Technology Transfer

Technology transfer remains a nascent movement, but more architects take up the challenge.

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In 1999 Mike Skura, vice president of architectural design at CTEK, a company that specializes in prototype glass for cars and airplanes, was startled by a phone call from architect Frank Gehry. "He said he had searched high and low for someone to do complex, compound curved glass," recalls Skura, "and wanted to know if we could do it." They had to try, of course. Skura broke a lot of glass struggling to bend large sheets into the tight curves of the Gehry-designed, glass-enclosed cafeteria in the Condé Nast headquarters in New York, but the eventual success solidified a partnership between Skura and Gehry and their separate industries. After that, CTEK got so many calls from architects for glass projects that it introduced a separate architectural division to accommodate the huge demand for complex, curved architectural safety glass.

By searching outside the confines of standard construction-industry methods and materials to find a business that supplies the automotive and aerospace industries, Gehry engaged in what is called technology transfer—simply the movement of processes or materials from one industry to another. (Of course, he had already made that leap with his much-publicized adaptation of CATIA—aerospace design software—to help rationalize the exotic geometries of his buildings.)

Technology transfer is not a new phenomenon. In fact, it's increasingly widespread in all industries, facilitated by both the Internet and federal legislation. The Space Act of 1958 required NASA to make its discoveries and inventions available to private industry. Early imports into the consumer marketplace from the aerospace industry included power drills, medical devices, Velcro, and Mylar. Countless other inventions have come from the military, including plastics, titanium, the earliest computers, rockets, and transistor radios, to name a few. Since 1980, when the Bayh-Dole Act allowed universities, not-for-profits, and small businesses to have ownership of inventions created with government funds, technology-transfer facilities have sprung up at universities across the country. Legislation in 1980 and 1986 made all federal laboratory scientists and engineers responsible for technology transfer, while over 700 laboratories were gathered under one umbrella organization, the National Technology Transfer Center.

Studio as laboratory

A renewed interest in materials and processes may also be related to the imaginative, fluid forms made possible by sophisticated software programs, especially in university architecture programs. "We feel we can control materials more now," observes Ron Witte, an associate professor at Harvard's Graduate School of Design (GSD). Osram Sylvania, for example, one of the largest manufacturers of light-emitting diodes (LEDs), has sponsored LED studios at the GSD for research, while scientists at NASA's Jet Propulsion Laboratories have worked with students to produce aerogel tiles from a solid form of the material.

Architecture schools that are closely allied with engineering programs tend to have more financial support for technology-transfer explorations. The Illinois Institute of Technology's (IIT) direction is particularly promising: The architecture program requires all undergraduates to take an Inter-Professional Curriculum (IPRO)—a series of courses that require students from different disciplines to work together on "real-life" projects. One such project for Skidmore Owings and Merrill (SOM) in Chicago had the students focus on the integration of energy-saving elements into SOM's newly designed convention center in Phoenix. The IPRO teams investigated the effect of using a building-integrated photovoltaic (BIPV) system, particularly in the exterior walls. The results were positive and provide an example of how

IPRO-generated innovations have spawned a strong relationship with IIT's technology-transfer department.

Slow but steady change

The introduction of unusual materials to architecture is incremental. In the near future, technology transfer will find its way increasingly into the development of more efficient construction methods and processes, such as factory-built components. "For the most part, exteriors are still glass, steel, and concrete. A builder is more likely to use a new lamination process borrowed from the auto industry or a joint from the sailing industry than to incorporate a totally revolutionary material or process," speculates Andrew Dent, director of the New York–based Material Connexion, a library of over 3,000 carefully reviewed innovative materials, including foams, fiberglass weaves, and photovoltaics.

There are other embedded obstacles. According to Mike Skura, part of the problem stems from the fact that insurance policies are not lenient, and there's a chain of liability that can result in expensive litigation if materials or systems fail. There are also issues of regulation. For instance, national testing requirements generally dictate that materials be tested and rated for flammability only, but local testing regulations around the country can be more restrictive.

And yet there are success stories. Even before the experimental Gehry found a company to bend glass for him, New York–based FTL Design Engineering Studio was emerging as a hybrid practice—part design, part engineering, part R&D, all innovation. Twenty-five years ago, Nicholas Goldsmith, FAIA, and Todd Dalland, FAIA, founded FTL to pioneer lightweight, tensile-structure design and other fabrication technologies. According to Goldsmith, this pursuit has less to do with inventing technologies than with finding new applications for existing ones, which is another definition of technology transfer. "We didn't invent photovoltaics," says Goldsmith. "But we did figure out a way to embed them into tensile structures." This transfer, of course, is not a simple or risk-free one. FTL conducts extensive analysis with its customized software and uses digital simulations to model the performance of materials and complex fabrication techniques.

More recently, CTEK's Skura and New York architect Joel Sanders designed a prototype for a chain of budget hotels in London called easyDorm. Prefabricated fiberglass units will be installed in the shells of gutted buildings. Mass customization allows the unit costs and maintenance costs of the hotels to be reduced so that the savings can be delivered to the customer. The modular system facilitates ease of installation, allowing the length and width of the rooms to be modified according to the dimensions of a given building or site. In rehab conditions, the system is not constrained by exterior window/wall configurations: A prefab translucent window/wall panel built behind the existing façade allows the transmission of borrowed light. The prefab components can be easily assembled on-site using local, standard construction methods and materials.

In another example of applied technology transfer, architect Christian Mitman was experimenting with a metal mesh created by a honeycomb process first used in the aerospace industry when he became so enamored of it that he developed a whole line of panels. Trademarked as Panelite, it was first used in interiors, but is now used in high-profile outdoor commissions, such as Rotterdam-based architect Rem Koolhaas's curtain wall for a new student center on the IIT campus, a panel that lets in natural light while muffling the rumblings of a nearby elevated train. Mitman's company has now progressed from adapting materials from other industries to developing them in-house, including a proprietary panel for the Koolhaas-designed Prada stores, as well as mica laminates and structural fabrics.

Technology-transfer advocates, Philadelphia-based architects Stephen Kieran, FAIA, and James Timberlake, FAIA, (page 34) are convinced that technology transfer will eventually change the way buildings are designed and constructed. "Our hope," says Kieran, "is that there will be regular affiliations and alliances with materials scientists and product engineers, working together as models of collective intelligence, making large parts of buildings in high-quality, controlled settings, using materials they're not using now, purposeful materials, not just collections of neat-looking materials."