

Leadership in Energy and Environmental Design at Johnson Space Center

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The designs of all new construction and major renovation of facilities at Johnson Space Center (JSC) meet the Leadership in Energy and Environmental Design (LEED) criteria. This criterion ensures energy and material efficiency and sustainability are inherent in all new construction.

The architect-engineer firm performing a specific design, the project manager, and project team perform an LEED design charrette at the pre-design stage to assure that JSC meets NASA Headquarters' minimal LEED Silver-level requirements. This charrette calls for an item-by-item review of the U.S. Green Building Council's LEED Project Scorecard to determine which LEED points are reasonable to accomplish within the scope of a project and which are open possibilities.

As a project progresses through its 30%, 60%, and 90% design review, the JSC team reexamines the scorecard to determine which points must be dropped out or might be added due to the latest engineering design data. At the 30% stage, the team justifies—by a life cycle cost analysis—the design concept proposed by the architect-engineer. This analysis is adjusted and refined as the project progresses to its final stage.

This process has enabled JSC to design, construct, and certify the following LEED buildings over the past 6 years:

LEED Certified

Building 27: The Astronaut Quarantine Facility

LEED Silver Certified

Building 207A: Gilruth Recreation Center facility addition

LEED Gold Certified

Building 2 North: Office of Communications and Public Affairs

Building 26: The Center for Human Space Flight Performance and Research

Building 265: Source Evaluation Board office additions

LEED Platinum Certified

Building 20: The New Office Building



Fig. 1. Building 20.

The New Office Building Description

JSC's newest facility (figure 1)—the New Office Building—is a three-story, 83,000-ft² office building employing numerous sustainable features. In the design, JSC originally strove for an LEED Gold rating; however, because of improvements and innovation during facility construction, the building received the agency's first Platinum LEED rating by the U.S. Green Building Council. The New Office Building was constructed to support JSC's multiyear building refurbishment program by providing "flex" space for employees who are temporarily relocated due to refurbishment of another building. The main design decisions for the new building centered on creating a highly flexible space that could be altered quickly at minimum cost. Additionally, designers meant to create a highly sustainable facility using the "less-is-more strategy" (i.e., an efficient building design reduces the programmed building area [footprint] and the amount of finishes, where applicable).

Features included in the project

The design team oriented the New Office Building to maximize daylight harvesting and installed an ENERGY-STAR-compliant, highly reflective roof. The team also selected low-flow restroom fixtures, including waterless urinals, dual-flush valves, and flow restrictors on faucets. Native plants and adapted species are seeded around the facility to reduce maintenance and water use, and condensate water is used as the primary irrigation source.

Faced with the extra challenge of optimizing building energy performance for a facility anticipated to undergo significant change over the coming years, the design team installed a high-efficiency under-floor Heating, Ventilation and Air Conditioning (HVAC) system for flexibility.

The building includes such extras as Solarban® 70 energy-efficient windows (figure 2), built-in solar shading barriers, solar hot water heating for the restrooms, ultraviolet lighting in air handlers to reduce microbial growth, and a detention pond and structural controls to manage and improve storm water runoff.

As constructed, the New Office Building will reduce potable water consumption for landscape irrigation by 54%, use 34% less water than a building that just meets baseline fixture performance requirements of the Energy Policy Act of 1992, be 55% more energy efficient than ASHRAE [American Society of Heating, Refrigerating and Air-conditioning Engineers] 90.1 specifies, and divert greater than 90% of all construction waste from disposal.

Facility occupants will benefit from a building designed to provide natural daylight to all office spaces. The design includes natural light in the stairwells, bicycle racks, and showers to encourage employee health and fitness.

LEED Under Construction

Building 29: Constellation Avionics Integration Laboratory
(will be submitted for LEED Silver certification soon)

Building 12: Administrative Support Building

Administrative Support Building Description

Building 12, one of JSC's oldest original permanent buildings, is undergoing a complete refurbishment to modernize it to help serve JSC well into the 21st century. This two-story, 67,348-ft² office building houses JSC accounting, administrative, and training groups, and is located on the historic Central Mall of the JSC campus.

Sustainability has been at the forefront of the design process since project inception, and such features are integrated into the building. Most of the inherent obstacles that presented challenges to the refurbishment program and to sustainability goals were creatively overcome and, in

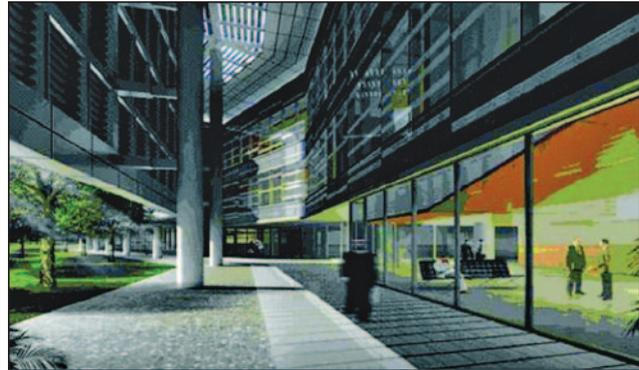


Fig. 2. High efficiency solar shades.

some cases, were turned into assets. The project posed the daunting task of complete renovation and upgrade to meet current applicable codes and standards. These included: life safety; environmental; energy; mechanical, electrical and plumbing engineering; and structural. Two of the largest existing building systems by weight and volume, however, were retained with new engineering analysis and upgrades in the refurbished design. These building systems included the iconic JSC white-quartz-faced precast concrete exterior wall panels and the building's steel framing and concrete foundations. The majority of all materials removed and demolished were accounted for and sent to recycling entities or, in the case of hazardous materials, to environmentally certified disposal. Project design started in 2008, and construction will be completed in 2012. Building 12 uses LEED for New Construction version 2.2 to track the sustainability aspects of the project. JSC is currently projecting a LEED Gold rating.

Features included in the project

The refurbishment effort involves all parts of Building 12— interiors, exterior skin, and roof. Interiors will use low-odor materials including paints and coatings, adhesives and sealants, composite wood, and carpet systems. Offices are located toward the central core of the building to enhance daylight and views to the outside.

Certified wood and durable materials will be used as well. New lighting will provide greater control to the occupants and reduce energy use. Lighting control features include occupancy sensors, daylight sensors, and low-voltage

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relays. Low-flow plumbing fixtures will be installed throughout the building, with a projected water use savings of 43%. The building will use JSC's existing central utility plant, but multiple strategies have been implemented to reduce energy use. Such strategies include:

- Under-floor air distribution system that also increases building-use flexibility
- Variable speed drives on mechanical equipment
- Daylight harvesting and occupancy sensors that reduce lighting costs
- Photovoltaics integrated into shading devices
- Four highly efficient vertical axis wind turbines placed on the roof (figure 3)
- Strategically engineered sun shading devices tailored to maximum solar efficiency while enhancing indirect natural day lighting inside the space

The exterior of the building includes a new curtain wall system with dual-glazed low-emissivity windows, premium exterior envelope insulation, and sun shades. Such features reduce heat glare and heat gain into the building, which improves occupant comfort and reduces energy use. A vegetated roof will help reduce the heat-island effect for the building and site, and will assist in mitigating storm water runoff (along with the site landscaping) (figure 4). JSC is making an effort to promote alternative transportation and added conveniences; therefore, bicycle storage is provided, and shower facilities are located within the building. The center is also setting aside parking spaces for fuel-efficient and carpool vehicles.



Fig. 3. Wind turbines on roof.



Fig. 4. Building 12.