weather satellites, in May I received a notice that the U.S. National Climatic Data Center (NCDC) was combining its satellite customer service operation in Camp Springs, Maryland, and its customer service operation in Asheville, North Carolina into one operation. Effective July 10, NCDC will begin servicing both satellite and in-situ requests from Asheville. If you have satellite data requests to make of NCDC, presumably involving weather and climate, the address is: National Climatic Data Center, Climate Services Division, 151 Patton Avenue, Asheville, North Carolina 28801 USA, telephone 704-271-4800, fax 704-271-4676, e-mail: sato@ncdc.noaa.gov.

The notice further indicates that if you require special assistance, experience a problem, or have a suggestion for improving service, you can contact Bob Money, Chief of the Climate Services Division, at 704-271-4680, e-mail bmoney@ncdc.noaa.gov, or Marc Plantico, Chief of the Climate Applications Branch, at 704-271-4400, e-mail mplantico@ncdc.noaa.gov.

SETI Music

Earlier this year, I received a copy of a new release from Instinct Records, 26 West 17th Street, #502, New York, New York 10011 USA, telephone 212-727-1360, fax 212-366-5979, called "SETI: Phoros." This double-CD album, composed by artists Taylor808 (not a typo) and Savvas Ysatis as the first of Instinct Records' "Instinct Ambient" artist series.

As the title indicates, the album is inspired by and based on the SETI project. According to the accompanying press release, the album follows another release last year entitled simply "SETI," which "captured the bleakness of the doomed NASA-funded SETI project and the tranquil emptiness of space." This statement refers, of course, to the fact
that the project, finally begun in 1992 (comprised of a targeted search of the nearest 1,000 solar-type stars and a general sky survey designed to continue for ten years), was canceled by the U.S. Congress just a year later, its potential vastly unfulfilled.

Subsequently, the nonprofit SETI Institute in Mountain View, California, took up the challenge to raise private funds to continue the targeted search portion of the original project. The new project is appropriately called Project Phoenix, scheduled to begin in January of this year with a six-month study at Parkes Observatory in New South Wales, Australia of the 200 target stars observable only from the Southern Hemisphere.

Anyway, the press release says that the first CD album caught the attention of Dr. Frank Drake of the SETI Institute and the institute's public relations department, and led to their assistance in the creation of the follow-up album—billed as a project to blend science, art, and technology into a musical form termed both experimental and, specifically, "ambient."

I had a listen to the two CD's, each about 54 minutes long, and the description is apt. If ambient music is music you use to fill up the background while you're doing something else, it works. I played them while I was working at my computer, and the sound grew on me. It combines electronic synthesizers and samplers with "radio leakage," the sound signatures of pulsars and the Arecibo message radio telescope white noise, and even the voice of Frank Drake talking about the search for extraterrestrial life (the last seeming as much for effect as the others, since it's hard to actually hear what he's saying above the other assorted sounds).

The combination sounds eerie and spacey and indeed experimental. I would have found it hard to sit quietly and pay attention to it for two straight hours, but as background that surged in and out of my mind while I was occupied with other tasks, I found it quite nice. In smaller doses, it would do a nice job of evoking the loneliness and indifference of the universe.

The two CD's are titled Arecibo and Phoenix, and there seems to be a bit of yin and yang going on here. It's evident even in the disk colors: "Arecibo" is black, Phoenix is white. Arecibo seems more passive—the passive listener even as the Arecibo radio telescope was, recording what the universe gives it; the sound is dark, lonely, atonal, repetitive, atmospheric. Phoenix, on the other hand, seems more active—the active searcher of significant signal patterns from space; it's brighter, more lyrical, more rhythmic, more musical. I like Phoenix better—it was more interesting to listen to—but the contrast between the two was quite striking to note.

I found myself thinking that the set would be interesting to experience in a dark planetarium with the stars above—perhaps not for two straight hours, but for a while. The album comes with a 20-page booklet including a short essay from Frank Drake, a sort of stream-of-consciousness short fictional story called "Pharos" by Madison Blue, and descriptions of the Arecibo message sent in 1974, the Drake equation for estimating the number of technological civilizations in the galaxy, the history of SETI, and Project Phoenix. It's a nice accompaniment to the music.

The Planetarian
Vol. 24, No.3, September 1995

SETI

SETI: Pharos retails for $16.98 U.S.—a very good price for a double CD album, I think. For more information, contact Janet Tzou at the address and number given above.

Strasenburgh Music

While we're talking music: Strasenburgh Planetarium producer/composer Steve Fentress recently sent me a copy of one of his facility's latest products: the Strasenburgh Planetarium Music Kit No. 1, featuring 70 minutes of Steve's music composed for planetarium programs and special events.

There are 41 different selections, ranging from musical "punctuations" a few seconds long to pieces up to six and a half minutes long. Most are between one and two minutes in length, all orchestrated with "a combination of digital samples and analog-synthe-

sized sounds."

The kit notes indicate that the collection was designed to be "a good thing to have around." And so it is. I took a listen, and the selections cover a wide range of styles and moods as one might expect from music designed for the planetarium—from quiet, reflective mood pieces, to drum roll/cymbal crash comedic punctuations, to bright and cheerful bits, to the eerie, to the jazzy, to the cute, to the "ornery" as Steve characterizes some of the choices available. It's good stuff and pleasant listening.

The music comes on chrome cassette with Dolby B noise reduction; for other formats, call Strasenburgh. The cassette also comes with interpretive notes and tips on use. It costs $75 U.S. prepaid, $80 U.S. if Strasenburgh must bill you; the costs includes the rights to use the music in your planetarium "any way you like."

Check it out; it's another good tool to have in your planetarium's musical bag of tricks. For more information, or to order, or perhaps to get a sampling, contact Charlene Oukes, Administrative Assistant, at the Strasenburgh Planetarium, Rochester Museum and Science Center, Box 1480, Rochester, New York 14603, telephone 716-271-4320, fax 716-271-5935.

Cosmic All-Skies

Anthony Fairall of the University of Cape Town, Rondebosch, 7700 South Africa, and the Planetarium of the South African Museum, P.O. Box 61, Cape Town, 8000 South Africa recently sent me some examples of all-skies with which he's been experimenting, for inclusion in the talk I presented at the Astronomical Society of the Pacific's Education Symposium at the end of June. And his work is definitely worth a mention here.

Tony is developing all-sky sets for use in registration with (or to substitute for) the conventional star projector—including views of the radio sky, an enhanced view of the Milky Way, the fluctuations in the Cosmic Microwave Background, and a three-dimensional view of galaxy distribution in the extragalactic sky. The all-sky images are being developed on a Silicon Graphics Indigo 2 in collaboration with W. Paver in the computer science department at the University of Cape Town.

I took the liberty of panning the sets he sent me (the radio sky at 2300 MHz and the distribution of galaxies) into our own all-sky system for a quick look, and the views are most impressive. The scenes are set with the South Celestial Pole at the zenith. The radio
sky shows, in false color, the emissions from the plane of the galaxy as well as supernova remnants and faint extragalactic sources. The southern extragalactic sky, depicting galaxy distribution (based on redshifts) out to 250 million light years, color codes the galaxies (single pixels except for the very nearest) according to distance from white to blue. It includes the mostly empty “Zone of Avoidance” which can be filled by the star projector’s Milky Way projection, and readily displays galactic clusters and voids.

Tony indicates that he’s also working on a more in-depth color-coded version of the galaxy all-sky that could be used with ChromaDepth spectacles from AudioVisual Imagineering to produce a more three-dimensional view of galactic distribution—all of this to further the cause of presenting an improved perspective of modern astronomical knowledge in his planetarium.

I don’t know if Tony has plans to make his all-skies generally available, but he has provided his galactic data base to Mickey Schmidt of the Air Force Academy Planetarium in Colorado Springs, Colorado USA, who has created several three-dimensional data bases (with different numbers of galaxies) for use with his Digistar planetarium.

Strasenburgh Planetarium has offered infrared and radio all-skies for some years (as well as filamentary and “soap-bubble” representations of the structure of the universe), and the Digistar’s “alternate skies” repertoire includes infrared, radio, x-ray, and gamma ray views. It’s nice to see work continuing on such alternate views, especially in the area of actual galactic distribution and COBE results.

All of this adds another important dimension to what we can display—and teach—in our planetarium theaters.

**Sky and Calendar Tools**

Sometimes, when my “What’s New” bin is a bit short on items, I’ll pop up to our museum gift shop to see what I can find. Sometimes, I make some nice discoveries—as I did recently in finding several wonderful products designed by Bernard Vuarnesson of Sculptures-Jeux in Paris, France, and marketed in the U.S. by a company named Sarut, New York, New York, telephone 800-345-6404, fax 212-691-1077.

The first is a perpetual calendar. A wood-and-cardboard shell (6.25 inches by 1.5 inches by 1.5 inches—16 cm by 4 cm by 4 cm) holds three wooden cylinders with designations for month, century, and year respectively, and patterns of lines below the designations. If you want to know the day on which any date fell (or will fall) between the years 1600 and 2299, you roll the cylinders until the proper month, century, and year appear through their respective windows on the front side of the shell. The line patterns appearing through the windows create connecting lines running from dates (1-31) on the far left portion of the shell front to the days of the week on the far right. You just dial up the century, year, and month, and trace the lines across the cylinders from the date to the day. It’s quite ingenious!

Do you know on which day of the week Neptune was telescopically discovered by Galle and D’Arrest? It was a Wednesday evening. If IPS 2006 begins on July 8, do you know which day that will be? Saturday. I suppose someone with one of these could get annoying, but it’s quite an attractive device and a conversation piece even if you’re not desperate to know the day on which every event over seven centuries has fallen or will fall. The wholesale price is $17.50, retail somewhat higher depending on the markup.

The second device is called a “Stellaroscope”—a clever twist on the standard planisphere. It has the shape and form of a spyglass in black plastic, about 8.5 inches (21.5 cm) fully extended, about 2.5 inches (6.5 cm) across at the base. The bottom portion houses transparent planisphere-like sky maps for either the northern hemisphere or southern hemisphere sky (it comes with both and they’re interchangeable). You insert the map you want, and insert one of four interchangeable masks which show the sky from four latitude ranges between 20 and 60 degrees north or south.

The barrel of the device is divided into two portions which rotate independently of each other and are marked in month-and-day and hour-of-day, respectively; you line up the day and hour you want by rotating the tube sections. Then you orient the device by aiming the East-West symbols at the proper directions, focus the eyepiece section in or out, and there you have it—the sky set for the time and latitude range you’ve chosen. There’s even a pocket light included for night use.

The Stellaroscope wholesales for $20 U.S. according to my information.

But my favorite is the “Planetcia” Planet Finder, which provides a simple model of the solar system with the ability to show where the planets are in relation to each other for any date between January 1, 1940 and December 31, 2019, with a general indication of their location in the skies of earth.

The device comes in the shape of a disk about 5.5 inches (14 cm) across and about 2.5 inches (6.5 cm) thick. It consists of a series of concentric, geared black plates on which ride small silver balls representing the planets from Mercury through Uranus, with a sun (which lights up when you push a button on the bottom of the device) in the center. The plates are enclosed by a clear plastic top which can be rotated by hand; the inside edge of the bottom portion shows the band of the zodiac against which the planets move in the sky.

The planet distances are of course not to scale, but when you rotate the clear plastic top by hand, the gears turn and the plates move the seven planets at their correct relative speeds. By rotating the top, you can set the planets’ relative positions for any year between 1940 and 2019 and for any day of the year. Further, by aligning a small hour dial attached to the earth in the clear plastic top, you can set your horizon line for any hour to see which planets will be above your horizon then, and approximately where in the sky.

Slow-moving Neptune and Pluto are also represented in the device as a series of white dots around the inside edge marking their slowly-changing positions from year to year from 1940 to 2019.

All-in-all, it’s quite a fascinating device. Like the Stellaroscope, the wholesale price is $20 U.S.

For more information on these items—which are functional, hands-on, and educational as well as attractive—you can contact Sarut as given above. The company may also be able to assist in obtaining a contact for Sculptures-Jeux in Paris for finding distributors outside of the U.S. Do check these items out!

**Mars Rides Again**

Earlier this year I received notice from Loch Ness Productions, P.O. Box 3023, Boulder, Colorado 80307 USA, telephone 303-455-0611, fax 303-455-1742, e-mail: markpet@sci.com.alphacode.com, that their popular program The Mars Show has been newly updated. The changes reflect the current state of Mars exploration, with the changes narrated again by actor Patrick Stewart and the new soundtrack digitally mastered on DAT format. There are just a couple of new slides required, but others have been improved and are available as an option.

The cost of the update is $125 U.S., including new script, soundtrack and three new slides; the optional slide set, consisting of 60 Wess-mounted slides, costs $300 U.S.

It was a good show the first time around; it’s nice to see that it will be usable for Mars oppositions to come in its new form.

**Finally . . .**

Until next time, enjoy the fall/spring, and, as always . . . what’s new?
Most Frequently Asked Questions:

**QUESTION:** What is the most frequently asked question about 'STAR HUSTLER'?

**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 HUSTLER'?

**ANSWER:** Most TV stations air 'STAR HUSTLER' just before nightly sign-off. However, due to 'STAR HUSTLER'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 HUSTLER' on my hometown PBS station, how can I see it where I live?

**ANSWER:** 'STAR HUSTLER' 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 HUSTLER' 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 HUSTLER' off the air and using it regularly as a way to reach their public.

**QUESTION:** Is there any way I can get 'STAR HUSTLER' other than my local PBS station?

**ANSWER:** Yes. A month's worth of 'STAR HUSTLER' 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) 305-854-4242. Ask for Mrs. Harper or Mr. Dishong.

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

**ANSWER:** Any teacher anywhere around the world can obtain 'STAR HUSTLER' 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; 15181 Route 58 South; Oberlin, OH. 44074.

**QUESTION:** Why does 'STAR HUSTLER' always say "Keep Looking Up!" at the end of each show?

**ANSWER:** Have you ever tried star gazing looking down?
Here’s hoping that everyone had a good summer (or winter, for those whose perspective on the universe is rotated 180 degrees from mine). Here in Amarillo, it’s been a relatively cool summer, but a busy one. (But then again, how often do you hear a tarian comment that they’re not busy?)

Please send or call in any new facts or stories, or just let me know how are going in your corner of the planet—I’d love to share your information with the rest of the planetarium community!

To Phil Gross (HPS) who’s about to become a father, to Jeff Guil (Gibbes Planetarium, Columbia SC) who now has a baby daughter, and to Bow Walker (Hudnall Planetarium, Tyler TX) whose wife is also expecting.

To Carole and Greenhouse (Mark Smith Planetarium, Macon GA) for hosting a great conference in spite of difficult circumstances. The major construction at their museum was delayed for a year, so they were busy dealing with possible water and power problems. I heard that you “did your museum proud, and a good time was had by all!”

to Jim Manning for a “wonderful presentation” at the Astronomy Education Symposium in Maryland—l’ve heard that your audience was very impressed!

to Mike Chesman (Bays Mountain Park, Kingsport TN) as SEPA’s new President-Elect, and to the former president-elect, Rick Greenwald, for his new position at Twin Falls, Idaho.

to Asuncion Sanchez (Planetario de Madrid, Spain) for her new show, a sort of poetic trip through the universe. It’s been called “one of the most visually beautiful planetarium shows ever.”

And to Kris McCall and the other employees of Sudekum Planetarium (Nashville TN) for receiving a Certificate of Commendation from the Tennessee Association of Museums for their production “Just Imagine.”

Did You Know...

Bill Gutsch is now consulting out of his home in New York; feeding the deer instead of listening to jackhammers. He says he is “alive, well, happy as hell, and as busy as ever”

According to Lonny Baker (Astronomical Society of the Pacific) the annual meeting in Maryland went very well; she says a large number of planetarians were present at the Astronomy Education Symposium. It sounds like the planetarium, education, and astronomy community are coming closer together—the Pacific Planetarium Association is meeting in conjunction with the California Science Teachers Association at San Jose at the end of September.

Speaking of coming together, there may be an international planetarium conjunction in 1996: John Peterson (El Paso ISD, El Paso TX) has invited RMPA, PPA, SWAP, and the Association of Mexican Planetariums for a joint conference in 1996! It sounds like an ambitious endeavor, but well worth the effort!

Thomas Kraupe (Forum der Technik, Munich) is having a successful run of his new show, “Gateway to the Mind’s Eye 2”—which features computer animation. He was assisted in its production by Mr. Dolby and by Miramar. With three wizards like that, how could it fail?

Fleischmann Planetarium (Reno NV) had a 40% increase in attendance for the first quarter of 1995, according to Director Art Johnson. He attributes it directly to the new 8 perforation 70mm film projection system they have running. They’ve also had a first for Fleischmann—a “meteorite” brought in for examination turned out to be (of all things)... a real meteorite! It’s only the third ever found in Nevada.

What do suspended water particles have to do with planetariums? No, not space nebulae this time—Dale Smith (Bowling Green State University, OH) was in a knock-down, drag-out fight at a CRAP picnic this summer... a waterfight, that is. According to Dale, Jeanne’s son Eric Bishop and Gene’s son Ben Zacaj teamed up on him. (Of course, we’re sure Dale would never start a water fight, right?)

Shoichi Itoh (Suginami Planetarium, Tokyo) has recently received word that the city will completely rebuild his planetarium over the next 4 to 5 years. Congratulations! It seems as if a lot of planetariums have been through a bout with construction lately, or are anticipating it. Bess Amaral (Robert Goddard Planetarium, Roswell NM) reports that they finally have restrooms at her facility, after 25 years of operating without them. (That’s a long time to hold it!) Wayne Wyrick (Kirkpatrick Planetarium, Oklahoma City) should have a new dome and shows running by now; he’s been plagued by delays for the past six months. Last but not least, Dave Hostetter (Lafayette, LA) hopes to be back in his dome (with or without leaks) which he has not operated since Hurricane Andrew.

Dr. York Clamann (Abilene TX) has accepted a new position in Abilene, acting as a Curriculum Director for St. John’s Episcopal School. He will remain the editor for SWAP’s newsletter. SEPA also has a new editor for their journal; Linda Hare (Bradenton, FL) has been overwhelmed with other tasks, including acting as Executive Director of ILDA and has abdicated in favor of Duncan Teague (Pink Palace Planetarium, Memphis Tennessee).

John Hare (Bishop Planetarium, Bradenton FL) has had a title change, allowing him to devote more time to the planetarium and expend less of his energy managing the museum. How do these professionals with multiple tasks manage? Somehow, Kris McCall (Sudekum Planetarium, Nashville TN) has been successful at directing a major planetarium while raising her 20 month daughter, Kyra Celeste. She’s been wondering if there are any other women directors with infants. She admits that her daughter does provide an excellent reason to leave work at a reasonable hour every day. Kris has also been working on the 1996 SEPA conference—she’s creating a conference management computer database for SEPA which might eventually be available to other regions.

Evidently, Jon Frantz (East Coast Control Systems) is moving to Pennsylvania. It should be a shorter drive to reach most locations—traveling through the length of Florida constantly was a tiresome task, even in the beautiful state of Florida. George Reed (Spitz) has also relocated to Nevada, where he and his wife have a view of Lake Tahoe from their house.

Bill Gutsch says that he has seen the next generation of planetariums and calls it “mind-boggling—it’s going to knock your socks off” IPS members should preview this new technology next summer in Japan! The
This is what the world's toughest audience had to say about America's first Minolta Infinium Planetarium:

"The most dramatic and realistic sky I've ever seen."
"In the future, all planetariums should be built this way."
"There was such detail...like looking at stars from a mountaintop."
"This is easily the most powerful planetarium ever made."
"Wow!"

A sky so real that you will believe.

Background is a photograph of actual Infinium sky

Last July, Florida's Brevard Community College hosted the International Planetarium Society. Pictured above are some of the nearly 500 planetarians from around the world who gathered to exchange ideas and witness America's first Minolta Infinium Planetarium. The result was nothing less than dazzling. For more information about the Infinium and other model projectors, call your nearest Minolta representative today. After all, at Minolta we know that once you have seen our sky, you too will believe.
The All-Sky Circle

Conducted by:
Deborah Judith & Ervin Bartha
NADA
P.O. Box 1661
Salt Lake City, Utah 84110-1661
801-355-2022 phone/fax

In this issue our friends from the University of Capetown/Planetarium of the South African Museum contribute a piece on how they produce a computer generated all-sky of the southern extragalactic sky. One of the interesting features of their work relates how they have been able to create a three dimensional view into the “great wall of galaxies.” Please enjoy.

The Southern Extragalactic Sky for 6-Projector All-Sky Systems

A.P. Fairall, W.R. Paverd and H. Mair
Departments of Astronomy and Computer Science
University of Cape Town / Planetarium of the South African Museum
fairall@uctvms.uct.ac.za

In Capetown, we developed a 6-slide all-sky set that accurately reproduces the positions and distances of galaxies in the southern sky, with the South Celestial Pole at the zenith.

Almost all the galaxies are shown as “single pixels.” Only twenty or so galaxies, excluding the Magellanic Clouds, are close enough to warrant being given slightly enlarged images to reflect their true angular sizes. This is quite a contrast to many popular depictions, used in planetariums that greatly exaggerate the sizes of galaxies, relative to the separations between them. In our view, NGC 5128 (Centaurus A) has the largest angular size—just enough for its famous dust lane to be made out. The distribution of galaxies shows a “Zone of Avoidance” due to the obscuration caused by the Milky Way.

The galaxies have been extracted from our “Southern Redshift Catalogue” (Fairall—University of Cape Town) which currently lists over 22,000 redshift measurements for more than 15,000 southern galaxies, but which is continually updated as new measurements become available. It also identifies and discards discrepant redshifts.

For visualization purposes, the database has been converted into X, Y, Z coordinates and held in a Silicon Graphics Indigo 2 (a dedicated graphics workstation). Various means of visualization are possible, such as interactive rotation, zoom and fly-throughs, using the mouse control. One software option is the generation of panels for 6-projector all-sky scenes using a mathematical mapping (devised by the first author). For reference, an all-sky grid can also be created. At present the screen is then photographed (in a darkened environment) on Fuj Velvia film, with correct scale and registration—though direct generation of 35mm slides is, of course, possible.

Whilst the entire galaxy database can be depicted in the panels, it makes sense to impose a distance cutoff. The redshift of a galaxy is an indication of its cosmological distance, so the software allows for a minimum and maximum distance to be selected. Our first general version, distributed to a number of planetariums around the time of IPS 94, went out to a redshift of recession (25000 km/s—which corresponds to a depth of over a billion light years. Since then, after trying various versions in a show, we have settled on a preferred depth to only 6000 km/s (250 million light years), since it is best for revealing the “voids” and “walls” in the distribution of galaxies.

Rather than vary the luminosity of the pixels to represent the relative apparent magnitudes, we were very keen to build in a distance effect. Accordingly, the color of the galaxies was graded from white, for the nearest galaxies, to blue at the distance cutoff. Blue was chosen for two reasons. First, it naturally suggests increasing distance. Second, when isolated blue and white dots are seen on a black background, the chromatic aberration of the eye creates a three-dimensional effect—the blue dots seem to be further away.

A completely three-dimensional view can be realized using ChromaDepth™ spectacles, as demonstrated by Audio Visual Imagine-ering at IPS 92 and IPS 94. These ingenious plastic holographic spectacles disperse light in opposite directions for left and right eyes, thereby creating a depth perception relating to color. They have the advantage of operating without the need of pairs of stereoscopic pictures (that would otherwise appear double when viewed without spectacles).

The ChromaDepth spectacles work perfectly well with the white-to-blue colored version, but we have also started producing red-to-blue versions for increased depth perception. Either way the effect is quite startling—to be able to see a three dimensional view that surrounds you!

Unlike the random distribution of nearby stars in three-dimensional space, galaxies are concentrated into a labyrinth of interconnected wall-like structures. Large voids, empty of galaxies, separate the major structures, while numerous small voids are embedded within “great walls” of galaxies.

The southern extragalactic sky is dominated by the concentration towards the “supergalactic plane.” The three-dimensional view reveals it as a great-wall of galaxies—yet seen edge on, from our position within it.

The first author’s research specialty is the mapping of such large-scale structures. The all-sky scene has played an important research role in contributing to this work. Numerous small voids have been located and catalogued using a “research set” of all-sky shells, each being viewed with the ChromaDepth spectacles. The scene has been displayed to visiting researchers, while all-sky panels have been shown and described at research conferences.

For the public, the all-sky scene offers an intriguing view of the universe on a very large scale. The distribution of multitudes of galaxies, normally too faint for the naked eye to see, is revealed. If required, the view can be used in register with the planetarium star projector, the Milky Way of the star projector filling in the “Zone of Avoidance” of the extragalactic sky. The star projector can also add in the Magellanic clouds.

In a recent presentation at our planetarium, we also created an “enhanced Milky Way,” an all-sky projection that could, when required, fill in the “Zone of Avoidance” or work with the conventional starfield. We hope to describe that scene in a further contribution to this department.

It is always refreshing to notice how creatively innovative producers and researchers in the planetarium field can be. We wish to thank our colleagues in South Africa for sharing a part of their inventiveness with our ever-growing readership.
LASER IMAGES, INC.

A GIANT LEAP ...
in laser display & presentations

Hardware · Software · Show-ware
Planetariums, Expos, World Fairs,
Theaters, Special Events, Theme Parks,
... and of course ...

LASERIUM®
6911 Hayvenhurst Ave.
Van Nuys, CA 91406 USA
818-997-6611
818-787-7952 FAX
Semi-Annual PIPS Meeting:

On Friday, June 16, a group of nineteen powerful interactive planetarium educators met on the Herkimer Co. BOCES campus. Our gracious hosts were Ted Stalc, Herkimer Co. BOCES director of a stationary planetarium with a Minolta MS-8 and 60 seats, and Lindarae Bauer, Oneida-Herkimer Madison BOCES Specialist.

Ted shared his exceptional creativity and formidable expertise by demonstrating highlights of three BOCES major programs which impact science education in his component school districts: a mobile observatory, distance learning techniques, and the planetarium.

Participants were treated to Thursday evening and Friday afternoon star parties where we examined characteristics of Jupiter and its four largest satellites, Mars, double stars, and the sun while gaining experience in operation of an impressive mobile observatory system. Everyone agreed that it is a marvelous teaching tool, and many can conceive of establishing a similar program. Ted's explanations helped us to realize that it could be done with many "found" materials to save money and he also shared several tips he discovered through experience so we don't have to reinvent the wheel.

The distance learning program is equally impressive as an example of one of the best in educational uses of technology of the 90s. Their set-up networks five sites with plans for expansion to twelve sites next year. This system makes it possible for small rural schools to provide classes in subjects not normally taught due to small enrollment. Ted taught a high school astronomy class for 45 minutes daily each semester to a small group of students at each of the five locations simultaneously. He goes to different sites on some days to maintain the "human contact." Teachers are trained to operate the system during a one week training session in the summer.

One of the technology involved includes: several TV monitors (including views of each remote site), Elmo (a TV camera mounted above a platform with interior lights. You can show slides, book photos, live telescope views), a VCR, surveillance cameras (automatically tracking the teacher or stationary), and a phone/fax set-up (in case the system goes down, or to fax quizzes). The only problems encountered (and solved) were the facts that all the schools do not have the same time schedules and all lesson materials need to be delivered to the schools three days in advance. All signals are carried over a fiber optic hard line Herkimer BOCES had installed. All this is paid for by grants, state aid and a per-class charge to the schools. We were pleased to learn that it works so well and the instructor adjusts to the technology quickly. Many of us had never seen a distance learning center before.

Ted's use of the planetarium is ingenious, both entertaining and dramatically effective educationally. His enthusiasm and dedication to higher level goals is obvious and was a joy to experience. Ted teaches multi-level science and astronomy topics to pre-school through high school students and also provides a unique environmental experience to special education (some severely handicapped) students. Through the use of the star field, live video camcorders and telescope, computer graphics, stuffed animals (Usa Minor is a soft, smiling 1.5m bear-with-a-diaper), and small robots, he captures the imagination and inspires thousands every year. Ted loves yard sales; other people's junk can be cleaned up and become a treasure in the planetarium! His techniques are completely interactive and lessons are one and a half or two hours in length. He says, "The objective is to make the planetarium a comfortable and fun place to work and learn. Technology just helps."

Lindarae Bauer brought some of her favorite planetarium music for middle and junior high students. This tape of upbeat and educational children's songs was produced by the Museum of Science in Boston for the Charles Hayden Planetarium. Sky Songs is available at $5.00 per tape plus $2 for shipping 1-3 tapes or $5 shipping of 4 or more tapes. Make checks payable to Museum of Science and send it to: Product Development, Museum of Science, Science Park, Boston, MA 02114. Allow 4-6 weeks for delivery. For more information call 617-589-0436. A video tape Lindarae mentioned was "Chair Dancing" (source unknown-check your local library) which gym teachers can use in the classroom while you set up your portable dome in their gym! Evidently the kids love it so maybe we should all get it to give to our disgruntled Physical Education teachers! We were also able to view some of Loch Ness Productions' (PO Box 3023, Boulder, CO 80307-3023 USA) beautiful new mythology slides which she uses during poetry lessons. A good tape for an African myth, "Why the Sun and Moon Live in the Sky", is Stories From the Enchanted Loom by Marsha Lane.

Betsy Whitlock (Farnsworth Middle School, 6094 State Farm Road, Gulielmer, NY 12084-9534 USA) demonstrated her unique use of the Radmar single slide projector (model 1210-see my column March 1993). After drawing their own pictures on 8 1/2 x 11-inch paper, students produce their own Kodakith slides to present with star gazing and storytelling activities in the planetarium. Betsy has altered her projector by installing an in-line dimmer for $15.

A discussion was held to examine opinions and experiences with specific astronomy topics at appropriate grade levels. Laura Lethonen, Wendy Suozo, and Jane McGinn...
BOCES, 6 British American Boulevard, Latham, NY 12110 are conducting an experiment with Jane's third grade class. Their attempt to provide intensive astronomy and space science education has evolved to a point where they may write a paper on it. They have provided 15 in-depth and specific Starlab lessons to third graders. They want to determine age appropriateness of specific tasks and topics for maximum learning and retention of process and information.

Fred Jaquin and Martin Barbour (MOST, 500 S. Franklin Street, Syracuse, NY 13210 USA) shared a story from the Anishinabe Indians of the Great Plains. The story is called "How Fisher Brought Warmth to the Earth" and can be used in conjunction with a circumpolar star clock/calendar because Fisher is in the location of the Big Dipper and can be used to tell the season. During the winter months Fisher struggles through the cold and snow toward the top of the sky. In Spring, Fisher climbs high in the sky and opens a hole for warmth. During Summer, as warmth is escaping, Fisher runs from the sky people. In the Fall they shoot him and he falls on his back. He never quite reaches the ground because Gitchee Manitou, the Creator, saves him and his journey begins again. This story was adapted by Mary Stebbins at the Museum of Science and Technology (MOST) and appears in a regularly scheduled planetarium show called "When Stars Were Alive: Native American Star Myths."

Gary Burgess (RR #3, Speach Drive, Central Square, NY 13036-9512) demonstrated a method for hanging cardinal points on the Starlab dome by Velcro. He has created a miniature screen with the words (or letters or numbers) lit up and very easy to see in the dark. He is selling these for a small fee. Call him at (315) 668-7412 or write for further information.


Another topic addressed by Lindaree involved her Student Intern Program which has proven to be successful and enjoyable for students in her districts. The following is a copy of her proposal for this project.

**Student Intern/ Mentor Program Proposal**

**Target Population:**

The target population for the Portable Planetarium Intern/Mentor Program is select fourth and fifth grade students from elementary schools in the Oneida County BOCES region. Each elementary school contracting for Portable Planetarium Service for the 1992-93 school year (dates of initialization of this project) will be eligible to designate one student. This student should demonstrate an interest in astronomy, general science, or teaching.

**Rationale-Needs Assessment:**

"A New Compact for Learning" directs educators to provide educational opportunities and resources to allow students to excel academically and to develop the skills necessary to meet the ever-changing challenges of society. High school students have access to Regional Programs for Excellence. No such program exists for elementary school students in the Oneida County BOCES region. During the past four years, when the Portable Planetarium was set up in a school, inquisitive students have lingered after presentations or approached the Planetarium operator before or after classes with questions. Their questions revealed an interest in material that extended beyond the classroom curriculum. This program would provide such students with the opportunity to explore, question, learn, and share their knowledge with peers within their home school.

**Goals and Objectives:**

- To provide an interactive planetarium experience for a select group of fourth and fifth grade students in the Oneida BOCES component school districts.
- Intern students will acquire a basic understanding of specific astronomy topics and the workings of the portable planetarium.
- To nurture a student's interest in science and to provide an opportunity through which self-confidence and esteem can be developed.
- Intern students will be able to orient their peers to the night sky.

(Please see Mobile on page 52)
Take control of them all...

The most flexible and expandable control system of them all

Omni Q® SMART™
Synchronized Modular Automated Response Technology

for more information contact Gregg Gillis at Commercial Electronics Ltd
1335 Burrard St. Vancouver, BC Canada V6Z 1Z7
Telephone (604) 669-5525 Fax (604) 669-6347
Comparisons of Popular Computer-Based Digital Audio Workstations

Jeff Bowen
Bowen Productions
3590 N. Meridian
Indianapolis, Indiana 46208
317-923-3838
317-923-3871 fax
bowenprod@aol.com

The March '95 installment of "Sound Advice" featured an overview of the editing of digital audio. We explored system requirements and applications using tape-based and computer-based digital audio workstations. The computer-based versions are often called DAWs. We will continue today with a comparative evaluation of some of the more popular computer-based DAWs. The following information is the most current as supplied by manufacturers at press time.

If you have not read the March issue of "Sound Advice" you should do so before continuing with this column as the information shared in the March column is a prerequisite to that presented here.

OK, so away we go. And this sure was a tough one to write. The world of digital audio has become too vast for any individual to completely master. I don't even think Sir Isaac N. could have known all there is to know about this subject. This issue focuses on computer-based workstations (at the request of the readers) and does not discuss "stand alone" DAWs such as AMS, ProDisk, Dyaxis, Foundation, Roland, etc. These DAWs do not actually use the horsepower of the computer for editing and mixing purposes, but rather only for display and user interface. These are very powerful and reliable DAWs... but reside in the upper end of the price scale ($7K and up), thus most of these units are beyond the financial reach of the majority of our readers. Also, there are now so many products available that it is impossible to review and even list all, so forgive any omissions. The DAWs discussed here have solid, proven track records and highly visible profiles among various levels of audio professionals.

Here are explanations of the terms featured in the tables.

**Channels**: Very important to understand this one! The maximum number of sounds that the DAW can generate instantaneously. Often is limited by hardware requirements. See Tracks as well.

**Tracks**: Could be considered as "work areas". Many DAWs allow far more tracks than there are channels to generate sound. These additional tracks are great to use for editing or to enhance the organization of your audio production. Here is an example: Let us suppose we are working with an 8-channel DAW in a specific section of a stereo show soundtrack. That means the DAW can generate no more than eight sounds instantaneously. Let's record two tracks of stereo music, two more of stereo ambient sound effects (sfx), one for breaking glass (??), one for a mono launch sfx, and two tracks of dialog. In places where all eight of these tracks are playing back the DAW is maxed out. We cannot record any more tracks, right? Right. But we could add another new track of alarm bell if it played only in spots where one of the other eight tracks was inactive. For organizational purposes it would be easier to add a complete new track titled "Alarm Bell" so you could view, edit, and otherwise manipulate all of the alarm bells at once instead of trying to tell them into unrecorded sections of the existing eight tracks. Then a recorded track would consist of a potpourri of unlike audio elements. You could continue to add tracks for other sfx or music cuts, etc., but only eight tracks will generate sound at once. Still the organizational power of adding these "virtual tracks" beats the socks off of how we all used to "checkerboard" audio elements onto the tracks analog tape machines.

**Inputs and Outputs**: Two inputs will provide the stereo sound input necessary for most of your productions. The software will then route these two inputs to the tracks where they are to be recorded. Stereo sound requires two outputs. A six-channel sound-track requires at least six outs (we have learned some nifty ways to work around this at Bowen Productions. See the section below about SMPTE sync). The number of inputs provided by the DAW is mostly hardware dependent. Some manufacturers use their own proprietary interface to provide more than two ins and outs.

**Automated Mixing**: Most workstations allow some sort of automation. The better ones allow the recording, editing, and playback of Fader moves, Panning moves and Mutes.

**Punch Record**: The ability to define a location where recording starts and a location where recording ends. This punch feature allows very precise hands-free replacement of lines of dialog and other audio elements. Better software allows the user to define the punch in-out locations in terms of SMPTE time-code addresses.

**Mix Emulation**: This is a display window that imitates the look and feel of a traditional audio mixer. Faders may be grabbed with a mouse and manipulated in ways similar to moving faders on a stand alone mixer. Knobs can be turned, buttons pushed, and all kinds of fun high tech audio toys can be played with.

**Effects Processing**: In an analog environment we would use separate stand-alone boxes for most of these effects. Now many of these treatments can be applied right on your computer screen.

**Lock to External SMPTE TC**: Very important. A DAW that does not lock to external TC will be minimally useful. By locking the DAW to time code from a digital 8-track machine one can transfer tracks and revisions of tracks back and forth while retaining valuable synchronization. That way you will not have to reprogram your automated control system every time you make a small change in your soundtrack. TC sync also allows you to record synchronized multiple passes from a DAW with only two channels out, thus creating soundtracks of 2-4-6 or even 8-channel sound! Then you use the digital 8-track fto playback of the program. If you like this idea, e-mail me for some pointers as it is easy to create some phasing problems if you have not used this technique.

**Audio Scrub/Jog**: Like rocking reels on an analog machine. Moving the track back and forth at fast and slow speeds so as to locate the exact edit or punch record points.

**Hardware Requirements**: Wow. I could write a 200 page book on this one. All I have tried to do here is give you an idea of what you need in addition to the software and your computer. Contact the manufacturer for specific requirements and especially for a list of recommended hard drives.

Well, there it is for now. My audio engineering colleagues and I have used all of the above products at one time or another with very good success. They all work very well, but only if the proper DAW is selected to fit your specific applications. As usual I invite you to call or e-mail to secure more info about these and other digital audio products. I'll be glad to provide the phone #s of the manufacturers. Watch Dome-L for my weekly tips regarding digital audio technology and remember to check in on "Sound Advice" in December!
**Comparisons of popular computer-based DAWs (Digital Audio Workstations)**

Information is based on latest data supplied by manufacturers as of 7-21-95.

### Macintosh-based Workstations

<table>
<thead>
<tr>
<th>Product</th>
<th>Manufacturer</th>
<th>Channels</th>
<th>Tracks</th>
<th>Inputs</th>
<th>Outputs</th>
<th>Automated Mixing</th>
<th>Punch Record</th>
<th>Mixer Emulation</th>
<th>Effects Processing</th>
<th>Lock to External SMPTE T.C.</th>
<th>Audio</th>
<th>Sampling Rates/Bits</th>
<th>Hardware Requirements</th>
<th>Retail Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound Edit 16</td>
<td>Macromedia</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>F, P</td>
<td>E,F,D</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td>All 8, 16 Mac</td>
<td>Digest and Nubus cards and interfaces</td>
<td>$149</td>
</tr>
<tr>
<td>Audioshop</td>
<td>Opcode</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td>E,F,D,N</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$3000+</td>
<td></td>
</tr>
<tr>
<td>Session 8 Mac</td>
<td>Digidesign</td>
<td>8</td>
<td>8</td>
<td>2-8</td>
<td>2-8</td>
<td>F, M, P</td>
<td>Yes</td>
<td>Yes</td>
<td>Many Options</td>
<td>Yes</td>
<td>44.1, 48, 16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DigiTrax</td>
<td>Opcode</td>
<td>4-6</td>
<td>4-6</td>
<td>2</td>
<td>2</td>
<td>F, M, P</td>
<td>Yes</td>
<td>Yes</td>
<td>N, EQ, E, F, D, R</td>
<td>Yes</td>
<td>44.1, 48, 16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deck II</td>
<td>OBC</td>
<td>4-16</td>
<td>4-16</td>
<td>2</td>
<td>2</td>
<td>F, M, P</td>
<td>Yes</td>
<td>Yes</td>
<td>N, EQ, E, F, D, R</td>
<td>Yes</td>
<td>44.1, 48, 16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Station +</td>
<td>Sonic Solutions</td>
<td>12</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>F, M, P</td>
<td>Yes</td>
<td>Yes</td>
<td>EQ</td>
<td>Yes</td>
<td>44.1, 48, 16</td>
<td></td>
<td></td>
<td>$5995</td>
</tr>
<tr>
<td>Prototols III</td>
<td>Digidesign</td>
<td>16-48</td>
<td>Unlim</td>
<td>2-8</td>
<td>2-8</td>
<td>F, M, P</td>
<td>Yes</td>
<td>Yes</td>
<td>Many Options</td>
<td>Yes</td>
<td>44.1, 48, 16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital Performer</td>
<td>MOTU</td>
<td>2-48</td>
<td>Unlim</td>
<td>2-64</td>
<td>2-64</td>
<td>F, P</td>
<td>Yes</td>
<td>Yes</td>
<td>Many Options</td>
<td>Yes</td>
<td>44.1, 48, 16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>StudioVision</td>
<td>Opcode</td>
<td>4-16</td>
<td>4-16</td>
<td>2-8</td>
<td>2-8</td>
<td>F, P</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
<td>44.1, 48, 16</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### PC-based Workstations

<table>
<thead>
<tr>
<th>Product</th>
<th>Manufacturer</th>
<th>Channels</th>
<th>Tracks</th>
<th>Inputs</th>
<th>Outputs</th>
<th>Automated Mixing</th>
<th>Punch Record</th>
<th>Mixer Emulation</th>
<th>Effects Processing</th>
<th>Lock to External SMPTE T.C.</th>
<th>Audio</th>
<th>Sampling Rates/Bits</th>
<th>Hardware Requirements</th>
<th>Retail Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wave</td>
<td>Turtle Beach</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>F</td>
<td>Yes</td>
<td>Yes</td>
<td>EQ, F, D, R</td>
<td>All 8, 16</td>
<td>Sound Card</td>
<td>$149</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sound Forge</td>
<td>Sonic Foundry</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>All the imaginative</td>
<td>All 16, 32</td>
<td>Sound Card</td>
<td>$495+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quad Studio</td>
<td>Turtle Beach</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>F, M, P</td>
<td>Yes</td>
<td>Yes</td>
<td>EQ, E, F, D</td>
<td>All 8, 16</td>
<td>Sound Card</td>
<td>$499+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAW</td>
<td>Innovative Quality Software</td>
<td>4</td>
<td>Stereo</td>
<td>2</td>
<td>2</td>
<td>F</td>
<td>Yes</td>
<td>Almost all except reverb</td>
<td>Yes</td>
<td>All 16</td>
<td>Sound Card</td>
<td>$599</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Session 8 PC</td>
<td>Digidesign</td>
<td>8</td>
<td>8</td>
<td>2-8</td>
<td>2-8</td>
<td>F, M, P</td>
<td>Yes</td>
<td>Yes</td>
<td>Many Options</td>
<td>44.1, 48, 16</td>
<td></td>
<td>Digidesign interfaces and cards</td>
<td>$6995+</td>
<td></td>
</tr>
<tr>
<td>Spectral Prima</td>
<td>Spectral, Inc</td>
<td>12</td>
<td>96</td>
<td>2-8</td>
<td>2-8</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>EQ, N</td>
<td>44.1, 48, 16</td>
<td>Complete</td>
<td>$59995</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Effect Legend: N=Normalize, EQ = Equilizer, E = Echo, F = Flange, D = Delay, R = Reverb, C = Compress
2 Sampling rates: All = at least 11.025, 22.05, 44.1, 8 bit, 16 = 16 bit.
3 These programs are actually powerful MIDI sequencers, used for music composition and arranging. They also feature powerful "built-in" digital multitrack recording and editing.
4 Mixer Legend: F = Faders, M = Mutes, P = Panning
a Very flexible program. May be used with Digidesign ProTools interfaces and various Nubus cards to expand # of tracks and channels. Also works with no additional hardware when used with Mac 6100, 7100, 8100.
b This very professional system is modular and can be configured with varying numbers of tracks, ins-outs, effects processors, digital ins-outs, etc. Options effect price of system.
c Includes sound card.
SPACE CREATORS

Mauna Kea,
The Australian Outback,
The Space Shuttle in Orbit and
A Goto GSS-Helios Planetarium Theater.....

What do all these places have in common?
A spectacular view of a crisp, clear star field!

So what are you waiting for?
Why not experience it?

The GSS-Helios (GSX) features 25,000 stars reproducing a sky seen only from space. Digital shutters mean panoramas without stray stars twinkling through the image. Computer-assisted functions give manual mode the ease of auto mode without replacing the lecturer. The list of special GOTO features goes on and on. Contact your nearest representative and find out what your planetarium could be like.

The G1014si offers Space Simulator functions plus GOTO's exclusive automatic lamp replacement mechanism. No more shows lost to lamp burnout. With the G1014si, your spare lamp leaps into action with a simple touch of a button at the console. Simple, fast and efficient. That's a GOTO Planetarium.

GOTO OPTICAL MFG. CO.

4-16 Yasaki-cho Fuchu-shi, Tokyo 183
JAPAN
TEL: Intl No. +81-423-62-5312
FAX: Intl No. +81-423-61-9571
Email: Lucy@goto.co.jp
Philosophically we need to promote information in the form of scientific knowledge and useful facts—facts about the earth sciences, astronomy, space exploration, and current theories about the nature of things. We should provide a forum where the general public can be brought up to date on the nature of the earth as our habitat, the earth as our observing platform of the night sky, and the earth as a base of operations from which to explore space. We ought to debunk where debunking is needed and provide programs and/or activities to encourage people to become thinkers and doers.

As far as specifics about the new millennium, there are several things we can do. Perhaps the most important is to offer information in the form of programs or written articles and television programs regarding when the millennium will actually begin—Jan. 1, 2001, not Jan. 1, 2000. Already people in the US are getting hyped about celebrating the new millennium starting Dec. 31, 1999 into Jan. 1, 2000. The best we can hope to achieve is to promote two celebrations: the last new years of the Old 20th Century, then later welcome the new Millennium on Jan. 1, 2001. Perhaps a calendar program dealing with such ideas as the various religious and ethnic calendars, the changes in the calendar wrought by the Romans and Pope Gregory, et al. We should make the presentation as ethnically broad as possible.

Second, we can promote exploration in the 21st century by highlighting amateur discoveries, and encourage people that anyone can “do” science and use the scientific method. Science is done at the cutting edge of knowledge, and for each individual there is a different level of understanding.

Third, we can promote preservationist attitudes through comparative studies of earth and other planets, and cyclical changes in the earth's environment brought about by astronomical effects over which we would have little control, i.e. supernovae, etc. to tracking earth-crossing objects over which we may be able to have a positive effect. Or to atmospheric changes wrought by volcanoes, or mankind's activities.

Fourth, promote programs that aggressively promote rational thinking and subtly debunk new-age ideas and superstition.

Mickey Schmidt, Director
Center for Educational Multimedia
US Air Force Academy

First, we should strive to spend as little time as possible explaining to people that the next millennium doesn’t actually begin until 2001. I know, I’ve already done a few interviews and while, yes, we all know it’s true, if the truth be known, you just come off as some kind of nerdy party-pooper and besides, everyone is going to be celebrating on December 31, 1999, like it or not.

Second, there are obvious planetarium shows just groaning to be written. Those of us who are Americans and old enough, can throw our minds back to our bicentennial year in 1976. Many of us had to do the “Last 200 Years of Astronomy Show” or the “How Greatly our View of the Universe Has Changed Since the Birth of America Show”. If we had a lick of sense, we also threw in the next 200 years at no extra charge, because spaceships to the stars were a lot neater than most of the stuff from the past. So … let’s get going on those “Last 1000 Years and Next 1000 Years Shows”. We could start at the Crab Nebula and end by flying to the Crab Nebula. Come to think of it, Mark Bourne already did that in his Star Trek show. Oh well, we have four more years to work on it.

Third, I figure this millennium thing is going to be one big party, from real space to CNN space to cyberspace, so we ought to think of lots of good ways to log on. A great solar eclipse right across Europe in 1999 could get the attention focused, as one planetarium after another takes over the watch for CNN and Internet, and reaps some good PR in the process. Perhaps on December 31, a planetarium in each time zone around the globe could be the sight of the official countdown as midnight approaches. April Whitt even tells me about a great New Year’s Eve ceremony at the South Pole where everyone runs or rides or drags themselves around the Pole and celebrates the stroke of midnight 24 times, or something like that. Thanks to NASA, CARA and Geoff-Halnes-Stiles, some
planetariums already went “Live from Antarctica” last year, so we know we have the technology to do it again.

For me, the big question is whether or not I really want to be anywhere near a planetarium on New Year’s Eve. Somehow, that South Pole gig or a balcony with some Champaign somewhere in Tahiti is more my style. But then again, if I have a lick of sense, I’ll probably just go to bed early.

Bill Gutsch
Former Director, Hayden Planetarium
New York

***

I imagine that the Internet will figure prominently in the minds of people, such as Bill, who would like to see planetarians using technology to celebrate the turn of the 21st century. I agree that this amazing public tool will undoubtedly be at the core of operations the world over. At the present rate of growth (100 new Web sites per week!) and ingenuity, in five years time the Internet will have mushroomed into something perhaps unrecognizable by today’s standards. New uses for the Internet and new horizons are being drawn daily, so who knows what will be possible. It’s exciting stuff.

I would like to propose that the IPS Council begins to think about coordinating planetarians’ millennium activities. We have a good deal of time for thought and preparation, and the worldwide publicity should substantially increase our organization’s profile.

The subject for the next Forum is one suggested by Gary Tomlinson, of the Chaffee Planetarium, Grand Rapids. I don’t want to make a habit of using other people’s suggestions, but his idea is particularly relevant in today’s society. It reads:

How can planetaria, which only see school children perhaps once or twice in their school careers, do programming consistent with current US educational reform (i.e. active participation, connection to the real world, constructivist approach and collaborative learning)? Or should they even try? Should they continue the traditional passive programming, in the hope that it will inspire and excite the student (and perhaps the teacher alike) and leave it to the classroom teacher to do the “real teaching?”

Until next time, have a nice Autumn/Spring, whatever your hemisphere bias is.

(Opening Dome, continued from page 20)

Francisco, CA 94112 U.S.A. The Abrams Planetarium Sky Calendar included in it is great!


D. Guy Ottewell’s Astronomical Calendar, Astronomical Companion. Another good yearly update on the sky.

E. Astronomical Tables of the Sun, Moon and Planets by Jean Meeus. Willmann-Bell, Inc. P.O. Box 3125, Richmond, VA 23235 U.S.A. Want to tell folks about the next transit of Venus? The earth-Mars distance during its next perihelion opposition? The answer to this and many other questions of the distant past and future are contained in this book.

F. 365 Starry Nights by Chet Raymo. Simon and Schuster, Rockefeller Center, 1230 Avenue of the Americas, New York, New York 10020 U.S.A.

G. Computer programs like “EZ Cosmos,” “Dance of the Planets,” “Distant Suns,” etc.

H. Sky services, like Sky & Telescope’s “Skyline”:(617)497-4168.

I. Astronomy textbooks, topical astronomy books.

J. Allen’s Star Names, other constellation books.

K. Chase’s Annual Events or similar book of days—all kinds of events are listed, some of which are astronomical in nature.

L. Your own book of days (and nights) collected from past research.

Good luck. A well-written, well-produced topical astronomy show on your local radio station is a terrific service that you can offer to your community which is guaranteed to bring you astronomical dividends.

NEW

VIDEO LIBRARY

now available with over 70 different astronomy animations

Add original video footage to your shows.

Planisphere Productions
Customized Computer Animations

1117 Leahy Road
Monterey, Ca. 93940
408-649-4361
71514.3145@compuserve.com
www.redshift.com/~planisphere
In reality, the Apollo 13 oxygen-tank explosion didn’t “just occur,” but rather, was the result of a series of events over a five-year period leading up to the mission. Together, they weave a fascinating story of how, in a complex technical project such as Apollo, isolated events and incidents with seemingly inconsequential results can—taken altogether—lead to a domino-induced disaster scenario.

Apollo 13: Why It Happened

With the recent release of the Ron Howard film Apollo 13, there has been a renewed interest in that “failed”, but historic 1970 spaceflight. In this installment we’ll take a bit of a departure from our standard Planetechnica fare and examine an obscure but essential aspect of this mission—the technical events that actually led to the oxygen tank explosion aboard the spacecraft.

Utter the words “Apollo 13” and images are evoked of heroic and ingenious flight controllers and astronauts, teary-eyed family members, tense TV viewers, and anxious prayer vigils. The dramatic elements of that mission are the ones that were reported by the media and are the ones seared into the memories of those of us old enough to still remember. Less well known, however, are the factors that created this near-disastrous space accident in the first place. Interestingly, even the most ardent of spaceflight devotees—planetarians among them—can recite little beyond the fact that “the oxygen tank exploded” on route to the Moon among the technical causes of that momentous space crisis. In reality, the Apollo 13 oxygen-tank explosion didn’t “just occur,” but rather, was the result of a series of events over a five-year period leading up to the mission. Together, they weave a fascinating story of how, in a complex technical project such as Apollo, isolated events and incidents with seemingly inconsequential results can—taken altogether—lead to a domino-induced disaster scenario.

Unlike with the 1986 Challenger accident, the Apollo 13 had no “obvious signs” with which attentive NASA or industry personnel could predict an impending calamity. Instead, the events which in-total led to the explosion of cryogenic oxygen tank #2 could, at best, be described as “innocent oversights” or “inadvertencies”. Perhaps this is what makes the Apollo-13-style accident scenario so unnerving. At least with Challenger,
craft systems. Because they remained attached during the bulk of an Apollo mission and were so interdependent, the combined command and service modules (CSM) have often been referred to as simply “the command module.” In this usage, the “command module,” as designed, was actually two separate craft. It is important to remember that the Apollo spacecraft for lunar landing missions was really three spacecraft. These were:

- the **lunar module** (LM), which was designed to ferry two members of the three-man crew between lunar orbit and the Moon’s surface;

- the **command module** (CM), which was the main residence, if you will, of the crew for the bulk of the mission, and was the only portion of the Apollo-Saturn vehicle capable of returning to Earth;

- and the **service module** (SM), which housed the majority of the environmental, electrical, and maneuvering systems and consumables used by the command module throughout the flight until just before reentry into Earth’s atmosphere.

The service module (Figure 1), which contained the liquid oxygen tanks in question, was basically a large cylinder, 4 meters (13 feet) in diameter and about 4.3 meters (14 feet) long, and was attached to the blunt end of the conical-shaped command module. The service module also included the 3-meter (10-foot) long **service propulsion system** (SPS) engine bell which was attached to the end of the module opposite the CM, as well as a number of communications antennas, including the large S-band **high-gain antenna**. The module’s cylindrical arrangement was roughly divided into six pie-wedge sections, or **bays**, with each bay containing specific equipment and systems for the spacecraft. (In addition, there was a smaller cylindrical center-section, which housed SPS engine components and helium tanks.) Four “quads” of **maneuvering jets** were spaced around the cylindrical exterior of the module, and an **umbilical coupling** at the top edge of the cylinder routed the necessary fluids, power, and data between the service and command modules.

Bay 4 of the service module contained the cryogenic **oxygen and hydrogen tanks, fuel cells**, and associated equipment. The oxygen supply in the service module had a dual purpose—**environmental and electrical**. Not only was the oxygen used to supply the crew in the command module with a breathable atmosphere, but together with the liquid hydrogen supply it provided the raw materials needed to operate the spacecraft’s fuel cells. The fuel cells chemically combined the two elements to produce electrical power as well as a drinking-water by-product. In fact, the only electrical power available from the pre-Apollo 14 service module was produced by the fuel cells. While the command module contained conventional batteries for power, these were only large enough to supply it with electricity for final re-entry operations, and therefore were not available as a redundant backup in the case of a fuel cell failure.

However, the general fuel-cell-based electrical system design had proven itself reliable since the Gemini Earth-orbital missions of the mid-1960s. Additionally, the Apollo design had redundancy in the form of two separate oxygen tanks, two separate hydrogen tanks, three individual fuel cells, and redundant ancillary tubing, valves, and wiring. The Apollo electrical system had performed nearly flawlessly on all previous manned and unmanned flights.

Each of the cryogenic oxygen tanks themselves (Figure 2) were comprised of an inner and outer shell, and a dome at the top to house the interconnecting fluid tubing and wiring for electrical power and sensor signals. The spaces inside the dome and between the inner and outer tank shells were filled with thermal insulation. Mounted inside the tank were two tubular assemblies—the **heater tube** and the **quantity probe**. The heater tube contained two thermally-protected **heaters** to build pressure inside the tank should it fall below the specified value, and two small **fans** designed to stir the tank contents, reducing periodic temperature-stratification of the liquid oxygen. The quantity probe (see Figure 3) contained a **temperature sensor**, a **capacitance gauge** (used to electrically measure the quantity of fluid in the tank), and—in the center of the probe—the **oxygen fill tube**. Power and sensor wiring for both assemblies passed from a conduit in the tank dome and through the top of the quantity probe.

### The Beginnings of the Accident

In February 1965—five years and two months prior to the Apollo 13 accident—NASA sent the specifications for the revised “Block II” Apollo command and service modules to their prime contractor, North American Aviation (later North American Rockwell, and today known as Rockwell International). The “Block I” spacecraft had been designed in the early 1960s for preliminary design shakedowns and tests. Based upon the evaluations of those early tests, NASA was able to further refine the spacecraft design into the Block II—the design eventually used for the Apollo moon program.

Among the Block II revisions was an upgrade of operating voltage for the service module’s cryogenic oxygen tank heater assemblies. Up until that time, the heaters had been rated to operate at 28 volts DC,
which was the voltage supplied by both the spacecraft itself and the launch-pad ground support equipment (GSE) at Kennedy Space Center. However, the revised GSE design incorporated a 65-volt DC electrical supply for the heaters in order to facilitate rapid tank pressurization during pre-launch operations. North American relayed the new heater specification to the oxygen-tank subcontractor, which, in turn, redesigned the heaters. However, the Apollo 13 review board discovered that, through an oversight, Beech had inadvertently failed to relay the new voltage specification to its supplier of the thermostatic switches used in the heaters. At no point did Beech, North American or NASA ever pick up on this discrepancy prior to the Apollo 13 flight. As a result, all Apollo Block II service module oxygen tanks up to the time of the accident flew with underrated thermostats in their heaters.

Taken alone, this upgrade-failure would have been of little consequence as long as the other equipment in the tanks performed as specified. The purpose of the thermostatic switches never was to turn the heaters off and on for tank-pressure regulation. That function was performed by a pressure switch in the spacecraft oxygen supply line leading from the tank. Instead, the thermostats performed a safety function by preventing the temperature in the tanks from rising above 27 degrees C (80 degrees F). As the normal operating temperature of the oxygen tank was typically around -183 degrees C (-297 degrees F), a properly operating tank would never bring the heater thermostats up to open-circuit, or heater turn-off temperature.

Since Apollo oxygen tank temperatures had never before reached the switch-limit, this thermostat discrepancy had never affected flight operations.

The Tank Changeout and Loose Tube

What ultimately may have made the difference for Apollo 13, however, was an incident which occurred at the North American Rockwell plant on October 21, 1968. Over the previous two years, Block II oxygen tank serial number 10024XTA00008—the one that eventually became oxygen tank #2 for Apollo 13—underwent assembly, testing, and integration into a dual-oxygen-tank shelf, with the shelf, in turn, installed into SM 106—the service module which would ultimately be used for Apollo 10. In the meantime, though, it was discovered that the "vac-ion" pumps mounted on the oxygen tank domes introduced some electromagnetic interference into the electronics of other spacecraft components. As a result, it was determined that the oxygen tank shelf in Apollo 10 would be removed and replaced with one having modified pumps. Later, the original Apollo 10 tanks would have their pumps replaced, and that shelf would be installed into another service module.

The procedure for extracting the oxygen tank shelf was to disconnect and remove its associated fluid lines and wiring, remove the bolts which fastened the shelf inside of service module Bay 4, and lift the shelf out of the bay using a special hoist fixture on a crane. However, in this particular removal, a North American technician neglected to take out one of the securing bolts before shelf-extraction was attempted. As a result, the front of the shelf was lifted about 2 inches, only to slip and drop off the hoist, and back into its original position. After the remaining bolt was discovered and removed—and the shelf ultimately withdrawn—tests were performed on the shelf in an attempt to determine whether any damage had occurred. The examinations included shelf integrity, pressure, leak, electrical, sensor, and pump tests. No problems were found. However, while these tests would have disclosed external leakage or most serious internal malfunctions, they would not detect a few lesser anomalies—among them, a leaky fill-tube.

The fill tube (see Figure 3) was actually a multiple-piece arrangement in which the fill line from outside the tank coupled to the fill-tube section inside the tank's quantity probe via two Teflon sleeves. The review board's investigation revealed that the dimensions and tolerances of these sleeves could lead to a "worst case" variation in which the two sleeves would fit very loosely. In such a case, it would be possible for the sleeves to slip and create a leak in the tank's fill tube. While this leak wouldn't create problems in actually filling the tank (as the leak was inside the tank itself) it would cause problems, as we'll see later, in draining the tank—an operation performed at the end of certain launch-pad tests.

On the Launch Pad

On March 16, 1970, the launch team at Kennedy Space Center began the Countdown Demonstration Test (CDDT) on the vehicle slated for the Apollo 13 mission the following month. Within Bay 4 of the service module was the oxygen tank shelf that had been removed from the Apollo 10 spacecraft nearly one-and-a-half years before. Along with its "sister" tank, oxygen tank #2 was prepared and loaded with cryogenic oxygen and pressurized to 23.3 kg/sq cm (331 psi). Later, the test called for both tanks to be partially emptied to about 50 percent capacity. The normal procedure to drain the liquid oxygen was to apply gaseous oxygen at 5.6 kg/sq cm (80 psi) through the tanks' vent...
monitor the "sub-zero" temperatures of the oxygen. In the event the tank thermostats were confident that the tank would prevent temperatures over 27 degrees C (80 degrees F), the control-center gauges at 27 degrees C (80 degrees F) attempted to open the circuit. This meant that the heaters in tank #2 had no way to shut themselves down during the entire improvised de-tanking on the launch pad. (The board also discovered that the pre-installation qualification and test procedures for the heater assemblies did not test the ability of the switches to open while under full-current conditions, so North American Rockwell had no mechanism in place to detect the problem in a launch pad.) Post-accident tests on a duplicate oxygen tank showed that the temperatures on the heater tube and its associated wiring may have reached as much as 540 degrees C (1000 degrees F) during the "boil-off" de-tanking procedure. (There were temperature gauges in the control center for monitoring the liquid oxygen tanks. However, they were primarily designed to monitor the "sub-zero" temperatures of cryogenic oxygen. In fact, since the engineers were confident that the tank thermostats would prevent temperatures over 27 degrees C (80 degrees F), the control-center gauges were designed to "peg" at 27 degrees C (80 degrees F). While tank #2's temperature had continued to climb into the hundreds of degrees, the gauge showed an "expected" reading of 27 degrees C (80 degrees C)—the highest the gauge could display.) Inspection of the disassembled test tank after the review-board simulation revealed cracks in the Teflon insulation of the fan and heater wiring. The resultant exposure of the bare conductors in these wires represented a major risk for electrical short-circuit, fire, and explosion inside a tank laden with pure liquid oxygen.

Ignotor of these facts at the time, however, and acting upon the successful results in filling tank #2, the Apollo organization had decided it prudent to proceed with the scheduled April 11 launch of Apollo 13.

The Explosion

Well into the third day of the mission, the Apollo 13 flight had been smooth and uneventful, except for a premature inboard-engine shutdown of the Saturn-5's second stage during launch. Well on their way to the Moon, the crew had earlier performed a "burn" of the spacecraft's service propulsion system engine to change their flightpath from the original "free-return" trajectory to one which would facilitate alignment with the planned landing site in the Fra Mauro lunar highlands. At 55 hours, 53 minutes into the mission—some 330,000 kilometers (205,000 miles) from Earth and less than a day away from lunar orbit—the crew had just completed a TV transmission from the spacecraft, and was preparing for their evening sleep period. Mission Control had relayed a series of requests for the crew to implement before turning in—among them, an instruction to briefly turn on the fans in the service module liquid oxygen and hydrogen tanks, to "homogenize" the temperatures and densities of the tank contents. At mission elapsed time of 55:53:20, telemetry data showed that the fans in oxygen tank #2 had, in fact, been powered up.

Less than three seconds later, the spacecraft's AC electrical bus #2 registered a voltage-drop of 1.2 volts, possibly indicating a major increase in electrical current draw. Almost simultaneously, an 11.1-amp current "spike" was recorded in fuel cell #3. This was followed by a drop in current and rise in voltage typical of a fan-motor shutdown. Most likely, a short-circuit had occurred in one of oxygen tank #2's fan motors or in its associated wiring. The energy available from the short was probably around 10 to 20 joules.

In rapid succession, a cascade of breakdowns followed, which soon reached crisis dimensions. Thirteen seconds after the fuel-cell current spike, the pressure in tank #2 began to rise, probably due to the combustion of Teflon wiring insulation immersed in the oxygen-rich tank environment. Evidence indicates that the motion of the fan had disturbed the windings in the motor.
itself, or its lead wires—shorting-out insu-
lated electrical conductors in those compo-
nents. This provided a “spark” that started
the combustion of more Teflon and metal
materials in the tank. Two seconds after
the tank pressure began to rise, AC bus #2 record-
ed an 11-volt drop, and in another three sec-
onds a second current spike occurred in fuel
cell #3—this time an increase of nearly 23
amps. Immediately afterward, another quick
current drop and voltage rise indicated that
a second fan-motor circuit had opened.
Apparently by this time, both tank fans—or
their lead wires—had shorted out.

At 55:54:00—just 22 seconds after Jack
Swigert had turned on the fans—the tank
pressure leveled off, only to begin rising once
again fifteen seconds later. Another sixteen
seconds after that, telemetry showed a rapid
increase in tank temperature. At 55:54:45, tank
#2 reached its maximum recorded pressure
value of 71 kg/sq cm (1008 psi). Seven seconds
later (92 seconds after activation of the fans),
tank #2 exploded, with a resulting loss of
pressure and temperature telemetry, oxygen-
fueled combustion of Mylar and Kapton
thermal insulation in Bay 4, the blasting
away of Bay 4’s exterior panel, and sudden
motions in all three spacecraft axes.

The Apollo spacecraft designers had con-
sidered the service module electrical and
environmental systems to be solid and sta-
ble, with plenty of redundancy for coping
with component failures. With two separate
tanks—each for oxygen and hydrogen, and
three fuel cells, it was thought that any con-
ceivable failure could be handled in flight
without affecting crew safety. But the antici-
pated problem scenarios were limited to
non-catastrophic events—not an explosion.
Had oxygen tank #2 merely developed a
slow leak, the situation would have been
quite different. In that case, while the mis-
sion rules would have prevented a lunar
landing, the crew could have made it back to
Earth on tank #1 only. However, with the unantici-
pated explosion of tank #2, plumbing
common to both tanks had been dam-
aged, and this allowed oxygen from tank #1
to bleed off into space.

With the oxygen rapidly depleting, both
the environmental and electrical systems of
the service module were “bleeding to death.”
Initially, the flight controllers monitoring
those systems in Mission Control assumed
they were seeing the results of some kind of
sensor problem. The readings that indicated
oxygen tank #2 and fuel cells 1 and 3 had
died, and that tank #1 was dying, were seen
as too incredible to believe. (Additionally,
the repeated firings of the service module’s
maneuvering jets confused flight controllers
into believing that they too were malfunc-
tioning, though later analysis revealed that
the jet firings were probably the result of
the spacecraft attempting to automatically com-
pensate for the inertial effects of the oxygen
venting.) Much of the confusion over what
was actually happening on the spacecraft
was due to the fact that the monitoring
instrumentation for the environmental and
electrical systems were functionally depen-
dent upon the same systems that they were
monitoring. The crew had to switch their
instrumentation for the oxygen tanks and
fuel cells back and forth from one electrical
buss to another before the true nature of
what was happening was finally apparent.
Only when it was realized that, in fact, they
had indeed lost an oxygen tank and two fuel
cells, did the astronauts and flight controllers
concentrate on saving what was left of tank
#1. Several attempts were made to stop the
leak in the remaining tank. But ninety min-
utes into the crisis it had become clear that
the service module soon would be complete-
ly out of oxygen and electricity.

Aftermath

Through heroic efforts of both the flight
crew and controllers, other NASA support
personnel, and Apollo spacecraft contractors,
astronauts Lovell, Haise and Swigert success-
fully splashed down in the Pacific Ocean on
April 17, 1970. But not before the crew had
endured another three-and-a-half days in
their lunar module “lifeboat” with electrical
power and cooling-water shortages, prob-
lems with a carbon-dioxide buildup in the
cabin, condensation on and in equipment,
lack of sleep, dehydration, a urinary-tract
infection, and near-freezing temperatures.
Everything had been shut down in the com-
mand module, and the lunar module—where
the crew had spent most of their time after
the accident—had only the radio and a single
fan turned on. There was a lot of uncertainty
about getting the crew back alive—even as
the Earth loomed large in the spacecraft
windows. The conditions experienced in the
spacecraft had never before been tested. It
was unknown whether electrical and elec-
tronic equipment in the command module
would operate without short-circuiting
given the amount of condensation visible
on the instrument panels. Neither was it
known whether the command module guid-
ance platform—necessary for orienting and
steering the craft in space—would work with
its heaters having been turned off for days.
Nor did the flight controllers know whether
the tiny command-module reentry batteries
would be frozen and dead when the crew
attempted a powerup. And, of course, there
was the concern over the heatshield. But, in
the end, it was the ingenuity, tenacity, and
teamwork which beat the odds.

Actually, “fate” (or “luck”, for those that
prefer the term)—as unscientific a concept as
it is—had perhaps as much to do with the
successful rescue of an otherwise doomed
space mission as anything. The day after
the explosion, the crew of Apollo 13 had been
due to enter lunar orbit and then separate
the lunar module Aquarius (the same
Aquarius that supplied the oxygen, propul-
sion, and electricity which brought them
back to Earth) for a descent of Lovell and
Haise to the lunar surface. Had the wiring in
oxygen tank #2 held out through the “fan
stir,” as it already had twice during the out-
bound trip, the astronauts would likely have
never made it back to Earth.

But remember that all of the Apollo space-
craft up until then had also contained under-
rated thermostatic oxygen-tank heater
switches, and all had the potential for loose-
fitting fill-tube sleeves. Any of the lunar-mis-
ion Apollo's could have fallen prey to an
oxygen-tank explosion, had the unfortunate
circumstances fallen into place.

Perhaps the most difficult of those mis-
sions to contemplate is that of Apollo 8. It
was—and remains—the only lunar mission to
do not carry a lunar module, as it was a lunar-
orbital mission only. Had an oxygen tank
with a loose fill tube been in the Apollo 8 ser-
vice module during the Countdown Demo-
stration Test, we almost certainly would not
have the joyful memories of a 1968 Chris-
tmas Eve broadcast from lunar orbit. For had
an oxygen-tank explosion happened at any
time after their departure from Earth orbit,
astronauts Frank Borman, Bill Anders, and
Jim Lovell—who would become the com-
mander of Apollo 13—would have had no
chance to make it back alive.

After the conclusion of Apollo 13, the U.S.
lunar program endured an additional delay
of four-and-a-half months as the accident
was investigated, and remedies were incor-
porated. As a result of this effort, all future
Apollo spacecraft would carry a backup stash
of electrical batteries and an additional oxy-
gen tank—isolated away from the other
cryogenic tanks in another bay of the space-
craft. And all of the oxygen tanks would be
rebuilt to include tighter fill-tube plumbing
and upgraded thermostats in the heaters—the
ones everybody had assumed had been there
all along. On the last day of January 1971,
Alan Shepard—the first American in space—
along with rookies Ed Mitchell and Stu
Roosa, began the successful mission to Fra
Mauro that was to have been the quest of
Apollo 13. Three more lunar landing mis-
sions were flown, with those followed by
three manned Skylab missions, and the his-
toric docking with a Soyuz spacecraft in
1975—finishing out the use of the Apollo space hardware.

Apollo 13 demonstrates how a few relatively innocuous mistakes and deviations can come together in a technologically-complex project to cause crisis and disaster. It also shows how teamwork and professionalism can help overcome very difficult problems. This mission is often referred to as a "failure," or as "unlucky 13." Given what happened during the flight, how the astronauts and ground crew dealt with the problems, what might have happened had circumstances been even slightly different, and the ultimately successful conclusion of the Apollo program—which very likely may have been terminated had the Apollo 13 crew not been rescued—it appears obvious that "13" was neither a "failure" nor "unlucky."

Bibliography


Portable Planetarium Service Commitment:
- To establish criteria for the selection of student interns;
- To provide the Portable Planetarium and Instructor/Mentor;
- To develop a comprehensive hands-on learning experience for student interns;
- To design a student, teacher, and school administrator evaluation to assess the educational success of the Student Intern/Mentor Program.

District/School Commitment:
- To designate one fourth or one fifth grade student as a Student Intern based on the following criteria;
  The Student Intern candidate will:
  a) possess an interest in science or teaching;
  b) be a conscientious student;
  c) work well in a group situation;
  d) demonstrate average communication skills;
  e) exhibit a sense of responsibility and a commitment to learning.
- To permit the designated student to attend the Portable Planetarium Student Project orientation;
- To permit the designated student to visit when the Portable Planetarium visits the Intern's home school;
- To, if needed, provide transportation of the Student Intern from the home school to the orientation and back to the home school.

Location of training session:
Oneida BOCES, Special Education Gym

Date and time of training:
Friday, June 4, 1993
9:00 a.m. to 2:00 p.m.

As you can see our day was jammed with wonderful discussions and demonstrations. Other tips too numerous to mention were shared as besides to conversations. We look forward to meeting again in the fall. The next PIPS meeting will be held from 9 a.m. to 5 p.m. on Saturday, September 23, 1995. The host facility will be the Science Museum of Long Island and co-sponsor will be Steve Tomesek of Science Plus. If you would like to start PIPS meetings in your area call me and we can discuss how easy it is to set up, people will be very grateful for the networking.

Materials Sources:
Duct tape—John Lange (Clear Skies, 10300 S. W. 4th Avenue, Portland, OR 97219) called to tell me he's found a source for eight-inch wide duct tape which he finds good for major repair of high wear areas of Starlab. Contact him for more information.

"The Universe at Your Fingertips: An Astronomy Activity and Resource Notebook" (Edited by Andrew Fraknob)—This comprehensive and ready-to-use collection of classroom activities, teaching ideas, and annotated resource lists is a result of Project ASTRO, an innovative program to form partnerships between teachers and astronomers. It features more than 90 classroom-tested, hands-on activities for teaching many aspects of astronomy, and dozens of resource sheets listing readings, software, organizations, and national projects for astronomy education. In addition, the notebook has useful articles on student learning, astronomy basics, and fitting astronomy in the science curriculum at a variety of levels. Strongly praised by all who tested the prototype edition, this updated and revised version of the Notebook is designed both for teachers who want to improve or increase the astronomy they teach, and for astronomers who work with teachers, students, or youth groups. While Project ASTRO focused on grades 4-9, much of the material can easily be adapted to higher grades. The approximately 400 sheets are three-hole punched and ready to put into a binder. Cost: $24.00 + $5.00 postage and handling for a total of $29.95 California residents please add sales tax. Send orders to: Astronomical Society of the Pacific, 390 Ashton Avenue, San Francisco, CA 94112 (phone 800-335-2624)

New Public Domain:

New Materials were generously donated to my files by Stu Chapman (Harford County Public Schools, Southampton Middle, Moores Mill Road, Bel Air, MD 21014 e-mail: schapman@umds.umd.edu). Stu is another long-time advocate for interactive and interdisciplinary planetarium and astronomy education. Thank you very much Stu for these valuable materials:

1992
- Planetarium Program for Elementary Schools Grades 1-5
- A maximum Impact Planetarium Program for Middle Schools
- Planetarium Use for High School Students

1993
- Follow the Drinking Gourd (an addition to Elementary Guide)
- A Planetarium Lesson for Music Classes-Gustav Holst: The Planets (an addition to Middle School Guide)

1994
- The Mass of a Binary System (an addition to High School Guide)
- Earth, Moon, Sun
- causes of phases (an addition to High School Guide) This one must be adapted for use in a portable.

1995
- The H-R Diagram (A classroom assignment to go with high school spectroscopic parallax program)

Program Evaluation:

Stu Chapman and several others (including me) are seeking examples of methods for evaluating planetarium lessons. Please send examples of your lesson/program evaluations to me so that we can help these people.

Signing Off:

Next time—a review of the Astronomical Society of the Pacific "The Universe in the Classroom Workshop" and "Education Symposium" (very worthwhile) and a discussion of my meeting with Ray Worthy (Hartlepool, England) who was visiting relatives in Pennsylvania. What a charming and ingenious man! That's all for now, see some of you in Italy. 
Regional Roundup

Steven Mitch
Benedum Natural Science
Theater
Oglebay Resort & Conference Center
Wheeling, WV 26003
(304) 243-4034
(304) 243-4110 fax
72467.2051@compuserve.com

Summer (winter for those of you in the southern hemisphere) must be slow for planetarium news because I did not receive the usual amount of interesting information to share with the worldwide planetarium community. I waited as long as I could for any late arrivals. The deadline for inclusion into the next issue is Wednesday, October 11, 1995. Please mark your calendars accordingly.

Association of Mexican Planetariums (AMPAC)

The Association of Mexican Planetariums recently held its 34th conference at the Pachuca Planetarium, State of Hidalgo, about 90 km from Mexico City, May 17-19th. The host for the conference was Guillermo Weber. Two dozen planetariums along with numerous astronomy clubs and planetarium vendors were in attendance for the conference.

Miguel Angel Delgado, Manager of the Alfa Cultural Center in Monterrey took over as AMPAC President and will serve until 1997. Guillermo Weber was appointed President-Elect. Special thanks were given to Miguel Gil for his dedicated work as outgoing president.

Two new sky shows were presented during the conference. They were "Extraterrestrial Life" and "A Planet Called Earth II," the latter being an interactive show where the audience can determine the direction and outcome of the show.

The planetarium in Pachuca is surrounded by an archeological park where Mexican pre-historic cultures are represented through sculpture replicas reminding visitors of their importance as skywatchers.

Astronomy lectures entitled "The Shoemaker-Levy 9 Comet" and "The Structure of the Chicxulub Crater" were given by Dr. Arcadio Poveda. Ing. Jose de la Herran, current Executive Secretary of the Ibero-American Planetarium Organization, gave a talk entitled "From Wireless Telegraphy to Satellites."

AMPAC's next meeting will probably take place in January 1996 at the Puebla Planetarium. The 1996 mid-year meeting has been proposed by the Victoria Planetarium in July or at El Paso, Texas in October as a joint meeting with the Rocky Mountain Planetarium Association. Vicky de la Macorra states that the Cuernavaca Planetarium is currently closed due to the fracture and partial collapse of its dome. A new facility is currently being planned.

Great Lakes Planetarium Association (GLPA)

The 31st Annual Great Lakes Planetarium Association Conference will be held October 25-28 at the new Van Andel Museum and Chaffee Planetarium in Grand Rapids, Michigan. The hosts for the conference are David DeBruyn and Gary Tomlinson.

Conference highlights include: an expanded Astronomy Update lecture by Dr. James B. Kaler; the much anticipated premiere of the GLPA financed planetarium program, "A Solar System Adventure," which is designed for the small or portable planetarium market. The program was written by Dave DeRemer and was produced in collaboration with Jeff Bowen of Bowen Music Productions; numerous 30th Anniversary activities; a used equipment flea market; numerous workshops, paper sessions, exhibits and optional activities. The Spitz Lecturer will be Robert C. Elliot, Director of the Phillips Planetarium, University of Wisconsin. For additional information about the conference, contact Dave or Gary at the Chaffee Planetarium, 272 Pearl NW, Grand Rapids, MI 49504.

The Cernan Earth and Space Center of Triton College, River Grove, Illinois recently received a $2,838 grant from the Chaffee Planetarium Student Association for the acquisition of production materials for the upcoming school year.

The Illinois State University Planetarium is sponsoring a series of star parties this summer at a community park with the assistance of the Twin City Amateur Astronomers.

The Lakeview Museum Planetarium in Peoria, Illinois, recently helped sponsor a bicycle ride through the Community Solar System scale model that they established a couple of years ago. The planetarium also played host to the Discovery Channel as they filmed an episode of a program entitled "Understanding the Universe."

The William Staerkel Planetarium of Parkland College in Champaign, Illinois, is presenting a six-week family workshop entitled "Reach for the Stars," dealing with backyard astronomy.

The Longway Planetarium in Flint, Michigan, is currently showing a program entitled "In My Backyard," an adaptation from a book written by Fred Penner. Mr. Penner helped to kick off the program by making a personal appearance.

Ohio planetarians held their annual spring meeting at the Sidney Frohman Planetarium in Sandusky, Ohio; it was hosted by Dick Speir. Dr. Paul Byard of the Ohio State University described the development of large telescopes and active optics. A variety of contributed papers covered a Boy Scout merit badge program, brute force constellation outlines, Ellison figures, using the Internet, and demonstrating Kepler's Second Law.

The Cleveland Regional Association of Planetariums held their March meeting at the Natural History Museum Planetarium, hosted by Joe DeRocher. Their May meeting was held in Lakewood, Ohio, and was hosted by Jim Cominski. The CRAP annual picnic and "summer zocalo" was held at the home of Gene and Pam Zajac in June.

Jeanne Bishop, Westlake Public Schools Planetarium in Westlake, Ohio was recently awarded the Thomas J. Brennan Award for exceptional achievement related to the teaching of astronomy at the high school level by the Board of Directors of the Astronomical Society of the Pacific.

The Chaffee Planetarium in Grand Rapids, Michigan, has a used Goto M-1 planetarium instrument and control console for sale to the highest bidder (minimum bid is $1,000). The purchaser will be responsible for dismantling, crating, transportation and all other charges. The instrument must be removed before December 31, 1995. Deadlines for written bids is September 30, 1995. For more information, write David DeBruyn, Public Museum of Grand Rapids, 272 Pearl NW, Grand Rapids, MI 49504.

Italian Planetarium's Friends Association

The municipality of Alessandria has opened an astronomical laboratory, named "Teatro delle scienze," which contains a small Goto EX-3 instrument. The management is handled by "Galileo," a group of local amateur astronomers founded in 1982.

Another Goto EX-3 planetarium is housed in a facility named "Areavere," located in Pontenuovo, near the city of Pistoia, Italy. Professor M. Antonia, a secondary level
From the creators of "LifeStyles of the Stars" 
and "Sandy, Pepper & the Eclipse" 

"MoonWitch" 

Ideal for grades 2nd through 5th, and super as a family Halloween program, this planetarium production examines the nature of the Moon and its changing appearance in the sky. On Halloween we meet Billy and Diana, a brother and sister who are trick-or-treating. Diana notices that no matter where she goes, the Moon seems to follow. Back home, Mom and Dad explain Moon appearance and motion. At school Diana continues to share her new knowledge of the Moon with teachers and classmates and demonstrates why the Moon goes through phases. The program ends with Diana’s discovery of the “dark side of the moon” and “earths-hine.” She tells her father that she sometimes dreams of being the first woman to land on the Moon...walking in the footprints of the Apollo astronauts! And...her lunar lander is named “The Moonwitch.”

Authored by Phil Groce. 
Running time of about 17:00. 
Includes 55 pin-registered glass-mounted slides. 
Original art by Jim Chapman of Sudekum Planetarium. 
Digitally mastered soundtrack featuring rich sound effects and an original music score by award winning composer Jeff Bowen. 
Review committee: Steve Mitch, Christine Brunello, George Reed, and Sharon Parker. 
Tape formats: DAT, 15 ips 1/4" 2-track, 4-track; cassette. Add $15 for ADAT digital format. 
Order now! Price: $375 (check with order) $395 with purchase order. Add $60 for custom kodakith masks.

AstroNotes by Bowen Productions

3590 North Meridian Street • Indianapolis, Indiana 46208 • 317-923-3838 • Fax 317-923-3871 • bowenprod@aol.com

Middle Atlantic Planetarium Society (MAPS) 

The new Officers for the Middle Atlantic Planetarium Society were announced during the MAPS Conference in Somerville, NJ. They are: President - Fred Stutz, Bowie High School, Bowie, MD; President-Elect - Laura Deines, Southworth Planetarium, University of Southern Maine, Portland, ME; Past-President - Joyce Towne, Fels Planetarium, Philadelphia, PA; Secretary - Sam Storch, Edwin P. Hubble Planetarium, Brooklyn, NY; Treasurer - Steven J. Russo, Cayuga Atmospherium/Planetarium, Cayuga, NY.

The 1996 MAPS Conference will be held at the Charles Hayden Planetarium in Boston, MA. Dates and highlights will be announced in the next issue.

Fred Stutz is busy working on a MAPS home page for the World Wide Web. It should be available soon.

MAPS recently had three award winners in the Griffith Observatory/Hughes Aircraft Writing Contest. Dr. George Reed won fourth place while Francine Jackson and Noreen Grice won honorable mentions. 

The 6th annual Maryland Planetarium Gathering will be held at the Howard B. Owens Science Center in Lanham, MD on October 9, 1995 from 9:00 a.m. to 3:00 p.m. There will be a series of invited talks by planetarium educators and guests from NASA.

Rocky Mountain Planetarium Association (RMPA) 

The Faulkner Planetarium will open its doors and light up its new dome on November 18, 1995. The Faulkner Planetarium is part of the Herrett Center for Arts and Science (formerly the Herrett Museum) located on the College of Southern Idaho campus in Twin Falls, Idaho. The Herrett Museum, which was operated by Norman and Lillie Herrett, sported a homemade planetarium instrument under a 20-foot dome. The museum was bequeathed to the college by the Herretts fifteen years ago. The artifacts were relocated to another facility on campus and the planetarium was abandoned. Now, the new Herrett Center will house a Digistar II under a 50-foot dome with 150 seats. Compli-
menting the planetarium will be numerous special effects, slide and video projectors. A 5-channel, 6000 watt sound system will enhance the multimedia experience. "Through the Eyes of Hubble," a program produced by the Henry Buhl, Jr. Planetarium in Pittsburgh, PA and the Space Telescope Science Institute in Baltimore, MD will be the opening show.

Rick Greenawald, formerly of the Roper Mountain Planetarium in Greenville, SC is the director of the new facility.

Southeastern Planetarium Association (SEPA)

Jon U. Bell, Director of the newly dedicated Hallstrom Planetarium at Indian River Community College in Fort Pierce, Florida, recently received that institution's prestigious Ambassador Award at the April 1995 faculty and employee recognition ceremony. The award is presented annually to the faculty member who best exemplifies the college's commitment of community outreach through public speaking, media interviews and, in Jon's case, presenting school and public planetarium programs to over 17,000 people in 1994. Jon also created and hosts the daily "Skywatch" series that is heard on the college's public radio station.

Former Buehler Planetarium intern Alex Lovell spent a week at the Planetarium in Bradenton, FL, before returning to the United Kingdom where she hopes to spearhead an effort for a major planetarium and science center in the "Midlands" region of England. The new Buehler intern is Mark Rosauer.

Valerie Jones has recently assumed the operational role of the Starlab Planetarium in Dolahan, Alabama.

Rick Greenawald has left the Roper Mountain Planetarium in Greenville, SC to assume the Directorship of the new planetarium in Twin Falls, Idaho. Rick's assistant, Rex Smith, is now the Planetarium Curator and Jim Flood has been hired as Production Assistant.

Dave Hostetter of Lafayette, Louisiana, has been using a Starlab for the past several years. Damage from Hurricane Andrew left several underground cracks in the permanent structure, forcing it to close. Dave has reported that the city has decided to repair the cracks rather than move the museum and planetarium. He is optimistic that he will be able to return to the dome sometime during the upcoming school year.

SEPA met in Macon, Georgia June 20-24th. Nearly 90 delegates were in attendance for a variety of planetarium shows, vendor displays, workshops, paper sessions and field trips. Mike Chesman of Bays Mountain Planetarium in Kingsport, TN, was elected as President-Elect to fill the vacancy created by Rick Greenawald's departure to Idaho. Mike will assume the SEPA Presidency on January 1, 1997.

The 1996 SEPA Conference will be held June 18-22 at the Sudekum Planetarium in Nashville, TN. The 1997 SEPA will be held in Pensacola, Florida.
Computer
Corner

Ken Wilson, Director
Ethyl Universe Planetarium
and Space Theater
Science Museum of Virginia
2500 West Broad St.
Richmond, VA 23220
(804) 367-0457
(804) 367-9348 fax
kwilson@cabell.vcu.edu

Earthwatch (v 3.0)
by Larry Nagy
Elanware, Inc.
134 Normandy Dr.
Brunswick, Ohio 44212
shareware - $25 (US) registration fee

Many planetarians are inveterate gadgeteers. After all, isn’t the planetarium itself
one of the world’s great gadgets? And many a planetarium special effect projector has put
Rube Goldberg to shame! (Perhaps this affinity that planetarians have for gadgets is
responsible, at least in part, for the popularity of computers in our business.) I must
admit that I’m a long standing member of this planetarian sub-group.

One particular gadget that I (and many others) have lusted to add to our walls is
something called a Geochron™ made by Geochron Enterprises of Redwood City, Cali-
ifornia. This elegant device displays a Mercator projection of the world with all its
time zones and a dynamic representation of
the day-night portions of our planet at
the present time. In the course of a day you can
watch the earth’s terminator slowly sweep
across the continents. In the course of a year
you can see the seasonal variations in the
length of daylight. It’s especially neat to see
the sunset and sunrise lines become straight
and parallel at the equinoxes. The Geochron
even has a dynamic display of the sun’s posi-
tion on the analemma.

Unfortunately, the Geochron is a pretty
expensive gadget, ranging in price from
about $1300 (US) to almost $2500. It’s hard
even for the most die-hard gadgeteer to justi-
fy the cost of a Geochron, especially on a
planetary’s salary, particularly to a spouse!
Thankfully, another, more ubiquitous, gad-
get has come to our rescue. The personal
computer can replicate the display of a Geochron’ with some added features to boot,
thanks to several programs including Larry
Nagy’s Earthwatch.

Earthwatch is a shareware program
designed to run on IBM compatible comput-
ers running DOS. The software comes with
two versions, one for a CGA graphics display
and the other for VGA graphics. Although the
documentation doesn’t specify a CPU, I’ve run the CGA version on a 286 processor
with no problem. The author recommends

This delightful little program displays a color Mercator projection
map of the world that slowly scrolls eastward ...

copying the program to a hard disk rather
than running it from the floppy disk. It took
less than 600K of memory on my hard drive
for both versions. The latitude and longitude
tracking feature of the VGA version requires a
Microsoft compatible mouse. Earthwatch
can be downloaded from many computer bulletin boards. Version 2.0 can be down-
loaded via anonymous FTP from

This delightful little program displays a
color Mercator projection map of the world
that slowly scrolls eastward across your com-
puter monitor, just like the Geochron. But, in
addition to showing the day and night zones
and sun’s position on the analemma,
Earthwatch displays the sub-solar and sub-
marine points on the earth’s surface; the phase
and age of the moon; the times of sunrise
and sunset for any preselected location in
the world; and the percentage of daylight at
the preselected location. In addition, the
VGA version allows you to switch off the
time zone boundaries and optional display
of yellow pixels at 250 major world cities.
Furthermore, pointing a mouse at one of
those cities triggers a display of the city’s lati-

dude, longitude and name. The VGA version
also has two different map graphics. One
shows false color regions determined by eleva-
tion. The other map displays white for
polar regions and high mountains, brown
and beige for arid regions, and green for the
better vegetarian habitats.

Earthwatch will use your computer’s
clock to set its display or you can enter any
AD date till the year 3000. You must enter
the latitude and longitude of the particular
city for which you want sunrise and sunset
data displayed. The program includes an
extensive table of latitudes and longitudes
for over 400 world cities. Unfortunately, it
will not allow you to pick a city from the list
with a mouse or cursor and have the coordi-
nates automatically entered, as some pro-
grams allow.

Earthwatch also includes two displays
that a Geochron does not. One, called
‘Almanac,’ lists the current Julian date; the
number of days and tenths until the next
season starts; the length of daylight for the
selected location and how it varies from the
previous day; the declination of the sun; the
present value for the equation of time; the
distance to the sun and moon in miles; the
age of the moon and number of days until
the next new moon; and the percentage
phase of the moon. A second option, the
’solunar’ screen, lists the sunrise and sunset
times and the moon phase percentage for a
whole month.

Negatives for Earthwatch are few and
minor. A spot check showed the sunrise and
sunset times computed by Earthwatch to be
about a minute off from the values that the
USNO’s MICA calculates for the same dates.
That’s not too bad for most uses. Program
setup is very straightforward, but crude by
today’s Windows/GUI standards. A menu
based selection of city coordinates would be
a nice improvement as would be the addi-
tion of moonrise and moonset times.

Nonetheless this is an inexpensive and
neat little program that will run on most of
the IBM hardware out there today. In fact, if
you look around, you could probably find a
used IBM AT-clone for around $200 (US) or
less and set it up as a dedicated Geochron
substitute either at home or in your planet-
arium. An ideal combination of recycling,
economy, and gadgeteering!

(Gibbous, continued from page 35)

conference itself will be incredible—Bill
expects that membership in IPS will expand
overnight, with the additional members
from Japan expected to attend! In an
unprecedented move of cooperation and good
spirit, GOTO and Minolta have agreed to
hold their user group meetings together and
simultaneously in conjunction with IPS.
Any IPS affiliate who would like a set of
slides and 1/2 inch video (showing the meet-
ing and hotel facilities as well as the pre-
and post-conference tour sites) to show at a
conference should contact Bill at (201) 492-
8165.
**NEW!**

**FLEX-TRAK™**

**Cove Light System from** JHE

*New from JHE!* Beautiful 2, 3, and 4-color Cove Lighting.

Incredibly Rich Colors which are mixable to many different shades! Imagine pink, orange, violet, or blood-red skies!

Flex-Trak can be quickly installed in almost any existing cove trough by JHE technicians and will give your dome a new beauty it never had!

**Flex-Trak is:**

- Dramatic and Exciting
- Seamlessly Smooth
- Blendable to Many Hues
- Easily Installed
- Affordably Priced
- Expandable
- Rich in Color Intensity
- Easy to Use

Sections join easily and are flexible to help fit around architectural obstructions.

For Pricing Guidelines, a set of color slides showing actual installations, and installation information:

Call 1-800-JHE-5960

Joe Hopkins Engineering
4301 32nd Street West C-1
Bradenton, FL 34205
President’s Message

Jim Manning
Taylor Planetarium
Museum of the Rockies
Montana State University
Bozeman, Montana USA

Greetings!

Following the Astronomical Society of the Pacific’s Education Symposium in College Park, Maryland last June, I took a few days off to drive down to North Carolina to my old stomping grounds. Lots of mountains in Montana, not much ocean—so I spent a couple of days on the seacoast along the Outer Banks, communing with the crashing surf, dining on fresh seafood (after all, can so many into those saddlebags comin’ over the pass back home), and generally getting reacquainted with humidity.

After a few footloose days, I headed back via Chapel Hill, where I spent my salad days in the business at the Morehead Planetarium on the campus of the University of North Carolina. I wanted to stop in and see the old (now a old and still one of the most beautiful ever constructed to house visit with friends and on the staff and learn about their version of OMSI’s “Orion Rendezvous” show which we’ll soon be run and do I try to do on my an-too-rare there: visit one of my old mentors, Mentor is a word. The first mentor was Mentor—in Greek mythology, a sage (some say Athena in disguise) to whom Odysseus entrusted the education of his son Telemachus before heading off for the Trojan War. The name—the word—has come to mean more than teacher; it also means counselor, someone to share and with the coming. We all—if we’re on the track of them when from the coast to the Carolina plain in summer, the word that comes to greet me at his door. one of those you count lucky to know—one of the durable pickme:ers of the A he his career World War II when he left the naval Philadelphia to became chief technician at the Fels Planetarium in 1946. Three years later Dr. Roy K. Marshall coaxed him down to Chapel Hill to install a dismantled Zeiss II instrument purchased from Sweden for John Motley Morehead’s new planetarium—and he never left.

When Dr. Marshall departed as Morehead Planetarium director in 1951, Tony became director and guided the planetarium for the next 30 years—through installation of a Zeiss VI projector in 1969, several renovations, sea changes in planetarium technology and production, the early decades of the Space Age, an internship program, uncounted and wonderfully terrible puns for which he was famous, and an explosion in our knowledge of the universe. He retired in 1981 and worked for ten years as a consultant for the Zeiss company before settling down to a quieter pace. He’s in his seventies now, and has slowed down, but there’s still a feisty glint in the eye—and perhaps a pun or a deft turn of phrase not long for the waiting.

It’s good to see him, and we have a wonderful visit, the conversation turning on family, old times, the latest rages in planetarium instrumentation. The wall of his covered with American astronauts from the moon and back. With last gram. Back in 1960, initiated a program of star and simulation training at Morehead for the first American astronauts. He and his talented staff—including people like Don Hall, Dick Knapp, John T. Brittain, Jim Gates, and later Jimmy Horn—designed Mercury, Gemini, and Apollo simulators for use in the planetarium. The astronauts sat in these trainers and peered through exact renditions of their space capsule windows at a planetarium sky that simulated the changing view from orbit, as they were drilled in recognition of the prime navigational stars and constellations and used devices that simulated operations they would or might need to perform on their missions.

The program ran for 15 years, from Mercury through Apollo-Soyuz. Tony was good buddies with Deke Slayton. He and his staff knew Neil Armstrong and Buzz Aldrin, the crew of Apollo 13—they knew them all. People like me grew up with the early days of the manned space program, but people like Tony and his staff participated in them.

As our visit ends, I resolve to keep in closer touch. And as I head back into the still-dripping evening, and make my way home over the next couple of days, I think of how much I owe him and that Morehead staff. I arrived as a green intern in 1975— alas, practically as the last astronaut training group (for Apollo-Soyuz) was walking out the door. But surely, if they’d trained the astronauts, they could train me! For two years, between university classes, they did. Tony, Dick Knapp who managed the interns, and the ever-practical technical staff put me to work, and I had some of the best times I’ve ever had in a planetarium, and learned some of the best things I’ve ever learned about what a planetarium should and can be. Things that formed the basis of my own outlook and philosophy of planetariums; things that—periodically reviewed and updated—form the core of my planetarium credo to this day.

And when the program was over, Tony had the faith (perhaps a leap of faith) to hire me for my first real planetarium job. I owe a lot to Tony Jenzano. He took a chance on me and helped me turn an internship into a career.

What’s the line from that old TV program? “There are a million stories in the Naked City ...” Well, if this is one of them, you could surely substitute your own story as easily. For if you think back to the start of your own career, you’ll also probably find mentors—people who inspired or encouraged you at the right moment, who took the time to listen and help you along, who gave you a leg up, who took a chance on you. And whose influence made a difference in your life and work.

And now many of us are in a position to do the same for others. Do we recognize these opportunities?

Last year at the Cocoa conference, after Don Hall made his parting remarks on his approaching retirement, Carrie Meyers from Andrus Planetarium in Yonkers, New York got up and remarked on how Don had been an inspiration to her when she was just starting out. It made me realize—first—that our profession, and all of us with it, are getting longer in the tooth! And second, that we’re
been graced with many mentors, and it's up
us to keep that tradition going, to carry on
the work that the Tony Jenzanos and Don
Halls of our profession spent their working
lifetimes achieving.

Some planetariums—Morehead, Strasen-
burgh, Hayden, Abrams, Adler, and others—
have formalized the mentoring process with
internship programs, and you might be sur-
prised how many graduates of these pro-
grams currently populate our ranks. Others
of us carry on the process more informally
but importantly by employing high school
and college students and others in paid and
volunteer positions, feeding their interest
and offering real planetarium work experi-
ences. However we do it, it's good to remind
ourselves now and again that it's a way of
giving something

wonders shily if we need any help. That's
when we need to think back, to recognize
ourselves in the person before us ... and then
listen, encourage, give a leg up, take a
chance—just as someone did for us. After all,
you can never tell where your influence stops.

Report from Japan

In late May, Past-President Bill Gutsch and
I traveled to Japan at the invitation of the
Science Museum of Osaka, the Minolta
Planetarium Company, and Goto Optical
Manufacturing Company to confer with the
1996 Conference Organizing Committee and
to visit meeting and tour sites. We came
away very impressed by the efforts of the
committee in planning and preparation, and
very excited about the prospects for IPS '96
to be one of the truly great IPS conference
experiences, filled with the superlative hos-
pitality of some of the best hosts in the
world.

Bill and I arrived in Tokyo on May 23, first
to attend the meeting of the Japanese
Planetarium Society (JPS) in the Makuhari
district of nearby Chiba City on Tokyo Bay.
We had an opportunity to renew friendships
made in Cocoa and earlier, to make many
new friends among the large Japanese plane-
tarium community, and to address our
Japanese colleagues in conference session; I
presented an overview of the history, mis-
sion, and work of IPS with an encourage-
ment to our colleagues to join us in our com-
mon goals, and Bill offered a look at some of
the innovative projects and technological
advances in progress at planetariums around
the world.

While there, we visited the nearby Chiba
offices of the Rikei Corporation (also the rep-
resenting agent for Evans & Sutherland in
Japan), where managing director Mr. Masaki
Ito and his staff hosted a tour of their facili-
ties. We saw some remarkable work being
done in computer-generated color video—
notably a model of the solar system through
which we could tour in three dimensions in
quite spectacular fashion.

Following the JPS conference, we traveled
back to Tokyo to visit the manufacturing
plant of the Goto Optical Manufacturing
Company—one of the planned stops on the
post-conference tour next year. Mr. Ryui-
chiro Goto, President, and Mr. Meguru
Kamiya, Director, hosted us on a fascinating
tour of the Goto plant, where we saw several
of their planetarium models under construc-
tion, including the Goto Helios, and had a
chance to visit the company's show produc-
tion areas and examine its extensive and
remarkable collection of artwork and
panoramas. (Both Goto and Minolta not
only supply their customers with planetari-
um projectors, they also offer fully-devel-
oped planetarium shows for presentation,
producing a number of new programs each
year.) Goto has a color catalog called
"Skyline Scenes" in which are displayed
color images of panoramas; it's quite stun-
ing.

Next we traveled by shin-kansen, the
famous bullet train, to Toyokawa, the site of
Administration Center of the Minolta Plane-
tarium Company—another planned stop on
the post-conference tour. There we were
greeted by President Mr. Masachiro Konishi
and his staff for a tour of the Minolta plant.
We examined several Minolta models and
were treated to a Minolta Infinium demon-
stration on their test dome—its exceptional
new starfield holds up beautifully even
under binocular scrutiny. We also had a
demonstration of Minolta/Iwerks' very
impressive 70mm film system, and of
Minolta's computerized control of
sun/moon/planet projectors for simulated
travel through the solar system and other
effects for which independently moving
dots are required.

After our Minolta visit, we continued by
shin-kansen on to Osaka to meet with Dr.
Tadao Nakano, Director of the Science
Museum of Osaka, and his staff including Dr.
Ken-ichi Kato, Mr. Singo Kawakami, and Mr.
Shun-ichi Emura, accompanied also by Mr.
Shigeru Tanaka of Minolta.

We found Osaka to be a lovely, modern
and bustling city, with ginkgo-lined boule-
vards, a neat and efficient subway and train
transportation system (which we used a number of times) and a sophisticated, cosmopolitan flavor. We stayed at the Awina Osaka Hotel, which is one of the business-class hotels designated for the conference. We found the hotel very pleasant. North Americans and Europeans may find the rooms smaller than they find back home, especially the single accommodation rooms which contain a single bed. But the rooms were comfortable, nicely-appointed, and contained all the usual amenities (telephone, TV, refrigerator) with a western-style bathroom containing an especially deep bathtub (shower head included) to accommodate the marvelous Japanese custom of soaking baths. Our rooms cost about $80-$90 U.S. per night—a good estimate, I think, for next year.

The food—as it was throughout our visit—was superb, and we sought out local dining experiences whenever possible. There are countless small restaurants where you’ll find the menu entrees displayed in very realistic plastic form in the windows—a great idea because you can see the choices and decide what you’d like before you go inside. And the food inside is wonderful—delicious and nutritious and filling. The sushi and tempura are excellent, as are the hot and cold noodles, and the various soups and meat and vegetable dishes. Fish and seafood is popular and plentiful. The prices in small restaurants and shops are really quite reasonable (in comparison to hotel restaurants and especially room service), and the ambience is authentic as you mix with the Japanese on meal breaks of their own. (For next year, we’re looking into the possibility of supplying conferees with maps of inexpensive eating places within walking distance of conference sites.)

International cuisine is well-represented, and there are a large number of Chinese restaurants. Western-style food is readily available as well, and for those who can’t live without it, you’ll find many familiar fast-food chains.

We were very impressed by our visit to the Science Museum of Osaka. The museum, which opened in 1989, is located in Kita-Ku, a northern district of Osaka in a lovely riverside setting. It features several floors of science exhibits (many of them interactive) on the physical sciences, concentrating on astronomy and space science and sciences related to energy, surrounding an atrium running the full
height of the building. Also on display is the Zeiss II projector which was installed in Osaka in 1937 as Japan’s first projection planetarium.

Of course, much has changed since then, and the museum’s modern-day planetarium theater features a Minolta Infinium Alpha, an Omnimax system, and 318 seats under a 26.5-meter (88-foot) dome, said to be currently the largest in the world. We attended a nicely-done planetarium program with a Japanese audience, which followed the format of many planetarium programs in Japan: a presentation on the current evening sky followed by a multimedia presentation—in this case, about the work of French astronomer Charles Messier and his catalog of deep sky objects.

Our planning sessions with the museum staff were very productive, and revealed the incredible amount of work that has already gone into conference planning. The dates (which have been shifted forward two days to allow for weekday travel for a little savings on air fares) are as follows: Council meeting, July 10; pre-conference tour, July 11-12; conference sessions, July 13-16 (with registration and evening reception on July 12); post-conference tour July 17-20.

The pre-conference tour will visit some of the shrines, temples and gardens in Kyoto and Nara, both once imperial capitals of Japan. The post-conference tour is planned to include visits to the Minolta plant in Toyokawa, the Nagoya Science Museum, the Nobeyama Radio Observatory in the Japanese Alps, the Goto plant in Tokyo, and some of the sights of Tokyo.

The conference days themselves are looking very good, with time scheduled for a welcome ceremony, a cultural event, paper sessions, workshops, a panel discussion, a vendor exhibition session, affiliate and committee meetings, a concluding banquet, and some free time for informal gatherings or exploring the surroundings. Our hosts are also planning an excursion, tentatively to include a Goto facility to offer conferences an opportunity to see both a Minolta and Goto planetarium in operation during the conference, and to see some of the sights of the city depending on scheduling.

Many meals will be included, but some will also be “on-your-own” to give conference opportunities to sample the culinary delights and settings of the city—perhaps with new Japanese friends and guides.

Our hosts are planning a complete conference mailing around January with details on registration, costs, accommodations, etc. The deadline for receipt of the full text of papers is likely to be three months ahead of the conference (which Bill and I have encouraged) to allow adequate time for translation preparations. Bill and I have also recommended that paper lengths be shortened a little to allow time for translations during paper presentations.

Given the current status of the yen compared to the dollar and some other foreign currencies, I can add that our hosts are working very hard to make conference costs as reasonable as possible.

Incidentally, we heard that both the Minolta and Goto users groups, in a spirit of cooperation and helpfulness, will be planning to meet in Osaka in conjunction with the IPS meeting. This will insure that the entire planetarium community of Japan will be represented, and will offer an unprecedented opportunity for discussion and exchange with that large and creative community.

Sunday, May 28 provided an opportunity to visit some of the sights of Kyoto and Nara, the destinations of the pre-conference tour. It was truly a feast for the senses, and a fascinating look into the culture and history of Japan. In Kyoto, we sat on woven mats in the Buddha’s hall at Higashi Honganji Temple, the air delicately scented with incense; experienced the “nightingale floor” and painted panels of Nijo-jo (Nijo Castle), the Shogun’s residence; and viewed Kinkaku-ji (the restored Golden Pavilion), its gold-leaf plating reflected in its still lagoon.

After lunch at the Kyoto Handicraft Center (a shopping bonanza, with floors of souvenirs, clothing, and objects ranging from painted chopsticks and lacquered boxes to exquisite woodblock paintings and antique bronzes), we traveled to nearby Nara. There we toured the massive Todaiji Temple (the largest wooden structure in the world) housing the gigantic Great Buddha, visited Deer Park, and strolled the peaceful Kasuga Shrine, a Shinto complex featuring forested pathways lined with countless stone prayer lanterns, lovely shrines, and a chance to secure one’s fortune and tie it to a tree branch in traditional Shinto practice. Altogether, it was a singular experience not to be missed if you come to Japan.

Monday the 29th, the final day of the visit, was reserved for touring the International House, the conference center which will be the primary meeting facility. It’s located in the central part of Osaka, just a few city blocks from Hotel Awina Osaka, and will be perfect for our needs. Facilities include a spacious lobby area for vendor display (with a smaller room off of the lobby which can be darkened for projected displays as necessary); an auditorium called the Main Hall for the welcome, the cultural event, and any large assembly needs; smaller meeting rooms for paper sessions, workshops, and affiliate meetings, a larger space for reception, meetings, or dining which can be divided into smaller spaces, plus a small hotel and restaurant. We also visited several additional hotel possibilities (conference accommodations will be divided between the Hotel Awina Osaka, the International House, and another site), all very comparable to cozy and modern Awina Osaka.

The day’s activities also included a trip to one of the premier attractions in the city and an excursion possibility: Osaka-jo (Osaka Castle), a restoration of the fortress
originally constructed in the 16th century, destroyed and rebuilt by the Shogun in the 17th, destroyed again in the Imperial Restoration in 1868, and restored in 1931. The imposing eight-story Main Tower houses a series of exhibits on the castle and its history, and the topmost floor offers panoramic views of the moat and elegant gardens below as well the surrounding city.

Then, sadly, it was time to leave. Bill’s flight connections took him out through the old Osaka airport, but I departed from the ultramodern and attractive Kansai International Airport, which will be the point of entry for most of next year’s international conference organizers.

Opened just last year, it’s located on a artificial island in Osaka Bay accessible by causeway, and is a tourist attraction in itself.

Special thanks to the staffs of the Science Museum of Osaka and the Minolta and Goto companies for their generous hospitality and support on this very useful visit. Our meetings were fruitful and helped to lay the final groundwork, I think, for what is going to be an exceedingly memorable conference. All I can say is save your travel money and don’t miss it! IPS ’96 is going to be an important and unforgettable opportunity to meet and make connections with colleagues in a nation with the second-largest number of planetariums on this planet, and to experience and enjoy a unique and fascinating culture as well as all the other benefits of our biennial gatherings.

It’s my understanding, as I write, that our Japanese hosts are planning a preliminary mailing referred to as a “call for papers” including a short “pre-registration” form. With this form, they hope to solicit some initial information for continued conference planning. If you’re thinking of attending and/or presenting a paper, please help them out by responding. If you haven’t yet made up your mind, not to worry; I understand that you will be able to submit paper proposals probably until the spring registration deadline, and will receive the January conference mailing regardless.

Report from ASP

On June 24-25, I attended the Astronomical Society of the Pacific’s Education Symposium in College Park, Maryland (mentioned last issue) with about 150 astronomy educators from North America and beyond. I’m pleased to say that the planetarium community was very well represented there. Planetarium-associated attendees included Jeanne Bishop, Stu Chapman, Suzanne Chippindale, Doug Duncan, Steve Fleming, Amie Gallagher, Noreen Grice, Lee Ann Hennig, Paul Knappenberger, Dave Linton, Larry Mascotti, John Mosley, Martin Ratcliffe, Sue Reynolds, Gary Sampson, Dennis Schatz, Eric Scheur, Dale Smith, Neil Tyson, and Elizabeth Wasiluk—plus former planetarians Edna DeVore who works for the SETI Institute, and Rob Landis who hangs his hat at the Space Telescope Science Institute. (Apologies to anyone I’ve misspelled or omitted.) Next time you see them, ask them about it.

The two-day conference (see last issue for its goals) was a treasure trove of useful nuggets of information. Among the many plenary and shorter talks, Andrew Fraknoi accurately portrayed the state of astronomy education and understanding in the U.S. while John Percy offered an international perspective. Andrew Ahlgren talked about Project 2061 and its aim to develop a hierarchy of concepts for teaching at specific grades, and Dennis Schatz discussed curriculum renewal in light of the standards proposed by the National Academy of Sciences.

Phil Sadler presented a study which suggests that there may exist a hierarchy of astronomical misconceptions that people go through as they zero in on the truth, and Neil Tyson offered examples of how sensitivity to the situations of underserved groups can lead to more effective astronomy education experiences for these groups.

Jay Pasachoff spoke on instructional materials, Carl Pennypacker on hands-on activities, Julietta Fierro on getting astronomers involved in astronomy teaching, and George Tucker on the advantages and disadvantages of astronomy education in two-year colleges.

Suzan Edwards provided insight into the American Astronomical Society’s very welcome education initiative, Laura Danyl talked about the Space Telescope Science Institute as an example of the role of national observatories in education. Gerhard Salinger spoke of the educational role of the National Science Foundation (Bob Russell adding from the audience that there are grant opportunities in informal education practically going begging), and Jeff Rosenhal explained the increasing role of education in NASA’s space science research programs and missions.

I made a presentation on the role of planetariums in astronomy education. Several of the attendees have suggested that this talk should be reprinted in The Planetarian. Having secured the appropriate permission from ASP, it will appear in a future issue.
There were also a number of small group discussion sessions—on K-12 astronomy, post-secondary astronomy, teacher training, the role of informal institutions in supporting formal education, public astronomy education, reaching underserved groups, creating networks and coalitions, and technology. These groups met, discussed their topics and developed suggestions for initiatives in each area, reporting back to the full group on the second day.

And in addition to all of this, there were a number of excellent poster papers on a wide variety of astronomy education projects.

Whew! There was a great deal to mine in this symposium, and perhaps the best way to do it is with the proceedings scheduled for publication later in the year. The document is bound to be sizable—and at a sizable price of $40 U.S. to non-attendees. When the proceedings come out, I'm going to see if I can get a few extra copies that can be loaned out to those of you who are interested in reviewing it. Perhaps some of the other planetarians in attendance would be willing to share peeps at their copies as well. Please consider this—I think you'll find much of interest and importance to our profession in its pages.

In the meantime, I received from Jeff Rosendhal a copy of a new NASA publication which many of you will also be interested in reading. It's called "Partners in Education: A Strategy for Integrating Education and Public Outreach into NASA's Space Science Programs." The document outlines NASA's deadly serious new commitment to incorporate education and outreach into its research and funding efforts—even offering suggestions to space scientists about how they can fulfill their education/outreach requirements (planetariums are liberally mentioned in suggestions for partnerships with informal educational institutions). This is absolutely must reading for anyone who thinks they may fall within the boundaries of NASA consideration. For it means that there will be new opportunities for creating relationships and partnerships with the scientific community—and for receiving funds to develop projects and products with these new partners.

I can't tell you exactly how to get a copy through the mail—the only address on the document is the general NASA address: NASA, Mail Code SA, Washington, D.C. 20546. (I'll see what else I can find out.) However, the document does provide a way to acquire it through cyberspace. It says it's available in "electronic form at the following file transfer protocol (ftp) site: ftp.hq.nasa.gov. Log in as anonymous and use your ID as the password. Go to the directory "pub/oss/edu". A "readme" file contains further instructions."

Go for it! You'll want to read this document.

---

Other Bridges

As mentioned last time, several other initiatives to build bridges of communication to other organizations have been started. The reports I've heard from the American Astronomical Society (AAS) meeting in Pittsburgh—where Martin Ratcliffe organized a half-day session on addressing the communication gap between research groups and the planetarium community—have been most encouraging for a beginning. We're going to try to get a report from Martin on the session and his perceptions of it in the next issue of The Planetarian.

In the meantime, Katy Garmany of the Fiske Planetarium in Boulder Colorado (who's both AAS and IPS) has been in contact with me about ways in which our two organizations can develop closer ties and increased dialog—starting with listing IPS events in the AAS Newsletter Calendar. We're discussing a number of other ideas, and if you have some of your own, please do get in touch with Katy, Martin, or me.

Another initiative is occurring this October at the meeting of the Association of Science and Technology Centers (ASTC) in San Diego (October 14-17), where, as mentioned last time, Dennis Mammana has organized an astronomy "showcase" in which a number of planetarians from North America and Europe will be participating. We'll let you know how it goes.

It's also important to hear from colleagues in Europe, Japan, and elsewhere about what's going on or what may be needed in forging closer relationships with related organizations and research groups around the world—about what IPS may learn from your experiences, or how we may be able to help. Do let us know.

The 1995 Directory

Based on the current publishing schedule as I write, the brand new "1995 Directory of World Planetariums" should be in readers' hands at the same time as this issue.

Voluminous thanks are due especially to two people who engineered and oversaw the final steps to publication. First, Keith Johnson, who did yeoman's work in compiling, organizing, and formatting a mountain of data in an amazingly intelligible form. And second, to Sheri Tribovich, who rounded up advertisers and ads in

Vol. 24, No. 3, September 1995

The Planetarian
breathtakingly short order, and who assisted Keith in working out details with Albert Smith of Victory Printing (who also does an excellent job in printing The Planitarian).

Special thanks are also due to Publications Chair Undine Concannon, whose timely and cogent critiques and suggestions were invaluable. And of course, to John Mosley, who never at the ready to offer advice and provide useful information—which he did on several key occasions.

When you see these people, thank them. And enjoy the directory.

Finally, it's an immutable law of the universe that once the data base is declared final for publication—things immediately begin to change. Be sure to send your updates to Keith no later than next year's membership dues deadline, so they can be incorporated into the directory addendum planned for next year.

The 1994 Proceedings

Hearty thanks are also due to Mike Hutton and his hardworking staff for the harrowing task of putting together, printing, and mailing the proceedings of the 1994 Cocoa conference. Excellent job!

Conference attendees received their copies some time ago. More recently, a modest conference surplus was put to appropriate use to print additional copies to be mailed to all 1994 IPS members who were unable to attend the conference. According to the planned schedule at the time of this writing, those copies should now—or will shortly—be in the hands of their intended recipients—a benefit of membership which we hope provides valuable and useful information on what was a very memorable meeting.

Again, when you see Mike or his staff, thank them.

1995 Council Meeting

In about a month's time as you read, the IPS Council will be convening in San Diego (on October 13) for its annual meeting. The agenda will include progress reports on the upcoming 1996 and 1998 conferences, bids for the year 2000 (for which there are some tantalizing prospects as I write), and a number of other items of interest and discussion.

If you have items or topics to raise, be sure to contact your affiliate representative. Remember, he or she represents you and your affiliate organization; let your voice be heard.

Finally...

That's all—and enough—for now. Until next time, dewa mata—see you!

Eric Chaisson
Air & Space Magazine
February/March 1995

NASA's Educational Programming

Despite all its rhetoric about education, NASA built history's most expensive and visible scientific instrument without having any associated educational program. No part of the space agency had any plans to share the fruits of Hubble's discoveries with the nation's youngsters. What's more, virtually every pre-college educational initiative that I mounted at the Space Telescope Science Institute was accomplished despite NASA. Citing the need for editorial control, the space agency regularly and consistently objected to the institute's teacher workshops, media briefings, teacher kits, classroom posters, and educational telecasts, and a host of other activities and products designed to help teachers, students, and the general public understand the subject of space science in general and the Hubble mission in particular.

Each NASA mission should have a small educational program meant to disseminate new findings in a manner understandable to the average citizen. To the question that Senate staffers used to ask me—"How much education is needed?"—I would reply, "One percent." If only one percent of each mission's funding were dedicated to informing the educational and lay communities in a responsible way, namely without hype, then NASA would be well served, and so would the public that underwrites NASA.

There is one critical caveat however. Those NASA missions that do have educational programs intended to propagate fact must be divorced from public affairs activities that tend toward cheerleading. The former are clearly tainted by the latter, which often border on disinformation. From what I have seen on the inside, NASA's public relations machine—technically inept, yet obsessed with winning credit for NASA—should be nearly gutted, for it actually does a great disservice to the agency.

Dear Editor:

Sharon Parker's article "Lessons from Museum and Leisure Research" (June 1995 The Planitarian) opened the door to some important questions. For more on these, I'd recommend The Museum Experience by John Falk and Lynn Dierking (Whalesback Books, 1992; ISBN 0-929590-07-4). It's a 200-page paperback that summarizes research into the visitor's perspective on museums. The authors are full-time professionals in the specialized field of museum studies and evaluation. I found the book easy to read and provocative. Planetariums are not discussed specifically, but most of the information is adaptable. An extensive bibliography is included.

You can buy the book (even if your institution is not a member) through the Association of Science-Technology Centers (ASTC), 1025 Vermont Ave. NW, Suite 500, Washington, DC 20005; phone (202) 783-7200. The ASTC book catalog lists many other publications under such headings as evaluation, research, and planning.

Steve Fentress
Producer/Music Director
Strasenburgh Planetarium

(Letters, continued from page 5)
Guidelines for Contributors

*The Planetarian* welcomes submissions that would be of interest to the planetarium community. Preference is given to articles that closely relate to the philosophy, management, technical aspects, or history of planetariums, and to ideas that can readily be incorporated into planetarium shows.

**Text:** *The Planetarian* is prepared on a Macintosh computer and laser printer. Text ultimately needs to be computer-readable and can be submitted in these ways (in order of preference):

1. mailed on disk as text file in Macintosh or IBM format. Please specify word processor used (do not use page layout software). Copies on disk should be accompanied by a clean printed paper copy.
2. as electronic mail; send via Internet to jmosley@cello.gina.calstate.edu.
3. mailed as clean, typed or printed copy on paper, suitable for scanning and optical character recognition; if dot matrix, please use highest-quality print mode.

Articles that are sent on disk or as email should be accompanied by one clean printed copy that notes italics, boldface, Greek letters, accent marks, and other formatting instructions and special characters that are lost when transmitting unformatted text. Handwritten and faxed articles are not accepted (please use fax for inquiries and proofing only, or to accompany email). Please inquire in advance when submitting text and illustrations on disk to insure that I have compatible software.

**Illustrations:** All illustrations must be camera-ready and publication-quality. Photographs should be full size b/w prints, and I will reduce to fit. All illustrations should be accompanied by captions (and credits where appropriate). Please allow 2 cm (3/4-inch) margins on full-page illustrations. It is the author’s responsibility to obtain copyright clearance; by submitting an illustration the author certifies that necessary permission has been obtained. Illustrations prepared by computer should be submitted on disk (along with a camera-ready paper copy) to allow the greatest flexibility in sizing them properly; inquire in advance about software compatibility and accepted file types. The inclusion of good illustrations is encouraged.

**Style:** Please refer to recent issues of *The Planetarian* and make your style consistent with the journal’s. Double check the spelling of proper nouns, and include accent marks. Include a brief (2-3 sentence) biography.

**Deadlines:** *The Planetarian* is published quarterly with cover dates of March, June, September, and December (the equinoxes and solstices). Final deadlines for receipt of all submissions, including advertisements, are January 21, April 21, July 21, and October 21 respectively. Some issues fill up early. Authors will be mailed or faxed proofs if their article is received at least ten days in advance of the deadline.

Address inquiries and submissions to:

John Mosley, Executive Editor
*The Planetarian*
Griffith Observatory
2800 East Observatory Road
Los Angeles, California 90027 USA
work phone: 213-664-1181 (8-4 Pacific time)
work fax: 213-663-4323 • home fax: 818-708-7314
I like to read my issue of *The Planetarian*. I skim it, from back to front, similar to the way I read the newspaper: comics first, then the rest of the stuff. I don't read anything on this first pass from back to front; I just identify which articles I am going to read. For some reason I don't read the table of contents, just start skimming.

There are certain types of articles I never read, some I always read. I always read the letters to the editor in hope of finding some scathing controversy like "The Meaning and Origin of the Christmas Star"; I always read the articles that fellow planetarians write on the "topic of the issue" such as "Do you think the planetarium is education or entertainment?" I always read scripts and lesson plans. Fellow planetarians are full of wonderful ideas that I can use in my school lessons. I skim the rest of the articles until I find a topic which interests me.

I always skip the technical articles completely: you know, the ones with the "pots" and the baby food jars and the motors and little diagrams of things. Yes, I confess: I'm not a planetarium techie.

Let me qualify that: I know how to change light bulbs. You may think that is not much, but think of all the different types of light bulbs used in the planetarium: I can change most of them while talking, during a show, so that most people don't even know anything is wrong! Me, to third graders: "Here comes the sun!... H-m-m, it looks as if the sun won't be up quite yet (sun bulb has obviously burned out sometime between last sunset and this sunrise). There are a few clouds..." I'm fumbling in light bulb drawer, finding one, going over to machine in the sky which must be blocking the sun. Everyone look up now, and see if you can be the first one to see that rising sun land don't look at me changing the bulb! Here it comes!"

Let me further qualify my expository announcement of non-techie-ness: I know how to computerize simple planetarium shows using a SMPTE time code to run slide projectors, laser disc player and VCR: yeah, that's a lot of fun!

Many fellow planetarians have tried to teach me other basic intricacies of the technical aspect of being a planetarian. With their assistance, I have picked up a few skills.

But putting together simple effects... I just don't do it! And don't start thinking that it's because I'm a woman! I'll have you know that when our gas grill came unassembled, I put it together even though some directions were in Japanese characters with which I was unfamiliar, and extra parts were included just to test the technical abilities of the assembler.

I'm frankly just not interested! Through the years, I've been able to substitute some non-technical talents and one shortcut to keep me in business with very little downtime. I will now divulge these to you, in case you should happen to be non-technical, also. They are as follows:

- I have two fire extinguishers handy (one CO₂ and one halon) in case I smell something funny,
- I know where the repair shop is. For any ancillary machine such as slide projectors, video projector, VCR, tape decks, i.e.: anything which will fit into my car, I take it to the shop whenever that machine stops working. You see, the people at the repair shop are not used to having broken machines accompanied by people and not paperwork, so this simple act circumvents the paperwork of getting something repaired. I simple hang around until they put my stuff to be repaired ahead of everyone else,
- My planetarium is 25 years old and has never had any "down time"! Luck? Actually, yes. Lucky am I that the "funding fathers" of my planetarium went cheap and didn't get the automation. My planetarium has three motors (diurnal, annual, and latitude) and that's all. They still work. The annual motion motor turns one gear to which each planet projector is attached, using the proper gear ratio at its cage location. Mars doesn't work very well. When I need to use Mars in a show, I just designate some other planet projector to be Mars and put a piece of red gel over it.
- I know how to juggle my budget to pay for repairs when there's no money for repairs in my budget,
- And most importantly, and the secret I mentioned: Eric. Eric fixes planetarium projectors. I mean he knows how to and does it for people all over the country. He works 15 blocks away from my planetarium. There! You know where my smugness comes from. He is a phone call away. H-m-m... I just realized that I'm going to need the real Mars to be working for my lesson tomorrow. Excuse me... gotta go call Eric!

**Observed and Overheard at SEPA in Macon, Georgia, in June:**

- Best T-Shirt at Southeastern Planetarium Conference (SEPA) was worn by Duke Johnson, Planetarian at SciWorks in Winston-Salem, N.C. The scene is a moon-like landscape with 5 hand-lettered signs stuck into the ground, intended to be read, in order, one at a time. The signs are: "1) Space is Big 2) Space is Dark 3) It's hard to find 4) A place to park 5) Burma-Shave".
- Speaking of T-Shirts, Kris McCall of Suke-kum Planetarium in Nashville, Tennessee was wearing a nice space-ye one. She wasn't too enthusiastic about it though, as she said: "I did an opening at the planetarium for the newest release of a recording artist (don't forget, this is Nashville: music city) and all I got was this lousy T-Shirt".
- Best "Slide-Used-to-Make-a-Point-during-a-Presentation" was shown by Edwin Faughn of the Pink Planetarium in Memphis, Tennessee. The slide was an astronaut in a space suit on the moon walking toward the LEM landing site; his facial expression shows that he is aghast because, as he approaches, the LEM takes off. The message written at the bottom of the slide: "Plan Ahead".
- As a response to customer requests, Mark Petersen of Loch Ness Productions in Boulder, Colorado now sells slides of his popular "constellations of the zodiac" in two versions. For example, you can buy a figure of "Gemini" or "GeminiPF". They are actually the same figure: "Gemini" is naked (erogenous zones are shaded so that nothing actually shows) and GeminiPF ("PF" is "Family Value") has clothes on.
- Rob Landis of the Space Telescope Science Institute in Baltimore, Maryland, spoke on the significance of Comet Shoemaker-Levy's crash on Jupiter in the summer of 1994. He said: "The power of the impact of the first fragment was equivalent to sixty-five megatons of TNT. The power of the impact of the second fragment was equivalent to six megatons of TNT. If any one of the fragments had hit Earth instead of Jupiter, Earth would have had a bad day!".
- Zeiss was bringing a new product to Fernbank Planetarium in Atlanta, Georgia. When the Zeiss representative had set up the star plates, he said, "Now for the test, turn on your stars." Planetarian Dave Dunlee replied: "They are on."
- Dave Johnson: "A man gazing at the stars is proverbially oblivious to the puddles on the ground" (attributed to Alexander Smith).

Overheard at Great Lakes Planetarium (GLPA) conference in May, 1995:

- Art Klinger of PiM Planetarium in Mishawaka, Indiana, was using constellation overlays in a show during the conference. The Big Bear and the Big Dipper are both represented in his overlay collection. The Big Dipper looks like a spoon in his set. Art faded up the Big Bear and then leaving it up, faded up the Big Dipper. A member of the planetarian audience said: "That bear doesn't know how to eat! How did that spoon get up there?"
Our POLYCHROMATIC ACOUSTO OPTIC MODULATOR

- Modulates up to 8 wavelengths simultaneously for Ar⁺/Kr⁺ lasers
- OEM driver modules available
- Competitively priced
- Easy to use
- Fast factory support

A MUST FOR LASER LIGHT SHOWS AND LASER DISPLAYS

Are your 3 modulators letting you down?...

Our new POLYCHROMATIC ACOUSTO OPTIC MODULATOR can stand up to your needs.

NEOS
4300-C Fortune Place, Melbourne, FL 32904
Phone: (407) 676-9020 Fax: (407) 722-4499
DIGISTAR II
Is Thrilling Planetarium
Visitors Around The World

Hansen Planetarium
Salt Lake City, Utah
The London Planetarium
Madame Tussaud's
University of South Carolina
Aiken, South Carolina
Hakui City Planetarium
Ishikawa Pref., Japan
College of Southern Idaho
Twin Falls, Idaho
Kalamazoo Community College
Kalamazoo, Michigan
Armagh Planetarium
Armagh, Northern Ireland
Orlando Science Center
Orlando, Florida
Redlin Art Center
Watertown City, South Dakota
Delta College
Bay City, Michigan
Yaizu Discovery Park
Shizuoka Pref., Japan
The Henry J. Buhl Planetarium
Carnegie Science Center
Pittsburgh, Pennsylvania
Columbus College Planetarium
Columbus, Georgia

And the List Grows On...

We're excited that these prestigious institutions will be using Digistar II to entertain and educate their audiences. Digistar II is the world's only digital planetarium system for dome theaters. Call us today to find out what all the excitement is about!

Digistar II

Evans & Sutherland

For more information about Digistar II, contact Jeri Panek at:
Evans & Sutherland - 600 Komas Drive - Salt Lake City, UT 84108 - Phone: 801-582-5847 Fax: 801-581-9852

Image courtesy of Digistar Users' Group