

# UTenSAils: A Design-Develop-Build Project

*Contributed by Mahesh B. Senagala*

February 2007

*The AIA collects and disseminates Best Practices as a service to AIA members without endorsement or recommendation. Appropriate use of the information provided is the responsibility of the reader.*

## SUMMARY

Learning through collaborative building is a great way to expose architecture students to the challenges architects face in the real world. Students from the University of Texas at San Antonio faced practical scenarios when they created two permanent tensile structures on their campus with the help of 24 industry partners.

## THE PROJECT GETS OFF THE GROUND

In the senior design-develop-build studio at the University of Texas at San Antonio, the cross-disciplinary notions of collaboration, leadership, and entrepreneurialism took center stage. In the spring 2005 semester, aided by \$102,490 in sponsorships, four full-scale permanent tensile membrane structures were successfully designed, engineered, and erected within a five-month period. Named collectively as UTenSAils, the work was realized through collaborations with 24 industry partners from Asia, Europe, Australia, and North America.

Given the lack of local resources or knowledge of these structures, the initial goal was to design, develop, and build a modest 200-square-foot temporary tensile membrane structure. The intention was noble, but the challenge was daunting.



*One set of 'sails' was permanently installed at the main entrance to the UTSA College of Architecture. The realized project of tensile membrane structure closely resembles the design as envisioned by the class. (Image courtesy of the author.)*

## STEP ONE: A REAL-LIFE SITUATION

In this case, students were asked to form a hypothetical architecture firm. An administrative layer of positions (office director, graphic designers, PR specialists, etc.) was established, with students invited to apply for positions based on experience and interest. A Web-based forum allowed project partners to communicate among each other at all hours. On top of the administrative layer, a professional layer of positions was created in which the students took on different roles to accomplish different project-specific tasks. These layers enabled a sense of ownership and responsibility. This form of studio organization engendered parallel and professional relationships between the members of the studio.



*Detail of stainless steel fittings, kevlar tie-back, and pvc fabric.*

## MOVING BEYOND STUDIO

Although budgets, schedules, systems coordination, resource management, and contingency planning are not fashionable educational topics, the studio brought these critical tasks to the enterprise. The students adopted these topics with great enthusiasm as they could relate to them concretely and personally. Also emphasized were the art of raising funds, forming partnerships, and creating opportunities where none exist. Many international companies and engineers were approached by the professor for the donation of materials and services, with students focusing on local sources for hardware donations. As previously mentioned, 24 international

entities expressed interest in participating in the design-build project. Given the generosity of the industry partners, and emboldened by the engineering support from four practicing engineers, the studio decided to expand the scope and scale of projects.

The first four weeks were dedicated to experimentation, learning the basics, and trying out the actual fabrication processes that would later be employed in building the full-scale structures. Contrary to popular belief, tensile fabrics are not stretched to assume a curvilinear form. In fact, the stretch of these fabrics is less than one percent, so understanding how double-curvilinear forms are achieved by combining flat, two-dimensional panels was very important. Teleconferences with the engineers and manufacturers became a weekly event throughout the process. The project was primarily designed and fabricated with the aid of specialized software.

**EXPLORING PRACTICAL APPLICATIONS**



*Second structure features Gore Tenara fabric in a five-sided sail.*

Two large, permanent structures of 1,200 square feet of fabric were considered, given the expanded scope. Four student teams were asked to produce proposals for five different entry points of the College of Architecture building. Two structures were chosen for immediate development in consultation with the college and university administration. All the students were expected to work on both the major projects in a collaborative fashion. Additionally, a small subset of the students was asked to experiment with "tensegrity" structures and a portable, stretched-Lycra structure. Thus, in all, two large and two small projects were to be built by the end of the semester.

Much time was spent in developing design and obtaining the legal permissions. Issues of liability were a big concern for all parties involved, and an engineer of record and a general contractor of record were required. Students spent countless

hours participating in the fabrication at various shops whose owners donated expertise. Even considering the educational and charitable nature of the project, all the sponsors were timely in their deliveries and responded professionally to the ever-changing details and specifications.



*UTSA students "welding" fabric panels using Chism Company's Radio Frequency Welder.*

There was much sweat shed in accomplishing the many daunting tasks of making the aluminum masts, fabric sails, concrete footings, stainless steel plates; installing the helical anchors; surveying the land; precisely establishing the anchor points; and organizing all the components for the final erection process. On June 25th, with the generous sponsorship of a general contractor, the structures were erected within a span of four hours. The cables were systematically tensioned to achieve the required pre-stress using precise engineering calculations by Robert Harper, PE.

**COLLABORATIVE BUILDING**

These poetic projects, which began as minor design-build experiments have grown into significant and permanent projects. UTenSails have become the seeds for community building at our institution. Especially for a college of architecture, with hundreds of students and professionals walking under these structures every day, they will remain the best introduction to the value of learning through collaborative building.

This article originally appeared in the Jan/Feb 2007 issue of *Texas Architect*. It was adapted with the Author's permission.

**ABOUT THE CONTRIBUTOR**

Maresh B. Senagala is an Associate Professor and the Associate Dean for Research at the UTSA's College of Architecture. He can be reached at [maresh@maresh.org](mailto:maresh@maresh.org).

Students participating in the project were Shad Calveti, Steven Cordero, Michael Czimskey, Curtis Fish, Hector Guevara, Matthew Martinez, David

Matiella, Hector Mendez, Sarah Ness, Joshua Pierce, Ryan Squyres, and Andrew Wit.

The UTenSAills project was made possible by AB Chance; Astrup Company; Bruni The Weldor; the Chism Company; Comet Signs; Constructors and Associates; Dazian; Delta Prime Specialities; Fiesta Bolt; Garces Metal Speciality; Hayn Enterprises; Hendee Enterprises; Hiraoka and Co.; Home Depot; Lawrence Calvetti, PE; Lowe's; Meliar Design; Rich Thorsten, PE; Robert Harper, AIA, PE; Ronstan International; Verseidag Seemee U.S.; W.L. Gore and Assoc.; and Wayne Rendely, PE. Industrial Fabrics Association International (IFAI) was instrumental in forging the key connections.

## RESOURCES

### More Best Practices

The following AIA Best Practices provide additional information related to this topic

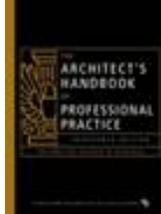
01.05.03 Firms Benefit When They Charrette with Design Students

01.03.01 Pro Bono Services: Improving the Profession

001.05.04 ACE Mentorship Program

### For More Information on This Topic

See also "Design-Build," by Ron Gupta, AIA, and Paul Doherty, AIA, in *The Architect's Handbook of Professional Practice*, 13th edition, Chapter 18, page 612.



See also the 14th edition of the *Handbook*, which can be ordered from the AIA Bookstore by calling 800-242-3837 (option 4) or by email at [bookstore@aia.org](mailto:bookstore@aia.org).



### Key Terms

- Leadership
- Disciplines
- Design disciplines
- Architectural disciplines
- Architectural education
- Architectural degree programs