

# GREEN BUSINESS QUARTERLY

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# MORPHOSIS

ARCHITECTS







Emergency breathing and oxygen equipment processing lab within the LEED Silver-certified Life Support Facility at the Kennedy Space Flight Center. Photo: NASA/KSC.





# S P A C E - A G E

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# D E S I G N S

NASA pushes the green envelope as the leader of the sustainability movement at the federal level

BY JENNIFER KIRKLAND





*The Flight Projects Center at the Jet Propulsion Laboratory in Pasadena, CA, is NASA's first LEED Gold-certified building. Architect: LPA, Inc.*

*In December 1968*, astronauts on NASA's Apollo 8 mission took the first photographs of the entire Earth from space. Today, many people point to the photographs taken during that mission as the beginning of the environmental movement and the inspiration for the first Earth Day in 1970. Those photographs not only revealed how fragile and precious Earth's environment is, but how far science can take us.

In the 40 years since Apollo 8, the environmental movement, driven in part by scientific innovation, in part by industry, and in part by public demand, has become mainstream. In recent years, the US government has mandated that all new government buildings carry LEED certification, and, according to the USGBC, government buildings make up a quarter of all LEED-certified buildings in the country. One of the government agencies leading the way is NASA.

In September 2009, the space agency completed its third LEED Gold project, the new Exploration Sciences Building at NASA's Goddard Space Flight Center (GSFC) in the Washington, DC suburb of Greenbelt, Maryland. The three-story laboratory and office building was designed by the Ewing Cole Firm of Philadelphia, Pennsylvania, and constructed by Manhattan Construction Company of Fairfax, Virginia.

Scientists, engineers, and technologists work together at GSFC to design, test, and build the spacecrafts, instruments, and new technologies used to study the earth, sun, solar system, and universe. The Exploration Sciences Building is almost 200,000 square feet and

includes 109,000 square feet for 60 new laboratories, as well as space for administrative and research offices. The Solar System Exploration Division is also housed there and performs a wide variety of research concerning the composition, chemistry, and dynamics of planetary systems. Physicists and astronomers also work at the center, studying microwave, infrared, ultra-violet, optical, gamma, and x-rays, the full spectrum of light, as well as cosmic-ray astronomy and astrophysics. The new building now allows as many as 900 scientists and technicians to better collaborate now that their labs are concentrated in one location.

Indeed, the state-of-the-art labs in the new building are highly flexible. Workers can create larger or smaller labs as needed, while maintaining the integrity of each individual lab. A central staircase links the major sections of the building, and collaboration areas on each floor near the staircase encourage more teamwork and communication. A conference hallway dominates the first floor, which also features a 200-seat symposium room. The building's three floors are color coded, and a large skylight floods the top two floors with natural light, helping to lower energy costs.

Some of these labs might have made Einstein scratch his head. All construction materials in the building are silicone free to avoid contamination of the satellite optics used and tested in the labs. All lab flooring is epoxy flooring, free of silicone and organic compounds to prevent off-gassing, which can contaminate a variety of laboratory materials. In addition, all lab flooring is grounded to prevent static-electricity buildup. The

building features several black labs, specially constructed rooms that contain no reflective surfaces that may disrupt laser and optic tests.

Originally, NASA was shooting only for LEED Silver, but during the 29-month construction, architects from Ewing Cole and engineers from Manhattan Construction and NASA found ways to score higher points. Achieving Gold certification often required on-site decisions. Sean Evans of Manhattan Construction explains one incident: “During construction a hidden site condition revealed concrete that is not normally recyclable. It threatened to negate two points for waste management. We responded by bringing a concrete crusher on-site to turn this landfill concrete debris into RC-6, a recycled crushed concrete, which we then used for the parking lot aggregate base.”

Such innovative approaches are one of the hallmarks of NASA. Eugene Mszar of the agency’s Facilities Engineering and Real Property Division says, “NASA has always had a can-do approach to problem solving and uses its diversity of people and their knowledge and interests to meet unforeseen challenges.” He has witnessed NASA’s green revolution firsthand. “Each new LEED building generates a contagious enthusiasm to move forward and do better,” he continues. He believes the new Obama Administration has brought sustainability to the forefront of policy, explaining, “In the last year, we’ve seen a more accelerated approach to meet energy- and water-reduction goals.”

But it is in NASA’s many new construction projects that are driving sustainability forward, and it is developing strategies and best practices to meet or exceed federal standards. Whereas the Exploration and Sciences Building at GSFC is NASA’s third LEED Gold building, the agency has completed many LEED Silver buildings in recent years. NASA’s first LEED Silver construction is Building 4600 at the agency’s Marshall Space Flight Center near Huntsville, Alabama, which won the 2005 Federal Energy Showcase Award. Building 4600’s energy consumption is 20 percent below 2010 guidelines and features many now-standard green components. The five-story office building includes a highly reflective roof to reduce the heat island effect, an open floor plan to maximize natural light, photovoltaic parking-lot lighting, and photovoltaic roof panels that provide 35 kilowatt hours directly to the grid. The building uses less than half of the electricity of other buildings at the Marshall Space Flight Center. The building was also constructed with 20 percent recycled material, and 85 percent of construction waste was recycled. NASA’s Marshall Space Flight Center constructed a second building and received LEED Gold recognition, while a third building is also being constructed to meet LEED Gold requirements.

## EACH NEW LEED BUILDING GENERATES A CONTAGIOUS ENTHUSIASM TO MOVE FORWARD AND DO BETTER.

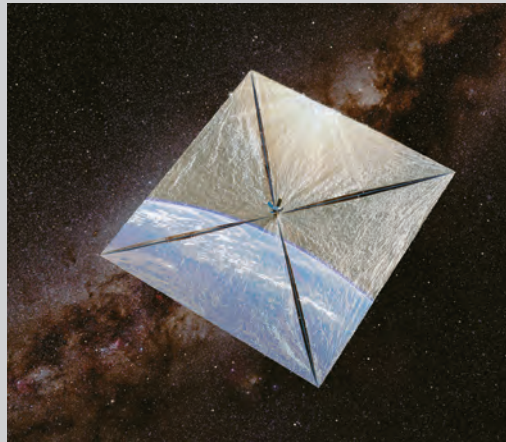
—EUGENE MSZAR, FACILITIES ENGINEERING & REAL PROPERTY DIVISION

### TECHNOLOGY TO WATCH:

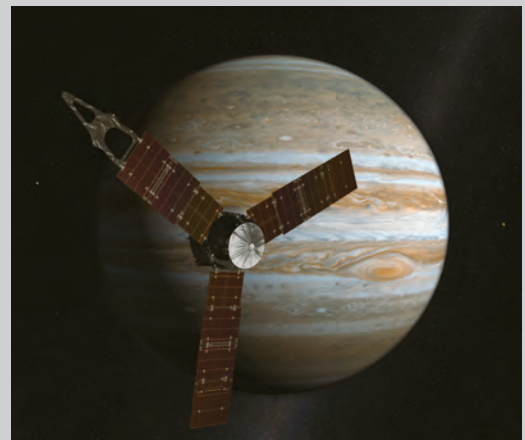
#### Solar-Powered Spacecrafts

Similar to the way a sailboat utilizes the power of the wind to navigate through water, solar-sail technology utilizes the pressure of the sun’s rays to propel itself through space.

While multiple attempts have been made to launch a solar spacecraft into orbit, none have lasted for an extended amount of time. Currently, the most anticipated launch is the Juno mission, set to take off in August 2011. Juno’s primary goal will be to collect data on the formation and evolution of Jupiter. With three solar arrays, Juno is set to reach Jupiter five years after being put into orbit.



*Artist's rendering of the Cosmos 1 spacecraft powered by a solar-sail system. Launched on June 21, 2005, from a submarine in the Barents Sea in the Arctic Ocean, the rocket Cosmos 1 was attached to failed and the spacecraft did not make it into orbit.*



*A rendering of Juno, the solar-powered spacecraft scheduled for launch in 2011, shown reaching its final destination in 2016, a low, elliptical orbit circling the planet Jupiter.*

## Tracking NASA's Sustainability Efforts and Inspirations

### 1958

The National Aeronautics and Space Administration (NASA) is formed

### 1968

Apollo 8 takes the first photographs of Earth from space

### 1970

Nation celebrates first Earth Day, said to be inspired by Apollo 8's images of the Earth

### 1999

NASA launches the first large aircraft powered by electric fuel cells, the Helios Prototype, which used solar panels to power its 10 electric motors

### SEPT. 2003

NASA establishes policy for LEED sustainable building requirements for new construction and major renovation projects

### JAN. 2006

Building 4600 at Marshall Space Flight Center in Huntsville, AL, NASA's 1<sup>st</sup> LEED Silver building, is constructed

### FEB. 2006

Astronaut Quarantine Facility at the Johnson Space Center in Houston is completed

### NOV. 2006

NASA's 2<sup>nd</sup> LEED Silver building, the Health and Fitness Center at the White Sands Test Facility in Las Cruces, NM, is completed



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### NASA'S ASSISTANTS

A look at the subcontractors and partners working with NASA to create its LEED-certified buildings.

**Ewing Cole Firm,**  
[ewingcole.com](http://ewingcole.com)

#### NASA PROJECT:

Designer for the Exploration Sciences Building at the GSFC

#### LOCATIONS:

Philadelphia, PA  
Washington, DC  
Irvine, CA

#### RECENT AWARD:

2009 NASA Team Recognition Award for the Exploration Sciences Building

**Manhattan Construction Company,**  
[manhattanconstruction.com](http://manhattanconstruction.com)

#### NASA PROJECT:

General contractor for the Exploration Science Building at the GSFC

#### HEADQUARTERS:

Fairfax, VA

#### RECENT AWARD:

2009 APWA Contractor of the Year by the American Public Works Association of Virginia/DC/Maryland

**Swinerton, Inc.,**  
[swinerton.com](http://swinerton.com)

#### NASA PROJECT:

General contractor for Collaborative Support Facility at Ames Research Center

#### HEADQUARTERS:

San Francisco, CA

#### LEED PROJECTS TO DATE:

75

#### LEED APS ON STAFF:

325

Each new construction job offers new opportunities for innovation. NASA's second LEED Silver building is the Health and Fitness Center at the White Sands Test Facility in Las Cruces, New Mexico, which features many water-saving fixtures and systems important for the desert location of the building. Waterless urinals and low-flow toilets, sinks, and shower fixtures save resources, a stormwater run-off system reduces waste by 25 percent, and desert landscaping requires no irrigation. A ubiquitous green roof reduces the heat island effect and energy requirements, and indoor environmental quality is maintained by carbon-dioxide monitoring devices. Mszar says, "Once the engineers on these projects see the benefits, they want to go forward and meet new challenges."

Mszar adds that one of NASA's most challenging green projects is the Astronaut Quarantine Facility at the Johnson Space Center in Houston, Texas. Space-shuttle astronauts use the building to prepare for missions in orbit, and they begin adjusting their circadian rhythms in preparation for the mission through exposure to normal daylight conditions using artificial light adjusted to the mission's schedule—a process that requires multiple rooms constructed with high-output fluorescent light fixtures that take up almost all of the ceiling space. Yet despite this tremendous and necessary energy usage, the building's energy efficiency is almost 16 percent lower than the LEED code requires.

NASA achieved this remarkable energy rating by using extra insulation in walls and windows, by reducing solar-heat gain through windows, and by using a high-efficiency HVAC system that includes variable-speed motors to match heating and cooling loads, and

**AUG. 2009**

Jet Propulsion Laboratory in Pasadena, CA, NASA's first LEED Gold building, is constructed

**SEPT. 2009**

1-MW solar photovoltaic farm is installed at the Kennedy Space Center

**DEC. 2009**

Marshall Space Flight Center Building 4601 is completed with a LEED Gold certification

**JAN. 2010**

NASA obtains its 3<sup>rd</sup> LEED Gold certification for the new Exploration Sciences Building at NASA's Goddard Space Flight Center

**MAY 2010**

Florida Power and Light completes a 11.5-MW solar photovoltaic farm on 50 acres of Kennedy Space Center property, the first solar-PV farm to be built by a utility company on NASA property

**PRESENT**

NASA's Propellants North Administration and Maintenance Facility at the Kennedy Space Center is under construction upon completion in September 2010 it will be NASA's 1<sup>st</sup> LEED Platinum building

**PRESENT**

NASA's Collaborative Support Facility at the Ames Research Center is under construction; upon completion in 2011, it will be NASA's 2<sup>nd</sup> LEED Platinum building



variable-flow control for chilled-water pumps. Another innovation is called an enthalpy wheel, which cools and dehumidifies incoming outside air during summer and warms incoming outside air in winter. The building also uses alternative energy in the form of purchased wind-generated electricity. Since the completion of the Astronaut Quarantine Facility, the Johnson Space Center has had another facility LEED certified as Silver, with three additional buildings awaiting either Silver or Gold recognition.

NASA has met other challenges with success, and the Kennedy Space Center has recently completed the installation of a one-megawatt solar farm that ties directly into a 13,200-volt power grid at the center. Through an agreement with Florida Power and Light, the solar farm was built at no cost to the center. The first LEED Silver building at the Kennedy Space Center, the Life Support Facility, houses three distinct areas, one of which includes the maintenance of 600 life-support suits and breathing-apparatus systems. NASA's first LEED Gold building is the Flight Projects Center at the Jet Propulsion Laboratory in Pasadena, California. The Flight Projects Center was designed to use 50 percent less water for landscaping and to reduce water use for building occupants by 30 percent. It also employs carbon-dioxide monitors to reduce heating and cooling when lightly occupied; a vegetative green roof; and green housekeeping products and procedures.

NASA has always spurred the development of new technologies, and one project currently under construction will feature technology developed for the International Space Station to monitor and control the building's environment. NASA's Ames Research Center

in Moffett Field, California, will actually be called the Collaborative Support Facility, and according to NASA's Web site it promises to be the "greenest federal building ever." The Collaborative Support Facility, currently under construction by Swinerton Builders of San Francisco, will be NASA's first LEED Platinum building when it opens at the end of 2011. It will be a net-zero energy building, using 90 percent less water than traditional buildings of a similar size use, and is expected to include 72 geothermal wells for ground-source heat pumps.

Also included in the design are systems for solar water-heating, fire detection and suppression, advanced lighting, security, communications operations, and site stormwater management. These systems will be designed to anticipate and automatically react to changes in sunlight, temperature, and wind, and they will use resources to optimize the building's performance. The new facility will feature a structural-steel frame, will stand two stories tall with two wings, and will have approximately 50,000 square feet of mostly open collaborative workspace, lunchrooms, and a glass-walled atrium. Like life-support systems in the space shuttle and the International Space Station, energy usage will be kept to a minimum, saving the agency millions of dollars over the life of the building.

"When the Apollo astronauts looked back and saw Earth, it was such an astounding image that it served as a touchstone for the whole environmental movement," says Steven Zornetzer, associate director at the Ames Research Center. "In the spirit of what's best for our country, we decided to focus on constructing the most energy-efficient building possible." GBQ