Building Envelope Technologies

This category includes technologies which relate to the structure, assembly of, the protection of, or the thermal efficiency of the exterior building envelope. Technologies outlined here relate to wall panels, roof and floor systems, and insulation applications. Some technologies outlined here are creative thinking about the exterior building shell and its function of protecting the occupants.

Technology Scanning

One of PATH's major research support services is PATH Technology Scanning. *Technology Scanning* tells us about technology developments in other industries, from other nations, from federal laboratories, and from other building sectors. PATH looks for breakthroughs in other industries that could be transferred and applied to housing. *Technology Scanning*—published by the U.S. Department of Housing and Urban Development/PATH and prepared by the NAHB Research Center, Inc.—are updated as technology developments dictate. The Research Center works to unite technology developers from outside of residential construction with manufacturers in the residential housing sector.

This issue of *Technology Scanning* is one in a series. Each issue in the series falls into one of the following categories:

- *Design and Internet Tools*
- *Safety*
- *Surfaces and Interior Finishes*
- *Building Envelope Technologies*
- *Electrical*
- *Plumbing*
- *Heating, Ventilating and Air Conditioning*
- *Energy/Power Systems Generation*
- *Basic Materials*
- *Information Technology*
- *Sustainable Design Strategies*
- *Materials Recycling and Reuse*
- *Thermal and Moisture Protection*
- *Indoor Environmental Quality*

Call the ToolBase Hotline at 800-898-2842 for information about other available *Technology Scanning* issues. Or, log onto pathnet.org and www.toolbase.org.

PATH
451 7th Street, SW
Washington, DC 20410
Email: pathnet@pathnet.org

International Space Station

NASA's Environmentally Closed Life Support Systems (ECLSS) group developed vehicle/habitat systems that incorporate lightweight, re-configurable materials, spaces, or modules. Included are fasteners that are quick, strong, and easy to use and assemble.

NASA has also developed new, inflatable living quarters made from a 24-layer composite of textiles. It is stronger than metal, and its indestructible outer layers protect inner bladders that hold air. An outer shell provides insulating properties from 250°F to -200°F. Using Nextel 3M material from the auto industry, Kevlar from DuPont, Combitherm from the food packaging industry, and Nomax from the protective clothing industry, NASA engineers have developed an innovative, thick, inflatable shell able to withstand extreme temperatures, meteorite debris, and other flying space debris. Many of these ideas can be transferred on an earthly scale to housing. Down-scaled, more earth-like applications of this material/textile composite could be used in walls and roofs of homes.

Contact:
Laura Nelson
NASA Johnson Space Center
Email: lnelson@ems.jsc.nasa.gov

Integrated Window and Wall System (IWS)

LBL National Laboratory, Environmental Energy Tech Division, has developed an integrated window/wall system. A pre-engineered panel extends full width and height and thickness of a wall section. It includes an operable or fixed sash, recessed night insulation panel, integral solar shading panel, and a moveable interior control device. It is designed to be a factory-built wall section shipped to the site and incorporated with the rest of the wall structure. It uses wall framing to anchor window sashes and does away with window frames and typical window header framing. With its night insulation deployed, its thermal resistance is R-12. Full-scale prototypes have been fabricated and are in test and structural analysis mode.

Contact:
Dariush Arasteh, LBL National Laboratory
Phone: 510-486-6844
Email: D_Arasteh@lbl.gov
http://windows.lbl.gov/adv_Sys/integrated/default.htm

Courtesy: Lawrence Berkeley National Laboratory

A sample of a GFP baffle, removed from its barrier bag. Inert gas fills the sealed interior of the panel.

Gas-Filled Wall Panels (GFPs)

Lawrence Berkeley National Laboratory, Building Technologies Program has been working since the late 1980s on gas-filled wall panels. Using the same principles that are now common in gas-filling air space in windows, they have developed wall panels filled with an inert gas in a controlled space. They are able to achieve an R-19 wall in the space normally consumed by a 2x4 wall cavity, and R-30 in the space of a 2x6 wall cavity. Some effort has been focused on residential wall panels, as well as insulation for appliances, namely refrigerator panels filled with gas.

Issue 1
November 2001

Gas-Filled Wall Panels (GFPs), continued

A cellular structure inside the panel, with low diffusion gas barrier films in a hermetic seal, retains the panel gas fill of argon or krypton. Cost per square feet = $0.69 for 2x4, 16" o.c. wall, and $0.94 for 2x6, 16" o.c. wall. The weight is comparable or less than the weight of traditional wall construction. Technical issues being addressed include thermal aging characteristics and search for low-flame spread materials.

Contact:
Dariush Arasteh, LBL National Laboratory
Phone: 510-486-6844
Email: D_Arasteh@lbl.gov
http://gfp.lbl.gov/

Composite Building

Funded by the Office of Naval Research and developed at the U.S. Navy's Manufacturing Technology Center of Excellence for Composites Manufacturing (CECMT), this technology employs composites for the entire house. The building/shelter technology is easy to assemble. It was assembled in the Dominican Republic in less than 24 hours by 10 people without specialized tools or heavy equipment. The outside finish and roofing materials were applied within an additional 36 hours. It has very good thermal values, with R-42 roofs and R-24 walls. It is also fire resistant, corrosion resistant, and termite resistant. The DOD labs are going to work with CECMT to incorporate composites into "contingency" structures and field test them.

Contact:
Loretta DeSio
Phone: 703-696-5032
Email: desiol@onr.navy.mil

Composolite FRP Panels

This is a new lightweight, high strength, glass fiber reinforced polymer modular construction system. It has been used extensively in Europe for over 10 years, and is now being produced by Strongwell in the U.S. Applications for housing include wall panels, floor decking, and roof decking.

Contact:
Phone: 540-645-8000
Email: dfayler@strongwell.com
www.strongwell.com

Composite Housing System Uses Waste Glass

The ACE awards, recognizing the composite industry's best new applications, went to the Ambiente Housing System made completely of composite materials in September 2000. It is billed as hazard-resistant housing, designed to resist hurricanes and withstand earthquake forces. It is also fire and flame resistant. With no timber or steel in the home, it's made entirely from recycled glass core material, generating no production waste in the manufacturing process. This housing system has superior thermal and sound characteristics, is low maintenance, durable, and long lasting.

Raw waste glass is processed into honeycomb-like material, then cast into a composite of resin and fiber. This technology uses non-degradable waste. It uses 13 tons of waste glass that would have gone to landfill for each house.

This system is affordable and durable (20-year warranty). It reduces damage from natural hazards and is environmentally responsible and friendly. Ambiente has turn-key manufacturing plants developed. This technology has direct potential application for advanced wall panel systems and whole house systems.

Contact:
Malcolm Parish, Director
Ambersham Technology Group
Ambiente Housing
Luquillo, Puerto Rico
Phone: 787-889-1362
Email: ambiente@prtc.net
www.ambientehomes.com

Emergency Housing Ships Flat, Folds Out

A Milan, Italy company, Top Glass S.p.A, has developed a portable, lightweight house that ships in folded form. It is stacked three high for shipping and folds out to 92 inches high when deployed. It was developed for the Universita del Progetto, Italy, as emergency housing or command centers in natural disaster areas. The units meet international modular shipping standards. When stacked three high, they occupy similar space to truck cargo containers. The units are insulated composite panels around a metal frame that is hinged for folding. The units can be folded and unfolded many times, so they are re-locatable as well.

The units consist of composite structural panels for the sides, end walls, and roofs. The units have been structurally certified independently in Italy and Japan for design, wind, and snow loads. The units, once folded out to an 88 inch wide x 260 inch long x 92 inch high (33 inch high when folded for shipping) rectangular cube, provide 151 square feet while weighing around 3,500 lbs. Many of these principles and ideas could be applied in whole or part to the U.S. housing industry.

Contact:
Top Glass S.p.A.
Milan, Italy
www.topglass.it or
www.compositestech.com
(March/April 2001 issue of Composites Technology)

Tilt-up Foam Core Panels

Energy Panel Structures, Inc, displayed its latest technology for pre-engineered buildings at the World Dairy Expo, which allows for one of the most flexible, low-cost building options for agricultural buildings. The tilt-up foam core panels are water resistant and have 50 percent better R-values with pre-finished interiors.

Contact:
Energy Panel Structures, Inc.
Graettinger, IA
Phone: 1-800-967-2130
www.epsbuildings.com

Keep Water Away from Foundation

ElectroOsmotic Pulse (E0P) is a technology developed for the U.S. Army. It repels water molecules electronically, controlling groundwater intrusion into structures. Keeping groundwater away prevents structural and corrosion damage, while improving indoor air quality.

Contact:
Vincent Hock
Army Corps of Engineers
Construction Engineering Research Laboratory (CERL)
Phone: 217-373-6753
Email: v-hock@cecer.army.mil