UNIVERSITY OF COLORADO
SOLAR DECATHLON 2005

DWELLING IN THE CU "BIO-S$^{(H)}$IP"

Livability and Buildability
The terms "livability" and "buildability" go hand in hand in the architecture of CU's home. The Team used natural materials in combination with a newly developed, biobased, modular building system to create an adaptable residence that can travel to a number of sites and provide a comfortable, beautiful dwelling option for many lifestyles. Called the **"Bio*S*$^{(h)}$*IP,"*** the CU design is a green-built solar mobile home with a movable roof for compact travel. After setting sail for Washington, D.C., the **Bio*S*$^{(h)}$*IP*** will reside on CU's campus for six months before establishing permanent residency in Prospect New Town, a New Urbanist Community in Longmont, Colorado.

Modular construction offers a strong, lightweight building method that is suitable for many locations and provides a repeatable, and therefore economical, building technique. However, since the words "modularity" and "environmental" are practically mutually exclusive, the CU Team took on the challenge of developing a new, environmentally-based structural insulated panel system (SIP system) from waste paper and soy for construction of their **Bio*S*$^{(h)}$*IP*** home. The system, named Bio-SIPs, will be demonstrated for the first time on the National Mall in the CU Team's **Bio*S*$^{(h)}$*IP*** competition entry.

Designing for a Real Client, A New Urbanist Community
The **Bio*S*$^{(h)}$*IP*** was pre-sold to Prospect New Town, and the CU Team worked closely with this client in designing its home. The **Bio*S*$^{(h)}$*IP*** will reside in Prospect's community of tree-lined streets, which connect residences to parks, public amenities, shops, and offices, all of which are directed toward a view of the Colorado Rocky Mountains. The **Bio*S*$^{(h)}$*IP*** will be the first solar mobile home in Prospect's established community of detached houses, townhouses, courtyard houses, apartments, and live/work lofts. The CU Team worked to create a home design with strong street appeal and architectural datum and color vocabulary responding to neighboring architecture within the Prospect community. Additionally, the Team worked to create a floor plan that flows easily to the outdoors and to adjoining residences and landscapes.

In June 2004, the CU Solar Decathlon Team had the opportunity to engage in a design charette with esteemed architect Andreas Duany, one of the developers of Prospect New Town. Also taking part in the charette were the Home Builders Association of Metro Denver, members of the Prospect community, and the town's architectural team. The charette was a chance to begin planning for inclusion of the **Bio*S*$^{(h)}$*IP*** into the architectural fabric of Prospect as well as to learn about lifestyles of Prospect residents. Discussions of livability, aesthetics, and experimental solar mobile design were weighted against issues of marketability and curb appeal. A critical discussion during the charette and one that continued well into construction of the CU home was, "what will make the **Bio*S*$^{(h)}$*IP*** a home that is comfortable and beautiful, as well as one that will appeal to a number of potential homebuyers?" In order to answer this question, the CU Team spent many future design sessions discussing their understanding of the lifestyles and values of Colorado homeowners and the changing face of "dwelling" in the Western U.S. The Team took on this design challenge with the long-range goal of producing a solar mobile home prototype that could potentially be adaptable to sites around the U.S.

Livability and dwelling influences that shaped the **Bio*S*$^{(h)}$*IP*** are evidenced in a home that reflects a lifestyle of relaxed living in an open and flexible "green-built" design. The residence is proposed to suit the lifestyle of individuals who travel, have careers, commute to work through

alternate methods such as bike and bus, and who spend most leisure time outdoors. Since the **Bio*S(h)IP 's*** future residents may have several jobs in their lifetime, the residence is constructed on a durable six-axle steel chassis for ease of mobility. The home's roof can be lowered and shut like a suitcase for easy travel. The **Bio*S(h)IP*** is "zero energy," which means it produces more energy than is required for its yearly operation, including powering its integrated electric car. The home has a composting toilet so that residents can live off the public utility grid by simply adding a water tank to serve domestic water needs.

Materials for the CU Home

Also providing integral comfort and beauty to the **Bio*S(h)IP*** is its construction palette of natural materials. The home is constructed from "low- to no-petroleum" resources, meaning that less fossil feedstock was used in manufacturing the home's materials and, thus, the home itself. Natural materials in the CU **Bio*S(h)IP*** come together to create a clean and serene environment both inside and out. By using these products, the CU Team predicts that their solar home will have an environment with increased interior comfort and measurably cleaner indoor air. Resources for the **Bio*S(h)IP*** include the following material categories of durable, low-maintenance products. All materials used in construction of the CU Home have met the required testing standards and building codes.

1 Biobased, or cellulose, building materials are produced from agricultural and forestry waste such as soy, wheat, corn, kenaf, jute, hemp, bamboo, and waste paper.
2 Recycled Content building products are manufactured from pre- or post-consumer recycled feedstocks such as paper, glass, metals, woods, and plastics.
3 Re-Used or "Experienced" Materials were purchased from Resource 2000, a local salvage materials yard. Salvaged structural aluminum for the project was acquired from an aluminum recycling company in nearby Brighton, Colorado.
4 Sustainably Harvested products include fast-growing woods from managed forests. Examples of these materials in the CU Home include bamboo for cabinets, furniture, and wall panels, as well as engineered lumber framing members.
5 Low- to No-Volatile Organic Compounds (VOCs): To maintain a clean indoor and outdoor environment for the CU Home, the Team selected Low- to No-VOC products for use as building materials, paints, and cleaning products.

The Bio*S(h)IP* Lifestyle

The floorplan for the **Bio*S(h)IP*** is an open concept design with natural lighting provided from windows and roof "slice" clerestories. Clerestory light contributes to usefulness of space from floor to roofline. It provides north light for a small, but accommodating, sleeping loft accessed from the kitchen; edible plants grow as a green "frieze" at Kitchen ceiling height and are sustained by southeastern sunlight. The Kitchen is a sunny and open space with a countertop that provides dining space or work surface for a laptop. The Kitchen sink is situated for its upcoming view of the Rocky Mountains. A Home Office is positioned below a north-facing skylight off the Bedroom. The Bedroom has a south-facing window with an active solar awning, which contributes to the home's energy collection. The design team watched closely throughout construction in order to take advantage of potential nooks and crannies -- spaces that are generally closed-in during standard building processes. The results are a deep shelf at ceiling height in the Storage Room and a composting bin (worms included!) in the Kitchen. The student Bath designer was given the task of creating a calming and tranquil spa in the modest space allotted. Natural bamboo wall covering, jade green glass tile, and an elegant sink on a recycled slab of wood provided the solution.

The **Bio*S(h)IP*** is a home that will live gracefully within a well-established New Urbanist community. If the home proves to be successful in providing a comfortable, beautiful, and marketable residential option for Prospect, the CU Team will continue working with the Prospect team to develop the first New Urbanist Solar Mobile Village within this vibrant community.