Factory Building & the Smaller Builder

by Jim Sackett

With improvements in technology and image, the modular approach is finding new niches

About five years ago, I was introduced to modular building while touring several of the largest housing factories in Japan. North of Tokyo, I watched a fully finished house assembled by crane from eight modules that were produced in just 45 minutes on a factory assembly line.

Since that time, I've had a chance to look at what's available from U.S. manufacturers. While I was developing a 15-unit "for sale" modular housing project for St. Louis this past year, I visited factories and developments across the country to evaluate the "industrialized" approach. I came away impressed with the benefits that modular construction can have for the small builder. The quality of these homes is excellent, and they offer real advantages both in reduced costs and shortened construction time.

Finding Acceptance

The idea of building houses in controlled, assembly-line fashion isn't new. Prefabricated iron and wood houses were shipped west to San Francisco during the 1849 Gold Rush, and over 30,000 of the legendary Sears mail-order houses were sold between 1908 and 1925.

It was in 1969 that the "Golden Age" of manufactured housing - Operation Breakthrough - was announced with great fanfare by HUD Secretary George Romney. The program, however, didn't take into account Americans' insistence on individuality, and the dream of great cost savings from factory standardization became clouded. Also, the industry has worked against itself by failing to distinguish the differences in the products it has to offer (see "Careful What You Call It," last page).

Many stick builders are skeptical because they've heard stories about factory-built modules that didn't fit the foundation when delivered or were damaged in transit. And there are always discouraging questions about what the building inspector is going to say about a finished house delivered to the site.

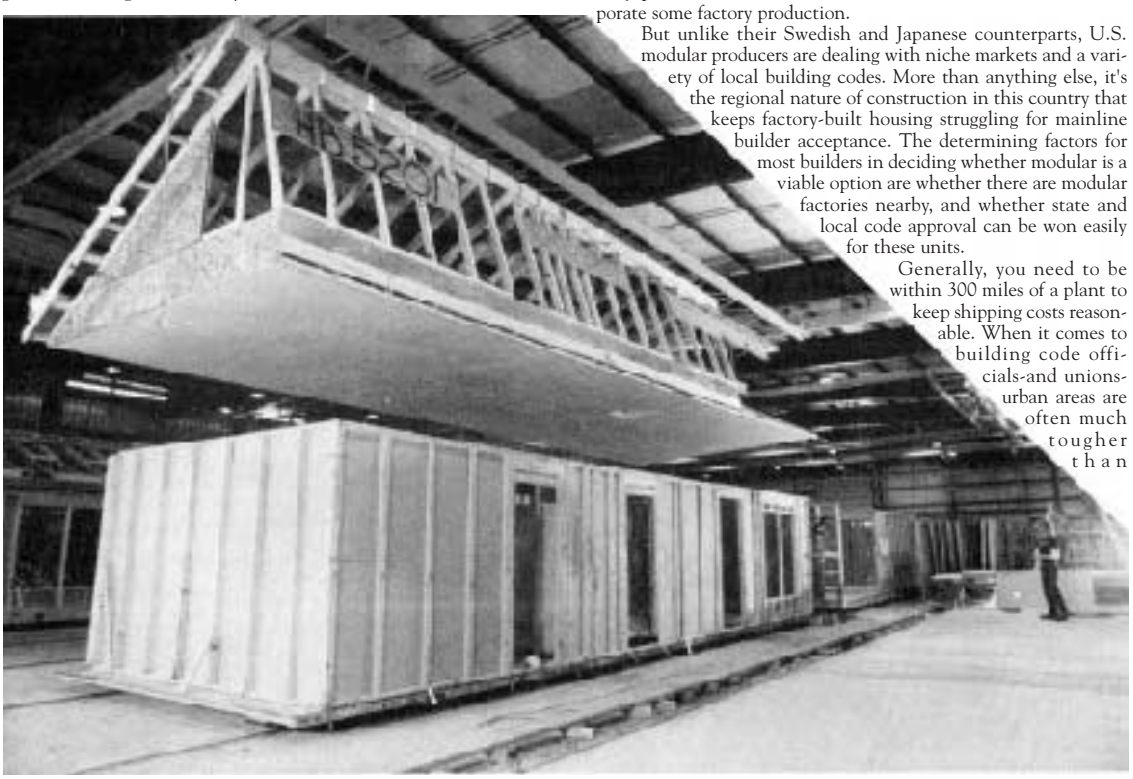
But the fact is, modular producers have become increasingly sophisticated in both technology and design during the past decade, and their products have found strong market acceptance in some areas. In most cases, it's the small builder - who's dealing with astronomical land prices, a scarcity of good subs, and competition from tract builders - who benefits the most.

Modular Here and Abroad

There are about 200 modular housing producers in the U.S. Estimates of how many new homes are built with modular vary widely. John Slayter, vice-president of research and engineering for Ryland Group, a producer of modular homes, claims there were 115,000 units built with modular in 1988. This represents about 5% of the one- to four-family homes in the U.S. (see "Factory-Built Housing: What the Numbers Say" page 21). By contrast, about 18% of the new home market in Japan is modular, and about 70% of the homes in Sweden incorporate some factory production.

But unlike their Swedish and Japanese counterparts, U.S. modular producers are dealing with niche markets and a variety of local building codes. More than anything else, it's the regional nature of construction in this country that keeps factory-built housing struggling for mainline builder acceptance. The determining factors for most builders in deciding whether modular is a viable option are whether there are modular factories nearby, and whether state and local code approval can be won easily for these units.

Generally, you need to be within 300 miles of a plant to keep shipping costs reasonable. When it comes to building code officials-and unions-urban areas are often much tougher than



Modular manufacturers complete up to 95% of the house on the assembly line, including cabinetry, carpet, and wallpaper. Modular size is limited by highway restrictions to about 14 feet wide by 60 feet long.

rural locales even if they're within striking distance of factories.

If you work New England or the Mid-Atlantic states of Pennsylvania, Virginia, Maryland, or Delaware, you have relatively easy access to modular housing. According to Fred Hallahan, a Baltimore-based consultant to the industry, the growth in factory-produced housing has unquestionably been in East Coast states. "To meet the pent-up demand for housing, builders have had a greater tendency to use modular construction, particularly on more expensive homes."

The Midwest also has a number of plants and generally good code acceptance in states like Michigan, Indiana, Illinois, Missouri, Iowa, and Kansas. Modular housing has much less of a toehold in the West where skilled labor is more available, and there is much greater competition from big production builders. In addition, distances are greater for shipping, and weather is less of a factor.

A Wide Range of Products

The modular market enjoys a range of products from modest units designed for low-income infill housing to apartments, condos, and single-family homes on the very high end. Here are some examples.

The low end. Urban builders and neighborhood groups are increasingly turning to modular housing for affordability. Also, it shortens construction time and reduces the number of contractors and subs involved. Modulars have even been used successfully in urban infill projects where the new homes must fit in historically.

Two urban housing projects using factory-built construction are the New York City Housing Partnership, and the Enterprise Foundation in Baltimore, Md. In Missouri, the Kansas City Neighborhood Alliance produced 40 low-income modular housing units in the Quality Heights neighborhood in a joint-venture with Heartland Homes (formerly Marley-Continental Homes). The 1000-square-foot single-family units (see Figure 1) cost $40,000 each to build, and are being rented to families with$12,000 to $20,000 annual income.

Middle and upper. The Ryland Group sells about 1,400 modular homes a year from three factories in Maryland and Virginia. With sales literature promoting the company as "The Builder's Builder," 90% of its houses are erected by builders doing ten homes a year or less. "Modular housing gives smaller builders the capacity to compete with the large guys who suck up the available subcontractors," says John Slayter, vice-president of research and engineering. Ryland produces traditional, mainstream American housing "whatever is being stick-built in a community," says Slayter (see Figure 2).

Factory costs to the builder of these homes in the mid-Atlantic region range from $32,000 to $80,000; once completed on the builder's or client's land, they sell for $100,000 to $400,000. "The sharp, small builder will get to know a factory, and then site customize the modular unit. They can order a house without roofing, and add shakes or dormers."

Across the Chesapeake Bay, Nanticoke Homes of Greenwood, Del., produces houses that range from ranches and Cape Cods starting at 1,120 square feet to custom homes of 4,000 square feet or more (see Figure 3). In contrast to Ryland, Nanticoke markets 90% of its housing to retail customers in Delaware. "Virtually every unit we build is different," says Carlton Goodhand, executive vice president of the firm. "Our average unit is $65,000 for a 1,400-square-foot ranch, with $15,000 to $20,000 in options." One key to Nanticoke's success is the acceptance of modular in the Delaware market, which imposes no limitation on factory-built housing.

In custom projects, Steven Winter Associates of New York City has pioneered the use of modular construction for high-end condominium and townhouse projects (see Figure 4). "We are achieving geometries and architectural shapes that weren't feasible in the past," says Winter. "These complex forms let us do a great deal with what was once only a simple, basic box." Winter's designs feature vaulted ceilings, stepped floor plans, and lots of gingerbread trim.

Douglas Cutleer, an architect in Ossining, N.Y., built a 5,700-square-foot custom "modular mansion" using a core of nine custom-designed modules. The project combines both modular and conventional framing. "Modular meant a savings of about $20 per square foot. It also meant far fewer headaches for the builder in coordination of subcontractors — 80% of the work was done before we showed up at the site."

Figure 1. *These 1,000-square-foot infill units were built for about $40 a square foot in Kansas City, Mo. Older urban neighborhoods are a growing market for lower-end modular housing.*

Figure 2. *This 2,700 square-foot modular was built in Ryland's Fredricksburg, Va., plant based on a popular stick-built floorplan. Cedar siding and shakes, (top) were installed on site, while interior frills (bottom) arrived complete.*

Figure 3. *Modular producers like Nanticoke want nothing to do with the low-end "cookie-cutter" approach as the 4,000 square-foot house above demonstrates. This Delaware home was manufactured and shipped in four modules.*

Figure 4. *Building consultant Steven Winter helped builders design and develop these upscale townhouses in the N.Y. suburbs using the modular approach. Winter contends that almost any design can be built in modules.*

Four Questions to Answer

If you're considering modular for a project, there are lots of questions that have to be answered before you jump in. As you begin to identify the manufacturers in your area and become familiar with what they have to offer, ask yourself the following questions.

Is my site really accessible? Trucking a modular house over interstate highways is one thing. Getting them through the woods, over the bridge, and under the wires to the site where grandmother will live, is another. Though most modular companies are good at logistics, it's up to you to make sure that there are no special conditions either on the way to or at the site that will get in the way of delivery and crane erection.

The big problems for shipping modules come from steep roofs and wall height. Many modular companies can do ``tilt-up'' hinged roofs that unfold to 8/12, 10/12 or even 12/12 pitches. This allows shingled roofs to be prefabricated in the plant, installed on the module sections, and quickly raised on site. Another alternative is conventional truss roof construction, applied after modules are delivered and set. For anything greater than standard 8-foot wall heights, overall trailer and module height must be considered, which can impose limitations on the design.

Can I get local code approval? According to Shep Robinson, publisher of the Manufactured Housing Newsletter, 36 states have industrialized building laws calling for either state or third-party in-plant inspection of factory-built housing. Theoretically, state approval supersedes the need for local building code approval. Many states have reciprocal arrangements, so state approval for a house built in Illinois can be accepted in say, Indiana. And most modular companies build to standard BOCA, UBC, or SBCC codes, anyway.

In practice, however, local building officials sometimes don't accept the state approval. "The guy at the top of the heap is the local building inspector," Robinson said. "If he doesn't approve the house, there is little

recourse for the builder." One alternative is site visits to the modular plant by local building department inspectors, but this is fraught with red tape and extra expense. The best way to avoid problems with code approval is to approach local officials very early in the process and find out where they stand.

Ultimately, modular housing will need changes in the building codes - perhaps a national, uniform modular code - to gain widespread acceptance. Calls for code changes are being heard, but the jury is still out on how long this might take.

Another obstacle is that few modular housing plants are union shops. Where this is an issue, you can sometimes arrange for union plumbing and electrical work on your units, but the cost often tips the scale back to stick building on site.

Can local factories produce the designs I need? This consideration is linked closely to cost. You don't want to compromise on design and lose your appeal with buyers, but the more you customize a standard design, the further you get from the economy of factory-built housing.

Most companies offer a variety of plans, from simple 900-square-foot ranch models, to nicer one-and-two-story models. Townhouse and apartment designs are also available. Given the large rural market for modular housing, particularly in the Midwest, some designs are pretty plain in appearance.

Modular costs generally include an allowance for architectural modifications. This is a benefit if a standard design can be adapted to your needs, since the allowance is generally lower than architectural design fees for a custom home. If you don't use your allowance you may be entitled to a rebate.

Depending on the company, you can have one of your own designs reviewed and estimated for factory production, usually with some modification. The trick is designing the house in modular sizes that can be shipped on the highway, typically 12- or 14-foot widths and up to 60-foot lengths. Shipping dimensions allowed for oversized loads vary from state to state.

Another design constraint is that plans produced in factories must generally gain state approval for code compliance - an inconvenience and expense that steers most companies to push set designs.

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Factory-Built Housing: What the Numbers Say

While the factory-built housing revolution hasn't yet overrun the country, it does control a significant portion of the housing market in some areas. This is made clear in a new study sponsored by the NAHB's Building Systems Council and conducted by Hallahan Associates, an independent research firm. The study, along with a 1987 NAHB builder survey, sheds light on how much factory-built housing is being used and who is using it where. The studies considered mainly modular homes, which are 80% to 95% complete when they reach the site, and panelized systems, which have preassembled wall sections - and sometimes floor and roof systems - requiring on-site assembly (for a definition of terms, see "Careful What You Call It")

Who's Building What?

The NAHB's 1987 survey asked builders what construction techniques they were using in 1981, what techniques they used in 1986, and what techniques they expected to be using in 1991. The survey shows a marked increase in the number of builders using and expecting to use factory-built systems in their businesses. Modular systems gained favor equally with builders of all sizes, while panelized systems found their greatest growth with larger builders (see Table A).

While as many as 22% of builders expected to use either modular or panelized systems by 1991, these systems made up a much smaller percentage of total housing starts in 1986 (Table B) - 2.4% for modulars, 7% for panelized systems, and 3.1% for precut systems. This suggests that few of the surveyed builders were converting completely to factory-built construction.

How Many Are They Building?

The question of how many factory-built homes the U.S. actually produces each year is not easy to answer.

For modulars in particular, estimates vary widely. McGraw-Hill's Red Book of Housing Manufacturers gives a 1988 figure of 51,000 units, for example, while Automated Builder counted 109,000 units produced that year. Meanwhile, in 1987 the NAHB used two methods to determine annual modular production for 1986 and came up with figures of 64,000 units and 91,000 units.

Finally, the 1989 NAHB-sponsored Hallahan Associates study, which included only residential production and counted only complete dwelling units, estimated 1988 U.S. production at 32,259 units. Perhaps the most significant fact is that all these studies found modular use rising steadily. Hallahan expects that trend to continue, projecting modular complete-dwelling production to rise to 42,000 in 1992 and 44,000 in 1994.

As for panelized systems, Hallahan Associates estimates total 1988 U.S. production at 130,000 units.

Factory-Built Still a Regional Phenomenon

The Hallahan Associates report confirms the regional concentration of factory-built activity.

Modulars - popular where it's crowded and wet. The Hallahan study confirmed what many suspected: most modular construction occurs east of the Rockies. In 1988, the Northeast produced almost half (45%) of the country's modular units, with the Middle Atlantic states alone accounting for 37%. Another 32% were produced in the South, mostly in the South Atlantic states. Midwestern states produced 19% of the country's modular homes, while the West accounted for only 4%.

Hallahan found the modular industry's prospects brightest in large metropolitan areas. Modular homes are most cost-effective when they are produced in low-cost areas but consumed in high-cost areas (areas that have high home prices and/or high labor costs). This cost differential has propelled Pennsylvania manufacturers to the industry's forefront. Three-quarters of the modular units produced in Pennsylvania (most of them are made in central Pennsylvania) are shipped out of state - most of them to high-cost Northeast metropolitan markets.

Metropolitan areas, because their zoning ordinances often prohibit mobile homes, also give modular its best advantage over manufactured homes (mobile homes). Hallahan found that in rural areas, where such ordinances usually don't exist, modular systems have difficulty competing with mobile homes.

Finally, in areas where builders must contend with long winters or disruptive weather patterns, the short and reliable production time associated with factory-built homes seems to give modular a boost. This too helps explain the industry's regionalization. In the West and parts of the South, mild weather year-round allows on-site builders to use conventional construction methods and still maintain dependable delivery dates.

Panelized takes a toehold in high-growth areas. Although less regionally concentrated than modular construction, panelized activity is strongest in the same areas - the Atlantic seaboard and East North Central states. This would seem to suggest that panelized activity is affected by the same region-specific factors (most notably weather) that help determine modular housing's distribution. But Hallahan Associates found that the primary factor influencing panelized construction is overall housing activity. Areas with strong total residential construction also have strong panelized activity. (This may be due partly to panelized systems' popularity among large builders, who often concentrate their business in high-growth areas.) Thus the drop in panelized construction from 137,000 units in 1984 to 130,000 units in 1988 (9% of the market share) is probably explained by the overall decline in U.S. housing starts in 1988.

Hallahan Associates sees the panelized sector as capable of phenomenal growth, potentially doubling its market share over the next few years. This projection is based on the market share panelized homes now hold in their strongest markets.

Where From Here?

The gradual, steady growth that has so far characterized factory-built housing in this country will likely continue. Any predictions of a factory-built revolution are probably premature. It is more likely that the industry will maintain its evolutionary course into and through most of the 1990s.

TABLE A:

Use of Factory-Made Housing by Builder Size

	Small Builder		Medium Builder		Large Builder	
	1981	1991	1981	1991	1981	1991
Modular	40%	12%	5%	12%	4%	13%
Open Wall Panels	10%	18%	12%	22%	16%	33%
Closed Wall Panels	5%	13%	4%	12%	10%	20%

TABLE B:

Percent of 1986 Housing Starts - Industrialized

	U.S.	Northeast	Midwest	South	West
Modular	2.4%	1.6%	4.8%	1.7%	0.4%
Panelized	7.0%	20.6%	8.9%	9.2%	0.2%
Precut	3.1%	0.6%	0.7%	5.7%	2.8%
Total	12.4%	22.8%	14.3%	16.6%	3.4%

Source: NAHB 1987 Survey of Builders

Adapted with permission from Housing Economics, a monthly NAHB newsletter. The Hallahan Associates full report, ``Factory-Built Housing in the 1990s,'' is available for $500 for NAHB members and $1,000 for nonmembers. Contact Jim Birdsong, NAHB Building Systems Council, 800/368-5242.

allowance or only use a portion of it, you may be entitled to a full rebate or a rebate of the unused portion. For custom projects, it is best to have your designer or architect work directly with the manufacturer from the start.

Are there real cost savings on this project? Although hard-cost savings are rarely emphasized by modular producers because there are so many variables, savings of up to 5% over stick building are possible in some areas. But the real savings, as much as 10%, are found in reduced soft costs - architectural design, overhead for management, and interest on construction loans.

When you get down to the bottom line, it depends on how close you are to a factory, what labor costs in your area are, and how well you're set up to spread out costs for cranes and other expenses by setting multiple units. "Generally, the cost benefit of modular housing in the mid-Atlantic states comes from shipping modular houses from rural areas with lower labor rates, to urban markets with higher land and labor costs," says Hallahan. Another benefit is in using modular housing in rural areas where the cost of getting skilled tradespeople to the site is prohibitive.

In general, the greatest cost benefits for modular is on projects of 10 to 20 units. On large, tract-housing stick-built developments, the efficiency of large-scale production and of buying materials in quantity may give you efficiency comparable to that of factory building.

On average, no-frills modular housing costs range from $30 to $35 per square foot. Transportation costs about $1 per mile per module. Crane time and site work to ``button-up'' the unit-inside and out-are the other major costs not associated with stick building.

In planning the "for sale" project in St. Louis, I compared conventional stick-built to modular costs on several attached and detached home designs. Using pricing from four Midwest factories, I found a savings of around 10% for modular in this case. The savings showed up in hard costs for the finished shell and in construction interest (by shortening completion time from 90 to 45 days on my project). Architectural cost savings, and overhead savings from reduced construction management, were not included.

But like any form of building, there are hidden costs. If you and your subs (site work, foundation, plumbing, and electrical) are new to pre-finished modules, bids will come in higher based on uncertainty, and you'll not be able to squeeze all the profit possible out of your first several projects.

Looking Toward the Future

As we enter the 1990s, more builders will be competing in the move-up market, while rising costs will make entry-level houses even tougher to build. In this atmosphere, smaller builders will find it even more difficult to compete with larger firms who command subs, financing, and available land.

The key to survival will be building smart. "The majority of builders are small and don't have a chance to be technically innovative," said Brian Curran, founder of Buffalo Homes of Butte, Mont., who is currently building modular homes in Delaware. "Modular housing can fill that void for the small builder."

With a solid base in middle and upper-end homes, and great potential in older urban areas facing shrinking federal subsidies, factory-built housing offers small stick builders another way to compete. In some ways, it may be a chance to beat the big guys at their own game. ■

Jim Sackett is a housing and energy consultant in St. Louis, Missouri.

Careful What You Call It

"Image" is a word used frequently by people involved in factory-made housing. Simply stated, this diverse industry has a large public-relations problem.

The PR concerns stem from the fact that the public (and many builders) think of all houses made in factories as mobile homes (now called manufactured housing, and often called HUD-Code housing).

But this is only one of four major categories of factory-made housing. The others are pre-cut, panelized, and modular. These three made up nearly 11% of all the one- to four-unit residences built in the U.S. in 1987. HUD-Code homes accounted for about 15%.

But back to image. In recent years, pre-cut, panelized, and modular housing manufacturers have made a point of separating themselves from the HUD-Code folks. The trade associations for the pre-cut, panelized, and modular manufacturers - The Building Systems Councils of the National Association of Home Builders (NAHB)- changed their collective name in 1987 to make the separation clear. This gives them an alternative to the term ``manufactured housing,'' which is sometimes still used for factory-built housing in general, but since 1980 has been used exclusively in federal documents to describe HUD-Code homes.

Still confused? You're not alone. Here is a short discussion of each category of factory-built housing to help you sort it out.

HUD-Code homes. Although a long way from yesterday's trailers, these manufactured homes are hauled to the site using a steel chassis that is part of their permanent floor structure. They are not subject to state and local codes, but regulated by their own national, uniform building code (Manufactured Home Construction and Safety Standards). And although the majority are being set on permanent foundations these days, they are restricted by many communities.

Pre-cut packages. This category includes log homes, domes, A-frames, and pre-cut timber frames. According to the Building Systems Council's definition, these packages contain ``all or most of the material for the central structure of the house. Outside doors and windows are generally included, and more elaborate kits contain everything needed to complete the house.''

Panelized. These homes are based on breaking a framing plan down into a series of pre-engineered, flat panels that can range from 4 to 40 feet in length. They are all sheathed or sided on the exterior, and often contain doors and windows. There are open and closed panels; both are trucked to the site and set with a crane.

Open-wall panels - with no drywall or interior finish - rarely beat stick-building on price, but do speed up the rough framing process. There is little problem with code officials since the walls are open, and all plumbing, electrical, and insulation is done on site.

Another benefit over stick framing is that you're buying a pre-engineered structural system. This relieves you of the responsibility of determining wall and roof loads. Shelter Systems, a leading manufacturer of wall panels, roof trusses, and floor trusses, offers a 30-year structural warranty to builders using its product. The company engineers the house, and provides all of the framing from the sill plate up in one package. Some builders report the warranty has proved to be a plus in selling homes.

Closed panels are delivered to the site with siding, insulation, electrical wiring, and drywall installed. These can include ``wet-cores'' - completed kitchen and bath modules in which all plumbing work is done in the factory. But closed panels have not met with widespread acceptance, largely because they offer little benefit over open panelization, and some of the problems of fully modular construction. Since walls are covered, local inspection can be a problem. Also, drywall is easily damaged in shipment.

Modular housing. This category consists of three-dimensional house sections, constructed in a plant using an assembly-line approach. According to the Building Systems Councils, "they are 90% to 95% complete." This can mean wallpaper, stone fireplaces, carpeting, and finish electrical and plumbing fixtures. Features like dormers, decks, and custom touches not offered by the factory are added on site.

Modules are typically 12 or 14 feet wide and up to 60 feet in length. Modules can be stacked for two or even three stories, and multi-family and commercial buildings are easily built this way.

Though most structural and finish elements are identical to site building, there are some interesting differences. Because these modules have to be trucked to the site and set by crane, they are heavily sheathed and engineered with very heavy floor systems to prevent racking. And since they are built where weather isn't an influence, exterior finishes can be applied last, allowing drywall finishing, electrical work, and insulation to be installed from the inside out. –*J.S.*

For More Information

Periodicals:

- ***Automated Builder.*** P.O. Box 120, Carpinteria, CA 93013; 805/684-7659. Monthly, $40 per year. Covers entire factory-built housing industry including trends, innovations, etc.
- ***Builder/Dealer.*** 16 First Avenue, Corry, PA 16407-1894; 814/664-8624. Monthly, $39 per year. Concentrates on modular, panelized, and pre-cut homes. Useful annual directory of manufacturers.
- ***Manufactured Housing Newsletter.*** Box 1307, Barrington, IL 60011; 312/381-4312. Twice monthly, $96 per year. Editor Shep Robinson has covered the full breadth of the industrialized housing industry with this newsletter since 1969.

Trade Associations:

- Building Systems Councils of the National Association of Home Builders (NAHB) (James R. Birdsong, Exec. Director), 15th & M Streets, N.W., Washington, D.C. 20005; 202/822-0576. The Building Systems Council represents manufacturers of pre-cuts, panelized, and modular homes. It is comprised of five separate groups: *Modular Building Systems Council, Panelized Building Systems Council, North American Log Home Council, National Dome Council, Assoc. Members Council (product/service suppliers).*
- *The Manufactured Housing Institute, 1745 Jefferson Davis Highway, Suite 511, Arlington, VA 22202; 703/979-6620, represents makers and suppliers of manufactured (HUD-code) homes.*

Books/Directories:

- ***The Complete Guide to Factory-Made Houses.*** A.M. Watkins. Chicago, IL: Longman Financial Services Publishing, 1988; 312/836-4400. A general guide to the industry; includes a directory of manufacturers, $11.95.
- ***Manufactured Housing: What It Is, Where It Is, How It Operates.*** Shep Robinson. Barrington, IL: Ingleside Publishing Co., 1988. A comprehensive guide to the industry that chronicles its development, and examines politics, technology, marketing, and even some of the major players. $60.
- ***Directory/Census of Manufactured Housing.*** Published by *Manufactured Housing Newsletter.* It contains 2,200 industrialized manufacturers from components to modular. $100.
- ***Housing Manufacturers Directory.*** Published by *Builder/Dealer* each year in May. Included in subscription; can also be purchased separately for $10.
- ***The Red Book of Housing Manufacturers.*** F.W. Dodge/LSI. McGraw-Hill Information Services, 1221 Avenue of the Americas, 18th floor, New York, N.Y. 10020; 212/512-3949. Annual directory with 1,600 listings; 1989's directory is $155 plus $5 shipping and handling.