National Aeronautics and Space Administration

# goddardview

Volume 7 Issue 4



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# Goddard's Role in Final Flight of *Atlantis*

By Malissa Reyes and Rob Garner

Orbiter *Atlantis* lifted off from NASA's Kennedy Space Center in Florida at 11:29 a.m. EDT, July 8, 2011, to begin the STS-135 mission. This was the final launch in the Space Shuttle Program.

Though the launch is finished, work is just beginning for staff at NASA's Goddard Space Flight Center more than 800 miles away from the launch pad.

Goddard employees will work around-the-clock to guarantee the four astronauts aboard *Atlantis* have constant, uninterrupted lines of communication with Mission Control. The careful dance of satellite relays necessary to keep channels open requires global coordination, but it all comes together in Goddard's Network Integration Center. Goddard has fulfilled this communication role in literally all of NASA's manned space flights. We all know the words, "One small step for (a) man; one giant leap for mankind," but no one on Earth would have heard Neil Armstrong say them on July 21, 1969 if not for Goddard.

The space shuttle has been vital in humanity's ability to reach beyond Earth's horizon. The 135 orbiter flights have not merely taken humans to space; they have carried satellites, telescopes, science experiments, and more. Among *Atlantis*' final contributions is the Robotic Refueling Mission (RRM), developed at Goddard. *Atlantis* will bring this module to the *International Space Station*, where it will provide key support in maintaining future spacecraft for years to come.

STS-135 astronauts traveled to Goddard to complete special training for these robotics, a major component of the final shuttle mission. RRM is one of dozens of Goddard payloads to travel aboard orbiters into space throughout the 30-year flight history of the Shuttle Program. ■

Photo credit: NASA/Goddard/Pat Izzo

*Caption: Inside the Network Integration Center at Goddard during the final launch of space shuttle* Atlantis *on July 8, 2011.*


# Goddard**View**

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On the cover: Space shuttle *Atlantis* launches into history from Launch Pad 39A at NASA's Kennedy Space Center in Florida.

Photo credit: NASA/Fletcher Hildreth


## **Goddard**View **Info**

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# *Atlantis* Soars into History

By Joshua Buck

Space shuttle Commander Chris Ferguson and his three crewmates are on their way to the *International Space Station* after launching from NASA's Kennedy Space Center at 11:29 a.m. EDT on Friday, July 8. STS-135 is the final mission of NASA's Space Shuttle Program.


Photo credit: NASA

*Caption: The final launch of space shuttle* Atlantis.

"With today's final launch of the space shuttle we turn the page on a remarkable period in America's history in space, while beginning the next chapter in our nation's extraordinary story of exploration," Administrator Charles Bolden said. "Tomorrow's destinations will inspire new generations of explorers, and the shuttle pioneers have made the next chapter of human spaceflight possible."

The STS-135 crew consists of Ferguson, Pilot Doug Hurley, Mission Specialists Sandy Magnus, and Rex Walheim. They will deliver the Raffaello multi-purpose logistics module filled with more than 8,000 pounds of supplies and spare parts to sustain space station operations after the shuttles are retired.

"The shuttle's always going to be a reflection to what a great nation can do when it dares to be bold and commits to follow through," Ferguson said shortly before liftoff. "We're not ending the journey today…we're completing a chapter of a journey that will never end."

The mission includes flying the Robotic Refueling Mission, an experiment designed to demonstrate and test the tools, technologies, and techniques needed for robotic refueling of satellites in space, even satellites not designed for servicing. The crew also will return with an ammonia pump that recently failed on the station. Engineers want to understand why the pump failed and improve designs for future spacecraft.

STS-135 is the 135th shuttle flight, the 33rd flight for *Atlantis* and the 37th shuttle mission dedicated to station assembly and maintenance.

For more information on NASA's Shuttle program, visit: http://www.nasa.gov/shuttle. ■


Photo credit: NASA/Goddard/Wade Sisler

*Caption: Goddard employees in a packed Building 8 auditorium await the final launch of space shuttle* Atlantis.

# Concluding Shuttle Mission Launches Robotic Possibilities

By Dewayne Washington

Now that *Atlantis* has risen above launch pad 39A on her final voyage, the transport is also carrying the distinction of hauling the most supplies and science components, by weight, of any other shuttle. Stowed in the aft end was a Goddard payload designed to begin demonstrations into the possibilities of future robotic satellite servicing.

The Robotic Refueling Mission (RRM) is a module, to be placed externally onto the *International Space Station* (ISS), designed to demonstrate technologies, techniques, and test tools needed to robotically refuel satellites currently orbiting Earth. This joint effort with the Canadian Space Agency (CSA) will be the first on-orbit attempt to test how to refuel a spacecraft not built with on-orbit servicing in mind.

Shared results of this two-year technology test bed are expected to reduce risks and lay the foundation and encourage future robotic servicing missions. Those future missions could also include repair and repositioning of orbiting satellites.

"You know NASA has been doing space servicing for quite some time now," said Frank Cepollina, Associate Director, Satellite Servicing Capabilities Office (SSCO) at Goddard. "We will be demonstrating abilities that will allow for the servicing of existing satellites and could influence the build of future satellites to allow easy on-orbit access for refueling and repair."

Photo credit: NASA/Goddard/Pat Izzo

*Caption: The Robotic Refueling Mission module stowed onboard* Atlantis.

Satellite servicing with astronauts is not new for NASA. *Skylab*, NASA's first space station, was repaired in space in 1973. *Solar Maximum* and *Syncon IV*, with help from the shuttle, were successfully repaired in the 1980s. In the 1990s, NASA serviced the *Compton Gamma Ray Observatory*, *Intelsat 6*, and began a series of highly successful servicing missions to the *Hubble Space Telescope* (HST).

More recently, human and robotic servicing capabilities have contributed to the assembly, upkeep, and repair of the ISS. With RRM, NASA can begin the work of confirming the robotic satellite-servicing technologies needed for the development of future robotic servicing spacecraft.

Cepollina believes it is just a matter of time before such servicing could become routine. "If we are to venture further from Earth, the need for robotic servicing will increase," said Cepollina. "With the build of the space station, we see the increase of collaboration between human and robotic abilities in space servicing."

On day five of the shuttle mission, space station astronauts removed RRM from the shuttle's cargo bay and placed the module onto a temporary position. Soon after the shuttle's departure, using Canadarm2, RRM will be permanently secured on ExPRESS Logistics Carrier 4 (ELC-4) also built at Goddard. The ELC provides command, telemetry, and power support for the module.

The RRM module is about the size of a washing machine and weighs approximately 550 pounds, with dimensions of 43inches by 33 inches by 45 inches. RRM includes 0.45 gallon (1.7 liters) of ethanol that will be used to demonstrate fluid transfer on orbit.

RRM operations will be entirely remote-controlled by flight controllers at Goddard, Johnson Space Center, Marshall Space Flight Center, and the CSA's control center in St. Hubert, Quebec. The station's two-armed robotic system, Special Purpose Dexterous Manipulator, or Dextre, will manipulate the tools necessary for the demonstrations. RRM will be the first use of Dextre beyond the planned maintenance of the space station for technology research and development.

Onboard the RRM module will be four unique tools developed at Goddard: the Wire Cutter and Blanket Manipulation Tool, the Multifunction Tool, the Safety Cap Removal Tool, and the Nozzle Tool. Each tool will be stowed in its own storage bay until Dextre retrieves it for use. To give mission controllers the ability to see and control the tools, each tool contains two integral cameras with built-in LEDs.

"Robotic refueling and satellite servicing could extend the lifetimes of satellites offering significant savings in delayed replacement costs," said Cepollina. "Such servicing has the potential to allow human and robotic explorers to reach distant destinations more efficiently and effectively."

Drawing upon 20 years of experience servicing the HST, the SSCO initiated the development of RRM in 2009. *Atlantis*, the same shuttle that carried tools and instruments for the final, astronaut-based HST Servicing Mission 4, will now carry the first step to robotic refueling and satellite servicing on the last shuttle mission to space. ■

# Media, Employees, and VIPs Invited to Explore Goddard's Robotic Refueling Mission

By Dewayne Washington

On June 28, Goddard hosted a Media/VIP/Employee Day to explain the Robotic Refueling Mission (RRM) payload onboard STS-135. The joint effort between NASA and the Canadian Space Agency is designed to demonstrate and test the tools, technologies, and techniques needed to robotically refuel satellites in space. Reporters were also provided an in depth look into how Goddard has provided the communications network for voice, data, and video support throughout the shuttle program. ■

Photo credit: NASA/Goddard/Pat Izzo

*Caption: Benjamin Reed, Deputy Project Manager, Satellite Servicing Capabilities Office, explains how the Robotic Refueling Mission module will operate when positioned on the* International Space Station.

Photo credit: NASA/Goddard/Pat Izzo

*Caption: During the demonstrations, journalists were able to take a turn operating a replica of the Canadian arm onboard the* International Space Station. *The joint effort with the Canadian Space Agency is crucial to the success of the Robotic Refueling Mission operations.*

Photo credit: NASA/Goddard/Pat Izzo

*Caption: With the replica of the robotic station arm, operators will be able to develop and refine techniques to be used on orbit during the Robotic Refueling Mission.*


Photo credit: NASA/Goddard/Pat Izzo

*Caption: Susan Hoge, Operations Director, Flight Dynamics Facility, explains the support Goddard provides during a shuttle mission from launch to landing.*

# The WINCS Factory

By Lori Keesey

More than a decade ago, technologist Fred Herrero realized that to truly understand the ever-changing dynamics of Earth's upper atmosphere, he would need an armada of satellites gathering simultaneous, multipoint measurements. With satellites costing $100 million or more, he knew that was out of the question.

His solution: Promote the development of tiny, less expensive satellites and develop a miniaturized instrument ideally suited to gather data about Earth's ionosphere and thermosphere, a volatile slice of the atmosphere that stretches from about 60 miles to more than 350 miles above Earth¹s surface. His vision is becoming a reality.

This fall, Herrero and his team, including technologists Rusty Jones and Patrick Roman, are expected to begin delivering the first of several units of the Winds-Ion-Neutral Composition Suite (WINCS).

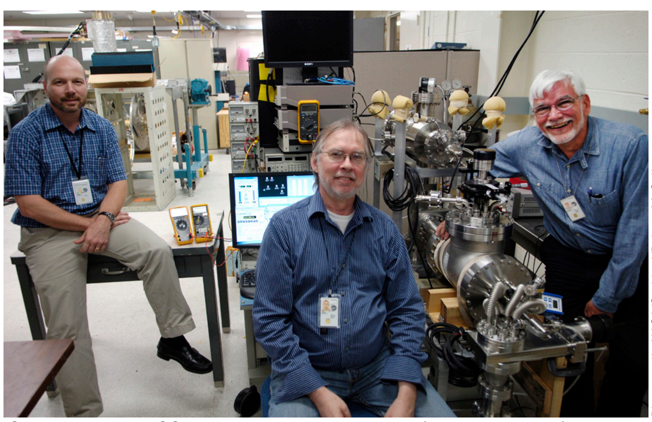

Photo credit: NASA/Goddard/Debora McCallum

*Caption: The WINCS development team includes (from left to right) Patrick Roman, Rusty Jones, and Fred Herrero.*

The instrument, developed with significant support from Herrero's partner, Andrew Nicholas of the Naval Research Laboratory (NRL), includes four spectrometers and three detectors assembled into a three-inch package using just 1.3 watts of power. Its diminutive size makes it an ideal payload for an emerging class of small spacecraft, often called Cubesats, promoted in recent years by the Defense Department and the National Science Foundation.

"By merit of Moore's law, the goal of any technological development should be the reduction of volume and power," technologist Jones said. "WINCS is a significant and brilliant step in that direction. Because of Fred's insights, I suspect that one day in the foreseeable future, we will see mass spectrometers the size of wristwatches."

As of today, the team is scheduled to deliver a total of seven instruments, all slated to fly on Cubesat missions over the next few years. In the fall, the team will deliver the first of three to NRL, followed by one to the Air Force Research Laboratory, one to the University of Michigan, and two to Boeing Aerospace, which is developing a Cubesat mission for the Air Force. The European Space Agency also is interested in buying the instrument, as is a Spanish aerospace company, Herrero said.

"Once we deliver the first, it will be like a little factory here," he added. "What's amazing about WINCS is not just its small size. It also will enable measurements we've never made before. For the first time, we will be able to measure the full vector of wind."

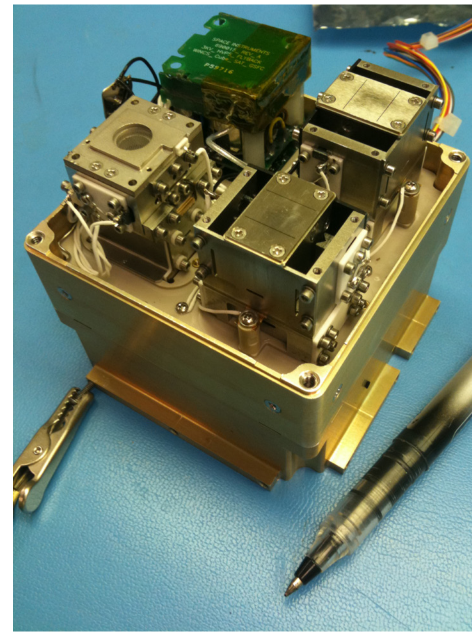

Photo credit: NASA/Goddard/Debora McCallum

*Caption: A close-up of the WINCS instrument.*

Herrero began conceptualizing WINCS more than a decade ago when he realized that to truly understand the ionosphere and thermosphere, scientists would have to gather multipoint measurements of the direction and temperature of winds, neutrals and ions, as well as their composition. Last year, the team received Goddard R&D funding to improve the instrument¹s resolution, and more importantly, its reliability. "The improvements drastically increased reliability far over any such instruments gathering data in this portion of the atmosphere," Herrero said.

The information he and his partners seek is of practical importance. "Everyone in this field is interested in the types of measurements WINCS can make," Roman said. The ionosphere and thermosphere are heavily influenced by the energy carried through space by the solar wind.

Under particularly tumultuous conditions, this energy can heat up the thermosphere, which then expands, exerting an atmospheric drag on orbiting spacecraft.

Ultimately, the spacecraft prematurely lose altitude and plunge to Earth.

The ionosphere, meanwhile, is the medium through which satellite communications must travel. If the ionosphere is disrupted, communications signals are thrown off.

Understanding this region is made more challenging because the environment changes quickly with distance—a situation that requires multiple satellites gathering the same data at various locations around the globe. "We're not going to learn anything new with just one satellite," Herrero said. "We need at least 50 satellites. Thank goodness someone came up with the idea of a Cubesat." ■

# 2011 System Engineering Leadership Development Program Class Graduates

By Haley Stephenson

Twenty systems engineers from across NASA, including three from Goddard, graduated from the Systems Engineering Leadership Development Program (SELDP) in June 2011.

The program's graduation featured presentations by each SELDP participant to the NASA Engineering Management Board, a talk by Orbital Executive President and General Manager for Advanced Programs, Dr. Antonio Elias, about the Pegasus rocket systems engineering story, and a visit from NASA Administrator Charlie Bolden.

The graduation week marked the culmination of a yearlong program that provided participants with knowledge, skills, and experiences aimed at preparing them for the challenges of systems engineering leadership at NASA. After a rigorous application process, the program kicked off in the spring of 2010. Once participants completed baseline assessments to identify strengths and areas for development, they embarked on a year of learning, developing, and practicing the qualities of a systems engineering leader: creativity, curiosity, self-confidence, persistence, and an understanding of human dynamics.

Photo credit: Haley Stephenson

*Caption: Carolyn Casey, Leadership Manager for NASA's Systems Engineering Education Development, stands in front of Ed Amatucci, SELDP Advocate (far left), and Michael Ryschkewitsch, NASA Chief Engineer (far right). In the middle are three Goddard employees (l to r) Chuck Zakrzwski, Don Whiteman, and Stephen DePalo.*

Program activities included mentoring and coaching, technical training, leadership development exercises, and forums. The 2011 SELDP class went on behind-the-scenes visits to Google and General Motors, and had the opportunity to participate in the 2011 PM Challenge in Long Beach, Calif.

The core of the SELDP experience was a hands-on developmental assignment at a new Center. Participants took on systems engineering roles that expanded their experience base and challenged them to incorporate new knowledge and skills in an unfamiliar organizational setting. Stephen DePalo, Mission Systems Engineer for the Mission Systems Engineering Branch, was assigned to Kennedy Space Center and served as Assistant Chief Engineer for the Operational Systems Engineering Office. Don Whiteman, a Microwave and Communication Systems Engineer, was assigned to Kennedy Space Center and served as a Mission Integration Engineer. Chuck Zakrzwski, a Senior Propulsion Engineer, was assigned to Marshall Space Flight Center and served as the Payload Operation Lead for the Payload Operations Integration Center.

"NASA exists to reach new heights and reveal the unknown, so what we do and learn will benefit all mankind," said Chief Engineer Mike Ryschkewitsch to the graduates. "What each of us do, no matter how small, it does make a difference. We are driven by being part of something bigger than ourselves and the opportunity to make a difference."

SELDP grew out of a need identified by NASA leadership and the Office of the Chief Engineer for an Agency-wide leadership development program that would help identify and accelerate the development of high-potential system engineers, with a focus on specific leadership behaviors and technical capabilities that are critical to success in the NASA context. Headed by Christine Williams of the NASA Academy of Program/Project & Engineering Leadership (APPEL), SELDP aims to develop and improve leadership skills and technical capabilities. ■

# ARTEMIS Spacecraft Prepare for Lunar Orbit

By Karen C. Fox

They've almost arrived. It took one and a half years, over 90 orbit maneuvers, many gravitational boosts, and only the barest bit of fuel to move two spacecraft from their orbit around Earth to their new home around the Moon.

The spacecraft have been through orbits never before attempted and made lovely curlicue leaps from one orbit to the next. This summer, the two ARTEMIS spacecraft—which began their lives as part of the five-craft Time History of Events and Macroscale Interaction during Substorms (THEMIS) mission studying Earth's aurora—will begin to orbit the Moon instead.

Even with NASA's decades of orbital mechanics experience, this journey was no easy feat. The trip required several maneuvers never before attempted, including several months when each craft moved in a kidney-shaped path on each side of the Moon around, well, nothing but a gravitational point in space marked by no physical planet or object.

"No one has ever tried this orbit before, it's an Earth-Moon libration orbit," says David Folta a flight dynamics engineer at Goddard. "It's a very unstable orbit that requires daily attention and constant adjustments."

The journey for ARTEMIS—short for Acceleration, Reconnection, Turbulence and Electrodynamics of the Moon's Interaction with the Sun—began in 2009, after THEMIS had completed some two years of science data collection on the magnetic environment around Earth, the aurora, and how these are affected by the Sun.

The spacecraft are solar-powered, but orbits for the two outermost THEMIS spacecraft had slipped over time and were going to be subjected to regular eight-hour periods of darkness. These spacecraft could withstand up to three hours without sunlight, but this much darkness would soon leave the batteries completely discharged.

Teams at UC-Berkeley and Goddard handled the day-to-day control of the THEMIS spacecraft. The Principal Investigator for the mission, Vassilis Angelopoulos of UCLA talked to the teams about moving the two spacecraft to the Moon to study the magnetic environment there. But quick models of a conventional boost technique showed that all the remaining fuel would be used simply in transit. There wouldn't be enough left over for the fuel-hungry process of adjusting direction and speed to actually begin circling the Moon.

So Angelopoulos pulled together a new, more complex multi-year-long orbit change plan. The move would rely predominantly on gravity assists from the Moon and Earth to move the spacecraft into place. He brought his idea to two engineers who had been involved with launching THEMIS in the first place: David Folta and another flight engineer at Goddard, Mark Woodard. The pair used their own models to validate this new design, and the plan was on.

First step: increase the size of the orbits. The original Earth-centric orbits barely reached half way to the Moon. By using small amounts of fuel to adjust speed and direction at precise moments in the orbit, the spacecraft were catapulted farther and farther out into space. It took five such adjustments for ARTEMIS P1 and 27 for ARTEMIS P2.

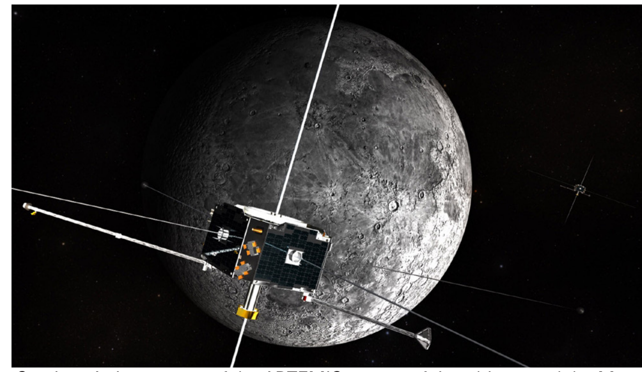

Image credit: NASA

*Caption: Artist concept of the ARTEMIS spacecraft in orbit around the Moon.*

Next step: make the jump from Earth orbit to the tricky kidney-shaped "Lissajous" orbit, circling what's known as a Lagrangian point on each side of the Moon. These points are the places where the forces of gravity between Earth and the Moon balance each other—the point does not actually offer a physical entity to circle around. ARTEMIS P1 made the leap—in an arc under and around the Moon—to the Lagrangian point on the far side of the Moon on August 25, 2010. The second craft made the jump to the near side of the Moon on October 22. This transfer required a complex series of maneuvers including lunar gravity assists, Earth gravity assists, and deep space maneuvers. The combination of these maneuvers was needed not only to arrive at the correct spot near the Moon but also at the correct time and speed.

History was made. Numerous satellites orbit Lagrangian points between Earth and the sun but, while this orbit had been studied extensively, it had never before been attempted.

Not only was this an engineering feat in and of itself, but the spacecraft were now in an ideal spot to study magnetism some distance from the Moon. In this position, they could spot how the solar wind—made up of ionized gas known as plasma—flows past the Moon and tries to fill in the vacuum on the other side. A task made complicated since the plasma is forced by the magnetic fields to travel along certain paths.

"It's a veritable zoo of plasma phenomena," says David Sibeck, the project manager for THEMIS and ARTEMIS at Goddard. "The Moon carves out a cavity in the solar wind, and then we get to watch how that fills in. It's anything but boring. There's microphysics and particle physics and wave particle interaction and boundaries and layers. All things we haven't had a chance to study before in the plasma."

Life for the flight engineers was anything but boring too. Keeping something in orbit around a spot that has little to mark it except for the balance of gravity is no simple task. The spacecraft required regular corrections to keep it on track and Folta and Woodard watched it daily.

# ARTEMIS Spacecraft Prepare for Lunar Orbit

Continued from Page 8

"We would get updated orbit information around 9 a.m. every day," says Woodard. "We'd run that through our software and get an estimate of what our next maneuver should be. We'd go back and forth with Berkeley and together we'd validate a maneuver until we knew it was going to work and keep us flying for another week."

The team learned from experience. Slight adjustments often had bigger consequences than expected. They eventually found the optimal places where corrections seemed to require less subsequent fine-tuning. These sweet spots came whenever the spacecraft crossed an imaginary line joining Earth and the Moon, though nothing in theories had predicted such a thing.

The daily vigilance turned out to be crucial. On October 14, the P1 spacecraft orbit and attitude changed unexpectedly. The first thought was that the tracking system might have failed, but that didn't seem to be the problem. However, the ARTEMIS team also noticed that the whole craft had begun to spin about 0.001 revolutions per minute faster. One of the instruments that measures electric fields also stopped working. Best guess? The sphere at the end of that instrument's 82-foot boom had broken off—perhaps because it was struck by something. That sphere was just three ounces on a spacecraft that weighed nearly 190 pounds—but it adjusted ARTEMIS P1's speed enough that had they caught the anomaly even a few days later they would have had to waste a prohibitive amount of fuel to get back on course.

As it is, ARTEMIS will make it to the Moon with even more fuel than originally estimated. There will be enough fuel for orbit corrections for seven to 10 years and then enough left over to bring the two craft down to the Moon.

"We are thrilled with the work of the mission planners," says Sibeck. "They are going to get us much closer to the Moon than we could have hoped. That's crucial for providing high quality data about the Moon's interior, its surface composition, and whether there are pockets of magnetism there."

On January 9, 2011, ARTEMIS P1 jumped over the Moon and joined ARTEMIS P2 on the side of the Moon closest to Earth. Now the last steps are about to begin.

On June 27, P1 will spiral in toward the Moon and enter lunar orbit. On July 17, P2 will follow. P2 will travel in the same direction with the Moon, or in prograde; P1 will travel in the opposite direction, in retrograde.

"We've been monitoring ARTEMIS every day and developing maneuvers every week. It's been a challenge, but we've uncovered some great things," says Folta, who will now focus his attention on other NASA flights such as the MAVEN mission to Mars that is scheduled to launch in 2013. "But soon we'll be done with this final maneuvering and, well, we'll be back to just being ARTEMIS consultants." ■

# Building 21 Cafeteria Reopens to Good Reviews

Photos by Debora McCallum

*Caption: Goddard Associate Director Nancy Abell and Matthew Yoo from IL Creations cut the ceremonial ribbon, opening the renovated cafeteria for business.*


*Caption: Goddard employees eagerly await the reopening of the Building 21 cafeteria.*

*Caption: Goddard employees cram the refreshed cafeteria. They enjoyed a plethora of new food choices.*

# Celebrate Goddard Photo Gallery

Photos by Bill Hrybyk and Pat Izzo

# Celebrate Goddard Photo Gallery




# **OutsideGoddard**: Telling Life Stories with Photographs

By Elizabeth M. Jarrell

Optical engineer Bert Pasquale says that "photography has always been an outgrowth of my interest in optics." According to Bert, "Art is all around you; you just have to find the image that is there." Pasquale calls his photographic style "life storytelling" because it combines aspects of environmental portraiture, fine art, and photojournalism to tell the story of his subject. Explains Pasquale, "For an image to be compelling, it must tell a story, and not merely be glamorous or artistic."

In 2006, Pasquale met internationally-recognized photographer James Roy through the Maryland chapter of the Professional Photographers Association (MDPPA). That meeting greatly influenced his art.

Roy specializes in wedding portraits and fine art portfolios, and was the first photographer Pasquale met who combined highly technical lighting techniques with artistic compositions. "James was equally adept at creating gallery-quality art pieces at Carnival in Italy or at a local wedding." In 2009, Roy began mentoring Pasquale.

The summer of 2009, Roy began developing several photo safari workshops on location throughout the world. He invited Pasquale and four others to join him on his final scouting trip for his American Southwest photo safari workshop. Explains Pasquale, "A photo safari is a photographer's guided tour of a particular location. The guide takes you to a location of interest but also provides technical instruction and compositional guidance. It is a 'learn as you go' situation." Roy picked the southwest for its unique lighting and iconic landscape subjects.

The first day of the safari involved a three hour, pre-dawn drive into a remote wilderness area on Navaho land known as "South Coyote Buttes." The group camped there three nights. "The area is aptly named; we heard the coyotes every night," remembers Pasquale.

Photographers are partial to shooting during the early hours and late hours of the day when the sunlight is the softest and the shadows are the longest. Accordingly, Pasquale's typical day began before sunrise to shoot during the early morning light until around 11:00 a.m. The group then went back to camp to eat and nap before returning for another shooting session from about 3:00 p.m. to sunset. The group spent their evenings together at the campsite enjoying and critiquing the pictures from the day.

Pasquale had hired a local Arizona model so he could simultaneously shoot both landscape and model photography. Says Pasquale, "We walked among these 'other-worldly' sandstone vistas. Some formations were 100 feet high yet had striations with exceptionally fine detail. There was no end to the compositional possibilities. Three days did not begin to cover it all."

Following the camping portion, they stayed two days at a hotel in Page, Arizona. From there, they photographed equally spectacular landscapes including Antelope Canyons, Horseshoe Bend, Lake Powell, and Glen Echo Ridge. "It was pretty much non-stop photography," Pasquale recalls.

Pasquale brings his technical experience as an optical systems designer to his photography. He uses a High Dynamic Range (HDR) imaging technique to accommodate desert and similar lighting situations, which he explains as follows: "The desert is a situation with extreme contrasts in terms of light. You have to be sure to expose for any shadow detail you want to capture, and then sometimes even take a second exposure to adequately capture the highlights."

He also uses an ultra-high resolution environmental portraiture method to photograph the wide vistas. Describes Pasquale, "I also often captured panoramic views using multiple, overlapping frames creating images hundreds of megapixels in size. The ultra-high resolution technique gave me the flexibility to be able to print some final images 10 feet long at full resolution or crop in on the model for a stunning portrait."

Pasquale's artistic career has further matured since going on photo safari with his mentor. He periodically teaches some of the photography techniques he used on the photo safari in classes for the PPA. His work has been displayed in local galleries and he hopes to publish a book of his photographs by next year. Pasquale is also a professional photographer specializing in weddings, portfolio work, and life story portraitures.

He won dual 2009 Photographer of the Year awards from the Maryland Professional Photographers Association, one in Portrait and a second in Electronic Imaging. His image "Cliffhanger" was recently accepted into the 2010 PPA National Loan Collection.


Photo credit: Bert Pasquale

*Caption: "Cliffhanger."*

Another of his images, "Pelican Bar," received a prestigious Kodak Gallery Award at the 2011 Maryland State PPA Convention and will now be considered for a National Kodak Gallery Elite Award. Three of his panoramic images will be featured in the 2012 "PanoBook." All five of these images are products of Pasquale's multiple frame panoramic method. His photography can be viewed online at: http://www.lifestoryimages.com. ■