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Final Shuttle Crew Visits Goddard

Photos by Pat Izzo

On October 11, NASA Astronauts of the STS-135 crew visited Goddard to share their spaceflight experiences. Commander Christopher Ferguson, Pilot Douglas Hurley, Mission Specialist Sandra Magnus, and Mission Specialist and Flight Engineer Rex Walheim recounted their adventures on their historic 13-day mission onboard *Atlantis*, NASA's last Space Shuttle mission. ■

GoddardView

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On the cover: A Delta II rocket lights up the night with the *NPOESS Preparatory Project* (NPP) spacecraft payload from Space Launch Complex 2 at Vandenberg Air Force Base, Calif. on Friday, Oct. 28, 2011.

Photo credit: NASA/Bill Ingalls

GoddardView Info

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NASA Launches Multi-Talented Earth-Observing Satellite

By Cynthia O'Carroll

NASA's newest Earth-observing satellite soared into space aboard a Delta II rocket after liftoff at 5:48 a.m. EDT from Space Launch Complex 2 at Vandenberg Air Force Base in California on October 28.

NASA's National Polar-orbiting Operational Environmental Satellite System Preparatory Project, or NPP, successfully separated from the Delta II 58 minutes after launch, and the first signal was acquired by the Tracking and Data Relay Satellite System. NPP's solar array deployed 67 minutes after launch to provide the satellite with electrical power. NPP is on course to reach its sun-synchronous polar orbit 512 miles (824 km) above Earth.

Photo credit: NASA/IVBill Ingalls

Caption: NPP is carried skyward by a Delta II rocket.

"NPP is critical to our understanding of Earth's processes and changes," said NASA Deputy Administrator Lori Garver. "Its impact will be global and builds on 40 years of work to understand our complex planet from space. NPP is part of an extremely strong slate of current and future innovative NASA science missions that will help us win the future as we make new discoveries."

NPP carries five science instruments, including four new state-of-the-art sensors, which will provide critical data to help scientists understand the dynamics of long-term climate patterns and help meteorologists improve short-term weather forecasts. The mission will extend more than 30 key long-term datasets NASA has been tracking, including measurements of the ozone layer, land cover, and ice cover.

NPP serves as a bridge mission between NASA's Earth Observing System (EOS) of satellites and the next-generation Joint Polar Satellite System, a National Oceanic and Atmospheric Administration (NOAA) program that will also collect weather and climate data.

Scientists will use NPP data to extend and improve upon EOS data records. These satellites have provided critical insights into the dynamics of the entire Earth system, including clouds, oceans, vegetation, ice, solid Earth, and atmosphere. NPP will allow scientists to extend the continuous satellite record needed to detect and quantify global environmental changes.

"The measurements from NPP will benefit science and society for many years to come," said Michael Freilich, Director of NASA's Earth Science Division. "NPP will help improve weather forecasts, enable unique scientific insights, and allow more accurate global environmental predictions. I'm confident that the strong partnerships forged in the NPP program between NASA and NOAA, industry, and the research and applications communities will ensure the success of the mission."

The satellite will be operated from the NOAA Satellite Operations Facility in Suitland, Md. NASA will operate NPP for the first three months after launch while the satellite and instrument are checked out. NPP operations will then be turned over to NOAA and the JPSS program for the remainder of the mission.

NPP data will be transmitted once every orbit to a ground station in Svalbard, Norway, and to direct broadcast receivers around the world. The data will be sent back to the United States via fiber optic cable to the NOAA Suitland facility. NPP data is then processed into data records that NASA and NOAA will make available through various data archives.

The Delta II launch vehicle that delivered NPP into orbit also deployed auxiliary payloads within 98 minutes after launch. The five small "CubeSat" research payloads are the third in a series of NASA Educational Launch of Nanosatellite missions, known as ELaNa missions.

Photo credit: NASA/IVBill Ingalls

Caption: The "launch arc" of the Delta II rocket carrying NPP.

The NPP mission is managed by Goddard for the Earth Science Division of the Science Mission Directorate at NASA Headquarters in Washington. The Joint Polar Satellite System program provides the NPP ground system. NOAA will provide operational support for the mission. Launch management is the responsibility of the NASA Launch Services Program at the Kennedy Space Center in Florida.

For more information about NPP, visit: http://www.nasa.gov/npp.

For more information about the ELaNa III mission, visit: http://go.nasa.gov/tgbuVn. ■

James Webb Space Telescope Visits Baltimore

By John M. Putman

The full-scale model of the James Webb Space Telescope (JWST), made its latest "World Tour" stop at the Maryland Science Center near Baltimore's Inner Harbor from Oct. 14-26. The model was displayed as part of the Association of Science-Technology Centers (ASTC) annual conference being held in Baltimore. ASTC is a nonprofit organization of science centers and museums dedicated to furthering public engagement with science among increasingly diverse audiences. There were several supporting activities with scientists and engineers to talk about the unprecedented science capabilities of the largest space telescope ever built.

Photo credit: NASA/Goddard/Pat Izzo

Caption: The full scale model of the James Webb Space Telescope *in front of the Maryland Science Center.*

On Friday, Oct. 14, NASA Administrator Charles Bolden made brief remarks, took questions from reporters, and toured the *Webb* model.

A press conference culminated the 13-day public display on Oct. 26 at the Maryland Science Center. Participants included U.S. Sen. Barbara Mikulski; NASA Deputy Administrator Lori Garver; Goddard's John Mather, *Webb Telescope* Senior Project Scientist; Adam Riess, recipient of the 2011 Nobel Prize in Physics, professor of astronomy and physics at the Johns Hopkins University, and a senior member of the Space Telescope Science Institute in Baltimore; Riccardo Giacconi, recipient of the 2002 Nobel Prize in Physics and professor at the Johns Hopkins University; and John Grunsfeld, Deputy Director of the Space Telescope Science Institute and a former NASA astronaut who participated in three spaceflights to service *Hubble*.

Photo credit: NASA/Goddard/Pat Izzo

Caption: NASA Administrator Charlie Bolden makes remarks at the Maryland Science Center.

Photo credit: NASA/Goddard/Pat Izzo

Caption: JWST experts await visitors to the model of the spacecraft.

The special event featured a JWST education tent with interactive games and activities, a mini-theater with a simulated environment of the cosmos, and a spectacular stargazing event on Friday evening for amateur astronomers and the general public. Experts were on hand to discuss the *Webb Telescope*'s deep-space mission, how it will observe distant galaxies and nearby stars and planets, and the progress made to date in building the observatory. Spokespeople were also be available throughout the model exhibition.

The *Webb Telescope* model has already been displayed around the world, visiting sites in France, Ireland, Canada, Germany, and across the U.S. The full-scale model of the *Webb Telescope* was built by NASA's prime contractor to provide a better understanding of the size, scale, and complexity of the observatory. The model is constructed mainly of aluminum and steel, weighs 12,000 lbs., and is approximately 80 feet long, 40 feet wide, and 40 feet tall. The model requires two trucks to ship it and assembly takes a crew of 12 approximately five days.

The *Webb Telescope* will provide images of the first galaxies ever formed and explore planets around distant stars. The unique observatory is a joint project of NASA, the European Space Agency, and the Canadian Space Agency. For more information about the *Webb Telescope*, visit: http://jwst.nasa.gov. To see more images of the model's time in Baltimore, visit: https://secure.flickr.com/photos/gsfc/6264039804/in/photostream. Watch a video of the model being constructed in Battery Park in New York for the World Science Festival at: http://youtu.be/EbCBeq2Rz9Q. ■

Goddard Conference on Exoplanets Draws World-Renowned Participants

By John M. Putman

On October 18, 19, and 20, an international collection of observers, modelers, and instrument builders gathered at Goddard to discuss an important astrophysical question: When we see a disk, what can we learn from it about the system of extrasolar planets it contains?

The Signposts of Planets Conference hosted a full schedule of international invited speakers, contributed talks, and posters. In total, one hundred and twenty scientists attended from the U.S., Canada, Switzerland, Germany, Spain, Chile, England, Japan, France, and the Netherlands.

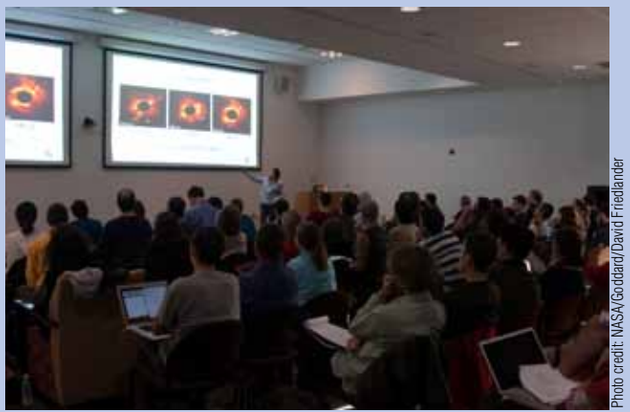

Photo credit: NASA/Goddard/David Friedlander

Caption: Hannah Jang-Condell from the University of Wyoming gives a presentation during the Signposts of Planets conference.

From the Exoplanets and Stellar Astrophysics Laboratory (Code 667), Thayne Currie, Carol Grady, Mark Clampin, Michael McElwain, Marc Kuchner, and Karl Stapelfeldt gave talks, and Thayne Currie and Aki Roberge chaired sessions. Erika Nesvold, Karl Stapelfeldt, Mark Clampin (Code 667), Deborah Padgett (Observational Cosmology Laboratory, Code 665), and Avi Mandell (Planetary Systems Laboratory, Code 693) presented some of the dozens of posters at the Conference. In addition, Mario Perez from NASA Headquarters attended and chaired a session, as did Goddard's David Leisawitz (Code 605).

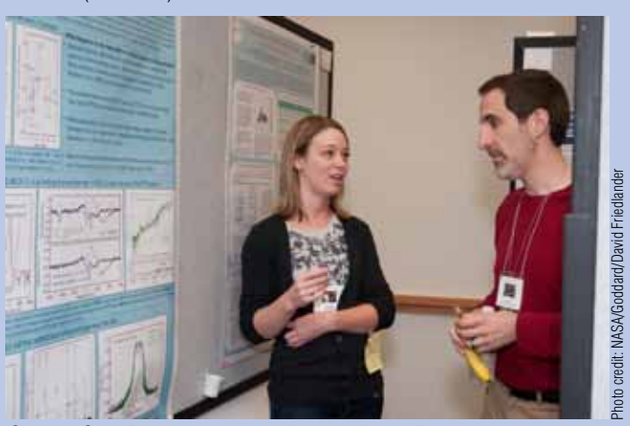

Photo credit: NASA/Goddard/David Friedlander

Caption: One of many posters on display and open for discussion at the SIgnposts of Planets Conference held at Goddard.

Photo credit: NASA/Goddard/David Friedlander

Caption: Observers, modelers, and instrument builders from around the world gathered at Goddard for the Signposts of Planets Conference.

Visitors were treated to tours of the *James Webb Space Telescope* High Bay clean room, conducted by Mark Clampin, Chuck Bowers, Erika Nesvold, and Jessica Donaldson, all from the Exoplanets and Stellar Astrophysics Laboratory.

Media coverage of the Conference included four press releases during the Signposts of Planets meeting, including one featuring Carol Grady. These were presented in cooperation with the Spitzer Science Center, Johns Hopkins University, The Pennsylvania State University, and the *Keck Observatory*. Marc Kuchner led a call-in panel discussion attended by several reporters.

Exoplanet news released at the Signpost of Planets Conference spawned almost 500 articles around the internet, including *TIME*, MSNBC, *New Scientists*, *Universe Today*, *International Business Times*, *Discovery News*, and other outlets.

To learn more about the conference, visit: http://science.gsfc.nasa.gov/667/conferences/signposts.html. ■

Firestation in Space to Open Firehose of Lightning Data

By Lori Keesey

When opportunity knocked, Goddard heliophysicist Doug Rowland answered. He and his team recently secured another flight opportunity for a pint-sized instrument studying lightning in Earth's upper atmosphere and now are bracing for a veritable "fire hose" of data about a little-understood phenomenon first discovered by scientists nearly two decades ago.

The instrument, Firestation, is one of four experiments manifested to fly on an experiment pallet the U.S. Department of Defense plans to deploy on the *International Space Station* in 2013. It's a near duplicate of Firefly, which Rowland and his team at Goddard began developing more than three years ago to fly on an emerging class of tiny satellites called Cubesats sponsored by the National Science Foundation. That mission also may launch in 2013.

Having secured a berth on the pallet, Rowland and his university partners must complete Firestation by the spring of 2012 for integration onto the pallet.

That shouldn't be an issue, Rowland said. Firestation is a knock-off of Firefly and, in fact, will be cobbled together from Firefly's spare parts. "We're basically ready," Rowland said. "We benefited from the fact that we had completed Firefly and had spare parts on hand. The only thing we need to do is develop a new housing appropriate for the pallet."

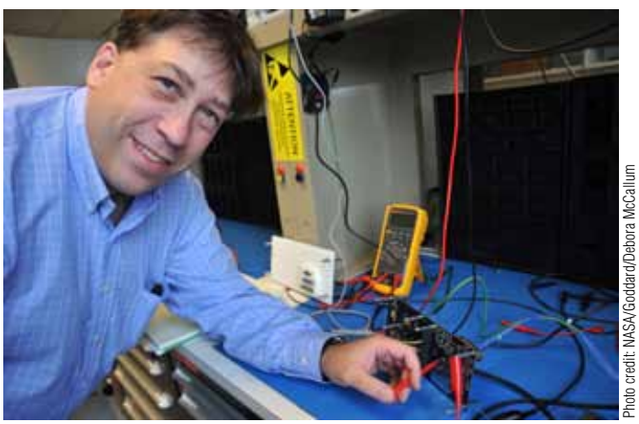

Photo credit: NASA/Goddard/Debora McCallum

Caption: Firestation's Principal Investigator Doug Rowland poses with the engineering unit of Firestation's interface board.

Although the instruments are closely related, they are different in key areas. Firestation covers a wider measurement range. It will take advantage of a camera, also onboard the pallet, to snap photos of lightning flashes so that researchers can precisely locate where they are occurring. Furthermore, Firestation will enjoy a data rate that is about 3,000 times larger than Firefly's, which means the team will be able to sample every lightning stroke, instead of Firefly's carefully selected sample.

Perhaps the biggest difference, however, is in mission duration. Firefly is expected to remain in low-Earth orbit for roughly a month, compared with Firestation's one-year sojourn aboard the space station. As a result, Rowland expects Firefly to gather only a tiny fraction of the science data that its sibling will collect. "This represents orders of magnitude better coverage," he said.

Their mission, however, remains the same. With their suite of sensitive photometers to measure lightning flashes, radio antennas to measure the strength of the lighting, and a combined gamma-ray electron detector, both instruments will gather data to find out whether lightning triggers Terrestrial Gamma-ray Flashes (TGFs). This little understood phenomenon was first discovered using the Burst and Transient Source Experiment (BATSE) on the *Compton Gamma-ray Observatory* and later observed by the *Reuven Ramaty High Energy Solar Spectroscopic Imager* (RHESSI) satellite.

Although no one knows why, it appears these flashes of gamma-rays that were once thought to occur only far out in space near black holes or other high-energy cosmic phenomena are somehow linked to lightning.

"The fact that they exist at all is amazing," said Rowland, who expects his instruments to observe up to 50 lightning strikes per day, at least one TGF every few hours, and a large TGF every couple days. "The electron and gamma-ray energies seen in TGFs are usually the domain of nuclear explosions, solar flares, and supernovas, not our relatively peaceful atmosphere."

In particular, Rowland and his colleagues, including the Universities Space Research Association in Columbia, Md., and Siena College, located near Albany, N.Y., hope to find out if lightning triggers TGFs or if they trigger lightning. Could they be responsible for some of the high-energy particles in the Van Allen radiation belts, which damage satellites?

"We'll be getting a fire hose of data, which we think will help answer those questions—20 million times as much data as a matter of fact, given the higher data rate and longer mission duration [of Firefly]. It's going to be a little crazy." ■

The Landing Site Specialist

By Elizabeth Zubritsky

Gale crater has been sitting just below the equator of Mars, minding its own business, for at least three and half billion years. But, in August 2012, a capsule is going to come screaming out of the sky, then brake its fall by popping a parachute and engaging rocket thrusters. After that, the "sky crane" inside the capsule will activate to lower the subcompact-car-sized Curiosity rover on tethers, suspending it beneath the rest of the craft until the whole assembly descends onto a carefully chosen patch of ground at the northwestern end of the 96-mile-diameter crater.

This is how Goddard's Jim Rice describes the arrival of NASA's Mars Science Laboratory (MSL) at Mars. "This region of Mars has no idea what is coming its way," he laughs. "It doesn't know that once the rover arrives, nothing will ever be the same."

Caption: Jim Rice.

Photo provided by Jim Rice.

Rice, a planetary geologist, has been thinking about MSL's landing because he participated in the process of choosing where the spacecraft will touch down. That meant attending a series of site-selection workshops, along with researchers from across the planetary science community, to consider nearly 60 potential landing sites. It also meant paying special attention to exactly how flat, how high, how windy, how dusty and how rocky certain regions of Mars are, as well as evaluating how interesting the geology is in those places.

Rice advocated for Eberswalde crater, which he favored because of its delta. Though it's been dry for eons, the delta resembles the mouth of a river here on Earth. Because the goal of MSL is to assess whether Mars was ever a habitable environment, Rice explains, every potential landing site "had to have a water story—some evidence that water was involved in the formation of the landscape and in the rock deposited there."

A site also had to have the potential to preserve biomarkers, the telltale indicators that organic material was once present. Any regions that didn't satisfy these two science objectives were eliminated. Once the list of candidates was pared down to half a dozen, the competition got tough.

"When you suggest a site at these meetings, you get grilled by the project engineers, the mission's science team and other scientists who are proposing alternative sites," says Rice. "You have to defend your choice through all kinds of ups and downs. It's a lot of work but a lot of fun."

Rice, now a veteran of the site-selection process, got his first taste in 1994 with NASA's Mars Pathfinder mission. "I was just a graduate student then, and I can't tell you how excited I was," he says. "It was the first mission to land on Mars in more than 20 years, and my site was chosen for the landing!"

When Pathfinder landed at Ares Vallis, the site he helped propose, he was hooked. He participated in site selections for the Mars Polar Lander and Phoenix as well as Spirit and Opportunity, the two vehicles of the Mars Exploration Rover (MER) mission. With MSL, he will have been involved in six missions that landed, or will soon land, on Mars.

By 2008, Eberswalde was hanging tough as one of MSL's final four, along with Gale crater, Holden crater, and Mawrth Vallis. From data gathered by NASA's *Mars Reconnaissance Orbiter*, researchers knew that all four sites had clays called phyllosilicates, which meant ancient water had to stick around long enough to break down rock. All four sites were also given the thumbs-up by engineers as being safe.

But ultimately, Gale crater, with its mysterious mound that rises higher than Mount Rainier near Seattle, won out.

"That mound is so enigmatic," says Rice. "We know that there are clays in it and also sulfates, another indication of water. But how did that mound get there? Did volcanic ash and dust blow in and contribute to the buildup of the mound? How and why did the area around it erode away? When water was there, where did it come from?"

To look for answers, the rover will drive at least partway up the mound, which Rice likens to exploring the Grand Canyon, but backwards. "As you hike down into the Grand Canyon, you go through all these rock layers. Every step takes you back in time," he explains. "But at Gale, we'll be climbing up through the layers instead."

Not deterred by Eberswalde's narrow defeat, Rice is already thinking about a landing site for a possible 2018 Mars mission: the Columbia Hills region in Gusev crater, which was first explored by the Spirit rover. "Thanks to Spirit," he says, "we now know that the Columbia Hills contain carbonate rock, which means there was water present in an environment that is friendly to life as we know it, and we know there are silica deposits, which formed in an ancient geyser-like area similar to Yellowstone. Best of all, we know precisely where these geological goodies are located."

"No matter where you go on Mars, it's an exciting experience," Rice adds. "No doubt, Gale crater will be full of surprises when we land. But the best part is that we'll get to know it. It will become a neighborhood that we roam in, just like Gusev crater and Meridiani Planum, where the Spirit and Opportunity rovers landed. And just like them, Gale will become an extension of our human consciousness." ■

Montana State University Education Student Contributes to NASA Outreach Efforts

By Anne Cantrell, Montana State University

A Montana State University education student spent the summer teaching others about the *James Webb Space Telescope*, the successor to the *Hubble Space Telescope* that is designed to unravel the mystery of how the universe grew from a big bang into galaxies, stars, and planets.

As an intern on the *James Webb Space Telescope* (JWST) mission at Goddard, Ryan Hannahoe helped coordinate JWST's role in various educational and public outreach events, such as an astronomy night on the national mall and an informal exhibit at a D.C.-area museum. Hannahoe also developed educational content, trained educators and worked with others, such as celebrity Bill Nye the Science Guy, to bring information about the telescope to the public.

Photo credit: NASA/Goddard/Chris Gunn

Caption: Montana State University education student Ryan Hannahoe, left, and Radford Perry, contamination control engineer at Goddard, examine a primary mirror segment of the James Webb Space Telescope.

"The internship was probably the best thing I've ever done," said Hannahoe, 26, who is originally from Pennsylvania. "By working with JWST, so many doors have opened."

At the National Air and Space Museum, Hannahoe helped revise an informal exhibit that incorporates hands-on science activities related to JWST.

Through that exhibit and other interactions with museum visitors, Hannahoe taught visitors that, among other things, larger telescopes collect more light and allow observers to see greater detail; larger telescopes allow astronomers to see farther into space; and the JWST views the universe in infrared light. Over the course of the summer, Hannahoe worked with nearly 1,800 museum visitors, he said.

And, in those interactions and in others throughout the internship, Hannahoe said the skills he learned as an education student at MSU served him well. "In terms of how I write lesson plans and the level of detail I write those, I definitely carry some of those aspects over from MSU to working at NASA." Hannahoe landed the internship through the lead optical designer of JWST, Joseph Howard, whom Hannahoe had met at a conference about a decade ago. The two kept in touch over the years, and Howard invited Hannahoe to NASA for the internship, which the Montana Space Grant Consortium funded.

A highlight of the internship was meeting and working with smart, accessible people, Hannahoe said. "At NASA, you could just go into somebody's office and just sit down and talk with them," he said. "It was very humbling."

Hannahoe also learned how much of a team effort a project like JWST is. "At any given time, 1,200 people are working on that mission to make it happen," he said. "Working with such a large team was something I haven't experienced before. Having that atmosphere to bounce ideas around and talk to those people was so productive."

"We want to see to the beginning of the universe...how galaxies formed," Hannahoe said. "Our galaxy is one of billions of galaxies out there. We also want to study the formation of solar systems and Earth-like planets. In our lifetime, we can never travel to an Earth-like planet, but at least we can study them. That's why you need an infrared telescope, and a big one."

Several individuals who worked with Hannahoe at NASA this summer said he was a valued member of the team.

Joseph Howard, JWST's lead optical designer, said Hannahoe contributed greatly to the project through his outreach efforts. "He amazed us with his enthusiasm and ability to get things done on a large scale with little or no supervision," Howard said.

Lynn Chandler, NASA Public Affairs Officer for the *Webb Telescope*, said Hannahoe was a "tremendous" asset to the outreach team.

"He came through the door ready to do outreach and really hit the ground running," Chandler said. "Through his efforts, Ryan reached out to Bill Nye, the National Air and Space Museum, SPIE [the international society for optics and photonics], teachers and students, as well as many other audiences. I feel Ryan's ties to the astronomical community were extremely beneficial to our organization."

Now, Hannahoe is spending the fall semester completing a practicum experience in a Bozeman-area school's 4th grade classroom. This spring, he plans to student teach and then graduate.

And, next summer, if funding and other considerations work out, Hannahoe said that he may accept an invitation to head back to NASA for a second internship.

"To have the ability to take my background in astronomy and education, and to basically design my own internship—to pursue what I wanted to pursue—was awesome," he said. "I would love to do it again." ■

Leadership Development and Excellence in Management Program Graduates New Class of Leaders

By John M. Putman

On October 26, a group of 29 Goddard employees graduated from the Leadership Development and Excellence in Management (LDEM) Program B. Along with an executive speaker and the presentation of certificates, the graduation ceremony included testimonials from Program B graduates.

Photo credit: NASA/Goddard/Pat Izzo

Caption: Joe Winiarz, Deputy Director of the Office of Human Capital Management at Goddard congratulates Program B graduates.

LDEM is made up of three Programs: A, B, and C. Program B is titled "Leading Groups and Teams–Expanding Your Sphere of Influence." It is for employees at the journey-level of their career whose job requires that they chair and/or participate on teams. Participants continue building their skills at the self and interpersonal levels, while learning and practicing new skills that focus on the group/team and higher organizational levels. In four highly interactive workshops, Program B participants stretch their comfort zones, experience significant personal growth, and learn and practice key skills involved in leading people and managing work within an organizational context. Most participants are at the GS 12 and 13 levels. GS 14 level employees who are not supervisors and whose job involves working on teams also benefit from this level program.

Photo credit: NASA/Goddard/Pat Izzo

Caption: Program B graduates had a chance to interact and reflect on their experiences.

All LDEM programs include an array of integrated learning experiences consisting of workshops with their cohort group; individual and group coaching; individual learning and reflection; team projects, learning, reflection and support; application of learning in a real work setting; assessment feedback; mentoring; shadowing (programs B and C only); exploring leadership colloquia; continuous learning through optional creative learning group mini-workshops.

During these aforementioned workshops, participants engage in learning, analysis, and discussion of leadership challenges they encounter in the workplace. Workshops range in length from 1 to 3 days, with most being 2 or 3 days in duration. The standard workshop day begins at 8:30 a.m. and ends at 5:00 p.m.

Participation in any LDEM program requires a commitment to learning outside of the scheduled workshops. In addition to attending the required workshops, we estimate that participants will spend approximately 10 to 15 hours per month completing required readings, working on team projects, working with their individual and team coach, meeting with a mentor, shadowing a senior executive, and working on other assignments.

The LDEM program philosophy that guides program design and implementation is multifaceted and is made of the following elements: Everybody is a leader–leadership is everybody's business; our dynamic environment requires people at all levels to step up as leaders; no matter where you sit, you influence others; a leader's role is to influence both the context and the mood of the organization; when you know what to look for, leadership opportunities abound; leaders make choices and take responsibility for their own learning and actions; leadership can be learned through a developmental, as distinct from training, program; adults learn best when they focus on real world issues and concerns, in a safe context, where learning is offered with a serious intent and light touch.

Photo credit: NASA/Goddard/Pat Izzo

Caption: The Program B graduates.

To learn more about the LDEM program, contact Kellie Murray, Leadership Program Manager, Code 111, at Kellie.J.Murray@nasa.gov or (301)286-2282. ■

In Memoriam: Pat Gary

By Daniel Pendick

James Patrick ("Pat") Gary, who passed away on September 15, 2011, spent much of his 43-year NASA career expanding the boundaries of the possible in high-speed computer networking. And this master networker of computers was also a master networker of people—a talent that sustained scores of collaborative projects over the decades and won praise and deep respect from colleagues at NASA, other Federal Agencies, and the IT industry.

NASA was Pat's first and only job. He came to Goddard in 1968, fresh out of the Catholic University of America in Washington, D.C., with a B.A. in mathematics. His first position was as a mathematician and programmer/analyst with the Advanced Development Division (Code 520), helping to automate NASA's data tracking and acquisition network.

Starting in the late 1970s, Pat headed a variety of computing-related sections, groups, and branches within the Goddard organizational ecosystem. It was high-speed computer networking and his genius for collaborative technology development, however, that proved to be the winning recipe in his career.

Starting in the late 1980s, a small team of network engineers and technologists had coalesced under Pat's leadership, taking the title High End Computer Network (HECN) group (606.1). This team has continually advanced the boundaries of what is possible with high-performance networks by developing innovative ways to connect high-performance computing equipment into networks both within NASA and externally with other Federal Agencies, universities, and foreign collaborators.

Photo credit: NASA/Goddard

Caption: From left: Kevin Kranacs, Bill Fink, Paul Lang, Pat Gary, Mike Stefanelli, Aruna Muppalla, Jeff Martz, and Kevin Fisher. Team member Mary Shugrue not pictured.

One of the group's early accomplishments was providing key support to the creation of what came to be called, in 1995, the Center Network Environment (CNE), which linked the Goddard campus over a local area network for the first time.

The group also picked up what turned out to be 14 years of stable funding from the new High Performance Computing and Communications (HPCC) Program, and shifted focus to the exciting new opportunities in high-performance computer networking. This led to the founding of the Science and Engineering Network (SEN) at Goddard as well as the HECN.

The networking team at Goddard has gained a reputation for expertise in configuring, testing, and troubleshooting networks to squeeze out the best performance possible. The suite of analysis tools developed by the team has grown over the years. These tools are open source and free; some commercial companies have actually incorporated some of the analysis tools into products as familiar as home routers.

Meanwhile, Pat continued to pursue strategic collaborations and foster mutually beneficial relationships. These connections allowed the Goddard team to obtain early versions of advanced equipment not yet commercially available and access to lightning-fast Internet connectivity—all on a very limited budget.

The technical accomplishments of Gary's group are only partly about obtaining access to advanced technology, according to NASA computer scientist James Fischer, a longtime colleague and friend in the Computational and Information Sciences and Technology Office (Code 606). The key ingredient was not just hardware, but the "wetware" of genuine human relationships. "He turned these relationships into opportunities for Goddard to have better networks and greater functionality," says Fischer. "He was even tempered in the face of resistance to collaboration, which can be a very frustrating process at times. He never showed it."

Pushing the boundaries of the possible with a lot of help from his friends. That is how colleagues remember Pat Gary, one of NASA Goddard's best and brightest. ■

In Memoriam: Paul Lowman

By John Putman. Photos by Debora McCallum

Dr. Paul D. Lowman, Jr. passed away on Sept. 29, 2011 at age 80. Lowman was one of the originals at Goddard.

Born in 1931, Lowman worked with the U.S. Army Ordinance Corps as a field assistant at the United States Geological Survey before being hired by NASA in 1959. As the first geologist hired by NASA, Lowman worked on pre-*Apollo* lunar geology. His early work at Goddard was in the Theoretical Division run by Robert Jastrow where he worked with John O'Keefe on the origin of tektites and pre-*Apollo* lunar geology. He was closely tied to the *Apollo* program, helping to plan the early missions while detailed to NASA Headquarters and was later involved in the analysis of lunar samples and the interpretation of *Apollo 15* and *16* X-ray fluorescence and gamma-ray data.

As a geologist, Lowman was asked to review proposals for a new Earth observation satellite called the *Earth Resources Technology Satellite* (ERTS-1), later renamed *Landsat 1*. Lowman helped manage some of the early *Landsat* research and coauthored "Mission to Earth: Landsat Views the World" and the Planetary Landforms chapter of "Geomorphology from Space." Lowman created one of the earliest maps using *Landsat 1* data and he authored a 1999 Photogrammetric Engineering and Remote Sensing journal article titled: "Landsat and Apollo: The Forgotten Legacy."

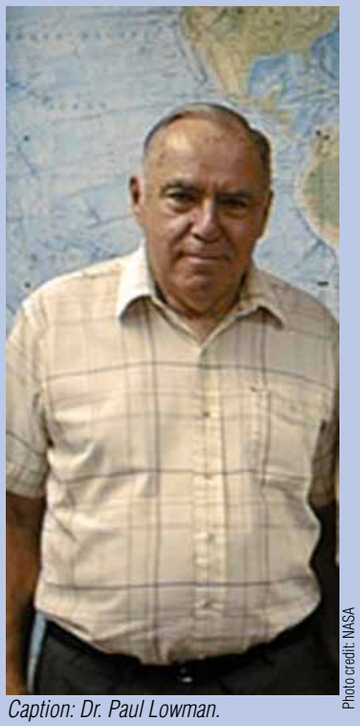

Photo credit: NASA

Caption: Dr. Paul Lowman.

Lowman was a Co-Investigator for the IRIS experiment on the *Mariner 9* mission to Mars. Long before it was a popular concept, Paul was actually doing "comparative planetology," asking what the new information from the Moon and Mars could tell us about the Earth. He was the father of Earth orbital photography, having initiated that effort for early *Mercury* and *Gemini* missions. This led eventually to multi-spectral imaging of Earth and the Landsat series of satellites. His field work included studies of ancient exposed rocks in Scotland and the Sudbury Crater in Ontario. In 2010, he returned to that crater as the leader for a Goddard Lunar and Planetary Academy summer intern group.

Also in 2010, Lowman recounted some of his *Landsat* memories with the Landsat Legacy team and explained the ways that *Landsat* has impacted the field of geology: revolutionizing our understanding of Asian tectonics, basement tectonics, and the discovery of active volcanoes. Lowman's Landsat Legacy interview will be preserved within the Landsat Legacy archive.

Nick White, Director of the Sciences and Exploration Directorate at Goddard added, "Lowman won the Lindsay Award in 1974 and the NASA Medal for Exceptional Service in 2003. He was author of several books on orbital photography of the Moon and Earth, and was on a first name basis with many *Apollo* and *Skylab* astronauts, including John Young, Jack Schmidt, Owen Garriott, and Neil Armstrong. Armstrong wrote the forward to Paul's latest book "Exploring Space, Exploring Earth" published by Cambridge University Press in 2002. That book describes the prominent role Goddard has played in space exploration, something Paul both witnessed and contributed to firsthand for more than 50 years. We will greatly miss Paul."

Photo provided by: F. Michael Flasar

Caption: Lowman's wife Karen (center), close friend Teena Tiedemann Blyth, and her husband Dewey pose with Lowman's bicycle.

On November 14, a celebration of Lowman's life was held in Building 34. The afternoon included planned and spontaneous eulogies and remembrances from friends, family, and colleagues. Members of Lowman's family attended and took possession of Lowman's famous bicycle.

"Paul had a remarkable NASA career," said Goddard Center Director Rob Strain. "Though it spanned more than 50 years, he never lost his love for science, or his commitment to Goddard." ■

OutsideGoddard: Nina Harris

By Elizabeth M. Jarrell

Not every Protocol Officer is a triple threat. Nina Harris, however, is a triple threat because, as they say in show business, she can act, sing, and dance. She began performing as an international folk dancer at the age of 13 and performed "at a gazillion Octoberfests." Explains Harris, "After living in Munich, my father returned to the states to work as a NASA engineer. He and my mother also taught German and Austrian folk dances for over 50 years." Harris' parents started one of the first German dance groups in the country specializing in schuplattling, which she describes as "a national ethic dance of Bavaria. The men wear lederhosen, which are leather pants with suspenders, and the women wear a dirndl, or a peasant dress. Picture 'The Sound of Music.'" Harris later joined the University of Maryland's International Folk Dance Group, which broadened her repertoire.

Harris began working at Goddard after college. One day, Dr. Jaylee Mead, a co-founder of Goddard's Music and Drama (MAD) productions with her husband Dr. Gil Mead, stopped by her office and said, "I hear you're a dancer." Just like that, Harris was recruited for MAD productions. She first appeared as a dancer in their 1979 production of "Bells Are Ringing." Thirty years later, Harris is still performing with MAD. "I got the theater bug," she says. "I got intrigued watching the leads. I wanted to be an actress too." She began taking voice lessons. Soon she got her first supporting role in "Mame" in the early 80s. In 1988, she landed her first lead role as Charity in MAD's production of "Sweet Charity" and has been acting ever since.

She has acted in dozens of productions over the years. Her two favorite roles were as Adelaide in "Guys and Dolls" and as Charity in "Sweet Charity." Explains Harris, "They are both classic Broadway theater. I liked that both characters were funny and had a lot of heart." Her most challenging role was that of Fanny Brice in "Funny Girl." Says Harris, "Fanny Brice was a demanding role vocally because she was on stage all the time, in almost every scene, and she had numerous songs to sing."

Photo provided by Nina Harris

Caption: Nina Harris sings at MAD's 2010 Winter Cabaret.

In fact, Harris developed laryngitis so severe that she was only able to perform in three of her eight shows. Remembers Harris, "Luckily, when my voice suddenly gave out, the other Fanny, the Office of Communications' Erica Drezek, was in the audience and took over without the audience knowing the difference."

Although Harris enjoys singing and dancing, she prefers acting. "It is the most fun because I get to explore the inner me. I get to build and develop a character from nothing," she explains.

Harris says, "Community theater is a great creative outlet." Her favorite places to perform are with MAD at Goddard and at the Bowie Community Theater, because she lives in Bowie.

She does not have a photographic memory; she learns her lines the old-fashioned way, she memorizes them. Explains Harris, "When you are learning dance steps, you are using motor memory. But when you memorize lines, it is done through repetition and practice. I read the lines over and over again just as I did to learn my spelling words in school." An actor's worst nightmare is forgetting the lines. Harris says that you have to improvise if you or your scene partner forgets lines. "Not only do you have to know your own lines," furthers Harris, "you also have to know those of your scene partner." She believes that you have to train and exercise your brain to learn the lines much as you train your body by going to the gym. "The mind is a muscle you need to use to keep fit," she concludes.

Her ability to memorize has served her well during theater emergencies. Several years ago, a cast member had to drop out of a lead role in "Dancing at Lughnasa" a mere two weeks before opening night. Although Harris was the choreographer and not even in the cast, the director asked Harris to assume the role because she was the only person who could learn the part in such a short amount of time. Needless to say, Harris came through.

As for why, after thirty years, Harris remains motivated, she says, "Community theater is a labor of love because none of us are paid. What is wonderful about it is that you develop camaraderie and a close knit family among your theater friends who, in the case of MAD, are also your work colleagues." Harris concludes, "Theater has given me a tremendous sense of self-confidence, self-esteem, and a sense of belonging. We share the same passion and support each other in a mutual endeavor that brings all of us, including the audience, joy and a sense of accomplishment." ■