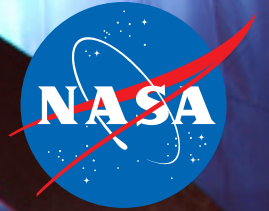


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The Road to Discovery

By Christopher Wanjek

In its goal to complete a remarkable 10 technology demonstrations by the end of 2006—a remarkable feat—the James Webb Space Telescope (JWST) team has achieved two important milestones: the validation for its two infrared detectors, which are the heart of the telescope.

JWST is called the successor to Hubble, but there are key differences. Hubble is primarily an optical telescope, albeit with significant capability to detect near-ultraviolet and near-infrared light. JWST will just peak its head into the optical range with an ability to detect reddish light, but its main focus is the infrared.

Why the wavelength shift to lower energies? JWST is chasing after the first stars and galaxies to form in the universe. These objects do indeed glow chiefly in optical and ultraviolet light, but they are so distant that their light has lost energy in the long journey to us. As the universe expands, the wavelengths are stretched, and what was once optical and ultraviolet is now infrared.

So the choice to “go infrared” was a natural one. That’s when the challenge began. The JWST team needs infrared detectors sensitive enough to collect the dim light of the first stars and galaxies, which is no easy feat. JWST has had to enhance the state of the art for infrared detectors by producing instruments with more pixels than anything that has come before. The detectors also need to maximize signal to noise and minimize heat, which can be difficult once your instrument gets big.

The instruments themselves produce heat, which is a form of infrared radiation. JWST has made a remarkable advancement in this area by reducing the detector’s background thermal noise by an order of magnitude over the previous generation.

The four near-infrared detectors, which detect light just below the visible range, are 2048 x 2048 pixels, the largest to fly in space. This adds up to 4 million pixels per detector. They are the eyes for JWST’s near-infrared camera, near-infrared spectrograph, and fine guidance sensor (FGS) instruments. In April, testing of the working model of these detectors proved that they meet JWST requirements.

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Cover Caption: Image shows a one-sixth-scale optical testbed, which was built to mature critical subsystems and reduce risk prior to the 2013 launch of the James Webb Space Telescope. The testbed was built by Northrop Grumman’s subcontractor, Ball Aerospace & Technologies Corp.

Photo Credit Courtesy of Northrop Grumman and NASA

GoddardView Info

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Deadlines: News items and brief announcements for publication in the *Goddard View* must be received by noon of the 1st and 3rd Wednesdays of the month. You may submit contributions to the editor via e-mail at alittle@pop100.gsfc.nasa.gov. Ideas for new stories are welcome, but will be published as space allows. All submissions are subject to editing.

Wallops and NOAA Monitoring the Chesapeake Bay

CoastalObs III Program A NASA/NOAA/CIT Joint Program

By Brian Campbell, Tracy Riley*, Tiffany Moisan, and John Moisan,

CoastalObs III is a collaborative effort between the Center for Innovative Technology (CIT), NASA Wallops Flight Facility (WFF), the National Oceanic and Atmospheric Administration (NOAA), and a number of governmental, academic, and nonacademic partners. The program's main focus is to monitor the physical and biogeochemical state of the Virginia coastal ocean region through the development, deployment, and use of various ocean observation tools.

Coastal regions within the Mid-Atlantic Bight (MAB) are directly influenced by regional freshwater fluxes that emanate from several large bay systems, such as the Delaware and Chesapeake Bays. The outflows from these bays have high sediment loads and high levels of nutrients, and particulate and dissolved organic matter (POM, DOM), which heavily influence the adjacent coastal margin ecosystems. In addition, this coastal region is downwind of a large number of metropolitan and industrial regions and the influence of these also impacts the region through airshed fluxes. "In order to develop the predictive capability that our society requires in order to address issues such as climate change, natural variability, over-fishing, pollution, and overuse, we must first develop an understanding of how the coastal ocean behaves. The path to prediction begins with observation," said scientist John Moisan.

Our effort is developing and deploying an observing system aimed at characterizing and monitoring this coastal region in order to understand the impact of climate change and continued human influences. A primary focus of this effort is to develop and apply cutting edge technologies and methodologies to support research, observation/monitoring efforts, and management applications on the coastal ocean. A second focus is to develop and test new sensors, platforms, and applications, which can be used to enhance this observing system and additionally support NOAA and NASA coastal ocean remote-sensing activities and products.

OASIS

This project is concentrating on developing, testing, and deploying a fleet of solar-powered surface autonomous vehicles called the Ocean-Atmosphere Sensor Integration System, (OASIS). OASIS is an autonomous surface vehicle, which functions as a platform for operating any number of oceanographic and meteorological instruments. It is powered by solar panels, traditional lead acid batteries, and has an electric motor. It can reach speeds in excess of 3 knots, and is controlled remotely through an Iridium satellite communication link.

OASIS can be used in various applications from oceanographic research to routine weather observation by the National Weather Service/NOAA.

The OASIS vehicle has been developed at the NASA Wallops Flight Facility by Wallops and Goddard personnel with NASA and NOAA support. It has also recently been commercialized through support from NASA's Small Business Innovation Research (SBIR) program.

COBY

Another major focus of CoastalObs III is the Coastal Bio-Optical Buoy (COBY). COBY is a scientific mooring that will be deployed approximately 25 miles offshore of Wallops Island, Va. The buoy will house instruments to measure the meteorological, biological, and physical oceanographic properties of the region. The COBY mooring will also profile the water column each hour with a suite of instruments to create a very detailed description of the oceanographic conditions in the area. The scheduled deployment date is late 2006. Every two weeks, an oceanographic cruise will be conducted to sample the waters between the coast and the buoy site.

BIOME

Another major part of the program is Bio-Physical Interactions in Coastal Margin Ecosystems (BIOME). This program entails seasonal oceanographic cruises that monitor various meteorological, biological, and physical interactions in the coastal region offshore of Delaware, Maryland, and Virginia. The cruises observe and interpret the seasonal variability of these interactions. These observations will then be available to the public for various efforts ranging from continued scientific research to improved fish catches.

CODAR

The Coastal Ocean Surface Current Radar (CODAR) is a series of three long-range and two standard-range, coastal surface ocean current high-frequency (HF) radar systems. The three long-range systems are being deployed along the Delmarva Peninsula and the two standard-range systems are being added to two existing standard systems already deployed at the mouth of the Chesapeake Bay. These systems will provide real-time coastal current estimates. This data will allow scientists to continually measure the coastal ocean surface current fields and aid in characterization of the coastal circulation dynamics in the Delmarva region.

CO-DAAC

The Coastal Data Acquisition and Archive Center (CO-DAAC) is being designed and developed to ingest, archive, and distribute data in support of the CoastalObs III.

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Electric Dust Storm on Mars

By Bill Steigerwald



Photo credit: NASA

Caption: This is an artist's concept of an electrically-charged dust storm on Mars. The "+" and "-" symbols represent positive and negative electric charges.

Dust storms frequently rise from the cold deserts of Mars, sometimes even raging across the entire planet. The storms might also crackle with electricity, which may produce reactive chemicals that build up in the Martian soil, according to a NASA-funded research team.

The chemicals, like hydrogen peroxide (H₂O₂), may have caused the contradictory results when NASA's *Viking* landers tested the Martian soil for signs of life, according to the researchers.

In 1976, the twin *Viking* landers scooped up Martian soil and added nutrients mixed with water to it. If microscopic life were present, the nutrients would be used up and waste products would be released. Three different experiments involved in this test gave conflicting results. The Labeled Release and the Gas Exchange experiments indicated something active was in the soil, because the nutrients were broken down. However, the Mass Spectrometer experiment did not find any organic matter in the soil.

In 1977, *Viking* researchers suggested that the contradiction could be explained if a very reactive non-organic substance that imitated the activity

of life by breaking down the nutrients was embedded in the soil. Hydrogen peroxide and ozone (O₃) were considered possible reactive compounds.

While ultraviolet radiation from the Sun could produce a certain amount of reactive chemicals in the atmosphere, nobody knew how large amounts of such reactive material could accumulate in the Martian soil. Some researchers at the time thought that dust storms might be electrically active, like thunderstorms on Earth, and that these storms might be a source of the new reactive chemistry.

This dust storm suggestion remained dormant for close to 30 years. Now, detailed analysis by the team supports this theory, based on their results from field and laboratory studies over the past five years. Lead authors Dr. Gregory Delory, senior fellow at the University of California Berkeley Space Sciences Laboratory, and Dr. Sushil Atreya, planetary science professor at the University of Michigan in Ann Arbor, reported their results in a tandem set of papers in the June 2006 issue of the journal *Astrobiology*.

Dust particles could become electrified in Martian dust storms when they rub against each other as they are carried by the winds, transferring positive and negative electric charge in the same way you build up static electricity

if you shuffle across a carpet. "From our field work, we know that strong electric fields are generated by dust storms on Earth. Also, laboratory experiments and theoretical studies indicate that conditions in the Martian atmosphere should produce strong electric fields during dust storms there as well," said co-author Dr. William Farrell of NASA's Goddard Space Flight Center, Greenbelt, Md.

Did You Know?

Compact Discs:

Compact discs were developed by NASA to store the vast amounts of information that have to be taken aboard spacecraft. ■

The researchers calculated that electric fields generated by the swirling dust are strong enough to break apart carbon dioxide and water molecules in the Martian atmosphere. They then identified the various ways the broken molecules recombine into reactive chemicals, like hydrogen peroxide and ozone, and calculated the amounts that might accumulate in the Martian soil over time. "We estimate dust electrification could produce so much hydrogen peroxide that it would snow out of the atmosphere and permeate the Martian soil," said Atreya.

The theory could be tested further by an electric field sensor working in tandem with an atmospheric chemistry system on a future Mars rover or lander, according to the team. ■

Can We Talk

By Alana Little and Sharon Wong



Caption: Dr. Weiler

Students and Interns are everywhere at Goddard this summer, experiencing, working, and learning, so it makes sense that two of this summer's "Can We Talk" sessions focused on the questions of Goddard's Interns and Student visitors.

On July 17 and August 1, Dr. Weiler met with Students and Interns and entertained all the questions and ideas that came out of the meeting. Attendees included Dr. Weiler, Center Director; Sharon Wong, Special Assistant for Diversity; Lori Simmons, Director of the Equal Opportunity Programs Office; and Dolly Perkins, Deputy Director–Technical, who attended the July session; and Judy Bruner, Assistant Director for Safety and Security, who attended the August session.

Students and Interns alike were both extremely interested in the different career paths that are open to them if they choose to work at Goddard. While many of the students are still early-on in their academic careers, some of the interns are unsure of their paths as well. Dr. Weiler shared some valuable advice and said "if you want to make money, the Government is not the place for you to be ... but if you want to do something important and fun ... something that will be talked about 100 years from now, then you should come here. In 100 years when your grandkids ask what you did for a living, do you want them to be told that you made cell phones more lightweight or do you want them to be told that you helped put people on Mars?"

Student and Interns were interested in how Goddard differed from other NASA Centers. Dr. Weiler explained that every Center is different and each has its own specialty. He went on to explain the roles of each of the nine Centers, but added that Goddard is the largest with 3,300 civil servants and 5,000 contractors working onsite.

Sharon Wong asked Dr. Weiler to share with the students some of the programs Goddard is involved in. His excitement for NASA's missions was obvious as he discussed the framed photographs surrounding the 6 floor Director's Conference Room, which depicts major events and missions Goddard was a part of. He spoke about SOHO and Hubble, and mentioned Hurricane Isabel and GSFC's management of the Nation's Space Communication Program. Dr. Weiler surprised students by telling them that Wallops Flight Facility (WFF), not Kennedy Space Center (KSC) is the only NASA-owned launch facility. The Air Force owns KSC's launch site as it actually sits on the Cape Canaveral Air Force Station. Dr. Weiler mentioned that a launch to orbit from WFF will be made on November 13, 2006. This is the first launch from WFF in 10 years and he is proud of that. "If you have ever wanted to see a launch but can't get to Florida, now is the time," he said.

The state of education today is heavily on the minds of today's young people and news reports in several high profile magazines are asking if America's students are prepared to enter the workforce. Lori Simmons asked Dr. Weiler if he felt that his own education prepared him for working at Goddard. He responded by plugging his Catholic school education and admonished students to not back off from advanced math and science courses and to throw themselves into English and Psychology as well because, "You'll need those skills if you want to go into management, and also to be able communicate and relate to others."

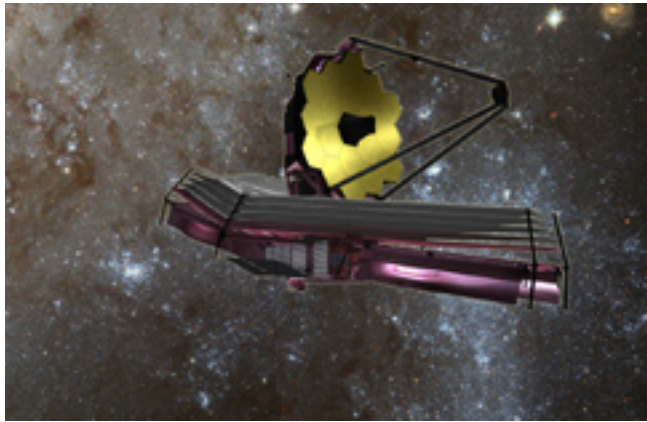
Interns who are closer to entering the job market were concerned about possible reductions in force (RIFs) in Goddard's future. Dr. Weiler stated that "As a result of lessons learned, what we may see is a more careful hiring process in which we look at the skills and competencies that the younger generation brings to the workforce as we think about the aging workforce," he said.

Students in both groups were interested to know what the major goal of any future missions will be. Dr. Weiler said that our goal is connected to the President's Vision for Space Exploration.

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The Road to Discovery

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Caption: JWST telescope image

Photo credit: NASA

The mid-infrared detector, sensing light of even lower energy, is 1024 x 1024 pixels, which is 16 times bigger than previous detectors in this energy band. The Goddard-built IRAC instrument on the Spitzer “Great Observatory,” for example, is 256 x 256 pixels.

The new detector is like four IRAC detectors, not just stuck together but rather etched onto one single wafer, an engineering breakthrough. This detector serves as the eyes for the aptly named Mid-Infrared Instrument, and passed its test in July.

Infrared is cool, not just in temperature, but in the science that can be had. JWST infrared detectors enable the mission to detect planets beyond our solar system, as well as cold clouds of gas and dust that evolve into stars and planetary systems.

Two other key technology demonstrations completed this year were for the sun shield materials and for the lightweight cryogenic mirrors. Six more tests in the next five months await the JWST team.

The mission doesn’t launch until next decade, but the team is off to a good start. Performing the demonstration tests early in the mission timeline ultimately reduces costs and minimizes the risk of schedule delays. Also, proving the technologies early on allows astronomers to anticipate the ultimate performance of JWST and to put plans in place to use these extraordinary capabilities.

For more information about JWST please visit:

<http://jwst.gsfc.nasa.gov/about.html> ■

Can We Talk

Continued from Page 5

“It’s my greatest fear that we go to the Moon and stop there,” he said. “We need to explore Mars and beyond ... the Moon is a good stepping stone, but we have to ask ourselves if we know how to go to the Moon still.” “We haven’t been in 40 years so we need to get that right first. He went on to say that if we do send humans to Mars that it’ll be an international effort. “Going to Mars is going to be expensive ... we’ll all have to work together and remember that this is a global community in which we have to be collaborative.”

Center Director Ed Weiler will be hosting the “Can We Talk” discussions throughout the remaining year in the spirit of NASA’s commitment to enhance communication. While there are additional channels such as the Ombuds Program, the Equal Opportunity Program, Alternative Disputes Resolution (ADR) Program, and others for raising individual/personal issues and concerns, the “Can We Talk” sessions are an opportunity for employees to share with the Center’s leadership regarding what’s on their minds regarding issues/concerns affecting the NASA/GSFC community, or questions on Center matters. The sessions are intended to provide constructive dialogue that will respond to existing anxieties and heightened concerns of employees and to achieve improved communications within NASA. These informal dialogues are held each month, and have no agenda or set topics. The “Can We Talk” sessions are open to all employees including contractors and civil servants.

Stay informed by visiting:

<http://internal.gsfc.nasa.gov/canwetalk.cfm> to attend and register for the next “Can We Talk.” ■

Intern Spotlight: Chris Wells

By Debbie Jensen



Photo credit: Chris Gunn

Caption: Chris Wells

Imagine an incredibly stiff and strong material that is smaller than a human hair. Now imagine using this material to conduct heat. Chris Wells, an intern with Code 562, works with making these materials called “carbon nanotubes” every day.

Carbon nanotubes are cylinders of pure carbon. Academia, researchers, and commercial industry use these tubes for their incredible abilities to conduct heat and electricity. Wells researches more efficient and less expensive ways to make new carbon nanotubes, which contain some non-carbon particles and have better qualities than pure carbon tubes, which are less stable than the new nanotubes.

Wells said he learned a lot from this project, namely that working with a mentor or co-worker on complicated calculations is very effective because you are able to get feedback from each other.

Wells, who is deaf, visually impaired, and mute, is a fourth year Ph.D. candidate at the University of Albany in New York. He will complete his doctorate dissertation about nanotechnology during this academic year. Once he obtains his degree, Wells said he would like to work in academia or conduct research for corporations or Government agencies.

“Working at NASA has given me a wonderful opportunity to learn about governmental research and how it functions,” Wells said. “By comparing it against the academic research and my own independent research, I can now see the similarities and differences between these systems.” ■

Wallops and NOAA Monitoring the Chesapeake

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The initial data set will be surface current measurements from the newly installed CODAR’s observations of the Delmarva coastal regions. CO-DAAC will host a Web site for access to browse data products and support standards-based interfaces for data exchange.

“The coastal oceans are not only the most biologically productive part of the oceans, but are effected greatly by human activity. This naturally leads to the importance of educating people about the coastal ocean environment,” said Brian Campbell, CoastalObs III Education Manager.

EDUCATION AND OUTREACH

There is also a major educational program associated with the CoastalObs III Project. An oceanography education journal publication entitled *Rising Tides* is being developed, which will include cutting-edge coastal oceanography research articles teamed up with classroom and laboratory activities, Web site interaction, scientist interviews, oceanography puzzles, further readings, and a teacher section. This journal will be distributed to teachers at national science teacher conferences and to teachers directly within the Delmarva coastal region.

Another component of the educational program is the development of a museum display to be initially hosted by the Wallops Flight Facility Visitor’s Center. The display’s purpose is to educate the public about the jobs of oceanographers, the equipment they use, current research being done, and why the research is important. It will also give the public a perspective as they observe the smallest element of current research, phytoplankton (very small free-floating aquatic plants) at the microscopic level, to the sampling of the phytoplankton from a research vessel, and finally, on to the macro-imaging techniques by satellite.

Working directly with teachers and students from high schools is a major component of our education program. Recently, 42 high school students and 7 teachers from Wilson High School in West Lawn, Pa. went aboard the Marine Science Consortium’s R.V. *Phillip Parker* to conduct shipboard experiments in phytoplankton filtering, water chemistry, and trawling. Following the onboard research, the students and teachers were taken to the NASA Wallops Flight Facility’s Phytoplankton Photo-physiology Laboratory to conduct coastal oceanography experiments.

NASA and NOAA researchers and scientists believe that there is a unique balance between the science and education of this program.

*Writer Tracey Riley is a student at Snow Hill High School in Snow Hill, Md. ■

Employee Spotlight: Pat Izzo

Edited by Elaine Firestone



Caption: Pat Izzo

Photo credit: Dan Hellfrich

Pat's interest in photography began at the age of 14 when he had to join a club in junior high school. "I wanted to join the automotive club, but it was closed and the only clubs left were the chess club, the math club, and the photography club. I had no interest at the time in chess and math so I joined the photo club by default. After making my first photograph in the dark room, I was hooked."

At the time, he thought it was magic and only later did he come to understand it was really a combination of math, physics, and chemistry. By the age of 16, he was enrolled (at night) at the Rhode Island School of Photography, while still attending high school during the day—graduating from both high school and photography school at the same time. His first job was working in a photo studio shooting weddings, portraits, and doing negative retouching.

The military soon came calling and three days before being inducted into the Army, he enlisted in the Navy. During basic training, Pat put in for a Navy photographer position, explaining that he had previous experience and promptly submitted his diploma as proof. "I guess it worked because I got orders to go to the Navy Schools of Photography in Pensacola, Fla." This began a colorful military career that saw him in San Diego first, and then through three campaigns in Vietnam (he actually volunteered for the 'Nam assignment!). His military service spanned public affairs, reconnaissance, battle damage, and on-the-scene photography of Naval operations in support of the Army's 9th Infantry Division. His last duty was being in charge of reproduction of Select Intelligence Photography of the South East Asia area.

Not only is Pat a veteran, he's a decorated veteran. "Among the decorations I'm most proud of are the Presidential Unit Citation; Navy Unit Commendation; Vietnam Service Medal, 3 campaigns; Combat Action Ribbon; and the Navy Achievement Medal with Combat 'V'." After his stint in the military, Pat's curiosity of how photography worked inspired him to enroll at the Rochester Institute of Technology (RIT) where he pursued a B.S. in Imaging Technology—specializing in high-speed instrumentation and motion analysis—and minored in Business. He also studied high-speed photography under Dr. Harold Edgerton (who is famous for his contributions to electronic flash and high-speed photography) at MIT.

After graduation, Pat worked in a number of capacities using his photographic and business skills. He was a photo engineer, where he worked in applied photo research, and then taught at his alma mater in the Department of Photo/Media at the National Technical Institute for the Deaf at RIT. "I'm proficient in sign language, as well as in the development of teaching materials and educational strategies.... I currently serve on the faculty at Prince George's Community College where I teach a variety of photo courses through the Department of Work Force Development and Continuing Education. I also designed, developed, and taught the premiere course devoted solely to Forensic Imaging offered through the Department of Forensic Science."

It is through his founding of Precision Imaging, Inc.—a commercial imaging and production company serving professional photographers, corporate, and government agencies with full service production and consulting services—that he first started working with Goddard. In 1986, he began offering high-speed instrumentation and technical imaging consulting to Goddard engineers.

"At Goddard, I'm known in the engineering community as 'Mr. High-Speed' because of my expertise in high-speed instrumentation and motion analysis." He has supported, both at home and abroad (including two trips to the Netherlands and one to Italy) a number of projects including MAP, EOS-Aqua, ST-5, Triana, NPOESS, and numerous Hitchhiker missions, with high-speed instrumentation for research and development and performance verification of spacecraft deployment mechanisms.

"You may run into me doing just about anything at Goddard. I've covered it all: fire scenes, crime scenes, rocket launches, laser experiments, laser ranging, high-speed motion analysis, videos, motion picture, spacecraft, spacecraft components, and of course—executive portraits." He also has expertise in image archiving and is the architect of Goddard's Digital Image Archive. ■