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Excellence Challenge

Thirty-year JPL veteran Daniel McCleese was named the Laboratory's chief scientist in June. He discusses his new position and his views on JPL's future in science.

By Mark Whalen

How's the new assignment going so far?

I am really enjoying the position. It's both challenging and fun.

In your new role, are you a mentor, a leader, a policymaker; is it some of or all of those things? What are your goals?

My first priority in this period of changing NASA priorities is to work with space scientists nationwide in support of a robust program of space research. The Vision for Space Exploration altered the agency's emphasis in many areas, and some of the changes generated deep concern within the research community. I believe that there are reasons to be optimistic, yet there is much work to do if NASA's robotic programs are to move forward robustly. First, we have in the past experienced difficult times in NASA's research programs, and the community has always bounced back with outstanding feats in space exploration. I am confident that the current situation will play out in much the same way. Second, a strong voice for research is needed within the agency, one that is able to speak in support of space science and its missions. Our longstanding and vigorous championing of space science demonstrates that JPL can be counted on to be that voice advocating science and technology in concert with the community.

Internal to JPL, my focus is on excellence in research. Quality in cutting-edge research is critical to JPL's future in many ways, some of which are not so obvious. For example, our researchers represent the Lab in committees and advisory groups charged with setting the nation's direction in space science. Today, there is an especially significant role that JPL researchers play—that of leading strategic planning for NASA's programs of exploration. Only those scientists who have gained the respect of their peers are asked to serve in these critical capacities. In addition, when conducting missions for NASA, JPL depends upon project scientists and investigation scientists who are themselves conducting high-quality research. In this instance it is important that we give mission scientists the time they need to accomplish their individual research or post-docs to help them. I am dedicated to doing all that I can to facilitate all research on Lab, as well as clearing the path of researchers so that the very best work can be done with a minimum of hassle. My first effort in this area was to help make publication of research easier in this era of intense export control.

Another goal of mine as chief scientist is to have the Lab rededicate itself to enabling JPL principal investigators on flight instruments and competed missions. Over our history, we have contributed many of the most significant spaceborne investigations yet conceived. We have built and operated principal-investigator instruments and missions in solar system and Earth science, astrophysics and heliophysics. The past two decades have seen few JPL principal investigators for planetary instruments, and no competed planetary missions with a JPL principal investigator. We must help the JPL scientists who have investigations in mind that require new observations and measurement techniques to ready themselves for these opportunities. It is also important that we attract young scientists in all disciplines of space science who want to take advantage of the enormous breadth and depth of JPL's engineering talent. Many of the most senior principal investigators at JPL came to the Lab for this very reason.

In addition to JPL principal investigator roles, how has the Lab been doing in competing for NASA missions and instruments?

I did a study for the Executive Council before becoming the chief scientist in which I looked at JPL's performance in flight competitions. The question was, are we gaining or losing ground? The answer is that by comparison with universities and other NASA centers, we are doing well. Universities and centers, alike,

Continued on page 2

excellence *Continued from page one*

rarely win more than a single instrument on a payload or more than one science leadership role on a NASA mission. Over the 15 years that I looked at, JPL did at least that well. In several instances we developed and operated an instrument as a facility for the science community at large. These too are big wins for JPL. It is significant that opportunities to compete are far greater in number now than they were even five years ago, and the number of competitors has increased manyfold. Ultimately, if we are to continue to be successful we must propose not only the best and most compelling investigations, we must also demonstrate, through field and laboratory experience, that the experimental approach will achieve its measurement objectives. I am a big fan of demonstrating measurement techniques, as well as data interpretation skill, prior to entering a competition. These are traditional strengths for JPL.

A tighter relationship is developing between JPL's science and technology communities. How is that going?

JPL's chief technologist, Paul Dimotakis, and I have developed an excellent partnership. Since July we have been working together to make the best use possible of the Lab's discretionary funds—a primary and shared responsibility in our positions. Charles Elachi, in the first two years of his tenure, increased funding tenfold for innovative research within JPL. Paul and I work with the directorates and divisions to use this precious institutional resource to bring innovative concepts within reach of future applications. These investments help set the direction of the Lab's future. It has been eye-opening for me to see the variety and range of new concepts brought forward by our scientists and technologists. It is also quite clear to me that two or three years of financial support can turn an innovative concept into an enabler for a flight mission.

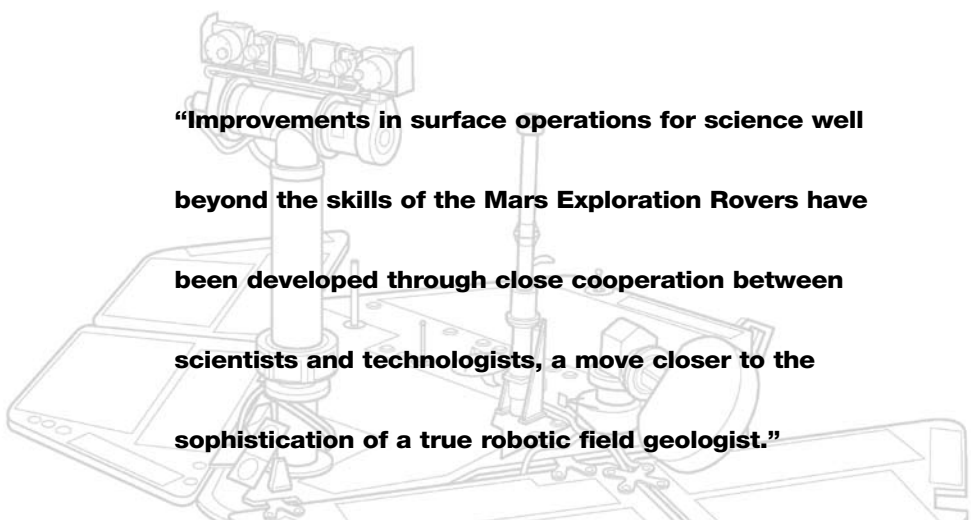
Discretionary funds also enable collaborations among technologists and scientists that are very different from those typical of direct funding. Often, one or the other side of these partnerships has a "what if" or "can we" idea that needs startup funding—all supported concepts undergo thorough internal competitive review. A kickoff effort is sometimes needed before such concepts are ready to compete in NASA-wide peer review. Downstream development and insertion of innovations that have benefited from early support can be less costly and more confidently adopted by users. We see this happening as JPL stands at the forefront of developing and deploying in-situ instruments on planetary surfaces. Improvements in surface operations for science well beyond the skills of the Mars Exploration Rovers have been developed through close cooperation between scientists and technologists, a move closer to the sophistication of a true robotic field geologist. Equally exciting are developments in sensors for astrophysics and Earth science. For example, scientists depend upon innovations in technology that improve detectors, which, in turn, depend upon close cooperation among researchers. For the astrophysicist, it is often the scientist with the best detector who gets the chance to develop an instrument to make a measurement in space.

How does JPL achieve external collaborations?

JPL has an amazingly diverse array of productive external collaborations. One that is managed by the offices of the chief scientist and chief technologist is the Strategic University Research Partners Program. Through this program, the JPL director forms and supports alliances with universities that share with the Lab a wide range of institutional objectives. Currently, the program has nine university members. Joint research projects are the products of the program.

The most common and doubtlessly the most productive external collaborations are those based upon the individual initiatives, where two or more researchers share a common interest. These collaborations number in the hundreds and include many international research projects.

Collaborations with Caltech faculty and staff are typically based upon one-on-one contact between individuals. Caltech's president, Jean-Lou Chameau, and Charles Elachi and have emphasized the importance of these collaborations, including the growing number of JPL–Caltech



"Improvements in surface operations for science well beyond the skills of the Mars Exploration Rovers have been developed through close cooperation between scientists and technologists, a move closer to the sophistication of a true robotic field geologist."

Photos by Dutch Slager/JPL Photolab

joint appointments. Four faculty members now have joint appointments: Professors Andrew Lange, Tom Prince, Anthony Readhead and Jonas Zmuidzinas.

You're the principal investigator on the Mars Climate Sounder instrument onboard the Mars Reconnaissance Orbiter, which after completing aerobraking began its observations on Sept. 24. How excited are you, considering that a similar instrument flew on the ill-fated Mars Observer and Mars Climate Orbiter?

Well, after 20 years of trying our investigation of the weather and climate of Mars has begun. The instrument is performing flawlessly. That is not only thrilling for me personally, but it is also a long-awaited goal for all the investigators here at JPL and in Britain who have worked on this experiment since 1986. Our interests in the Martian atmosphere include both past and present climates. We are particularly interested in the water cycle in the modern atmosphere in which the atmosphere is a significant reservoir of water as vapor and clouds. The water cycle is known to involve sources and sinks at, and possibly below, the surface—identified thus far are the polar regions. Mars Climate Sounder measurements of the vertical profiles of water vapor over the entire planet will help identify where and how water may be exchanged elsewhere. The vast reservoirs of ice less than a meter below the Martian surface may be communicating with the atmosphere, but over what time scales remains a mystery. We made a decision early on in our investigation to couple the Mars Climate Sounder observations of the atmosphere with numerical models of the general circulation through data-assimilation schemes. The objective here is to extend our studies beyond the parameters that Mars Climate Sounder measures directly, such as winds and the transport of water and dust.

You were chief scientist for the Mars Exploration Directorate prior to your new position. How is that program going?

The Mars community has had a decade of accomplishment unparalleled in the planetary sciences. Between 1996 and 2006, strategic planning has played a very important role in the success of Mars research. The Mars Exploration Program is unusual in having formulated science strategies for testing hypotheses through sequential investigations, mission after mission. The development of a strategic plan requires cooperation between the community of Mars scientists and mission architects, with the support of NASA leadership, so that common goals can be identified. Of course, these goals must be implementable within the constraints of resources of the program, as well as technological feasibility. I think the Mars Program has been extremely successful over the past 10 years in part because of the enormous talent JPL brings to the planning process. Leading some of the strategic planning activities, responding to discoveries along the way, is a highlight of my career.

Do you see a promising future for aspiring researchers? What can a place like JPL do to help them become established in their chosen careers?

Yes, the future for young researchers and students in science and engineering is bright. With regard to getting started, I recommend to students an education experience that mixes in-classroom lectures with research done outside the classroom in a research environment. This was my own experience and it led to my eventual choice of career in atmospheric physics. I worked at several labs, including JPL, while an undergraduate as a co-op student—an approach much like JPL's current opportunities for summer students, only longer, sometimes up to a year spent in the workplace. My work-study experiences, including at JPL, were excellent preparation for moving on to graduate work.

"It is important that we attract young scientists in all disciplines of space science who want to take advantage of the enormous breadth and depth of JPL's engineering talent. Many of the most senior principal investigators at JPL came to the Lab for this very reason."

I believe that JPL can help young people establish careers in science and engineering. We should reach out to students who show an interest in these professions by encouraging them to pursue a technical career. I believe strongly that we should, when speaking to students, present ourselves in human terms, making it clear that we too were once in school facing similar choices and challenges. I enjoy seeing researchers expressing themselves in a way that is accessible to students. Unfortunately, evidence suggests that many students turn away from careers in research relatively late in their education. That path may seem to be too difficult or insufficiently rewarding. They may respond to encouragement from scientists and engineers like us who can express the excitement of a life in research, particularly space research.

What makes a successful scientist at JPL?

A track record of high-quality research is most important. Excellence in science and a good standing in one's community are essential for success in the NASA peer-review process through which JPL researchers obtain salary and supporting funds. Flexibility and eagerness to work in direct support of JPL's missions also play a role. JPL scientists are encouraged to seek opportunities in project science, leadership in line management, and in support to the directorates. Many successful JPL scientists have a strong streak of the entrepreneur, which is important in promoting one's ideas. This ability can be essential if a scientist wishes to strike out to pursue his or her own large-scale research. The environment of competitive science programs and highly-sought-after mission support roles has driven the evolution of a cadre of scientists at JPL that is well matched to its needs in planetary science, astrophysics, Earth science, and in heliophysics. ■

The FOREST for the TREES

JPL WILL BEGIN CONSTRUCTION NEXT YEAR ON ITS NEW FLIGHT PROJECTS CENTER, to be located at the intersection of Surveyor and Mariner roads. As part of the project, a number of trees will soon be removed, with many more new trees to be planted in their place. Mark Gutheinz, manager of the Facilities Engineering and Construction Section 281, discusses the plans.

What is the general scope of the building project?

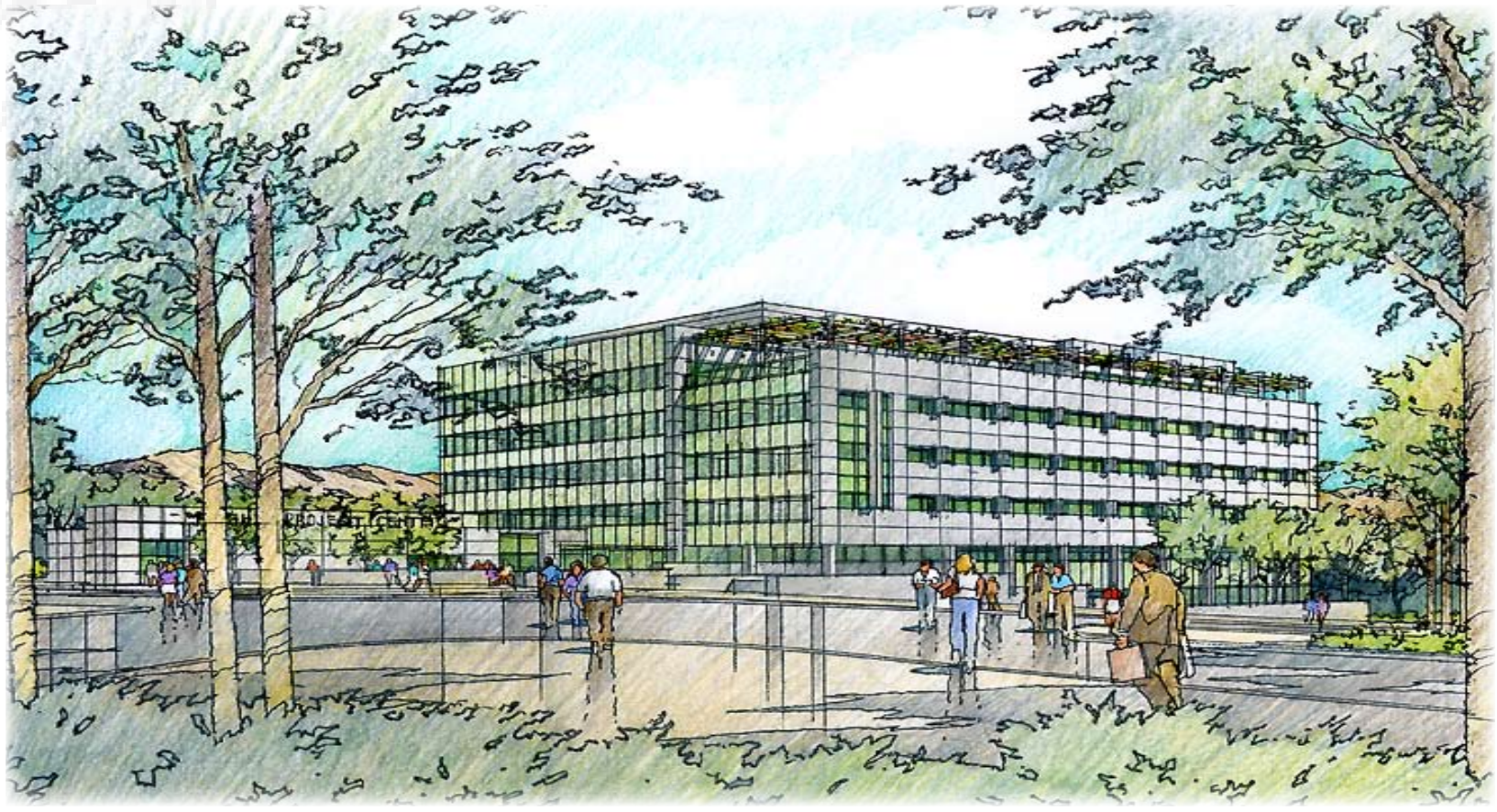
The new JPL Flight Projects Center will provide offices and meeting space to support collocation of flight projects. Construction of this new building will allow us to vacate out-of-date buildings and trailers on Lab.

The goal is to move employees away from the older, energy-inefficient buildings that were constructed in the 1940s, '50s and '60s to newer, utility-friendly facilities.

The Flight Projects Center will have six stories plus a basement, and will be constructed of structural steel frame, glass and metal panels. The new building will contain a mix of private offices and open landscape workstations as well as teaming space, meeting rooms and project-specific "war rooms" located on floors adjacent to offices. The building will also contain a 400-seat, sloped-floor auditorium and a 200 moveable seat flat-floor conference room that will be divisible into two 100-seat rooms.

The building is designed to meet current safety, seismic accessibility and environmental requirements. NASA mandates its new buildings be constructed according to standards for environmentally sustainable construction set by the Leadership in Energy and Environmental Design Green Building rating system, developed by the U.S. Green Building Council. JPL seeks gold certification, the second-highest level, based on our plans for sustainability, energy conservation, life-cycle maintainability, building materials and other factors.

NASA best practices of constructability, partnering, pre-project planning and commissioning are being implemented. We anticipate construction will commence in mid 2007 with probable occupancy in late 2008.



Artist's rendering shows the new Flight Projects Center, looking southeast. At far left is the facility's auditorium.

How many trees are identified for removal? When will they be removed?

Thirty-two trees will be removed from the Flight Projects Center site. They are: canary pine (10), liquid amber (10), deodar (6), eucalyptus (3), oak (1), palm (1), and plum (1). Trees will be removed during the last two months of 2006.

What work has been done to evaluate potential impacts to the environment?

A biologist has surveyed the site and determined that there will be no substantial impacts to terrestrial animals. Birds use the trees to roost and have, in the past, made nests in them. Nevertheless, prior to disturbing the trees, we will have a biologist come out to complete a survey for any active nests. If any are found, we will take appropriate action to protect them.

Our environmental impact study determined that birds typically nest at certain times of the year, and the tree removal is being done during a window of opportunity when nesting doesn't occur.

Furthermore, Labwide surveys have determined that two endangered species, the Southwestern Arroyo Toad and the California Gnatcatcher, are not found on the site. All these activities are documented in an environmental assessment, which has been completed for the site as required under the National Environmental Policy Act.

Will the trees be cut down or removed and boxed for transplanting?

There is a small oak tree on the site that would be a perfect candidate for relocation if it had not been identified as diseased by L.A. County's oak tree inspector. The oak and the remainder of the trees will, unfortunately, need to be removed from the site.

Is anything being done to offset the loss of the trees?

Yes. Dr. Charles Elachi has directed that five trees be planted on Lab for every one that is removed to make room for the new Flight Projects Center.

Landscape architects from building architect LPA Inc. have formulated an overall landscape enhancement plan with the objective of developing improved existing green spaces within the Lab. The main objective is to provide a strategic approach to developing green areas where birds can roost and employees can relax and enjoy the trees and wildlife.

How many trees will be planted to replace those that have been lost?

There will be at least 175 new trees planted.

Where will the new trees be located?

The trees will be planted in strategic areas throughout the Lab where they can enhance and supplement existing stands of trees. Species of trees have been selected based on the existing trees within proposed planting areas. Tree planting will occur in three phases over two years:

Phase 1 includes planting about 46 trees around buildings 306 and 318 and will take place in November and December.

Phase 2 includes at least 47 trees (137 tree locations have been identified). Planting will take place between January 2007 and January 2009.

Phase 3 includes 93 trees at the new Flight Projects Center. At the end of the building project, the new trees, plus a variety other plant materials, will take the place of the original 32 trees. ■

Photos by Tom Wynne/JPL Photolab

Top: Terry Gentry of the Construction Administration Group, left, and Mark Gutheinz among the trees to be removed.

JPL fares well in Discovery concept studies

By Mark Whalen

JPL would provide project management services to three proposed concept studies selected by NASA on Oct. 30 under its Discovery Program. In addition, the Lab would provide a science instrument to another of the selected mission concepts.

In all, NASA selected three new missions for concept studies, as well as three missions of opportunity that would make new use of two NASA spacecraft that have completed their primary objectives.

A proposal to study the structure of the Earth's moon that was submitted by Maria Zuber of the Massachusetts Institute of Technology, with JPL as her project implementing institution, was one of the three new missions selected for Phase A concept study.

The Gravity Recovery and Interior Laboratory, or "Grail," mission would use high-quality gravity field mapping to study the moon's thermal history as well as to determine its interior. Leon Alkalai of the Autonomous Systems Division is the proposal manager. David Lehman of JPL is the definition phase project manager. Michael Watkins of JPL is the project scientist. Zuber is the principal investigator. Lockheed Martin has been named as the industrial partner.

The mission would launch in 2011 or 2012.

"Grail will be critical to the understanding of the Earth–moon system," said Alkalai, noting in particular the value the mission will bring to increased understanding of the moon's far side and polar areas. Alkalai characterized the mission as inspired by JPL's successful Gravity Recovery and Climate Experiment (Grace) mission, in which two spacecraft flying in tandem are very precisely measuring Earth's gravitational field. Watkins is also the project scientist for Grace.

Two of the concepts for missions of opportunity were proposed by JPL.

George Carlisle of the Outer Planet Mission Analysis Group is the proposal manager for the Stardust "NexT" mission, which would use the existing Stardust spacecraft to fly by comet Tempel 1 and observe changes since the Deep Impact mission visited it in 2005. Last year, Tempel 1 made its closest approach to the sun, possibly changing the surface of the comet. JPL's Tom Duxbury is the definition phase project manager. Joseph Veverka of Cornell University is the principal investigator.

A proposal to use the existing Deep Impact spacecraft for an extended flyby mission to a second comet that was submitted by Michael A'Hearn of the University of Maryland includes JPL as the project's implementing institution.

The Deep Impact eXtended Investigation of Comets, or "Dixi," mission, would fly Deep Impact to comet 85P/Boethin to take pictures of its nucleus to increase our understanding of the diversity of comets. Robert Abelson of the Orbiter Missions System Engineering Group is the proposal manager. Duxbury is the definition phase project manager. A'Hearn is the principal investigator.

Dixi would bring Deep Impact out of hibernation next September, with an Earth flyby scheduled for December 2007 to provide a gravity assist to the comet for a December 2008 encounter. "We're excited to be given the opportunity to resurrect both Deep Impact and Stardust and are looking forward to confirmation of these proposals," said Duxbury.

In addition, JPL would provide a submillimeter wave atmospheric sounder, called the Submillimeter Line Spectrometer, to the proposed Vesper mission, a Venus orbiter that would advance knowledge of the planet's atmospheric composition and dynamics. Sam Gulkis of the Astrophysics and Space Sciences Group is the instrument scientist and Mark Allen of the Earth and Planetary Atmospheres Group would be responsible for the interpretation of observations in terms of active atmospheric chemical processes. Other JPL co-investigators would be David Crisp and Mark Hofstadter. The project would be managed by the Goddard Space Flight Center. Gordon Chin of Goddard, Vesper's principal investigator, also is responsible for the basic spectrometer design concept.

Another mission of opportunity selected for a concept study is the Extrasolar Planet Observations and Characterization mission, or "Epoch," which would use the high-resolution camera on Deep Impact to search for the first Earth-sized planets detected around other stars. L. Drake Deming of Goddard is the principal investigator.

In addition to the mission proposals with JPL involvement, NASA also selected a concept study for the Origins Spectral Interpretation, Resource Identification and Security mission, or "Osiris," which would survey an asteroid and provide the first return of asteroid surface material samples to Earth. Michael Drake of the University of Arizona is the principal investigator. Goddard would manage the project.

The selected proposals were among approximately two dozen submitted in response to NASA's Discovery Program 2006 announcement of opportunity in April. The announcement solicited two types of investigations: complete missions to design, build and fly new spacecraft to accomplish specific planetary science objectives; and missions of opportunity that propose scientific uses for existing spacecraft or build instrumentation for spacecraft of other space agencies.

NASA may select one or more investigations to continue into a development effort after detailed review of the concept studies. Decisions about which mission concepts will proceed to development are expected next year.

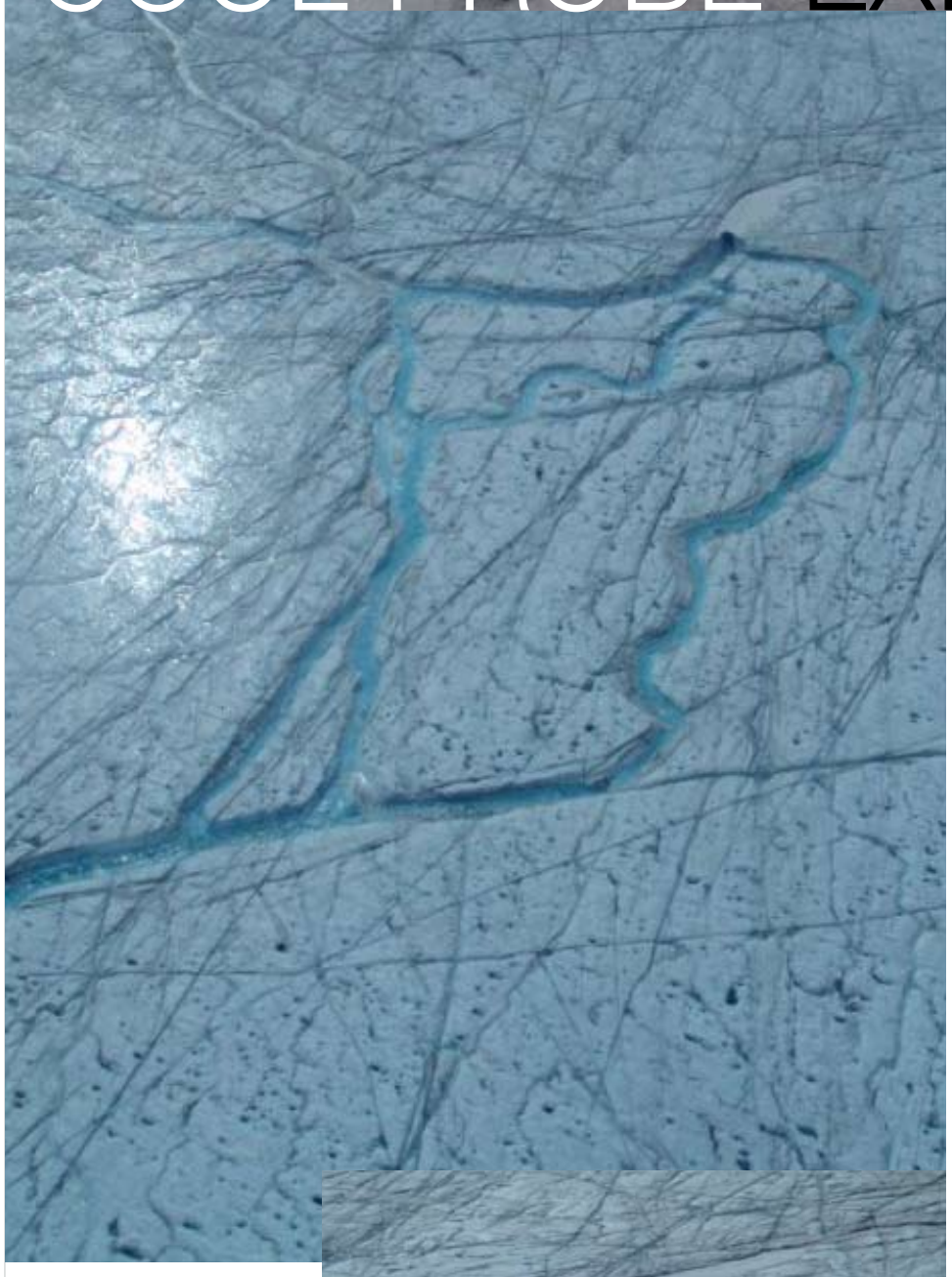
New missions will receive $1.2 million to conduct concept studies. If selected for continuation beyond the concept phase, each project must complete its mission, including archiving and analyzing data, for less than $425 million.

Missions of opportunity will receive $250,000 to conduct concept studies. If selected for continuation, each mission of opportunity must complete its project, including data archive and analysis, for less than $35 million.

"The science community astounded us with the creativity of their proposals," said Mary Cleave, associate administrator for NASA's Science Mission Directorate. "We look forward to the new knowledge of our solar system that these concepts may provide." ■

COOL PROBE EXPLORATION HELPS CLIMATE SCIENCE

By Mark Whalen



Alberto Behar prepares the Antarctic Borehole Probe for immersion.

Technology developed at JPL to one day explore the icy bodies beyond Earth is making its mark right now on some of the "other worldly" areas of our home planet.

On the frozen tundra of the island of Greenland, a 30-minute helicopter ride from the nearest village, researcher Alberto Behar and colleague Konrad Steffen of the University of Colorado recently conducted successful tests of the JPL Antarctic Borehole Camera in an area where there were two active moulins, or whirlpools, being fed by a network of surface melt rivers.

The summer ice melt forms ponds on the surface, with water forming into huge channels. Meanwhile, under the ice, water flows between the icepack and the ground, to the ocean.

The camera produced video images that showed both downward and side views of the flow of ice and water, which will help scientists to better understand the ocean water/ice shelf relationship.

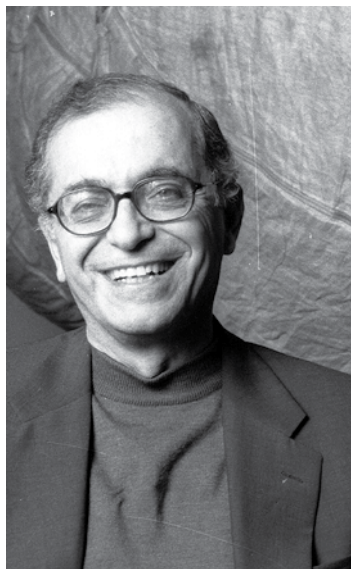
"The unit went down in two locations on a cavernous portion of the moulin," noted Behar, who works in the Life Detection and Sample Handling Technologies Group. The probe descended 100 meters on the first drop and 110 meters on the second before running into horizontally flowing water and debris.

Behar said the studies will help confirm theories that moulins might be responsible for the increase of ice flux towards the coast by lubricating the underside of the ice sheet with melt water. The results will also be useful in the study of long-term climate change, he said, including possible indications of global warming.

"A radar survey next year will give us accurate measures of the ice thickness in this location so as to better interpret the results and plan for future tests," said Behar.

The borehole probe has made three successful studies of the Antarctic ice sheet, a natural analog for future solar system ice-surface missions. The research is supported by NASA and the National Science Foundation. For more information, visit *http://eis.jpl.nasa.gov/~behar.* ■

News Briefs



Elachi honored as one of America's best leaders

JPL Director Charles Elachi has been honored as one of "America's Best Leaders" by U.S. News & World Report, in collaboration with the Center for Public Leadership at Harvard University's John F. Kennedy School of Government.

Elachi and 19 other leaders were featured in the magazine's Oct. 30 issue. The distinguished list includes U.S. Coast Guard Commandant Admiral Thad Allen; New York City Mayor Michael Bloomberg; Berkshire Hathaway, Inc. CEO Warren Buffett; former U.S. Supreme Court Associate Justice Sandra Day O'Connor; and world-renowned architect Frank Gehry.

"At a time when the public's confidence in leadership is low, 'America's Best Leaders' celebrates individuals who exemplify true leadership and serve as models for others," said David Gergen, U.S. News' editor-at-large and director of the Center for Public Leadership.

A selection committee sought leaders who embody and define leadership today and have achieved measurable results in their fields, challenged established processes and inspired a shared vision. The committee was particularly seeking leaders with resilience, adaptability and sustainability who empower others and value their colleagues' personal growth.

"I am deeply honored to be recognized in this way," said Elachi. "I am fortunate to have the opportunity to lead an exceptionally talented, innovative and dedicated group of men and women at JPL. Every individual's contribution helps us make magic happen, as we explore Earth and space and develop new technologies that will carry us into the future."

Research and Technology Development poster session

JPL's latest advances in science and technology will be presented by Laboratory investigators in a Nov. 15 Research and Technology Development poster session.

Posters will be presented from the following categories of Research and Technology Development tasks: strategic initiatives, topic areas, spontaneous concepts and Lew Allen Awards.

All posters will be on display between 8 a.m. and 4 p.m., with strategic initiative and topic area posters displayed on the mall, and spontaneous concepts and Lew Allen award posters displayed in von Kármán. The principal investigators will be available from 11 a.m. to 2 p.m. to discuss their work.

At 11:30 a.m., JPL Chief Scientist Dan McCleese and JPL Chief Technologist Paul Dimotakis will speak on the importance of internal investment in developing new and enhanced science and technology capabilities. Refreshments will be served in von Kármán.

The poster session is an excellent opportunity for employees to explore potential collaborations with JPL investigators. Last year, more than 750 scientists and technologists attended the session.

The JPL Research and Technology Development Program is internal-fund administered by the offices of the chief scientist and chief technologist. The program's primary purpose is to enhance JPL's ability to address the future objectives of JPL and NASA missions. Initiated in 2001, JPL's commitment to this investment will continue to grow until it reaches 3 percent of the Laboratory's business base. The program funds proposals in the areas of basic research, applied research, development, systems and other concept formulation studies.

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Passings

Elaine Cottle, 45, died Sept. 28.

Cottle joined JPL as supervisor of safety engineering in the Occupational Safety Program Office in May 1999 and is credited with making many important contributions to the health and safety of JPL employees during her career.

She is survived by sons Austin and Kalen; parents Kathleen and Joseph Quaglino; and brothers Steve, Larry, Jamie and Anthony.

Services were held Oct. 4 at St. Mel Catholic Church in Woodland Hills. Donations in Cottle's memory may be made to St. Jude's Children's Research Hospital, 501 St. Jude Place, Memphis, TN 38105 or 800-873-6983.

Lynda McKinley, 63, formerly employed in JPL's Deep Space Mission Systems Program Office, died Oct. 9.

McKinley, a JPL employee from 1987 to 1999, is survived by daughter Sunny Hancock; granddaughters Chelsie and Morgan; mother Wilma Thomas; sister Susan Bird; and brother Dennis Smith. Services were held Oct. 14 at Eternal Valley Memorial Park in Newhall.

Doris Joslyn, a former JPL contract negotiator, died Oct. 12.

She is survived by her husband, Richard; sister Alice Mahon; and stepsons James and John Joslyn. Services were held Oct. 18.

Stanley Britt Seng, 86, a retired optics test engineer, died Nov. 2.

Seng worked at JPL for 23 years, supporting the Voyager, Ranger, Mariner and Hubble Wide Field Camera programs. He is survived by his wife, Irene; daughters Barbara (Chris) Wood and Judy Phillips; granddaughters Emily (Scott) Mencken and Melinda (Charles) Phillips; and great-granddaughter Katherine Mencken. Services were held Nov. 9 in Ballard, Calif.

Letters

My family and I want to thank you very much for your prayers, words of kindness, expressions of sympathy, and plant received at this difficult time for the death of my dear brother Richard. God bless you.

Olivia Tyler

My family and I would like to thank my JPL friends for the many expressions of sympathy and comfort in the passing of my mother, and to thank the ERC for the beautiful orchid. Your kindnesses will always be remembered.

Debbie Bungartz

I am sorry to say my darling Eleanor passed away Oct. 25 at 9:05 p.m. She had a rough time since July 4. She had a heart attack Aug. 12, was told she had failed kidneys, started dialysis three times a week. Then some strokes, two or three, we don't know. She was in four hospitals and two rest homes. I will really miss her. Thanks for all you have done.

Forrest Janes

The Bodie family would like to thank all of our friends at JPL for the sympathy and support shown to us during the difficult times we have had since the death of Alice (the wife of Charles and the mother of Jim). The flower arrangements, cards and letters sent to us were a comfort knowing that the folks here were holding us in their thoughts and prayers. We especially want to thank Divisions 37 and 34 and the information technology people who recently split from Division 37.

Charles Bodie
James Bodie

Retirees

The following JPL employees retired in November:

Frank Singleton, 41 years, Section 315B; Elaine Dobinson, 36 years, Section 3875; Yvonne James-Bivins, 29 years, Section 960; Kurng Chang, 26 years, Section 352G; Patrick J. Murphy, 25 years, Section 352H; Luanne Cathey, 20 years, Section 920; Yu Wang, 11 years, Section 3827.