A Flight Projects Directorate Quarterly Publication
A Newsletter Published for Code 400 Employees

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INSIDE THIS ISSUE:

Update on *Hubble Space Telescope* Operations and Discoveries

April 24 of this year marked the 23rd anniversary of the *Hubble Space Telescope*'s celebrated deployment into space as one of NASA's Great Observatories. Its long and productive operational lifetime has been the direct consequence of its purposeful design to be serviced periodically by astronauts. Because of this, not only have the spacecraft's limited-life components—like its gyroscopes—been regularly replaced, but just as importantly, the telescope's instruments have been exchanged over time with subsequent generations of more sensitive and more capable ones. During its last servicing mission in May 2009, the observatory was newly outfitted with

(Hubble continued on page 26)

A Closer Look at LDCM's First Scene

Turning on new satellite instruments is like opening new eyes. This week, the Landsat Data Continuity Mission (LDCM) released its first images of Earth, collected at 1:40 p.m. EDT on March 18. The first image shows the meeting of the Great Plains with the Front Ranges of the Rocky Mountains in Wyoming and Colorado. The natural-color image shows the green coniferous forest of the mountains coming down to the dormant brown plains. The cities of Cheyenne, Fort Collins, Loveland, Longmont, Boulder and Denver string out from north to south. Popcorn clouds dot the plains while more complete cloud cover obscures the mountains.

(LDCM continued on page 32)

Message from the Director Of

Who can believe it's May already? It's been quite an eventful and successful year so far. Tracking and Data Relay Satellite – K (TDRS-K) was successfully launched from Cape Canaveral Air Force Station (CCAFS) on a United Launch Alliance (ULA) Atlas V launch vehicle on January 30, 2013. Activation, orbit raising, and check-out has proceeded extremely well. Congratulations to Jeff Gramling and the entire TDRS team. The Landsat Data Continuity Mission (LDCM) was successfully launched from Vandenberg Air Force Base (VAFB) on a ULA Atlas V launch vehicle on February 11, 2013. Activation, orbit raising, and check-out has been flawless. The handover to the United States Geological Survey for operations is scheduled for May 30, 2013. Congratulations to Ken Schwer and the LDCM team!

Four more launches are scheduled for this calendar year. What a year! Next in line is the launch of the *Interface Region Imaging Spectrograph* (*IRIS*) Explorer Mission which is scheduled for June 26, 2013, from VAFB on an Orbital Pegasus launch vehicle. The Lunar Atmosphere and Dust Environment Explorer (*LADEE*) will launch in September from the NASA/GSFC Wallops Flight Facility (WFF) on a Minotaur V. Next will be the launch of the first NASA/GSFC Mars mission, the Mars Atmosphere and Volatile Evolution (*MAVEN*) Mission, in November from CCAFS on a ULA Atlas V launch vehicle. The Total Solar Irradiance Calibration Transfer Experiment (TCTE) will also launch on the Space Technology Program – 3 (STP-3) host spacecraft from NASA/GSFC WFF on a Minotaur-I late this year. Good luck to the IRIS, LADEE, MAVEN, and TCTE teams. Please give the teams all of the support necessary for success.

GSFC was selected to implement the Transiting Exoplanet Survey Satellite (TESS) and the Neutron Star Interior Composition Explorer (NICER) as a result of the recent Explorer Program selection. Congratulations to Dr. George Ricker, TESS PI at MIT, and Dr. Keith Gendreau, NICER PI in Code 662.

In-house instrument management at Goddard is being reorganized to capitalize on the strengths of both the Flight Projects Directorate (FPD) and the Applied Engineering and Technology Directorate (AETD). Management responsibility for in-house instruments will be moved from Code 505 to a new division (Code 490) being established within the FPD and instrument systems engineering will be consolidated within the Mission Engineering and Systems Analysis Division, Code 590, of AETD. Ken Schwer will lead the new Code 490 division. Instrument new business activities will be under the responsibility of Bob Menrad, Code 401.

To say the least, the year has so far been quite unique and interesting from a budget perspective also. I want to thank everyone for the patience and perseverance exhibited in dealing with the impacts of Sequestration and other budget uncertainties (replans, training, awards, travel, etc.) and for the substantial extra effort this is costing each of us. As a whole, NASA and GSFC have come through the situation relatively well, much to the credit of all of you.

Lastly, I want to thank everyone for fully supporting the Flight Projects Directorate Peer Awards nomination process even though these awards will not include a monetary component this year. I made the decision to continue with the Peer Awards this year without the monetary component because I feel strongly that the recognition of the individual hard work and wonderful efforts of our personnel should be recognized in spite of the budgetary situation. The nomination process closed at the end of April and more than 90 nominations were received.

In closing, I want to encourage you to take some time off to rest, relax, and enjoy family and friends this summer.

George W. Morrow
Director of Flight Projects
george.w.morrow@nasa.gov

PERSONALITY TINTYPES

David Mitchell

Since 2006, David has worked on the Mars Atmosphere and Volatile Evolution (MAVEN) Project, initially as a part-timer when the mission was first proposed, and then full time as Project Manager once MAVEN was selected in 2008. David also works within the Explorers & Heliophysics Projects Division, focused on the planetary line of business which includes the OSIRIS-REx mission, an asteroid sample return mission launching in 2016.

Every day on the job brings a new challenge, particularly working within the constraints of launching under a tight planetary launch period. If MAVEN doesn't launch within a month's time, we have to wait another 26 months for the next opportunity to go to Mars. With launch coming up in November 2013, the project is in the midst of a very active phase; system-level environmental testing is in full force, mission operations training and testing have ratcheted up, and plans for transport and processing at Cape Canaveral are being finalized. The MAVEN mission is very exciting because we are building a complex machine that will travel to another planet and study aspects of the planet that have never been explored before in great detail – the upper atmosphere. The information MAVEN delivers should tell us much more about how the Martian climate has evolved over the past several billion years.

Born: Dayton, Ohio
(Wright-Patterson Air Force Base).

(MitchellTintype continued on page 21)

Barbara Fillip

Barbara is the Knowledge Management Project Manager for the Flight Projects Directorate. In that role, she provides support for project learning with Pause and Learn sessions, she organizes knowledge sharing workshops such as the annual Goddard Masters Forum and more recently the K-MAP (knowledge map) workshops. Barbara came to Goddard in 2008 via the Office of the Chief Knowledge Officer (OCKO) – the best place to learn about Goddard and about Goddard projects. She transitioned to the Flight Projects Directorate in the fall of 2012.

Born: Paris, France.

Education:
BA, Political Science, Barnard College
MIA, International Development, Columbia University
Ph.D. International Affairs, University of Pittsburgh
Project Management Professional (PMP) Certification

Life before Goddard

Before joining Goddard, Barbara worked in the field of international development, starting her career as a volunteer in Liberia where she accomplished very little but managed to stay alive in between civil wars. She moved on to work with agencies such as the United Nations, World Bank, United States Agency for International Development, and smaller non-

(Fillip Tintype continued on page 31)

For NASA to Build TIRS on Schedule, Every Day Counted

From the very beginning it was a looming ticking countdown clock to get the Thermal Infrared Sensor (TIRS) instrument ready for the Landsat Data Continuity Mission (LDCM) launch. Even on their very first day, the TIRS development team started a year behind schedule to design, build and test an instrument in three years instead of the more typical four-year development cycle.

The project began on a tight schedule, but then outside forces intervened. There was the earthquake, hurricane and a near government shut down—but that didn't stop the TIRS team from being ready for a successful Landsat* launch on February 11, 2013. "We received our first image from the TIRS instrument on March 7, and it was just spectacular," said Betsy Forsbacka, TIRS instrument manager at Goddard Space Flight Center (GSFC).

TIRS came about to help scientists and resource managers monitor water evaporation and transpiration over land surface by measuring radiation emitted in two thermal bands of the electromagnetic spectrum. TIRS operates at a resolution of 100 meters (328 feet), allowing for monitoring fields for agriculture, which is especially important for water managers. The instrument was a relatively late addition to the Landsat mission, which is why there was a tight production schedule.

"We took three years here at NASA Goddard to take it from initial concept development design, go through all the major reviews to make sure the design was valid, then build and test the instrument, which we did here at NASA Goddard," Forsbacka said. "We delivered the instrument to Orbital Sciences Corporation, in Gilbert, Arizona, integrated onto the spacecraft, and tested the two instruments and the spacecraft as one large system. In December we delivered the spacecraft with instruments aboard to the launch site and launched on February 11 at Vandenberg Air Force Base in California."

As the TIRS deputy instrument manager and now instrument manager, the largest unyielding aspect of the project Forsbacka had to manage was time. "For us, it was schedule, schedule, schedule," she said. "Time was the one thing we couldn't make. If we didn't make our delivery date, we would not fly." And then there were the events that couldn't be anticipated. Even with tight project management planning, who could have foreseen an earthquake and hurricane occurring within one week, but that is what happened in August 2011.

The team was in the midst of thermal vacuum testing, cycling between very hot and very cold temperatures, when the earthquake tremors began. The test team fled the building, and when it was safe to return, the instrument was put into a safe configuration. A couple of days of testing were lost while the team determined if there was any damage. "Actually launch is harsher than the earthquake," Forsbacka commented, "but you don't know that at the time and you wonder what is happening to the instrument."

* Upon completion of on-orbit check-out, LDCM will be renamed Landsat-8.

(TIRS continued on page 5)

(TIRS continued from page 4)

Just on the heels of the earthquake, time was lost to planning for Hurricane Irene, which was forecast to arrive only days after the earthquake. The hurricane diverted the schedule by a couple of days for planning essential personnel in the event of a GSFC campus closure and determining what testing would take place and which tests would be put on hold in the event of a severe hurricane. It turns out there was even more unplanned excitement to come for the TIRS team.

Because TIRS uses Quantum Well Infrared Photodetectors (QWIPs) to detect specific light wavelengths used to measure surface temperature, TIRS had to be outfitted with a cryocooler to keep the QWIP detectors working at the necessary cold temperatures. The cryocooler supplied by Ball Aerospace—the project's largest procurement—was also being developed on a compressed timetable. To keep TIRS on schedule, members of the GSFC TIRS team worked onsite at the Ball Aerospace facility in Boulder, Colorado, for a year to facilitate swift decisions.

"After going through all of the steps of this very complicated procurement, and the design, build, and all the reviews, and getting it through environmental testing, when it came time to ship the cryocooler, it was the weekend of the potential government shutdown in April 2011 [due to a stalled spending deal in Congress]," Forsbacka said. "How do you plan for that?" So the TIRS team worked at a furious pace with Ball Aerospace to get the unit shipped to GSFC as quickly as possible.

But the TIRS team faced a host of uncertainties about being allowed to report to work due to moratoriums over weekend work. And the cryocooler was in transit to be delivered on a Friday, on the day of the pending shutdown. Forsbacka said the team had to weigh the options. "Do we delay it? With our schedule, we didn't delay anything if we could avoid it. We couldn't get it delivered earlier. If it arrived on time, would anyone be here to receive it?"

Simple variables such as the delivery truck being delayed due to getting stuck in traffic at various points from Boulder also had to be considered. As it turns out, the cryocooler arrived that Friday night, barely before the midnight cutoff, and just before the team was no longer allowed to work due to the imminent government shutdown.

Beyond the earthquake, hurricane and threat of a government shutdown, a host of decisions along the way kept the project on track for meeting the launch deadline. At the beginning during the TIRS design, the team focused on meeting requirements rather than seeking perfection. In some cases when a requirement was hard to meet, they asked the scientist if it was a number they absolutely had to have. "In some cases the answer was yes, but in many cases, what you have is good enough," Forsbacka said. "If you don't communicate with your scientists, you can chew up a lot of time."

Each requirement builds in a worst-case scenario, said Dennis Reuter, the TIRS instrument scientist who authorized any TIRS requirements changes. Sometimes if one requirement meets specifications, another one can be relaxed to still perform the desired task, he said.

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Testing also helped keep TIRS development on track. “We tested much earlier and more often with TIRS than we normally do to meet the accelerated schedule,” Reuter said. Instrument subsystems were also developed in parallel so one delay wouldn’t hold up the schedule.

“Schedule is everything, and we couldn’t afford to lose even a day,” Forsbacka said. “Over three years, if you lose a day, it turns into a week, then a month and then you don’t fly.” She said it was particularly challenging to get all of the subsystems delivered so the instrument could be assembled for testing. “If there is one subsystem not delivered, it is a showstopper,” she said.

The Landsat Program is a series of Earth-observing satellite missions jointly managed by NASA and the U.S. Geological Survey. Once LDCM completes its on-orbit check-out phase in late May, the satellite will be turned over to the USGS and renamed Landsat 8. Data from TIRS and the Operational Land Imager will be processed and added to the Landsat Data Archive at the Earth Resources Observation and Science Center in South Dakota, where it will be distributed for free over the Internet.

To learn more about TIRS and its applications, visit:

Landsat's TIRS Instrument Comes Out of First Round of Thermal Vacuum Testing:
http://www.nasa.gov/topics/technology/features/tirs-thermal.html

NASA Landsat's Thermal Infrared Sensor Arrives at Orbital:
http://www.nasa.gov/mission_pages/landsat/news/tirs-arrives.html

NASA Earth Observatory: Water Watchers:
http://earthobservatory.nasa.gov/Features/WaterWatchers/page1.php

For more information on the LDCM mission, see the lead story beginning on page 1.

To learn about the Landsat mission and the status of LDCM, visit:

http://ww.nasa.gov/landsat

http://landsat.usgs.gov

Audrey Haar
Science Writer / Code 470

Reflection on the Accomplishment and Upcoming Deployments of the Business Change Initiative (BCI)

An Interview with Steve Shinn, Deputy Director for Planning & Business Management, Flight Projects Directorate, NASA Goddard Space Flight Center

The Flight Projects Directorate Business Change Initiative (BCI) is a comprehensive evaluation of management and information sharing mechanisms intended to improve cost, scheduling, and overall performance across GSFC Flight Programs and Projects. Led by the Deputy Director for Planning and Business Management, Steve Shinn was interviewed to report the 2013 second quarter status of deployed changes and recent accomplishments managed by the Management Reporting, Earned Value Management (EVM), Cost Estimating, Scheduling, and Knowledge Management - Business, Rapid, Information, Skills, and Knowledge (*BRISK) Action Teams.*

Steve, what are some of the advancing activities under the Business Change Initiative?

Following the appointment of the five Action Teams in the core discipline areas (Management Reporting, Schedule Management, Cost Estimating, Knowledge Management, EVM), Action Teams and subject matter experts have engaged in research, assessment, and review of processes and standards within the projects, Directorate, and Center. In addition the teams are coordinating with other agencies and industry to identify best practices in project planning and control. The Action Teams have completed stakeholder analyses across the FPD and GSFC workforce to understand gaps and recognize areas for improvement. The outcome of these analyses has allowed the teams to define, develop, and implement best practices, requirements, tools, templates, and procedures to improve efficiency and our standard way of business. As a result, we are working towards our first set of changes to be deployed to enhance our capabilities of project teams.

What are the changes in the first set being deployed under the Business Change Initiative?

The first 10 changes being implemented include:

1. Issue the Procedural Guidelines for Schedule Management of Flight and Ground System Projects and Activities via the Goddard Directives Management System (GDMS).
2. Circulate GSFC Scheduling Best Practice Instructions on critical techniques, processes, and tools for program/project schedule management.
3. Publicize the GSFC Planning & Scheduling Knowledge Network SharePoint

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Environment (includes repository of scheduling material, links to applicable sites, and accessibility to current requirements, guidance, and documentation).

4. Develop Center-wide EVMS architecture, collect EVM tooling requirements, and identify gaps and opportunities for design and deployment to GSFC EVM users.
5. Update pre-Monthly Status Review (MSR)/MSR requirements and reporting guidance.
6. Publish and distribute Joint Confidence Level (JCL) Handbook.
7. Produce training information for gaps found in existing GSFC EVM training program material.
8. Coordinate a deployment strategy of the initial set of EVM/Project performance metrics.
9. Identify and streamline the acquisition and deployment of EVM software.
10. Organize and improve the OHCM PIP Repository to increase availability and accessibility to presentations.

Additional changes will continue to be identified based on feedback, assessments, and new requirements/guidance. Action Teams will plan and rollout as appropriate and coordinate with Changes 1-20 status and lessons learned.

Steve, are there any recent accomplishments that can illustrate the value-add of the Business Change Initiative?

The BCI is helping to establish a new way of thinking. The Action Teams have been successful in engaging not only the FPD workforce but other partners of interest across the Center and Agency. There has been a series of BCI products that the Action Teams have deployed with major changes and initiatives due for imminent release.

These recent accomplishments include:

- **Scheduling Action Team**
  The Scheduling Action Team has identified three industry- and government-standard schedule performance metrics for inclusion in project reviews and management reporting: the Hit-Miss Index (HMI), Baseline Execution Index (BEI) and Current Execution Index (CEI). These new performance metrics will be added to the pre-MSR/MSR guidance package and regular MSR reporting.

  The Scheduling Action Team launched the GSFC Planning & Scheduling Knowledge Network SharePoint Portal that includes 31 Planning & Scheduling Best Practice Instructions along with supporting implementation guidance and templates; the Goddard Master Schedule summarizing major milestones for all flight projects; an Intent Guide for the forthcoming "Procedural Guidelines (PG) for the Schedule Management of Flight and Ground System Projects and Activities;" as well as resources to support schedule management activities and requirements.

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These accomplishments will allow projects to provide greater transparency, management of personnel resources and cost, and help streamline communication to improve project planning and execution.

- **Management Reporting Action Team**
  The Action Team updated the pre-MSR/MSR Requirements through identified and selected leading indicators that measure Code 400 project progress. The GPM and MMS projects volunteered to pilot the new MSR package changes. As a result of the successful piloting efforts, an MSR guidance package was produced and released to all project teams on April 1, with full implementation planned for the May MSR cycle. The new MSR requirements will streamline reporting and provide greater insight to programmatic health with respect to cost and schedule commitments with consistent formats and language to communicate status across all GSFC projects.

- **Cost Estimating Action Team**
  The Cost Estimating Action Team has worked to formalize and communicate the goals and requirements of the JCL estimating approach. GSFC has now developed an advocate JCL process for project development and review. Continued enhancement to the GSFC JCL process will ease creation of documents for Key Decision Point-C of a project or mission, providing guidance for adequately preparing and responding to a JCL assessment.

  The Team is currently working to distribute the GSFC JCL Handbook which focuses on JCL basics, schedule/ cost uncertainty, output analysis, and the JCL operational process. The Handbook is an operational guide to provide guidance and procedures for developing, maintaining, and reporting JCLs. The goal is to provide sufficient familiarity with the technical and programmatic aspects of the process to aid in performing a JCL analysis.

  Training will be provided to supplement the material found in the JCL Handbook.

- **Earned Value Management (EVM) Action Team**
  The Action Team inventoried the Center-wide use of EVM software licenses and successfully upgraded all known subscriptions to the current version available by the provider. This upgrade helped to coordinate the user community at GSFC to streamline charts, provide accessibility, and distribute to GSFC projects.

  The Team also provided guidance and artifact templates to projects and others who use EVM metrics for performance reporting. These standards have been submitted to the Management Reporting Team for inclusion in the updated MSR guidance package.

  Currently, the Team is piloting material that was conducted as a training course to ICESat-II for EVM Project Control Account Managers. The training is intended to increase skills and introduce new approaches in the upgraded EVM server environment.

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- **BRISK Action Team**
  The Team developed and deployed a Resource Analyst Assessment Tool to support developmental discussions with supervisors. The intent is to assess skills that Resource Analysts need to execute processes. The tool identifies strengths and gaps to adequately define tracks for individual development of necessary skills.

  The Team also developed and incorporated new training materials into courses to expand project planning skills including: Budget Execution; NF533; Planning and Scheduling for Resources Analysts, and Product Development Lead Training. A Configuration Management course has also been developed for Product Development Leads and is awaiting Code 500 review. Finally, the Foundations Course process was presented to the Combined Resources Forum and serves as a good example of Code 150/400 collaboration.

  The Team has been crucial in building relationships and identifying partners across the Center, especially in the areas of training and business management to establish consistency and accuracy in standards. The outcomes aid FPD's programs and projects in eliminating redundancy of efforts.

How can people get involved to support the effort?

It is important for our workforce to engage as participants and volunteers to assist in the deployment of the stated changes, and our upcoming implementations. We encourage feedback that will help address frequently asked questions, concerns, and possible gaps for guidance and policy. These upcoming deployments of new and revised policy, guidance, templates, tools, and information will require acceptance from the Goddard community to add value and be effective. I ask that everyone continue to collaborate and share lessons learned to help the BCI Action Teams identify additional best practices.

For more information on the Business Change Initiative, go to:

BCI SharePoint: https://fpdspi.gsfc.nasa.gov/sites/fpdat/BCI/SitePages/Home.aspx

BCI Website: http://fpd.gsfc.nasa.gov/bci-intro.html

The Flight Projects Directorate's Business Change Initiative: Improving Planning & Scheduling Techniques to Meet the Challenges of Today's Complex Projects

The Business Change Initiative (BCI) is introducing several planning and scheduling resources to help projects meet the challenges of managing today's complex projects. By leveraging ideas and suggestions from Goddard project practitioners, external organizations, and industry guidelines, this initiative introduces enhancements to the Center's planning and scheduling capabilities which include:

- The *Procedural Guidelines for the Schedule Management of Flight and Ground System Projects and Activities* – a mandatory directive for formulating and implementing flight and ground system projects consistent with Federal and Agency schedule requirements, and conforms to *generally accepted* planning and scheduling principles.
- A corresponding *Schedule Management Intent Guide* to provide additional guidance for implementing the schedule management PG.
- Planning and scheduling best practices and associated instructions, templates, and examples to address topics such as *Developing Schedule Basis of Estimates, Verifying Schedule Integrity with Schedule Health Checks, and Planning the Project Schedule Margin.*
- A Goddard Schedule Analysis Tool that will help calculate schedule performance indices such as the Baseline Execution Index and Current Execution Index.
- An archive for historical Goddard schedule data to support future project planning.
- *The Goddard Master Schedule* – a continuously updated summary schedule of all flight projects and their associated major milestones.
- Links to planning and scheduling documentation such as the GAO Schedule Assessment Guide, the NASA Schedule Management Handbook, and the NASA Schedule Test and Assessment Tool Users Guide.
- Tips and service bulletins for dealing with MS Project problems and anomalies.

These resources can be accessed on the new GSFC Planning & Scheduling Knowledge Network at: https://fpdspi.gsfc.nasa.gov/sites/fpdat/Schedule/SitePages/Home.aspx. If you do not have access to the portal, please click the "Request Access" link under the Error Message and provide a quick statement for the applicability and use of the resources.

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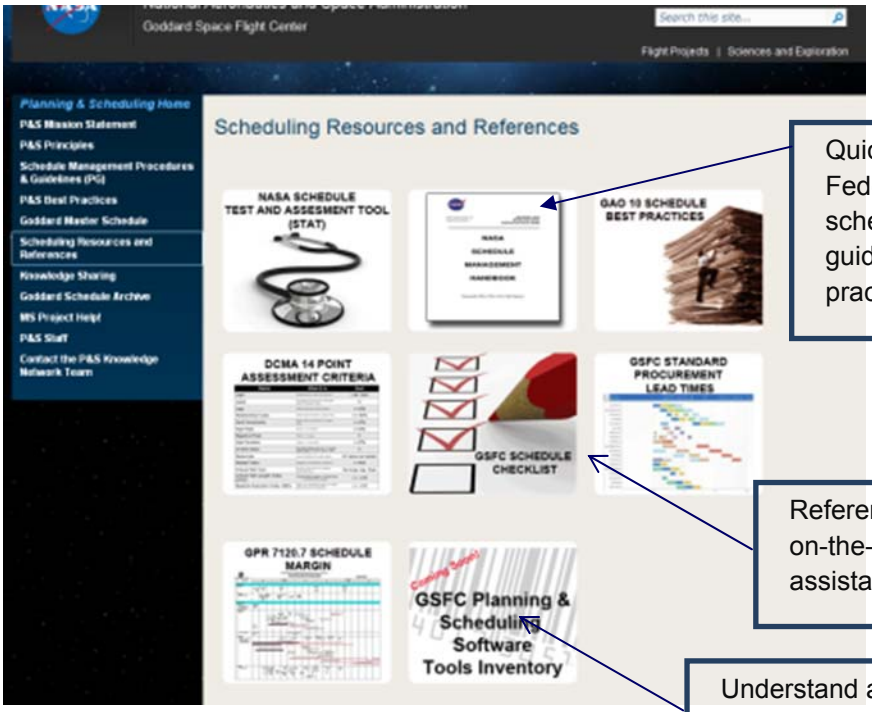
Links to:

- P&S Staff
- Procedural Guidelines
- P&S Best Practices
- Goddard Master Schedule



Quick links to Federal schedule guidance and practices

References for on-the-job assistance

Understand available tools and how they work

BCI Planning and Scheduling Knowledge Network

The Schedule Management Action Team will continue to coordinate, design, and deploy additional changes as required to comply and meet the mandates and standards of the GSFC, NASA Program Offices, and external stakeholders.

If interested in getting involved, provide feedback, or ask questions, please email Walter.Majerowicz@nasa.gov or submit a discussion on the GSFC Planning & Scheduling Knowledge Network, using the link above.

The BCI Team

Social News

- Congratulations to Jeff Roddin (J&T/408) & his wife Julie, who are the proud parents of a baby boy, Jacob Hugh Roddin, born on March 4, 2013 at 1:56 p.m. Jacob weighed 6 pounds 1 ounce and was 19.5 inches long.

- Kathryn Gaulke (SGT/408) welcomed her first grandchild on April 9, 2013 at 10:53 p.m. Reid Jennings Lutz weighed 8 lbs, 5 oz, and was 22 inches long. Congratulations to Kathryn's daughter, Jolene and her husband Andrew.

The New and Improved Professional Intern Program (PIP) wiki site

The PIP is a developmental program for entry-level scientists, engineers, and administrative professionals designed to acquaint them with NASA and GSFC missions and operations, integrate them into the workforce as quickly as possible, and prepare them for more complex and responsible duties that they can perform with increasing independence. We want to bring to your attention a new and improved centralized and categorized PIP presentation repository as well as the recent collaboration that created it. The owner for this site is Jose Maldonado/Code 114 and it is located at: https://aetdwiki.gsfc.nasa.gov/display/PIP/Home

Here's the story….

In December 2011, I was reassigned within the Program Analysis Office (Code 153.2) as the Resources and Finance Training (RAFT) Subject Matter Expert (SME).

To better understand the training needs around the Center, one of the first places that I researched was the repository found on the AETD wiki. It is managed by the Office of Human Capital Management (OHCM), which houses the PIP Presentations that were given within the past 11 years. I thought for sure that I would find many training theme needs. I read each of the more than 40 business related presentations to see if there was a training need theme that surfaced within the resources community. They provided insight to a particular resource or finance problem and then provided either a solution or process to correct or minimize the issue. What I found to my delight was that the PIP Presentations were a "gold mine" of valuable resources information! I also concluded that the information I found was a wealth of knowledge that could easily be shared and used within the GSFC resources community.

I next attended a Flight Projects Directorate sharing session hosted on February 29, 2012, by Jonathan Bryson and Kwasi Horton. Kwasi's facilitation of a group of 15 recent PIP mentees and their PIP Presentations was the final step of his own PIP project. Each PIP gave a condensed version of his or her PIP presentation across a wide variety of topics which included Earned Value Management, Business Tools, Monitoring Unobligated Balances, etc. Jonathan leads the Code 400 Business Rapid Information Skills Knowledge (BRISK) Action Team which is part of the overall Code 400 Business Change Initiative. In parallel to my own efforts, a Code 403 team including Fred Lim, Steve Brill, Lesley Young, and Matt Ritsko reviewed the PIP presentations on the OHCM PIP site. We shared all of our insights and recommended to OHCM to make this site the single repository for business PIP project presentations. This was embraced and implemented by Jose Maldonado, Code 114 and the AETD wiki Lead, Jon Verville, Code 580.

In total, the team members reviewed and categorized the 44 presentations into the following topics: Training; Procurement; Earned Value Management, and Budget Execution. The Budget Execution category is then further divided into the following sub-categories: Reporting; Tools; Cost Analysis, and Reimbursables. Two examples of interesting PIP presentations are a Resources Onboarding Guide document by Deysi Peterson which is a follow-on to the Center on-boarding process and a Grassroots Travel Estimation Sheet by Aaron McCleskey which is a robust spreadsheet tool.

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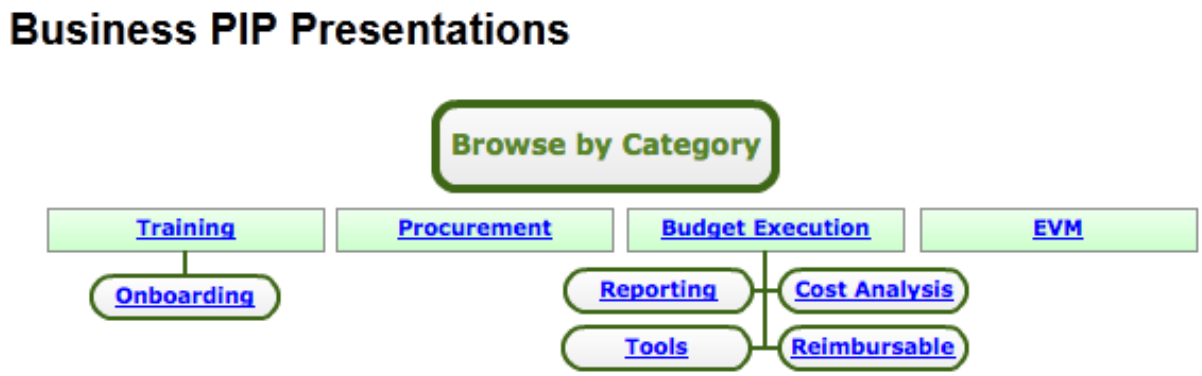
One of the challenging aspects of the PIP process is to select a suitable and interesting topic. The topic should help the PIP mentee to learn and add to the overall body of knowledge if possible. It was apparent that this site could be a valuable resource for new PIP mentees. We wanted to add this forward-looking concept to the PIP wiki-site. This collaborative team is in the process of collecting future PIP research projects and hosting them on the wiki-site. We have made a call for PIP topics out to the Center DRMs. If you have any topics that you want to suggest, please send them to Bonnie Matters at bonnie.j.matters@nasa.gov.

We expect this will be a valuable repository and a user friendly resource for the entire GSFC Resource and Finance community, as well as, others looking to learn about the research completed on a variety of Project Management topics.

Kudos to all of the team members who helped develop and implement the PIP Presentation Website Enhancement. There were team members from Codes 114, 153, 403, 420, and 580 to get this task accomplished in a timely manner. It was truly a Goddard Space Flight Center team collaboration!

Again, you may visit this wiki site at _https://aetdwiki.gsfc.nasa.gov/display/PIP/Home.



Bonnie Jean Matters with Jonathan Bryson

Bonnie Jean Matters is a Program Analyst in Code 153
Jonathan Bryson is the Code 400 Directorate Resources Manager and BCI BRISK Action Team Lead

ICESat-2 – The Benefits of Collecting Altimetric Measurements of the Earth's Surface

Understanding the causes and magnitude of change in the cryosphere remains a priority for Earth science research. Over the past decade, NASA Earth observing satellites have documented a decrease in both the extent and thickness of Arctic sea ice, and ongoing loss of grounded ice from the Greenland and Antarctic ice sheets. Understanding the pace and mechanisms of these changes requires long-term observations of ice sheet mass, sea ice thickness and sea ice extent.

As a result of the success of NASA's ICESat mission (2003-2009), the Earth Science Decadal Survey of the National Research Council (NRC) recommended a follow-on mission to continue these observations. In response, NASA tasked Goddard Space Flight Center in February 2008 with the development and deployment of what has become the ICESat-2 mission, now scheduled for launch in 2016. The primary goals of the ICESat-2 mission are consistent with the direction provided by the NRC: deploy a spaceborne sensor to collect altimetry data of the Earth's surface optimized to measure ice sheet elevation change and sea ice thickness, while also generating an estimate of global vegetation biomass. As a result of this direction, the ICESat-2 science definition team developed the following four science objectives:

- Quantify polar ice-sheet contributions to current and recent sea-level change and the linkages to climate conditions.
- Quantify regional signatures of ice-sheet changes to assess mechanisms driving those changes and improve predictive ice sheet models; this includes quantifying the regional evolution of ice sheet change, such as how changes at outlet glacier termini propagate inward.
- Estimate sea-ice thickness to examine ice/ocean/atmosphere exchanges of energy, mass and moisture.
- Measure vegetation canopy height as a basis for estimating large-scale biomass and biomass change.

The ICESat-2 mission will collect these observations using a laser based altimeter system to measure the elevation of glacier ice sheets, and how these elevations change through time, by observing the same tracks over the ice sheets 4 times each year. Over sea-ice covered areas, the mission will distinguish between the height of ocean surface, and the height of the sea ice to determine the sea ice thickness as the density differences between ocean water and sea ice are well-known. In the mid-latitudes, ICESat-2 will measure both the elevation of the Earth's surface, and the elevation of the top of the tree canopy to enable estimates of global vegetation canopy height.

System Overview

For mission definition and formulation purposes, the ICESat-2 mission is defined at the highest level in terms of three segments - the Space Segment, Ground Segment, and the Launch Support Segment.

(ICESat-2 continued on page 16)

(ICESat-2 continued from page 15)

The space segment of ICESat-2 consists of the observatory, and the single instrument on that observatory - the Advanced Topographic Laser Altimetry System (ATLAS). The ICESat-2 Observatory, operating in a frozen 92 degree inclination orbit consisting of 1387 revolutions repeated every 91 days, is responsible for the collection and downlink of all science data. These data (as well as housekeeping telemetry data from both the Spacecraft and ATLAS) are stored on solid-state recorders. Data is downlinked to ground stations via an X-band communications link. The observatory will also receive ground commands and transmit real-time housekeeping telemetry via an S-band link to the NASA Near Earth Network during nominal operations and to the Space Network immediately after launch and during contingency operations.

The Ground Segment provides for observatory command and control, monitoring, and health and safety of the observatory on-orbit, as well as the generation of all data products from the level zero data transmitted from the observatory, and the distribution of these data products to the Data Center. The ground segment provides mission planning and scheduling, coordination with the ground stations for data downlink, and generation of the observatory command loads necessary to execute the mission plan and protect the observatory.

The Launch Support Segment (LSS) provides those assets and services associated with the launch vehicle (LV) and the mission integration planning necessary to place the ICESat-2 Observatory into the required orbit. Included along with the LV are all ground support equipment, property, and facilities to integrate the ICESat-2 observatory with the LV, verify the launch service interfaces, and conduct pre-launch testing with the LV and ICESat-2 ground systems.

The ICESat-2 Observatory is designed to be accommodated by a Delta II launch vehicle. ICESat-2 will launch from the Western Range at the Vandenberg Air Force Base (VAFB) in the third quarter of 2016. Launch Support Segment activities are considered to be complete when the ICESat-2 successfully separates from the launch vehicle. The Launch Support Segment interfaces with both the Space Segment and the Ground Segment.

ATLAS Instrument

As noted above, ICESat-2 is a single instrument mission, consisting of the ATLAS laser altimeter. ATLAS collects three key pieces of information to measure the height of forest canopy, or changes in ice sheet elevation: the travel time from the altimeter to the target (such as the surface of the Earth), the direction ATLAS was pointing when that travel time was measured, and the position of the observatory in space.

Unlike its single-beam predecessor from ICESat, ATLAS is a multi-beam, photon-counting laser altimeter. It illuminates 6 spots on the ground simultaneously by splitting the light from a single 1 nanosecond laser pulse. While the altimeter on ICESat operated at 40 Hz and used, producing a measurement every ~140m along-track, ATLAS will use lower-energy pulses at a repetition rate of 10 kHz to produce measurements every ~70 cm along track for each of the six spots. A small fraction of the transmitted laser light is scattered by the Earth's surface and atmosphere and collected by the ATLAS receiver, along with "background" light from sunlight also scattered by the Earth and clouds. The ATLAS detectors record the arrival times of individual photons and can

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only distinguish signal photons from the laser and background photons after significant processing on the ground. Using precise measurements of both the time that a laser pulse is transmitted, and the times that photons are detected, we calculate the time of flight of a given photon to ~150 pico-seconds.

In order to convert that time of flight measurement to an elevation, the ICESat-2 Observatory carries a GPS antenna and receiver. The low-level data from the GPS is downlinked and processed on the ground to determine the position of the observatory, to within about 3 cm, at the time of each transmitted laser pulse. Once the observatory position is known, we can remove the effects of changes in the observatory altitude and convert differences in time of flight into elevation along the ground track illuminated by ATLAS.

The last key piece of information is the pointing direction. This is important, as it allows the ground segment to determine where on Earth the laser spots are illuminated for a given shot. In order to meet the mission requirement of knowing where the laser spots fell on Earth to within 6.5m, ATLAS has an advanced Laser Reference System (LRS). Within the LRS, ATLAS monitors the pointing of the laser beams and a star field with respect to a common reference structure and reports both to the ground.

Although these are the essential measurements that enable generation of the science data products, in order to produce high quality measurements, ATLAS has a number of other capabilities. Perhaps the most important is ensuring the reflected light from the laser will be viewed by the ATLAS telescope and the time of the returning photons recorded. If the laser and telescope fall out of alignment, the ATLAS detectors will only record background photons. To avoid this situation, ATLAS uses an alignment monitoring control system to actively align the transmitted laser beams with the telescope field of view. This system monitors the pointing direction of the telescope, and uses a beam steering mirror to keep the laser spots in the telescope field of view.

Another important capability is the pointing control of the ICESat-2 Observatory. Since one of the objectives of the mission is to measure elevation change in the Polar Regions, it is imperative to illuminate the same ground tracks every 91 days. Therefore, the observatory needs to be able to control where the observatory is pointed and adjust as needed, as well as knowing where the observatory was actually pointed. To do this the spacecraft monitors where the laser beams are pointed with respect to the starfield, and uses reaction wheels to adjust the pointing direction of the observatory. The pointing control requirement for ICESat-2 is 45m.

ICESat-2 is NASA's next-generation laser altimeter, scheduled for launch in 2016, and will continue the important observations begun by ICESat. Together, these data sets will allow for continent wide estimates of changes in the Greenland, and Antarctic ice sheets over a 15-year period, long-term trends in sea-ice thickness, and enable determination of global vegetation height.

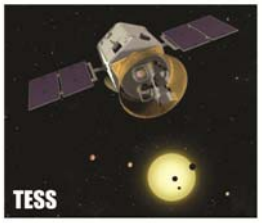
For more information, go to: http://icesat.gsfc.nasa.gov/icesat2/index.php

Paula Everson
Requirements Manager / Code 425

New Business News
- An Update on FPD "New Business" Activities -

Looking at the recent past…

Transiting Exo-planet Survey Satellite (TESS) – GSFC wins! Congratulations to the TESS Capture Team for having their mission selected as an Astrophysics winner in the Explorer 2011 Announcement of Opportunity (AO). This selection represents the end of a year-long second step in the competitive Explorer process that included definition of a detailed Concept Study Report (CSR), Site Review hosted at the Massachusetts Institute of Technology/Lincoln Labs and culminating with a Selection Official presentation at NASA/HQ. Yes, it was a long path but the TESS Capture Team prevailed despite the many challenges inherent with the competitive new business process. With the selection of the TESS mission, those members of the TESS Project currently in Code 401 will now be reassigned to Code 460 so the project may start Phase B activities. (Remember: this is part of the Directorate's workforce strategy: enabling people to advance their career through competed opportunities to become members of a new capture team. Then, once the work is captured, the practitioner follows the new project into FPD's Code 460.) Again, congratulations to the entire TESS Capture Team on their selection…it was a great Center-wide effort!



Neutron Star Interior Composition Explorer (NICER) – GSFC wins a new in-house instrument! While free flier-class concepts were competing with each other under the Explorer 2011 AO cycle, a second set of instrument competitors were also hard at work competing under the Mission of Opportunity (MoO) provision of the AO. Here too, the Center was successful as it was announced that NICER, with its GSFC-Principal Investigator (PI), was selected along with TESS! NICER will be delivered to the ISS from where the GSFC-developed instrument will measure the variability of X-ray sources to explore the states of matter within neutron stars revealing information on their composition. Congratulations to Dr. Keith Gendreau, Code 662, and the AETD-led Capture Team for their success in producing the CSR, completing the Site Review and a successful Selection Official presentation. Members of the FPD New Business community were proud to support this effort.

Atmosphere-Space Transition Region Explorer (ASTRE) – As exciting as the news on TESS and NICER may be, it is with regret that I share with the FPD community that ASTRE was not selected under the Heliophysics provision of the Explorer 2011 AO.

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GSFC executed a superb effort led by GSFC-PI Rob Pfaff, Code 674, and the FPD-led capture team. This team was one of the most capable capture teams I have seen and there is no doubt in my mind that the quality of their CSR, completeness of their Site Review preparations and quality presentation downtown to the Selection Official made the selection decision very difficult; but, in the end, ASTRE was not selected. Kudos to the ASTRE Capture Team for their outstanding effort and it is without reservation that I say the next capture team to propose this exciting concept will have some outstanding technical and programmatic work to build upon.

Looking at the present…

Mars 2020 Instrument Competition – Relatively speaking, it takes planetary missions a long time to cruise to their intended destination and there are only special times defined in a trajectory design (i.e., conjunctions) in which to launch the trip. That is why competition for those instruments that will comprise the payload on NASA's 2020 mission to Mars starts now. In anticipation of this competition during the late-summer months of 2013, the Center's Planetary Line of Business (LOB) has completed its vetting of in-house instrument concepts, the Cross-Directorate Executive Council (C-DEC) has reviewed the LOB's recommended priorities and, by the time you read this, the GSFC New Business Council (NBC) will have sanctioned the start of instrument capture team activities. As the FPD's senior representative for each of these steps, I have a unique vantage point from which to see the concepts being considered; and, I can tell you without reservation, that the GSFC science community is comprised of amazing people all of whom have come up with innovative and compelling concepts to study the "Red Planet." Going forward, the FPD New Business community will be heavily involved with Codes 300, 500 and 600 in this competitive cycle for in-house instruments. I look forward to sharing some of the concepts being proposed in future editions of *The Critical Path*.

Earth Venture Class - Instruments (EV-i) – The Science Mission Directorate's Earth Science Division manages the Earth Venture Class competitive process. This robust activity has three opportunities occurring regularly and spanning instruments, sub-orbital (e.g., balloons, sounding rockets, etc.) campaigns and free-flier orbiter missions. The EV-i cycle will be coming this summer and focuses on instruments. Here too the Center's Earth Science LOB has completed its vetting of in-house instrument concepts, the C-DEC has reviewed the LOB's recommended priorities and the GSFC NBC will

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sanction the start of instrument capture team activities. I am constantly amazed at the sheer number of compelling investigations being designed by our science community for the study of our home planet. The FPD New Business community will be heavily involved with Codes 300, 500 and 600 in the EV-i competitive cycle for in-house instruments as well and I will share some of these compelling concepts in the future.

Looking to the future…

The Opportunity Forecast – As we are all aware, uncertainty continues regarding impacts to the Agency's budget from factors including the Continuing Resolution, Sequestration and changing priorities. This uncertainty also extends to the timeframe for when the next round of competitive mission-class AOs will be released. As an example, the next Small Explorer (SMEX) AO was anticipated to be released in FY14; however, NASA/HQ has announced release will be delayed until FY15. This uncertainty also extends to the Planetary Science Division's next Discovery AO, which may actually be moved up on the schedule. What's the bottom line? The Center's LOBs are focusing very closely upon the planning taking place at NASA/HQ with the goal of insuring that the Center is as agile as possible in responding to these impacts, whatever they may be.

Did you know…?

Introducing the "FPD New Business Framework" – an organizational framework may be defined as: *a real or notional definition of roles, responsibilities and relationships intended to serve as the architecture upon which the organization's members communicate, collaborate and operate more effectively and efficiently than would otherwise be possible; and, once established becomes a cultural norm.* The example of a framework we are all used to seeing is the classic organization chart. How does this relate to FPD New Business? When I began my tenure as FPD's Associate Director for Formulation, I learned that we did not have a new business framework. Not surprisingly, there existed a great deal of uncertainty within our workforce on: 1) how does the FPD conduct its new business roles within the Directorate; 2) who are the members of the FPD new business community; 3) how do these members exchange knowledge on tools, best practices and cost-saving techniques; and, 4) how can I become engaged in the many new business opportunities as a means of gaining job experiences that in

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turn supports career growth? I am proud to announce that the members of the ACFO – in their roles as the Champions of the FPD New Business "Center of Excellence" – have defined a formal framework that is now serving to address all of these aspects. Interested in knowing more? Then I invite you to spend some time visiting the FPD's new business website at http://acfo.gsfc.nasa.gov for a detailed look into this new "cultural norm."

Regards,

Bob Menrad / Code 401
Associate Director for Formulation

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Education: Bachelor's degree in Mechanical Engineering from the State University of New York at Buffalo (David's hometown); Master's degree in Engineering Administration from George Washington University, and a one month stint at the Kennedy School of Government at Harvard University.

Family: David and his wife Madeline live in Alexandria, Virginia. Madeline scaled back from corporate accounting when their kids came along and now does part-time accounting in Old Town Alexandria. They have a daughter, Juliana, who is 15 and a son, Alex, who is 12. They also have a curly coated retriever named Rio.

Life Before MAVEN: David's love for the space business was nurtured early in that his father was an Air Force pilot and aeronautical engineer who worked with a number of the future astronauts and mission controllers in the 1960s. His father's stories and David's direct experiences during his formative years (e.g., going to air shows as a toddler) fueled his interest in aerospace. Coming out of college, he started his career with the Navy Department testing solid rocket motors in Indian Head, Maryland. After 3 years, he moved to Goddard in 1987 and has been here ever since. Some of his adventures before MAVEN included working on the GOES N-Series of weather satellites, flying on an Air Force C-5 aircraft escorting the Cosmic Background Explorer spacecraft in 1989, and being on launch console for many of the Scout, Pegasus, Atlas, and Delta missions in the early/ mid-1990s, including the Mars Global Surveyor and the Mars Pathfinder missions. In 2005 and 2006, he went on detail assignments to NASA/KSC, NASA/Headquarters, and Capitol Hill, working for Senator Bill Nelson of Florida. He has had the pleasure and honor of working with many incredibly talented and hardworking people throughout his career.

Hobbies: In addition to trying to keep up with the kids, some of David's outside interests include snow skiing, biking, travelling, attending sporting events, and hosting dinner gatherings with family and friends.

Knowledge Management Corner

Gathering Project Lessons on LADEE: An Interview with Karilys Montanez

Karilys Montanez is the Resource Analyst for the Lunar Atmosphere and Dust Environment Explorer (LADEE) project. Karilys is a recent participant in the Professional Intern Program (PIP). This article will focus on an activity she undertook in the context of the PIP, namely, to develop and implement an approach to gather project lessons on LADEE.

LADEE is a robotic mission that will orbit the moon to gather detailed information about the lunar atmosphere, conditions near the surface and environmental influences on lunar dust. Onboard, LADEE will include three science instruments (NMS, UVS, and LDEX) and a technology demonstration (LLCD). GSFC is in charge of managing the LADEE payload office, the Science Operations Center (SOC), the launch vehicle support, and providing general engineering support to the spacecraft (e.g. mechanical, electrical, etc.).

Q1. Can you tell us about your career path at Goddard and your current position?

Answer: I started my career at GSFC as an intern in the summer of 2009. I supported the Explorers and Heliophysics Projects Division (EHPD) during 10 weeks as part of the Summer Institute in Engineering and Computer Applications (SIECA) Business Program. I was converted to a co-op student in January 2010 and I spent 7 months supporting the Living With a Star (LWS) and the Solar Terrestrial Probes (STP) Programs. After I completed the 7 months co-op tour I went back to Puerto Rico to finish my Bachelor of Business Administration (BBA). In 2011 I returned from University of Puerto Rico ready to start a full-time career at GSFC. That's when I started supporting the LADEE project as its Resource Analyst. At that point I also became part of the GSFC Professional Intern Program (PIP).

Q2. What is your role on LADEE and how did you come up with the idea of doing your PIP project on LADEE Lessons Learned?

> PIP projects have now been aggregated into a single searchable and user-friendly repository. https://aetdwiki.gsfc.nasa.gov/display/PIP/Home (see the other article in this issue of The Critical Path).

Answer: As I previously stated, I started supporting LADEE as a Resource Analyst. However, a couple of months after I joined the team the former LADEE Business Manager (BM) accepted another position and moved on. Since no one else took over that position I stayed as the only resources/business contact for the project. In other words, I'm the Resources Analyst but I have been performing as the project Business Manager (I should mention that the former BM and my supervisor have always been there to support me when I need it).

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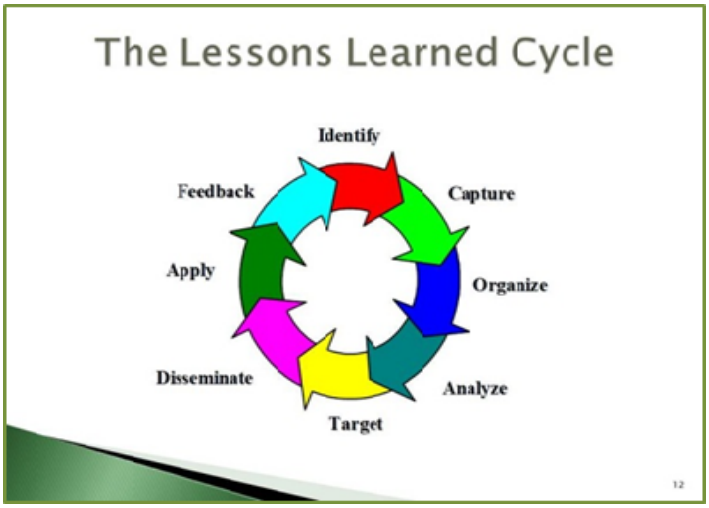
My PIP I was focused on Earned Value Management (EVM). After the successful completion of the PIP I, I was trying to decide whether I wanted to continue my PIP project on EVM or if I wanted to choose a new topic. Since NPR 7120.5E requires the projects to capture its lessons learned and I noticed that LADEE did not have such a program in place, I decided to use it as my PIP II project. I had several meetings with the LADEE Project Manager and with my supervisor and we all agreed that it was a great idea. And that's how it started…



Slide from Ms. Montanez's presentation to the LADEE team.

Q3. How did you go about gathering lessons? How did you come up with that approach?

Answer: I wanted to engage as many LADEE team members as possible. For that reason, I created the LADEE Lessons Learned Survey. I thought a survey was a good method to approach all of them because they could do it at their convenience. The survey was online and completely anonymous; with the intention of allowing the participants to express freely their experiences without having any consequences associated with their inputs. The survey was divided into six main topics and 29 questions. They were specifically related to management, communication, schedule, cost, scope, and the different mission phases. The link to the survey was sent to the LADEE GSFC team list, which includes 68 members.

Q4. Did any of the inputs you gathered from team members surprise you?

Answer: The main issue found on the responses was related to the lack of communication between the GSFC and the ARC teams. That was not a surprising fact. Other themes that emerged were related to budget limitations, scope changes, instrument calibration, etc. One theme that surprised me was an issue related to the use of two different configuration management (CM) systems. I knew that we were using two systems (MIS at GSFC and MINX at ARC); however, I didn't know that it represented such a big deal for the LADEE team members. They concluded that a collaborative project between two (or more) NASA Centers,

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should utilize a common CM system. That system should be robust enough to address proprietary and ITAR elements. This lesson could avoid duplication of effort, improve the approval process, save time, costs, and ease the search for important documents on future projects.

Q5. Once you were done collecting and synthesizing the lessons, what was your plan for sharing them with the team and then more broadly, with others within Goddard?

Answer: After I was finished collecting and synthesizing the lessons, the plan was to share them with the GSFC LADEE team so they could apply them in their current tasks. After that, continue collecting lessons until the launch and then in phase E, complete the process by sharing the LADEE lessons learned with other similar NASA projects. The Project Manager also thought about the possibility of creating a handbook on how to build payloads.

> There's a famous quote, "Those who do not learn from history are doomed to repeat it". The quote may be overused, but it is worth reminding ourselves that the purpose of our Lessons Learned effort is so others can avoid our mistakes, but repeat our accomplishments.
>
> Robert Caffrey, LADEE Project Manager

However, after Barbara Fillip offered the Knowledge Management presentation to the EHPD and we talked about LADEE, I thought that her idea of sharing the lessons we already have through the Flight Projects Directorate (FPD) Knowledge Exchange was great! The Knowledge maps (K-MAPS) can help not only the LADEE team members but other NASA employees.

Q6. Where can people find out more about these lessons?

Answer: Currently, the lessons are available in PowerPoint format in the FPD Knowledge Exchange. We're working with Barbara Fillip to add some details about the lessons. We realized that for lessons learned to be useful to others, it's important to include as much of the background, contextual information as possible and practical. Eventually these lessons will be integrated in the Knowledge maps within the Knowledge Exchange. In the meantime, if you have any questions don't hesitate to contact me at karilys.montanezmojica@nasa.gov.

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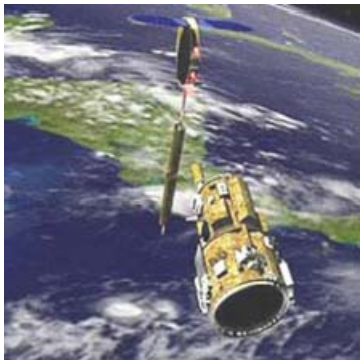
Case Study Highlight: Learning from the Past

The DART Mission



DART (Demonstration of Autonomous Rendezvous Technology) originated in 2001 as a low-profile project to demonstrate that a spacecraft could rendezvous with a satellite without the assistance of ground control. By 2004, the mission had emerged as NASA's "first flight demonstration of new exploration capability," the vanguard of the Vision for Space Exploration. With the high profile came high pressure.

After a cost increase of more than 100 percent and schedule delays, DART failed halfway through its mission. Software development and testing in the guidance/navigation/control system, and inadequate systems engineering, were identified as causes.

Could failure have been prevented? What are some of the lessons to be drawn from this experience in addition to the immediate causes of the failure? If you are unfamiliar with the DART Mission you can read several case studies for background information.

- The DART Mission: Hard Decisions in a Changing Environment (OCKO case study) http://gsfcir.gsfc.nasa.gov/dl/casestudies/36/Case/The_DART_Mission_.pdf
- Fender Bender – DART's Automated Collision (NASA Safety Center System Failure Case Study) http://nsc.nasa.gov/SFCS/SystemFailureCaseStudyFile/Download/32
- DART Risk Management Case Studyhttp://www.nasa.gov/externalflash/dart/Text%20Case/DART%20Text%20Case.pdf

Suggestion for project teams:

a) Pick a case study that addresses topics of relevance to your mission;

b) Discuss the case's lessons and implications for your mission at a project staff meeting.

Need help identifying a relevant case study? Contact the Chief Knowledge Officer, Ed Rogers, or the FPD Knowledge Management Lead, Barbara Fillip.

Barbara Fillip, Code 400
Knowledge Management Project Manager

(Hubble continued from page 1)

the Wide Field Camera 3 (WFC3), a panchromatic imager operating from ultraviolet to near-infrared wavelengths, and the ultra-sensitive Cosmic Origins Spectrograph (COS). During the mission, astronauts also repaired *Hubble*'s Advanced Camera for Surveys (ACS) and the multi-purpose Space Telescope Imaging Spectrograph (STIS). As a result, *Hubble'*s scientific productivity is currently at an all-time high. The astronomical community submitted more than 1,000 proposals to use the telescope in response to the last advertised "call for proposals" and requested approximately six times the total orbits that were available to award.

This image of the iconic Horsehead Nebula was taken with Hubble's infrared camera, one of two cameras that are part of the Wide Field Camera 3 instrument, to mark the 23rd Anniversary of the launch of the historic telescope.

In these four short years since the last servicing mission, scientists have used the observatory to further our knowledge of the universe across many diverse fields of study. The science enabled by the telescope continues to make headlines. As examples, astronomers discovered two new moons of the dwarf planet Pluto (its fourth and fifth) as part of an observing program to assist NASA's New Horizons spacecraft in planning its flyby of the Pluto system in July, 2015.

Hubble scientists also broke their own previous record for imaging the most distant galaxy. The newly discovered object is estimated to be more than 13 billion light-years away. Similarly, the telescope was recently used to detect the furthest Type Ia supernova found to date—Supernova UDS10Wil, which, at z=1.914, is more than 9 billion light-years distant. This is especially significant, because by finding Type Ia supernovae so early in the universe, astronomers believe they can distinguish between two competing models of how these stellar explosions occur and thereby deter-

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mine better how quickly the universe was enriched with heavy elements like iron. Using STIS, *Hubble* also made observations of variations in the atmosphere of an exoplanet for the very first time. The target planet was HD 189733b, a gas giant 14 percent larger than Jupiter that circles its star at a distance of only 3 million miles. Significant changes in the atmosphere of the planet were detected from those seen by STIS a year and a half earlier. Scientists conclude that the atmospheric variations occurred in response to a
powerful eruption on the planet's host star, an event observed by NASA's Swift satellite a few days before the latter *Hubble* observation.

Realizing that *Hubble's* unique capabilities that produce such scientific results will not be reproduced by any existing or planned astronomical research facility on Earth or in space for the foreseeable future, the operation teams at GSFC and at the Space Telescope Science Institute continued to pursue Life Extension Initiatives (LEI) to keep *Hubble* scientifically productive and to achieve the goal of providing at least a year of overlap with James Webb Space Telescope (JWST) operations. LEI activities focus on instruments and subsystems that exhibit higher failure probabilities due to their age and failure history. Some of these initiatives, such as reduced gyro operations, Multi-Access Transponder cycle reduction, Science Data Formatter temperature mitigation, and reaction wheel speed reduction during slews, are already implemented and reducing the risk and impact of failure. Initiatives currently being worked have a common goal of restoring science capability quickly after a failure by reducing recovery times from weeks or months to days. These include preparing for instrument or spacecraft electrical problems, identifying alternative communication options and impacts arising from transponder failures, and implementing new safe modes. Accordingly, a reduced-wheel reduced-gyro safemode is now available that will provide for satellite safing in the event of two successive reaction wheel failures. Similarly, target acquisition failures due to an increase in the gyroscope bias caused by bus voltage transients produced during day/night terminator crossings has been compensated for in flight software. This will allow for the reinstatement of a gyro exhibiting more noise than typical into the spacecraft control loop.

Over the past several years the Project has also been addressing the issue of reduced future budgets. One of the main associated challenges completed by the team is the reduction of flight operations costs through an Automated Operations Development (AOD) effort. This change transformed flight operations from a 24-hour per day, 7-day per week, 365-day per year continuously staffed console approach to an 8-hour Monday through Friday single-shift operation that employs automated data monitoring and alert notification during unstaffed periods. In the past, around-the-clock flight operations personnel were responsible for identifying anomalous conditions onboard Hubble. However, the automated monitors within the new AOD system now play an important role as well. The system has performed flawlessly in identifying and alerting key personnel to several anomalous conditions since implementation. This has expedited their timely resolution and minimized loss of science data.

With the retirement of the Space Shuttle program, however, the astronomical community realizes that *Hubble* is now operating like other scientific satellites, with no opportunity to replace or upgrade its aging systems through astronaut servicing. Because of this, astronomers feel a sense of urgency to fully harness the observatory's powerful capabilities by using it to deposit the largest possible volume of high-quality images and spectra into the mission's data archive. In this way, future

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generations of astronomers can “mine” this data treasury and continue to address the major questions in modern astronomy even after the telescope itself becomes inoperable.

Therefore, in August 2009, a call was released to the astronomical community to submit bold proposals for a new class of *Hubble* observations called Multi-Cycle Treasury Programs (MCTPs). For the first time, observers were invited to submit programs that were unusually large and which spanned multiple years. It was recognized that in many cases such large programs would provide astronomers the opportunity to tackle key scientific questions that cannot be fully addressed through the smaller number of telescope orbits awarded in the standard time-allocation process. Approximately 750 *Hubble* orbits were allocated for use by these multi-cycle programs in each of three consecutive years. The total of 2,250 orbits equals 20 to 25 percent of the entire observing time available to astronomers during the three-year period.

In response, researchers submitted 39 proposals, and a specially convened peer-review panel selected three: the Cosmic Assembly Near-infrared Deep Extragalactic Legacy Survey (CANDELS), the Cluster Lensing And Supernova Survey with *Hubble* (CLASH), and the Panchromatic *Hubble* Andromeda Treasury (PHAT). Unlike typical *Hubble* observations that give one-year proprietary data rights to the principal investigator who proposed the observation, the images and spectra from the MCTPs have no such period. Instead, they are put into *Hubble*’s data archive where the observations are immediately made accessible to all.

The first of these programs, CANDELS, is an in-depth imaging survey of the distant universe being carried out with *Hubble*’s WFC3 and ACS instruments. By looking deeper into space (and hence further back in time), the CANDELS program follows the evolution of galaxies from the time of their infancies into the present. The program also indirectly explores the nature of cosmic dark energy—the mysterious force believed to be accelerating the expansion of the universe. It does this by measuring the brightness of distant Type Ia supernovae and using these data to calculate how the cosmic expansion rate varied with time.

While the CANDELS program focuses on distant galaxies and what they can tell us about the nature of dark energy, the CLASH program is designed to probe the distribution of dark matter with unequalled precision in 25 massive galaxy clusters. Such clusters are the largest gravitationally bound structures yet to form in the universe. Reflecting conditions in the cosmos at large, these clusters are evidently dominated by an enigmatic material called dark matter—some 85 percent or more by mass. Visible galaxies comprise only about 5 percent of the universe’s mass; the remaining 10 percent consists of hot gas between the galaxies that can be detected by X-ray telescopes.

Focusing on the nearby universe, the PHAT program is an extensive, multi-wavelength study of the Andromeda galaxy (M31), which is the nearest large spiral galaxy to the Milky Way. Astronomers expect to map approximately one-third of M31’s star-forming disk across a wide range of ultraviolet, optical, and near-infrared wavelengths. Such observations are sensitive to stars of many types and evolutionary phases: from hot, hydrogen-burning dwarfs; through luminous red giants; to extremely hot, helium-burning objects nearing the end of their lives. The team expects to image more than 100 million stars and then catalog them by their identifiable characteristics such as luminosity and

(Hubble continued on page 29)

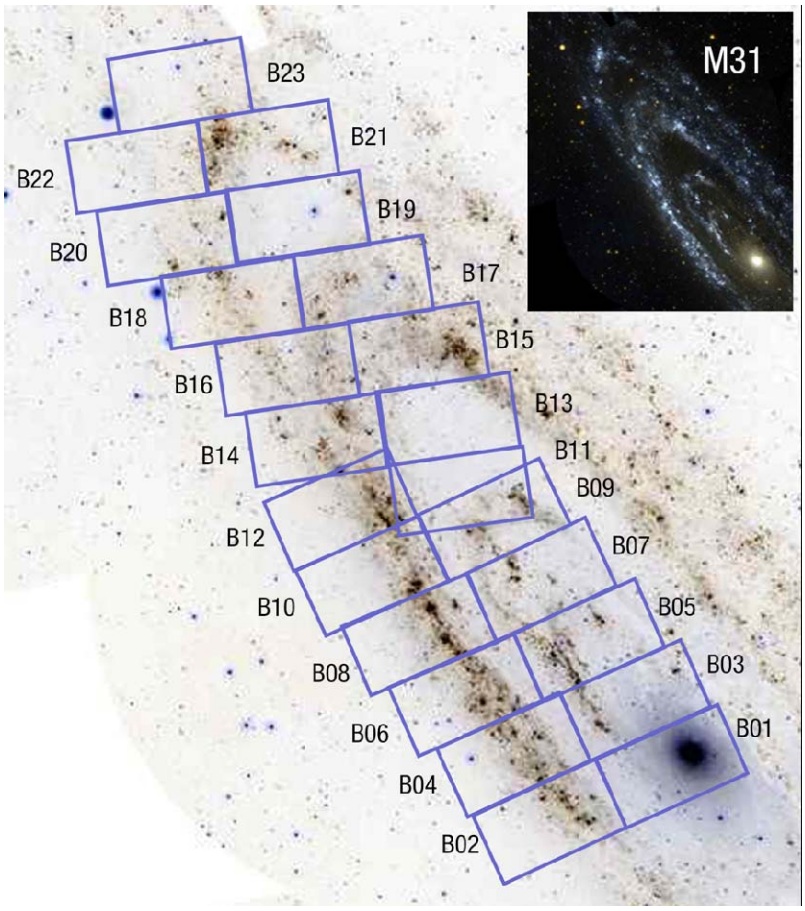
(Hubble continued from page 28)

temperature. Using these data, the scientists plan to calibrate and refine existing computer models of stellar evolution and thereby improve their general understanding of stellar ages and aging processes.

More than 3TB of data have been put into the data archive already by the MCTPs, while over 36 TB have been distributed to the astronomical community. To date, these programs have also produced over 80 scientific papers.

Following the successful conclusion of the MCTPs in FY13, the *Hubble* program will commence two new initiatives: a deep-field imaging campaign to measure cosmic variance at the fringes of the universe, and a concerted effort to utilize the ultraviolet imaging and spectroscopic resources of the telescope.

In the first of these, the Space Telescope Science Institute director's discretionary observing time will be used to undertake a revolutionary 3-year deep-field observing program to build on earlier deep-field initiatives and peer further into the universe than ever before. Called the Frontier Fields, these observations will combine the power of *Hubble* with the natural magnifying power of gravitationally lensing galaxy clusters to characterize the nature and density of galaxies at various points on the sky. Six deep fields centered on strongly lensing galaxy clusters will be taken in parallel with six deep "blank fields." These will be the second deepest observations of "blank fields" and the deepest observations of clusters and their lensed galaxies ever obtained.



The PHAT observations are grouped into 23 "bricks." Each brick consists of a mosaic of 18 Hubble pointings in a six-by-three array. Odd-numbered bricks extend from the bulge (B01) area of the galaxy and out along its major axis. The even-numbered bricks form an adjacent strip that covers the blue star-forming ring of one of the galaxy's spiral arms.

(***Photo credit:*** *NASA/JPL/California Institute of Technology)*

The key science goals of these twelve Frontier Field observations are:

- to reveal hitherto invisible populations of z = 5–10 galaxies that are 10–50 times fainter intrinsically than any presently known;

(Hubble continued on page 30)

(Hubble continued from page 29)

- to solidify astronomers' understanding of the stellar masses and star formation histories of faint galaxies at the earliest visible times;
- to provide the first statistically meaningful morphological characterization of star forming galaxies at z > 5;
- to find z > 8 galaxies stretched out enough by cluster lensing to discern internal structure and/or magnified enough by cluster lensing for spectroscopic follow-up.

These analyses will lay a solid foundation for the exploration of even fainter, more distant galaxies by *Hubble*'s follow-on, JWST.

The object NGC 3314, imaged by Hubble, is a rare case of two visually overlapping galaxies that are widely distant from one another in space. The chance alignment of the two galaxies along Earth's line of sight provides an uncommon look at the silhouetted spiral arms of the foreground system. The motion of the two galaxies indicates that they are both relatively undisturbed and are moving in markedly different directions. They are actually separated by tens of millions of light-years.

In the second initiative, the astronomical community will be encouraged to exploit *Hubble's* currently unique ultraviolet (UV) capabilities to address a wide range of topics from planetary systems to the fundamental fabric of the cosmos. An UV Initiative has been introduced that will use orbit-allocation targets to increase the share of primary general observer (GO) observing time dedicated to UV observations (wavelengths < 3200 Angstroms). This UV Initiative also extends to archival proposals, where review panels will be asked to preferentially fund qualified UV-specific archival research proposals that provide UV high-level data products and tools for the *Hubble* archive, and enable broader use of those datasets by the community.

Projects such as the Multi-Cycle Treasury Programs, Frontiers Fields, and UV Initiative are keeping *Hubble* at the forefront of astronomical research. They are enabling scientists to address many seminal topics in astrophysics, and are populating the *Hubble* archive with data to be mined for generations to come. At the same time, *Hubble* retains its role as one of NASA's Great Observatories and with support from our European Space Agency (ESA) partners, synergistically supports a diverse science program with other NASA and ESA satellite missions as well as ground-based observatories. To date, *Hubble* data has produced over 11,000 papers in refereed journals, with over 400,000 citations to these works. Data from the telescope directly contributed to the discovery that the expansion rate of the universe is accelerating—a finding that made Dr. Adam Reiss of the Space Telescope Science Institute a co-recipient of the 2011 Nobel Prize in Physics.

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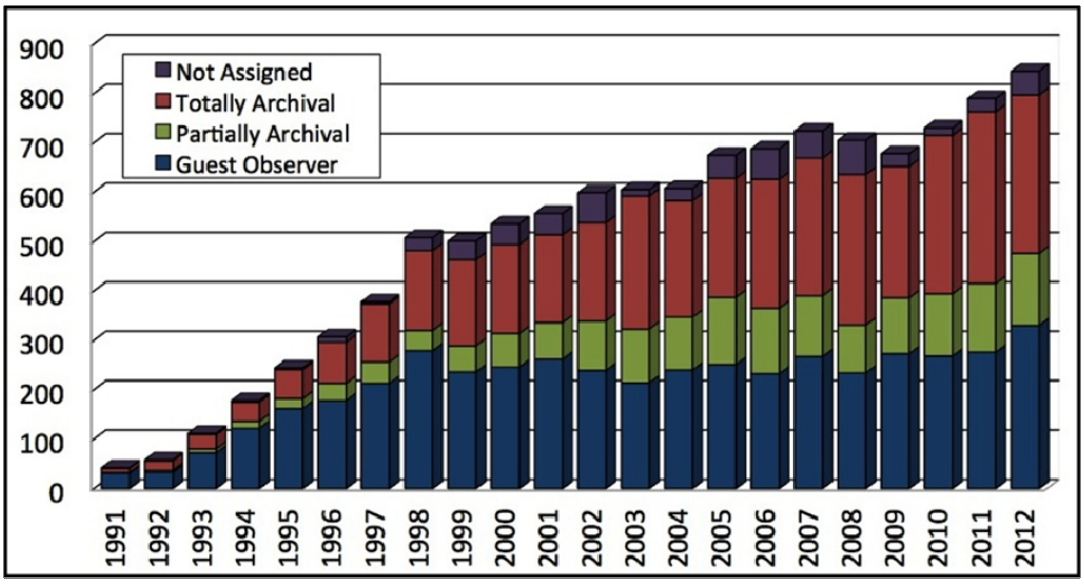

Over 11,000 refereed Hubble papers have been published.
Yearly productivity continues to increase with time.

Hubble's discovery potential in all areas of astrophysics has never been greater, and its ability to confirm or extend discoveries made by other observatories continues.

The Hubble Team

(Fillip Tintype continued from page 3)

governmental organizations all trying to do some good around the world. Most of her work focused on developing and implementing monitoring frameworks for projects (aka project controls) and performing project evaluations. Success and failure are very subjective in international development projects, therefore project evaluations can become politically sensitive … and so at some point Barbara decided to take a break from trying to do some good around the world and she turned to an even more ambitious mission, joining NASA as a contractor in 2008. In the past few years at NASA, she has learned that while there are significant differences between international development projects and space missions, there are probably more commonalities than one might think in terms of how things can go wrong and what contributes to a successful project.

Family: Barbara has two wonderfully opposite daughters. Alexandra is a first-year student at the University of Virginia pursuing a degree in Media Studies, or perhaps business, or even political science, or all of them at once. Natasha is an 8th grader who enjoys rock-climbing, pottery, and anything that allows her to create with her hands.

Life Outside of Goddard: Barbara lives in Arlington, Virginia where she recently started experimenting with backyard composting, rainwater harvesting, and gardening. She fancies herself a lifelong amateur fiction writer (sorry, her novels are not available in bookstores or on Amazon YET), and just tries to be the best mom she can be.

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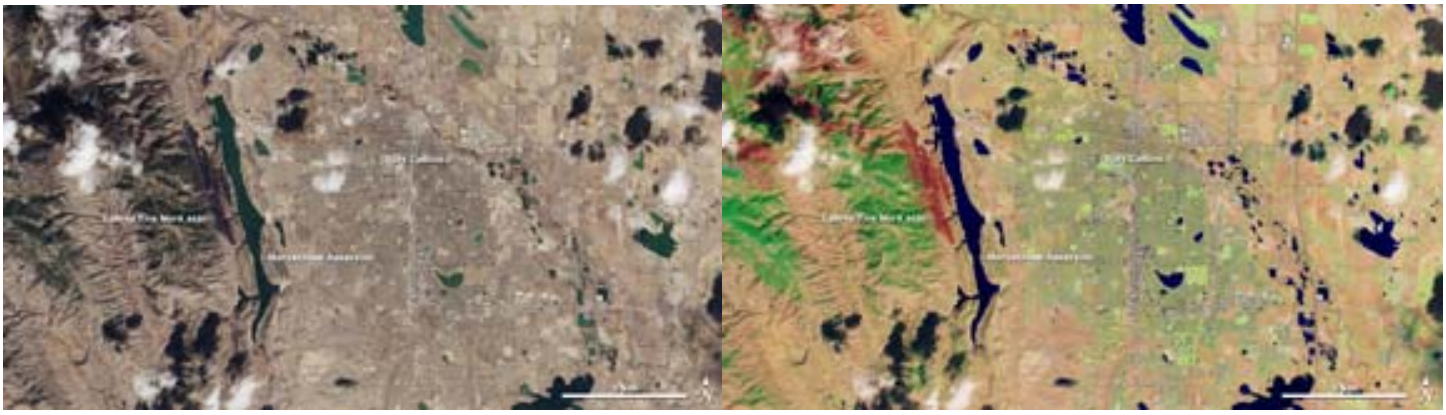

These LDCM images zoom into the area around Fort Collins, Colorado. On the left, the image is shown in natural color, created using data from OLI spectral bands 2 (blue), 3 (green), and 4 (red). The image on the right was created using data from OLI bands 3 (green), 5 (near infrared), and 7 (short wave infrared 2) displayed as blue, green and red, respectively. In the left-hand natural color image, the city's elongated Horsetooth Reservoir, a source of drinking water, lies west of the city. A dark wildfire burn scar from the Galena Fire is visible just to the left of the reservoir. The scar shows up bright, rusty red in the false color image.

Credit: *USGS/NASA Earth Observatory*

LDCM is a joint mission of NASA and the Department of Interior's U.S. Geological Survey.

"It's a really great day," said Jeff Pedelty, an instrument scientist at Goddard Space Flight Center (GSFC), who worked on the LDCM Operational Land Imager, or OLI instrument, that took the natural color image. He's very impressed with the level of detail they can see with the advancements to the sensor. "It's wonderful to see, there's no doubt about it, and it's a relief to know that this is going to work wonderfully in orbit."

The natural color image showed the landscape in the colors our eyes would see, but Landsat sensors also have the ability to see wavelengths of light that our eyes cannot see. LDCM sees eleven bands within the electromagnetic spectrum, the range of wavelengths of light. OLI collects light reflected from Earth's surface in nine of these bands. Wavelengths on the shorter side include the visible blue, green, and red bands. Wavelengths on the longer side include the near infrared and shortwave infrared.

LDCM's second instrument, the Thermal Infrared Sensor (TIRS)* detects light emitted from the surface in two even longer wavelengths called the thermal infrared. The intensity of the emitted light at the longer wavelengths measured by TIRS is a function of surface temperature. In the black-and-white image of the first thermal band on TIRS, warmer areas on the surface are brighter while cooler areas are dark.

The first thermal images seen by Dennis Reuter, TIRS instrument scientist at Goddard, were forwarded to him from the data processors. "To say it was exciting was an understatement," said Reuter, who was blown away by the data quality. "Wow! This is beautiful!" he wrote in an email. "Look at those amazing clouds! And the detail!"

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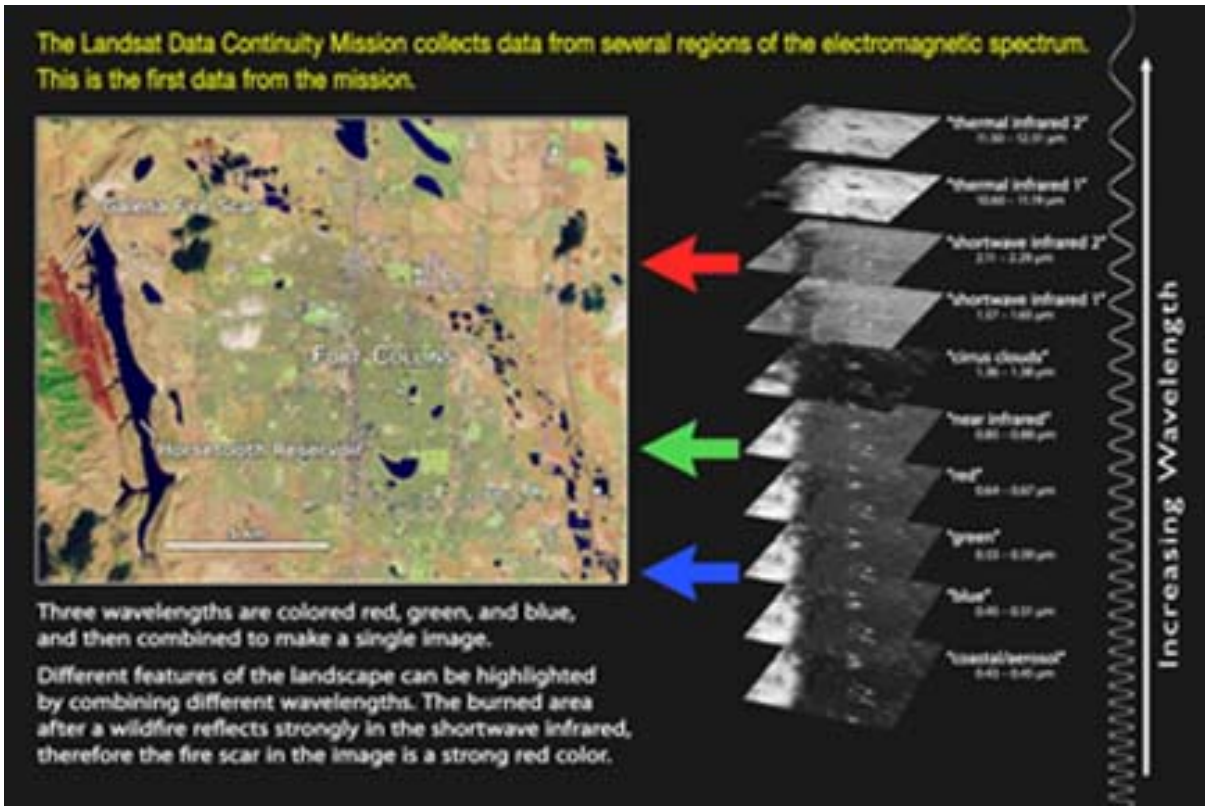
Clouds in the colder upper atmosphere stand out as black in stark contrast to a warmer ground surface background. The TIRS images were collected at exactly the same time and place as the OLI data, so all eleven bands can be used together.



This diagram illustrates how LDCM's observations at different wavelengths are combined to create one image.
Credit: *NASA's Goddard Space Flight Center*

The infrared bands on both TIRS and OLI complement the visible bands, said Reuter. "You're seeing things in the visible that you don't necessarily see in the infrared, and vice versa," he said.

Different characteristics on the ground dictate the intensity of the reflection and emission of light in different bands from the surface, ultimately allowing scientists to distinguish between different surface features. To highlight differences across an image, analysts sometimes assign artificial colors to data from different spectral bands for display.

For example, zooming in to the area around Fort Collins, Colorado, the natural color image was created from OLI bands 2 (blue), 3 (green), and 4 (red) data. In the image, a dark stripe can be seen just west of the Horsetooth Reservoir, a source of drinking water for the city. The stripe is a scar left in the aftermath of the Galena wildfire. That same burned area bursts out of the image as a bright, rusty red scar with greater contrast between the surrounding areas in the false color image. The false color image was created using data from OLI bands 3 (green), 5 (near infrared), and 7 (short wave infrared 2), assigned the colors blue, green and red respectively. These types of LDCM

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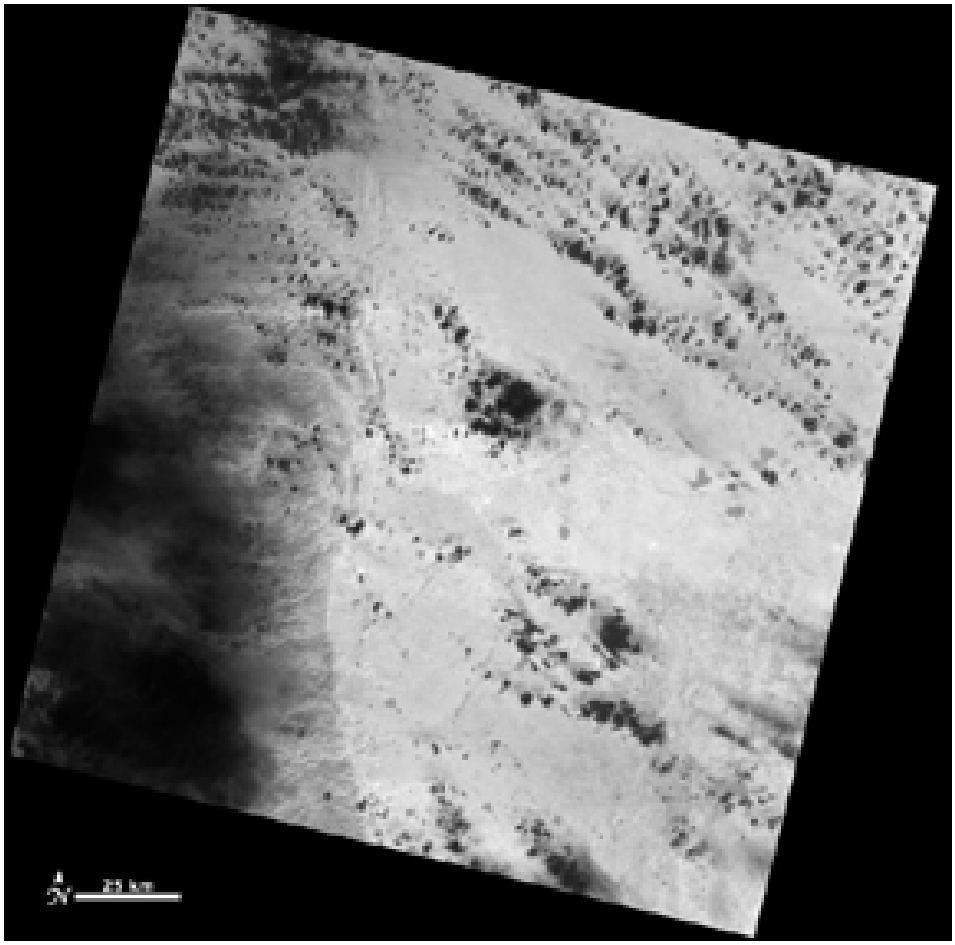
(LDCM continued from page 33)

images and the accompanying data will be used by multi-agency Burned Area Emergency Response teams to plan and carry out wildfire recovery measures.

Similarly, the thermal bands that detect wavelengths dependent on surface temperature show more than just high altitude clouds. This ability to measure differences in temperature across the land surface is essential to one of the major applications of LDCM data: water management. Analysts in western states will use TIRS data in conjunction with OLI data to determine the amount of water being used in irrigated agricultural fields.



This black-and-white Landsat scene shows the area where the Great Plains meet the Front Range of the Rocky Mountains in Wyoming and Colorado. The image was created using data from the first TIRS thermal infrared band. Warmer surfaces appear light gray to white in the thermal image while cooler areas appear dark gray to black. Clouds in the colder upper atmosphere, for instance, appear black against the lighter background of the warmer ground surface. When the satellite begins normal operations, data products will contain co-registered (simultaneous) data for all of the OLI and TIRS.

Credit: *USGS/NASA Earth Observatory*

(LDCM continued on page 35)

(LDCM continued from page 34)

"When you water plants they take it in through their roots and it comes up to their leaves, and if they have a plentiful water supply, they transpire," said Reuter. Transpiration, as well as evaporation from the soil, means that the water goes back into the atmosphere.

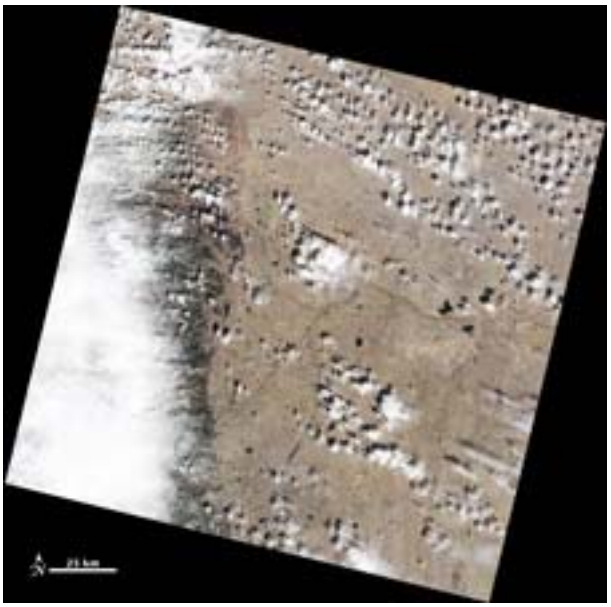
"It's just like when we sweat, we cool down. [Plants] cool down when they have a lot of water," said Reuter. "It's a beautiful illustration of the physics of radiative transfer and also the usefulness of the data." This application of LDCM data will be essential to the effective management of scarce water resources in our arid and semi-arid states.

Both Reuter and Pedelty were impressed with the level of detail they see in the OLI and TIRS data. Part of that detail comes from the push broom design of both instruments. Instead of instruments that scan back and forth across a swath on the ground, push broom data collection looks across a whole swath at once, allowing the sensors to observe each patch of ground longer.

"It's like taking a thermometer and letting it sit there longer to get a more stable measurement," said Reuter.

But the work is only beginning for validating the data quality and getting ready for normal mission operations. These images were processed using pre-launch settings, which must be checked and adjusted now that LDCM is in orbit to ensure that the data accurately measure the intensity of reflected and emitted light received by the instruments. The mission operations team also needs to ensure that each pixel is accurately located on Earth's surface.

Among the first activities planned in the next two months are reference checks for both OLI and TIRS. OLI will look indirectly at the sun with its solar diffuser panel.



LDCM captured this image on March 18, 2013, the first day that OLI observed Earth from space. This natural color Landsat scene was created using data from OLI spectral bands 2 (blue), 3 (green) and 4 (red), and it emulates the true colors the human eye would see from space. The data were collected at the same time as the TIRS data in the black-and-white image.

Credit: *USGS/NASA Earth Observatory*

"We let the sun shine on the panel so it makes a bright uniform target and we image that," said Pedelty, who adds that while it may seem mundane compared to an image of Earth, it's a key reference measurement for updating OLI's calibration.

In addition, for both OLI and TIRS calibration, LDCM will view deserts, the ocean and the moon, surfaces with relatively stable and well-known reflectance and emittance properties. The mission operations team also plans to fly underneath the currently orbiting Landsat 7 to collect data at the same time in order to cross-calibrate the two LDCM sensors with the Landsat 7 Enhanced Thematic Mapper-Plus (ETM+) instrument.

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(LDCM continued from page 35)

"Everything has been very exciting," said Reuter. These first images are the culmination of a lot of hard work from the people at NASA and USGS, the Landsat Science Team and their industry partners at Ball Aerospace Corp. in Boulder, Colo., that built OLI, and Orbital Science Corp. of Gilbert, Arizona, that built and tested the spacecraft, he said. "As a tool for science, for looking at the whole planet and seeing how we're affecting it, and how it's affecting us, it's gratifying in all ways."

Pedelty agrees. "I was privileged to work onsite at Ball Aerospace as they designed, built and tested the OLI. Then I moved to Orbital Sciences to help test the LDCM observatory. A lot of talented people worked very hard and everything had to work. And it has."

The area around Boulder, Colorado, is shown here in a true color image collected by the OLI aboard LDCM on March 18, 2013. The OLI and an important component of TIRS, its cryocooler, were built at the Ball Aerospace & Technologies Corporation facility in Boulder.

Credit: *USGS/NASA Earth Observatory*

LDCM's normal operations are scheduled to begin in late May when the instruments have been calibrated and the spacecraft has been fully checked out. At that time, NASA will hand over control of the satellite to the USGS, which will operate the satellite throughout its planned five-year mission life. The satellite will be renamed Landsat 8, and data from OLI and TIRS will be processed and added to the Landsat Data Archive at the Earth Resources Observation and Science Center in South Dakota, where it will be distributed for free over the Internet.

For more information, visit: http://www.nasa.gov/mission_pages/landsat/main/index.html
For more information on the TIRS Instrument development, see the story beginning on page 4.

Note: These images are slightly offset from the standard Path 33, Row 32 Landsat scene as LDCM has not yet reached its nominal 438 miles (705 kilometer) operational orbit.

Ellen Gray
Outreach Coordinator / Science Writer / Code 612

Comings & Goings
January 1 thru March 31, 2013

Comings:

* Olivia Lupie (from 584) to 441 / HST Operations Project, Instrument Systems Manager
* Jim Bangerter to 450.1 / NIMO, Consultant
* John Wolfgang to 400 / Flight Projects Directorate, Consultant
* Julie Lander (from 505) to 443 / James Webb Space Telescope Project, Deputy JWST OTIS Manager
* Andy Carson (from NASA HQs) to 401 / Advanced Concepts & Formulation Office, TESS Mission, Deputy Project Manager
* Sharon Straka (from 546) to 420 / ESPD Earth Systematic Mission Program Mission Manager
* Richard Von Wolff (from 566) to 452 / Space Network Project, Deployment, Transition & Operations Manager

Goings:

* Ed Torres-Martinez from 407 / Earth Science Technology Office, Technology Development Manager
* Donna Mudd retires from 420 / Earth Science Projects Division, Division Secretary
* John Wolfgang retires from 400 / Flight Projects Directorate, Assistant Director
* Pamela Henderson from 453 / Near Earth Network (NEN) Project to 703 / Resources Analyst
* Eleanor Silverman (from 420) to United States Air Force Program Director
* Jerry Esper (from 450) to Federal Retirement Thrift Investment Board
* Melanie Crespo from 461 / MMS Project to 600 / Senior Resources Analyst
* Jonathan Hartley retires from 407 / Earth Science Technology Office, Technology Program Manager
* David Affens retires from 450.3 / Search & Rescue (S&R) Mission Office, S&R Mission Manager

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(Comings and Goings continued from page 37)

Reassignments/Realignments/Details within Code 400:

* Tom McCarthy to 420 / Earth Science Projects Division, Associate Director
* Joy Bretthauer (from 440) to 450 / Exploration & Space Communications Projects Division, Observatory Manager
* Mike Talley (from 440) to 443 / James Webb Space Telescope Project, Financial Manager
* Akinwunmi Akinwande (from 450.1) to 453 / Near Earth Network (NEN) Project, Resources Analyst
* Mike Goeser (from 427) to 417 / GOES-R Flight Project, Launch Vehicle Manager
* Chasity Kisling to 441 / HST Operations Project, Sr. Resources Analyst
* Lisa Mazzuca to 450.3 / Search & Rescue Mission Office, Mission Manager
* Space Network Ground Segment Sustainment (SGSS) Project, Code 458 (formerly 450.3 / Systems, Concepts Integration & Planning Office)

Reorganizations within Code 400:

* Exploration and Space Communications Projects Division, Code 450
* Networks Integration Management Office, Code 450.1
* Lunar Laser Communications Demonstration (LLCD) Office, Code 450.2 (formerly Ground Systems Development Projects)
* Search & Rescue (SAR) Mission Office, Code 450.3 (formerly Systems, Concepts Integration & Planning Office)
* Laser Communications Relay Demonstration (LCRD) Project, Code 451 (formerly Lunar Reconnaissance Orbiter (LRO) Project)
* Space Network Project Office, Code 452
* Near Earth Network (NEN) Project, Code 453 (formerly Ground Network Project)
* Tracking & Data Relay Satellite (TDRS) Project Office, Code 454
* Exploration Systems Projects, Code 455
* Space Network Ground Segment Sustainment (SGSS) Project, Code 458 (formerly 450.3/ Systems, Concepts Integration & Planning Office)

Lisa Hoffman, Administrative Officer
Code 400

Quotes To Think About

"The brain is a wonderful organ; it starts working the moment
you get up in the morning and does not stop
until you get into the office."
Robert Frost

"Two possibilities exist; either we are alone in the Universe
or we are not. Both are equally terrifying."
Arthur C. Clarke

"Human beings, who are almost unique in having the ability
to learn from the experience of others, are also remarkable
for their apparent disinclination to do so."
Douglas Adams

"Thinking is the enemy of creativity. It's self-conscious,
and anything self-conscious is lousy.
You can't try to do things. You simply must do things."
Ray Bradbury

"He who knows not, and knows not that he knows not, is a fool.
Shun him."
Arabic Saying

Cultural Tidbits

Did you Know……

... April 2nd was World Autism Awareness Day? Autism impacts information processing in the brain. Twenty out of 1,000 in the United States are diagnosed with one of the recognized disorders within the autism spectrum. Autism usually appears in the first several years of a child's life. A third of individuals with autism do not develop enough natural speech to meet basic, daily communication needs. There is no known cure for autism. About 40% diagnosed with autism have average to above-average intellectual abilities. Many have exceptional abilities in visual, music ,and academic skills. Others can have significant disability and are unable to live independently. The wide range of impacts of autism means the development and delivery of effective treatments can be challenging. Increasing awareness and support for individuals with autism can have a positive influence to help raise their quality of life.

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.

TDRS-K and LDCM Launched!

The first of NASA's three next-generation TDRS launches successfully lifted off on January 30, 2013 from the Cape Canaveral Air Force Station, Florida aboard an Atlas 5 rocket. All operations are proceeding in excellent fashion. TDRS-L is scheduled for launch in January, 2014.

LDCM was successfully launched from Vandenberg Air Force Base (VAFB) on a ULA Atlas V launch vehicle on February 11, 2013. All operations are flawless.

FUTURE LAUNCHES CY 2013	
Interface Region Imaging Spectrograph (IRIS)	JUNE
Lunar Atmosphere and Dust Environment Explorer (LADEE)	SEPTEMBER
Mars Atmospheric and Volatile EvolutioN (MAVEN)	NOVEMBER
Total Solar Irradiance Calibration Transfer Experiment (TCTE) - STP-3	DECEMBER

ATTENTION INTERNET BROWSERS:

We're on the WEB
http://fpd.gsfc.nasa.gov/news.html
Or via the New "Code 400" Homepage
http://fpd.gsfc.nasa.gov

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Howard K. Ottenstein,
Editor

Laura Paschal,
Production Assistant

Paula L. Wood,
Editorial Assistant

If you have a story idea, news item, or letter for The Critical Path, please let us know about it. Send your note to Howard Ottenstein via email: Howard.K.Ottenstein@nasa.gov, Mail: Code 403, or Phone: 6-8583. Don't forget to include your name and telephone number. Deadline for the next issue is July 19, 2013.