National Aeronautics and Space Administration

The Critical PATH

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MMS Launched and in Commissioning Operations!

The Magnetospheric Multiscale (MMS) mission received a perfect launch on March 12, 2015 at 10:44 p.m. EDT by an Atlas-V series 421 launch vehicle from Cape Canaveral Air Force Station. The four spacecraft, designated MMS-1, MMS-2, MMS-3, and MMS-4, were launched in stacked configuration with the bottom observatory, MMS-1, attached to the launch vehicle Centaur upper stage. Approximately an hour and a half after launch, the Centaur spun up the stack to 3 rpm and commanded separations every 5 minutes starting with MMS-4 and ending with MMS-1. It was a bittersweet moment for many at GSFC who had worked on this challenging in-house project for many years, as MMS entered a new operations phase to explore the mysterious process of magnetic reconnection.

MMS is a Solar Terrestrial Probes mission comprising four identically instrumented spacecraft that fly through the outer region of the Earth's magnetosphere. MMS will investigate how the Sun's and Earth's magnetic fields disconnect and reconnect, explosively transferring energy from one to the other in a process that is important on the Sun, other planets, and everywhere in the universe, known as magnetic reconnection. Reconnection limits the performance of fusion reactors and is the final governor of geospace weather that affects modern technological systems such as telecommunications networks, GPS navigation, and electrical power grids. Solving magnetic reconnection will unlock understanding of a fundamental and universal energetic plasma process that drives our space weather and affects and limits our use of technologies on Earth.

MMS GSFC Team before launch

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Inside This Issue

DSCOVR on its way to Sun-Earth L1

After more than 15 years in existence, many starts and stops, cancellation, storage, restart, repurposing, renaming, refurbishment and retests, the Deep Space Climate Observatory (DSCOVR) spacecraft (formerly known as Triana) was launched on February 11, 2015, aboard a SpaceX Falcon 9 rocket provided by the United States Air Force (USAF).

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David Mitchell

Message from the Director

While it was certainly not what I expected when I became the Deputy Director of Flight Projects last summer, I am nonetheless very humbled and proud to step in as the Director of Flight Projects as George Morrow moves up to the 6th floor to become our Deputy Center Director. I will definitely miss George's day-to-day leadership of Code 400, but I know that in his new position George will continue to have a positive impact on not only the Flight Projects Directorate but Goddard as a whole. And I know that all of you join me in wishing him well in his exciting, new position.

I suspect that some of you might be wondering about my plans to backfill the Code 400 Deputy Director position. An ad for the position was posted for 30 days, closing on April 15th. Following the normal processes and timeline, I anticipate that we will fill the position in the June/July timeframe. In the meantime, Tom McCarthy (Code 420) has stepped in during the month of April to be the acting Deputy and Nick Chrissotimos (Code 460) will be doing the same in the month of May. I very much appreciate what Tom, Nick, and their respective home organizations are doing to help me out in this period of transition.

As the head of the Flight Projects Directorate, I don't plan to make any substantive changes to the organization as it is currently structured, but I do plan to provide an additional, personal focus on several areas that are particularly important to me. For starters, I believe that the people of this directorate are the engine behind our successes and I want to do everything I can to help each person to find his or her best "fit" in the directorate. Another key area of interest for me is lining up "new work" for the Center, particularly in light of our recent completion and successful launches of two in-house missions, MMS and DSCOVR. I am happy to report that there is a lot of activity on multiple fronts lining up new work for the Center. Some of the activity will take time to bear fruit, but new work is now arriving in the form of in-house instrument projects, PACE, Landsat-9, JPSS follow on, Satellite Servicing, and WFIRST. Additionally, NASA Headquarters will soon be issuing selection notifications on Announcements of Opportunity to which we recently responded. I am hopeful that Goddard will be receiving some of those selections based on the high quality work generated by our new business teams.

Another area of focus for me will be to continue to enhance our relationship with NASA Headquarters. Because I live in Alexandria, NASA Headquarters is right on my way home from Goddard. So I've made a point of stopping in at Headquarters and walking the halls at least a couple times each week at the end of the business day. To me there is nothing better than face-to-face interactions when it comes to relationship building.

I promise you that I will do my best in this new, challenging position, and I will always make time for you if you want to drop by to simply say hi and talk about what's going on in your jobs or to discuss potential future opportunities.

Lastly, I want to take a moment to thank you, the members of the Flight Projects Directorate team, who, along with the support of your families, deserve full credit for everything that you do to make us successful. While I believe this work is a labor of love for everybody, I recognize that it comes with a great deal of personal sacrifice. Please know that your efforts are much appreciated!

Dave

David F. Mitchell
Director of Flight Projects
david.f.mitchell@nasa.gov

George Morrow

Message from the Director

It is with mixed emotions that I write my last Director's message for *The Critical Path*. My excitement and enthusiasm for taking on the broad responsibilities of Deputy Center Director are tempered by the fact that I will not be working daily with the wonderful staff of the Flight Projects Directorate. The last 7.5 years as Director of Flight Projects were a great time for me. During that time, the organization grew and evolved and we successfully launched more than 23 missions together. The sense of reward and accomplishment is tremendous.

Please know that I will continue to do everything I can to sustain the great success of Goddard and our mission in my new position. We are here to enable scientific research and technology development through our missions and we can never forget that.

Even though I'm moving a few floors north in building 8, my door will be as open as always. Please don't hesitate to stay in touch and I will do the same.

Sincerely and with gratitude,

George W. Morrow
GSFC Deputy Director
george.w.morrow@nasa.gov

George Morrow (R) with Goddard Center Director, Chris Scolese (L) and MAVEN Deputy Project Manager, Sandra Cauffman (C)

Personality Tintypes

Val Lunz

Val Lunz

Val is Special Assistant to the Flight Projects Directorate. She is responsible for supporting the day-to-day activities of the directorate office and performing programmatic analyses for executive management while maintaining awareness of the directorate's capabilities and mission landscape.

Born

Baltimore, MD

Education

BFA – 3-D Design – Salisbury University, Maryland
MBA – Contract and Acquisition Management – American Graduate University

Life before Goddard

After college, Val accepted a position in Salisbury, Maryland to teach art at Parkside High School. There she also had the opportunity to be the head coach for the boys and girls indoor and outdoor track and field teams, coaching the team to a regional 2nd place finish for the mid-Atlantic/Delmarva area. Her enthusiasm and spirited coaching (some would maybe say her loud mouth) caught the attention of her future husband, Mr. Ruark, who was the boys' baseball coach and school's mathematics teacher. With the help of the students playing matchmaker and after a forced awkward first meeting, it was love at first sight… so much so that after the school year they took a leap of faith and moved to St. Petersburg, Florida.

In Florida, life was sunshine and palm trees. The economy was tight so Lee and Val made do by working at a local sports pub that was operated by two retired gym teachers, who took a liking to the two because of their teaching background. The pub was situated 10 steps from Tropicana Field and developed from an old gas station but with flooring and attributes from old gymnasiums. At the time, the Baltimore Orioles had not seen a good season in almost a decade and the Tampa Bay Rays were having their first good season since EVER, this being the first season with their makeover look and dropping the "devil" from the name. The Rays were on their way to the playoffs and since the Os had another unfortunate season, Lee and Val felt it was acceptable to jump on the bandwagon and

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Bill Sluder

Bill Sluder

Bill is the Deputy Project Manager for Resources on the Magnetospheric Multiscale (MMS) project. He was also recently selected to the same position on the Pre-Aerosol Clouds and ocean Ecosystem (PACE) project. MMS launched on March 12, 2015 and will soon complete observatory commissioning and begin helping scientists understand how the Sun's and Earth's magnetic fields connect and disconnect, explosively transferring energy from one to the other. PACE is currently in Pre-Phase A and will study Earth's aquatic ecology and chemistry and address the uncertainty in our understanding of how clouds and small airborne particles called aerosols affect Earth's climate.

Born

Leonardtown, Maryland

Education

B.S. Business Administration (Finance and Economics Concentrations), Towson State University

Life Before Goddard

Before coming to Goddard, Bill was a college student at Towson State University, now known as Towson University. He grew up in southern Maryland in the town of Lexington Park, which is in St. Mary's County.

Life At Goddard

Bill came to Goddard in 1990 after graduating from Towson. His first position was as a Resources Analyst in the Flight Projects Directorate office. After a few months of learning about Goddard and the directorate he moved to the International Solar Terrestrial Physics (ISTP) Program where he was a Resources Analyst for the Solar and Heliospheric Observatory (SOHO), Cluster and Geotail projects. He was responsible for the financial management and analysis, several instrument contracts and project functions. Upon completion of those missions, Bill moved on to the Hubble Space Telescope (HST) Operations and Ground Systems project. He was the Resources Analyst

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(MMS continued from page 1)

Over 300 NASA civil servants and onsite contractors at GSFC designed, built and integrated the MMS observatories. GSFC also built one of the key instruments for MMS known as the Fast Plasma Investigation comprised of both ion and electron spectrometers. The Mission Operations Center is located at GSFC and the Science Operations Center is located at the University of Colorado. The science instruments were built by a team of institutions that include the Southwest Research Institute (SwRI) in San Antonio, the University of New Hampshire, John Hopkins Applied Physics Lab, the University of Colorado, UCLA, the Austrian Institute for Space Science, Meisei Corporation in Japan, and NASA GSFC. SwRI provides science leadership for the mission and integrated all instruments onto an instrument suite for delivery to GSFC.

MMS launch site processing at Astrotech

With 4 observatories, 100 instruments and 32 boom deployments, the MMS commissioning phase of five-and-a-half months is both challenging and longer than most missions. To date, operations have gone extremely well, with all instrument low voltage operations checked out, and instrument high voltage and boom deployments in process. A total of 60 propulsive maneuvers have been performed in the first month of operations to raise perigee, spin up observatories for deployments and stabilize the orbits to allow the MMS observatories to drift towards each other. The simultaneous nutation-precession-spin controller and the closed-loop thruster control systems are exceeding expectations in their accuracy. Science instrument data shows that the MMS team succeeded in building observatories with an extremely low magnetic and electrostatic signature. Fully deployed, each MMS observatory will have a footprint the size of a baseball field while flying in a tetrahedron formation as close as 10 km apart.

MMS launch

Shortly after launch, MMS set a world record when its GSFC-built weak signal GPS receivers known as Navigator were turned on. The Navigator is significantly exceeding its performance requirements, tracking more GPS space vehicles at higher altitudes than planned. With an apogee at more than 70,000 km above the surface of the Earth, MMS is now the highest satellite in the world to use GPS signals for onboard orbit determination. Because MMS is travelling so fast at perigee at more than 10.5 km/sec, it is also the fastest satellite in the world using GPS. GSFC's demonstration of this technology has benefits to not only MMS but to future missions that could use autonomous orbit determination far away from Earth.

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Although much work lies ahead to complete commissioning operations with four observatories, the MMS team is well positioned to complete this phase and start science operations in September 2015 as planned. Many people worked long hours to support both the launch campaign and flight operations. MMS team members gained invaluable experience during the execution of MMS, overcoming many challenges of building and testing an immense amount of hardware. They demonstrated that GSFC is more than capable of meeting its commitment of executing a challenging mission on budget. Although it is sad to see a great team disbanded, GSFC future projects will benefit from the experience that MMS personnel bring of building not one but four large spacecraft. All MMS personnel can proudly say that they had a major role in making new discoveries in science and increasing our knowledge of the universe.

http://mms.gsfc.nasa.gov/

Brent Robertson, Code 461
MMS Deputy Project Manager

(DSCOVR continued from page 1)

The DSCOVR spacecraft will orbit between the Earth and Sun, measuring the properties of particles and magnetic fields – also called solar wind – emitted by the Sun. Solar wind ebbs and spikes depending on the activities of storms within and on the solar surface. A significant burst of solar wind and magnetic fields directed towards Earth can affect power grids, communications systems, and satellites close to Earth. In addition, from its position situated approximately one million miles from Earth, DSCOVR will observe our planet. DSCOVR will provide measurements of the radiation reflected and emitted by Earth as well as provide images of the sunlit side of Earth for science applications.

The DSCOVR mission is a partnership between the National Oceanic and Atmospheric Administration (NOAA), NASA and the USAF. NOAA is responsible for the DSCOVR mission, providing program management, spacecraft operation, and distribution of all mission data. DSCOVR will succeed the NASA Advanced Composition Explorer (ACE) spacecraft in providing data used to produce solar wind alerts and warnings from NOAA. The Goddard Space Flight Center (GSFC) provided the DSCOVR spacecraft, performed the refurbishment and retest, developed and delivered the ground system, and prepared the spacecraft for launch on the SpaceX Falcon 9. NASA will also process Earth science data provided by DSCOVR. The USAF provided the launch service.

In addition to repurposing the Triana spacecraft for space weather monitoring, the DSCOVR mission represents several firsts:

- First GSFC science payload launched aboard a SpaceX Falcon 9 rocket
- First SpaceX payload to travel beyond Earth orbit
- First USAF Space & Missile Systems Center Rocket Systems Launch Program (RSLP) liquid-fueled space launch
- First RSLP launch from Cape Canaveral Air Force Station
- First NOAA space weather satellite
- First NASA Joint Agency Satellite Division program launch
- First Goddard spacecraft refurbishment that involved the total disassembly and reassembly of a fully qualified spacecraft
- First Earth observing mission from a Sun-Earth L1 orbit.

Importance of Solar Wind for Earth

Space weather and the resulting geomagnetic storms have demonstrated the potential to disrupt virtually every major public infrastructure system, including transportation systems, power grids, telecommunications and GPS. With timely and accurate alerts produced from DSCOVR data, infrastructure managers can take action to avert the greatest damage. NOAA's geomagnetic storm warnings are critical for these key industries.

Measurements from L1 Between Earth and Sun

DSCOVR will be stationed in orbit around the first Sun-Earth Lagrange point (L1). The L1 point is on the direct line between Earth and the Sun located 1.5 million kilometers (930,000 miles) sunward from Earth, and is a neutral gravity point between Earth and the Sun. The spacecraft will orbit the Sun, not Earth, positioned on the Sun-Earth line. At this location, DSCOVR will have a 6-month orbit with a spacecraft-Earth-Sun angle varying between 4 and 15 degrees. The particles that stream as the solar wind move extremely fast. Depending on particle velocity, DSCOVR at L1 will measure the strength of waves of energy and particles from storm events up to an hour before they strike Earth. This satellite location is the only

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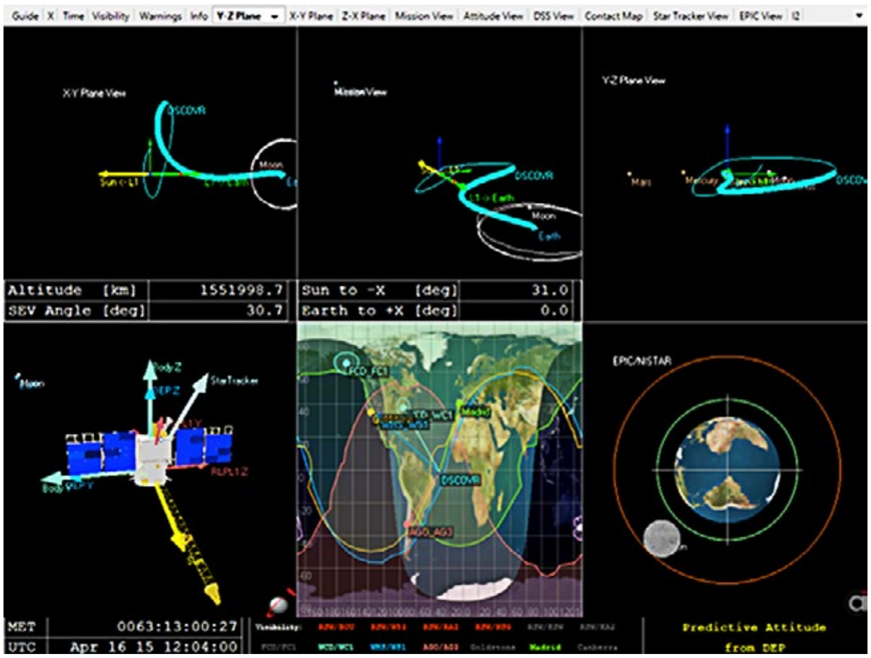
place to obtain a 15 to 60-minute lead time for geomagnetic storm warnings. At the time of this writing, DSCOVR is nearly mid-way through the long arc designed into the trajectory as it approaches the L1 orbit insertion point. The DSCOVR journey is shown as the thicker portion of the trajectory (or flight path) below.



DSCOVR mission trajectory

In early June, the NASA DSCOVR team will execute the L1 orbit insertion burn to place DSCOVR in its Lissajous orbit.

For the NASA Earth science mission, the L1 vantage point also offers a unique continuous view of the entire sunlit half of Earth in an "Earth at noon snapshot," as opposed to other Earth observing satellites situated closer to Earth that capture an image strip that is later "stitched" together.

Instruments Flying on DSCOVR

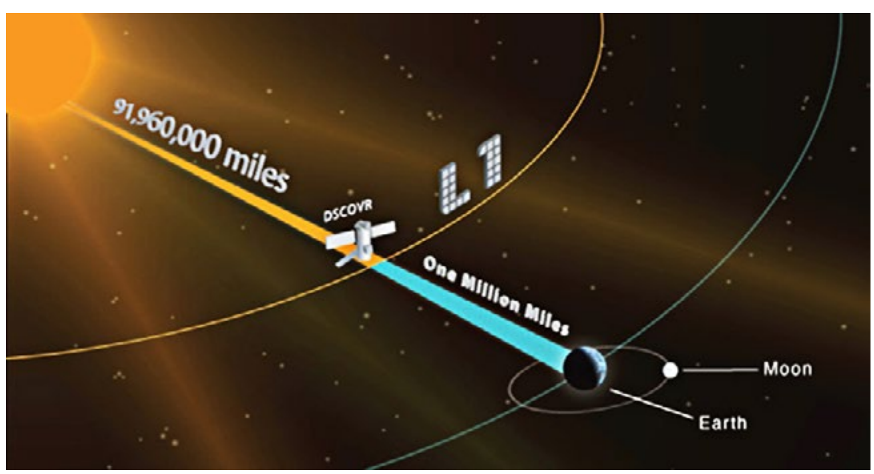
PlasMag – Plasma-Magnetometer measures solar wind activity to provide highly accurate and rapid warning of geomagnetic storms with lead times of up to one hour. The PlasMag (Magnetometer, Faraday Cup and Electron Spectrometer) will measure the magnetic field and the velocity distribution functions of the electron, proton and alpha particles (Helium nuclei) of solar wind with higher time resolution than existing instruments. The instrument suite was developed at GSFC and the Massachusetts Institute of Technology in Cambridge, Massachusetts, and optimized for small size, low power, simplicity and dynamic range.

EPIC – Earth Polychromatic Imaging Camera instrument provides spectral images of the entire sunlit face of Earth, as viewed from an orbit around L1. EPIC is able to view the entire sunlit Earth from sunrise to sunset. EPIC's observations will provide a unique angular perspective, and will be used in science applications to measure ozone and aerosol amounts, cloud height, vegetation properties, and ultraviolet reflectivity of Earth. The data from EPIC will be used by NASA for a number of Earth science developments including dust and volcanic ash maps of the entire Earth. EPIC makes images of the sunlit face of Earth in 10 narrowband spectral channels. As part of EPIC data processing, a full-disk, true color Earth image will be produced about every 2 hours. This information will be publicly available through the NASA Langley Research Center Atmospheric Science Data Center in Hampton, Virginia, approximately 24 hours after the images are acquired.

NISTAR – National Institute of Standards and Technology Advanced Radiometer is a cavity radiometer designed to measure the reflected and emitted energy (in the 0.2 to 100 micron range) from the entire sunlit face of Earth. This measurement is intended to improve understanding of the effects of changes in Earth's radiation budget caused by human activities and natural phenomena. The information from NISTAR can be used for climate science applications by NASA. NISTAR will measure the amount of reflected sunlight and the thermal radiation of Earth in the direction towards the Sun. These quantities are key ingredients of current climate models.

Path to DSCOVR

DSCOVR (formerly known as Triana) was originally conceived in the late 1990s as a NASA Earth science



DSCOVR at L1

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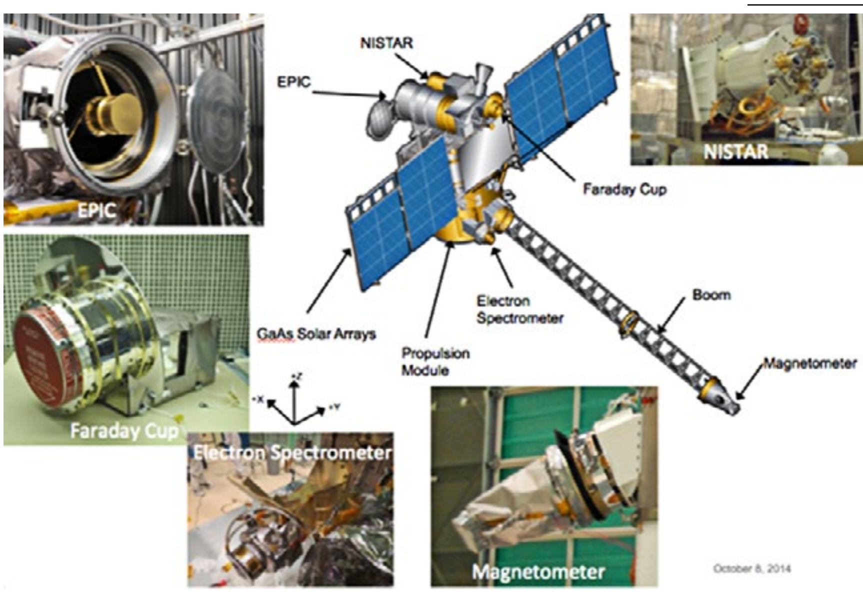
(DSCOVR continued from page 7)

mission that would primarily provide a near-continuous view of Earth and measure Earth's albedo. Space physics sensors were added to the mission payload. The Triana program was suspended and the satellite went into storage in 2001. NOAA funded NASA to remove DSCOVR from storage and test it in 2008. The same year, the Committee on Space Environmental Sensor Mitigation Options performed an interagency assessment requested by the White House Office of Science and Technology Policy. The Committee determined that DSCOVR was the optimal solution for meeting NOAA and U.S. Air Force space weather requirements. NOAA funded NASA to refurbish the spacecraft, recalibrate the space weather sensors, prepare the spacecraft for launch, develop the ground systems and operations, and provide technical management of the space segment. In 2012, NASA brought the spacecraft out of storage at GSFC, where the spacecraft was originally built. NASA inspected the instruments, tested the mechanisms, provided new electrical components and conducted environmental tests of the observatory.



DSCOVR Instruments

Spacecraft Refurbishment

All spacecraft components were evaluated to determine their condition, whether repairs or replacement was needed, whether the components met the DSCOVR requirements, and whether they would withstand the launch environment. Triana had been designed for a Space Shuttle launch nestled in a payload bay cradle. The loads environment DSCOVR would see would be significantly different and required detailed analysis, structural modification and a thorough coupled loads analysis working closely with SpaceX.

All spacecraft components and subsystems were evaluated and refurbished. Following completion of the component refurbishment, a full environmental test program was executed at Goddard. As a result of the outstanding effort of the DSCOVR team in all of these areas, the overall mission risk was significantly reduced.

SMEX-lite bus separated from the propulsion module

Breaking the Spacecraft in Half

Similar to any home or auto repair, the DSCOVR refurbishment was not as straightforward as planned. A critical element of the spacecraft refurbishment was the repair or replacement of components in some of the electronics boxes. In particular, there were Government-Industry Data Exchange Program (GIDEP) alerts on interpoint DC/DC power converters. The problem was with DC/DC converters that had been filled with potting compound to increase their ability to pass Particle Impact Noise Detection (PIND) testing. When placed in a vacuum, the lids could bow and pull the internal components off the printed circuit board. After a series of meetings with the electrical engineers, the parts branch, mission assurance, and the project a plan was developed to remove the suspect boxes out of the Small Explorer (SMEX)-lite bus and test the DC/DC converters without removing the converters from the boards. The electronics boxes are secured to a "picture frame" in the spacecraft structure by a series of bolts around the perimeter. When the mechanical engineers attempted to remove the first box, the fasteners were removed but the box hit a snag that prevented it from sliding out. It wouldn't move any further. On examination, it was evident that the boxes could slide in and out freely, but the electrical connectors protruding from each box prevented them from coming out. There was not enough clearance to demate the electrical connectors. The only alternative was to separate the propulsion module from the SMEX-lite bus to gain access to demate the connectors

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and remove the boxes. Since new mechanical ground support equipment (MGSE) would be needed to hold the SMEX bus once it was separated from the propulsion module, the project was facing a 3-month schedule delay. The mechanical team went to work on this problem and in rapid fashion, a fixture at the Laurel warehouse was modified, proof tested, and the bus and propulsion module were separated in under 3 weeks. This was an outstanding effort that avoided 2 months of potential schedule delay.

Stormy Weather

In early 2014, the DSCOVR observatory was put into the thermal vacuum chamber to be tested under extreme thermal and vacuum environmental conditions. This is normally a very long test that requires around-the-clock coverage by the observatory engineers, thermal engineers, test conductors, mission assurance and others. These are very long days for an extended period. During our multi-month test there were a number of challenges including issues with the test facility, the test article and other things necessary for running the test. More challenges were presented by Mother Nature: two major snow events occurred during the thermal vacuum test. The small DSCOVR team responded very well to these events. Minimal staffing levels were defined, food was stockpiled and emergency plans were put in place.

There wasn't always advance warning. On June 29, 2012, a strong, fast-moving storm front called a Derecho moved swiftly from the Ohio Valley down through the mid-Atlantic region causing massive power outages and damage throughout the region. One of the effects on DSCOVR was that a server went down and we lost our version of the Next Generation Information Network (NGIN). NGIN stores all DSCOVR configuration controlled documents, drawings, work orders and other data needed to understand how the spacecraft is built and documents the work that has been done to it.

The project team worked closely with the Information Technology (IT) support group to restore the data and after a great effort by everyone, the system was back up and running without affecting the ongoing development activities. If these were not enough weather-related issues, Mother Nature threw another curveball. The observatory and its science instruments are very sensitive to damage from contamination. After a particularly heavy rain, water had gotten into the clean tent. The water had pooled on the roof of the building, found a way in and dripped on top of the tent. Eventually the water worked its way around the edges of the plastic panels on top of the tent and dripped into the clean area. Luckily, the water just missed the NISTAR instrument and only hit some of the ground support equipment and tools in the area. The team worked quickly with the I&T facilities group to put in place a system that would channel the water away from the tent while the leak was fixed.

There are many other stories, like the government furlough of 2013, where the DSCOVR team was confronted with unplanned, unforeseen, man-made or natural events that impacted planned activities. The team persevered through it all and launched the DSCOVR mission on schedule.

DSCOVR Launch and Early Orbit Operations

Following completion of the refurbishment and full environmental testing of DSCOVR, the spacecraft was shipped to Astrotech in Titusville, Florida for final preparations for launch. Final preparations included performance tests, solar array deployment tests and loading of propellant. Following propellant loading, DSCOVR was integrated with the SpaceX payload adapter and encapsulated in the Falcon 9 fairing. SpaceX then transported the encapsulated DSCOVR spacecraft to the SLC-40 Hangar Annex for final processing and mating to the launch vehicle.

DSCOVR being mounted on Falcon-9 Flight Payload Adapter

After two scrubbed launch attempts, DSCOVR launched on February 11, 2015, aboard a SpaceX Falcon 9 v 1.1 launch vehicle from Cape Canaveral Air Force Station Space Launch Complex-40. Following separation from the Falcon 9 second stage, the solar arrays successfully deployed, spacecraft systems immediately took over control, and DSCOVR was on its way to L1. The excellent performance of the SpaceX Falcon 9 vehicle was quickly realized in the tracking data so the initial mid-course correction planned for 24 hours after launch was delayed to the following day and only required a very small burn to correct the trajectory.

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DSCOVR launch successful

DSCOVR is operated from the NOAA Satellite Operations Facility in Suitland, Maryland. The DSCOVR commissioning activities are proceeding as planned and all systems are performing well. The magnetometer boom was successfully deployed. Instrument calibration is ongoing and will be completed once the spacecraft is in its final orbit. The L1 orbit insertion burn will occur in early June. Once in-orbit, the EPIC door will be open and final instrument calibrations will be completed. Once all commissioning activities are completed, the spacecraft and mission operations will be transitioned to NOAA to begin its job of providing early warnings of coronal mass ejections destined for Earth.

Distribution of DSCOVR Data

NOAA will operate DSCOVR from its NOAA Satellite Operations Facility in Suitland, Maryland, and distribute the data to its users and partner agencies. NOAA will process the space weather data, providing products and forecasts through the NOAA Space Weather Prediction Center in Boulder, Colorado, and archive the data at the NOAA National Geophysical Data Center in Boulder, Colorado.

NASA is responsible for processing the Earth sensor data. The Earth science data will be processed at the DSCOVR Science Operations Center at GSFC and publicly distributed through the NASA Langley Atmospheric Science Data Center.

DSCOVR

Through the diligent efforts of the original Triana team in building the spacecraft and the creativity and perseverance of the DSCOVR team in refurbishing and repurposing the spacecraft for the DSCOVR mission, the DSCOVR spacecraft is well on its way to meeting mission requirements and providing new insights on the Sun, the Earth and their interaction.

Al Vernacchio / Code 426
DSCOVR Project Manager

(Lunz continued from page 4)

cheer them all the way to the World Series – the ride was unforgettable.

Quickly following the hype, the market continued to worsen in Florida and when it came time to visit for the holidays, rather than packing a suitcase, they loaded up a budget truck and headed back to the land of Old Bay, blue crabs, and sunflowers; yet, it was not without first adopting their first girl (K-9), Rylee, who accompanied Lee in the passenger seat for the journey.

Life at Goddard

Val started at Goddard under the PAAC II contract with the Information Technology and Communications Directorate (ITCD) as a project support specialist for the directorate office. Later, within ITCD, she became the Center lead for the capital planning and investment control (CPIC) federal requirement, assisting programs, projects, and offices with their IT needs and budgeting plans, as well as managing the Goddard submission to the Agency for the annual Office of Management and Budget data call.

In 2010, Val founded and with the co-leadership of several others, established the New and Developing Professionals advisory committee. The advisory committee was formed to assist with the on-boarding of new employees and facilitate networking, development opportunities, and guidance for entry, mid-career, and senior level employees – both civil service and contractor. Today, the committee is still fully operational under new leadership.

In late 2012 Val joined the Flight Projects Directorate. Since then she has served as the Special Assistant to the Flight Projects Directorate.

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(Lunz continued from page 10)

Life Outside Goddard

Val and her husband Lee reside in Canton located in Baltimore City and enjoy being in the mix of Baltimore sports, steamed crabs, and 'natty boh.' They have two dogs, Rylee and Ryker, who accompany them to almost every event. They take advantage of all the diversity of Maryland – lazy rides down Big Gunpowder Falls, biking around the harbor, boarding down Liberty Mountain, and relaxing on the beach in Ocean City. Both are HUGE Baltimore Orioles and Baltimore Ravens fans.

(Sluder continued from page 4)

assigned to the Space Telescope Science Institute contract as well as conducting other financial assignments for the project. Bill then left the Code 400 directorate for a few years and went to Code 153 as a Program Analyst in the Chief Financial Officer's (CFO) office. He was responsible for all the Earth Science missions and the space and ground network missions. This experience gave him valuable insight into how the center conducted operations at a high level as well as how NASA headquarters conducted financial management activities. It is also where he met many of the center's resources and financial managers that he still interacts with today. In 2002, Bill briefly supported the Earth Science Data and Information Systems (ESDIS) project before going back to the CFO office and then onto the Landsat Data Continuity Mission (LDCM) as the Financial Manager in 2003. He participated in the Source Evaluation Board (SEB) for the mission but soon after it was decided to not make a selection and to investigate alternate mission scenarios, he went on to the Lunar Reconnaissance Orbiter (LRO) project. This was his first experience working on a project as an in-house mission. It was quite exciting to take a short walk to buildings 5 and 7 to see the pieces of the spacecraft come together with the instruments to form the observatory. It is also where he made the transition from Financial Manger to Deputy Project Manager for Resources. After the successful launch of LRO, Bill moved on to the MMS project with four in-house built spacecraft. He was fortunate enough to spend some time with the propulsion team and volunteered to go into the cleanroom and assist with taping insulating material around many of the propulsion lines. It is a career highlight to know that his handiwork is now flying in space! With MMS winding down, Bill is now devoting part of his time to the new PACE project. Bill has had many great coworkers, mentors, supervisors and friends during his time at Goddard and looks forward to keeping those relationships while building new ones as the next phase of his career begins.

Life Outside Goddard

Bill has a son at the University of Maryland studying computer science and a daughter at Towson University studying to be an elementary school teacher. He is looking forward to his son maybe someday working on a NASA project and to his daughter's graduation in May. Soon after that, she will be getting married so there is much excitement coming in the next few months. Bill enjoys doing almost anything outdoors and is a big sports fan. He no longer plays or coaches his kid's teams but he does find time to watch the pros. He is a Redskins, Capitals and Yankees fan. He enjoys watching the Orioles and Nationals and will root for them as long as they aren't playing the Yankees.

Quotes to Think About

"Great works are performed not by strength but by perseverance."

— Samuel Johnson

"No idea is so outlandish that it should not be considered with a searching but at the same time a steady eye."

— Winston Churchill

"The one thing you shouldn't do is try to tell a cab driver how to get somewhere."

— Jimmy Fallon

"The most exciting phrase to hear in science, the one that heralds new discoveries, is not 'Eureka!' but 'That's funny...'"

— Isaac Asimov

"Optimist: Someone who figures that taking a step backward after taking a step forward is not a disaster, but a Cha Cha."

— Robert Brault

"When you are courting a nice girl an hour seems like a second. When you sit on a red-hot cinder a second seems like an hour. That's relativity."

— Albert Einstein

"Kids should be allowed to break stuff more often. That's a consequence of exploration. Exploration is what you do when you don't know what you're doing. That's what scientists do every day."

— Neil deGrasse Tyson

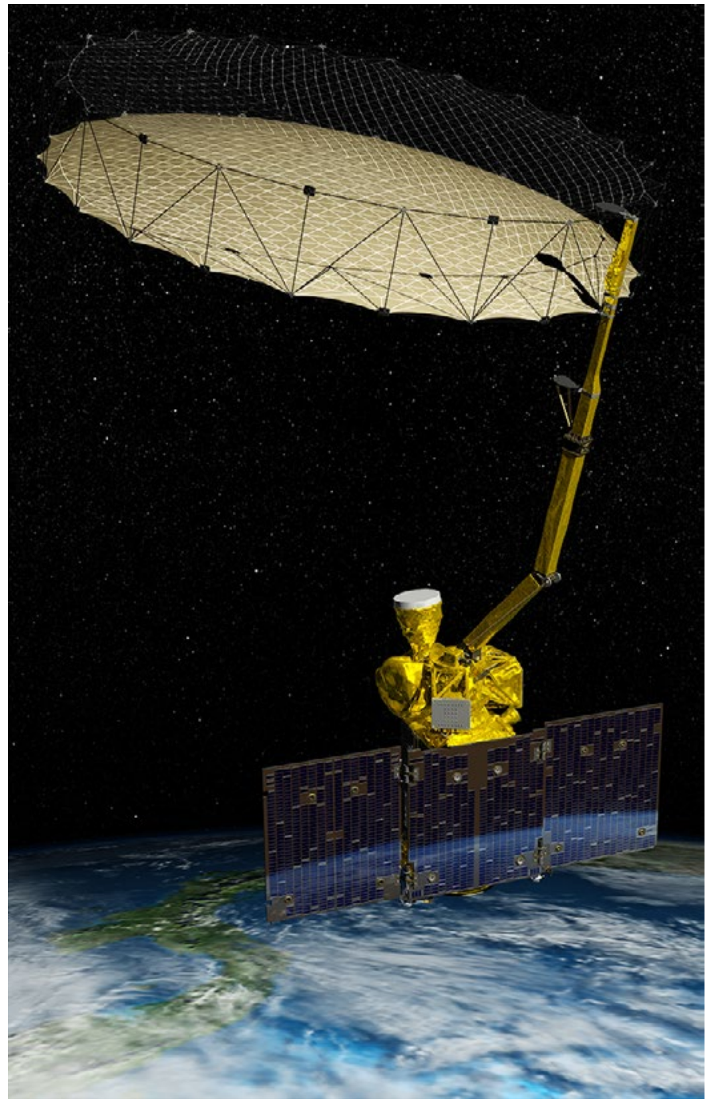
GSFC SMAP Radiometer Successfully Operating On-Orbit

The Soil Moisture Active Passive (SMAP) observatory launched from Vandenberg Air Force Base, California on January 31, 2015 into a sun-synchronous near-polar orbit.

SMAP Observatory Launch

SMAP Observatory during I&T

Onboard, the SMAP microwave radiometer built at GSFC is measuring Earth surface brightness temperature at L-band (1413 MHz) in the presence of radio frequency interference (RFI) for soil moisture remote sensing. The radiometer must measure brightness temperature with better than 1.3-K uncertainty to meet the mission requirement to measure



SMAP Observatory fully deployed

volumetric soil moisture with 0.04 m^3/m^3 uncertainty. The SMAP radiometer is the third L-band radiometer launched this decade after SMOS and Aquarius. The radiometer electronics design is largely adopted from the Aquarius design with one major difference: the SMAP radiometer uses a superheterodyne digital receiver to enable advanced RFI mitigation and full Stokes polarimetry. The system design includes a highly linear microwave receiver with internal calibration sources and a digital signal processor for RFI detection. The front-end comprises an RF cable-based feed network, with frequency diplexers and coupled noise source, and a radiometer front-end (RFE) electronics package. Internal calibration is provided by reference

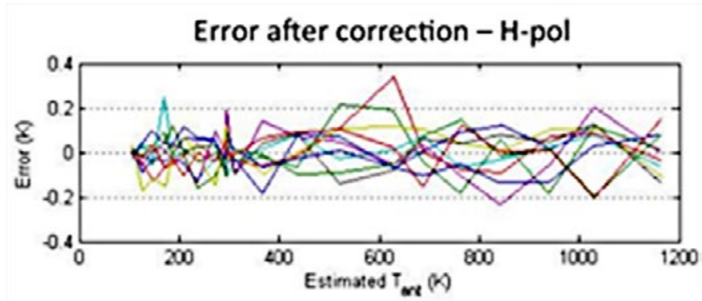
(Continued on page 13)

(SMAP continued from page 12)

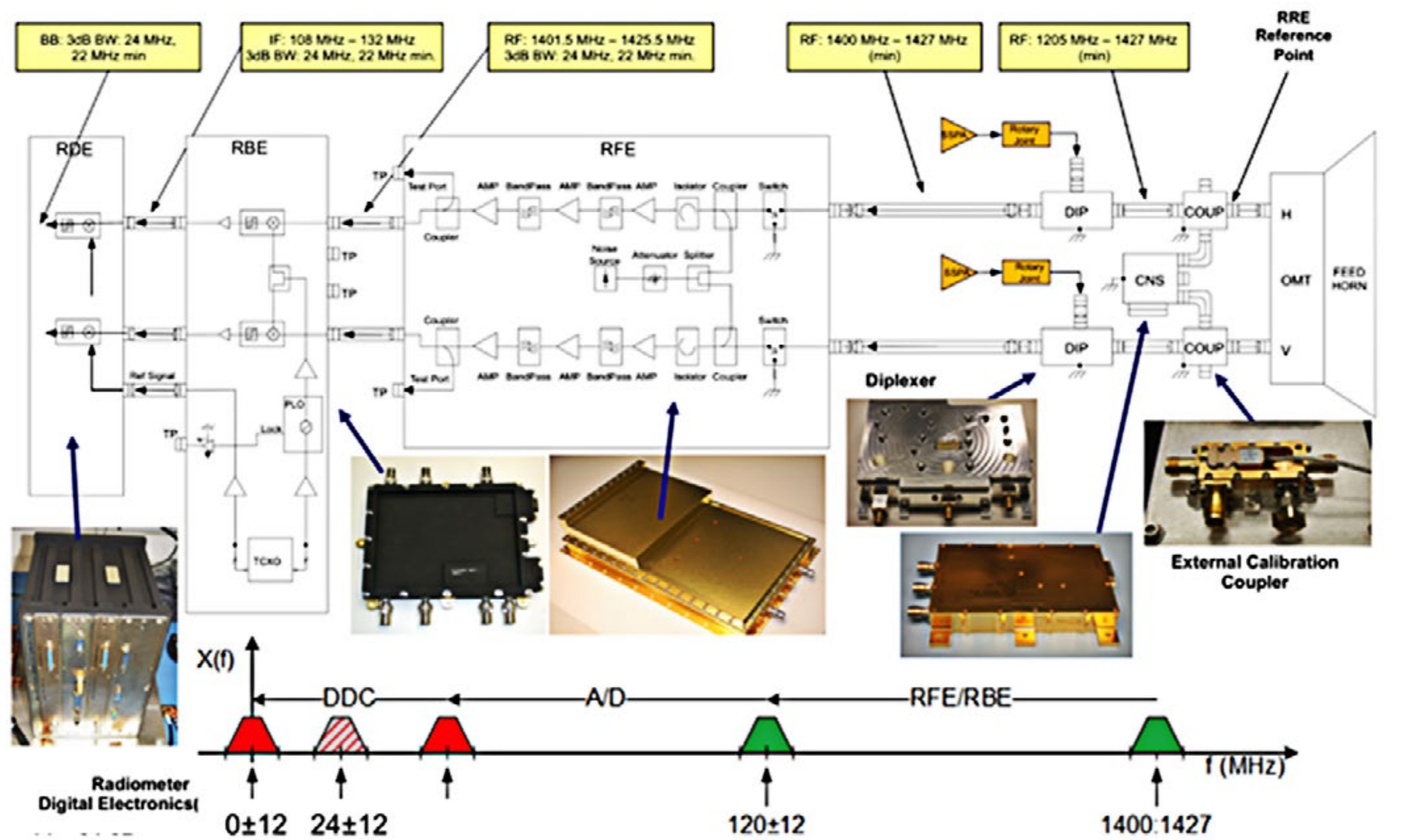
switches and a common noise source inside the RFE. The RF back-end (RBE) downconverts the two 1413 MHz channels (for vertical and horizontal polarizations) to an intermediate frequency (IF) of 120 MHz. The IF signals are sampled to analog-to-digital converters (ADCs) in the radiometer digital electronics (RDE). The RBE local oscillator and RDE digital clocks are synchronized to ensure coherency between the sampled IF signals. The RDE performs additional filtering, sub-band channelization, cross-correlation for measuring third and fourth Stokes parameters, and detection and integration of the first four raw moments of the signals. These data a re packetized and sent to the ground for calibration and further processing.

A block diagram of the radiometer electronics is shown below with photographs of hardware accompanying each block.

the RDE. Special consideration was given to specifying system linearity because of the system (~80 dB) and presumed presence of RFI. Measurements indicate the system operates at most 25-dB below 1-dB compression, resulting in <0.2K of non-linearity error before correction.



Estimated error after nonlinearity correction is applied as function of input antenna temperature for horizontal polarization. The average error is less than 40 mK. Vertical polarization is similar.



SMAP radiometer block diagram showing signal paths and frequency plan. Photographs of the hardware accompany each block.

Starting on the right, external noise source and directional couplers, diplexers, RFE and RBE compose the radio-frequency (RF) electronics subsystem. Testing shows the noise figure is approximately 1.5 dB. The RF signal enters the system and the radiometer band is selected by the diplexers. The RFE amplifies the signal and applies calibration sources. The RBE shifts the frequency of the L-band signal an IF suitable for sampling by the ADCs in

Testing was performed to characterize the nonlinearity and residual error after correction.

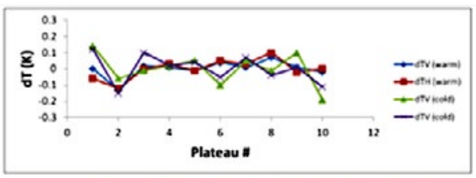
The RDE performs digital signal processing to the vertical and horizontal polarization channels output by the RF subsystem. The RDE is the first spaceflight processing to produce radiometer data in all four Stokes parameters and first four raw moments integrated across the full-band

(Continued on page 14)

(SMAP continued from page 13)

channel and 16 sub-band channels. This new capability enables aggressive RFI mitigation to be applied to the data. In the DSP algorithm, a polyphase filter bank is used to separate a 24-MHz bandpass into 16 x 1.5-MHz channels. Testing shows there is greater than 40-dB isolation between every other adjacent channel, which provides the ability to isolate RFI in individual channels while successfully making science measurements in others.

A repeatability test was performed in thermal vacuum testing in part because of these new features. The radiometer hardware was thermal cycled while observing a stable coldFET at its input. The changes in calibrated output between test plateaus is shown in the figure below. The performance was found to be comparable to the Aquarius radiometer pre-launch test results.



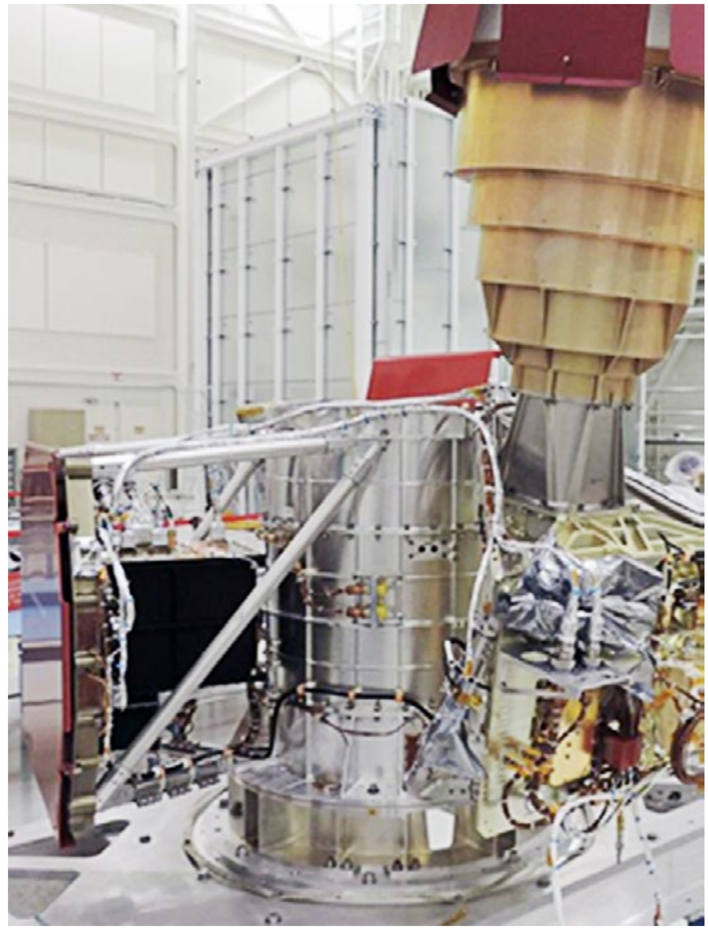
Plateau	1	2	3	4	5	6	7	8	9	10
ΔT_H, warm (K)	0.00	-.13	.02	.01	-.01	.04	.01	.07	.01	-.02
ΔT_V, warm (K)	-.06	-.12	0.00	.03	-.01	.05	.03	.10	-.02	0.00
ΔT_H, cold (K)	.14	-.06	-.01	.02	.05	-.10	.05	-.01	.10	-.19
ΔT_V, cold (K)	.12	-.15	.10	.02	.04	-.05	.07	-.04	.01	-.11

Calibration repeatability of the radiometer electronics during several thermal cycles of testing.

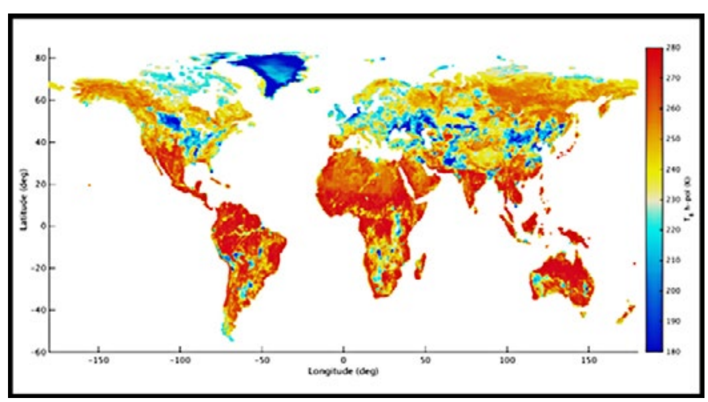
The proliferation of RFI in the terrestrial environment is a major driver to the SMAP radiometer spaceflight electronics design. The implemented design contains features specifically developed to mitigate RFI and to meet or exceed science mission requirements. The design implementation employed both hardware and software applications that work in concert to enable the detection and removal of RFI-saturated data. The hardware architecture includes a digital channelized radiometer/polarimeter with a superheterodyne front-end. To process the science data and remove RFI-saturated data, a complex ground algorithm is employed. The system outputs data packets containing time, frequency, polarization, and statistical diversity (8 packets with 360 samples each) that are processed by the ground algorithm to detect and remove RFI. The photo above and to the right shows the Radiometer electronics installed to the SMAP Observatory.

After a successful on-orbit check-out and commissioning, the first data products are being generated, as seen in the figure at the right, land brightness temperature (TB) values are showing response to drought and precipitation events. This indicates that the radio-frequency interference (RFI) mitigation algorithms are performing to remove hot spots and make soil moisture retrievals possible. Instrument, calibration, and processing performances are meeting expectations. The imagery shows exciting results for the first 3 days of operation after instrument power-on. The SMAP mission is on schedule to move into Phase E on May 11, 2015.

Robert Estep / Code 490
SMAP Project Manager



Radiometer electrical components installed to spun-side assembly of the Observatory



Radiometer Brightness Temperature (H-Polarization) over land regions

Raising Phoebe: A Guide Dog Candidate

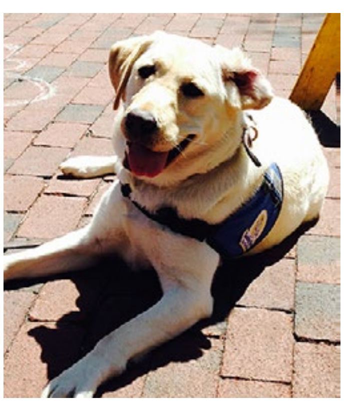
Phoebe usually awakens each day with the morning sun. She slept in today, but who could blame her? She's now thirteen months old and has entered into dog teenage-hood.

Phoebe, a yellow Labrador retriever, was bred and is owned by the Guiding Eyes for the Blind (GEB), headquartered in Yorktown Heights, New York. Phoebe was delivered to her volunteer puppy raisers, Ed and Laura Ruitberg, on May 28, 2014, when she was eight weeks old and a mere fourteen pounds. Today she is a solid 60 pounds. Ed and Laura are empty nesters, but their house in Davidsonville, Maryland, is certainly active with Phoebe and the three cats. Everyone has gained a mutual respect for one another, but Phoebe doesn't like it when Charlie, the senior cat, sits and stares at her.

Phoebe and Ed are members of the local GEB 'Bay Region' and attend bi-weekly training classes in Bowie, Maryland. Phoebe is very smart and spirited. She completed her GEB Bay Region foundation classes and earned her Guiding Eyes for the Blind jacket in early October 2014. We're working to improve Phoebe's house manners and she is making good progress. When she grabs something she's not supposed to have, she gives you a look with her dark brown eyes and pauses before she releases the object.

Each day Phoebe has breakfast and takes her first walk at about 7:30 a.m. She often sees the middle school kids at the bus stop and they have all come to know her. She loves greeting people, especially children. She usually naps in the late morning and often goes to the park for exercise, walking, and training in the afternoon. Following dinner, Phoebe likes to do training exercises in the basement, although her motive is to get extra treats for her good work.

Part of Phoebe's socialization training is to expose her to different environments and situations. Beginning October 2014, Phoebe has accompanied Ed to his office at the Joint Polar Satellite System (JPSS) building about once a week. She has become accustomed to working at the JPSS Program Office and occasionally can be seen on the Goddard main campus. The security guards have come to know her and enjoy her arrival.


Phoebe in Annapolis

Ed and Phoebe have been taking Metrobus rides up and down Greenbelt Road to accustom her to the use of public transportation. An urban setting is a possible destination for her career work assignment. She likes riding the bus, likes the adventure, and doesn't mind a crowd. We go further each time and will soon try Metrorail rides.

Ed and Phoebe at the GEB booth in Annapolis

Phoebe's on track to return to GEB in New York in the late summer or early fall 2015 timeframe, about the time she will mature into adulthood. She will receive an entrance test that will be a big factor in determining her career path. Besides becoming guide dogs, some dogs are selected to become breed dogs, others may be trained to help children with autism, others may join law enforcement, and others are released to live as family pets. Wherever she goes, she'll make someone's life much happier.

To learn more about Guiding Eyes for the Blind, please see: https://www.guidingeyes.org

Ed Ruitberg / Code 470
Program Planning Analyst

Knowledge Management Corner

The Evolution of Pause and Learn at Goddard

This article was prepared for a forthcoming issue of the *NASA CKO Knowledge Journal*.

A Pause and Learn (PaL) session is a team conversation. On the surface, it is deceptively simple, just conversation among members of a team, typically conducted after a significant event or project milestone. But it is different in many ways from other conversations—from a staff meeting, for example. A PaL is facilitated by a knowledgeable outsider who helps the team identify and capture knowledge gained at key project stages. Essential elements of the conversation are documented in the form of Knowledge Maps (KMAPs) which can then be shared to benefit others. A Knowledge Map is a visual representation of a conversation, highlighting valuable insights and comments within the context of that conversation.

The PaL practice was introduced at Goddard in 2005-2006 by Ed Rogers, the Center's Chief Knowledge Officer (1). As of April 2015, more than 100 Pause and Learn sessions have been facilitated at Goddard, 24 of which took place in 2014 (a record year) and 15 will have been completed by the end of the first quarter of 2015. Carrying out PaLs for almost ten years has taught us a lot about what works and what doesn't. We have learned which core elements are essential and where useful changes are possible.

The fundamental elements that make a PaL effective are:

- a facilitated conversation
- key questions
- team ownership of the process
- clear and immediate benefits.

Outcomes can be less than optimal when any of these core elements is disregarded. At the same time, it is important to keep learning from the process and be flexible. In a 2012 *ASK Magazine* article, I described an adaptation of the process to allow one team to learn directly from another by observing a PaL (2). Since then, we have tried other innovations, some with more success than others.

A Facilitated Conversation

A PaL session is best facilitated by someone outside the project or organization participating in the PaL, someone who doesn't have a personal stake in the conversation but whose primary goal is to act as a facilitator and guide to maximize the benefits participants get from the conversation. At the same time, the facilitator must be sufficiently knowledgeable about the general operations and processes of the organization to understand its issues and goals. This facilitator function was initially provided by the Chief Knowledge Officer and now continues within the Flight Projects Directorate by a Knowledge Management lead.

This facilitated approach works well, with the corollary that all participants must understand that they are coming to the conversation as equals. The organizational hierarchy is temporarily set aside and everyone in the room has an equal opportunity to speak up. To ensure an open and honest conversation, expectations need to be set ahead of time with the team leaders. In practice, this means that it is best for the team leaders to set the tone by sending the PaL invitation to the participants and explaining the intent, but allowing others to take the lead when the conversation starts.

Open conversation is less likely when management layers above that team are invited to the process. In some cases, it is also valuable for the team to meet and talk without their immediate leadership/management in the room.

Getting the right participants in the room is critical. When a mission is being built out of house and Goddard's role is limited, it may be difficult or even not advisable to suggest a Goddard PaL. Since the primary objective is for Goddard to continuously learn from its missions, a focus on Goddard's lesson can be achieved by focusing on the Goddard team's lessons rather than those of the entire mission team.

We recently sat down with a mission manager to talk about what he learned as mission manager for a PI-led out-of-house mission. There is value in doing that even when a traditional PaL with all the key stakeholders is not possible, but the benefits of PaLs usually come from group discussion.

One PaL last year failed to achieve its intended objectives when key members of the team were not able to attend. We decided to gather insights from the rest of the team by conducting one-on-one interviews, but the process quickly fell apart. The failure demonstrated that a PaL conversation with all key team members in the room is different from and more than a collection of individual perspectives. It allows individual perspectives to be expressed, but also gives the team an opportunity to correct misunderstandings and come to a common understanding of each other's perspectives. What can be achieved in ninety minutes of conversation is not achieved by compiling independent insights from team members gathered in one-on-one interviews.

(Continued on page 17)

(Pause and Learn continued from page 16)

That experience reminded us to stick to the basics of the PaL and watch out for the risks of diverging from the original approach. While it's still a good idea to collect insights from a core member of the team who isn't able to attend the PaL, it is not advisable to try to build a PaL out of individual interviews. If it is not a team conversation, it is not a PaL.

Starting with Key Questions

The second fundamental element of a successful PaL is a focus on key questions. The facilitator meets with the team leader (ideally face-to-face) to explain what a PaL is, how it is conducted, its benefits, expected outputs, and to discuss who should be invited as well as the dynamics of the conversation. The facilitator also asks a few questions to get a sense of the top issues that should be addressed. While the key questions are always the same—"What happened? What went well? What didn't go well? What could we have done differently?"—there can be variations. For example, a project moving from Phase B to Phase C might want to focus on "What are we going to do differently moving forward?"—a question likely to provide immediate benefits.

In the past year, we have worked with one office to make the PaL a complement to their existing lessons learned process which had one individual write up lessons learned in a pre-formatted presentation which was then given to management. The process was primarily meant to capture lessons at the level of the technical workforce and worked well to identify technical issues and strategies to remedy them. It did not sufficiently capture the project challenges that originated at higher levels in the interactions between key stakeholders, however. When a Pause and Learn is conducted, these higher level stakeholder dynamics are discussed (and ideally all the stakeholders are represented in the room). Sometimes teams are reluctant to talk about issues that are externally imposed on them and, they think, not open to change. Why bother talking about it when we know there's nothing we can do about it? But it is precisely those issues that need to be brought to the attention of management through as many channels as possible. A Knowledge Map is a tool that is one way to convey important messages.

As the PaL process has become better known at Goddard, team leads have sometimes asked for a PaL when they needed a facilitator to help with a group discussion. When the key questions are significantly different from those of a traditional PaL though, it's probably not a PaL and should be called something else.

A Team or Project-owned Process

Initially, PaL sessions focused almost entirely on supporting the team's learning. The conversation maps or knowledge maps developed were owned by the team and were not disseminated outside the team, in part because the lessons might not be fully understood without their local context. The preferred method for sharing lessons across projects was a face-to-face workshop where participants could have open discussions about their experience.

This internal PaL format is still used occasionally, but most project-specific PaL sessions are now accompanied by conversation maps meant for dissemination across projects. The web of maps that has evolved over the past two years is accessible to everyone at Goddard and by extension everyone at NASA.

For the Flight Projects Directorate, the PaL sessions and associated maps are the preferred approach for identifying and sharing lessons learned. It has therefore become important to document the sessions and lessons in a way that makes them accessible to other projects. "Accessible" means available for review and constructed in such a way that they make sense to someone outside the project.

Making the maps accessible to other projects can have disadvantages. Project team members can become concerned about who is going to see the maps and how the information might be interpreted or—more to the point—misinterpreted. The map review and validation process is designed to address these concerns. Team leaders review the draft knowledge maps before they are integrated into the aggregated map system known as the KMAP web. The review is meant to identify key elements that may have been missed, correct errors, adjust the wording to avoid misinterpretations. The key is to keep the maps as close to the essence of the conversation as possible.

Once they have been approved by the team's leadership, the maps go through a second review by management, giving them the opportunity to ask for clarifications and add comments. Management does not redact the maps but has the ability to provide additional guidance when a lesson or insight from a project could be misread or misinterpreted.

Clear and Immediate Benefits

There were 24 Pause and Learn sessions in 2014. One office has fully institutionalized the process and conducts a PaL after each key event. One project conducted two PaLs in one year, both follow-ups to key reviews. This is a relatively small, very fast-paced project whose leadership has found value in the PaL conversation within the team and in the careful articulation of key insights on the knowledge maps, which they have posted on the wall in the project's central office hub.

In one case this past year, a different PaL format was deployed to gather lessons learned. This effort was carried out by an external consultant, with the support of the Office

(Continued on page 18)

(Pause and Learn continued from page 17)

of the Chief Knowledge Officer, within the Management Operations Directorate. A much more structured approach was used and a more structured, linear report was generated, with specific recommendations for action. The process required two full days of meetings. While this format has value under certain conditions, it is not realistic to ask project teams to set aside two days for a Pause and Learn activity. A typical PaL session is scheduled for ninety minutes with the entire team. The PaL map review/ validation process requires another hour or so of the project leaders' time.

The return on investment of a traditional ninety-minute PaL is quite substantial, in part because the team's investment of time—a scarce project resource—is reasonable.

Reflection time tends to be undervalued, especially where keeping to the schedule is critical to success—a fact of life for many projects. But just as project managers regularly point out that a key lesson learned is to know how to spend some reserves early to address issues that would cost much more to deal with later on, time invested in reflection early on and throughout the project life cycle can save time and money later. And of course identifying the most effective way to spend reserves requires some reflection.

In the end, a project increases its chances of success when art meets science, when people are able to work well together to address tough technical challenges. Working well together means communicating well. That is why the Pause and Learn is so important. It develops or reinforces a team's ability to engage in open, honest conversations; it maintains or opens up ways for team members to talk to each other and address issues that may not necessarily come up in traditional staff meetings or in one-on-one conversations.

Continued Learning and Improvement

While keeping the fundamental PaL principles in mind, we continue to look for ways to improve and expand this valuable practice. Here are a few potential improvements we are working on or considering:

- *Approaching the large projects at a lower level.* Large, complex projects cannot easily do PaLs at the mission level. There would be some value in conducting PaLs on a more regular basis with instrument teams or sub-systems, especially for in-house instruments.

- *Demonstrating the value of aggregating lessons and making them accessible to other projects.* The return on a ninety-minute investment of time is clear. The return on investment of time and effort spent making lessons widely accessible needs to be demonstrated. There is more work to be done with the project teams to demonstrate the value of looking through and discussing insights and lessons from other projects and more to be done to ensure that knowledge maps present lessons and insights in a usable way.

- *Analyzing and using lessons better.* There is a need for more in-depth analysis of aggregated lessons, more use of lessons and insights in workshops, and more follow-up by management, which could benefit from reviewing and discussing the Knowledge Maps on a regular basis.

- *Conducting timely workshops based on the project lifecycles.* For example, if multiple projects will be going through integration and testing in the next six months, a workshop bringing together projects about to enter that phase and projects that have recently completed that phase would enable an exchange of valuable knowledge when it is needed.

- *Increasing integration of the PaL process/lessons learned process with other knowledge-management-related efforts within the Flight Projects Directorate.* Integrating the PaL process with professional development, best practices and associated knowledge networks and other activities can provide new benefits. This has already started to happen and will likely increase.

Related Resources / References

(1) Richard Day and Ed Rogers, "Enhancing NASA's Performance as a Learning Organization." ASK Magazine, Issue 22, January 1, 2006. *http://appel.nasa.gov/2006/01/01/enhancing-nasas-performance-as-a-learning-organization/* & Edward W. Rogers, "The Knowledge Management Journey", August 11, 2013, ASK Magazine, Issue 51. *http://appel.nasa.gov/2013/08/11/the-knowledge-management-journey/*

(2) Barbara Fillip, "Project Knowledge in the Moment." ASK Magazine, Issue 48, November 1, 2012. *http://appel.nasa.gov/2012/11/01/project-knowledge-in-the-moment/*

Barbara Fillip, Code 400
Knowledge Management Project Manager

We're on the Web!

http://fpd.gsfc.nasa.gov/Critical_Path.html
or via the Code 400 homepage
http://fpd.gsfc.nasa.gov

George Morrow: Movin' On Up!

As you probably already know, George Morrow has assumed a new position as Goddard's Deputy Center Director. Our fearless leader of the past eight years has moved on up, vacating his old office on the second floor of Building 8 and settling into his new one on the sixth. What you might not know is that George has very deep roots here at Goddard. Over the past three decades, George has transitioned from being a component engineer, to a systems engineer, to an Observatory Manager, to a Deputy Project Manager, to a Project Manager, to the Deputy Director of Flight Projects, to the Director of Flight Projects, and finally to the Deputy Center Director. He's a man with a plan!

George studied chemical engineering at the University of Virginia. A chemistry professor shared a job announcement at Goddard, and George followed up on the lead. In 1983 he was hired to support the Goddard Space Power Applications Branch, with responsibility for spacecraft energy storage systems (which are electrochemical systems), so his background fit. Thus started a long and successful career at Goddard in the Engineering Directorate.

George's first job as an engineer at Goddard was supporting a project called Earth Radiation Budget Satellite (ERBS), a small satellite launched on the Space Shuttle in 1984. He supported ERBS through launch, and after being at NASA only a year, he found himself at Cape Canaveral, in the shuttle bay, supporting prelaunch preparations. His career was off to a running start.

During his first five years at Goddard, George worked on the battery and power systems for most of the flight projects. He observed numerous project managers in action, and dreamed of becoming one himself. He gained first-hand knowledge of the roles of the project manager, deputy project manager, observatory manager and instrument manager. Because of that exposure, he was able to say "I'm a component engineer now. If I ultimately want to be a project manager, I first need to be a systems engineer, then an observatory manager, and then a deputy project manager." He sought out a broader systems engineering position in 1988, when he joined the Hubble Space Telescope (HST) Project team.

On HST, he held a succession of positions of increasing responsibility. First he was a systems engineer, then the Observatory Manager, then the Deputy Project Manager for the HST Development Project, and finally the HST Deputy Program Manager. He was a key member of the management team that identified Hubble's mirror flaw, repaired it on the first servicing mission, and then improved it on the second. George spent ten years working on HST, several years prior to HST's initial launch in 1990 through the second servicing mission in 1997. Working under Joe Rothenberg, John Campbell, and Frank Cepollina, George made the most of any opportunity to absorb a great deal of their collective experience and know-how. He learned how to quickly identify and solve problems, communicate NASA's endeavors with the outside world, and build advocacy for the Agency's initiatives. In 1998, George became the Earth Observing System Aqua project manager. In 2001, he briefly left government service but he returned to Goddard in 2003 as the Deputy Director of Flight Projects, becoming the Director of Flight Projects in 2007.

As you can see, George steps into this new position as Deputy Center Director with a wealth of programmatic and technical management experience, as well as a unique knowledge of the Center and its capabilities. Standing behind him is the unwavering support of the strong and successful Flight Projects Directorate (FPD) that he helped build.

His colleagues shared some thoughts about his tenure as Director. "His character, work ethic and outstanding leadership skills reflect devotion, perseverance, reliability and loyalty," said Lisa Hoffmann, FPD Administrative Officer. Steve Shinn, FPD Deputy Director for Planning and Business Management, said, "From the most mundane meeting to a highly complicated negotiation, George made it all look so easy. Yet, there's no magic secret to his leadership legacy. It was achieved through hard work, dedication, an altruistic concern for his staff, and a fervent commitment to making a difference at NASA. We'll miss George in code 400, but I'm thrilled to know he's not far away." "I have known George for 25 years as a colleague, boss, mentor, golf league partner, and friend," said Bill Ochs, James Webb Space Telescope Project Manager. "His leadership, honesty, integrity, humor, and caring for the folks in Code 400 have been a big influence on my own management style. He will be missed in Code 400, but I can't think of anyone more deserving of the Deputy Center Director's position and look forward working with him in his new challenge."

George's successor as Director of Flight Projects, Dave Mitchell, added, "I've learned a lot from George through the years and really appreciate what he has done for me and the rest of the Flight Projects Directorate. I'm very happy about George's promotion and look forward to continuing to work with him in his new role as Deputy Center Director." Everyone within Code 400 looks forward to seeing George overcome new challenges as he continues Goddard's legacy as a Center of excellence for world-class scientific research. We wish him all the best!

John Decker/Code 400
Consultant

2014 Agency Honor Awards Code 400 Awardees

Distinguished Public Service Medal
Bruce Jakosky/University of Colorado/432

Outstanding Leadership Medal
Ardeshir Azarbarzin/422
Sandra Cauffman/432
Donald Cornwell/450
Vicki Dulski/416
Jeffrey Gramling/454
Linda Greenslade/470
Nicholas Jedrich/460
Thomas Johnson/490
David Littmann/454
Dawn Lowe/423
David Mitchell/460
James Nelson/428
Pamela Sullivan/417
Ronald Williams/417

Outstanding Public Leadership Medal
Edward Knight/Ball Aerospace & Technology Corporation/472
Kari Wulf/Aerospace Corporation/428

Exceptional Achievement Medal
Robert Caffrey/460
Lorrie Eakin/454
Robert Lilly/490

Exceptional Service Medal
Jeanne Behnke/423
Edwin Griego/454
Del Jenstrom/401
Jason Williams/428

Exceptional Engineering Achievement Medal
Jeffrey Cheezum/443
Ralph Jones/452
Tony Yu/443

Exceptional Technology Achievement Medal
Bryan Robinson/450
Matthew Sammons/408

Exceptional Public Achievement Medal
Marie Bussman/ASRC Management Services, Inc./443
Fevzi Ekinci/Honeywell Technology Solutions, Inc./444
Jonathan Little/Aero Systems Engineering, Inc./452
Scott Texter/Northrop Grumman Space & Mission Systems/443

Exceptional Public Service Medal
Guy Beutelschies/Lockheed Martin Space Systems Company/432
Robert Cherney/Orbital Science Corporation/454
David Curtis/University of Colorado/460
Paul Koster/Raytheon/474
Marcia Rieke/University of Arizona/443

Silver Achievement Medal (Individual)
Dominic Licon/Exelis, Inc./452
Andrew Royle/SGT, Inc./410

Silver Achievement Medal (Team)
Optical Telescope Element Simulator Team/443
Tracking & Data Relay Satellite (TDRS) Project Team/454

Group Achievement Award
Global Precipitation Measurement (GPM) Team/422
GOES-R EXIS Instrument Development Team/417
GOES-R SUVI Instrument Development Team/417
ISIM Integration and Test Team/443
JPSS MMCS Operations & Sustainment Team/474
JWST Spacecraft CDR Team/443
Landsat Data Continuity Mission Team/490
MAVEN NGIMS Tiger Team/490
Remote Robotic Oxidizer Transfer Test Team/408
S-NPP Mission Risk Mitigation Team/424
SORCE Return to Science Team/428
TDRS-K Orbit Raising and On Orbit Test Team/454
TDRS-K/L Mission Analysis and IV&V Team/454
The Lunar Laser Communications Demonstration (LLCD) Team/450
The MAVEN Team/432
Wallops CubeSat Ground Station Support Team/453

2014 Robert H Goddard Awards Code 400 Awardees

Exceptional Achievement Award for:

Engineering (Individual and Team Recognition)

Dino Rossetti/SGT Inc./408
Scott Appelbaum/Qwaltec Inc./410
Timothy Gordon/National Oceanic and Atmospheric Administration/417
William Reeve/Lockheed Martin Information System & Global Service/417
John Koenig/Honeywell Technology Solutions Inc./428
Joseph Pitman/Genesis Engienering Solutions Inc./441
Kenneth Friberg/Friberg Autonomy, LLC/454
GOES-R Space Environment In-situ Suite Development/417
ISIM Electronics Compartment Team/443
LRO Engineering Team/444
Boeing/General Dynamics TDRS-K/L Team/454
Goddard LADEE Mission Support Team/460
OVIRS Instrument Team/494

Professional Administrative (Individual and Team Recognition)

Cathy Strickland/441
Cristina Doria-Warner/443
JPSS Business Team/470

Customer Service (Individual and Team Recognition)

Peter Sooy/ARTS/408
Peter Phillips/Aerospace Corporation/417
Monica Coakley/Affiliate/417
Melissa Jones/452
ESPD Information Technology Team/420

Diversity and Equal Employment Opportunity (Team)

Flight Projects Development Program (FPDP)/400
Inclusion Ally Core Team/417

Leadership (Individual Recognition Only)

Ardeshir Azarbarzin/400
Stephen Shinn/400
James Valenti/416
Candace Carlisle/424
John Deily/472
Kenneth Schwer/490
Cynthia Simmons/491

Quality and Process Improvement (Individual and Team Recognition)

Sarah Kirby/ARTS/433
Business Change Initiative Team/400
Cross-Cutting Risk Initiative Team/400

Robert H. Goddard Award of Merit (Individual Only)

George Morrow/400

Cultural Tidbits

Did you know that July 18th is Nelson Mandela International Day? In 2009, the United Nations established the day to recognize the former South African President's contributions to peace and freedom. On the day, individuals are encouraged to give 67 minutes of time to helping others – in recognition of Nelson Mandela's 67 years of public service.

Do you have a cultural tidbit to share? Send it to the Code 400 Diversity Council
c/o Matthew Ritsko at:
matthew.w.ritsko@nasa.gov
and we'll publish it in a future issue of
The Critical Path.

Social News

Landon Perry

Dylan Elias

- Congratulations to Kayla Mrowczynski (Code 407) on the birth of her son, Landon Perry, born on December 2, 2014, weighing 7 lbs., 4 oz.
- Bob and Amy Menrad's 4th child (Samantha Lynne) gave birth to their 4th grandson on December 30, 2014. Dylan Elias Wampler weighed in at 6 lbs. and is 14" long. Mother, Daddy and Dylan are doing just fine at home in Frostburg, MD.
- Congratulations to Jonathan Little (Code 452), the proud father of Chloe Little, born on October 15. She weighed 7 lbs., 6 oz.
- Michelle Hamilton (Code 452) is a grandmother. John Jerome Dunford, Jr. was born on December 19, weighing in at 7 ½ lbs., and 19 ¾ in. long.
- Congratulations to Dr. Aprille Ericsson, who has been nominated to serve on the Board of Higher Education and Workforce (BHEW) at the National Academy of Sciences.

Comings and Goings

January 1, 2015 through March 31, 2015

Comings:

- ❖ George L. Jackson (from 560) to 450/Exploration & Space Communications Projects Division, Supervisory-Deputy Program Manager for Flight Implementation
- ❖ Ferzan Jaeger (external hire) to 490.1/MOMA-Mass Spectrometer Instrument Project , Deputy Instrument Project Manager
- ❖ Jerry S. Esper (from 703) to 420/Earth Science Projects Division, Information Technology Specialist
- ❖ Brian Roberts (external hire) to 408/Satellite Servicing Capabilities Office (SSCO), Robotics Lead
- ❖ James E. Simpson (from 599) detail to 490.2/ASTRO H Deputy Instrument Project Manager
- ❖ Jonathan J. Carpenter (from 273) detail to 490/ Instrument Projects Division, Resources Analyst (3/22/15 NTE 9/19/15)

Goings:

- ❖ Sharon M. Garrison retires from 401/Advanced Concepts & Formulation Office
- ❖ Nassema M. Maroof retires from 401.1/Rapid Spacecraft Development Office, Mission Integration Manager
- ❖ Michael P. Pasciuto retires from 407/Earth Science Technology Office, Technology Program Manager
- ❖ Marco M. Midon (from 450) to 581/Software Engineering Division, GOES-R Senior Systems Engineer
- ❖ Cynthia W. Simmons (from 491) to 550/Associate Division Chief
- ❖ Karen S. Jackson retires from 426/DSCOVR Project, GS14 Financial Manager
- ❖ Donald M. Cornwell (from 450.2) to HQs/HEOMD, AST, Navigation, Guidance and Control Systems Manager
- ❖ Neil Martin (from 401) to 301/Systems Review Office, Office Chief
- ❖ Jonathan G. Bryson (from 403) detail to 150/Office of the Chief Financial Officer, GSFC Lead for Center Business Learning & Career Path Initiative
- ❖ Margery A. Rich retires from 420/Earth Science Projects Division, Project Support Specialist
- ❖ Chasity N. Kisling (from 441) to 603/Senior Resources Analyst
- ❖ Justin T. King (from 490) detail to 153.1/Program Analyst

Reassignments/Realignments/Details within Code 400:

- ❖ Sandra A. Cauffman (from 401) to 410/GOES-R Program, Supervisory-Deputy Program Manager
- ❖ Elizabeth (Betsy) Forsbacka (from 401) to 453/Near Earth Network (NEN) Project, Deputy Project Manager
- ❖ Hsiao Smith (470) to Joint Polar Satellite System Program, Deputy Program Manager
- ❖ Bobbie Stoker (470) to Joint Polar Satellite System Program, Financial Manager
- ❖ Charlette Johnson (426) to DSCOVR Project, Financial Manager
- ❖ Christopher R. Caldwell (from 460) to 490/Instrument Projects Division/GEDI Project, Financial Manager
- ❖ Monique S. Collins (from 403) to 408/Satellite Servicing Capabilities Office (SSCO), Resources Analyst
- ❖ Antonios A. Seas to 401/Advanced Concepts & Formulation Office, Deputy Chief
- ❖ Benjamin E. Hall (from 432) detail to 426/DSCOVR Project, Senior Resources Analyst
- ❖ Aaron C. McCleskey (from 474) detail to 490/GEDI Project, Resources Analyst
- ❖ Stephanie A. Gray (from 401) detail to 403/FPD Business Management Office, Resources Management Officer
- ❖ Sherri L. Wood (from 450.2) to 450.1/Networks Integration Management Office, Financial Manager

Reorganizations within Code 400:

- ❖ Instrument Projects Division, Code 490
  - Inactivated the Neutral Mass and Ion Mass Spectrometer (NGIMS) Instrument Project, Code 490.4
  - Established the Global Ecosystem Dynamics Investigation—Light Detector and Ranging System (GEDI-LIDAR) Instrument Project, Code 496
- ❖ Satellite Servicing Capabilities Office (SSCO, Code 408) (Pending)
  - Establish the Satellite Servicing Capabilities Division, Code 480
  - Establish one staff office (Contributing Technologies)
  - Establish two implementation sub-orgs (Flight Projects and Technology Demonstration Projects)
- ❖ Earth Science Projects Division, Code 420 (Pending)
  - Inactivate the Global Precipitation Measurement (GPM) Project Office, Code 422
  - Rename the Polar Free Flyer Project to the Solar Irradiance Data and Rescue (SIDAR) Project, Code 424
  - Modify the Landsat Data Continuity Mission (LDCM) Project to the Pre-Aerosol, Clouds, and ocean Ecosystem (PACE) Project, Code 427
  - Modify the NPOESS Preparatory Project (NPP) Office to the Landsat 9 Project, Code 429

Lisa Hoffmann, Code 400
Administrative Officer

The Critical Path

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If you have a story idea, news item, or letter for *The Critical Path*, please let us know about it.

Send your note to Paula Wood at
Paula.L.Wood@nasa.gov,
Mail: Code 460, or phone Ext. 6-9125.

Don't forget to include your name and phone number.

The deadline for the next issue is July 17, 2015