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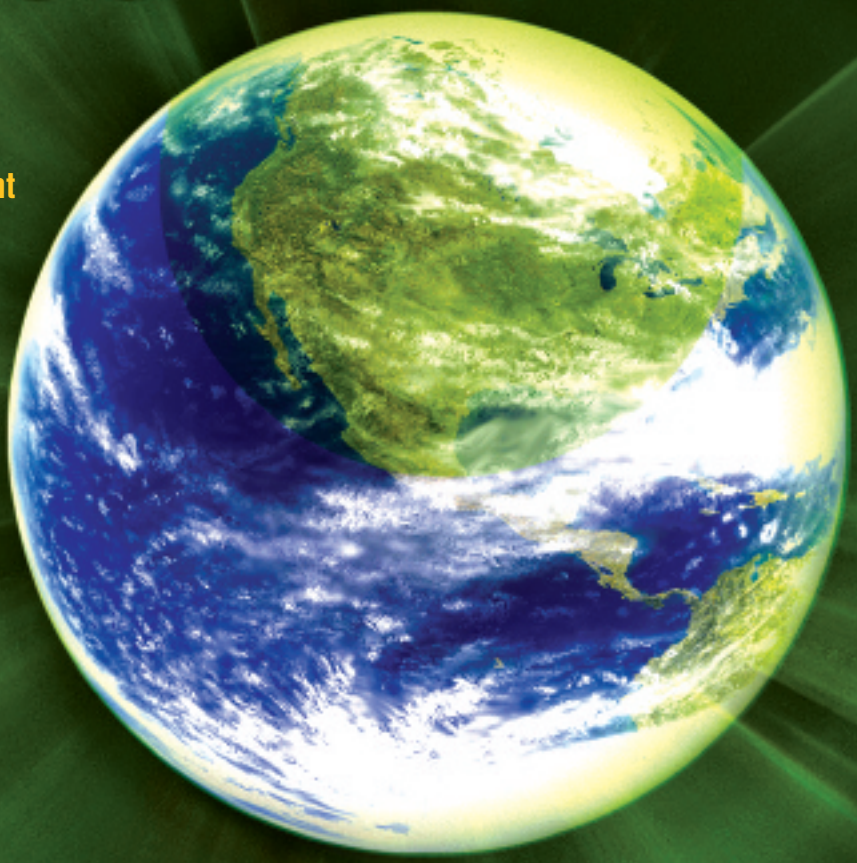
SUSTAINABILITY



PLUS

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EARTH AND ITS RESOURCES

NASA Buildings Go "Green"

By Eugene Mszar
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NASA has taken a "giant leap" into green building practices through an Agency-wide facilities sustainability program. Inspired by an executive order requiring federal agencies to significantly improve energy management by reducing greenhouse gas emissions, reduce energy consumption by improving energy efficiency and expand the use of renewable energy, NASA is developing strategies and best practices to meet federal goals and guidelines for high-performance and sustainable buildings.

Green design refers to design and construction practices that significantly reduce negative impacts of buildings on the environment and are more pleasing to occupants.

As a result of the executive order, NASA issued a new policy that laid out instructions for incorporating sustainable design principles for all of the facility projects planned, designed and constructed under Agency authority or control. Partnering with NASA's Environmental Management Division, the Agency's Facilities Engineering and Real Property Division (FERP) provided direction for the new design and construction. FERP strives to meet the U.S. Green Building Council Leadership in Energy and Environmental Design (LEED®) guidelines, which incorporate innovative design, construction, maintenance and emerging technologies. NASA's new building policy stipulated that projects planned for fiscal year 2006 and beyond must meet the minimum LEED® rating of Silver and strive to meet a rating of Gold. LEED® credits toward certification are obtained in five broad areas: sustainable sites, water efficiency, energy and atmosphere, materials and resources and indoor environmental quality. Following is a sample of the NASA facilities incorporating green design principles.

Building 4600 at Marshall

NASA's first LEED® Silver building was completed at the George C. Marshall Space Flight Center (MSFC) in 2005. Building 4600, a five-story, 139,000-square-foot office building, has a capacity for housing 392 employees. As designed, the operational energy consumption of the facility was specified to be at least 20 percent below the 2010 energy efficiency goals of the executive order, based on the existing energy usage baseline.

Building 4600 features an open floor plan to maximize natural light; uses day-lighting sensors, photovoltaic parking lot lighting and a reflective ENERGY STAR® roof membrane; and has photovoltaic roof panels that provide 35 kilowatts directly to the electrical grid.

Twenty percent of the building material is made of recycled content, and more than 85 percent of all construction waste was re-used or recycled. The building is currently operating at 47 percent of the electrical consumption of comparable structures throughout the campus, and it was one of four facilities throughout the nation to receive the 2005 Federal Energy Showcase Award.

Health and Fitness Center at White Sands

The second NASA building to receive a LEED® Silver rating is the Columbia Health and Fitness Center at the White Sands Test Facility (WSTF). Features include designated parking for carpools and vehicles using alternative fuel; a system that reduces storm water run-off by 25 percent; the use of desert landscaping, which requires no irrigation; and incorporation of items that reduce water use, such as waterless urinals and low-flow toilets, sinks and shower fixtures.

LEED® energy credits include ENERGY STAR® compliance, highly reflective and high-emissivity roofing, and 20 percent use of construction materials manufactured within a 500 mile radius. NASA also improved the fitness center's indoor environmental quality by installing CO2 monitoring devices; maximizing day-lighting and using low-VOC adhesives, sealants and paints.

Astronaut Quarantine Facility at Johnson

One of the most challenging LEED®-rated buildings that NASA designed and constructed is the Astronaut Quarantine

PHOTO CREDIT: NASA

The Child Care Center at Johnson Space Center uses multiple renewable energy platforms.

Facility (AQF), which is located at the Johnson Space Center (JSC). The AQF was constructed with energy-savings features that reduce annual energy consumption by 15.8 percent, relative to energy code requirements.

Astronauts begin adjusting their circadian rhythms prior to flight by being exposed to normal daylight conditions using artificial light that is turned on and off to coincide with the mission work schedules. Requirements for this process create a challenge in the area of energy conservation. At the AQF, four rooms are constructed with high-output fluorescent fixtures that occupy 90 percent of the ceiling space. The lights consume electricity and generate heat in quantities well above those of most buildings. This added heat must be removed by the building's air conditioning system, adding significantly to energy consumption.

But by utilizing energy-saving techniques, the AQF meets this challenge 15.8 percent more efficiently than the energy code requires. The savings were accomplished by installing extra insulation in walls and the roof, reducing solar heat gain through windows and using high-efficiency HVAC equipment. The HVAC system includes motors that operate at variable speeds to match heating and cooling loads, and variable flow control for chilled water pumps. In addition, heat and moisture is exchanged with air that is exhausted from the building through an "enthalpy" wheel. The wheel cools and dehumidifies incoming outside air during summer and warms the outside air during winter, thereby reducing energy consumption.

Other green strategies and materials used at the AQF include landscaping with native grasses and many trees to drastically minimize irrigation needs; permeable paving and a retention pond to reduce storm water runoff; an energy-efficient, highly reflective roofing system that reduces heat buildup and cooling requirements; recycled building materials, such as 100-percent recycled steel in the structure and concrete reinforcing, and flooring made from used tires; and purchasing 100-percent wind-generated electricity for the building's first two years of operation.

Child Care Center at Johnson

In 2007, JSC designed and installed a Multi-Platform Renewable Energy System (MPRES) at its Child Care Center. This project supports JSC's Engineering Directorate mission by providing an opportunity to better understand large, surface-based photovoltaic (PV) arrays necessary for lunar surface exploration. It also allows JSC to gain experience with various renewable energy technologies, demonstrates sustainable building principles and assists in meeting federal energy mandates. The Child Care Center was selected for the project because the size of the facility allows for renewable energy system flexibility and a manageable tie-in

*Continued: see **GREEN** on pg. 57*

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to the electrical grid, and because the location would provide excellent educational opportunities for the children.

The MPRES includes three renewable energy technologies: PV panels and wind turbines to generate electricity, and a solar thermal panel to provide hot water. Data is collected in real time and is displayed locally and online, showing performance figures on each individual system as well as historical information. (To view the real-time performance and energy savings, go to http://view2.fatspaniel.net/SacredPower/nasa/HostedAdminView.html.)

Goddard Exploration Sciences Building

One of 12 additional NASA buildings in design or under construction that will have or will register for LEED® certifications, the Exploration Sciences Building at Goddard Space Flight Center is to be the first high-performance building at the Goddard complex. NASA is using more than 35 strategies within the LEED® rating system to pursue the Silver rating, with a focus on sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality.

The 193,000-square-foot building -- the first new structure to be added at Goddard in more than a decade -- will house three stories of offices and laboratories. The facility will enable cutting-edge research and promote greater internal collaboration among Goddard scientists. It is the first project in a campus-wide master plan and is to be the centerpiece of a unified campus that will help meet a goal of consolidating related research initiatives.

Also at Goddard, methane gas from a nearby landfill is used to heat the 33 buildings that dot the Center's 1,270-acre campus. Using methane instead of natural gas at Goddard eliminates the equivalent of pollution generated annually by 35,000 cars, and it will save NASA more than $3.5 million in energy costs over the next decade.

(See feature story in this issue for information on other green initiatives at GSFC.) ■

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