

In 25 years,
a new house won't look like
a spaceship, but appearances
can be deceiving

BY ROGER YEPSEN



The Future of

The future isn't what it used to be—not when it comes to forecasting how houses will be built. In the past, Homes of Tomorrow showcased the gee-whiz technology of the moment. Reinforced concrete or steel or plate glass or plastics would deliver us to a better life. We had Mies van der Rohe's minimalist boxes, Bucky Fuller's Dymaxion Living Machine, the all-metal Aluminaire House, and Philip Johnson's fishbowl-as-home. In the 1950s, when Monsanto built its 30,000-lb. plastic House of the Future in Disneyland, Walt Disney suggested that Tomorrowland's technological wonders could help to foster world peace.

As we move into a new millennium, Walt's hopefulness sounds almost quaint. Homes of Tomorrow no longer seem to grab the public's attention. Today, the best-known futuristic home is probably the Jetsons' goofy space pad. We've lost the sense that home building can be a revolutionary means of improving society.

Even the future of home building itself is in question. We have fewer acres ripe for suburban development. Real-estate prices are escalating

beyond the reach of many families. Traditional building materials are becoming scarce and expensive. Energy is an enormous concern: witness the record-high cost of oil, a nonrenewable resource whose supplies are finite and whose global demand is increasing. With even the way we build houses under scrutiny, it shouldn't surprise anyone that design is going to be a big concern.

You'd feel at home in the future

Most consumer items play up technological bells and whistles, but our homes tend to conceal them. "We still like a house that looks like a house," says Sarah Susanka, an architect whose Not So Big House gospel has gotten a great deal of attention. No matter where building science takes us, the home of the future probably will be packaged in a familiar, cozy form, not in the shape of a bubble or dome or Modernist slab. In part, this may be a reaction to the gangly solar homes of the 1970s, which tended to be overwhelmed by their good intentions. Similarly, A-frames, yurts, and domes haven't aged well in the



Why bother forecasting the future?

It's fun to speculate about the home of the future, but what's the point?

- Winston Churchill said, "We shape our homes, then our homes shape us." And Frank Lloyd Wright boasted he could prove it, claiming he could design a dysfunctional house that would dissolve the marriage of any couple unlucky enough to live in it.
- Building new homes and remodeling old ones make up one-fifth of the U.S. gross domestic product. It often is said that housing starts can lift the United States out of a recession.
- Heating and cooling our homes consumes 13% of U.S. energy, an expense that may become unaffordable for many households.
- In a recent study, 8 out of 10 contractors predicted that their biggest headache in years to come would be a shortage of skilled carpenters.

Home Building

public's eye. Forward-looking architects and builders still are forced to reckon with clients who would rather live in a *Leave It to Beaver* colonial than an envelope-stretching marvel.

Another factor behind the slow evolution of home design is the reality of 77 million retiring baby boomers. According to a recent survey, an overwhelming majority of this white-haired tide will choose to grow old in their present homes.

Accordingly, the home-building industry can be expected to show more interest in homes that enable living in place, according to Andy Kochera, senior policy analyst with the AARP's Public Policy Institute. These homes will incorporate many senior-friendly features, such as single-floor living, excellent task lighting, and wheelchair-level appliances, switches, and counters. Another potential barrier for older occupants is dealing with the sophisticated appliances and systems that the future certainly will bring. Robert Hodder, senior policy adviser on transportation and livable communities at AARP, predicts that because this generation of homeowners is defined more

A vision of the future, 60 years ago. Buckminster Fuller's aluminum prototype house, the *Dymaxion Living Machine*, was designed to be factory-made, energy-efficient, and affordable. However, the unusual shape and a leaky roof doomed the project. Photo courtesy of the Wichita-Sedgwick County Historical Museum.



Forward-looking architects are forced to reckon with clients who would rather live in a *Leave It to Beaver* colonial.

clearly as a special market, a broad range of products will be designed with them in mind.

McMansions or shoeboxes?

Although the colonial, the Cape, the Victorian, and the bungalow seem to be with us for the foreseeable future, it's less clear if these homes will come in small, medium, large, or jumbo. Houses expand and contract like binge dieters. For now, they keep growing even though the average family is getting smaller. In 1950, new houses offered just 290 sq. ft. per family member; by 2000, that figure had swollen to more than 800 sq. ft.

An unfortunate result, says *Environmental Building News* editor Nadav Malin, is that advances in energy conservation tend to be canceled out by increases in house size. An often-repeated prediction is that homeowners (and the builders and architects who serve them) eventually will come to their senses and realize that bigger isn't necessarily better. Smaller homes not only are cheaper to build and live in, but the savings also can be put into finer materials and craftsmanship. It remains to be seen if this revelation will come about only when big houses become forbiddingly expensive.

It's not difficult to trim excess square footage from a design. But if houses shrink, architects will have all the more reason to break out of the traditional boxy assemblage of rooms, says Jean Rehcamp Larson of Rehcamp Larson Architects in Minneapolis; they will need to create "spatial experiences." Varying ceiling heights, placing windows on at least two walls of each room, providing easy access to the outdoors: These are some of the strategies that will allow homes to grow small graciously. "Builders have tended to flatten things out," says Larson. They think in terms of floor plans rather than freely exploring varied levels and ceiling heights. "But AutoCAD has the potential to help builders design in three dimensions. And 3-D modeling allows clients to see what their spaces will be like so that they may be less hesitant to accept these designs."

Green houses of every color

Just how green will our future be a generation from now? To date, our strides have been short of remarkable. "In conscience, we must mark the end of the era of substandard housing that is cheap to build but expensive and wasteful to maintain," wrote renowned timber-framer Tedd Benson. Even crediting Benson with being ahead of his time, it's disappointing to note that his words were published 25 years ago and are seldom heeded.

While contemporary sustainable homes often may look like the house next door, their design is based on forecasts of our actions on a world that doesn't yet exist. Virginia architect William McDonough calls the failure to consider the future a "generational tyranny." For example, what will be the impact of extracting enough petroleum to manufacture an asphalt roof that has an expected life of 30 years? And how about the environmental consequences of disposing of that roof? The life-cycle cost of building materials increasingly will shape

how building materials are chosen. Vinyl is now the most popular siding because of its low cost, ease of installation, and minimal maintenance, but the long view favors other alternatives. McDonough speaks of the "cradle-to-cradle" model of designing with the goal of reusing components of worn-out or obsolete products, rather than junking them or recycling them into a less-valuable form.

Does wood have a future?

If you invite someone to envision the house of the future, chances are the place won't be made of 2x4s. But ask the same person to conjure up the house of their dreams, and it's likely that wood plays a role, and not just in token touches, like a scrap of burl walnut on the dashboard of an expensive car.

Wood feels good, smells good, can look better with age, and has a lot going for it from the green point of view. It is sustainable (as long as it is harvested responsibly), healthful (it doesn't outgas toxins), and relatively durable (if maintained). Compared with other commonly used siding materials, it requires the least energy to produce and involves the least total embodied energy over its lifetime. On top of that, wood potentially has the lowest environmental impact. When a house has come to the end of its useful life, the wood components may live on in another structure—the cradle-to-cradle scenario—as when oak barn beams live on capably in a second or even a third building.

In the green scheme of things, builders also can save the expense, pollution, and energy costs of shipping by using locally produced materials. In looking for native species of wood for buildings at the Center for Maximum Potential in Texas, co-director Pliny Fisk was able to make use of mesquite, a wood best known for flavoring grilled food. Mesquite is too twisted to serve as saw logs, but it can be sawn into small blocks for parquet floors. "If you stick to your region," says Fisk, "you understand things better."

Even on a local level, though, as wood becomes pricier, conventional lumber increasingly will give way to engineered products: LVLs, roof trusses, and wall panels, as well as plywood. Just a decade ago, engineered I-joist flooring was used in only 20% of new construction; that figure is now approaching 50%. Engineered wood can be made with relatively little waste, using trees that traditionally are overlooked in favor of awe-inspiring forest giants.

As for traditional clapboard siding, don't count it out. According to the USDA Forest Service Forest Products Laboratory, horizontal lap siding will be with us for years to come. It does a good job of keeping out the rain, and it has the look that vinyl siding strives to mimic. This isn't to say that wood can't be made more durable. Sam Williams, supervising research chemist with the lab, says, "The next generation of siding materials will probably be various forms of wood/plastic composites," most of it arriving at the site with a factory finish.

Concrete, steel, and dirt

The future of wood-frame construction is far from secure. Steel framing may make dramatic inroads if lumber prices spike. Pulte Homes,

the second-biggest builder in the United States, recently began using webbed-steel joists in its manufactured homes. Concrete wins green points for durability and for making use of such potential waste products as the ash residue from coal-fired power plants. Autoclaved cellular concrete may become a household term if this material (also known as ACC) catches on. A mix of portland cement, lime, sand or recycled ash, and water, ACC has a closed-cell structure that makes it lightweight, allows it to be cut to size, and even adds a bit of insulation value. ACC panels can have a timeless look that belies their unusual makeup. Jeannie Babb Taylor, CEO of SafeCrete, an AAC manufacturer, says the material has the potential to be cast with integrated detailing. “Quoins, keystones, arches, and carvings will become the norm,” she predicts.

The redemption of the manufactured home

For centuries, the job of fabricating dwellings has been carried out by hand in a highly visible, sweaty, noisy, and somewhat hazardous process. It is a tradition-bound dance that has changed remarkably little in the past 150 years. “You wouldn’t drive a Ford Model T,” says Nebraska builder Fernando Pagés Ruiz, “but you live in one.” Innovations have been restricted largely to substituting one material for another, rather than taking an evolutionary step forward. True, the stick-built process has been tweaked in recent years to cut costs and to increase energy efficiency, but William McDonough sees this cautious approach as minimizing the bad rather than seeking bold new answers. “We are perpetuating the wrong system,” he contends. Instead, he favors designing houses that can accept new technologies easily as they become economically attractive.

Manufacturing promises to provide the paradigm shift required to dislodge the industry from its antiquated ways. The image of factory-built shelter has been tarnished by the legacy of cheaply built, disposable mobile homes. But change is well under way. While 90% of conventional homes were stick-built 25 years ago, that figure has dipped below 70% as panelized construction has built momentum. The advantages of prefabrication are clear and persuasive.

Tolerances and workmanship are closer in the factory than in the field, meaning less waste. Building a typical single-family home in the field generates an astounding 8000 lb. of leftovers destined for a landfill. Rising energy prices favor prefabs because panels are potentially more airtight than stud walls. Also, standardization allows suppliers from around the country to compete, bringing down costs and stimulating innovation.

The implications are enormous, according to Kent Larson, principal research scientist at MIT’s architecture and planning school and director of the college’s Open Source Building Alliance. He predicts that technology companies and other firms from outside the home-building industry largely will have captured the market by 2015. Beyond that, large nationwide firms will be able to afford to keep current with state-of-the-art practice, and even to invest in new technologies. Their size also will allow them to tell suppliers just what products they need, such as specifying entire wall systems.

Finally, prefab homes require little or no on-site skilled labor from the shrinking pool of capable framers and carpenters. A crew of semi-skilled installers or assemblers can do the job, points out Larson. And if a single supplier provides the home’s utility core, there won’t be the

need for a stream of subcontractors arriving in their pickup trucks and getting in each other’s way.

Redesigning the design process

The popular notion of factory-built homes is that they roll out on an assembly line, as identical as toasters. But if MIT’s Kent Larson has his way, prefabrication will allow architects and even their clients to customize homes in a revolutionary way.

Here’s the projection. Dozens of competing suppliers around the country will produce a great array of standardized components, which then can be combined in almost countless ways. To allow prospective buyers to view these components and reconfigure them into the home of their dreams, architects will develop an Internet-powered “design engine.” This program will guide buyers through the design process in much the way that a real architect might. Then, after coming up with their design, the buyers will “tour” a virtual model to see if it suits them. In this way, Larson says, architects will be able to influence the design of modestly priced houses that traditionally haven’t benefited from their professional attention.



Modified concrete as the perfect material? The scarcity of wood and the need for more energy-efficient houses may drive builders to materials such as autoclaved cellular concrete. Extremely lightweight, the concrete mix can be cast into blocks or panels, is insectproof and energy-efficient, and can be cut with a circular saw. Photos courtesy of Aercon Industries.

Larson calls this approach mass-customized rather than mass-produced, and he points out that consumers already may be familiar with the process, having specified the options for a Lexus car or a Dell computer.

For now, most manufactured homes strive to look absolutely traditional, as if to conceal their humble birth in a factory. But the constraints imposed by a set inventory of prefabbed components may have a liberating effect on design. “People say that manufactured houses have no style,” says Jean Rehcamp Larson. “But I like many of them. There is a sense of rigor, a discipline about them. They’re really intriguing, and they still allow for individual expression.” As architects develop a new manufactured aesthetic, we may find that

homebuyers begin warming up to the clean, industrial look.

Choreographing a more elegant construction

The usual way of piecing together a house is clumsy—“insane,” as Kent Larson puts it—and is problematic when designing for maximum energy efficiency. Joseph Lstiburek of Building Science Corporation in Massachusetts cites the wasteful example of carefully crafting a well-insulated, airtight house and then having an HVAC subcontractor install a conventionally sized system that’s too beefy for the job. According to the Department of Energy’s National Renewable Energy Laboratory, a home’s energy needs can be slashed by as much as 50% to 70% if the architects, contractors, and tradespeople work in an integrated way.

Open building is one way of ensuring that the design and construction processes are coordinated. As explained by Stephen Kendall, professor in the urban-planning department and director of the Building Futures Institute at Ball State University, open building “isn’t a technical idea, it’s an organizational idea.” It considers the home’s major systems individually as they will function over time, anticipating the service life of each as well as the likelihood that owners will want to make changes—turning two bedrooms into one when the kids leave home, for example.

The design of an open-built house anticipates the need to repair or upgrade these systems by keeping them “disentangled,” a term used by timber-framer Tedd Benson. One system can be worked on without interference from the rest.

Open building is a way of inoculating houses against becoming obsolete as new and improved technologies reach the market. Virginia architect William McDonough gave an example to a Sierra Club forum on energy policy. We can “prepare our buildings now for photovoltaics so that when they’re cost effective, we’re ready to put them on. One of the big problems with design is that people don’t anticipate these things.”

Going high-tech without getting weirded out

No one knows exactly how technology will affect the design of the home. But all indications are that the house will be a terrifically busy place. Digital technology is making it possible for more people to work at home, to shop on the Internet, to pick up college credits online, to do banking and read the local paper, to be entertained, and to grow old gracefully. The home also likely will generate at least some of its own energy, making it still more independent from the outside world. Zero-energy homes are being built now, as evidenced by the article that begins on p. 102 in this issue. Mark Ginsberg, deputy assistant secretary of DOE’s Office of Energy Efficiency and Renewable Energy, says we should shoot for homes that are net producers of electricity, generating 20% above their energy needs.

Lenders increasingly will allow homebuyers to fold the cost of photovoltaics into the mortgage.



Photovoltaics are looking better all the time. Thin-film, high-efficiency solar panels that can be integrated into a house’s structure will increase consumer demand, which banks and local governments will fund with energy-related subsidies.

Solar remains a best bet for on-site energy production, although the technology suffered a case of the hiccups in the 1970s. Clunky, faltering systems were tacked onto houses with less than convincing results. Although solar-generated electricity is far cheaper today than in that era, photovoltaic juice still costs two to four times that from coal or gas. As nonrenewable resources become scarcer and state and federal incentives come into play, though, PV power will look more attractive. Also, lenders increasingly will allow homebuyers to fold the cost of photovoltaics into the mortgage, making it easier to commit to incorporating PV units with a new home. PVs look more attractive, too. Silicone-wafer panels are slimming down. Still less obtrusive is the newer “thin film” technology that can be applied to the home’s skin and even windows and skylights so that the entire structure is available to generate power.

A new generation of “smart” appliances might perform still better by communicating with the world outside the household. William McDonough suggests that the home’s electrical feed could transmit information as well as kilowatts, alerting air conditioners of an impending heat wave so that they could precool at night. He even foresees that appliances might be able to search for cheap electrical energy during off-

hours and then store it for later use.

Neighborhoods for the new millennium

Sustainable houses will flourish only in sustainable communities, believes Illinois developer Perry Bigelow, whose homes are legendary in the industry for their energy efficiency. And our suburbs have failed to provide the services—and the neighborliness—that many homeowners are looking for. The boomtown approach to development, practiced by builders since the close of World War II, has got to go. That’s clear to people both within the industry and those taking a critical look at it from other fields.

The community of Amelia Park, Fla., sprang up just a few years ago, yet it looks almost eerily well-established, with mature trees shading front porches and even alleys that serve the garages in the backyard. There is a mix of houses, big and modest; cottages; row houses; and in a throwback to small-town America, apartments above shops.

Amelia Park is one of the new communities laid out according to the tenets of what has been called the new urbanism and traditional neighborhood development. Starting from principles laid down by the Florida architecture firm of Duany Plater-Zyberk & Co., these large-scale developments attempt to counter suburban sprawl. Housing is clustered, which serves both to allow setting aside open space and to make it possible to reach neighbors, parks, shops, and workplaces on foot. The quiet, leaf-shaded streets serve as social spaces, having been planned in a way that prevents cars from threatening pedestrians and bicyclists. New-urbanist communities are exploring “traffic-calming” strategies such as speed bumps, rumble strips, narrowed sections of road, and gateways.

Emily Talen, associate professor of urban and regional planning at the University of Illinois at Urbana-Champaign, says that living more compactly doesn't have to be a bitter pill. We stand to gain "much better access to services," she says, "and much higher densities of daily-life needs within easy reach. If you look at places like Seaside, Fla. [the first new-urbanist community], you realize that people are willing to pay a very high price to live in very small places." Compactness involves more than scaling down rooms. Good design is critical: "Americans will have to become much more knowledgeable about the basics of good design. It will be a good time for architects and homebuilders who have these skills."

Densely settled, well-planned towns will be easier to serve with new public-transit lines, which tend to be unfeasible when people are scattered thinly and randomly over a wide area. Just as bungalows sprang up along trolley routes a hundred years ago, tomorrow's communities can be fostered by the speedy light-rail networks now making a comeback in a number of metropolitan areas. Alternatives to cars will become especially crucial to the aging baby-boomer generation, who may be isolated in their homes if they no longer are able to negotiate high-speed freeways safely (or legally). A lack of transportation options has been found to cause older people to drop out of community life, says AARP's Robert Hodder. The result may be depression, mental decline, physical deterioration, and alcohol abuse.

Another variation on urbanism is cohousing, which combines the appeal of traditional homeownership with the advantages of living in a shared community. Although cohousing communities can be started by a developer, true cohousing is designed with the involvement of the future residents.

Typically, each household has its own living room, dining room, and kitchen, and shares a common lounge, meeting rooms, recreational facilities, and play spaces for kids. There also is likely to be a shared commitment to green values. "Most communities have some level of sustainable living written into their mission statements," says architect Mary Kraus, who lives and works in a Massachusetts cohousing complex.

Housing and the law

Thomas Jefferson believed that homeownership was key to the health and wealth of the nation. Two centuries later, the laws of the land continue to ensure that homes will be safer, more efficient, and affordable for most Americans. After World War II, the first flush of suburbs was stimulated in large part from FHA and VA loans. The current tax exemption on the interest portion of home mortgages has been called the biggest federal housing subsidy of all.

The future will hold other incentives and types of aid as well. By requiring a certain percentage of lower-priced properties, new laws will guarantee that buyers with modest incomes won't be shut out of communities in which builders might offer only high-end homes. As described by Randy Udall, head of the Community Office for Resource Efficiency in Aspen, Colo., this lower-income incentive acts as a "subsidy" that builders have to provide to be allowed to sell especially profitable mini-mansions.

After a lapse of 20 years, the recently passed federal energy bill offers tax credits for domestic-solar applications. It's predicted that states will follow with similar incentives. But laws also can slow the rate of positive change. Architects and builders may run into

restrictive codes as they pursue new methods and technologies. Similarly, mortgages either can fund innovation or frustrate it. Recently, the lender Fannie Mae began offering energy-efficient mortgages to coax people into frugal energy habits. Energy-sparing options can be financed up to 5% of the home's overall value.

Community statutes often state a minimum square footage for houses. In an interesting reversal, some jurisdictions have begun setting a maximum square footage. This restriction helps to ensure that a community won't exclude buyers with lower incomes, and it also avoids what has been called the "mansionsing" of a streetscape with homes that overwhelm their dinky lots. Also, most communities have zoning laws that segregate residential neighborhoods from commercial centers, increasing reliance

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An old idea that fights urban sprawl. To make communities more pedestrian friendly and to give public transportation a boost, future developments may look more like villages that have grown over time, built with varied building types that are America's small-town archetype.

on the automobile. These laws will have to be amended if new neighborhoods are to be pedestrian friendly.

The future, without the shock

In architectural writing about what's around the corner, the word "explosion" comes up a lot. And the phrase "tipping point" is used to get across the idea that home building is on the cusp of cataclysmic change.

Maybe. Keep in mind that concepts are easier to construct than objects that require scaffolds or cranes. And judging by an open-built MIT/Bensonwood prototype now under way, the future will arrive peering out through multipane windows and wearing a gable roof. "I don't think the gable roof is going anywhere," says Jean Rehcamp Larson.

Stephen Kendall, one of the pioneers of open building, was asked not long ago if someone who stepped into an open-built house would be aware of the fact. "Oh, I hope not!" he said with some emphasis. □

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