



Goddard View

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Goddard Unveils New Antenna Network in White Sands

By Rob Garner



Photo credit: Bill Gardner

Caption: Dr. Weiler gives remarks before cutting the ribbon to dedicate NASA's new Ka-band antennas at the White Sands facility in New Mexico.

Goddard engineers showcased the new 18-meter Ka-band Antenna Network, the first such system in Agency history, during a ribbon-cutting ceremony at the White Sands Test Facility in New Mexico on November 8.

"Ka-band" refers to a section within the microwave portion of the electromagnetic spectrum. Much like how listeners can't pick up FM waves on AM radios and vice versa, Ka-band signals require special equipment to receive them. The three new dishes help meet the growing demand for ground stations to handle high volumes of science data generated by today's new satellites.

The Ka-band system allows satellites to transmit more data to the ground than ever before—around 45 terabytes a month. That's about the equivalent of 1,152 fully loaded 40-gigabyte iPods, or 67,408 CDs!

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Cover: White Sands Test Facility Team posing in front of one of the Ka-band antenna's.

Photo credit: Bill Gardner

GoddardView Info

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Goddard Unveils New Antenna Network in White Sands

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Photo credit: Tom Gregor

Caption: Shown are two of the new 18-meter Ka-band dishes installed at the White Sands Test Facility in New Mexico.

The dishes are 18.2 meters in diameter, and they need to be able to rotate quickly to acquire satellite signals. To make the dishes lighter, they are largely held together with glue, rather than bolts and other fasteners. But this is no ordinary wood glue. The network makes use of a two-part epoxy developed at NASA's Jet Propulsion Laboratory in Pasadena, Calif. Tests have shown that the glue and the dishes will last for decades, according to Raymond Pages, Chief of Goddard's Ground System Development Office.

The first missions to use the network will be the Solar Dynamics Observatory (SDO) and the Lunar Reconnaissance Orbiter (LRO). SDO will study solar variations that affect life on Earth. LRO will focus on selecting landing sites, identifying lunar resources, and studying how the Moon's environment will affect humans. Both probes are slated for launch in late 2008.

"The design, development, and delivery of three 18-meter Ka-band antenna systems in just over two years is a major accomplishment for Goddard and NASA," Pages said. "People will be munching on data [from these missions] for years to come."

Once SDO and LRO conclude, the antenna network will be available for other missions. White Sands was chosen as the location for the new antennas because of the existing infrastructure available there, making it a cost-effective option.

Weather was also a factor in the decision, because data must be able to reach the antennas with as little weather interference as possible for optimum quality.

Datron Advanced Technologies in Simi Valley, Calif., built the antennas. Honeywell Technology Solutions, Inc., in Columbia, Md., built and assembled the ground station. The Cospal Composites SRL in Ambivere, Italy, manufactured the primary reflectors. Honeywell, Datron, and Goddard helped to design the antennas. Goddard manages the White Sands Complex for NASA.

The total development cost of the new antenna system was \$20 million.



SDO Instrument to Peer Inside the Sun Arrives at Goddard

By Andrew Freeberg



Photo credit: Barbara Thompson

Caption: The Helioseismic and Magnetic Imager.

The Helioseismic and Magnetic Imager (HMI), an instrument for the Solar Dynamics Observatory (SDO) built by Stanford University and the Lockheed Martin Solar Astrophysics Laboratory, Palo Alto, Calif., has arrived at Goddard.

The imager will use a technique called “helioseismology” to gaze through the Sun, which will help us to understand the origins of solar weather. It is one of three instruments on the Observatory. Near the surface of the Sun, extremely hot, ionized gas is churned up by convection, just like a pot of boiling water. These motions generate the Sun’s magnetic field, but also create sound waves that move through the Sun. It is possible to see these sound waves as Doppler shifts when they hit the surface of the Sun, each one hinting at the activity going on below.

Once launched aboard the Solar Dynamics Observatory (SDO), the Helioseismic and Magnetic Imager (HMI) will measure these Doppler shifts over the entire visible part of the Sun. The data will then be used to create maps of the Sun’s interior and the plasma flows that generate its magnetic field. To do so, HMI will measure 120 million pieces of data every 45 seconds.

This is no small task, “It’s like deducing the interior structure of a piano by listening to it fall down a flight of stairs,” explained Phil Scherrer, SDO HMI Principal Investigator. “In a sense, we hope to measure the sound of the Sun in magnetically active regions, which generate a lot of severe solar weather.”

The technique of tracing sound waves reverberating inside the Sun to build up a picture of the interior is known as “helioseismology” and works similar to the way an ultrasound scan is used to create a picture of an unborn baby.

Helioseismology can even be used to map sunspots all the way on the other side of the Sun from Earth.

The precursor to HMI is the Michelson Doppler Imager (MDI), launched in 1995 onboard the Solar and Heliospheric Observatory (SOHO). MDI, however, has only limited coverage of the Sun, whereas HMI will provide a full-disk view with about 1,000 times the data.

HMI will also be capable of measuring the strength and direction of the magnetic fields emerging on the Sun’s surface. SDO will carry two other instruments in addition to HMI.

It is hoped that the combination of their observations will enable researchers to establish the relationships between the internal dynamics and surface activity. “These three instruments together will enable scientists to better understand the causes of violent solar activity, and whether it’s possible to make accurate and reliable forecasts of space weather,” said Liz Citrin, SDO Project Manager at NASA Goddard. “SDO will provide a full-disk picture of the Sun in super HD [high definition] quality.”

The Extreme Ultraviolet Variability Experiment (EVE) arrived at Goddard this September and the Atmospheric Imaging Assembly (AIA) will arrive before the end of the year. SDO and its components will be integrated and go through rigorous testing at Goddard’s state-of-the-art facilities up until it is shipped for launch sometime between the end of 2008 and the beginning of 2009.

SDO will be the first mission of NASA’s “Living with a Star” program. The goal of both SDO and “Living with a Star” is to help us understand and work towards predicting the changes in the Sun that influence life on Earth and human technology.

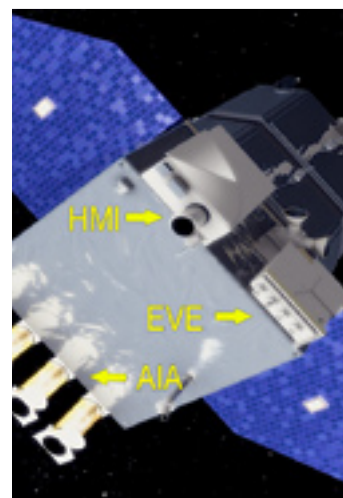


Image credit: Bryan Zuber/NASA GSFC

Caption: SDO contains a suite of instruments that will provide observations leading to a more complete understanding of the solar dynamics that drive variability in the Earth’s environment.

SDO is being designed, managed, and assembled at NASA Goddard. HMI was built in Palo Alto, Calif. at Stanford’s partner institution Lockheed Martin Solar Astrophysics Laboratory (LMSAL) as part of the Stanford Lockheed Institute for Space Research. The Stanford group will provide the science data processing center for both the HMI and the AIA instruments. AIA is also being built at LMSAL. EVE was built by the University of Colorado at Boulder. ■

NESC Honors Goddard Employees and Partners for Technical Excellence

By Keith Henry

Four NASA Goddard employees and two industry partners were honored for their individual contributions to critical technical assessments over the past year by the NASA Engineering and Safety Center (NESC).

Goddard was the only NASA Center recognized in each of five award categories during ceremonies at a recent NESC leadership meeting held at NASA Langley.

Individual Goddard recipients were Daniel Polis, Jeffrey Stewart, Paul Guy, and Michael Hagopian. Industry partner recipients represented ATK Space and Genesis Engineering.

Polis was honored with the NESC Director's Award in recognition of his contribution to the Composite Crew Module (CCM) Team "through practical methodology and approach for managing structural reliability through material properties, building block testing, and factors of safety for composite spacecraft structures." The Director's Award honors individuals who take personal accountability and ownership in initiating clear and open communication on controversial issues.

Stewart was presented the NESC Leadership Award for his work in establishing the organizational structure of the CCM Team, and for designing and implementing the CCM Concurrent Design Center at Goddard.

Also receiving the Leadership Award was industry partner David Watson of ATK Space for coordinating the work of 16 designers and analysts from across the country "resulting in a mature Preliminary Design Review of the Composite Crew Module."

Guy was honored with an NESC Engineering Excellence Award for outstanding technical leadership of the independent review of the NASA Standard Initiator for the Phoenix Project.

Also receiving the Engineering Excellence Award was partner James Jeans of Genesis Engineering for "rapidly and accurately building an engineering analysis model for the Composite Crew Module Project."

Hagopian received an NESC Special Recognition Award to mark his "outstanding leadership and engineering excellence" as the NESC's Chief Engineer at Goddard.

In addition to the individual awards, Robert Cherney of Orbital Sciences accepted a Group Achievement Award for the Shuttle Power Transfer System Open PRACA Risk Evaluation. This is the fourth year that NESC has recognized NASA employees and partners for outstanding contributions to NESC-sponsored activities and to encourage critical examination of engineering problems. ■

Daniel Glavin Wins Center's First IRAD Innovator of the Year Award

By Lori Keeseey

Goddard technologist Daniel Glavin, who is developing an instrument concept that could determine the abundance of water and other volatiles in the permanently shadowed areas of the Moon's polar regions and reveal clues as to their origins, has won the first-ever 2007 "Internal Research and Development (IRAD) Innovator of the Year" award.

Glavin, along with his 13-member Volatile Analysis by Pyrolysis of Regolith (VAPoR) team, received the award at the IRAD Poster Session November 13, sponsored by the GSFC Chief Technologist. The Chief Technologist administers GSFC's research and development program and invests in technologies and new mission concepts that support NASA's short- and long-term missions' goals and ensure the Center's competitiveness and ability to capture new work. This is the first year that the Chief Technologist has recognized an innovator for outstanding performance during an investment year.

"I was surprised and humbled by the 2007 Innovator of the Year award," Glavin said. "I am very fortunate for the opportunity to lead the VAPoR Instrument Team. We really appreciate the Center support and recognition and are excited about the possibility of getting this instrument on the Moon to search for water and other volatiles that may have been delivered by a comet."

VAPoR is a miniaturized mass spectrometer similar in concept to the GSFC-developed Sample Analysis on Mars (SAM) instrument, 1 of 10 instruments flying on the 2009 Mars Science Laboratory rover. Like SAM, VAPoR is designed to analyze gases in the atmosphere, as well as vapors that are produced when its onboard oven heats soil and rock samples to temperatures exceeding 1200 °C (about 2200 °F).

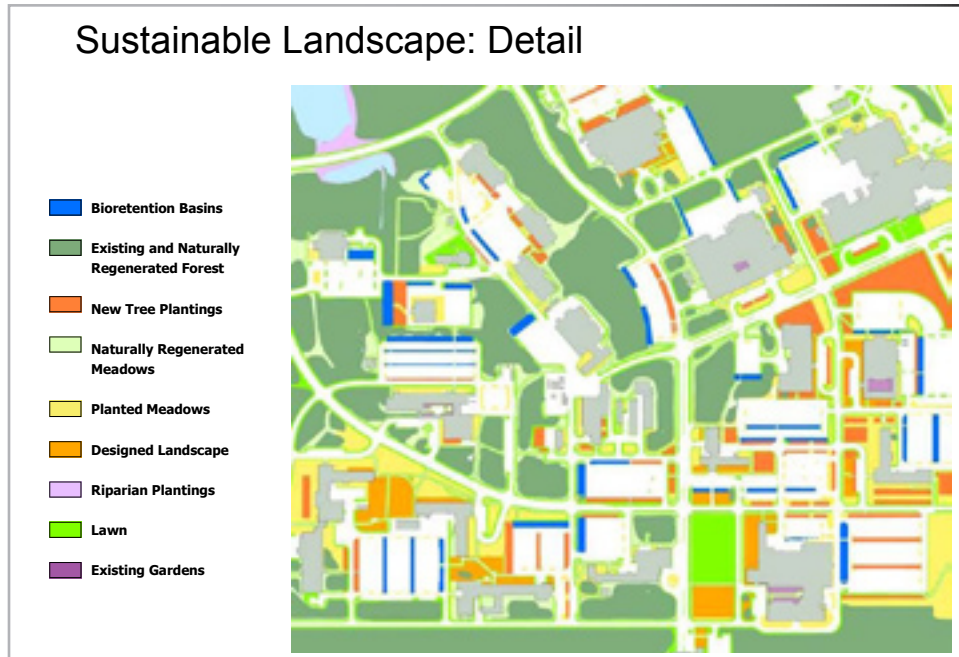
Such a mission would help scientists and NASA's Science Mission Directorate to determine whether the large concentrations of hydrogen are actually "water ice" deposited by cometary bombardments or simply hydrogen implanted by the Sun. It also could answer whether organic compounds exist on the Moon.

Glavin attributed his win to the fact that he had received GSFC IRAD funding to advance his idea, assemble a talented team of Goddard scientists and engineers, and begin building a laboratory instrument, which the team is now testing.

NASA is interested in discovering the origin of the Moon's vast hydrogen deposits because if they turn out to be water ice, the Agency could use the resource to sustain humans living in lunar habitats and use pyrolysis or another technique to extract oxygen from water ice and lunar soils to produce breathable air. ■

Employees Participate in Tree Planting as Part of the GSFC Sustainability Program

By Alana Little and Alan Binstock



Caption: Sustainable Landscape Detail.

As part of the GSFC Sustainability Program, and in order to continue the work that has been done towards becoming better stewards of our resources, Goddard has embarked on several initiatives geared towards making our environment greener.

One of the most recent activities, and one that called for employee participation, was the massive tree planting event, which took place on Thursday, November 8. Approximately 20 people gathered to plant trees on the sloped green space surrounding the B23 North parking lot. Alan Binstock of the Facilities Management Division led the effort with Darlene Squibb and team members from the Safety and Environmental Division.

Goddard employees were also on hand as volunteers to plant the trees. About 250 trees were planted in two hours. The trees were selected from 10 native species to approximate a natural forest.

Our existing forest, including wooded lots, consists of approximately 428 acres. Deforestation and construction projects have taken away 32 acres

of woodlands; however, through GSFC's Sustainability Program, we have developed an additional 40 acres.

Future tree planting activities will involve local students, and will be incorporated into Sustainability Education and Outreach activities. A pilot presentation of the GSFC Sustainable Site activities was made to the entire 5th and 6th grades of the Thomas Stone Elementary School in Mt. Rainier, Md.

Image credit: NASA

In addition to the reforestation plan, other sustainability management initiatives are in place, including the Storm Water Management Program,

which creates bioretention basin areas, which naturally filter auto-created pollutants from surface water runoff, reducing their flow into storm water ponds, rivers, and the Chesapeake Bay.

The Wetlands Mitigation Program consists of mitigating land areas defined as wetlands that are disturbed within a construction zone, in accordance with the US Army Corps of Engineers and the Maryland Department of the Environment. The Soil Conservation Road relocation caused about 20,763 square feet of existing forested wetlands to be impacted negatively. Through the Wetlands Mitigation Program, 43,526 square feet of new forested wetlands are being created. This includes the excavation and replanting of existing plant life.

The Meadow Program maintains areas of lawn that are limited to tracts used for employee and visitor pedestrian activities, and areas with specific security/safety requirements. This program will convert 85 acres of lawn into meadows.

For more information on future GSFC Sustainable Site activities, please contact Alan Binstock in the Facilities Management Division, x6-3889, or Alan.S.Binstock@nasa.gov. ■

Employees Participate in Tree Planting as Part of the GSFC Sustainability Program

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Photo credit for all photos: Debbie McCallum

The BMW Hydrogen 7 Visits Goddard

By Tom Weisz



Photo credit: Tom Weisz

Caption: BMW Hydrogen 7 at the Goddard Pond.

For six weeks in October and November, Goddard provided a site for BMW to temporarily install and operate a liquid hydrogen fuel station and mobile vehicle maintenance workshop.

As the world's supply of petroleum continues to diminish, use of alternative fuels and new energy sources for vehicles are increasingly becoming more vital. The BMW Hydrogen 7 is the first and only production vehicle in the world to use liquid hydrogen for fuel. Based on the BMW 760Li, the vehicle can also run on conventional gasoline. When the vehicle operates on hydrogen, it consumes no fossil fuels, produces no CO₂, and the exhaust is essentially nothing but water vapor.

Presently, hydrogen is primarily obtained through the reforming or oxidation of natural gas, or the gasification of coal; processes that create carbon monoxide. In the future, mass production of hydrogen will be possible through emission-free processes (e.g., solar or wind power) involving the electrolysis of water.

Throughout the United States, BMW has been introducing the vehicles to Government agencies and the public. As part of that effort, their mobile fuel stations and workshops have been installed at temporary locations to refuel and support the vehicles. According to Jason Perron, BMW's United States CleanEnergy Manager, a partnership between BMW and Goddard was a natural choice because "NASA also has a mission to educate the public about science, technology, and the environment, and that is one of the things we are doing with these cars."

The 10 vehicles based out of Goddard were driven by a variety of organizations and individuals in the Washington, D.C. area (e.g., the Department of Energy and Placido Domingo), and were involved in several events (e.g., a "ride and drive" at Georgetown University).

As the host for the fuel station, Goddard had use of one vehicle, which was made available to employees through the Motor Pool. All drivers were required to complete a brief training session concerning the vehicle's operation and safety features.

As a driver of the vehicle on a trip to Wallops Flight Facility, George Morrow, Director of Flight Projects, noted that "it was a wonderful car, like riding on air." He also said that "the car performed flawlessly, including the switch-over from hydrogen power to gasoline." During the length of its stay, 71 Goddard employees drove this "special" motor pool vehicle for approximately 2200 miles.

In addition to the many underlying technology and engineering aspects that enable a hydrogen fuel vehicle, there are several visible features, including: an "H2" button on the steering wheel to switch on-the-fly between hydrogen and gas, fuel gauges for both fuel types, and door lock buttons that will flash red if a hydrogen leak is detected. Hydrogen refueling of the vehicle takes about six to eight minutes and the vehicle has a driving range of 425 miles (including 125 on hydrogen). As a high-end BMW, the vehicle also includes numerous performance, luxury, and safety features.

The BMW Hydrogen 7 is a highly technical and advanced alternative fuel vehicle. In contrast, Goddard's vehicle fleet uses less complex technologies, but are also environmentally-friendly. These include vehicles using E85 ethanol, compressed natural gas, and biodiesel as fuel, as well as hybrid and electric vehicles. Goddard's participation in this project was coordinated by the Logistics and Transportation Management Branch. ■



Photo credit: Tom Weisz

Caption: The vehicle's cryogenic tank stores 8 kilograms (kg) of liquid hydrogen at -250°C.

GSFC Replaces Standard Government Sedan with a Neighborhood Electric Vehicle

Edited by Alana Little



Photo credit: Pat Izzo

Caption: Lixa Rodriguez from the Safety and Environmental Division posing with the GEM e4 Electric car.

Is it a golf cart or is it a car? Can it actually run on the road or is it only for the 55 and better crowd in active communities? Actually, the Global Electric Motor (GEM) battery-electric vehicle is the newest in technology transportation. The GEM battery-electric vehicle's literature reads like the glossiest luxury car brochure. It boasts an open, spacious interior and a variety of options, accessories, and colors, but the highlight of this little beauty is that it runs on a battery, making the vehicles in this class very environmentally friendly.

GEM cars are classified as low-speed vehicles by the National Highway Traffic Safety Administration. They are street legal in nearly all 50 states on public roads posted at 35 mph or less, so while you won't want to take this compact vehicle out on the highway, it is fine for neighborhood driving, hence the GEM car's designation as a "neighborhood vehicle."

While compact vehicles are getting a lot of attention in the media for their environmentally friendly qualities, the GEM car is special in that it runs on an electric battery.

GEM cars plug into a standard 110-volt outlet and recharge in approximately six to eight hours. Because GEM cars run solely via battery power, they don't use any gas, therefore, they produce no tailpipe emissions!

GSFC's own Safety and Environmental Division, has replaced a standard Government sedan with a neighborhood electric vehicle. In October, GSFC received a GEM e4 all-electric vehicle with four belted seats capable of traveling up to 30 miles on a single charge.

Acquiring environmentally friendly vehicles are just another way GSFC is working to enhance and preserve our environment.

For more information on the GEM e4 please visit:

<http://www.gemcar.com/uploads/resources/394/gem-2007-my-retail-brochure.pdf>. ■

NASA Warms Up to Maryland's Trash

By Rani Chohan, Updated by Barry Green



Photo credit: NASA

Caption: Flare at Sandy Hill Landfill.

Imagine heating your house with trash. That's what Goddard is doing.

The Center harnesses methane gas from a nearby landfill and uses it to fire boilers that produce steam, heating 31 buildings at the Center. "The environmental benefits are huge," said Barry Green, Goddard Energy Manager. "We are reducing emissions equivalent to taking 35,000 cars off the road per year or planting 47,000 acres of trees."

One County's Trash is NASA's Treasure

NASA will save taxpayers more than \$3.5 million over the next decade in fuel costs. Goddard is the first Federal facility to heat its buildings with landfill gas. Landfill gas provides all of the Center's heating needs 95 percent of the time, with natural gas serving as the back up.

Over half of the solid waste generated in the United States is disposed of in landfills, where it naturally decomposes and produces landfill gas. By volume, landfill gas is about 50 percent methane (a potent greenhouse gas) and 50 percent carbon dioxide. It also contains trace amounts of non-methane organic compounds, which contribute to odors and smog if left uncontrolled.

Recovering landfill gas and using it to produce energy significantly reduces emissions of these compounds. The Prince George's County Sandy Hill Landfill has collected about 5.2 million tons of trash and is expected to generate landfill gas for at least 30 years. NASA plans to use the gas for at least 10 years. "We're hoping to extend that use to 20 years," Green says.

Cleaning Gas

Before Goddard used Sandy Hill's landfill gas, all of it was burned off in a flare. A few years ago, Dallas-based Toro Energy, approached NASA offering landfill gas as a way to reduce fuel costs while helping to protect the environment. At no cost to the Government, the company built a purification plant and a five-mile pipeline from the Prince George's County Sandy Hill Landfill to Goddard. Toro also modified two boilers at Goddard.

Unused landfill gas is burned off in a flare. The flare burns up any volatile organics and breaks down the methane to carbon dioxide and water. Now the gas is intercepted from the flare and directed to an onsite purification plant where the gas is cleaned and sent to Goddard.

Partnerships were key to completing this project. The Environmental Protection Agency's Landfill Methane Outreach Program (LMOP) provided expertise to help complete this project. Other key partners include Prince George's County, Toro Energy, and Waste Management, Inc.

Gassing Up

Methane is drawn out of the landfill by wells that look like long, perforated pipes. Methane is a natural product of trash. Waste Management, Inc. placed over 80 wells approximately 250 feet apart all over the Sandy Hill Landfill. The wells are attached to a central vacuum system that sucks out the methane and delivers it to the purification plant.

Gas Purification Process

Water-free gas is much easier to transport through a five-mile pipeline and easier to burn; therefore, water removal is a major part of the landfill gas purification process.

There are four major steps to purifying the landfill gas.

1. Filters in the landfill gas purification plant sift out tiny particles and water.
2. A gas compressor squeezes out more water.
3. The gas is then chilled, drawing out even more water.
4. The plant reheats the gas and transports it to Goddard.



NASA Warms Up to Maryland's Trash



Photo credit: NASA

Caption: Landfill Gas Processing Plant, Sandy Hill Landfill. This plant purifies the gas before sending it to Goddard Space Flight Center.



Photo credit: NASA

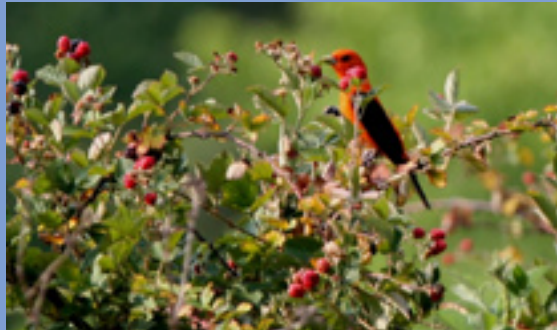
Caption: Purification plant.

Employee Spotlight:

Fred Pierce

By Alana Little

They call it “birding” and Fred Pierce, a database administrator with Code 690, has been doing it since the 1950s. He’s been working at Goddard for the last 30 years, first as a photo technician supporting the Landsat and Nimbus missions, and then moving into computers in the late 1980s when he supported the Upper Atmosphere Research Satellite (UARS) project. His love for nature and photography has led to an interest in the sport of birding.



Caption: Scarlet Tanager.

Photo credit: Fred Pierce

With this type of history at Goddard, who better than a veteran—along with Jeff Pedelty and other members of the Goddard Conservation Club—to monitor Center woodlands and wetlands and photograph changes during different times of the year? Fred normally takes an hour-long hike around the Center, which takes him to the Goddard Pond, as well as through the wooded jogging and walking trails on Center. He’s seen some beautiful sights, which he photographs and displays on his Web site at: http://avialantic.com/nature/goddard/nog/summer_07/index.htm

Thus far, the only formal bird population studies done at Goddard are a breeding bird survey conducted in 2002 as part of the Goddard biodiversity study, and the ongoing (2002–06) Maryland/DC Breeding Bird Atlas Project (MAP). So, throughout the year, Fred and his nature-loving cohorts carefully list the various species of birds seen around Center, noting their favorite locations and the time of year they are seen. Fred’s cataloging has enabled him to notice some things most of us don’t such as a lack of understory, (i.e., plant growth on the forest floor). This lack of understory is generally attributed to the deer population. Although it has improved considerably, the forest floor still seems to be pretty barren, lacking cover for songbirds and ground nesters such as ovenbirds. “You shouldn’t be able to see through the woods,” Fred said. “If you can, there are not enough trees.”

He’s also noticed that the Center lost some forest wetlands because of the Soil Conservation Road construction, but is happy to see that the Center is doing a great job of replenishing it.



Caption: Pileated and Red-bellied Woodpeckers.

Photo credit: Fred Pierce

“There is a certain mystique behind birds,” Fred said. The flying, the colors... then you find out how they control insects and help with pollination and you find out they are very useful. I just want to build awareness about what we are loosing when we don’t take care of our forest and wetlands areas,” he said. To that end, Fred has set up informational booths on the

Goddard Mall for Community Day and Earth Day to help educate employees about birding and to help recruit for the Conservation Club.

“It’s not just about watching birds,” Fred said. “One day, I came outside of my home to find a pumpkin had been smashed on the windshield of my car, cracking the whole thing. This was followed by a severe computer glitch that was messing up my system. After a while, I went on a walk, and as soon as I turned the corner onto the wooded path I felt better.”

The Maryland Ornithological Society and its counterpart, the Virginia Ornithological Society, are excellent sources of information and ways to pursue your interest in birds. For more information, please visit: <http://www.virginiabirds.net/>

The Audubon Naturalist Society of the Central Atlantic States addresses not only birds, but all things environmental in our area and operates several sanctuaries in Maryland and Virginia. For more information, please visit: <http://www.audubonnaturalist.org/>

To learn more about the Goddard Conservation Club, please visit: <http://gewa.gsfc.nasa.gov/clubs/conservation/>



Caption: Northern Mockingbird.

Photo credit: Fred Pierce