



JPL should be well placed to make major contributions to NASA's revitalized space technology program, the agency's new chief technologist told JPLers in a Lab visit Aug. 11.

Bobby Braun, an engineer with more than 20 years' experience performing design and analysis of planetary exploration systems for NASA, including being part of development and review teams for numerous Mars missions, informed the crowd in the Flight Projects Center auditorium that President Obama's fiscal year 2011 budget request includes \$572 million next year for space technology, with increases over the next five years to total about \$5 billion.

The future is now. Braun noted that NASA this year has started or accelerated eight high-priority technology efforts, each of which received approval from two House and two Senate committees.

"JPL will be involved in at least two of those—the Supersonic Inflatable Aerodynamic Decelerator, and in optical communications," Braun said, adding that JPL is also heavily involved in the agency's technology roadmap activity this year. "We're going to use the roadmap to engage with the National Academy—much

like the Science Mission Directorate uses the decadal survey process—as guiding documents in our selection processes."

The funding represents a significant increase for technology development expenditures in recent years, noted Braun, who started his position in February after a teaching stint at Georgia Tech. "I came back to NASA because I was excited about the opportunity to rebuild the research and technology competency," he said. "It's something that's been down for the better part of a decade. Research and technology needs to be funded at a level where there's a critical mass, and [where] there's a foundational effort that can feed our future missions in aeronautics, science and exploration."

Braun noted significant differences in the new program compared to NASA's past technology efforts. First, the program is going to be largely managed in a competitive model. Solicitations for 10 separate space technology studies will be released in October.

The second change involves the way NASA will approach risk. "We want to go after grand challenges; we don't want to go after technology for the next Earth science mission or next Mars mission," Braun said. "If you're going to be more long-term in your thinking, then it's probably also true that we need to take more risk in this element of NASA's overall portfolio. We

have to be able, as an agency, to have both more smaller and more agile teams that are taking risks and still maintain full system-engineering rigor on those larger flagship missions and human spaceflight missions that are so critical to our agency's future.

"So [to] those of you who are thinking of proposing to the space technology program, bring your best ideas and take risks. Don't bring me something that you're 100 percent sure you can do in six months, because then I would argue that it wouldn't be a grand enough challenge."

Braun opined that the public doesn't expect NASA to be perfect, so some element of risk is acceptable. "When I talk to the public about NASA, they expect us to be cutting-edge; a phrase like that is almost always the first thing I hear when I go to schools or when I'm on Capitol Hill," he said. "When people describe NASA, that's what they say. They don't say safe, they don't say conservative, they don't say perfect; they say cutting-edge. And I will argue the only way to be cutting-edge is to take some risks."

The third new aspect to the technology program is in its management, which Braun said would be done in a "projectized" manner, where peer reviews will be used to select projects—all of which will be of two to three years in duration.

"We're going to empower project managers; when they submit their plans, we're going to give them the resources

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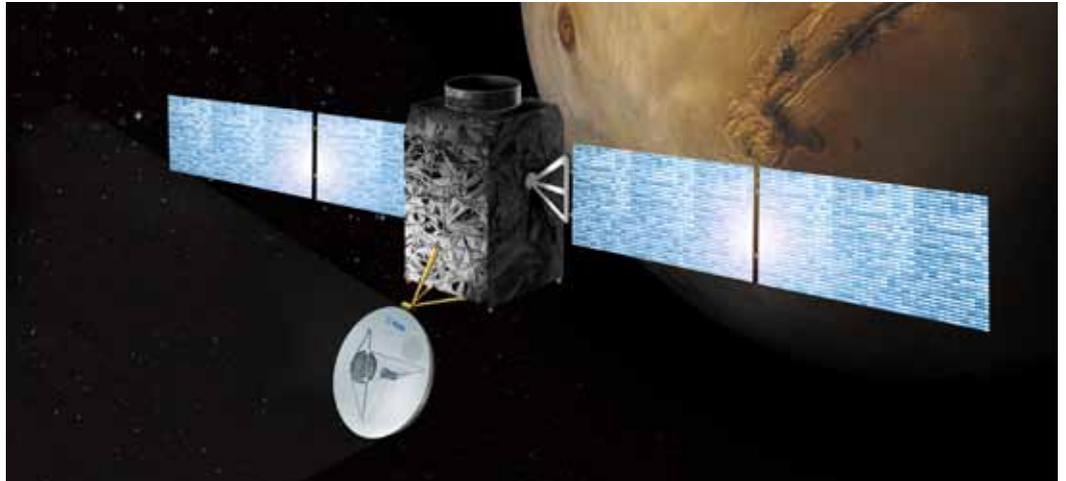
Ian Clark of the EDL Systems and Advanced Technologies Group is shown with a one-fifth-scale model of a candidate inflatable decelerator for the Supersonic Inflatable Aerodynamic Decelerator project.

Probing Mars' atmosphere for clues of life

2016 ExoMars Trace Gas Orbiter will carry instruments led by JPL and Caltech

By Mark Whalen

Caltech's Paul Wennberg, top, will lead the Mars Atmosphere Trace Molecule Occultation Spectrometer; JPL's Tim Schofield will lead the ExoMars Climate Sounder investigation.



Two of the five instruments onboard the ExoMars Trace Gas Orbiter, scheduled to launch in 2016, will be led by JPL and Caltech principal investigators.

The mission, the first orbiter planned under a new NASA/European Space Agency pact, will focus on trace gases, including methane, which could be potentially geochemical or biological in origin and be indicators for the existence of life on Mars.

The Mars Atmosphere Trace Molecule Occultation Spectrometer, or Matmos, will be led by principal investigator Paul Wennberg of Caltech.

Matmos is designed to measure a broad suite of molecules—essentially all gases that absorb infrared light—with exquisite sensitivity. “This includes all major and nearly all minor constituents of the Martian atmosphere,” Wennberg said. Matmos, for example, can detect methane at a few parts per trillion. “These measurements will provide important constraints on the exchange of gases between the surface and the atmosphere, and by inference, can help diagnose the size and location of any remaining biosphere in the near surface,” he said.

A collaboration between Caltech, JPL and the Canadian Space Agency, the instrument brings a new approach to Martian atmospheric science, Wennberg added. “Although the method and technology has been demonstrated on Earth by such instruments as JPL’s Atmospheric Trace Molecule Occultation Spectrometer, Canada’s Atmosphere Chemistry Experiment–Fourier Transform Spectrometer and JPL’s MkIV interferometer, it has never been used before in planetary science.”

Several key advances are to be implemented for Matmos, primarily in signal processing. “These new technologies are necessary to deal specifically with conditions unique to Mars,” he said, noting that the dusty environment places important constraints on how the signals are collected and processed. In addition, the limited telemetry requires significant onboard data compression.

Wennberg, who has built a number of instruments for NASA Earth science that have been deployed for

ground-based and aircraft-based investigations of atmospheric composition, considers Matmos to be “an ideal instrument” for exploration science. “Its broad spectral coverage, high signal-to-noise ratio, and high spectral resolution allow for discovery. In many ways, Matmos is to atmospheric composition what a camera is to orbital surface exploration—we don’t need to know in advance what we are looking for; the data will drive the investigation in directions that are a priori not known.”

Vicky Hipkin will lead the Canadian Space Agency’s contribution as Matmos co-principal investigator. Researchers from Canada, Belgium and the United Kingdom join JPL and Caltech researchers on the Matmos science team. Data analysis will be performed on campus with support from the Infrared Processing and Analysis Center. Team members from JPL include instrument manager Wayne Hartford, systems engineer Ian Harris and JPL scientists Mark Allen, Armin Kleinboehl, Jean-Francois Blavier (systems architect for the early Matmos testbed), Linda Brown (spectroscopy) and Geoffrey Toon (instrument scientist and retrieval lead). At Caltech, professors John Eiler and Yuk Yung will be involved with data analysis and interpretation.

The ExoMars Climate Sounder investigation on the orbiter, led by principal investigator Tim Schofield of JPL’s Earth and Planetary Atmospheres Group, will map daily, global, pole-to-pole profiles of temperature, dust, water and carbon-dioxide ices, and water vapor. These profiles will be assimilated into Mars general circulation models to generate global, interpolated fields of measured and derived parameters such as wind.

Schofield noted that the instrument will determine the global atmospheric state needed to understand the trace gas profile data from high-resolution spectrometers such as Matmos. He described ExoMars Climate Sounder as closely related to two other JPL-built instruments: Mars Climate Sounder onboard Mars Reconnaissance Orbiter, now approaching four years of atmospheric measure-

ments, and the Diviner radiometer experiment currently flying on Lunar Reconnaissance Orbiter. Schofield is deputy principal investigator for Mars Climate Sounder and a co-investigator on Diviner as well.

Schofield said by covering a wide range of local times of day on Mars, ExoMars Climate Sounder would extend high vertical-resolution measurements of the lower and middle atmospheres begun by Mars Climate Sounder. “The variable local-time coverage gives us the greatest chance of discovering new atmospheric phenomena not observed by recent solar-fixed missions such as MRO, Mars Global Surveyor and Odyssey,” Schofield said.

In addition, the instrument could support future Mars missions with measured climatology and near real-time density profile measurements for landing and aerocapture, Schofield said, noting that Mars Climate Sounder has already demonstrated this capability in supporting the Phoenix lander. As such, ExoMars Climate Sounder will support Mars surface missions beginning in 2018.

Team members from JPL include instrument manager Marc Foote and co-investigators David Kass, Daniel McCleese, Allen and Kleinboehl. There are five co-investigators each from the United Kingdom and France.

“The instrument will be built at JPL, with some major components such as actuators, optics and filters built elsewhere by contractors,” Schofield noted. “During the mission, the instrument will be run by a team on Lab; data will be queried, calibrated and converted into atmospheric profiles at JPL before being delivered to our U.S. and European co-investigators.”

Schofield, who has been working on Mars atmospheric science at JPL since 1984, served as deputy principal investigator on the Pressure Modulator Infrared Radiometer instrument that flew on two unsuccessful missions, the 1992 Mars Observer and the 1998 Mars Climate Orbiter. He was later science team lead on the atmospheric structure investigation/meteorology experiment on the 1997 Mars Pathfinder lander mission. ■

BRAUN *Continued from page 1*

to make it happen,” Braun said. “We’re not going to come back later and impose additional reviews and additional oversight. We’re not going to change the rules of the game in that project timeline.

“This projectized mode is very important because it provides accountability for the programs to Congress,” he added. “It provides a steady stream of products that we can point to as we defend the budget.”

Braun also stressed the importance of developing

partnerships in technology development activities—whether it’s teaming up with academia, industry or other branches of government. On the latter, he pointed to a partnership with the Defense Advanced Research Projects Agency to study launch capabilities, power-beam propulsion and in-orbit satellite servicing.

“We’ll be encouraging those partnerships where they make sense,” he said. “For example, for technology demonstration missions, which have the biggest per-project dollar value award—these are missions that would go to

space in a flight-like setting—we’re requiring that 25 percent of those awards come from outside the Office of the Chief Technologist. They could come from NASA mission directorates, from another government agency or from commercial industry.

“In Congress right now, in all four of the draft bills being considered, there is discussion about a national space technology plan. Congress has asked the Office of Science and Technology Policy to put together a coordinated plan for the next fiscal year.” ■

Celebrating the camera that saved Hubble

By Mark Whalen



Clockwise, from top left: David Gallagher, integration and test manager for the Wide Field and Planetary Camera 2; retired JPLer Norm Haynes; Wide Field and Planetary Camera 2 principal investigator John Trauger, right, shows the camera to, from left, Charles Elachi, Congressman Adam Schiff, his wife Eve and their children Alexa and Elijah, and NASA's Ed Weiler; Ed Krupp, director of the Griffith Observatory; former California governor Pete Wilson, actress June Lockhart, Ed Weiler, and Charles Elachi; Larry Simmons, former Wide Field and Planetary Camera 2 project manager.



JPLers and local dignitaries gathered Aug. 12 to celebrate the return to JPL of the camera that saved the Hubble Space Telescope, the Wide Field and Planetary Camera 2.

Currently on loan to JPL prior to moving to its new home at the Smithsonian National Air and Space Museum, the camera has engendered memories of the Hubble's troubles and frustrations that were turned to hope and, ultimately, science history.

The camera, on display within a carefully protected glass and wooden case in von Kármán Auditorium, was the centerpiece of a reception that included many of those who worked on the venerated mission.

Not long after Hubble launched in 1990 and returned its first images, scientists found that the main mirror on the planetary camera had been ground incorrectly and produced a tiny spherical aberration, compromising the telescope's capabilities. But through the intense efforts of the JPL development team, Wide Field and Planetary Camera 2 went on to achieve the great fame anticipated at Hubble's beginnings.

But before the triumph came the tribulations. Ed Weiler, head of NASA's Science Mission Directorate and former Hubble Space Telescope chief scientist, recalled the anguish he and others experienced when Hubble's problems became public.

"Many in the press called the mission a national disgrace, and we were trying to get out of that hole," he said. "We were trying to do the impossible."

But the JPL team was focused and relentless. "This sort of thing doesn't just happen," noted Wide Field Planetary and Camera 2 principal investigator John Trauger. "The technicians, engineers and scientists—everybody—had to get this right. Besides, I imagine [while] there's more than 1,000 ways things could go wrong, there was only one way things could go right—and that would be if everyone did their job."

Indeed they did, and as Weiler noted, some in the media later ended up terming the telescope the "miracle in space" mission, as Space Shuttle Endeavour's crew installed WFPC 2 into Hubble during the December 1993 servicing mission.

"And the miracle in space occurred," Weiler said. "It was like dream sequence, watching the spacewalks from the control room."

It wasn't long before redemption for the camera and for Hubble, as the camera proceeded to deliver some of the most breathtaking images ever to be returned from space. The grand "Pillars of Creation" within the Eagle Nebula struck a chord with Weiler.

"I was one of the first people on Earth to see this picture," Weiler recalled. "The first thing out of my mouth was, 'My god, this is going to be on the cover of Time magazine.' A few weeks later, it was peer-reviewed, a paper was written, and we had a press conference. This image appeared the next day on almost every front page on Earth.

"If there's one iconic picture of Hubble, this is it—a stellar nursery where young stars and planets are being born right today, the next generation of stars and planets."

Weiler said contributors to the mission should be proud of and realize the impact of their efforts.

"I've never worked with a better team," Weiler said. "As far as I'm concerned, the team that worked on fixing and saving the Hubble was probably the high point of my career; I'll never work on another team like that. It can't get that good again.

"This telescope has done more than make astronomers happy; it's brought science to everyday people, and most importantly, to our kids," Weiler added. "Because you can't open an astronomy textbook written in any language on Earth that isn't filled with WFPC 2 pictures."

U.S. Rep. Adam Schiff (D-Burbank) attended the reception with his wife, Eve, and children Alexa and Elijah. "I wanted to make sure we brought our kids today; we want our kids to be as excited about science as we are," the Congressman said. "They are, we hope, part of the generation that will one day set foot on Mars. We want them to be part of this experience and this celebration."

Wide Field and Planetary Camera 2 was returned to Earth in May 2009, the fifth and final space shuttle servicing mission to the Hubble Space Telescope. ■

News Briefs



Moustafa Chahine

Chahine honored by homeland

For his leadership in the theoretical modeling and space observation of Earth and planetary atmospheres, JPL Senior Research Scientist Moustafa Chahine has been named a full member of the Lebanese Academy of Sciences.

A native of Lebanon, Chahine is science team leader for the Atmospheric Infrared Sounder instrument on NASA's Aqua spacecraft, and previously served as JPL chief scientist. He headed the Lab's former Planetary Atmosphere Section, and established the Division of Earth and Space Science at JPL in 1978.

Chahine is a Fellow of the American Physical Society, the American Association for the Advancement of Science, the American Geophysical

Union, the American Meteorological Society and the British Meteorological Society. He is also a member of the U.S. National Academy of Engineering.

The honor from the Lebanese Academy of Sciences will be given in November in Beirut.

Heie pens book on leadership

Former JPL Business Operations Director John Heie is the author of the recently released book "Leading from the Heart: What Workers Say about Good Leaders."

Heie notes that while almost all leadership books are written from the perspective of the leader, this book is unique in that its story is told from



John Heie

the perspective of the workers. Heie covers 12 attributes that he believes

workers want, a critical one being that workers want an open invitation to speak and be heard.

Heie was director of business operations at JPL for almost 10 years, retiring in 1995. He has since taught leadership classes at three universities and consulted with a large non-profit organization in the area of strategic planning. The book includes many specific examples from his experience at JPL, as he attempted to establish a culture in which the 12 attributes were being realized.

The book is available on retail websites, through the publisher's website at www.iuniverse.com, and at the JPL Store. The soft cover sells for \$12.95, and an eBook sells for \$9.99, through the publisher. For more information, visit www.johnheie.com.

Passings

Retiree **Beverly Mendoza**, 74, died March 28.

Mendoza worked at JPL from 1971 to 2000. She is survived by her husband, Paul; children Paul and Stephanie; and stepdaughters Arlene, Nancy and Anna.

Services were held at Rose Hills in Whittier.

Retiree **Alex Stone**, 95, died June 8.

Stone worked at JPL as a software engineer and supervisor from 1970 until his retirement in 1990. He is survived by his wife, Susan, sons Victor and Peter, and grandsons Michael and Zachary.

Charles (Bill) Badgley, 87, retired manager of plant protection, died June 27.

A former FBI special agent, Badgley joined JPL in 1978 and retired in 1988. He is survived by his wife, Bertha, son Terry, daughter Janice, stepdaughter Doreen, eight grandchildren and six great-grandchildren.

Services were held July 8 at Mountain View Cemetery in Altadena.

Retiree **Norman Kimmel Sr.**, 88, died July 1.

Kimmel worked at the Lab from 1977 to 1987. He is survived by sons Norman II and Leonard and daughter Roberta Ann.

Services were held July 8 at Forest Lawn in Glendale.

Retiree **Clifford LaGreide**, 94, died July 2.

LaGreide joined JPL in 1952 and retired in 1978. He is survived by son Gary and daughter Carol Athey.

Services were private.

John J. Beck, 88, a retired clean-room mechanical engineer, died July 18.

Beck worked at JPL from 1973 to 1987. He is survived by his wife,

Alice; sister Betty Young; daughters Celeste and Angela; sons John III and Paul; eight grandchildren and four great-grandchildren. Services were held in San Jose, Calif.

Beck's family requests that contributions in his name be considered to mendpoverty.org or sacredheartcommunityservice.org.

Joseph Skipper, 68, a member of the Mission Systems Concepts Section 312, died Aug. 12.



Joseph Skipper

Skipper joined the Lab in 2004 and worked as a systems engineer on the Jupiter Icy Moons Project and many aspects of the Constellation Program. He was currently developing a physics-based simulator for traversing the lunar or a near-Earth object surface.

Skipper is survived by his wife, Beverly Corbett; children Melanie Relysea, Jennifer Loyless and James Skipper; nephew Gary Skipper; four grandchildren and three siblings.

Services were held in Monterey, Calif.

Doug Caldwell, an electrical and software engineer in the Power and Sensor Systems Section, died Aug. 20. He had returned to JPL only four days earlier, after having worked at the Lab from 1992 to 2000.



Doug Caldwell

In 1995 Caldwell became lead avionics systems engineer for the Deep Space One mission. From 1998 to 2000 he served as systems element manager for the Mars Ascent Vehicle sample return mission, leading development of a rocket that was to have been the first vehicle to launch from Mars.

Caldwell was co-founder and vice president of engineering for Ecliptic Enterprises, a space-technology firm operating commercial, civil and defense markets that produces RocketCam, a video device that operates in harsh environments, including spacecraft and rocket launches.

Before rejoining JPL earlier in August, Caldwell had been chief architect for Boeing's renewable energy solutions group.

Services are pending.

Letters

My family and I would like to express our appreciation to the JPLers who sent us their thoughts and prayers in response to the passing of my stepmother. We also want to thank the ERC for the beautiful purple phalanopsis. Your support was appreciated and valued in this time of need. Thank you all. Sincerely,

John Diehl

My sincere thanks to all my friends and colleagues at JPL for your kind words and cards. They were indeed a comfort upon the passing of my only sibling, Mary Kay Doody. I appreciate your kindness. Thanks to JPL for sending the nice living plant to my home. Sincerely,

Dave Doody

As the anniversary of my wife's passing nears (8/17/09), my daughter and I would like to thank JPL, my co-workers and many friends for the cards, e-mails, phone calls and beautiful plants we received. Also, thank

you all for your prayers, thoughtfulness and continued support during this most difficult time.

Carl and Erin Simon

My family and I would like to thank ERC for thinking of us at this time and for the lovely anthurium plant in regard to my mother-in-law passing on.

Richard Aragon and family

My husband and I would like to thank my JPL friends and co-workers for the kind words expressed for the passing of my father-in-law. Thank you also for the beautiful plant; your thoughtfulness was appreciated.

Anne Vyhnalek

Jan, my dad, my brother and I wish to thank the JPL and ITT community for their thoughts and prayers leading to and coming after the passing of my mother. She was a wonderful person. I also want to say thanks for all the flowers and plants sent to the funeral and to my home.

Pat Beyer

On behalf of my husband and family, thanks to the members of the AIRS project for their thoughtful card and the beautiful peace lily on the passing of my father-in-law, Dick Ray. Dick was an example of living life to the fullest, which included traveling through the Amazon last year at the age of 90. His presence will be missed, and it is the kindness of friends that makes the passing easier.

Sharon Ray

Retirees

The following JPL employees retired in August:

Neil Yarnell, 44 years, Section 5010; **Richard Aragon**, 41 years, Section 1832; **Christopher Yung**, 31 years, Section 3820; **Mary Wong**, 24 years, Section 7010; **Zheng Xinyu**, 12 years, Section 3220.



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