



lunar & planetary information bulletin

NUMBER 38

MAY 1984



Fifteen and Counting. . .LPSC A SUCCESS

The Fifteenth Lunar and Planetary Science Conference was held at NASA Johnson Space Center (NASA/JSC) in Houston on March 12-16. The conference was sponsored by the Lunar and Planetary Institute (LPI), NASA/JSC, American Geophysical Union, Division for Planetary Sciences of the American Astronomical Society, and the Meteoritical Society. 500 scientists representing 14 different countries attended the conference. The program was developed on the basis of abstracts solicited by a committee consisting of Co-chairmen K. Burke, LPI, and M. Duke, NASA/JSC and members M. Carr, USGS Menlo Park; E. Gibson, Jr., NASA/JSC; J. Gooding, NASA/JSC; A. Harris, Jet Propulsion Laboratory; D. Heymann, Rice University; C. Hohenberg, Washington University; G. Lofgren, NASA/JSC; R. Morris, NASA/JSC; C. Pieters, Brown University; A. Rubin, University of California, Los Angeles; G. Ryder, LPI; P. Schultz, LPI; L. Taylor, University of Tennessee, and C. Wood, NASA/JSC.

Abstracts submitted for the Conference were considered by the Program Committee for inclusion in Lunar and Planetary Science XV and/or for oral or poster presentation at the Conference. Of the total abstracts submitted, 491 were printed, 333 were selected for oral presentation, and 32 were selected for poster presentation.

The first meeting of the Mars Data Analysis Study Project "Volatile Evolution and Climate History of Mars" was convened March 9-10, just prior to the LPSC. The conveners for this organizational meeting

were Robert Pepin, University of Minnesota and Peter Schultz, LPI. Objectives of the meeting were to outline an organizational plan for the three-year duration of the project, and to review and discuss the scientific elements of the NASA MDAP research program around which the study project will be built. Approximately 40 scientists attended the meeting. Ronald Greeley, Arizona State University, was elected to chair the project's steering committee. Other members of the steering committee include Michael Carr, USGS-Menlo Park; Fraser Fanale, Institute for Planetary Geoscience-Honolulu; Robert Haberle, NASA-Ames Research Center; Peter Schultz, LPI; and ex-officio members Joseph Boyce, NASA-Headquarters; and Kevin Burke, LPI.

Special sessions held during the Conference included: a session entitled "Planetary Program Status





Review" held March 12 in the evening at the Gilruth Center which was open to the public and all conference participants; in the early evening of March 12 a meeting of European Planetary Scientists was convened by K. Runcorn; an informal discussion on the age of multi-ring basins convened by K. Runcorn March 14 in the early evening in the LPI Hess Room; and an evening session on March 14, organized by C. Wood, G. Ryder, and A. Binder, was held at the Gilruth Center for the purpose of discussing the question "Do we need a Lunar and Planetary Geoscience Society?", plus a review of the publication of the LPSC *Proceedings*.

The Fifth Annual LPSC Chili Cook-off was held Tuesday evening, March 13, on the LPI grounds. Enjoying the chili tasting, country-western band, and barbeque dinner were 475 conference participants and their guests. The evening activities included the awarding of trophies to the winners of the chili cook-off and special events such as the cow chip throwing contest and the beer drinking contest. This year's social event was made a great success due to the presence of perfect weather, the cooperative efforts of LPI's staff and those of Double LL Western Productions, the lively spirit of the chili teams and judges, and the enthusiastic participation of the conference attendees.

Copies of *Lunar and Planetary Science XV*, abstracts submitted to the conference are still available. If you have not yet obtained your copy, please use the order form included with this BULLETIN.

RARE SOLAR ECLIPSE VISIBLE FROM SOUTHEASTERN UNITED STATES

For about twelve seconds on Wednesday, May 30, the moon will almost completely cover the face of the sun, creating the rare phenomenon known as an annular solar eclipse. The moon will appear just slightly smaller than the sun, and the edge of the sun will still be visible, causing an extremely thin ring, or annulus, to be seen.

Though anyone in the United States will be able to see the partial phases of the eclipse, only observers along an extremely narrow path stretching from the Gulf of Mexico near New Orleans to the Atlantic

Ocean near Richmond, Virginia, will be able to see the annular effect. This "eclipse path" is only three to seven miles wide; outside it, only a partial eclipse will be visible.

At about 8:40 a.m. CST on May 30, the moon will begin to edge over the disc of the sun. Just before 10:04 a.m., the annulus, or "ring of fire", will come into view for about 12 seconds. Then the sun will begin to reappear gradually until the eclipse ends at 11:39 a.m.

The ring will be extremely thin—about the width of a dime seen from over a mile away—yet the remaining sunlight will still be bright enough to illuminate the landscape. Some darkening will occur, to about the brightness level of a cloudy day, but the darkness associated with total eclipses will not happen.

And since some of the sun's disc will always be visible, although as much as 99.5 percent of it will be hidden by the moon, it will still be harmful to watch the eclipse with the naked eye. Looking at the sun directly, especially with a telescope or binoculars, can result in permanent eye damage. Telescopes must be equipped with special filters placed over the lens for safe viewing.

An easy way to watch the eclipse is by projecting the sun's image, readily accomplished by punching a tiny hole in one end of a box. The image of the sun can then be projected onto the opposite end of the box, and the side is left open for viewing the image.

One of the best locations for viewing the spectacle will be from southern Louisiana. This will be the only place where the entire unbroken ring will be visible at once. From other locations, the ring will not be a complete circle at any given time.

A two-day "eclipse extravaganza" is being sponsored by SPACE NEWS, a bi-weekly newsletter on astronomy, and by the Louisiana Arts & Science Center Planetarium in Baton Rouge. On May 29 participants will gather for seminars on observing and photographing the eclipse, along with a crawfish boil and other activities. The next morning, buses will take observers to the best location in the world for viewing the spectacle. Anyone interested in participating in "Moonshadow '84" can call the LASC Planetarium at (504)344-9465 for more information, or write to Moonshadow '84, P.O. Box 66521, Baton Rouge, LA 70896.

There are three types of solar eclipses that can occur in nature. Partial eclipses, the most common, can usually be seen a few times each year. Total eclipses are rare. During these, the moon completely covers the sun, thrusting the landscape into darkness at mid-day as the moon's shadow crosses the earth. The next total solar eclipse visible from North America won't be until the year 2017. Annular eclipses are almost as rare; it will be hundreds of years before the next one is visible from the southern United States.

It will be a once-in-a-lifetime opportunity to witness nature's ring of fire. Hope for clear weather, and don't miss it!

SPACE NEWS RELEASE 2/17/84

1984 LPI SUMMER INTERNS SELECTED

The following students have been selected from this year's applicants to participate in the Summer Intern Program at the Lunar and Planetary Institute. The program, now in its eighth year, is designed to acquaint undergraduates or recent graduates to the world of research. Each intern will have a project directed by a scientist-advisor from the LPI or the Johnson Space Center. As the ten-week program progresses, each intern will present a seminar outlining the project and detailing the results. At the end of the summer, each intern will submit a written report of the research.

This year's interns, their advisors, and projects are:

Connie Bertka, University of Cincinnati

ADVISOR: Dr. Graham Ryder, Lunar and Planetary Institute

PROJECT: A detailed petrographic, microprobe, and chemical analysis of selected samples from a single horizon in the Stillwater (Montana) intrusion, to clarify crystallization mechanisms in terrestrial and lunar basic plutonic systems.

Lisa Block, Texas A&M University

ADVISOR: Paul Morgan, Lunar and Planetary Institute

PROJECT: A model has been proposed to explain the topography of Venus by variations in the thickness of its thermal lithosphere (thermal isostasy) with limited areas of low density crust. This

model has been successful at explaining the range and general distribution of topography on Venus. It is proposed to test the model further by predicting the Venus gravity field from the model and comparing this field with the field deduced from satellite orbit perturbations. In addition it is proposed to use the model to predict stresses in the Venus lithosphere and compare these predicted stresses with surface geologic/geomorphic features. The goal of these studies is to test the hypothesis that Venus is a planet without plate tectonics.

James R. Bollinger, Cornell University

ADVISOR: Dr. Charles A. Wood, NASA Johnson Space Center

PROJECT: More than 700 comets have been observed carefully enough for their orbits to have been determined. For many of these comets additional information on tails, coma, and spectral properties is available, although widely scattered throughout a diverse literature. It is the principal task of the project to compile the orbital, chemical, and physical observation in order to address fundamental questions concerning how comets may be related. The intern will help ferret out comet data, use an IBM computer to compile it in a database, and search for questions and answers to further our understanding of comets and their origins.

Roger Bonner, State University of New York at Albany

ADVISOR: Dr. Kevin Burke, Lunar and Planetary Institute

PROJECT: This project involves work in geodynamics to review the tectonic evolution of hinge zones - more places where subduction zones and boundaries join. Although these environments have been thoroughly studied seismically, their evolution over 10^6 - 10^8 years has been little considered.

Jane Fuller, University of Washington

ADVISOR: Dr. Andrew Potter, NASA Johnson Space Center

PROJECT: The surface of the Moon exhibits a special kind of luminescence. It can be detected only in high-resolution spectra of sunlight reflected from the lunar surface, where it "fills in" the narrow, deep Fraunhofer lines normally present in the spectrum of sunlight. In our study of lunar luminescence, we have collected a large number of lunar spectra from different lunar sites and at different phase angles, using the 107" University of

Texas telescope. Only a few of the spectra have been analysed. The intern will analyse some of the lunar spectra on hand, using existing LPI computer programs, and assist in interpreting the results, i.e. defining the variations of luminescence with lunar site and lunar phase.

Susan Haber, Hofstra University

ADVISOR: Dr. Peter Schultz, Lunar and Planetary Institute

PROJECT: The drainage-density distribution of Martian narrow-valley networks will be determined in $10^\circ \times 10^\circ$ bins across the entire planet. The purpose is to determine regional differences in drainage densities not only due to changes in lithology but also due to subsequent geologic processes. The project should provide a quantitative estimate of inferred ancient fluvial systems and their causative processes.

Paul Johnson, Duke University

ADVISOR: Dr. Steven Clifford, Lunar and Planetary Institute

PROJECT: Investigations by the Viking Landers revealed the presence of a crusty salt-rich near-surface layer in the Martian regolith. This material, which has been dubbed "duricrust", may play an important role in determining both the stability of Martian eolian deposits and the magnitude of volatile exchange which occurs between the planet's atmosphere and regolith. Based on our current understanding of the chemical and physical properties of the Martian duricrust, as well as the origin of analogous salt-rich layers on Earth, we will attempt to construct a detailed numerical model for the development and subsequent evolution of a duricrust layer. Following experimental verification, the long-term implications of duricrust formation will then be explored.

Walter S. Klefer, Texas Christian University

ADVISOR: Dr. Bruce Bills, Lunar and Planetary Institute

PROJECT: This project will involve using the Pioneer Venus Orbiter tracking data to derive a high resolution spherical harmonic model of the gravitational potential of Venus for use in compensation. Many of the recently developed data editing programs of the Geophysical Data Facility (GDF) will be utilized. Work will also involve interpretation of the numerical results in terms of global scale tectonic processes.

Gregory T. Marks, Ohio State University

ADVISOR: Dr. Everett Gibson, NASA Johnson Space Center

PROJECT: The study of early solar system volatiles is underway with the examination of Archean rocks for their trapped volatiles. A very large suite of Archean samples from 3.45 b.y. age to 1.5 b.y. age has been obtained and the detailed petrographic description of the samples is underway. Samples will be searched for both primary and secondary fluid inclusions. Heating and cooling experiments will be carried out on selected samples in order to determine homogenization and freezing temperatures. These experiments will assist with the identification of the trapped volatiles. Some samples will be analyzed with the laser microprobe gas chromatograph system for the identification of the vapor and fluid phases.

Andrew F. McDowell, Rice University

ADVISOR: Dr. Larry E. Nyquist, NASA Johnson Space Center

PROJECT: Semi-empirical production model for spallogenic noble gases in chondritic meteorites - a re-evaluation of parameters for a model for the production rates of cosmic-ray produced noble gases in chondritic meteorites as a function of meteoroid size and location within the meteorite. The model is based on an earlier model for iron meteorites which has been found to adequately describe the measured concentrations of noble gases in iron meteorites. Specific tasks include conversion of a FORTRAN coded program used on a CDC 1604 to operation on the JSC/SSSD DEC 11/45 and/or VAX computer system. Upon completion of this task the model will be applied to noble gas data for the Grant Iron meteorite to verify basic parameters. The model will then be applied to noble gas data for iron-nickel metal separated from chondrites and to bulk samples of the same chondrites. Further comparison will be to the observed depth-variation of cosmic-ray produced noble gases in large chondrites and to theoretical models for production rates. The model will be applied to infer the pre-atmospheric sizes of SNC meteorites (Shergottites, Nakhilites, Chassignites) which are hypothesized to be of Martian origin.

Shelley E. Olds, University of Colorado, Boulder

ADVISOR: Dr. Friedrich Horz, NASA Johnson Space Center

PROJECT: Support and conduct impact experiments with the vertical gun in order to address the differential comminution of planetary regoliths via suitable terrestrial analogs.

Lee Rhudy, University of Texas at Austin

ADVISOR: Dr. Lewis Ashwal, Lunar and Planetary Institute
Dr. William Phinney, NASA Johnson Space Center

PROJECT: Fluid inclusions in proterozoic charnockites including microthermometry of fluid inclusions in granitic rocks associated with Labrador anorthosites. Compare fluid in rocks from unmetamorphosed terrain with those of rocks from granulite grade terrain.

Suzanne Smrekar, Brown University

ADVISOR: Dr. Mark Cintala, NASA Johnson Space Center

PROJECT: The destruction of rocky bodies by impact is a process applicable to many aspects of Solar System evolution and the development of planetary surfaces. Unfortunately, almost all of the experiments by which we attempt to gauge the effects of these collisions have been performed at temperatures that are too low by comparison. Because the physical behavior of rocks at temperatures characteristic of interplanetary space or the outer Solar System is poorly understood, the relation that laboratory results have with reality is uncertain at best. This project will involve the execution of a series of laboratory impacts into target rocks at various low temperatures in an effort to understand the differences between the hot and cold cases.

Carol Grace Young, University of Washington

ADVISOR: Dr. David Gust, Lunar and Planetary Institute

PROJECT: Experimental study of the dlopside-jadellite system at intermediate and high pressures. Experiments analyzed by optical, XRD and electron microprobe methods. Results applicable to lower crustal and mantle phenomena such as melting of granulites and eclogites.



ECG Related Report Again Available

Because of the number of people who requested LPI TR 82-01 *Workshop of Magmatic Processes of Early Planetary Crusts: Magma Oceans and Stratiform Layered Intrusions* after the original printing was exhausted, it was decided to reprint a limited number of copies. In the interest of economy, the reprints are stapled rather than perfect-bound and the two oversize foldouts have been reduced to 8½ by 11". Copies will be available on a first-come, first-served basis at the same postage and handling charge as the original. For U.S. mailing \$3.00 or an addressed franked label; Foreign air mail \$9.50 foreign surface \$4.50. On foreign requests use either a check made on a U.S. bank account or international Postal Order. If this is not possible please include \$10.00 for bank costs. An order form for this report and other current publications of the LPI is included in this BULLETIN.

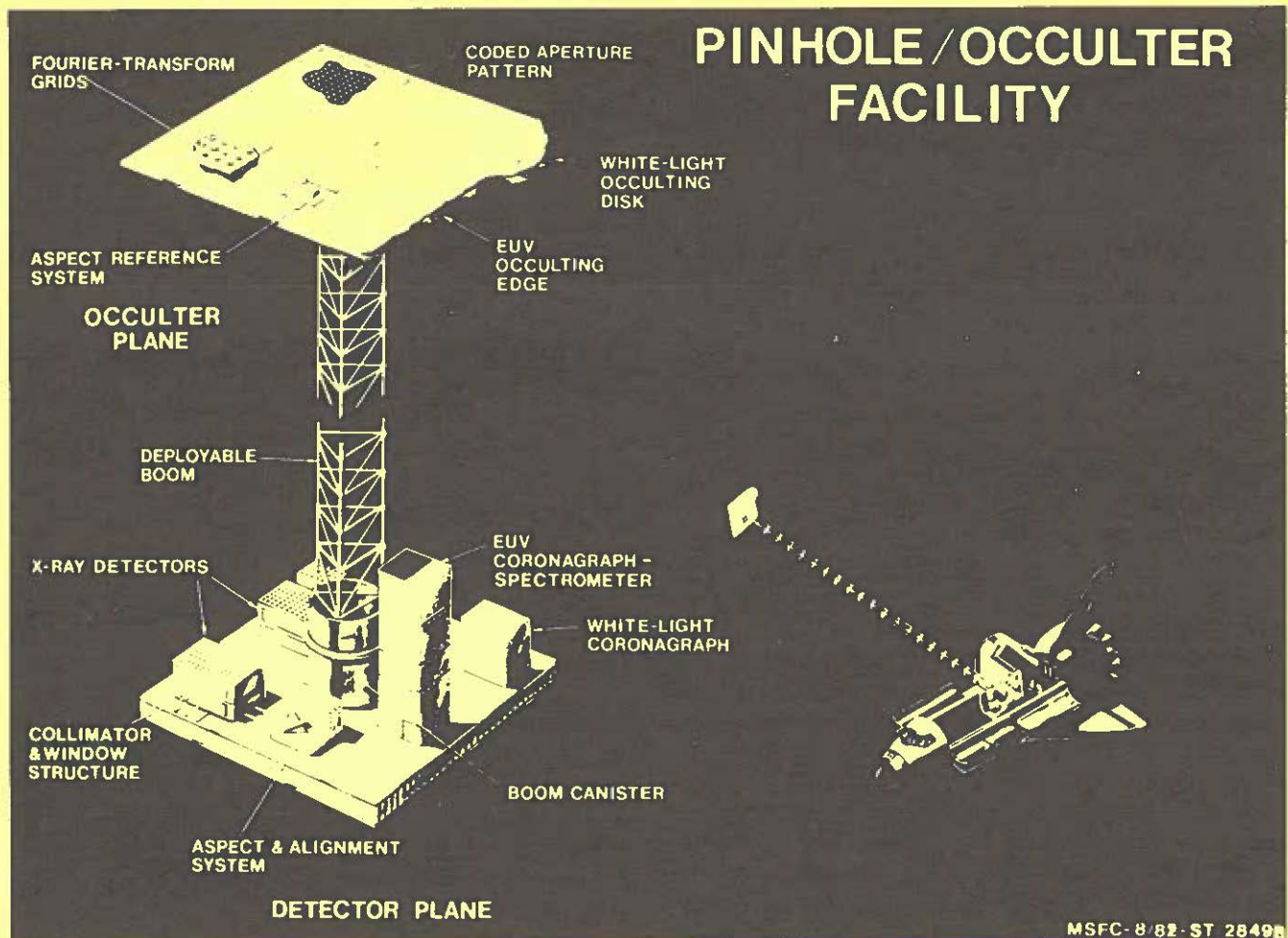


Box-Camera Principle to Decipher Solar Secrets

NASA's Marshall Space Flight Center, Huntsville, Ala., recently finished a conceptual study of an orbiting facility that would examine the sun by using, in part, the principle of an old-fashioned box camera.

The Pinhole/Occulter Facility derives its name from its functions. It studies the sun with a plate filled with thousands of microscopic holes—a method Marshall study manager Joe Dabbs describes as "a high-tech approach to a child's cardboard pinhole camera." The facility uses a mask that obscures, or "occults," the bright disk of the sun so that its fiery corona can be observed closely. "In effect, it creates an artificial solar eclipse," said Dabbs.

The Pinhole/Occulter would be an element of the Advanced Solar Observatory, a combination of instruments of an unmanned orbiting platform—possibly flying in formation with the Space Station—that would study the full spectral range of electromagnetic radiation from the sun. The Advanced Solar Observatory could fly in the mid-1990s.



"But we hope to fly the Pinhole/Occulter itself before that," said Dabbs. "The facility might be part of the advanced observatory, but it still would have an integral identity of its own. If we can make it part of the Spacelab mission series aboard the Space Shuttle, we could have the facility in orbit in the early 1990s. The year 1992 would be especially timely, because that will be the peak of the 11-year solar cycle."

The facility would consist of a small platform called a "detector plane," containing an array of x-ray detectors, visible-light and extreme-ultraviolet coronagraphs and spectrographs. Centered on the platform would be a deployable boom, at the end of which would rest the "occulter plane," a flat, rather square device about six feet across, containing two separate grids of tiny openings, a rounded occulting disk at one corner and a straight occulting edge. The grids and occulting edges would be aligned with their detectors below on the detector plane. The boom would extend about 105 feet. The

x-ray detectors would study the disk of the sun, while the occulters would be used to study the corona.

Like the child's crude box camera, in which a pinhole at the front allows an image to be formed at the rear where film is placed, the Pinhole/Occulter relies upon the same principle—but with dramatic differences. "In the box camera with a single pinhole," Dabbs said, "the image is very faint because of the small amount of light that passes through the hole to the film. You can't make the hole bigger to get a brighter image, because, the larger the hole, the fuzzier the image. So it's better to use lots of small holes."

"The same principle applies with the Pinhole/Occulter. The occulter plane has literally thousands of holes which permit a much brighter image of the sun as x-rays pass through the detectors below.

"But there's an important difference in results between a box camera and the Pinhole/Occulter, which has many tiny pinholes for brightness. If you

were to punch a considerable number of holes through the front of your box camera, you'd get nothing but a lot of confusing images cast by all those pinholes on the film. The Pinhole/Occulter, however, would have an image proportional counter—a computer that would know how to decipher all those images into a single bright one."

Brightness is required to obtain the full dynamic range of solar intensities. A faint image would only permit the study of relatively bright, active regions and solar flares.

Although many studies of the sun have been accomplished over the years, especially during the Skylab missions of the early 1970s, the Pinhole/Occulter would provide a next generation opportunity. "The solar observations made by Skylab were outstanding," said Dabbs, "but technology continues to advance. The difference between the Skylab solar observations and those that would be possible with the Pinhole/Occulter would be about a factor of 10 in sensitivity and spatial resolution. This difference would apply across the board—x-ray detection and visible-light and ultraviolet coronagraphs. Skylab effectively was working with one-inch optics, while the Pinhole/Occulter would have 14-inch optics."

These finer optics would allow a higher time resolution, that is, an ability to record events from moment to moment rather than over long durations. Furthermore, the optics would enable observers to look much more closely at the sun, to see the lower corona and surface of the sun more clearly than is currently possible.

The facility promises to reveal answers to many mysteries of the sun, such as how flares develop; how the corona of the sun is heated to temperatures 20 times hotter than its surface; and exactly where and how the corona is accelerated to form the solar wind, which blows throughout our solar system.

"The complexity of the sun demands a facility like the Pinhole/Occulter to unravel these mysteries," said Dabbs. "But when you realize that the facility has its foundations in a number of simple principles, it raises an interesting question: 'Who would have guessed that the principle behind a child's box camera might someday help unlock the secrets of the sun?'"

NASA NEWS RELEASE 84-45 April 1984

ENTERPRISE GOES TO THE WORLD'S FAIR IN UNUSUAL WAY

The Space Shuttle orbiter Enterprise will earn its "sea legs" during a land, sea, and air move from the West Coast to the Louisiana World Exposition in late March and early April.

The final leg of the 4,300-kilometer (2,300-mile) trip will be by a barge from Mobile, Ala., to the world's fair site on the New Orleans waterfront.

The 68,000-kilogram (150,000-pound) orbiter test vehicle will be displayed at the fair from May 12 through November 11.

The barge trip from Mobile is the only viable method of transporting the DC-9 size orbiter to the New Orleans waterfront. It is too large to transport by rail or road and particularly through the streets of New Orleans to the fair location.

The unusual constraints of the move allow NASA to test techniques and train personnel on methods for safely handling a Space Shuttle orbiter at sites other than Shuttle launch and landing facilities at Kennedy Space Center, Fla., Edwards Air Force Base and Vandenberg Air Force Base, Calif.

Permanent structures are normally used for mating and demating the orbiter from the Shuttle Carrier Aircraft, a modified 747. If an orbiter ever has to land at a contingency landing site, methods of handling and moving perfected and documented on this trip will be invaluable.

At Mobile's Brookley Field, two large transportable cranes and other special ground support equipment will detach the orbiter from the 747 and position it on a 90-wheel transport trailer.

From the airfield the Enterprise will be moved to the nearby Mobile-Brookley Coast Guard Station for loading aboard a large ocean barge for the water leg of the trip.

The barge will be towed from Mobile through Mississippi Sound, then south through Chandeleur Sound. The barge will enter the Mississippi River near Venice, La., and proceed upriver to New Orleans. The barge trip is expected to take three days.

The Enterprise is scheduled to arrive at the Louisiana World Exposition site on the New Orleans waterfront the afternoon of April 5. The transporter trailer will be off-loaded and towed to a location in front of the U.S. Pavilion. There cranes and ground support equipment will remove the Enterprise from the transporter and place the 37-meter (122-foot) -long vehicle on its display location.

At the conclusion of the Louisiana World Exposition the Enterprise will be ferried back to Vandenberg AFB where it will be used for additional fit-and-function checks at the West Coast Shuttle launch facility.

NASA NEWS RELEASE 84-35, 3/16/84



SHUTTLE MISSION 41-D LAUNCH DATE ADJUSTED

The National Aeronautics and Space Administration has adjusted the planned June 6, 1984, launch date of the Space Shuttle Mission 41-D to June 6, 1984. The mission will be the inaugural flight of the Shuttle orbiter Discovery.

The date change is due to the planned changeover of the orbital maneuvering system (OMS) pods from the orbiter Challenger to orbiter Discovery between flights 41-C (April 6, 1984) and 41-D.

NASA News Release 84-46, no date

EARLY CRUSTAL GENESIS PROJECT ACTIVITIES

ECG Field Workshop to Godthab, Greenland (Tentative)

The LPI is currently exploring the possibility of organizing a workshop/field trip to the Archean of Greenland in the Godthab area during the summer of 1985. The field trip would be part of the ongoing activity of the Early Crustal Genesis Study Project. The

trip has been proposed by Dr. Victor McGregor, who would be the field trip leader. In addition to the Godthab area, trips to Isua, Qôrquut and Fiskanaesset are being considered. The expense for the workshop would be borne by the individual participants, who would be limited in number to thirty. Avenues for keeping the cost to a minimum are being actively pursued. If you are interested in participating in this workshop, or would like more information, please contact Pam Jones, LPI Projects Office (713-486-2150).

Workshop on the Early Earth Held April 23-25, 1984

Fifty-seven scientists attended the *Workshop on the Early Earth: the Interval from Accretion to the Older Archean* which was held at the Lunar and Planetary Institute, April 23-25. The goal of this workshop, convened by Kevin Burke, LPI, was to review current understanding of the processes of earth formation and that of the older Archean rocks, with a view to addressing the questions: What was the earth like between its formation and that of the oldest preserved rocks? What theoretical, observational or experimental studies can be initiated at this time to address this question?

Attendees at the workshop addressed the following program topics:

- Accretion of the earth: processes accompanying and immediately following accretion, including core formation;
- Impact records and other information from planets and the Moon relevant to early earth history;
- Isotopic patterns of the oldest rocks: what do they tell us about earlier times?
- Igneous, sedimentary, and metamorphic petrology of the oldest rocks; the structure of the oldest rocks and implications for the oldest continents; and
- Volatiles and early earth history, especially noble gases.

An LPI Technical Report will be prepared which will include revised abstracts, summations of the sessions, etc. Availability of the Report will be announced in a later BULLETIN.



THERMOTECTONICS AND DETACHMENT IN CONTINENTAL AND PLANETARY EXTENSIONAL TECTONICS—PRELIMINARY MEETING ANNOUNCEMENT

Recent studies of continental terranes (such as the U.S. Basin and Range Province) where extensional deformation is dominant have shown that thin-skin tectonics are a common characteristic of this deformation, while low-angle faults (detachments or decollements) separating domains differing greatly in mechanical behavior are a key feature. The common association of volcanism and other thermal phenomena with the extension suggest that at least some of the deformation is thermally controlled.

The spectacular data obtained from missions to the planets and satellites of the solar system indicate that volcanism and other thermal effects are conspicuous on some of these bodies; the data also show clear evidence of tectonism that in many cases is best explained by decoupling between layers under an extensional stress regime.

Even though much is known and more is being learned every day about continental extension, much remains to be done to test hypotheses, generate a synthesis, and point out areas of inadequate knowledge. A good way to achieve this aim is to bring together people who can provide field, experimental and theoretical information on the subject in a congenial environment that encourages discussion and exchange of information. A promising approach is to focus on specific mechanisms that are likely to play a major role in continental extension, rather than again examining extension in general; and to promote interaction between terrestrial and planetary geologists, on the grounds that the former have abundant and detailed knowledge of a single system, Earth, whereas the latter have knowledge that is less abundant and detailed, but pertains to a number of different systems. Pooling these resources should yield insights not obtainable from each field of study alone.

The Lunar and Planetary Institute is organizing a conference to explore the role of heat and mechanical decoupling in controlling the style of extensional tectonics on terrestrial continents and planets

of our solar system. This conference is the third of a highly successful series that has already explored Plateau Uplift, and Processes of Planetary Rifting. Co-conveners for the conference are Ivo Lucchitta (USGS, Flagstaff, AZ), Paul Morgan (LPI, Houston, TX, and Purdue University, West Lafayette, IN), and Larry Soderblom (USGS, Flagstaff, AZ, and Caltech, Pasadena, CA). The conference is tentatively scheduled for the first half of April, 1985, at a location to be selected in northern Arizona. If you are interested in receiving more information about this conference as it becomes available, please write to Ms. Pam Jones, Projects Office, Lunar and Planetary Institute, Houston, TX 77058, or call (713) 486-2150.

Workshop on Cosmogenic Nuclides

A two-day Workshop on Cosmogenic Nuclides will be held July 26-27, 1984, at the Los Alamos National Laboratory in beautiful northern New Mexico. The dates are the Thursday and Friday just before the 47th Annual Meeting of the Meteoritical Society, which will be held in Albuquerque, New Mexico, from July 30 to August 2, 1984. Los Alamos is a half-hour airplane flight or a 100-mile drive north of Albuquerque and is 35 miles northwest of Santa Fe, home of the Santa Fe Opera. The co-conveners of the Workshop are Dr. Robert C. Reedy, Los Alamos National Laboratory, and Dr. Peter Englert, University of Cologne, FRG.

Informal discussions, plus possibly some invited papers, will address topics related to cosmic-ray-produced nuclides such as:

1. The origins, fluxes, composition, and spectra of the cosmic-ray particles in the solar system as a function of space and time.
2. The histories of the targets bombarded by cosmic rays, like meteorites and lunar samples.
3. Measurement techniques (such as the new ones like accelerator mass spectroscopy) and problems related to measurements (such as standards).
4. Models and calculations for the production of cosmogenic nuclides and the needs for predictions of production rates.
5. Terrestrial and extraterrestrial problems that are or should be studied with cosmogenic nuclides.

The final program will be designed around the interests of the participants as expressed in contributed abstracts, which will be due June 1, 1984. As the Workshop participants will come from many, varied disciplines, this Workshop will provide a rare opportunity to informally discuss topics and problems related to cosmogenic nuclides.

To express an interest in attending this meeting or to obtain more information contact:

Dr. Robert C. Reedy
Mail Stop J514
Los Alamos National Laboratory
Los Alamos, NM 87545
Phone (505)667-5446; FTS 843-5446



AMES-STANFORD FORM SPACE INSTITUTE

NASA's Ames Research Center and Stanford University have formed the Stanford-Ames Institute for Space Research to pursue joint undertakings in space research, astrophysics, and technology development.

An agreement establishing the institute was signed at Ames by Ames Director William F. Ballhaus, Jr. and by Dean Norman K. Wessels of Stanford at 3 p.m., Friday, March 16.

Both organizations already carry out substantial independent space science activities, and have cooperated on some limited space efforts in the past. The new institute is intended to foster joint research, and the sharing of technical capabilities and people.

Plans are being considered under the new arrangement, for courses and seminars at Stanford in areas of Ames research to be taught by Ames scientists. In some cases, Ames researchers will hold uncompensated consulting Professorships.

Stanford students may work on scientific projects at Ames. There will be mutual use of shops and computer facilities where practical. A space science and astrophysics seminar series to be held periodically each year, and a summer faculty fellowship program for professors from other universities are planned. Opportunities for post-doctoral fellows to collaborate in joint research programs may be provided, and distinguished scientists from the U.S. and abroad will be brought to Stanford-Ames.

The new institute will be administered by a Chairman from Stanford, and an Associate Chairman from Ames, as well as by an eight-member executive committee, composed of four Stanford and four Ames scientists.

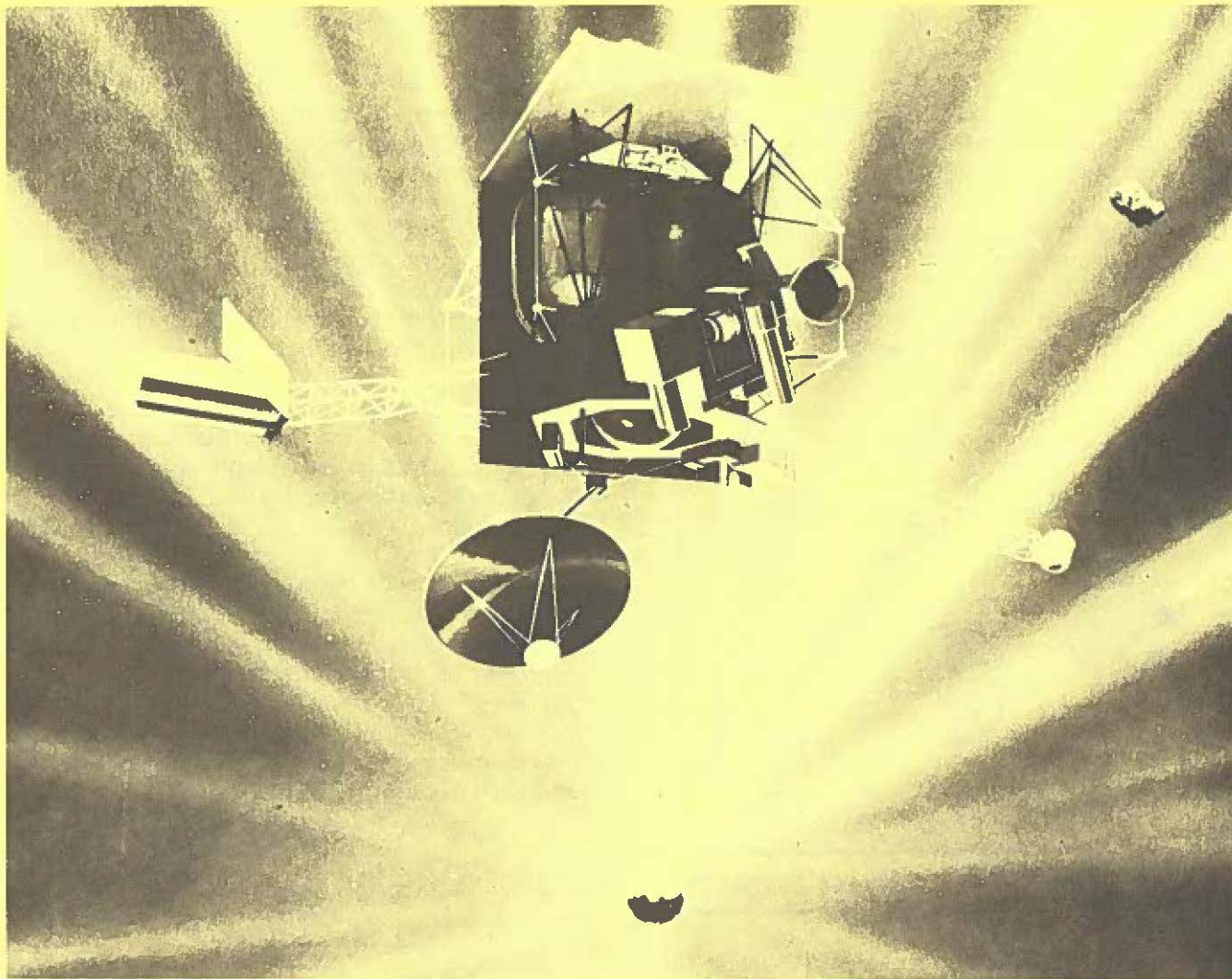
First Chairman of the institute is Professor Vahe Petrosian, Stanford, and first Associate Chairman is Dr. Lawrence Collin, chief of the space sciences division at Ames. Stanford members of the executive committee are Professors Arthur Walker, Von R. Eshelman, Robert Wagoner, and Robert Helliwell. Ames members are Drs. Harold P. Klein, Palmer Dyal, Henry Lum, and Patrick M. Cassen.

NASA/AMES NEWS RELEASE 84-18, no date



DPS PLANS 16th ANNUAL MEETING

The Hawaii Institute of Geophysics and the Institute for Astronomy of the University of Hawaii will host the 16th Annual Meeting of the Division for Planetary Sciences of the American Astronomical Society. The meeting will be held at the King Kamehameha Hotel, Kailua-Kona, Hawaii from October 9 to 12, 1984. Contributed reports from all areas of planetary science are welcome. Abstracts in the standard AAS format must be postmarked by August 1 and received by August 10, 1984. Send abstracts to the program chairman, Tom McCord, Planetary Geosciences Division, Hawaii Institute of Geophysics, University of Hawaii, 2525 Correa Road, Honolulu, Hawaii 96822. Questions regarding travel and accommodations should be directed to the local arrangements chairman, David Morrison, Institute for Astronomy, University of Hawaii, 2680 Woodlawn Drive, Honolulu, Hawaii 96822.



COMET Kopff to be TARGET for NASA RENDEZVOUS

A relatively bright, active short-period comet named Kopff has been recommended by a scientific advisory group as the target for a rendezvous with a NASA spacecraft.

The mission would use a new planetary spacecraft, the Mariner Mark II, which the Jet Propulsion Laboratory is studying as a successor to the Mariners, Rangers, Vikings, and Voyagers. The rendezvous mission is the first in a series of proposed explorations of primitive solar system bodies—such as comets and asteroids—and the far outer planets.

Comet Kopff was selected at a recent meeting at Caltech of NASA's Comet Rendezvous Science Working Group, a team of 20 U.S. and European scientists appointed to advise the space agency on the planning for such a mission.

Current plans call for the NASA spacecraft to rendezvous with comet Kopff in May 1994, after a July 1990 space shuttle launch. A rendezvous mission would differ from a flyby in that the spacecraft would match the comet's orbit around the sun and then stay with the comet for several years. This extended encounter would allow for close-up observations under a variety of conditions.

Scientists in the Comet Working Group say they are enthusiastic about plans for a rendezvous mission as a follow-up to the flybys to be carried out in 1985 by NASA's International Cometary Explorer, which will explore comet Giacobini-Zinner, and in 1986 when European, Soviet, and Japanese spacecraft will encounter Halley's comet.

The scientists chose Kopff from a list of short-period comets. Longer-period comets generally have orbits that are more difficult to match for rendezvous missions.

Comet Kopff, one of the brighter short-period comets, orbits the sun every 6.5 years. It was observed by ground-based astronomers and by two spacecraft—the International Ultraviolet Explorer and Infrared Astronomical Satellite—when it was in the inner solar system this past summer. The data show that Kopff is somewhat dustier than most short-period comets.

Kopff was selected because of its relative active state and because the spacecraft would be able to perform the rendezvous maneuver more than two years before the comet's closest approach to the sun.

The spacecraft would orbit Kopff and study it in great detail from ranges of less than 10 kilometers before the comet becomes active as a result of solar heating. After Kopff forms its coma and tail, the spacecraft would back off some distance to continue operation in the dusty near-comet environment.

An additional attraction of the mission to comet Kopff is the opportunity to take close looks at two main-belt asteroids named Namaqua and Lucia. Flybys of these bodies would take place during the spacecraft's journey from Earth to Kopff.

JPL is conducting systems-development studies for a variety of Mariner Mark II missions, the deep-space elements of the Core Program of future projects recommended by NASA's Solar System Exploration Committee.

These will be carried out during the next two decades and include missions to Saturn, its satellite Titan, Uranus and the main-belt asteroids. The Mariner Mark II comet mission is planned for a fiscal 1987 new start.

The payload for the comet Kopff mission would include scientific instruments mounted on the spacecraft bus or on a scan platform, depending on the pointing requirements. The Mariner Mark II's will use electronics and parts from other spacecraft—including the Vikings, the Voyagers, Galileo, and the Venus Radar Mapper—in order to minimize development costs

NASA PRESS RELEASE 2/21/84

SPACE FOUNDATION ANNOUNCES SPACE INDUSTRIAL FELLOWSHIP

A \$5,000 stipend to reward and encourage innovative thinking in disciplines related to the use of space resources through commercialization is to be awarded by the Space Foundation. New frontiers are opening in microgravity, remote sensing, biotechnology, materials processing, space robotics, solar power, satellite engineering, heat transfer, artificial intelligence, space transport and many other space oriented research areas. Outstanding graduate students from accredited universities whose research work expands a frontier area will be encouraged to apply. Applicants are solicited not only from the sciences and engineering, but from business, law, economics, social sciences, environmental studies and the humanities.

Applicants for the fellowships should be superior graduate students holding bachelor degrees from accredited universities and who intend to devote their careers to the furtherance of practical space research, engineering, business or other application ventures. Deadline for application is November 15, 1984. Awards will be announced in the spring of 1985.

The Space Foundation is a public, nonprofit foundation established in 1979 to channel private sector resources into promising research directed toward the economic development and use of space. The Foundation's Space Business Roundtable is a monthly education and awareness program to brief business leaders on the economic issues of space applications and the potential for private development of space. The Fellowship Program rewards and encourages innovative thinking in disciplines related to the peaceful use of space.

Further information and application materials may be obtained from:

Ms. Nancy Wood
Associate Director
The Space Foundation
P. O. Box 58501
Houston, Texas 77258



SPACE STATION APPOINTMENTS ANNOUNCED AT JOHNSON SPACE CENTER

Nell B. Hutchinson has been named manager of the Space Station Program office at NASA's Johnson Space Center in Houston. Deputy manager is John W. Aaron. Both appointments were effective April 9, 1984. Gerald D. Griffin, Johnson Director, announced.

NASA Administrator James M. Beggs announced in February that Johnson Space Center would be "lead center" for the agency's Space Station Program.

Hutchinson has been serving in a staff assignment to the Johnson Director since his return in January 1984 from a one-year assignment at NASA Headquarters, where he was Director, Space Shuttle Operations Office in the Office of Space Flight. He has been with NASA since 1962 and has worked on the design and development of the Mission Control Center's Real Time Computer Complex. He served as a flight controller on Gemini and Apollo missions before becoming a Flight Director in 1972. Hutchinson served as Flight Director for the final Apollo lunar landing mission, Apollo 17; for all three manned Skylab missions in 1973-1974; for the Apollo-Soyuz Test Project in 1975; and for Shuttle developmental and orbital flight tests from 1978 to 1981. In addition to his flight control and flight director responsibilities, Hutchinson served as head of the Systems Logic and Processing Section, assistant chief of the Apollo Command and Service Module Systems Branch, chief of the Guidance and Propulsion Systems Branch and deputy chief of the Flight Integration Office at Johnson.

Aaron has been chief of the Spacecraft Software Division at Johnson since 1981. He also served as Avionics Flight Software Project manager for the Shuttle Approach and Landing Test and Orbital Flight Test programs; as technical assistant to the chief, Spacecraft Software Division and as section head for the Electrical Power, Sequential and Instrumentation Systems for the Apollo Command and Service Module. In addition to his organizational responsibilities, Aaron also served as a flight controller responsible for vehicle systems operation on Gemini, Apollo, and Skylab programs.

NASA News Release No. 84-50; 4/9/84

THE 1984 INTERNATIONAL CHEMICAL CONGRESS OF PACIFIC BASIN SOCIETIES

There will be a symposium on Nuclear Cosmochemistry and Meteorites at the PAC CHEM '84 Meeting to be held in Honolulu, Hawaii, December 16-21, 1984. It will include 4 or 5 half-day sessions. Session topics include: petrology, trace elements and organics in meteorites; origin of meteorites and the solar system; cosmochemistry. Abstracts should be submitted before June 1, 1984. For information and abstract forms write:

Mr. T. A. Winstead
Meetings Department
American Chemical Society
1155 16th Street, N. W.
Washington, D. C. 20036
(telephone 202-872-4396)

FIRST ANNOUNCEMENT AND CALL FOR PAPERS: LUNAR BASES AND SPACE ACTIVITIES FOR THE 21ST CENTURY, A Symposium

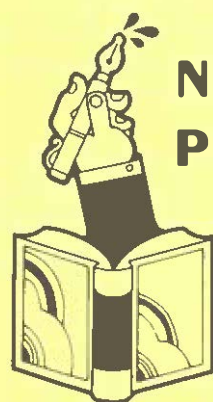
The National Aeronautics and Space Administration (NASA) will sponsor a symposium **Lunar Bases and Space Activities of the 21st Century** to be held October 29-31, 1984 at the National Academy of Sciences Auditorium, 2101 Constitution Avenue, Washington DC.

The symposium will take a serious and scholarly view of important issues relevant to the process of deciding when and how a lunar base might be incorporated into space activities of the next Century. Topics for discussion will include scientific rationale, experiment descriptions, utilization of the Moon for industrial purposes, aspects of habitation, growth of a lunar base, technology challenges, and political and social implications. Interested scientists, engineers, planners, and scholars who believe they can make a substantive contribution to the symposium are invited to submit abstracts for invited contributions. In addition, space will be available for poster presentations, which can be given outside the oral presentation sessions.

To submit an abstract, contact Dr. Michael B. Duke at the address given below to obtain a copy of the abstract format. Abstracts must be submitted by September 1, 1984 to:

Lunar Base Symposium Program Committee
c/o Dr. Michael B. Duke
Mail Code: SN
NASA Johnson Space Center
Houston TX 77058
Phone: 713-483-4464

Contributors of papers accepted for oral presentation will be notified by September 30. Abstracts of all accepted contributions will be distributed to all registrants at the symposium. A volume of selected contributions will be published as a result of the symposium. It is anticipated that final manuscripts will be required by January 1, 1985 and the publication will be in late 1985.



NEW PUBLICATIONS

Please order the following publications from the sources indicated. The LPI is not a distribution center for these materials. In general, government documents can be ordered from the Superintendent of Documents, Government Printing Office, Washington DC 20402. Although the agency requires prepayment on all orders, they will accept Mastercard or VISA credit cards. Just include the account number and expiration date on your order to them. Some of the publications may be available from the GPO bookstores which are found in major cities around the U.S. Check your city directory for a local listing.

NASA PUBLICATIONS

Star Splitters: The High Energy Astronomy Observatories

This new NASA publication written by Wallace H. Tucker is the story of a space science project. It traces, literally from the word "go", the many elements of a major and highly successful space program. Astronomers began to dream about the research they would ultimately do with HEAO back in the mid-sixties.

Today, 20 years later, some of those same astronomers are still writing papers on the results of that research. You will learn how a science project is conceived, funded, and managed, and you will experience with the HEAO team the emotional ups and downs and the frustrations and rewards that go with participation in such a venture. Dr. Tucker, a lucid writer and distinguished scientist, brings alive the human drama along with the significance of the discoveries made with HEAO.

You will learn much about our universe from this book—from the creative violence that spawns new galaxies, planets, and ultimately you and me, to the nature of the galaxies' missing mass. The scientific discoveries on the three HEAO's greatly exceeded the anticipation of the astronomers. This book makes good reading! NASA SP-466, 182 pp., illustrated, some color, hard cover. Available from the Government Printing Office U.S. \$12.00; Foreign \$15.00.

Repairing Solar Max: the Solar Maximum Repair Mission

This brief (16 pages) NASA Educational Publication explains in text and pictures the efforts successfully performed on Shuttle mission 41-C to rescue and repair the Solar Maximum Satellite. Although written, of course, prior to the mission itself so that time-lines and procedures used to capture and repair the satellite are different from those outlined in the booklet, it still presents a colorful and informative discussion of the mission and its objectives.

NASA EP-205, 16 pp. illustrated, some color. Available from the Government Printing Office, U.S. \$1.50; Foreign \$1.90.

OTHER PUBLICATIONS OF INTEREST

Worlds in Comparison; a slide set

How many Earths would fit side by side into the giant Red Spot on Jupiter? How large are Saturn's satellites compared to the Earth's Moon? If the largest volcano on Mars were placed on the eastern seaboard of the U.S., how much room would it take up?

Dramatic visual answers to questions like these can be found in a new slide set called "Worlds in Comparison" produced by the non-profit Astronomical Society of the Pacific. Designed by former NASA Visual Information Specialist Stephen Meszaros, the 15 slides bring together the best spacecraft and radar images of various planets and moons in our solar system for easy comparison.

The set includes a detailed caption booklet giving all the relevant characteristics for each body and explaining the significance of each comparison.

The set is available for \$14.95 including postage and handling from: A.S.P., Worlds Slide Set Dept., 1290 24th Avenue, San Francisco, CA 94122.

BIS Offers Special Issues

The British Interplanetary Society has informed us that they have a number of copies of some of the issues of their *Journal* available free of charge. The following items are available:

A number of specimen issues of the *Journal* devoted to interstellar studies;

A special issue of the *Journal* devoted to Halley's Comet.

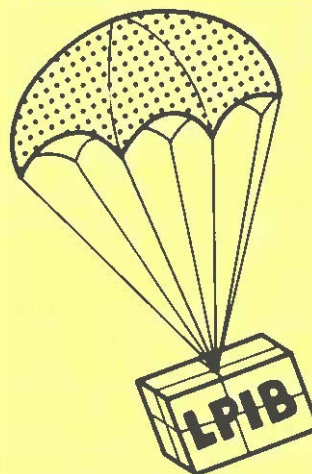
These issues are being distributed on a first-come, first-served basis by the British Interplanetary Society, 27/29 South Lambeth Road, London SW8 1SZ, UK.

If you want to be sure that you get all of your mailings from the institute promptly, be sure to send a change of address to: Mailist, Lunar & Planetary Institute, 3303 NASA Road One, Houston, TX 77058. It often takes the postal service 60-90 days to return an item to us with the address correction. Do yourself and us a service. Remember the LPI Mailing List when you move. Thanks. (ye editor)

The **LUNAR AND PLANETARY INFORMATION BULLETIN** is published by the Lunar and Planetary Institute. There are usually three issues per year. It is distributed free on request to lunar and planetary scientists, educators, students, and their institutions.

The next issue will be in November. Copy deadline is October 15, 1984. If you have any announcements which you would like to have printed in the **BULLETIN**, please send them to the Editor. We reserve the right to select and edit copy.

Editor: Frances B. Waranius,
Lunar and Planetary Institute
3303 NASA Road One,
Houston, TX 77058
Phone: 713/486-2135



NOTE TO OUR READERS: PLEASE let us know when you move. Each change of address which we get through the postal service costs us \$.25-\$.80 in return postage costs. Because of the high costs of postage, we will make the address change on our list but we will no longer send the current issue out to you on a straight third or first class mailing. This means you will miss receiving whatever mailing from the LPI we get from the Post Office with your change of address.

calendar

June 8

ABSTRACT DEADLINE GSA Annual Meeting

Contact: GSA Headquarters
P. O. Box 9140
Boulder CO 80301

June 10-13

American Astronomical Society 164th Annual Meeting
Baltimore Maryland

Contact: Richard Henry
Johns Hopkins University
Dept. of Physics
Baltimore MD 21218
Phone: 301-338-8000

July 2-28

CNES Summer School for Space Physics
Internal Geophysics and Space

Toulouse, France
Contact: Centre National D'Etudes Spatiales
Dept. des Affaires Universitaires
18, avenue Edouard-Belin
31055 Toulouse CEDEX France

July 10-12

96th Scientific Meeting of the Astronomical
Society of the Pacific

University of California, Santa Cruz
Contact: Santa Cruz Meeting
A.S.P.
1290 24th Avenue
San Francisco CA 94122

July 10-14

Case for Mars II: Annual Conference
of the Mars Institute

University of Colorado, Boulder
Contact: Helen Hort
Lab. for Atmospheric & Space Physics
University of Colorado
Boulder CO 80309
Phone: 303-492-8822

July 15

ABSTRACT DEADLINE: LPI Topical Conference on
the Origin of the Moon

July 26-27

Workshop on Cosmogenic Nuclides

Los Alamos National Laboratory, New Mexico
Contact: Dr. Robert C. Reedy
Mail Stop J514
Los Alamos National Laboratory
Los Alamos NM 87545
Phone: 505-667-5446; FTS 843-5446

July 30-August 2

47th Meteoritical Society Annual Meeting

University of New Mexico, Albuquerque, New Mexico

Contact: Dr. Klaus Kell

Institute for Meteoritics

University of New Mexico

Albuquerque NM 87131

August 1

ABSTRACT DEADLINE DPS/AAS Meeting

Contact: Dr. Thomas McCord

Planetary Geosciences Division

Hawaii Institute of Geophysics

University of Hawaii

2525 Correa Road

Honolulu HI 96822

October 9-12

Division for Planetary Science/AAS 16th

Annual Meeting

King Kamehameha Hotel, Kailua-Kona, Hawaii

Contact: David Morrison

Institute for Astronomy

University of Hawaii

2680 Woodlawn Drive

Honolulu HI 96822

October 13-16

Topical Conference on the Origin of the Moon

Kona, Hawaii

Contact: Pam Jones

Lunar and Planetary Institute

3303 NASA Road One

Houston TX 77058

Telephone: 713-486-2150

October 29-31

**Lunar Bases and Space Activities in the
21st Century**

National Academy of Sciences, Washington D.C.

Contact: Dr. Michael B. Duke

NASA Johnson Space Center

Mail Code: SN

Houston TX 77058

Phone: 713-483-4464

November 5-8

**Geological Society of America 97th annual
meeting**

MGM Grand, Reno Nevada

Contact: Geological Society of America

Conference Coordinator

P. O. Box 9140

Boulder CO 80301

Phone: 303-447-2020

December 3-7

American Geophysical Union Fall Meeting

San Francisco California

Contact: Meetings

American Geophysical Union

2000 Florida Avenue NW

Washington DC 20009

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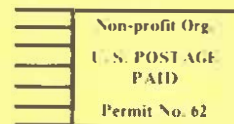
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