PSI Hosts Data Review by Carol Neese

One of the ongoing projects at PSI is the Asteroid Subnode of the NASA Planetary Data System (PDS). The PDS is a NASA project charged with archiving solar system data from NASA spacecraft missions and from the ground. All asteroid data archiving for the PDS is handled by the Asteroid Subnode at PSI, which is run by Don Davis and Carol Neese, with help from Mark Sykes at the University of Arizona and David Tholen at the University of Hawaii.

Last month, on May 29th, the Asteroid Subnode held its 10th Annual Asteroid Data Review meeting. Once each year in the late spring or early summer, the PSI conference room is crowded to capacity with PDS representatives as well as planetary scientists invited to be reviewers of that year’s crop of asteroid data sets. The reviewers have a month to look the data over, and then we all spend a full day going over them with a fine-toothed comb and identifying any errors or deficiencies. These deficiencies must then be corrected before the data can be archived. It’s hard work, but we usually manage to have quite a good time doing it.

Behind the scenes, these data sets have been carefully gathered from the investigators and prepared with all the documentation needed for a scientist to use the data. In this way, asteroid data is made available to the planetary science community and also preserved for the future.

Data which have been archived in recent years include spacecraft data from the NEAR (Near-Earth Asteroid Rendezvous), Galileo and IRAS (Infrared Astronomical Satellite) missions, as well as ground-based data products such as asteroid spectra, lightcurve polarimetry, radar shape models, surface maps, densities, sizes, and many others. We are also starting to branch out from asteroids and have included data sets on transneptunian objects and small planetary satellites.

If you’d like to learn more about PSI’s Asteroid Subnode, or to see any of the archived data, check the website at www.psi.edu/astsubnode.html.

At left: The phased color lightcurve of Transneptunian Object (TNO) 2000 GN171 was among the data reviewed at this year’s PDS Asteroid Data Review. This lightcurve, which shows how the light reflected from the TNO varies as the object rotates, shows that there are no significant color variations in the lightcurve, suggesting that TNO 2000 GN171 is an elongated body with a nearly uniform surface. A TNO is an asteroid- or comet-like body orbiting beyond the orbit of Neptune.
MARS PHOTO OF THE MONTH:
GULLIES AND MORE GULLIES

by William K. Hartmann

This issue's featured Mars image is a recent release from the Mars Odyssey THEMIS (Thermal Emission Imaging System) instrument. Our previous featured views of Mars have mostly come from the Mars Global Surveyor camera, which shoots very small areas but shows extreme detail; THEMIS shows larger regions.

This image shows a large crater whose inner walls have been highly eroded, apparently by water flow that created a host of gullies. As you look at details in the wall, you can see not only gullies carved into the wall slopes, but also gently rounded masses of deposits especially at the foot of the south (bottom) wall, implying that water deposited the eroded material on the crater floor. Some researchers think that snow packs may have covered these slopes. (For a related image, see the glacier-like feature on a crater wall in our Summer 2001 issue.)

A continuing mystery is the source of the water. One group of theories favors underground sources, such as melting of underground ice. This could create aquifers that produce springs and seeps where they intersect crater walls. The other group of theories favors atmospheric sources, namely blankets of dusty ice deposited about every 10 million years when the Martian polar axis tips at a higher angle toward the sun, creating extreme summers and extreme winters.

Challenging both sets of theories is a small isolated hill, shown in the second image. It lies just northwest of the crater in the featured picture. The strange thing here is that the south side is laced with gullies. If the water came from underground, how did it get up into the hill? (The gullies seem recent, implying that the water wasn't there at the beginning.) The gullies thus seem to favor the "dusty snowfall" theory, except then there is a question about why every slope of every hill in this area doesn't have similar gullies.

PSI researcher Dr. Melissa Lane is a member of the Mars Odyssey research team working with THEMIS data, and the regions here are near the areas being worked on by Dr. David Crown and graduate student Dan Berman, where ice-rich soils seem to have created flow features such as "debris aprons," as discussed in our Fall 2002 issue.

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Lofty Goals

When reviewing our data collection,
We strive to achieve near-perfection.
The reviewers we prize
Have got patience, good eyes,
And a strong anal-type predilection.

Anne Raugh, 2003

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Martian crater whose inner walls have been dissected by gullies apparently caused by water flow. Mars Odyssey THEMIS image I01657002. Latitude near 37 degrees south, longitude near 247 degrees west.

Isolated hill, just northwest of the crater in the previous image, with erosion gullies on its south face. If the gullies are caused by water, as widely accepted, where did the water come from? Mars Odyssey THEMIS image I01657002.
A SHORT HISTORY OF PSI — Part 2
by William K Hartmann, Donald R. Davis and Stuart Weidenschilling

Continued Evolution of PSI

Around 1975, PSI moved to an office on North First Avenue, and moved again in 1978 to the Sun Building at 2030 E. Speedway, to be closer to the University of Arizona. We were quite happy at this location; however, the University of Arizona administration expanded and took over neighboring office space, including the Sun building. Despite appeals from University planetary scientists that PSI be allowed to stay, we were evicted in 1988 and moved to nearby quarters at 2421 E. Sixth St, several blocks further from the university. After a few years, this location proved unsuitable and we had to move again, relocating in 1993 to our present building at 620 N. Sixth Ave., about a mile west of the university.

Our work during the 1980s featured a continued series of papers about planet formation using the PSI planet-growing model, as well as observational work on asteroids and comets from Rick Binzel, Humberto Campins, Clark Chapman, and William K. Hartmann. Hartmann collaborated with Dale Cruikshank and Dave Tholen (U. Hawaii) to use the Mauna Kea telescopes in observations which were the first to show that outer solar system asteroids and comets all have similar, very dark colors, and are closely related to each other. One discovery successfully predicted that Halley’s Comet would be a black body with only 4% reflectivity (as confirmed by the European Giotto probe), when the prevailing wisdom was that it would look like a dirty iceberg with about 26% reflectivity.

During this period, Clark Chapman landed a plum assignment as a team member on NASA’s Galileo Mission to Jupiter. He spent several years planning the mission and then analyzing photos of Jupiter’s satellites, as well as editing the Journal of Geophysical Research–Planets for a short period from our office. Hartmann was selected to be on the Mars Observer mission, which failed as it approached Mars, and then was appointed to the Mars Global Surveyor (MGS) imaging team. MGS successfully sent back close to 100,000 images from 1997 to 2002.

PSI continued to evolve as some members left and others arrived. Among notable staff were the well-known asteroid researcher Rick Binzel, who came in 1985, and the comet observer Humberto Campins, who came in 1986. Alan Binder departed in 1976 to work in Germany; Greenberg went back to the University of Arizona in 1985; Binzel went to MIT in 1991; Campins to the University of Florida in 1994; and Chapman to the Southwest Research Institute in 1997.

Steve Howell joined the group in 1988, first on an appointment split between computer systems administration and science. He broadened our coverage into astrophysics and quickly succeeded in attracting grants and developing a full-time program emphasizing observations and interpretation of cataclysmic variable stars. Steve left for a few years to go to the University of Wyoming, but returned in 1997, staying until 2002 when he moved to the University of California at Riverside.

A Jump to San Juan Research Institute

During the 1980s, we saw a variation of an earlier cycle. Science Applications International Corporation (SAIC), our parent company, was a for-profit company that faced intense competitive pressure and operated in the commercial world rather than in a basic research environment. Also, higher management saw better opportunities for expanding profits in fields other than planetary science, and so were not willing to invest resources in PSI that would enable us to grow. A key item was when we tried to recruit an outstanding young scientist named Alan Stern who was interested in building an instrument/spacecraft group. After discussions, SAIC management declined to help him in setting up a laboratory, so Stern moved instead to Southwest Research Institute where he developed one of the outstanding planetary groups in the U.S. After much debate, we elected to pull out of SAIC and merged with a fledgling group in San Juan Capistrano, established by former JPL scientist Doug Nash. The merger of the two groups greatly strengthened the California group, and gave PSI Tucson non-profit status. The Tucson group retained its identity at PSI, while administrative and financial management was located in the San Juan Capistrano office. The San Juan Capistrano office included not only Doug Nash and his lab, but Bruce Betts, who had worked on various problems in Mars research, and a very active community outreach education program, staffed partly by continued on page 4
However, Nash retired in 1998, shortly after our merger, and Bruce Betts took a three-year leave to work at NASA HQ in Washington, DC, so maintaining the California home office (in a refurbished bank building in San Juan Capistrano) became untenable. The California office relocated to a series of smaller facilities and currently occupies offices in Laguna Niguel, CA. Donald Davis became Institute Director following the retirement of Doug Nash.

Also, the name of the organization was legally changed to the Planetary Science Institute which aptly describes the nature of the work that we do and has a long history within the planetary research community.

**Recent Developments**

The late 1990s saw a prosperous period of expansion for PSI. Steve Howell worked with several graduate students and post docs, and oversaw PSI’s involvement with a consortium of four other institutions, led by the Western Kentucky University, to refurbish the old 50-inch telescope on Kitt Peak for remote control and robotic operation. Part of our support for this program came from The Planetary Society founded some years earlier in Pasadena by Carl Sagan and former JPL director Bruce Murray.

As Mars work geared up for the Mars Global Surveyor mission in 1997-2002, we attempted to attract new, younger staff by offering opportunities for recent PhD’s to develop proposals through PSI, to be submitted to NASA. The first case was Dr. Jennifer Grier who wrote a proposal with Hartmann and was funded as PI for a three year project to study a volcanic province of Mars. Grier is now pursuing this work off site from a base in Boston, where her husband took a position with MIT.

Dr. Cathy Weitz, at NASA HQ, affiliated with PSI in 2000 from the Washington, DC area. Next was a successful proposal from Dr. Melissa Lane to study unexpected mineral deposits on Mars, and she pursues this from Tempe, AZ. Then came a funded proposal with Dr. Elizabeth Turtle as PI in a study of ice flow processes on Mars; she shares her position between PSI and the University of Arizona.

These developments not only added a significant number of lower overhead operations off site, but also created, in part, a 21st century virtual institute.

In a similar direction, we were recently joined by Dr. Tom McCord and his group in the Seattle area, with PSI providing a corporate framework and collegial assistance to support his work on NASA and ESA (European Space Agency) missions: Galileo, Cassini, Mars Express, Rosetta and the new Discovery mission, Dawn.

Dramatic developments occurred in 2001-2002 in the Tucson office, too, as numerous new staff appeared. Dr. Elizabeth Pierazzo joined PSI from the University of Arizona to work on cratering and impact theory. Dr. David Crown joined PSI from the University of Pittsburgh to work on Martian geological processes. And Dr. Steve Kortenkamp joined PSI from the University of Maryland to work on PSI’s continuing interest in the origin of planetary systems by modeling of accretion processes. These additions to the staff led to growth strains as well as opportunities, and will result in a move to a new building.

**DIRECTOR’S NOTE**

At last: A home for the PSI Tucson office

Our efforts to find a new home for PSI-Tucson are close to fruition. After a long search and looking carefully at a number of properties, we have converged on a condominium-office building that fits our needs. This is a new building (approximately four years old), located about two miles north of the University of Arizona. We have negotiated a five year lease with an option to purchase in the first year, which we fully intend to pursue. This facility will adequately house the present staff and allow for additional growth of perhaps two to three scientists in future years. While it does not have the historic charm of the YWCA building that we looked at (that option fell through when all of our potential partners decided that they were not interested after all), the current building will not require a great deal of maintenance nor involve us in property management activities.

This purchase is a big step for PSI — the first debt that the Institute has taken on — but one that I feel is right for our future. Now we have to get those proposals funded. But, when we hold our mortgage-burning party in five years and the building is free and clear, we will know that it was the right decision. Plus, we will then have additional resources with which to build a better science institute.

Donald R. Davis
Director
RCT PROJECT NEARS COMPLETION
by Donald R. Davis

"First light" through the Robotically Controlled Telescope (RCT) that PSI co-owns (see the Winter 2000 newsletter) occurred in April, 2003 when members of the RCT consortium (Western Kentucky University, South Carolina State University, Villanova University and PSI) spent three nights putting the telescope, CCD camera and computer software through their paces. As is typical of first tests, numerous small problems were identified that the contractor on the project, EOS Technologies, will remedy before turning the telescope over to us for science operations, expected to commence in the Fall, 2003.

PSI, in association with Western Kentucky University, plans to carry out a search for extra-solar planets (ESP) by looking for the reduction in light from the parent star as the planet passes in front of the star as seen from the Earth. Given the small fraction of stars that apparently have planets and the small fraction of those whose orbits allow the planet to pass between the Earth and star, the project will have to look at thousands of stars in order to discover an ESP. But if you don’t look, you don’t find. Wish us luck for an early discovery!

ASTEROIDS FOR ESQUERDO & HOWELL by Carol Neese

Last month two PSI-ers were honored by having asteroids named after them. Steve Howell, for whom asteroid 15091 Howell was named, joined PSI in 1988 and led the PSI Astrophysics group from 1997 until 2002. He's now working at the National Optical Astronomy Observatories in Tucson. His asteroid was discovered by the Spacewatch Group at the University of Arizona, and the name was suggested by Don Davis. Gil Esquerdo, now sharing his name with asteroid 14026 Esquerdo, has worked at PSI on observational projects since 1995, with a year away on an asteroid spectro-photometry project at the University of Western Ontario. Gil's asteroid was also discovered by the Spacewatch Group and the name was suggested by Peter Jedicke. We can't show them with their asteroids but the accompanying pictures show them with their celebratory cakes. Under each picture is the official citation as printed in the M.P.C. (Minor Planet Circular).

(14026) Esquerdo = 1994 ST
Gil Esquerdo (b.1976), a former research assistant at the Planetary Science Institute in Tucson, was appointed in 2002 research assistant for the Near-Earth-Asteroid Physical Study project at the University of Western Ontario.

(15091) Howell = 1999 CM136
Noted student of cataclysmic variable stars, master of high-precision photometry, and explorer of TOADs (tremendous outburst amplitude dwarf novae), Steve B. Howell (1955 - ) is equally at home developing theoretical stellar models, working with the latest instrumentation, or mentoring students in esoteric astrophysics.
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The California Division’s Science Education Program is requesting your aid in purchasing a hand operated vacuum pump. To send your tax-deductible donations for the California Science Education Field Trip Program, please see the new Laguna Niguel address (below left). Thank you!