PLANETARY SCIENCE INSTITUTE

NEWSLETTER

FALL 2011 Vol. 12, No. 3

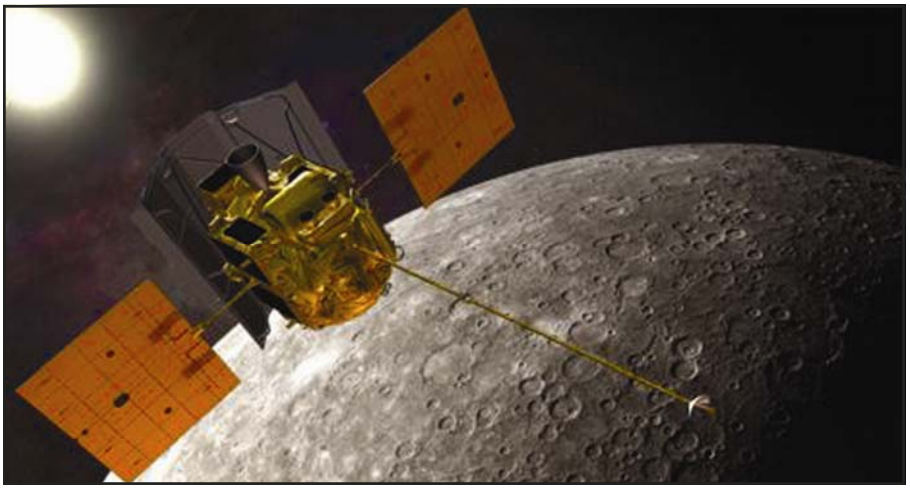
Est. 1972 www.psi.edu

MESSENGER Scrutinizes Mercury

by Alan Fischer and Chris Holmberg

MESSENGER offers a new look at Mercury, the planet closest to the sun, with some surprises about its magnetic field.

In August 2004, NASA's MESSENGER mission — **ME**rcury **S**urface, **S**pace **En**vironment, **GE**ochemistry and **R**anging — was launched on a seven-year-long journey to Mercury. And, on March 18, 2011, it made its historic entry into orbit around the planet.



This is an artist's depiction of the MESSENGER spacecraft in orbit around the planet Mercury. Launched from Cape Canaveral on August 3, 2004, it returned to Earth for a gravity boost on August 2, 2005, then flew past Venus twice in October 2006 and June 2007. The spacecraft used the tug of Venus' gravity to resize and rotate its trajectory closer to Mercury's orbit. MESSENGER will be orbiting Mercury and collecting data until March 2012.

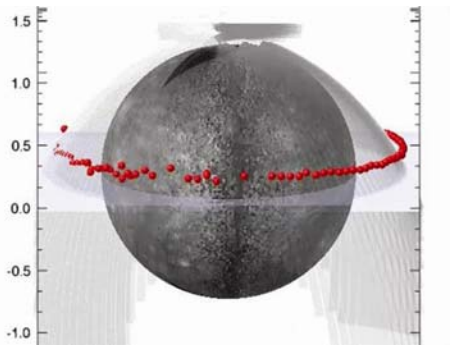
Six PSI scientists, with differing areas of expertise, are on the MESSENGER mission: Deborah Domingue Lorin, William Feldman, Robert Gaskell, Elizabeth Jensen, Catherine Johnson and Faith Vilas.

Onboard the spacecraft are seven scientific instruments that are providing researchers with new data on the planet's geochemistry, geophysics, geologic history, atmosphere, and magnetic field environment. With data from one of these instruments—the magnetometer—Catherine Johnson, PSI Senior Scientist and MESSENGER mission participating scientist, is investigating Mercury's magnetic field and finding very interesting results. By characterizing the magnetic field, MESSENGER will help answer the question of why the inner planets differ in their magnetic histories.

Some scientific views based on earlier Mercury flyby missions are being proven incorrect; one is about Mercury's magnetic field. "Scientists thought Mercury's magnetic field was a miniature version of Earth's," said Sean Solomon of the Carnegie Institution of Washington, the mission's principal investigator. "What we're seeing is, it is not."

In the 1970s, scientists learned from NASA's Mariner 10 that Mercury had a significant magnetic field, as does Earth. (Venus and Mars do not.) Now, in 2011, the magnetometer instrument finds that the source of this magnetic field is not dead center in Mercury's interior but 480 km (300 miles) north of the planet's geographical equator. This is a surprising discovery, and it remains to be seen what this means about how Mercury's field is generated. One consequence is that the magnetic field protecting

(Continued next page)



The red dotted line shows the location of Mercury's magnetic equator, as recently determined by data from MESSENGER's spacecraft. The magnetic equator is far north of the planet's geographic equator (the horizontal light gray line at 0° latitude), located about 300 miles north of the planet's center. *Both images credited to: NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington.*

Inside this issue:

VISUALIZING VESTA	2
2011 PSI RETREAT	3-5
JAPANESE PUPILS COUNT CRATERS, WIN PRIZE	6
DIRECTOR'S NOTE	6
AWARDS AND NOTICES	7

Arizona, California, District of Columbia, Indiana, Kentucky, Maryland, Maine, New Mexico, Nevada, South Carolina, Texas, Utah, Virginia, Vermont, Washington, Wisconsin, West Virginia

MESSENGER Scrutinizes Mercury *(continued)*

the southern hemisphere is weaker than that protecting the northern hemisphere, leaving the southern hemisphere more vulnerable to being bombarded by charged particles from the sun.

"This is an exciting result that suggests something fundamentally different about what processes play a key role in the generation of Mercury's magnetic field compared with those important to Earth's magnetic field," said Johnson. "The result may have important implications for the internal dynamics of the planet and how the planet cools today."

Johnson is also studying data from MESSENGER's Mercury Laser Altimeter, which is systematically mapping the topography of Mercury's northern hemisphere. Major features on the planet – previously seen only at comparatively low resolution – are now in sharp focus. After more than two million laser-ranging observations, the planet's large-scale shape and profiles of geological features are being revealed in high detail. We now know that the north polar region of Mercury is a broad area of low elevations.

"We have in our solar system four experiments in how four Earth-like planets evolve once they form under slightly different conditions," said Solomon, referring to Mercury, Venus, Earth and Mars, the four rocky planets of the inner solar system.

"What we're learning is each of those experiments had an extraordinarily different outcome," he said. "And one of those experiments we live on. So it behooves us, in a very general way, to understand how Earth-like planets form and evolve and operate."

Other instruments on MESSENGER are producing interesting results as well. Measurements of the chemical composition of Mercury's surface are providing important clues to the origin of the planet and its geological history. Maps of the planet's topography and magnetic field are revealing new insights into Mercury's interior dynamical processes. And scientists now know that bursts of energetic particles in Mercury's magnetosphere are a continuing product of the interaction of Mercury's magnetic field with solar wind.

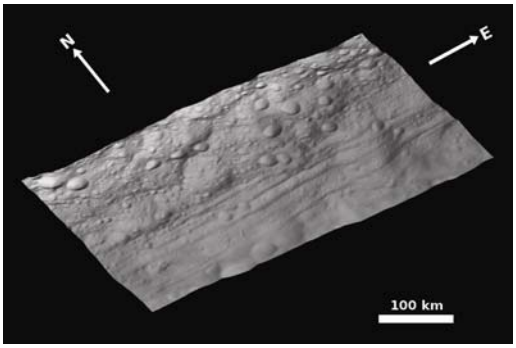
Look for future articles about Mercury MESSENGER findings in the PSI Newsletter and on the PSI website.

A first series of papers using orbital data from MESSENGER was published in the September 30th issue of Science magazine. For up-to-date news on the MESSENGER mission see http://messenger.jhuapl.edu.

Visualizing Vesta *by David O'Brien*

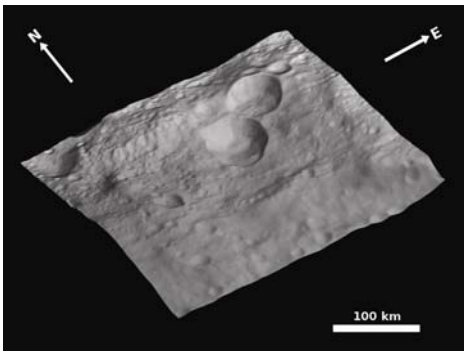
With spacecraft observations, we can't always pick the perfect vantage point or place the sun exactly where we'd like it to be. But by using a computer graphics technique called raytracing, we can take spacecraft data and generate a new view of any location and with any lighting conditions.

For NASA's Dawn mission, which is currently in orbit around the asteroid Vesta, I've been using raytracing software called POV-Ray, together with photographs taken by Dawn, to better visualize the asteroid. To aid in the identification and mapping of geologic features, I have produced relief images of the topography, created animations of Vesta as it rotates, and generated simulated flyovers of its surface.

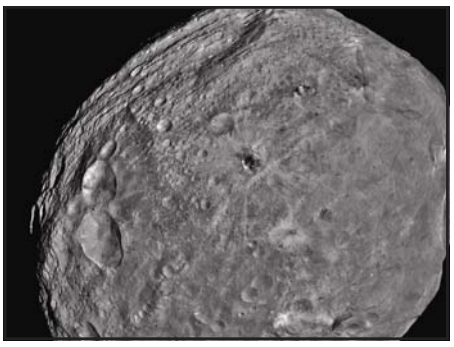


The images at left and top right show examples of how this software can be used to visualize the imaging and shape data together. They were made by combining image mosaics of Vesta's surface, produced by the German Aerospace Center (DLR), with a shape model of Vesta generated by PSI Senior Scientist Robert Gaskell.

The image at left is centered on the equator, and shows a relatively smooth surface with prominent east-west grooves transitioning to a more heavily-cratered surface in the north.



The image at right shows a group of three prominent craters referred to as "The Snowman," as well as a mysterious dark spot towards the left of the image. The elevations are exaggerated by a factor of approximately two in order to better highlight Vesta's surface features.



This photograph, taken 3,200 miles from Vesta on July 24, 2011, shows nearly a full hemisphere of the asteroid's surface. "The Snowman" feature, at left, is one area that Dave O'Brien has created models of (see above) using Dawn's framing camera photos and raytracing software.

The NASA Dawn mission will study Vesta for a year before departing for its second target, the dwarf planet Ceres, arriving in 2015. PSI is deeply involved in Dawn, with 12 scientists on the mission, and operates the Gamma Ray and Neutron Detector (GRaND), the instrument that will measure the elemental abundances of Vesta's surface and constrain its mineralogical composition. For more information about the Dawn mission, go to http://www.nasa.gov/dawn . *Vesta images: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA*

PLANETARY SCIENCE INSTITUTE
NEWSLETTER
Fall 2011 Vol. 12, No. 3 ***Published Quarterly***

Chris Holmberg, ***Editor***
Alan Fischer, ***Contributing Science Writer/Photographer***
Amy Hartmann-Gordon, ***Friends of PSI Update***

Special thanks to Gil Esquerdo, Emily Joseph, Carol Neese and Elaine Owens

Photo: Jesse Stone

PSI Retreat 2011

PSI members at the retreat, front row (l-r): Jesse Stone, Mark V. Sykes, Kathi Gardner, Deborah Domingue Lorin, Joe Michalski, Karly Pitman, Tom Prettyman, Elizabeth Jensen, Eldar Noe Dobrea, Candace Kohl, Chris Holmberg. Second row: Kimberly Kuhlman, Elaine Owens, Susan Benecchi, Kristin Lawrence, Lijie Han, Cathy Weitz, Dan Berman, Beatrice Mueller, Rose Early. Third row: Kelly Yoder, Catherine Johnson, Rebecca Ghent, Luke Sollitt, Susanne Douglas, William Feldman, Carol Neese. Fourth row: Sanlyn Buxner, Candy Hansen, Rebecca Williams, Tommy Grav, Alice Baldridge, Joe Spitale, Julie Rathbun, Thea Cañizo. Fifth row: Robert Reedy, Asmin Pathare, Jeff Morgenthaler. Sixth row: Bruce Barnett, Melissa Lane, David Crown, David Acklam, Jade Carter-Bond, William Hartmann, Emily Joseph, Amy Trueba Knudson. Seventh row: Andy Nelson (guest), Frank Chuang, Michael Gibbs, Mark Bishop, Brent Garry, Ross Irwin, Michael Wendell, Henry Throop, Gavin Nelson, Stu Weidenschilling, David O'Brien, Dave Vaniman, Michelle Greer. Eighth row: Ed Tedesco, Alan Fischer, Jim McElwaine, Larry Lebofsky, Tim Hunter, Marc Fries, Mary Chapman, Kitty and Marvin Killgore (guests). Back row: Alexis Palmero Rodriguez, Pasquale Tricarico, Eric Palmer, and Al Anzaldua.

Photo: Henry Throop

PSI Board Chair Tim Hunter gave Don Davis (in green) a plaque that recognized his leadership of the Institute as co-founder and Director for over 30 years, his 15 years on the PSI Board of Trustees, and his many contributions to planetary science including advancing our knowledge of asteroids and the origin of the moon. Thank you, Don!

In August, local PSI employees and off-site scientists from around the globe assembled at the historic Westward Look Resort, in the mountain foothills near Tucson, for the seventh annual retreat.

Beautiful desert surroundings were the backdrop for the meeting where members spent two days at scheduled science talks, small group discussions, poster presentations, and shared meals. This year, 79 people attended the retreat from 14 U.S. states, Australia, Canada, Japan, and the United Kingdom.

PSI staff and their guests filled Janos restaurant for the retreat banquet and relished the superb southwestern cuisine. Afterwards, tributes were made to Don Davis and Kelly Yoder in honor of their many years of service at PSI. Visit our website for the complete retreat program: www.psi.edu/retreat/2011

More retreat photos on pages 4-5

Photo: Alan Fischer

Kelly Yoder received an award from Mark Sykes commemorating her 15 years with the Institute as our amazing Sponsored Projects Manager, efficiently administering 173 grants and contracts this year alone. Bravo, Kelly!

PSI 2011 Retreat Photo Gallery

Director Mark Sykes welcomed everyone to PSI's seventh retreat .

PSI Trustees at the retreat: l-r, Secretary Michael Gibbs, Chair Tim Hunter, Vice Chair Candace Kohl and Trustee Emeritus John Mason.

Liz Jensen (TX) presented her research on measuring the "invisible" magnetic field in the solar atmosphere.

Photo: Henry Throop

Tommy Grav came from Maryland for his first PSI retreat.

Dave Vaniman described Mars Science Lab's Curiosity rover's upcoming exploration of mineralogy at Gale Crater on Mars.

Rebecca Williams (WI) talked about her fieldwork this year in Chile and S. Australia.

L-r, Kristen Lawrence (CA), Rebecca Ghent (ON), and Catherine Johnson (BC) at lunch.

Eric Palmer described the Mercator project's goal to provide navigation for future NASA missions to Mars and the moon.

Rebecca Ghent, from Toronto, detailed her investigations of regolith cover on ejecta rocks.

Joe Spitale's presentation was on the detection of free unstable modes and massive bodies in Saturn's outer B ring.

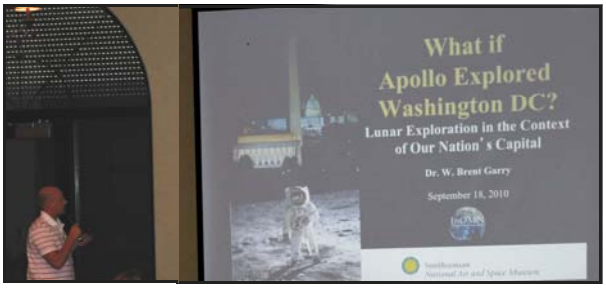
Luke Sollitt (SC) described the Atsa Suborbital Observatory that PSI and XCOR Aerospace have agreed to develop. PSI's Mark Sykes and Faith Vilas are two of the crew members who will operate this observatory during flight.

Catherine Johnson, from Vancouver, BC, reported on MESSENGER's findings about Mercury's magnetic field. Six PSI scientists are on the MESSENGER team.

A lot of interest is generated by the first images received from the Dawn mission's look at the asteroid Vesta. PSI has 12 scientists on the Dawn mission.

Kristen Lawrence explains her poster on interactions between the early Martian dynamo, surface water, atmosphere, and solar wind to Tim Hunter and Al Anzaldua.

L-r, Jim McElwaine (UK) is admiring meterorites with the collector Marvin Killgore, who owns these and many more. Some retreat goers took a field trip to the Southwest Meteorite Lab.



To illustrate where and how far the Apollo missions traveled at each landing site on the moon, Brent Garry (DC) compared where the Apollo astronauts would have explored if they had landed in DC. The first three Apollo landings (Apollo 11,12,14) would not have left the National Mall, whereas the final three missions (Apollo 15,16,17) would have crossed the Potomac River into Virginia.

Tommy Grav (MD) presented his research on the Jupiter Trojans as seen from the Wide-field Infrared Survey Explorer (WISE).

Frank Chuang (at left) from Chandler, AZ, talked about PSI's software licenses and institutional field equipment at the meeting.

Gavin Nelson, PSI's Infrastructure System Administrator, with off-site scientist Candy Hansen (UT), for an on-site tutorial during the retreat.

The Retreat Banquet at Janos

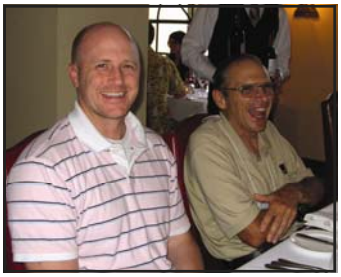
At the banquet: Jeff Morgenthaler (ME) and Ed Tedesco (NM).

Some of our California scientists at the banquet: l-r, in front, Karly Pitman, and Julie Rathbun; behind them are Eldar Noe Dobrea and Susanne Douglas.

Board Chair Tim Hunter and wife Carol Hunter.

Cheers! L-r, Alice Baldridge (CA), Cathy Weitz (DC), Melissa Lane (PA) and Amy Trueba Knudson (WA).

PSI retreat attendees filled Janos restaurant: from left, Liz Jensen (TX), Dave Vaniman (NM) and Henry Throop (DC).



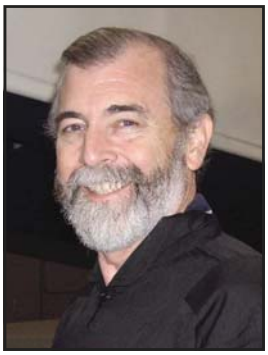
Enjoying the banquet: l-r, Brent Garry (DC) and Bob Reedy (NM).

Trustee Michael Gibbs (MD), Bruce Barnett, Tammi Palmer and Marilyn Guengerich.

Facing the camera: l-r, Trustee Pat Simmons and wife Sandy Simmons, Ewen Whitaker and Trustee Ben Smith.

**Unless otherwise noted, all photographs were taken by Alan Fischer and Chris Holmberg.*

Director's Note



PSI's Annual Retreat is always energizing! It is great to have so many of our scientists in from around the country and the world, interacting face to face, listening to presentations by our newest members, pushing forward existing collaborations and starting up new ones.

We heard about asteroid populations, volcanism on the moon, planet formation in star clusters, Mercury's odd magnetic field, lunar paleomagnetism, probing magnetic fields in the solar atmosphere, volatile atmospheres of satellites, microbes living in rock, and Saturn's rings.

We watched movies of avalanches in the Alps (what we do for science...), how to navigate on the moon from topography, construction of the Atsa Armrest Camera by students at The Citadel (with whom we did centrifuge training a few months ago), and plans for the study of Gale Crater by Curiosity (NASA Mars Science Lab rover) that launches for Mars this November.

This year we experimented with having posters. These proved very popular and useful for breakout discussions throughout the meeting. New additions kept popping up. We'll undoubtedly have more next year.

Our traditional banquet was also a great success (and delicious as usual, thanks to Janos!). A highlight of the evening was our Sponsored Projects Manager, Kelly Yoder, being surprised and stunned at being recognized for her 15 years of service at PSI. It has been a real pleasure, these past several years, to recognize the long tenure of so many of our staff and the great work they do.

This retreat was also marked by a PSiPad exchange. Since we only get together once a year, we always need to be working on improving our communications infrastructure to increase and promote interaction within our distributed Institute. The advent of the iPad 2 with a camera and capability for Skype and FaceTime was irresistible. I expect that we will get to the point, ultimately, where easy video communication is the norm.

Now we just need to get going on those flying cars!

Mark V. Sykes
October 2011

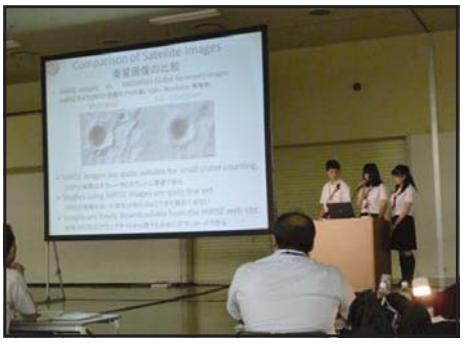
Japanese School Adapts PSI Crater Count Dating System, Wins Prize *by William K. Hartmann*

Japanese high school students in Osaka use a measuring scale to record diameters of craters on Mars.

In August, 2010, I received an email from Yoshio Okamoto, a geosciences teacher at Tonnoji High School, affiliated with Osaka Kyoiku University, in Osaka, Japan. He was interested in using the crater chronometry system developed and used at PSI since the 1970s to estimate ages of planetary surfaces. The idea is simple: the more impact craters, the older the surface. Like many simple ideas in science, the implementation has been complex. We calibrated our system by using dates from rocks collected at Apollo moon landing sites, then translated the whole system to Mars. Starting in 2006, a strong confirmation of the system came, when cameras on Mars Global Surveyor and more recently Mars Reconnaissance Orbiter detected craters forming on Mars at a rate very close to our predicted rate.

Okamoto stayed in touch, sending sample data and questions from the Japanese students and, as he noted, the system is ideal for classroom use. Teachers anywhere in the world can download scaled photographs of Martian geologic formations from many websites and distribute them to students. Students can measure diameters of craters in millimeters and convert to meters or kilometers on Mars. By measuring the area of the photos, they can derive the number of craters per square km in various diameters. Using data from our PSI web site (www.psi.edu/research/isochrons/chron04a.html), teachers and students can plot their data on our "isochron diagram" (bottom of page 2 on PSI webpage) of the number of craters per square km versus crater diameter. Their results can then be compared to our "isochron" curves that show the predicted crater densities for various ages, such as 1 million years (My) or 1 billion years (Gy) and the student can read off the approximate age. The project is ideal not only for teaching simple geometric arithmetic, but also principles of statistics (the more craters that are counted, the less the scatter in the diagram), astronomy (the craters are caused by impacts of asteroids scattered through the solar system), and geology (younger geologic formations, such as new lava flows, are superimposed on older surfaces, such as ancient river beds).

I received word in July that the students were off to present their results at the international "Super Science High School" conference and competition among Japanese and Asian science students, held in Kobe, Japan. And then on August 21, I received an excited email from Okamoto that the students had won the Japanese Science and Technology Master prize—Silver medal—in the competition. As the students said, they have apparently taken crater counting to a higher level than any other high school in the world!



The Japanese students presenting their prize-winning crater chronometry results at the international "Super Summer High School" competition, August 11-12, 2011, in Kobe Japan.

It's exciting to see our work move from esoteric scientific journals into distant classrooms, and we hope for additional interest from more teachers. We stand by to advise and assist.

PSI Postdoctoral Research Scientist Jade Bond and Jason Carter were married on Feb. 26, 2011, at St. Ann's Chapel, in Tucson AZ.

The newlyweds have recently moved back to Jade's home country, Australia.

Best wishes, Jade and Jason!

On August 10, Ruby Michelle was born to first-time parents Dana and Michael Wendell. (He is a PSI Software Developer). Ruby weighed 7 lb. 12 oz., and measured 18.5 inches.

Congratulations Dana and Michael, she's beautiful. And welcome Ruby Michelle!

Asteroid Named for Betty Pierazzo

The asteroid originally designated 1992 AS2, discovered in January 2002 by Spacewatch at Kitt Peak, is now named for our recently deceased colleague and friend Betty Pierazzo and will be known as (15296) Pierazzo.

Elisabetta (Betty) Pierazzo (1963-2011) was an expert in impact modeling, in particular of the Chicxulub impact, as well as in modeling the astrobiological and environmental effects of impacts on Earth and Mars. She was an enthusiastic communicator of science to the general public and a dedicated teacher of planetary science for students and educators.

See the Summer 2011 PSI Newsletter for the full obituary.

Sad news: Robert J. Parks, PSI Trustee from 1998 to 2004, died on June 3, 2011, of complications following injuries suffered from a fall in his home. He is survived by his wife, Hanne, three sons, and two grandsons. Bob and Hanne lived on Balboa Island.

Bob spent many years at JPL, retiring in 1987 as Deputy Director. In his long career at JPL, Bob oversaw the development and operation of numerous planetary spacecraft, including the Mariner, Ranger, Surveyor, and Viking series. When JPL was a U.S. Army installation, Bob worked on the Corporal and Sergeant missiles.

He served in the Army in Europe during World War II. He was a graduate of Caltech, and was a classmate of Gene Shoemaker, Stan Holditch, and John Mason, all former PSI Trustees. Bob was elected to the National Academy of Engineering in 1973. He will be missed by all who knew him.

Trustee Michael Gibbs Receives Award

LAUREL, MD (August 24, 2011) – PSI Board member Dr. Michael G. Gibbs, vice president for advancement of Capitol College, is a recipient of *The Daily Record's* 2011 "VIP List of very important professionals successful by 40" award. The award is given to Maryland professionals under the age of 40 on the basis of professional accomplishment, civic involvement and impact of achievement.

Bravo, Michael!

Kortenkamp Receives Teaching Award

Steve Kortenkamp (center) and his wife Jane Morrison with UA College of Science Dean Joaquin Ruiz at the award presentation.

PSI Senior Scientist Steve Kortenkamp was selected by the faculty of the College of Science at the University of Arizona to receive the 2011 "Innovations in Teaching" award. Kortenkamp has been an adjunct instructor at UA since 2007, teaching a planetary science course each fall for astronomy and planetary science minors as well as non-science majors. He was selected for the award on the basis of his stunning custom-made computer visualizations, innovative examination techniques, and utilization of hand-held RF devices for student participation in large lecture halls. During the award presentation UA's Dean Ruiz also highlighted Kortenkamp's series of childrens' science books and the distribution of his visualizations to K-12 science teachers through PSI's Project WISER E/PO program.

Hooray, Steve!

Notice to PSI Newsletter readers:

Beginning with the Winter 2011 issue, the PSI Newsletter will be sent *only* to ***Friends of PSI*****!**

To continue receiving news about PSI and be a part of our success, become a ***Friend of PSI***.

Yearly membership is only $40.00!

Join us at **www.psi.edu/Friend**

Planetary Science Institute

CEO and Director
Mark V. Sykes, PhD, JD

Assistant Director
David A. Crown, PhD

Chief Financial Officer
Bruce Barnett, CPA

Senior Scientists
Natalia Artemieva, PhD
Matt Balme, PhD
Mary C. Bourke, PhD
Mary G. Chapman, PhD
Donald R. Davis, PhD
Deborah Domingue Lorin, PhD
Susanne Douglas, PhD
Jack Drummond, PhD
William C. Feldman, PhD
Robert W. Gaskell, PhD
Cyrena A. Goodrich, PhD
Jennifer A. Grier, PhD
Lijie Han, PhD
Candice J. Hansen, PhD
William K. Hartmann, PhD
Keith Holsapple, PhD
Anton Ivanov, PhD
Sumita Jayaraman, PhD
Catherine Johnson, PhD
Stephen Kortenkamp, PhD
Kimberly R. Kuhlman, PhD
Melissa D. Lane, PhD
James N. McElwaine, PhD
Jeffrey P. Morgenthaler, PhD
Beatrice E. A. Mueller, PhD
Thomas H. Prettyman, PhD
Julie Rathbun, PhD
Robert C. Reedy, PhD
Nalin H. Samarasinha, PhD
Joseph N. Spitale, PhD
Matthew Staid, PhD
Edward F. Tedesco, PhD
Henry Throop, PhD
David Vaniman, PhD
Faith Vilas, PhD
Stuart J. Weidenschilling, PhD
Catherine Weitz, PhD
Rebecca Williams, PhD
Charles A. Wood, PhD
R. Aileen Yingst, PhD

Research Scientists
Sarah Andre, PhD
Alice Baldridge, PhD
Daniel C. Berman, MS
Leslie F. Bleamaster, III, PhD
Marc D. Fries, PhD
Brent Garry, PhD
Rebecca Ghent, PhD
Tommy Grav, PhD
Rossman P. Irwin III, PhD
Scott C. Mest, PhD
Joseph Michalski, PhD
Eldar Z. Noe Dobrea, PhD
David P. O'Brien, PhD
Asmin Pathare, PhD
Alexis Palmero Rodriguez, PhD
Karly M. Pitman, PhD
Nicholas J. Tosca, PhD
Pasquale Tricarico, PhD

Associate Research Scientists
Susan Benecchi, PhD
Mark Bishop, PhD
Elizabeth Jensen, PhD
Amy Trueba Knudson, PhD
Stephen Metzger, PhD
Nic Richmond, PhD
Luke Sollitt, PhD

Postdoctoral Research Scientists
Jade Carter-Bond, PhD
Kristin P. Lawrence, PhD
Eric E. Palmer, PhD
Naoyuki Yamashita, PhD

Senior Education Specialists
Steven Croft, PhD
Larry A. Lebofsky, PhD

Education Specialist
Sanlyn Buxner, PhD

Education Support Specialist
Thea L. Cañizo, EdD

Science Support Staff
Frank C. Chuang, MS
Research Associate/Software Specialist
Rose Early
Lead Software Developer
Gilbert A. Esquerdo
Research Assistant
Emily C. S. Joseph
Research Assistant
Carol Neese, PhD
Senior Research Associate
Jesse Stone
Software Developer
Michael Wendell
Software Developer

Affiliate Senior Scientists
James N. Head, PhD
Hideaki Hirdy Miyamoto, PhD

Affiliate Scientists
Matthew A. Chamberlain, PhD
Yan Jianguo, PhD

Corporate Staff
Alan D. Fischer
Public Information Officer
Kathleen Gardner, MA
Information Technology Technician
Michelle Greer
Accountant
Amy G. Hartmann-Gordon, MBA
Development Officer
Chris Holmberg
Newsletter Editor/Assistant Administrator
Gavin Nelson
Infrastructure System Administrator
Elaine Owens
Office Manager
Linda Rueger
Human Resources Specialist
Kelly Yoder
Sponsored Projects Manager
Terrill Yuhas
Information Technology Manager

Board of Trustees
Tim Hunter, MD, Chair
University of Arizona Medical Center
Candace Kohl, PhD, Vice Chair
Independent Consultant
Michael G. Gibbs, EdD, Secretary
Capitol College
Brent Archinal, PhD
Geodesist
William K. Hartmann, PhD
Planetary Science Institute
Pat H. Simmons
Alliance Bank
Benjamin Smith, JD
Attorney at Law
Mark V. Sykes, PhD, JD
Planetary Science Institute

Trustees Emeritus
Donald R. Davis, PhD
Planetary Science Institute
John L. Mason, PhD
Applied Research & Technology

PLANETARY SCIENCE INSTITUTE
Newsletter Published Quarterly

1700 E. Fort Lowell Rd., Suite 106
Tucson, AZ 85719-2395
Phone: 520/622-6300
Fax: 520/622-8060
www.psi.edu

Change Service Requested

NON-PROFIT ORG.
U.S. POSTAGE
PAID
TUCSON AZ
PERMIT NO 356