

# From the Knowledge Base of TranSystems' Legacy and Merger Firms



## Master Plan for Sustainable Facility Management Yields 39.8% Energy Savings

Published in The Military Engineer September/October 2008

BY

David G. Campbell, AIA, LEED  
**TranSystems**



**EXPERIENCE** | Transportation

Project Design Team:	
Project Management/Architecture	TranSystems
Structural Engineering	TranSystems
Interior Design	TranSystems
Civil Engineering	Forsberg Engineering
MEP	Van Wagnen & Deavers
Geothermal Well Design	Redding Linden Burr
Fire Protection	James Maddry Engineering

---

### **Master Plan for Sustainable Facility Management Yields 39.8% Energy Savings**

At Shaw AFB, outdated housing is being transformed into a sustainable campus of energy-efficient, low-maintenance dormitories. Master planning based on environmental principles resulted in a first dorm that is on target for LEED Gold and advances dormitory design with a groundbreaking geothermal heat transfer system – all within the typical per-airman budget.



Impressed with energy-efficient designs for a series of base projects – and mindful of Executive Order 13423 calling for 30% energy use reduction in government buildings by 2015 – the Air Combat Command (ACC) decided to test the limits of sustainable yet affordable design. TranSystems' LEED-certified team was let loose on a Master Plan for a dormitory campus on Shaw Air Force Base, S.C. Six energy efficient, low-maintenance dormitories will replace twelve outdated buildings on a park-like campus from which half the central parking area and two roads will be removed.

The first new dormitory, FY07, proves that in the right setting and with the use of carefully-planned geothermal well technology, a projected 39.8% in energy savings can be achieved within the typical budget for new dormitory construction. The ACC Showcase project of the year is on target for LEED Gold certification, which will make the ACC the only branch of the Air Force with a Leadership in Energy and Environmental Design certified project. The design achieves the triple goals of sustainable facility management, affordability, and compliance with AT/FP guidelines while simultaneously providing benefits for decontamination of a Brownfield site.

Relevant to on-going facility management is the ease of maintaining the energy-saving geothermal heat transfer system to provide heating, cooling and domestic hot water. Without boilers, chillers, water heaters, or condensing units, mechanical maintenance is virtually limited to the water pumps and packaged water-cooled heat pump units. The individual living module heat pumps are located with direct exterior access to facilitate routine maintenance. The geothermal technology is but one of the multiple sustainable features of the building itself and its master-planned setting that has set up this project to earn a projected 42 credits.

#### **A Forward-looking Plan for Replacement**

The current dormitories at Shaw Force Base were built in the 1950's and are deficient by current standards. They are plagued with inadequacies such as antiquated HVAC systems for which it is difficult to procure parts, mold and mildew caused by poor drainage systems, and inability to control temperature.

Similar problems had driven the replacement of two dormitories at Barksdale AFB with new dormitories designed by TranSystems. These were a significant step in the direction of sustainable design, reorganizing the site of an

old BX into a campus of high-performance residential buildings in a park-like setting. The second dormitory won a 2006 ACC Merit Award and paved the way for the Shaw AFB Dormitory Master Plan.

Randy Jenkins, ACC Civil Engineer project manager, was an early supporter of the approach, which made sense to Col. Timothy Byers, ACC director of installations. The TranSystems Design Team was able to base planning decisions on environmental principles so the cost delta was negligible when it came to the building design. LEED credits often not possible to achieve on “one-of” projects came within reach due to proper planning.

The existing dormitory infrastructure is automobile-oriented, crossed by multiple streets and large parking areas. The Master Plan creates a centralized recreation and green space while locating parking at the perimeter. A major benefit is a reduction in impervious surfaces by 40% for a 20% decrease in storm water runoff. A new 11-ft-wide multi-use path will accommodate pedestrian, bicycle and emergency vehicle access and connect park and recreational facilities. The curvilinear “Central Park”-like path encourages energy-saving modes of circulation and the use of exterior spaces as an extension of the indoor environment. Dormitory walkways connecting to the site circulation create social nodes within the buildings and throughout the new campus. Covered bicycle racks are also included enabling occupants to commute by bicycle rather than by car.



The Design Team brainstormed sizing and location of geothermal well fields well in advance. Another early design goal was effective placement of the new dormitories on a sloping and constrained site. At the same time, the planning was careful to meet the requirements of AT/FP setbacks and provisions for demolition and new construction without disturbing base activities. Maintaining a constant number of “beds” throughout the transformation process was also necessary.

### **First New Dormitory on Target for LEED Gold**

The FY07 dormitory is reinvigorating a dated living area into a cohesive, visually integrated group of easily maintainable residential buildings. The project is the catalyst for the removal of parking and roads and replacement with the walkways and recreational areas, as well as a modern living facility affording a high standard of comfort and convenience. The showcase energy- and water-saving features are but one of its achievements.

The building is a 3-story facility with 4-person living modules arranged in two wings accommodating 72 airmen, each connected by a covered walkway on each floor. Layout and placement provide multiple “fronts” to interact with nearby dorms and the Dining Hall and access points to the exterior recreational areas. The entire facility creates many high-quality nodes for social gathering.

The living module features a central common living, kitchen, and laundry area; each bedroom includes a private bathroom and walk-in closet. This creates shared social space on a small level while retaining privacy. A one-story Commons building is located between the two wings, providing central mechanical, electrical, communications, and fire protection rooms, plus vending/pay phone, and office areas. A multi-use Common Room serves as another social node. On the outside, the use of decorative split-face and burnished concrete masonry units and a Sierra Tan roof blends with the fabric of the surrounding area.

The building is not only highly functional but also sustainable. Regional materials meeting green standards were researched during the planning process and are verified for origin. The flooring contains high recycled content. The carpet is CRI certified green. Other materials with high recycled content include the metal roof, steel structure, window systems, ceilings and metal partition framing. Countertops in the bathrooms and kitchens are

100% recyclable solid plastic. Renewable ceramic tile is used for the flooring where durability is necessary; bathroom and kitchen cabinets were specified to be made out of strawboard which is also highly renewable.

The building maximizes day lighting in all work task areas. To conserve water, all shower heads are low flow and the landscaping eliminates the need for an irrigation system. The metal roof coating is Energy Star compliant. The paint, as well as other products, was selected for low VOC's.

While it was important to provide a home-type atmosphere, low-maintenance finishes and materials were emphasized to reduce the long-term cost of facility maintenance. The integral color of the exterior wall concrete masonry units eliminate the need for future refinishing. Windows are anodized aluminum and the metal roof, fascia, and trim are all factory-finished galvanized steel. The hand rail and guard rail system have a factory-applied powder coat finish.

The crown jewel of the sustainable design is the use of the geothermal heat transfer system to provide heating, cooling, and domestic hot water. A geothermal vertically drilled heat exchange system will provide the heat/sink source for the heat pump system. The 180 drilled wells of the earth heat exchange, spaced at a minimum of 30 feet on center, are being located around three sides of the dormitory, and partly in the area of a removed parking lot.

Energy savings and low maintenance are not the only virtues of this system. The project is being built on a Brownfield site and the geothermal system will actually aid its remediation. After consultation with the South Carolina Department of Health and Environmental Concern and the Shaw AFB Environmental Group, the geothermal loop field was designed to be shallow and wide to prevent penetration and spreading of the contaminated zone. A by-product of the system is introduction of heat into the contaminated zone, which may enhance breakdown of the contaminants and accelerate clean-up.

The Design Team was given the "go" to incorporate the geothermal method at the 35% design stage. Due to the advance planning, the additional cost of this system over a four-pipe water- or air-cooled chiller system was less than \$1 more per square foot of area, or  $\pm$  \$50,000 for the 54,302 square-foot facility. The budget for the showcase dormitory is consistent with the typical average per-airman cost, despite the sustainable features and the structure's progressive collapse design. The 39.8% energy savings will continue to pay off in the years to come as will the reduced costs of facility maintenance.

The quality of life for airmen residing at Shaw AFB will be significantly enhanced by the comfortable accommodation and integration of living space with recreational areas. A healthful environment will provide proper rest, relaxation and personal well-being – and encourage a more physically-fit, socially-integrated way of life at the base.

David G. Campbell, AIA LEED  
Assistant Vice President  
TranSystems – Ft. Worth office  
500 West Seventh Street – Suite 1100  
Fort Worth, TX 76102  
[dgcampbell@transystems.com](mailto:dgcampbell@transystems.com)  
817 339-8950 x3574  
Fax: 817 336-2247

Design Team

Project Management/Architecture	TranSystems
Structural Engineering	TranSystems
Interior Design	TranSystems
Civil Engineering	Forsberg Engineering

MEP  
Geothermal Well Design  
Fire Protection

Van Wagenen & Beavers  
Redding Linden Burr  
James Maddy Engineering