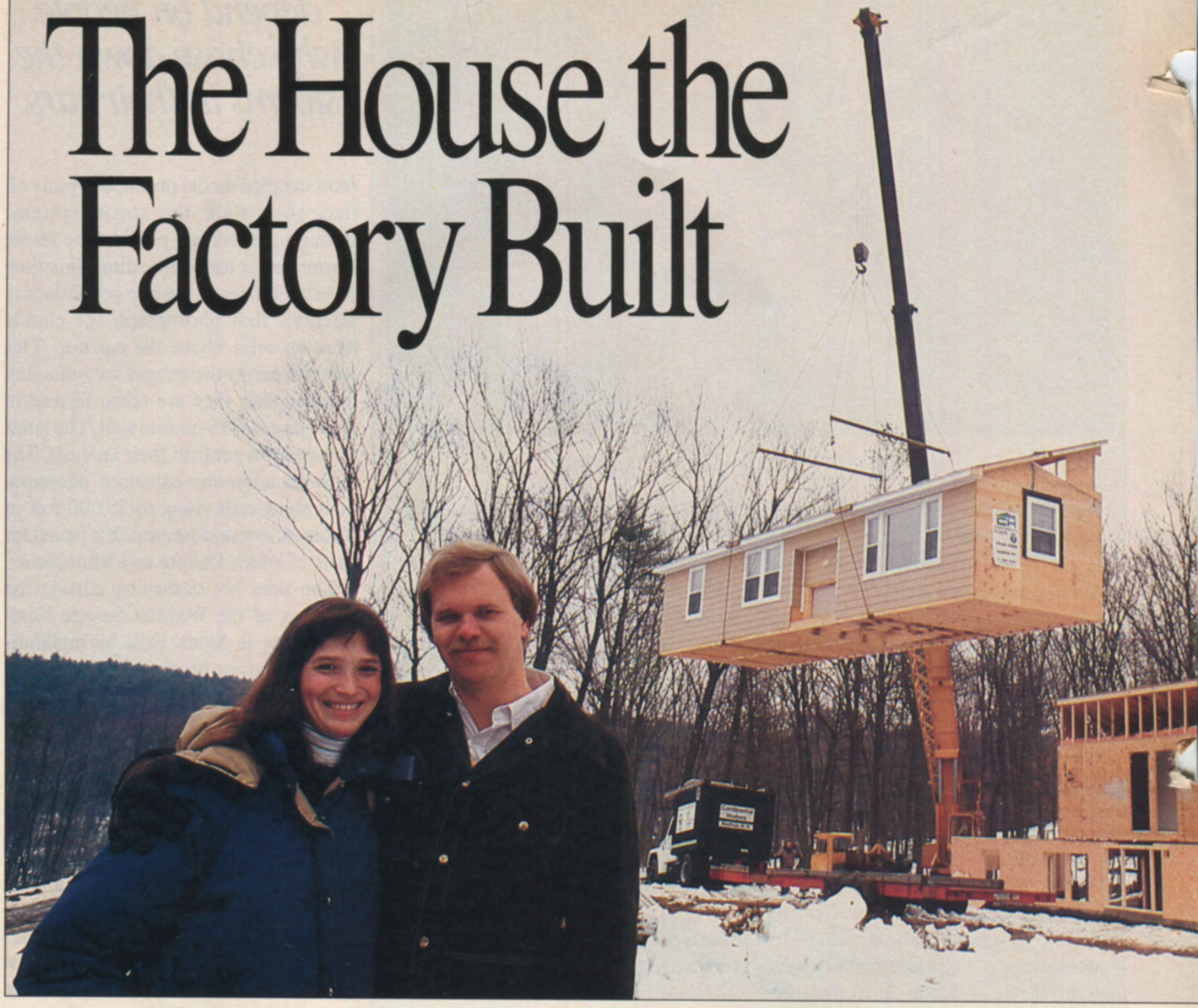
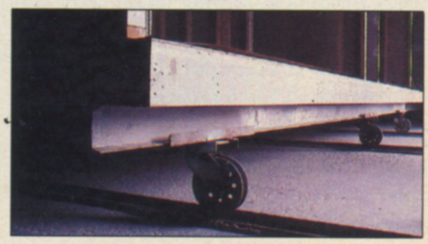
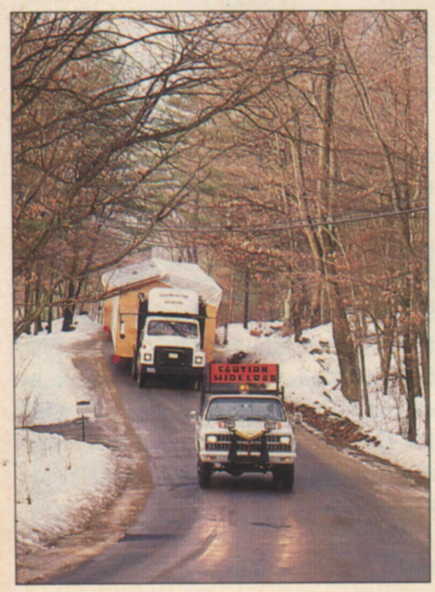
The House the Factory Built



After a scenic trip through the countryside, one of Continental's homes is lowered in place by a crane (left) while its owners wait for the final installation. BELOW: While still in the factory, the houses are transported through the assembly line on casters and temporary rails.





The American dream house can be built in four days, folded, and shipped in halves.

by John Sedgwick
photography by David Mendelsohn

Ever since the Bauhaus visionaries Le Corbusier and Walter Gropius first introduced the idea, architects have dreamed of manufacturing homes as cheaply and efficiently as cars. Now a substantial segment of housing in the United States is finally being constructed not by traditional methods on building sites, but by mass production in a factory. No one so far has done for housing what Ford (not to mention Mitsubishi) has done for automobiles, but progress has been made to bring the industrial revolution to the last major holdout—the construction trade.

One of the largest of nearly 200 home manufacturers currently rolling full-scale houses off assembly lines, Continental Homes illustrates both the successes and limitations of prefabrication technologies. While conventional builders may take months to construct even a modest ranch house, Continental turns one out of its hangarlike factory in Nashua, New Hampshire—complete with wallpaper, carpeting, and, if ordered, a dishwasher—in no more than four days. At that rate, a brand-new house is ready to be trucked to the building site every 4 hours and 45 minutes.

To meet legal restrictions for the road trip, the prefabricated house is built in sections no wider than 14 feet and no higher than 11 feet. Most of Continental's houses come in halves, with the rafters on each side hinged to fold down during transit. The pairs pass through the factory side by side, not to be joined until their final installation.

Houses begin life at Continental as mere floors—with a large square cut for each staircase—that are hoisted onto temporary rails to ride through the two-acre factory on casters. Nine pairs of sections, which at first resemble open sheds, travel at one time through the long, L-shaped assembly line to roofed, sided, and shingled completion. "Turntables" at the L's corners let the bulky freight cars make the turn. The workers provide the locomotion at Continental; at other plants, the houses are hauled by cable.

It's a labor-intensive operation despite the abundance of machinery, and 250 workers of both sexes staff the factory. Organized in teams, they scramble about the 19 work stations performing a variety of construction tasks, from framing the walls and roof, to laying out fat rolls of linoleum and wall-to-wall carpeting, to stuffing in electric wiring and insulation, to screwing in the smoke alarm and, finally, the front doorbell.

"Prefab is essentially an assembly business," explains John Mervine, owner of Nanticoke Homes, another home-manufacturing business. That's the impression you get at Continental, where construction proceeds like clockwork along the assembly line. Materials and components, from plywood panels to whole walls, are stacked to the side of the long L and hoisted onto the assembly line by an overhead crane system. As a

ABOVE: The houses-to-be move down the assembly line in various stages of completion. FAR RIGHT: In the first step of construction, the floor joists are built using a pneumatic nail gun. Once insulation has been attached (above right), siding is nailed into place (left). RIGHT: A grand vision of manufactured housing built for Montreal's Expo 67, Moshe Safdie's Habitat featured modular houses stacked like building blocks.

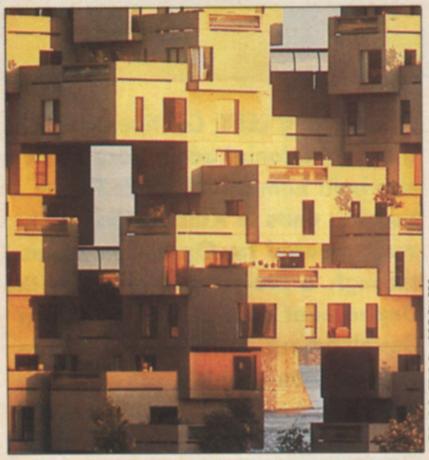
precaution against the eventual bumpy ride, much of the paneling is not only nailed in place, but glued—with pneumatic glue guns that resemble modified bicycle pumps.

Because the house doesn't have to be enclosed immediately, as it would outdoors, the workers essentially build a house inside out—laying carpeting first and installing fixtures such as insulation, wiring, and plumbing before the outside sheathing. While site builders have to contend with ladders and bulky scaffolding, prefabbers can reach the roof by ascending a carpeted staircase. Some home manufacturers have been able to cut lumber costs by recycling the scrap that collects during a job, using a tongue-and-groove machine that bonds end pieces into full-length beams.

At the end of the assembly line, the house's sections are hoisted up by a jacking system, lowered onto a trailer truck, and then hauled to the home site. The transportation route must be approved by highway authorities in advance, and the houses are prohibited from traveling on some highways during peak traffic hours. Once there, the dwelling is jacked up onto long rails and, with the aid of rollers, eased sideways onto a cement foundation. The sections are then bolted together and the siding is finished to conceal the joints at either end. The entire construction at the site usually takes about four hours.

While the transportation factor generally dictates a slightly smaller house than usual (1,500 square feet instead of the 1,600-square-foot average), prefab proponents insist that it makes for a more solid one, largely because the house is built to withstand the journey from factory to foundation. "Ours is the only form of residential housing designed by engineers as well as architects," notes Pat DiChiro of the Manufactured Housing Institute, a lobbying and trade association.

Although the limitations of manufactured housing might seem to hamper the



MOSHE SAFDIE & ASSOCIATES

designs, every conceivable style of the average American home is available prefabricated: two-story townhouses, mansard-roofed colonials, even A-frames and log cabins. Continental rolls out an occasional church or office and, in fact, recently completed a 258-room resort hotel for Snowshoe Mountain in West Virginia, which took three months to build, ship, and install. Even the industry's competitors, such as Leon Weiner, a major developer of site-built housing in Wilmington, Delaware, admit that once they're in place, "you can't tell a manufactured house from a stick-built."

Between 36 percent and 45 percent of all new homes are now prefabricated—an increase of at least 12 percent in the last five years. Most of this is attributable to the attractiveness of cheaper housing in today's recessionary market—about three-quarters of the prefabs are small, single-section houses that sell in the $19,000 range.

Nevertheless, the prefab industry still is far from realizing the expectations that its boosters have had since the turn of the century. Hoping to apply mass production to the housing industry, Moshe Safdie designed what is probably the most famous prefabricated building—his Habitat, an agglomeration of boxlike, cement units, first displayed at Montreal's Expo 67. Ironically, because of the high transportation costs for the precast concrete and the wasteful doubling of floors and ceilings in the stacked boxes, the price of a Habitat was twice what it would have been if built conventionally.

Other high architectural solutions to the problem of prefab housing have proved scarcely more successful. But the answers that the industry is now building on have come from low architecture instead—from the humble trailer. Cheap, sanitary, and easily produced, mobile homes burgeoned just after World War II to house returning servicemen. Since that time, they have been built for middle-income home buyers—at a lower price than conventional builders could

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ABOVE and LEFT: Continental's gambrel colonial easily resembles a site-built home. FAR LEFT: These housing units in Kalamazoo, Mich., were created for Operation Breakthrough, a project sponsored by the Department of Housing and Urban Development in the early 1970s to demonstrate that affordable housing could be built in an industrialized manner.

charge. Prefab savings, which stem largely from the economies of bulk purchases, continuous weather-free operation, and streamlined building methods, now range from 10 percent to 15 percent.

Still, such a modest differential disappoints some prefab enthusiasts, who claim that, with more sophisticated technologies, far greater savings could be achieved. Charles Owen, a professor of design at the Illinois Institute of Technology, is now designing a House for the Future that will be created from a kit of modular rooms and components. He believes that prefab plants could be even more innovative, and he looks forward to the use of computerization and robotics, by which the beams and boards that are now so laboriously hammered into place could be attached mechanically without the touch of a human hand. And he suggests that the finished house could one day be transported by dirigible, although he grants that some design improvements would be necessary before the structure could withstand the trip.

Today's home manufacturers say that such automation remains impractical because market fluctuations discourage heavy capital investment and the location of a plant limits the market it can serve. Thomas Nutt-Powell, author of *Manufactured Homes,* adds that, unlike the metal of cars, lumber is ill suited to machine tooling because it is difficult to cast and shape. And customization of houses makes them poor candidates for automobilelike mass production.

But even if the manufacturing techniques are not totally innovative, prefabs are quicker to produce and cheaper to buy than their conventionally built counterparts. Plus, the manufactured houses have one significant advantage over the creations of the Bauhaus architects. Unlike those imagined mass-market products, today's prefabs actually sell.

John Sedgwick, a Boston-based writer, has been interested in the housing industry since he built a cabin at the age of 12.