National Aeronautics and Space Administration

The NRP Post

A publication of NASA Research Park

Summer 2013

Planetary Sustainability—2013 WEST Summit

by Diane Farrar

CA Governor Jerry Brown with (L-R) Dr. Dan Rasky, Space Portal Director and co-host; Dr. Waleed Abdalati, former NASA Chief Scientist; Dr. James Hansen, former NASA GISS Director; Professor Anthony Barnosky, UC Berkeley, Integrative Biology; Bannie Bannerjee, Director, Stanford ChangeLabs

California Governor Jerry Brown, May 23 at NASA Research Park, roused the 2013 WEST (Water, Energy, Smart Technology) Summit, joining 500 scientists in a groundbreaking Call to Action warning that Earth is rapidly approaching a tipping point at which human impacts are causing alarming levels of harm to our planet.

Hosted by NASA Ames' Space Portal and Sustainable Silicon Valley (SSV), the Summit's Showcase of Solutions for Planetary Sustainability featured Brown, Ames Director Pete Worden and Associate Director Steve Zornetzer, acclaimed scientists and academics, industry and nonprofit experts, and talented solution contestants. The jam-packed

WEST Summit cont'd on page 5

NASA's IRIS Launched with Antennas from CMU-SV Startup X5 Systems

by Sarah Stanek, Web Communications Manager, CMU-SV

NASA's latest small explorer mission, launched June 27, took off from Vandenberg Air Force Base in California with communication equipment from X5 Systems, a spinoff startup of Carnegie Mellon University Silicon Valley (CMU-SV) co-founded by CMU-SV Associate Research Professor Jason Lohn.

X5 Systems antenna deployed on the IRIS spacecraft

The IRIS mission (for Interface Region Imaging Spectrograph) will observe activity in the sun's lower atmosphere, using an ultraviolet telescope to examine the movement of solar material and energy between the surface and the corona. The information carried by the advanced antennas will advance understanding of this complex region.

Lohn, the director of the Carnegie Mellon Innovations Lab (CMIL), has worked on several projects with NASA, including leading a team that successfully deployed X-band antennas in space aboard the Space Technology 5 mission in 2006. CMU-SV is located on the NASA Research Park and has ongoing collaborative research partnerships with NASA.

CMUS-SV X5 Systems cont'd on page 4

Made in Space Bringing 3D Printing to Space

by Grant Lowery

U.S. Representative Mike Honda and NASA Administrator Charles Bolden visited the Made in Space exhibit. At the NASA Research Park, Made In Space is developing a 3-D printer that can operate in weightnessless. The company got its start as a project at Singularity University.

In May, the space manufacturing company Made in Space, Inc. announced their plans to launch the first 3D printer into space. In coordination with NASA, Made in Space will send the printer to the International Space Station (ISS) in 2014 via a SpaceX rocket as part of the 3D Printing in Zero-G Experiment.

The customized 3D printer, built specifically to handle the particular environmental challenges of space, will be the first device to manufacture parts away from planet Earth. 3D printers use extrusion-based additive manufacturing to build objects layer by layer out of polymers, composites, metals and other materials. The 3D Printing in Zero-G Experiment will validate the capability of additive manufacturing in zero-gravity.

"As NASA ventures further into space, whether redirecting an asteroid or sending humans to Mars, we'll need transformative technology

Made in Space cont'd on page 5

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NRP Welcomes

Flight Research Associates

Building Rooms 1072 and 2022
Commencement: 7/16/13

Flight Research Associates, Inc. (FRA) will become a key partner at Ames in advancing aviation and aerospace research, development, test, training and evaluation. FRA is currently providing services to Ames' Code AF (Aviation Systems) including providing pilot and air traffic controller expertise and data analysis for the NextGen air traffic management. FRA will expand its services to Ames to include developing manned and unmanned flight test design, development and vehicle integration and STEM outreach. FRA was established in 2005 and is headquartered in Jacksonville, Oregon.

Logyx, LLC

Building 19 Rooms 2072 and 2092
Commencement: 7/16/13

Logyx has been supporting NASA ARC as a prime contractor since 2005, providing subject matter expertise in IT/Cyber Security, Multi-Mission Operations, Small Spacecraft, the NLSI and the ISS Program Office.

In 2011, Logyx was selected as the "NASA ARC 2011 Small Business Prime Contractor of the Year." Logyx is an industry-recognized leader in cyber security and was one of the original eight companies in the U.S. to receive the prestigious Federal Risk and Authorization Management Program's (FedRAMP) Third Party Assessment Organization (3PAO) accreditation providing security preparation services and compliance assessments for both commercial and government Cloud Service Providers (CSPs) for NASA and other government organizations. In addition to 3PAO accreditation, Logyx provides subject matter expertise related to compliance with the Federal Information Security Management Act (FISMA). The additional office location in the NRP will help to accommodate the company's growth in its IT and Cyber Security business focusing on IT governance, compliance, and security. The Logyx headquarter office is located at 425 North Whisman Road, Suite 400, Mountain View, CA 94043.

NRP Integrated Product Team Receives NASA Group Achievement Honor Award

The NASA Research Park Integrated Product Team (IPT) received the NASA Group Achievement Honor Award for outstanding contributions to the NASA mission. (L-R): Roy Williams, Andrew Martin, Ann Clarke, Rocci Caringello, Geoffrey Lee, Cynthia Carbon-Norman, Karen D. Thompson, Courtney Lopez, Lorial Pham, Mejghan K. Haider, Mark Beskind, and Bob Lopez. Not pictured: David Shiver, Larry Singer, and Kathleen Burton.

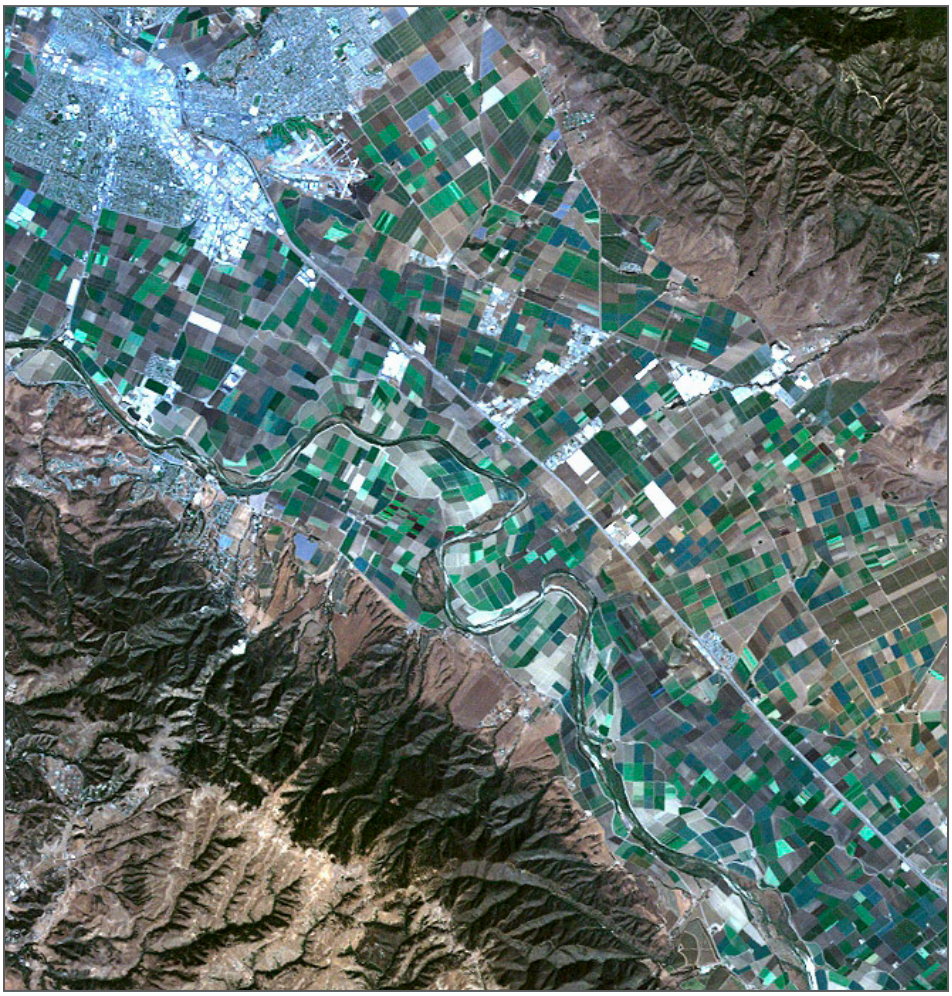
Managing Irrigation from Space

by Dr. Rama Nemani

Scientists in the NASA Research Park are applying satellite data to support California growers in managing irrigation and improving on-farm water use efficiency. Using NASA technologies including the Terrestrial Observation and Prediction System (TOPS), the NASA Earth Exchange (NEX), and satellite data from the Terra, Aqua, Landsat 7 and Landsat 8 satellites, the Satellite Irrigation Management Support (SIMS) project team is developing a system for mapping crop conditions and crop water requirements across 3.7 million hectares of California farmland.

"Our goal is to find new ways to make satellite information both highly useful and easily available to growers in California and across the western U.S." says Forrest Melton, a senior research scientist with the NASA Ames Research Center Cooperative for Earth Science Research and Technology (ARC-CREST) and California State University, Monterey Bay (CSUMB).

California's 81,500 farms and ranches produced $43.5 billion in cash receipts in 2012. Like other western states, California agriculture uses approximately 80% of the available water resources, and growers and water managers are concerned about both drought impacts and the long-term sustainability of California water supplies.



Landsat view of Salinas Valley, CA.

While solving California's water problems is complex, one of the lowest cost solutions is improving water use efficiency where possible. The SIMS project is using the TOPS modeling framework to rapidly process satellite data to produce measures of crop conditions and crop development at least once every eight days. By combining this data with information provided by a network of agricultural weather stations operated by the California Department of Water Resources (CDWR), the SIMS framework can provide daily estimates of crop water requirements for every field in the state.

The project is also using the high-end compute resources provided by NEX to accelerate the development of an operational system for mapping crop water requirements. "Without NEX, we would be spending weeks and weeks to reprocess the data every time we made an improvement in the algorithms" say Melton. "Using NEX reduces this time to a matter of hours."

The SIMS project is working closely with growers across California. To assess the accuracy of the satellite-based measures of crop water requirements, the SIMS team has been deploying wireless sensor networks on commercial farms across California. "Support and advice from our partner growers and the Western Growers Association has been a very important part of the project," says Christopher Lund, a research scientist with ARC-CREST and CSUMB. "One of the many rewarding parts of the project for the team has been the opportunity to work directly with California growers."

Results to date have been highly encouraging, and the project team has initiated demonstration projects with scientists at the University of California Cooperative Extension and the USDA Agricultural Research Service. Trials conducted in Salinas in 2012 and 2013 on lettuce and broccoli have shown that use of the approach employed by SIMS can reduce total applied water by 25-33% relative to standard practice, without reducing yields. In addition, the initial results indicate that the SIMS approach can also have benefits for water quality, with reductions in nitrate loss below the root zone of up to 50%. The SIMS project team initiated trials on commercial farms with partner growers in Salinas this summer, and plans to expand the demonstration trials in 2014. "Data collection under the highly controlled conditions of these trials provides a valuable opportunity to verify key aspects of the SIMS processing chain, and thus far demonstrates the validity of the satellite-based approach" says Lee Johnson, a research scientist with ARC-CREST and CSUMB.

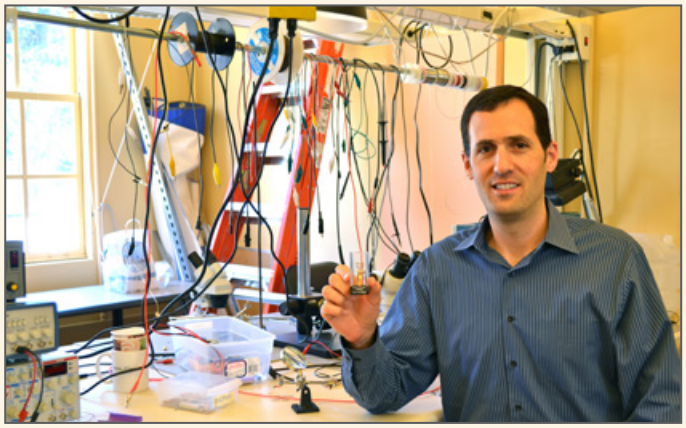
The project is working with the California Department of Water Resources to evaluate options to sustain the new information products as a freely available public resource. Through interactions with companies based in the NASA Research Park, the project team has also received inquiries about licensing the new technology from a number of commercial firms, including both start-ups and established agricultural equipment and information suppliers.

CMUS-SV X5 Systems cont'd from pg. 1

"NASA's IRIS mission has demanding antenna requirements that were hard to meet with conventional antenna designs," Lohn explained. The advanced evolved antenna optimization technology from X5 Systems was able to meet these needs.

X5 Systems develops communication antennas that include artificial intelligence optimization algorithms, and also licenses antenna synthesis software to optimize design, allowing faster, more efficient development for complex projects like the IRIS mission. In 2012, they received a $1 million grant from the Office of Naval Research under the Rapid Innovation Fund program.

"We were pleased that our technology was selected and ultimately deployed as three antennas on the IRIS spacecraft," Lohn said. In addition to his research, Lohn also advises students from CMU's bicoastal Ph.D. program in Electrical and Computer Engineering as an Associate Research Professor.



CMU-SV Professor Jason Lohn holds the antenna deployed on the IRIS spacecraft designed by his startup, X5 Systems

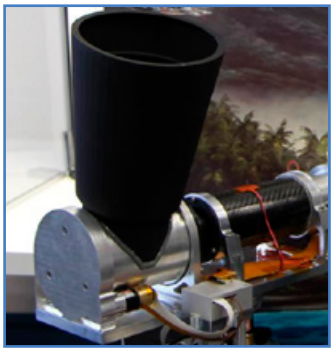
World's First Mission to the Moon's South Pole Announced by Moon Express, Inc. and the International Lunar Observatory Association

by Daven Maharaj
July 18, 2013

The world's first mission to the South Pole of the Moon was announced today by the International Lunar Observatory Association (ILOA) and Moon Express, Inc. The private enterprise mission will be both scientific and commercial, and will deliver the International Lunar Observatory (ILO) to the Moon's South Pole aboard a Moon Express robotic lander, establishing permanent astrophysical observations and lunar commercial communications systems for professional and amateur researchers.

Moon Express will also utilize the mission to explore the Moon's South Pole for mineral resources and water. Lunar probes have provided compelling evidence of mineral and volatile deposits in the Moon's southern polar region where energy and resources may be abundant.

The ILO, with its two-meter dish antenna, will be the world's first instrument to conduct international astrophysical observations and communications from the lunar surface, providing scientific research, commercial broadcasting, and enabling Galaxy 21st Century education and "citizen science" on the Moon. The announcement was made during a NASA Lunar Science Institute conference at NASA Ames Research Center in Mountain View, California.



The ILO-X precursor telescope designed and built for ILOA by Moon Express will be the first private telescope on the Moon.

"The ILO will demonstrate the value of the Moon for scientific study of the Galaxy, Moon, Earth, Sun and Stars," said Steve Durst, founder and director of the ILOA and Space Age Publishing Company. "We are a global consortium of scientists, educators, entrepreneurs and visionaries who seek to establish a scientific presence on the Moon followed by human exploration and eventual settlement." Space Age Publishing Company, ILOA's commercial affiliate, intends to broadcast its Space Calendar weekly and Lunar Enterprise Daily via the ILO. ILOA expects that the South Pole mission could take place as early as 2016 and contribute to humanity's growth as a multi-world species.

Moon Express is the mission partner in the venture, providing the lunar lander, mission architecture, and operations. The company was unveiled in August 2010 as a commercial lunar resource company and is partnered with NASA for its lunar lander development. Moon Express will send a series of robotic missions to the Moon in support of science, commerce and exploration starting in 2015.

"We are very excited to announce that our second Moon mission will be to the lunar South Pole to deliver the International Lunar Observatory and to prospect for resources," said Moon Express CEO Dr. Robert (Bob) Richards. The mission will provide a historic landing in an unexplored region of the Moon that may harbor some of the greatest resource deposits in the solar system.

Earlier this year on May 25th, ILOA and Moon Express unveiled the ILO precursor instrument that will fly to the Moon in 2015 aboard the inaugural Moon Express mission. Details of the "ILO-X" flight instrument hardware are available here at https://app.box.com/ilox-faq. The ILO-X instrument was on public display and actively demonstrated during the Singularity University/Fox Studios "Backstage Pass to the Future" event on June 1st, 2013 in Los Angeles.

The ILO and its precursor will have an internet-based access and control system and will be the first private space telescope to operate from the lunar surface, available to researchers, educators and the general public through the internet, allowing the world to access Galaxy astronomical images from the surface of the Moon and creating a new model of "citizen science" public participation and international collaboration.

Made In Space cont'd from page 1

Noah Paul-Gin (left), Microgravity Experiment Engineering Lead, tests three Made in Space 3D printers in microgravity with team members Jason Dunn (center) and Mike Chen.

to reduce cargo weight and volume," NASA Administrator Charles Bolden said during a recent tour of the agency's Ames Research Center at Moffett Field, Calif. "In the future, perhaps astronauts will be able to print the tools or components they need while in space."

In June, Made in Space's printer passed critical microgravity flight tests at the Johnson Space Center in Houston, Texas. The tests were conducted during four microgravity flights lasting two hours each, simulating conditions found on the ISS.

"The 3D printer we're developing for the ISS is all about enabling astronauts today to be less dependent on Earth," said Noah Paul-Gin, Microgravity Experiment Lead. "The version that will arrive on the ISS next year has the capability of building an estimated 30% of the spare parts on the station, as well as various objects such as specialty tools and experiment upgrades."

The flights were made as part of NASA's Flight Opportunities Program. In 2011, Made in Space was chosen to perform both parabolic and suborbital test flights. The company was then awarded a NASA Phase 1 SBIR Contract to deliver their 3D printer to the ISS.

Following the success of the microgravity trials, Made in Space delivered their hardware to Marshall Space Flight Center (MSFC) in Huntsville, Ala. on June 17th. The engineering test unit printer, whose design was accomplished in a six month Critical Design Phase (CDP), was subjected to rigorous environmental and functional testing. The results confirmed that the hardware design would survive launch and function in microgravity.

Simulated launch conditions were produced at NASA MSFC to ensure vibrational compliance. The battery of tests also included electromagnetic interference (EMI), acoustic and MSG integration verification. In each case the printer passed all significant tests. Additionally, the fit check indicated no issues with how printer hardware would integrate with the Microgravity Science Glovebox (MSG).

Made in Space is now working on the Critical Design Review for their printer design. The passing of multiple crucial milestones has kept Made in Space on target for their 2014 goal of delivering the 3D Printing Experiment to the ISS.

"The 3D Printing Experiment with NASA is a step towards the future. The ability to 3D print parts and tools on-demand greatly increases the reliability and safety of space missions while also dropping the cost by orders of magnitude," said Aaron Kemmer, CEO of Made in Space. "The public has been hearing about what this 3D printing technology can do, but most people haven't seen a genuine impact on their lives yet. Space is one of the key places where humanity will see the first impact of this incredible technology."

WEST Summit cont'd from page 1

event had four panels, almost forty sustainability exhibits, a judging session, and ten winning solutions with awards presented by CA State Senator Jerry Hill and Karol J. Bobko, Colonel, USAF, Ret. NASA Astronaut (former).

"Our mission at Ames is to invent technology and systems that can be applied to solve the greatest challenges of planet Earth," said Worden. "We are proud at NASA to collaborate with SSV through a Space Act Agreement to bring together our systems engineering technology and large scale solutions capability with the ingenuity of Silicon Valley to address global challenges. Through the Planetary Solutions Collaboratory, we will bridge, we hope, the gap between science, technology, politics, business, finance, and implementation—finding and developing solutions that are scalable and game changing. "

Ames Associate Director Steve Zornetzer, SSV Chair Frank Teng, and SSV Executive Director Marianna Grossman welcomed the crowd of almost 400 to Bldg. 152. "NASA's partnership with SSV is about finding game changing technology to help us adapt to or mitigate climate change. Our species has, through technology advances, significantly impacted our climate over the past millennium. Human creativity and technology, through unintended consequences, have brought us to where we are today," said Zornetzer. "Can this same human creativity and new technology help us mitigate and perhaps even reverse global warming? This is our challenge as a species, and our responsibility."

Photo by Gerd Peter May

(L-R) Ames Assoc. Director Steve Zornetzer, Ames Director Pete Worden, SSV Exec. Director Marianna Grossman, CA Gov. Jerry Brown, and SSV Chair Frank Teng listening to science experts on scope of challenges

"This Summit is about science, solutions and implementation. We are making a call to higher leadership. We have just reached 400 ppm CO_2 in the atmosphere. This is terrifying, a symbolic threshold. Sustainable Silicon Valley and NASA are both networks of people who

WEST Summit cont'd on page 12

CMU-SV Director Martin Griss to Step Down, Continue as Research Scientist

Jessie Hao, Marketing Coordinator, CMU-SV

Dr. Martin Griss

Martin Griss, director of Carnegie Mellon University's Silicon Valley campus since 2009, will step down as director at the end of the 2012-13 academic year. Griss will continue with the campus as a principal research scientist.

"I'm excited to help the campus grow in a different capacity as I focus on research while spending more time with my family and on my artwork," said Griss.

Griss has been with the Silicon Valley campus since its inception in 2002, first as a mentor, a role that grew and led to the nickname 'MOM' —'mentor of mentors.' In 2003, Griss became director of the Software Engineering program and eventually led the nascent Software Management program as well. Soon afterward, Griss became the associate dean of education and associate dean of research after bootstrapping the CyLab Mobility Research Center in 2008. He was named director of the Silicon Valley campus and associate dean for the College of Engineering (CIT) in 2009.

Griss' time at CMU-SV in these various roles has been characterized by immense growth. Carnegie Mellon's branch campus initially served solely part-time students and has since transformed into a thriving intellectual community that has produced over 700 alumni and is welcoming the largest incoming class of full-time students to date in fall 2013. "In 2006, there was a very real sense of, 'are we going to make it?'" explained Griss. "We've really accomplished the promise that we saw back then."

"While serving as director of the Silicon Valley campus, Martin helped effect a number of important changes to the campus," said CIT dean James Garrett. "We began offering MS and Ph.D. degrees in Electrical and Computer Engineering, as well as a bicoastal MS in partnership with the Information Networking Institute; a Disaster Management Initiative was launched; and the CyLab Mobility Research Center was created."

The former dean of CIT and currently chancellor of the University of California, San Diego, Pradeep Khosla, who worked closely with Griss on many of these initiatives, praised him as "a man of great vision and commitment." Khosla continued, stating, "Under Martin's leadership, Carnegie Mellon's Silicon Valley campus has grown and become more vibrant. It was a pleasure working with him because he is extremely collaborative and creative, and focused on solving problems that advanced CMU and the College of Engineering's mission and vision."

The growth of the research program during Griss' time as director has resulted in notable collaborative projects with NASA, a key partner of the campus since 2001. "About a third of our research scientists are NASA-affiliated," said Griss.

"Martin has made CMU-SV relevant to the daily lives of many Silicon Valley leaders and organizations," noted Michael Marlaire, director of NASA Research Park. "His willingness to engage others and share his expertise on a host of initiatives has made CMU-SV a key component of the world-class Silicon Valley innovation ecosystem. NASA Ames Research Center and the NASA Research Park in particular owe Martin a great debt of sincere appreciation for his efforts."

Griss serves as director of the Disaster Management Initiative (DMI), created from the development of the Mobility Research center. The DMI ran its third workshop in fall 2012, which resulted in several published papers, the release of an influential report on the San Bruno fire, several proposals and new relationships with FEMA and emergency management organizations in Mountain View, Palo Alto and Menlo Park.

As the campus has matured, the CMU-SV community has become defined by its emphasis on innovation, entrepreneurship and real world learning. "The students who come here want that hands-on approach to learning," Griss commented. "They also want to be in Silicon Valley and fully take advantage of the opportunities to innovate in the center of tech innovation. They possess that entrepreneurial spirit that we really value; they want to invent and create and I think that makes our campus a little different from other universities." Griss has continued to teach and advise several masters and Ph.D. students throughout his tenure as director.

"As an advisor, Martin has always been incredibly supportive and encouraging," said Faisal Luqman, a Ph.D. candidate who will defend in December 2013. "I always feel that I come out of every interaction with Martin with something valuable, having gained new insights, and learned to analyze things from different perspectives. I'm very grateful to Martin for believing in me and enabling me grow as a researcher and as an individual."

The Ph.D. program will graduate its first students this summer and continues to produce innovative research that is recognized in notable conferences and journals. From the masters programs, already over a dozen start-ups have spun out of the campus' students and faculty, and the MS Software Management program in particular nurtures the ideas of budding entrepreneurs while connecting them to the Silicon Valley venture community.

"I've been very privileged to have been a part of the campus' development of a robust research program and full-time student population," said Griss. "I think we're poised to do even more in our next five year phase. The synergy that takes place in this melting pot for doing collaborative things is something you can't get everywhere. We're small, creative and collaborative and we can do great things for CMU and our surrounding community through that."

"With Martin's guidance, the campus has grown and strengthened relationships with local industry, faculty, staff, alumni, donors and the Pittsburgh campus," praised Garrett. "I sincerely thank Martin for his leadership of the Carnegie Mellon University Silicon Valley Campus and welcome him back to the CMU-SV faculty." Dean Garrett will appoint a new director of CMU-SV, to be announced this summer.

CMU-SV held a reception for Griss on August 10 at the Fourth Annual Technology Showcase and Alumni Reception.

Space Artists Converge on the NASA Research Park

by Taksha Staff

Taksha University, in collaboration with Singularity University, Carnegie Mellon University, SETI Institute, and the Zero Gravity Arts Consortium, organized the fourth International Space Arts Workshop (ISAW4) on May 20–22, 2013 at NASA Research Park. Co-chairs Profs. Lowry Burgess and Frank Pietronigro, and Adarsh Deepak, Ph.D., invited an impressive group of internationally renowned space artists to discuss the Space Art community's direction, message, and momentum in the emerging commercial space community and planning for Space Arts Workshop in 2014. There were over 45 participants on site, and more joining in online via Google Hangouts.

2013 ISAW4 Space Art Exhibit at the SETI Institute curated by Jean-Luc Soret

On Sunday, May 19th, there was a pre-workshop Yoga Therapy session led by Dilip Sarkar, M.D., FACS, (Chair, TU School of Integrative Medicine (SIM), co-chair, with Dr. Joan Vernikos TU workshop on "Space Health, Aging, and Yoga Therapy: Metabolic Changes" (http://www.yogaforspacehealth.com/)).

The next Monday, May 20th, energized participants kicked-off the workshop with presentations on diverse topics ranging from co-chair Lowry Burgess on his "Lunar Art" project, to Bettyann Kevles (Yale University) on "Art in Space and Art about Space" to Virgiliu Pop (Romania) on "Rockets, Astronauts, and Shrines." After the morning talks, the participants broke into working session PODs. The eight PODs were directed to establish roadmaps with defined goals for their projects, such as, "Space Arts Archives", "Space Art Financing and Economics", "Space Messaging: Art to Inspire Space Exploration", and "International Space Development Conference 2014 (ISDC2014) Arts in Space Track Programming". When the workshop ended for the day, the artists moved to the SETI Institute, Mountain View, CA, to view the Space Art Exhibit curated by Jean-Luc Soret (Paris). The exhibit was well-received with a healthy turnout from the public.

On May 21st, the workshop continued with presentations from Jok Church (creator of TV edutainment show Beakman's World), and Tetsuro Fukahara (from Tokyo Space Dance). The POD discussions were mixed with more presentations, such as from Dr. Yvonne Clearwater, who described NASA's Art Space program. Artist Nelly Ben Hayoun (Director,

Co-Chair Adarsh Deepak, PhD, speaking on transforming his solar aureole experiment into an art piece

International Space Orchestra (ISO)), after her impressive ISO performance with musician Beck at San Francisco's Davies Hall on May 20th, gave examples of performance arts. Co-chair Frank Pietronigro, who had flown one of the first art projects in the reduced gravity parabolic flight, announced his next project, Space Wishes, on his planned XCOR suborbital flight in 2014. Most of the ISAW4 attendees gathered for an enjoyable symposium dinner in Mountain View to reflect on the progress of the workshop and give cheer to continuation of its success.

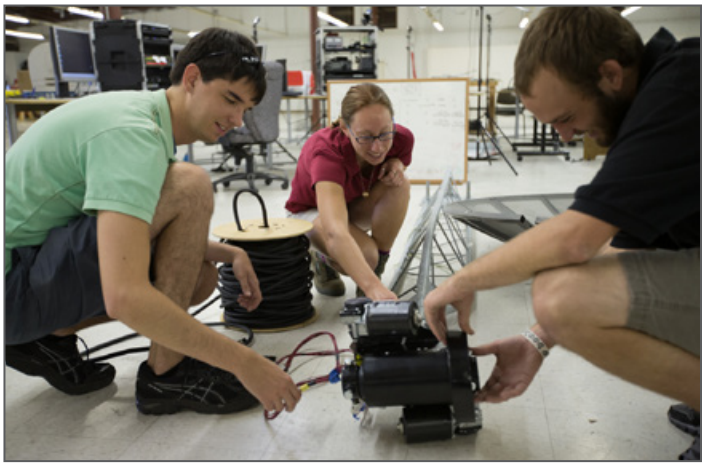
The final day opened with selected POD speakers presenting their POD's resolutions and working plans to continue their dialogues post workshop. Afterward, participants tuned-in to thought provoking keynote speeches from NASA Ames Research Center Director Simon (Pete) Worden, PhD, and Singularity CEO, Rob Nail. When the workshop concluded, refreshed and inspired, the PODs dispersed from of the Research Park with new connections and directions for taking Art to Space.

A group of Swedish innovation specialists visited NASA Research Park on June 7, followed by a visit to Ames Research Center on June 10–11. NRP Director Michael Marlaire provided an overview of the NRP. Marc Cohen, President of Astrotecture, an NRP partner, and Fredrik Bruhn, CEO of AAC Microtec, a Swedish based company located in the NRP, provided briefings. NASA Ames Research Center Director, Dr. Pete Worden, is pictured in the center.

CREST/SCU Program Recognized by the National Academy of Engineering

by Christopher Kitts

Photo by Mike Rasay



Santa Clara University students Tom Hoye, Jasmine Cashbaugh and Jimmy Erskine work on a new satellite tracking system for supporting mission control activities with NASA Ames spacecraft such as the currently orbiting O/OREOS satellite.

In a new National Academy of Engineering publication entitled "Infusing Real World Experiences into Engineering Education," NRP partner Santa Clara University is recognized as one of the nation's exemplar programs in incorporating real world engineering experiences into their curriculum. Much of this program is run by the School's Robotic Systems Laboratory, which is the lead organization in CREST (Center for Robotic Exploration and Space Technologies), a multi-institution collaborative housed in Building 554 in the NASA Research Park.

"One of the premier aspects of this real world engineering program is our decade-long collaboration with NASA Ames Research Center in providing mission control services for a series of small satellite missions," said Mike Rasay, an SCU staff member and doctoral student, and the Ground Segment Lead for many of the Ames missions. "SCU students, staff and faculty develop all mission control center and communication station facilities and command and telemetry processing software. This provides a rich set of opportunities for students to participate in real NASA space missions, to interact with industry professionals and to engineer mission-quality systems."

SCU has been a mission partner with NASA Ames on numerous successful missions, to include GeneSat-1, PharmaSat, NanoSail-D2, and O/OREOS. The SCU team is currently working with Ames scientists and engineers on several new missions: SporeSat, EcAMSat and EDSN. Several other academic institutions have contributed to this program, to include Ohlone College, Saint Louis University, Worcester Polytechnic University and Baylor University. These schools have participated with students developing telemetry processing software and by hosting remote communication stations at their campuses across the country.

The SCU Robotic Systems Laboratory conducts a number of other real world engineering activities that contributed to the NAE recognition. Several of these activities involve marine robotic systems that are also developed in the CREST/SCU facility in the NASA Research Park. Examples of these include an automated bathymetric mapping boat that is used in Lake Tahoe and several other inland bodies of water in support of U.S. Geological Survey and Monterey Bay Aquarium Research Institute activities, tethered underwater robots that have been used to support science missions with NOAA and the US Navy, and a small fleet of kayaks that have been used to demonstrate advanced control techniques for the National Science Foundation.

Photo by Mike Rasay

Santa Clara University students Anne Mahacek, Tom Hoye and Jimmy Erskine adjust a tracking beacon on the Triton underwater robot, which is being prepared for a mission in Lake Tahoe with scientists from the U.S. Geological Survey.

Santa Clara University and the Space Portal Team Up for Aerospace Innovation Events

by Christopher Kitts

During the Spring 2013 academic quarter at Santa Clara University (SCU), the SCU School of Engineering conducted a series of extra-curricular innovation/entrepreneurship activities with the NASA Ames Space Portal as their partner. Activities included a seminar by Ames Portal personnel Dan Rasky and Bruce Pittman on new initiative in the commercial space industry, an informal lunchtime chat with a topic of the future of the US space program, a tour of NASA Ames, a mentoring reception with more than 50 students and industry engineers, and a video competition that included a $2,000 grand prize. More than 25 students entered the video competition, which challenged students to create a 1-minute YouTube production that stated the value proposition of space, that highlighted exciting developments in the rapidly evolving commercial space market, and which expressed a vision for NASA's future role in space.

SCU conducts a series of these extra-curricular innovation/entrepreneurship activities every quarter with different industry partners throughout Silicon Valley. This is done as part of the School's involvement in the Kern Entrepreneurship Education Network (KEEN) program; KEEN is a group of about 20 universities across the country supported by the Kern Family Foundation and with a common interest in improving the entrepreneurial mindset of undergraduate engineering students. Previous industry partners have included companies such as BMW and Nvidia. According to SCU program director Dr. Christopher Kitts, "These extracurricular activities provide an exciting way to engage students outside of the classroom, to provide them with opportunities to interact with industry engineers, and then challenge them to complement their engineering knowledge with an entrepreneurial way of thinking."

NASA's Newest Virtual Institute Celebrates First Anniversary

by Deborah Bazar

The NASA Aeronautics Research Institute (NARI) is celebrating its one-year anniversary in 2013. NASA's youngest virtual institute has had an exciting and busy first year, which includes funding over 76 aeronautics and aviation projects—both within and outside of NASA—each meant to develop innovative and cutting-edge concepts and ideas. Located in NRP's historic Building 17, NARI was officially established in March 2012 to pursue NASA's Aeronautics Research Mission Directorate's (ARMD) objective to make deliberate investments in early-stage and potentially revolutionary aviation concepts and technologies. The Institute represents a new approach to introduce fresh lines of research into existing ARMD Programs and Projects. Additionally, the Institute manages prize competitions on behalf of ARMD that promote creative solutions and harness innovation from citizen inventors, academics, and entrepreneurial firms.

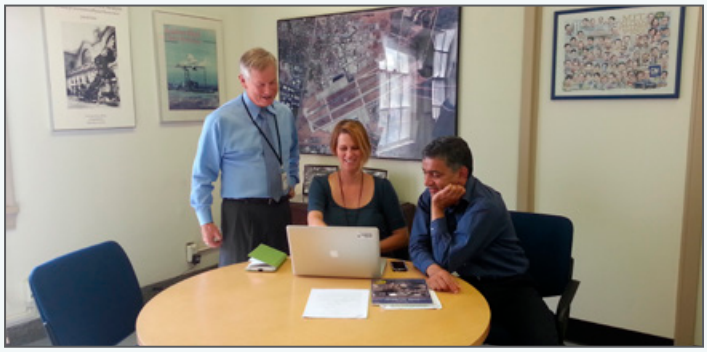
Seedling and LEARN Funds

NARI manages the Seedling Fund, providing NASA civil servants the opportunity to perform research, analysis, and proof-of-concept development of novel ideas that have the potential to meet national aeronautics needs.

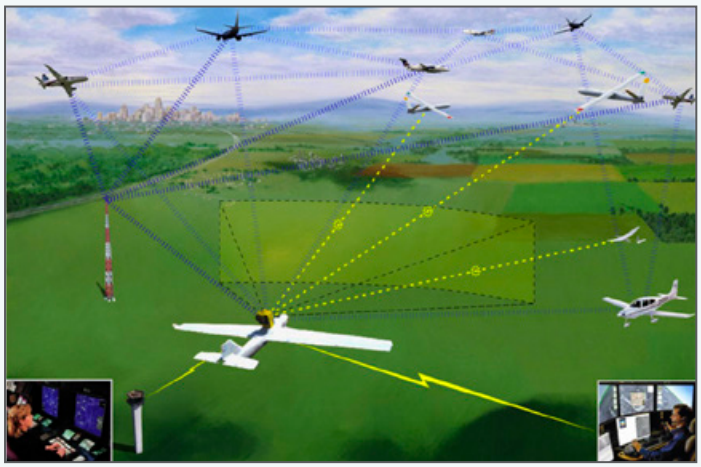
The Fund provides resources for early-stage efforts, with the goal of infusing promising ideas into the ARMD research portfolio or into NASA's Small Business Innovation Research program for further development. Only NASA civil servants are eligible to lead the Seedling research teams. The Leading Edge Aeronautics Research for NASA (LEARN) Fund is complementary to the Seedling Fund and has similar goals, but it invests in innovative ideas from outside the agency. LEARN is open to all domestic researchers.

In May 2013, NARI introduced the Seedling and LEARN Team-Based Fund solicitations, representing the next step for the new Institute. The Team-Based Funds were created to encourage multi-disciplinary teams from across different organizations and institutions to work collaboratively on larger-scale revolutionary aeronautics concepts. The approach is akin to NARI's sister institutes, the NASA Astrobiology Institute and the Solar System Exploration Research Virtual Institute, where research teams use virtual technology to work together, collaborate, share ideas, and discuss results of their research from almost anywhere, at any time.

These virtual meeting capabilities are put to work by NARI during its annual technical seminars. In July 2013, NARI hosted the second ARMD Seedling Technical Seminar, which showcased the results of the 2012 Seedling Fund recipients. The three-day seminar featured seventeen presentations and technical discussions with NASA program management, as well as active participation from the virtual audience with questions and comments submitted through chat and teleconference. Recordings of the presentations, as well as general information about the Seedling and LEARN Funds, can be found at the NARI website: http://nari.arc.nasa.gov/



(L-R): Michael Dudley, NARI Director; Deborah Bazar, Special Projects Lead; Koushik Datta, Seedling Fund Manager



Artist's conception of the Unmanned Aircraft Systems Airspace Operations Challenge (UAS AOC).

Centennial Challenges

NARI is working with NASA's Space Technology Mission Directorate's (STMD) Centennial Challenges prize program to manage the Unmanned Aircraft Systems Airspace Operations Challenge (UAS AOC). NASA's Centennial Challenges seek unconventional solutions to problems of interest to NASA and the nation. Competitors have included private companies, student groups, and independent inventors working outside the traditional aerospace industry. Unlike contracts or grants, prizes are awarded only after solutions are successfully demonstrated. The UAS AOC, announced earlier this spring, is a collaboration between NASA, the Air Force Research Lab, the FAA, and Development Projects Inc. (a non-profit in Dayton, Ohio selected from among many proposals to partner with NASA under a Space Act Agreement). The challenge is focused on developing and demonstrating key aviation technologies, particularly the ability to sense and avoid other air traffic. This will make it possible for robotic aircraft to operate safely in the same airspace as piloted aircraft. NASA STMD is providing a $500,000 prize purse for the first phase of the competition. The challenge is currently planned for May 2014. More information can be found at the UAS AOC website: http://uasaoc.org

Summer Students

One of the best ways to capture and incorporate fresh perspectives and new ideas is to work with the many talented student interns who spend their summers at NASA. Partially funded by NARI, the Aeronautics Academy pairs exceptional undergraduates and graduate students with NASA mentors in their area of study. One team of students is working with NARI staff to develop a Student Seminar Series, featuring one-hour weekly talks from aeronautics researchers within and outside of NASA. The seminar is free and open to all. More information is found on the Student Seminar page on the NARI website: http://nari.arc.nasa.gov/summerseminar

With the successful conclusion of its first year, NARI looks forward to growing and expanding its projects, portfolio, and contributions to the aeronautics community in the many years to come.

First Field Simulation of the Human Exploration of Near-Earth Asteroids, Phobos, and Deimos

by Pascal Lee, Chairman of the Mars Institute, a senior planetary scientist at the SETI Institute, and Director of the NASA Haughton-Mars Project at NASA Ames Research Center.

As NASA envisions deep space human missions to Near-Earth Asteroids (NEAs) and to the two moons of Mars, Phobos, and Deimos, a team of researchers from the Mars Institute, the SETI Institute, NASA Ames Research Center, and the space robotics company Honeybee Robotics, recently carried a first series of field tests aimed at investigating how humans will explore, and work on, these small bodies.

From 13 to 15 April 2013, field experiments were conducted at the U.S. Army's National Training Center (NTC) at Fort Irwin, California, to evaluate geotechnical methods and systems that will enable humans to be productive explorers in the low gravity environment of small rocky worlds. Human missions to NEAs and to the moons of Mars present us with the exciting challenge of exploring planetary bodies with extremely low gravity. Even on the largest NEAs (433 Eros and 1036 Ganymed) and on Phobos (the largest of Mars' moons), surface gravity is over 1,000 times weaker than on Earth. The goal of our field test was therefore to learn how to characterize the physical properties of small body surfaces, and to test ideas that might enable humans to more productively explore their low-gravity environments.

Our Mojave field test included three investigations: 1) a study of whether conventional field tools commonly used to characterize the mechanical properties of soils on Earth are suitable for small bodies; 2) an evaluation of how different anchoring systems might allow

Simulation cont'd on page 20

Photo by First Canyon Media

Pascal Lee (SETI Institute and Mars Institute) (left) measures the bearing capacity of gravelly soil at Asteroid Hill, National Training Center, Fort Irwin, California, using a static cone penetrometer, while Kris Zacny (Honeybee Robotics) drives an anchor into the same material to evaluate the system's design and performance. These field tests will help design surface exploration systems optimized for the exploration of Near-Earth Asteroids, Phobos, and Deimos. 14 April 2013.

Mars Institute: Educating Future Mars Explorers

by Pascal Lee, Chairman of the Mars Institute, a senior planetary scientist at the SETI Institute, and Director of the NASA Haughton-Mars Project at NASA Ames Research Center

Inspiration

Do you remember how you first got interested in space? Was it a childhood visit to a planetarium, a sci-fi movie or TV series, a space toy, or maybe a book about planets? For me, it was all of the above, and also the era I grew up in. I was born in that first decade of human spaceflight that succeeded in landing humans on the Moon and returning them safely to the Earth. Working in space just seemed like a no-brainer.

The Apollo program did not only spawn a wave of space scientists and engineers. It inspired a whole generation in all STEM (Science, Technology, Engineering, and Mathematics) fields, which has gone on to becoming the foundation of our current tech-savvy society.

For many of us at the Mars Institute, the human exploration of Mars is the new Apollo, in that such a goal, if embraced, would undoubtedly inspire a new generation of scientists and engineers. There's just no denying the power of Mars. *Curiosity*'s landing last summer riveted the public worldwide, and now *Inspiration Mars*, the privately-initiated project to send a crew of two on a free return trajectory to Mars during the launch window of January 2018, is starting to take the world by storm.

The purpose of Apollo was of course not Moon rocks. Science on Apollo was excellent, but merely a collateral benefit. What was really gained was an advantage of global strategic importance for the nation: the demonstration of what a free society can achieve, and the building of foundational technological know-how. Apollo was a game-changing investment that created a surge in STEM competency, a tide that continues to serve the nation to this day.

But cutting-edge know-how does not stay sharp forever. As Apollo recedes ever further into history, a new generation needs to be inspired. Going to Mars would once again spur competency in all STEM fields, and thereby serve the national interest like no other endeavor could. It would be both exciting and critically useful for us. And now is the time.

Mission: Mars

According to the most recent *Trends in International Mathematics and Science Study*, an international assessment of 4th and 8th graders, the United States continues to lag behind many countries in both math and science. For example, the average science score for American fourth graders ranks sixth out of 45 nations, and 8th graders rank tenth out of 38.

Pascal Lee and the Mars Institute's Moon-1 Humvee Rover visit science teacher Michael Wing and his students at Sir Francis Drake High School in San Anselmo, CA.

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In 2009, the Obama Administration launched *Educate and Innovate*, an initiative aimed at strengthening the nation's competitiveness in STEM fields, in particular by getting K-12 students more engaged and better prepared in STEM education. The idea is to bring kids up to the top and keep them up there.

The Mars Institute (MI) has taken action to contribute to this effort. MI was founded in 2002 as a non-profit research organization dedicated to advancing the science, exploration, and public understanding of Mars. For its first 10 years, MI's education efforts have focused on multiplying face-to-face visits to K-12 schools, and on involving undergraduate and graduate students in research projects, including in fieldwork at remote Mars analog locations such as the Haughton-Mars Project site on Devon Island in the Arctic. Research projects sometimes engage high school kids as well. For instance, MI has been supporting a global study of microbial growth underneath rocks led by Michael Wing, science teacher at Sir Francis Drake High School in San Anselmo, CA.

As we step into a new decade, MI is intending to broaden its focus and lead new education initiatives that will reach out to many more students, in particular to educate, inspire, and impact many more kids in grades K to 12.

MI's latest education project: a non-fiction children's book on the human exploration of Mars. Titled *Mission: Mars*, the book is aimed at kids aged 9 and up. Visually driven, it takes readers through Basic Training to become Future Mars Explorers. Developed with editors at Scholastic, the world's leading publisher of educational children's books, the book aims to be both an indispensible teaching tool for teachers and an exciting, inspiring read for kids. The book contains fun, accessible examples of STEM, and frequently points to exciting research done by the Mars Institute, the SETI Institute, and NASA.

Beyond *Mission: Mars*, MI plans to continue its educational outreach efforts through many other high-impact projects. There is still a long road ahead to get humans to Mars, but we're going, taking kids and teachers with us, and not looking back. New partners interested in joining the Mars Institute on this journey, welcome!

Mission: Mars **aims to excite kids about science and exploration. Available in September 2013 at www.scholastic.com/missionmars**

Tim Draper, Bloom Energy's Sridhar: Why Now is the Perfect Time to Start Up in Japan

by Lauren Hepler, Economic Development Reporter, Silicon Valley Business Journal

San Francisco-based mobile payment startup Square started swiping credit cards in Japan two months ago. Bloom Energy Corp. is about to start selling its power-generating Bloom Boxes in Japan.

Advocates of U.S.-Japan business ties are hoping to build on these relatively isolated but promising expansions by fostering more startup activity. That's both in the form of home-grown Japanese entrepreneurship and by encouraging more American startups to jump into the market.

The Japanese startup cheerleaders include some serious Silicon Valley venture capital muscle.

"The Japanese economy has been flat for a very long time," said Draper Fisher Jurvetson co-founder Tim Draper at the 2013 Japan Innovation Awards held Friday by the Japan Society of Northern California and Stanford's U.S. Asia Technology Management Center at Stanford University. "Now is the time for the entrepreneurs to soar."

Japan's economy remains sluggish, especially compared to neighboring China's recent explosive growth, with economists forecasting decades more of GDP stagnation, according to University of Pennsylvania research. But on top of Bloom Energy and Square, incubators have started popping up in tech-savvy Japanese cities. Prime Minister Shinzo Abe's economic philosophy of "Abeonomics"—a combination of government spending, looser regulation and a goal to increase foreign investment—is also bolstering Japan optimists.

Draper himself has helped establish the Draper Nexus venture capital firm, with offices in Silicon Valley and Tokyo dedicated to funding Japanese entrepreneurs. The firm is part of DFJ's international network of independent venture firms. For Bloom Energy CEO KR Sridhar, whose company was honored with an award at the event Friday, the big Bloom opening in Japan came just last week.

Japanese investment company SoftBank teamed with Bloom Energy, each chipping in $10 million to create Bloom Energy Japan Ltd. The new international arm of the Sunnyvale business will market its Bloom Boxes—fuel cells that generate power from natural gas – to the Japanese market.

The expansion was spurred by an energy shortage in Japan after the 2011 earthquake, tsunami and resulting nuclear disaster in Fukushima, after which the country's nuclear power plants were forced to shut down.

"Just imagine if one-third of all the power in the country had to be taken offline," Sridhar said at Stanford on Friday.

He explained that Japan's centralized power system left a void that he now hopes to fill with Bloom's distributed generation systems. In contrast to massive traditional power plants, Sridhar said small Bloom Boxes produce power on-site wherever they operate. Declining prices of natural gas make the company even more attractive to the Japanese market, he said.

The opportunity is "the confluence of not just an innovation, but the market forces, the market dynamics all converging toward a solution" for Japan's energy shortage, he said.

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care about solutions, about mastering big, audacious challenges that are impossible, like sending people into space and bringing them home safely. Creating revolutionary new technology that changes the way we live and work happens every day here at NASA. We need to apply this ingenuity and capability to the challenges of our planet," Grossman said.

Space Portal Director Dan Rasky, citing "undeniable impacts of global industrialization—Arctic sea ice loss, fertile plains' drought, tornadoes in Oklahoma and Texas, and new milestone concentrations of CO_2" opened and moderated the first panel who "Set the Stage and Scope of Challenges."

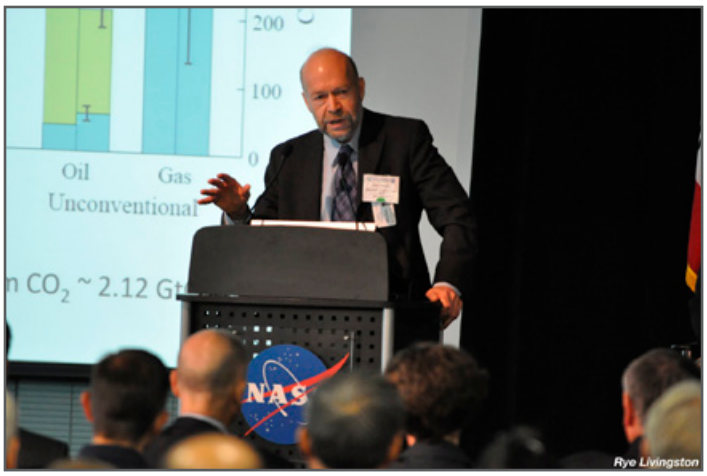
Dr. Waleed Abdalati, former NASA Chief Scientist, now Director of the Earth Science and Observation Center, University of Colorado, Boulder, detailed signs of a warming planet and tangible implications. "Polar ice melt is on the rise substantially. This is a meteorological event, but happening against a backdrop of warming. We are moving from older, thicker ice cover to a new regime of newer, thinner ice cover. Humans have never known a time when the Arctic has no ice. The changes associated with this, we don't know, but it is like taking a sledgehammer to the Earth's climate system. Ice melt can make sea level rise fast." Abdalati's admonition: go to climate.nasa.gov, and read graphs consistently.

Dr. James Hansen, considered the world's best climatologist and former Director of NASA's Goddard Institute for Space Studies, quantified the severity of Earth's energy imbalance, saying data shows we cannot burn even current fossil fuel reserves without extreme risk to our planet. "We would be handing our children a system where sea level is going up and would be out of their control. Once the ocean is heated, it does not cool off for centuries."

Hansen's plan: "To stabilize climate by the end of the century we need to reduce fossil fuel emissions 6%/year. Governments are ignoring this. As long as fossil fuels are the cheapest energy, somebody will keep burning them. They are heavily subsidized and the human health effects of air and water pollution, and climate effects, are borne by the public. We need to collect a fee on fossil fuels at the domestic mines and ports of entry. This money needs to go to the public. If fossil fuels are properly priced, the market place will find the best substitutes. This will stimulate the economy and innovation."

"We are in the greatest extinguishing of species since the dinosaurs died off 65 million years ago," said Professor Anthony Barnosky, Integrative Biology, University of California, Berkeley. Barnosky, summarizing the Call to Action, cited an incredible extinction crisis, climate change, population growth, loss of diverse ecosystems, and pollution as the "big global problems we face, but can fix if we act today." Air pollution alone, he said, kills six million people a year. "If you count the number of days lost to work and productivity from environmental contamination, it is more than malaria, AIDS and tuberculosis combined."

Barnosky initiated the Scientists' Consensus on Maintaining Humanity's Life Support System in the 21st Century—Information for Policymakers Document, endorsed by CA Gov. Brown at this Summit. Barnosky is hopeful. Humanity reacts, he said, when they know the big problem. "At the beginning of WWII, the U.S. produced 3000 airplanes, seven years later, we produced 300,000 planes. It took the U.S. eight years to go from no manned space program to putting a



Dr. James Hansen, world-renowned climatologist and former Director of NASA's Goddard Institute for Space Studies

person on the Moon. As for replacing infrastructure—it took 20 years to rebuild from devastation of WWII, and in 50 years, we built enough roads to go around the Earth twice." What it takes, Barnosky says—recognize the need; individual initiative (which Silicon Valley and the world have in spades); technology and infrastructure (we can do); and bottom up and top down cooperation.

Bannie Bannerjee, Director, Stanford's Change Lab, teaches innovation and design methods for ill defined problems at the lab, which aims to initiate rapid, large-scale transformation in the complex issues of water, energy, climate change and social inequity. The global score card, said Bannerjee, illustrates our propensity for short-term versus long-term interests. "We are in a crisis of commitment, direction, means and application. Our systems are integrated. Our solutions are piecemeal, but our problems are not. We are driven by growth and finance, with social issues secondary. This force pulls our global systems apart. We need leveraged interventions that can scale, have impact, and be in time."

Following the panel, the Honorable Gov. Brown issued an inspired plea to media, citizens and policy makers to make climate change a priority, as he officially launched the Call to Action at the WEST 2013 Summit. Visit http://mahb.stanford.edu for the Executive Summary. "We are in a contest here for ideas," he said. "Newspapers don't talk about oil, they talk about fracking, housing developments or the super bowl. These are not linked to the message here that we are part of a system. The 400 ppm (CO_2 concentration) did make the top of the fold right hand side of the NY Times one day, but where was the follow up?"

Dr. John Hogan, NASA Ames Bioengineering Branch, who makes life support systems for small spacecraft, opened the "Life Support Systems of the Planet" panel saying "Earth is the most elegant Life Support System I have seen. Life itself is Earth's life support." Noting the UN's Millennium Ecosystem Assessment finding that 2/3 of Earth's life support systems are in decline, Hogan stated that our human made life support systems are damaging Earth' basic systems, that we need to align human made systems with Earth's life support systems—making them like the Earth's—regenerative, with total recycling.

Panelist Wes Jackson, Founder and President, The Land Institute, Salina, Kansas, a foremost expert in "wild" agriculture, compared

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today's challenge to the high moral vs legal conflict prior to the U.S. Civil War. He focuses on the ecological stability of natural grasslands, as well as a high grain yield. "We are living with the illusion we can improve on the biosphere. We are losing 30 million acres a year worldwide due to degradation of agricultural lands. Planting annuals is like clear cutting every year. Soil is more important than oil!" he warned. Jackson promotes planting perennials with elongated rooting depths, saying the plough has destroyed more options for future generations than the car. The only true economies are nature's economies, of forests, meadows, he said.

Dr. Forrest Melton, senior research scientist, CSU Monterey Bay, NASA Ames, uses remote sensing, high-end computing and data visualization (using NASA Earth Exchange architecture) to aid growers with optimal water use. "We turn satellite data—NASA has about 17 Earth observing platforms—into information products for growers, partnering with over 100 growers, including the Western Growers Assoc." Accurate information, Melton said, accelerates innovative solutions and can lead to win/win solutions.

Dr. Wallace J. Nichols, Research Associate, CA Academy of Science, co-founder of Ocean Revolution.org, dedicates his research to ocean health and the power of human connection. Falling in love at a young age with nature and turtles, he went to Mexico for graduate work, finding massive losses in turtle population. Forming a group with turtle hunters, he tracked "Adelita" across the entire Pacific Ocean, publishing hundreds of research papers. But science doesn't save turtles, policy doesn't save turtles, he said, people save turtles.

"Our GDP is $15 trillion. The ocean is downstream from our economy. We spend less than $2 billion on protection and restoring the ocean, from which comes life. We have an ocean crisis. We are overfishing. Leatherbacks, who migrate from Indonesia to California, are full of plastic. We have a plastic crisis - production outpaces disposal, and recycling doesn't really work. Our pharmaceuticals end up in the ocean. The wear on our clothes goes into our waterways and ends up in the ocean. We need to rethink our relationship with the ocean. In this golden age of neuroscience we need to pair up for research. We have a deep relationship with water. The ocean is inspiring. We go to the water to think, to relax, for fun. Stepping out to water—getting your blue minds on—builds healthy minds. Fishermen love water, people love seafood, people protect what they love, we love healthy ecosystems. Let's study the neuroscience of the L word—love."

Dr. Kristina Vogt, Professor of Forest Resources, University of WA asks "Why are we not moving forward? Our solutions for climate change are niche markets. We need to get the general public involved in the forest, in the soil. We need to target the loss of forests, and our consumption patterns. We need to invent a soil carbon bank. We have lost ½ the carbon in soil in agriculture. We need to start loving waste. We need to target where we invest in preserving forests, to invest in forests that are vulnerable, not just ones with conservation value. We need to combine information to assess tipping points. We need to make it locally based, so the general public can go outside and understand, and have skin in the game."

"We need to convert waste material into useful products, and pack carbon back into the soil. These are local solutions, but as a society we don't like local solutions, we are "tourists" in nature. Our kids have nature deficit. We need to develop renewable energy fuels and distributed infrastructure. Convert urban waste to methanol for fuel cell charging stations for electric vehicles. Over 1000 years ago Amazonian Indians started adding charcoal to the soil, which increased the carbon content in the soil, by two. We need to adopt the Native American business model, thinking about the Seventh Generation. For them, some things cannot be sold. We need to get dirty, love the waste, love the forests. We don't love the soil, we need to change this."

Students from the Redwood Academy of Environmental Leadership (REAL), James Ngaluola and Gabriel Mena, brought a surprise hit before lunch—cheering the crowd with an original rap song and video "Save the Fishes" (or One Bottle at a Time.) From Redwood High School, Redwood City, Gabe and Jay collaborated with teacher/musician Tom McFadden to make the music video about polluted creeks, wasted water, littering, and carbon footprints. Gabe, who helped write the lyrics, said that incorporating music into science is a good idea and can increase peoples' knowledge, that rapping about science is like another door for people to understand and remember the material. "Our message is about water conservation. Not many people would spread that through a rap song."

Photo by Rye Livingston

First place winner re.source sanitation co-founders (L-R) Kory Russel and Sebastian Tilmans with former Space Shuttle Commander Karol Bobko, CA State Senator Jerry Hill, and SSV Exec. Director Marianna Grossman.

Moderated by Jim Keene, Palo Alto City Manager, the afternoon panel "Solutions Implementation—Intelligent Integrated Infrastructure" featured Q&A with industry leaders in sustainability: Peter Graf, Chief Sustainability Officer & Executive VP, SAP; Rami Branitzky, CEO, GROK; Michelle McLean, Director, Product Marketing, Silver Springs Networks; and John Igoe, Director, Design and Construction, Google. Introducing Keene, Heyword Robinson, former mayor of Menlo Park, SRI senior scientist and SSV board member noted that seventy percent of greenhouse gas emissions are related to cities. Keene, taking the podium, declared "the City is the Solution." Cities are on their own (due to federal and state dysfunction), he said, they have to lead. Palo Alto now supplies 100% of electricity to the community in a carbon neutral form and has an ambitious Zero Waste program by 2021 (now almost at 80%), he said, likening Palo Alto to a scrappy 'start up city' aspiring to be America's greenest.

Asked what would make the biggest difference in an American city, panelists replied: "Public/private partnerships, collaboration and alignment of goals," said Google's John Igoe. Google (who has done so) also recommends signing up for former Pres. Clinton's initiative—20% reduction in energy, water and waste in two years. SAP' s Graf stressed the importance of getting the incentives right. At SAP financial optimizing and access to power encourages car sharing.

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NewSpace 2013 and AIAA Joint Propulsion Conference

Bruce Pittman (center) talks with former Indian President Dr. A.P.J. Kalam (right) and Kirby Ikin, Chairman (left) of the Board of the National Space Society, at the NSS International Space Development Conference that was held in San Diego on May 23-27.

The Space Frontier Foundation just wrapped up its NewSpace 2013 conference that was held in Silicon Valley on July 25-27 and attracted over 400 participants. This event featured presentations by NASA Deputy Administrator Lori Garver and NASA Human Exploration and Operations Mission Directorate head Bill Guerstenmaier (remote presentation). Both Gerstenmaier and Garver stressed the importance of public/private partnerships in their remarks. Dr. Dan Rasky and Bruce Pittman of the NASA Space Portal in the NASA Research Park both chaired sessions at the conference relating to technology development and transfer. Dr. Rasky's session focused on game-changing technologies that need to be developed to enable NASA to carry out its exploration mission while Pittman"s session focused on technologies that were being develop outside of NASA that could be "spun-in".

In addition to the Space Portal there were a number of other current or former members of the NASA Research Park that presented at the conference including:

Alex MacDonald – Program Executive, Emerging Space Office
Robbie Schingler – co-founder Planet Lab
Dennis Wingo – President, Skycorp
Dr. Brad Bailey- NASA Lunar Science Institute
Dr. Ioana Cozmuta – NASA Space Portal
Rex Ridenoure – Founder and former CEO of Ecliptic Enterprises
Dr. John Cumbers – Synthetic biologist at NASA Ames
Jason Dunn – CTO, Made In Space
Dr. Bob Richards – co-founder and CEO, Moon Express

The previous week the American Institute of Aeronautics and Astronautics (AIAA) held its 49th Joint Propulsion Conference which attracted over 1000 people to the San Jose Convention Center. Bruce Pittman was also involved in this conference. On July 16th, in his role as chairman of the AIAA Commercial Space Group, he led a panel discussion on reusable commercial space vehicles. On the panel were senior technical representatives from SpaceX, United Launch Alliance (ULA), Moon Express, and Firestar Technologies.

Verdigris Technologies Named Founder.org Winner

by Jessica Kinloch, Business Development
July 4, 2013

The nation-wide search conducted by Michael Baum, former CEO and Founder of Splunk, to find 10 top start-ups from among 500 applications has culminated with the selection of Verdigris Technologies. Verdigris was the only company selected from Stanford University. They had just completed a stint at StartX, the Stanford incubator when they were told of the news.

During the inaugural Founder.org search, 50 semi-finalists were spread among eight leading technology universities across the country. MIT had 14 semi-finalists, followed by 10 from UC Berkeley, seven from Stanford, five from UT Austin, four each from Penn and Harvard, and three each from NYU and Carnegie Mellon. Each of the 10 finalists will receive a grant of $100,000 from Founder.org, plus 12 months of mentorship.

Verdigris Technologies has developed an innovative product for enterprise buildings that allows them to see every electrical device being used in real time. This real-time data finally allows owners and occupants to interact with the buildings they are in, change their behavior, and verify those changes within seconds.

Mark Chung, Jonathan Chu, Jessica Kinloch, and Thomas Chung are the four founders of Verdigris Technologies, with alma maters spanning four of the universities: Stanford, Harvard, Carnegie Mellon, and UT Austin. Their team is growing rapidly: they are recently hired Chaitanya Sharma, a seasoned building engineer, and Andrew Jo, an amazing developer; they are also looking for additional Machine Learning and developers to address growing demand for Building.AI.

(L-R:) Jon Chu, Jessica Kinloch, Mark Chung, Thomas Chung, founders of Verdigris Technologies

Founder.org is committed to helping founders chase big ideas and foster economic innovation and growth. The kickoff event is going to be held August 6 in San Francisco at the Presidio Golf Club.

See more at: www.verdigristech.com and www.founder.org/100k/

Real-Life 'Star Trek' Tricorder Project Raises $1 Million

by Clara Moskowitz, SPACE.com Assistant Managing Editor

"Star Trek" fans may soon get a chance to have their own Dr. McCoy moment with the world's first real-life medical tricorder, which will be available to the public soon thanks to a crowdfunding campaign that raised more than $1 million for the Space Age technology.

On "Star Trek," Dr. Leonard "Bones" McCoy used a medical tricorder to scan patients and immediately diagnose their ailments. While the new real-life version, called the Scanadu Scout, is missing some of the features of its science fiction counterpart—namely the ability to make internal scans and complex diagnoses—it still can be a handy device for medical checkups on the go.

Within about 10 seconds of pressing the Scanadu Scout to your forehead with thumb and forefinger, the tool reads out your heart rate, temperature, oximetry (blood oxygen level), respiratory rate, blood pressure, stress and electrocardiography (ECG).

"It's the 21st-century version of the medical tricorder from 'Star Trek,'" said Scanadu founder and CEO Walter de Brouwer. "Basically it has a complete emergency room in there—when you go to the emergency room and they hook you up, the same readings you get out of [the Scout]. It's one more device out of 'Star Trek' that will see reality."

About a month ago, Scanadu started a crowdfunding campaign for the device on Indiegogo, hoping to raise $100,000. As of Monday (June 24), the company had raised more than $1.18 million.

The Scanadu SCOUT

Shortly before the campaign's one-month deadline, Scanadu decided to extend it for another month. The public now has until July 20 to order a first-generation Scanadu Scout for $199, before they are out in stores.

De Brouwer founded Scanadu out of NASA's Ames Research Center in Moffett Field, Calif. The Scout device even uses some real-life space technology as its operating system; the 32-bit RTOS Micrium platform was also used in the SAM instrument on NASA's Mars rover Curiosity.

De Brouwer said his invention was inspired by "Star Trek," and hopes over time the Scout will become more like the futuristic tool of the television series.

"If you look at the tricorder in Star Trek, it has four ideals: It is non-contact, it is non-cooperative—you may even be unconscious— it is non-sampling (doesn't take a sample of blood) and it is non-invasive," de Brouwer told SPACE.com. "The technology, probably in 10 years from now, will be built into our environment, so preventive medicine will almost disappear into the walls, into the fabric of our reality."

Early adopters of the Scanadu Scout will get to try the device out as an exploratory tool. In order to market the product as a medical device to the consumer market, the company will have to seek approval from the FDA. Scanadu plans to use experiences and data collected by its first customers to improve and understand the product in preparation for that stage.

"It's great that you can have a customer who pays but is also a developer and thinks with you, and at the same time you make a planetary effort to make this device come out of a movie," de Brouwer said.

Scanadu CEO Walter DeBrouwer (left) shows SPACE.com's Clara Moskowitz (right) how to use the Scout medical tricorder. Watch the video at http://bit.ly/12cAqvX

Turkish business and government delegation of 15 from the industrialized city of Konya visited the NRP on June 20, 2013. NRP Director Michael Marlaire provided an overview of the Park and the delegation visited Vasper System pictured here with Peter Wasowski.

A group of Finnish technology and business development specialists from the start-up portal Otaniemi.FI, and VTT Technical Research Center in the City of Espoo visited NASA Ames Research Center and NASA Research Park on June 13. Michael Marlaire, Director of NRP provided an NRP overview.

WEST Summit cont'd from page 13

People tend to NOT react to future threats, Graf said. SAP sees sustainability as transformational, he said, and creates software for transformational efficiencies.

McLean described Silver Springs intelligent sensors for energy networks, profiling an Oklahoma Gas and Electric (OGE) success. Deploying smart metering, OGE achieved a 30% drop in energy demand during peak performance (peaking plants are gas fired, dirty and expensive) by sending a price message to programmable thermostats "tomorrow at this time your energy costs will be $0.46/hr (normal rate $0.04/hr)." Branitzky, GROK CEO, said "we believe in fast data rather than stored (big) data. We recommend infusing smart into machine-to-machine communication. If intelligence is injected into the machine, it could predict what will happen next and optimize consumption."

The "Revolutionary Leadership and Breakthrough Results" panel, introduced by Marianna Grossman, the driving force behind this summit, was asked "what is the role of visionary leadership in driving change, and what is working in the international, national, corporate, venture capital and banking worlds?"

Robert Bishop, President and Founder, International Centre for Earth Simulation described his not-for-profit, neutral, based in Geneva, Switzerland, non-political, open science, open source code, open access publishing simulation-based discovery platform. "We are a catalyst to bring together natural and economic science, for a decision support platform. NASA is seen worldwide as a major source of knowledge and good will, but of all the data NASA brings to the table, only 20% of it is used." Bishop used Cascadia as an example- with 18 active volcanoes linked to subduction zones, a nuclear sub base in Puget Sound and a nuclear weapons site across the river.

Dr. Steven Zornetzer, Ames Assoc. Director – "We invigorated our workforce and galvanized awareness of sustainability when we built Sustainability Base (the greenest building in the federal government). At the agency and government level we are still trying to figure out our role. NASA should and will remain the provider of unassailable data. The rest of the government is moving slowly, but the GSA (the principle purchaser of commodities for the government, whose buying power far exceeds that of WalMart) has decided to buy green across the entire government. This will have a significant impact across society."

Kathrin Winkler VIP Corporate Sustainability, EMC Corporation – "Our customers are driving us to sustainability. In product acquisition – and IT serves every sector—our customers are asking what we are doing. As an industry, IT has formed Electronic Industry Citizens Coalition to set common standards and created "Green Grid" to resource efficiencies in IT. And our employees are driving us toward sustainability. The incoming workforce wants to work for a company consistent with their values, have a sense of purpose and know their role."

Mohanjit Jolly, Managing Director, DFJ – "Entrepreneurs are thinking big to change the world, every day." Jolly, who spent a decade in Silicon Valley and five years in India, said Silicon Valley is the innovation hub, and India is about the proliferation and impact of what is working. DFJ, who funded Elon Musk (Tesla, SpaceX, Solar City), also funded two Stanford students who created a solar lantern, moved to India and China, and have now touched 20 million lives. And the emerging markets are capturing the latest and greatest technology, he said, describing a Mumbai hotel with smart sensors deployed everywhere.

Vince Siciliano, President & CEO, New Resource Bank, San Francisco, CA– New Resource Bank is a mission-focused bank with the mission to build a more sustainable community. "We are seeing an explosion of young companies who are adopting a new style of running a business where financial and social objectives are paired. We are often asked, 'is there a trade off between doing good and profit?' The Global Alliance for Banking on Values (25 international banks) found sustainably-managed banks to have been more resilient in the last 10 years, with better returns on equities and profits. And we are beginning to see discussions of a more conscious capitalism."

Following the awards, State Senator Jerry Hill and former Space Shuttle Commander Karol Bobko closed the summit. Senator Hill, Chairman, Environmental Quality Committee – " This incredible summit today (I heard almost the whole summit on the news driving from Sacramento) . . . underscores the need for action and leadership in climate change . . . and the many faces of leadership that are needed . . . from NASA technology (as showcased in Sustainability Base) . . . to entrepreneurs. We all have the ability, and truly the responsibility, to step up. We must be vigilant and hold decision makers to a high standard to ensure a sustainable future. Some are burdened with lack of knowledge of what to do. The key is education. We must educate the decision makers and ourselves. We demand of you to hold us accountable. Inspire us to be better stewards of our environment. If the game is going to change, it will have to change here."

Bobko shared inspired observations from his colleagues – astronauts and cosmonauts – from their many days in orbit. When viewed from space, they say, the Earth is amazing and beautiful, looks fragile, and is a small place compared to the vastness of space. Astronaut Loren Acton, STS–51 " Looking onward to the blackness of space, sprinkled with the glory of a universe of lights, I saw majesty, but no welcoming. Below was a welcoming planet. There, contained in a thin moving, incredibly fragile shell of a biosphere, is everything that is dear. That's where life is, that's where all the good stuff is." Astronaut Ulf Merbold, STS-9, 42, Soyuz TM-19, 20 "For the first time I saw the horizon as a curved line, with a thin seam of dark blue light … not the ocean of air as I had been told. I was terrified by its fragile appearance." Sigmund Jahn, Soyuz 31, "Only when I saw our planet from space did I realize humankind's most urgent task is to cherish and preserves it for future civilizations. "

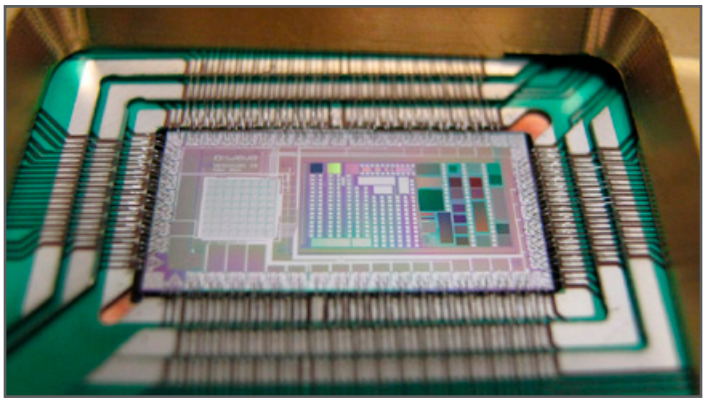
"With the many bright minds and capable hands engaged by this event—from the fields of science, engineering, business, government and public Policy—prospects are good that new solutions for planetary sustainability, eventually scalable to global application, can be identified. This event's "Show-Case of Solutions" featured some interesting first examples," said Space Portal Director Dr. Dan Rasky, co-host for this event.

"We are very pleased with the level of interest, as well as the broad engagement we've seen to date for this activity, including our Planetary Sustainability Collaboratory concept. We are hoping to add new members and demonstration projects to the Collaboratory as we proceed. The challenges of global climate change are indeed formidable, but so are the many individuals who attended this event, and others who have expressed interest in joining with us to address this important and critical challenge."

For more info visit:
www.sustainablesv.org/
www.nasa.gov/externalflash/sustainability-base/
bit.ly/16qKTCz

Quantum or Not, New Supercomputer is Certainly Something Else

by Geoff Brumfiel, National Public Radio



Google and NASA are betting that quantum forces are at work inside D-Wave's 512-bit chip.

It's exactly the sort of futuristic thinking you'd expect from Google and NASA: Late last week, the organizations announced a partnership to build a Quantum Artificial Intelligence Lab at NASA's Ames Research Center.

But questions surround the new type of computer at the lab's core. D-Wave Systems, the company that makes the machine, says it is a quantum computer—a machine that runs on the strange laws of quantum mechanics. But although the computer can solve a certain type of problem much faster than conventional computers, critics say that the company's claims are not supported by scientific evidence.

"It's not exactly science, what they're doing," says Christopher Monroe, a physicist with the Joint Quantum Institute at the University of Maryland. "It's high-level engineering, and I think it's high-level salesmanship, too."

The quantum computer is a giant black box, or more precisely, a black cube approximately 10 feet on a side. Inside is a refrigeration system that chills the guts to near absolute zero, and shields the workings to protect them from external radiation.

In this rarefied environment, the laws of quantum mechanics can come into effect. These quantum rules are pretty strange. Particles can be in two opposite states at once, and they can be intrinsically tied together through a process known as "entanglement." For example, two quantum coins could be in a state of heads and tails simultaneously, as though they were flipping through the air. If the two coins were entangled, reading "heads" on one after the flip would instantly tell you that the other was heads—even if it were on the other side of the galaxy.

The D-Wave Two computer has 512 quantum "bits," or units of information, in its supercooled central processor that can be entangled together, according to the company. The entanglement allows the computer to do things that a conventional computer can't. In particular, it's good at choosing between many different solutions to a problem, according to Geordie Rose, D-Wave's chief technology officer.

Here's (roughly) how it works: Just like quantum coins, the quantum bits exist in two states at once, and because they are entangled, that means the entire chip is simultaneously in many different configurations of "heads and tails." The quantum computer, in a sense, simultaneously tries every answer imaginable before settling on an efficient one. Running the computer just a few times will give a subset of highly efficient solutions. By contrast, a conventional computer would have to individually test millions or billions of solutions to find the right answer.

Rose says that the new machine won't always be better than a regular computer, but for machine learning and searching—activities both Google and NASA are interested in—the D-wave's computer could be far more effective.

"The best answer, or the highest or the lowest or the smallest or the meatiest . . . no matter what," Rose says. "If it's got an '-iest' at the end and you can write down a mathematical equation for what you mean about that, then you can attack it with one of our machines."

But proving exactly what D-Wave's computer does is tricky. Quantum states are highly sensitive to outside intrusion. The very act of trying to measure entanglement can easily destroy it.

There is solid evidence that the D-Wave machine is unusual. New research by computer scientist Catherine McGeoch at Amherst College suggests it can solve one particular kind of problem thousands of times faster than a regular computer. But McGeoch adds that the D-Wave Two was not measurably faster at solving two other types of problems tested.

And work from the lab of John Martinis, a researcher at the University of California, Santa Barbara, also seems to hint at quantum processes at work inside D-Wave's previous generation of quantum chip, the D-Wave One.

But Monroe remains skeptical. He believes that the D-Wave team has never demonstrated that entanglement is happening on the chips in its machine. He believes that D-Wave's supposedly quantum bits are actually working instead as tiny electromagnets. Those magnets, Monroe believes, could be interacting in ways to solve a certain problem very quickly without quantum mechanics. "There's no evidence that what they're doing has anything to do with quantum mechanics," he says. If he's right, then D-Wave's machine may be far more narrow in its abilities than the company believes.

D-Wave's Geordie Rose acknowledges the criticism, but says he believes that D-Wave's machine ultimately will also prove faster than conventional computers at solving the problems facing companies like Google, NASA and aerospace giant Lockheed Martin (which has also purchased a machine).

"What we do is build computers," Rose says, "and if we can build the fastest computers the world has ever known, you can call them whatever you like, and I'll be happy."

NASA ROSES Seagrass/Coral Reef Project: UAV Accomplishments

The NASA ROSES Seagrass/Coral Reef Project involved testing the use of unmanned aerial vehicles (UAV) technology to research changes in seagrass and coral reef biomes. The Project continues to be led by Principal Investigator Dr. Stanley Herwitz, working with his team of co-investigators specializing in coastal biology, marine remote sensing and optical oceanography. Dr. Herwitz is the Director of the UAV Collaborative, a NASA Research Park partner. Extensive airborne and water-based datasets were collected from representative seagrass and coral reef sites in Florida in 2012 and 2013. The Project showcased 26 UAV flights involving three different low-flying UAVs equipped with different payloads operating with Federal Aviation Administration (FAA) approval under Visual Flight Rules (VFR) in the National Airspace System.

The airborne data collection featured four UAV deployments to Florida. The first deployment in May 2012 featured MLB Company's fixed-wing Bat-4 UAV equipped with a Tetracam multispectral imaging system. The second deployment in October 2012 featured NASA's fixed-wing SIERRA UAV operating from the Key West Naval Air Station under an agreement with the U.S. Navy. The SIERRA acquired more than 320 gigabytes of data using a Galileo hyperspectral sensor. The third deployment in November 2012 featured the Bat-4 equipped with the Tetracam operating in the area of Cedar Key north of Tampa. These three deployments led to the completion of 14 UAV flights.

Following a series of pre-deployment test flights over south San Francisco Bay's Guadalupe Slough in April 2013, the fourth deployment to Florida in May 2013 featured Xtreme Aerial Concepts' Vision-II "jet-engine" rotorcraft UAV. Equipped with a downward-looking NovaSol hyperspectral imaging system, the Vision-II served as a slow low-flying stable platform, operating at less than 2,000 feet above sea level. Flight operations for the seagrass site were conducted along the shoreline of Sugarloaf Key, while flight operations for the coral reef site were made possible using a 40-foot floating barge positioned offshore in the protected Cheeca Rocks marine sanctuary. Twelve historic morning and afternoon takeoff and landing sequences of the Vision-II were conducted at these two sites, each lasting 30-40 minutes. The Vision-II acquired more than 500 gigabytes of data using the NovaSol hyperspectral imaging system.

NASA ROSES cont'd on page 19

Vision-II launched from shoreline and in flight over nearshore seagrass site in the Florida Keys.

Vision-II during flight preparation on barge over Cheeca Rocks coral reef site in the Florida Keys

Vision-II during flight preparation with yellow cable serving to initialize NovaSol hyperspectral imaging system;

Aerial view of Cheeca Rocks reef, the barge serving as the UAV launch pad, and the Project's associated research vessels.

NASA ROSES cont'd from page 18

The NASA ROSES Seagrass/Coral Reef Project achieved a collection of high-resolution airborne spectral data using UAV-based hyperspectral and multispectral sensors in synchrony with intensive field measurements used to characterize current biological conditions. The water-based data acquisition effort involved the use of leading-edge instrumentation. Of particular interest to the Project were processes that increase our understanding of the spatial distribution and vigor of seagrass, such as light-water interactions, the biogeochemical properties of the water column, benthic O2 and CO2 gas exchange, and biological productivity. Analysis of these extensive datasets is currently in progress.

NRP Partner SkyTran was featured in an article highlighting personal rapid transit systems as the transportation of the future in the July 2013 issue of Government Technology magazine.

Dr. Ann Clarke's last NRP IPT meeting prior to her retirement. (L-R): David Shiver (BAE), Mark Beskind, Rocci Caringello, Andrew Martin (Earth Resources Tech, Inc), Dr. Ann Clarke, Larry Singer (AECOM)

Singularity University's Graduate Studies Program

by Ralph Rogers

Participants in Singularity' Universities Graduate Studies Program

Singularity University is abuzz with the energy of 80 global participants in this year's Graduate Studies Program (GSP). The GSP is designed for leaders who want to build innovative solutions to Global Grand Challenges (GGCs). The GSP is held each year between June and August and allows students from around to do a deep dive into SU's atmosphere of innovation and exploration. This year, the participants represent 36 countries with only 6 of the 80 participants from the US.

The single largest component of participants' time is spent on the team projects, where students actively respond to the 10^{9+} challenge: how to positively impact a billion people within a decade.

The GGC areas addressed by the program (Food, Energy, Water, Health, Environment, Education, Poverty, and Security) represent problems affecting tens of millions to a billion or more people. The GGC categories are just a starting point—some problems may be easily identified as being a single GGC, while most will sit at the intersections of several challenges.

The GSP creates an unparalleled opportunity for participants to work together in international and interdisciplinary teams to address large-scale humanitarian challenges. Participants in this unique educational environment learn from each other, and from renowned experts in multiple disparate fields, in order to understand and apply these transformative, exponential technologies.

SU amplifies the focus on GGCs with nearly 400 hours of academic activities: classes, hands-on workshops, site visits, and collaborative teamwork activities. In addition to these scheduled events, students lead their own self-organized sessions, trips, and workshops.

At the mid-point of the GSP, participants form teams tasked with designing preliminary solutions addressing a challenge, and then work in teams to prototype, research, and develop solutions which can make a difference to the lives of a billion people.

Meeting the challenges is no simple feat, and not every solution will succeed, but many SU teams have taken their work out into the real world, creating lasting projects, companies, and organizations working towards their goal. Stay tuned for updates on this year's class as they complete their projects and then move on to starting companies and/or returning to their countries to continue their efforts to change the world.

Singularity University was featured on in Bloomberg TV's show, BRINK, on June 4, 2013. Watch the video at http://bloom.bg/15BMOml

Simulation cont'd from page 10

Photo by NASA

Pascal Lee (SETI Institute and Mars Institute) (right) and Sgt Andre Pearson (U.S. Army, NTC) conduct "small body" geological sampling in simulated spacesuits while anchored and tethered on a steep boulder slope at Asteroid Hill, National Training Center, Fort Irwin, California. 15 April 2013.

robotic spacecraft and astronauts to remain safely bound to a low gravity body, and yet allow them to explore laterally; 3) a study of how astronauts might conduct geological sampling on a small body while using anchors and tethers. Analyzing in detail and understanding how conventional civil engineering methods and systems perform in natural settings on Earth before adapting them to the exploration of small bodies is an important first step.

The Mojave field test was carried out on a small rocky hill at the NTC with many exposed blocks of weathered granite called tors. The site, now named "Asteroid Hill", is reminiscent of the blocky surface of Near-Earth Asteroid (25143) Itokawa, which was explored in 2005 by Japan's Hayabusa robotic spacecraft. While neither the composition of the rocks nor the gravity at Asteroid Hill are similar to what they are on NEAs, the relevance of the site resides in the similarity in terrain texture (gravel and block abundance and sizes), topography, and scale between Asteroid Hill and Itokawa.

Asteroid Hill is indeed an interesting analog site for planning future NASA robotic and human asteroid exploration, as it not only resembles the surface of the only sub-kilometer NEA explored by spacecraft to date, Itokawa, but it is well supported logistically by the NTC.

Our Mojave field test actually builds on an existing partnership between NASA and the NTC. The latter is home to NASA's Goldstone Deep Space Network (DSN) tracking station. The NTC's participation in this field test with NASA is just a new example of Joint Interagency Intergovernmental and Multinational (JIIM) partnership. It allows the NTC to showcase its assets, community, and vast training resources, while enabling NASA and its partners to cost-effectively and securely meet their research objectives.

Our Mojave field test will be featured in an upcoming television documentary filmed by First Canyon Media, Inc. titled Mission Asteroid. Produced by the Canadian Broadcasting Corporation (CBC), Mission Asteroid is expected to air in North America in Spring 2014.

RMV Technology Group Invited by NASA to Chair G-19 & G-21 Sub-Committee Packaging Engineering Working Groups

by Renee Mitchell, President, RMV Technology Group LLC.

RMV Technology Group LLC, located in Building 19, has been invited by NASA to chair both SAE G-19 & G-21 Sub-Committee Packaging Engineering Working Groups for the development of protocols in mitigating Suspect Counterfeiting of ESD sensitive devices and material. In addition, Bob Vermillion, CEO & Founder, was asked by NASA to be vice-chair of the ESD Association 20.21 Aerospace Committee, chaired by NASA LaRC/ Mission Assurance, whose mission is to revise and better define related protocols necessary for aerospace/defense in ESD protection of mission critical systems.

In follow-up to a study on ESD packaging materials for the Defense Ammunition Center (DAC) in which four out of five packaging schemes failed, RMV was recently engaged by a defense contractor to test three static control materials—all but one supplier failed the standardized ESD testing. The lack of periodic verification of protective shipping materials for mission critical parts continues to be a growing problem for Industry. By special invitation for small business to speak on technology innovation, RMV's topic "Supplier Non-Compliance and Suspect Counterfeit Materials" was presented during NASA Ames Industry day, 12 August 2012. In an upcoming event, Bob Vermillion, in collaboration with Boeing, will present "A Study of ESD Packaging for Supplier Non-Conformance and the Importance of Proper Qualification Testing as an Effective Countermeasure for Supply Chain Non-Conformance" at the Annual DMSMS Conference, 2-5 December 2013.

A third party technology engineering and test laboratory, RMV tests and evaluates engineered and advanced materials for ESD integrity and Triboelectrification Mitigation for Space Bound Materials. Vermillion can be reached at 650.964.4792 or email bob@esdrmv.com

May 9, 2013, The Greater Stavanger Economic Development delegation representing the largest business park in Norway visited NRP to learn about the facilitation of infrastructure, internal processes, and business collaborations. Michael Marlaire, Dir, NRP provided an in-depth briefing covering these points and a park tour was conducted by Mejghan Haider, Dep Dir, NRP.

NRP Post

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