



OPEN Prototype Initiative

Transforming the Way America Builds Homes



An Initiative of **MIT House_n** and **Bensonwood Homes**

OPEN_2: Unity House Fact Sheet

OPEN Prototype Initiative Background

The OPEN Prototype Initiative (OPI) is a joint venture with a goal of improving the way homes are built in America. OPI brings together advanced academic research prototypes with sophisticated commercial design and production processes with an overarching goal of developing better standards for homebuilding, creating more adaptable, affordable and environmentally sustainable homes.

A collaboration between Bensonwood Homes, the Massachusetts Institute of Technology (MIT), and other industry members, OPI is developing a series of prototype homes. The first prototype home, OPEN_1 was built for brain injury clients at the Crotched Mountain Rehabilitation Center in Greenfield, NH. The home illustrates how houses can adapt to the changing needs of its owners and was built using green principles. The second prototype home dubbed "Unity House" is schedule to be assembled on-site at Unity College, known as "America's Environmental College" in May, 2008. Unity House takes the principles and innovations developed in the first house even further, illustrating how highly adaptable, customizable, Net-Zero homes could be mass-produced right now.

Unity House at a Glance

Project name: OPEN_2 Prototype, aka, "Unity House"

Location: Campus of Unity College, Unity, Maine

Unity House resident: Mitch Thomashow, Unity College president and his wife Cindy

Total square footage: 1,930 sq. ft.

Architectural design: Bensonwood Homes, Walpole, NH and MIT Open Source Building Alliance

OPEN_2 Development Partners: MIT Open Source Building Alliance, Bensonwood Homes, Dow Chemical Company, J.M. Huber Corporation

Product Sponsors: Crown Point Cabinetry, groSolar, Hallowell International, Hodell-Natco Industries, Loyalist Forest, Stevens Roofing Systems

Time line of project: Eighteen months of development. Prefabrication: two weeks. On site construction: 20 working days.

Usage

Private living area: Master Bedroom Suite with bath; guest bedroom suite with $\frac{3}{4}$ bath; two home offices; and sitting space



Model of Unity House, side view



OPEN Prototype Initiative

Transforming the Way America Builds Homes



An Initiative of [MIT House_n](#) and [Bensonwood Homes](#)

Public area: Function/multi-purpose common room (includes living space, dining area for 20 people, or area for seminars and board meetings); kitchen with open access to the common room; powder bath; screened porch; mudroom/storage area; and entryway/foyer

OPEN Prototype Initiative Goals

Goals

New paradigm: Develop a better design and building process which increases efficiency and control for builders.

Affordability: Create efficiencies of manufacturing components that will drive down the costs of construction.

Adaptability: Create homes that are readily adaptable to changing needs over time.

Conservation: Reduce the amount of waste generated in the construction process.

Education: Raise public awareness of new strategies and methods of building.

Forward thinking: Research next-generation consumer design and configuration to make high quality custom designs that are more affordable.

Upgradable: Implement new home-based health and energy management applications, networks, and sensors as they become available.

What's Cool About Unity House?

- It's designed to be Net-Zero and carbon neutral and is the first home of this type that's accessible to the average homeowner.
- You can remove walls, and access utilities and wiring, using simple hand tools.
- The home adapts to the occupants changing needs. (For example, because Unity House is a college president's home, it needs to be a living space, a function facility and a classroom. Walls with wiring can be moved and removed to create larger or smaller spaces as needed).
- Unity House is designed to generate enough power to sell excess electricity back to the grid. Adopting OPI building standards will enable the average homeowners and builders to build these types of homes.
- The average home project creates 8,000 pounds of waste. Unity House is so precisely designed there is almost no on-site construction waste (Goal is to produce only 3 garbage barrels of waste).



OPEN Prototype Initiative

Transforming the Way America Builds Homes



An Initiative of **MIT House_n** and **Bensonwood Homes**

- It's Open Source – The OPEN Prototype Initiative is sharing construction innovations with the industry to encourage adoption of improved techniques, creating efficiencies throughout the supply chain of building. OPI believes creating standardization and manufacturing and cost efficiencies throughout the industry will produce more affordable, adaptable and environmentally sound homes.



Model of Unity House

Unity House Design Elements

Environmental design: Unity House will achieve a Platinum LEED [Leadership in Energy and Environmental Design] rating standard, the highest designation for green building design and construction.

Adaptability: Designed to change with technology, occupancy, and use. Walls can be removed or repositioned with simple hand tools.

Net-Zero energy & carbon neutral: Solar hot water production; PV [photovoltaic] panels for passive electrical power generation (the house is designed to create as much electricity as it consumes); rainwater collection cistern (for use of gray water in all non-potable fixtures); state-of-the-art California Title 24 sensory feedback system to monitor indoor air quality and temperature.

Other features: Water line to an active well, sewer, underground electric lighting, underground electric conduit, fiber optics.

Construction waste: Best practices of prefabrication reduce waste from hundreds of pounds of debris (in a conventional home construction project) to about the contents of three wheelbarrows.

Project Targets

Energy usage: Build a Net-Zero home that produces as much energy as it consumes.

Open concept: Express a new model of design, fabrication, and assembly that could be used as the blueprint for the future of affordable, high performance, low energy houses.

Interior wall & fit out systems: Allow the simple transformation of spaces to expand rooms as necessary.



Unity House Model, Interior View



OPEN Prototype Initiative

Transforming the Way America Builds Homes



An Initiative of **MIT House_n** and **Bensonwood Homes**

Open Building is the Key

One of the cornerstones of the OPEN Prototype Initiative is Open Building, developed in part at MIT by John Habraken who headed MIT's Department of Architecture from 1975 to 1981, and embraced by Kent Larson, who currently heads MIT's House_n Consortium and Open Source Building Alliance.

These principles have been further refined and expanded on by Tedd Benson, founder of Bensonwood Homes of Walpole, New Hampshire. Bensonwood has been involved with Open Building techniques for nearly three decades. The Open-Built® systems that Bensonwood has developed during the past decade currently represent the state-of-the-art of Open Building in America.

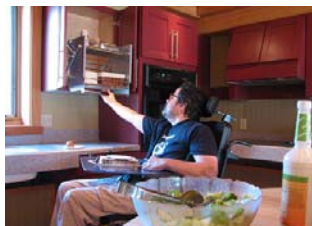
Open Building "layers" the home, disentangling components to create greater access for updating its configuration and/or services. This can extend the useful lifespan of a house from decades to hundreds of years.



OPEN_1 houses brain injury patients at Crotoned Mountain Rehabilitation Center, and can be adaptable to their changing needs.

Design for Flexibility

The systems and components in the OPEN Prototype Initiative homes are designed to accommodate changing needs and uses. This is particularly important for the occupants of OPEN_1, brain injury patients at the Crotoned Mountain Rehabilitation Center. As these occupants redevelop their physical and cognitive abilities, the home will evolve with them.

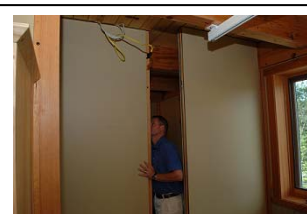


A brain injury client at Crotoned Mountain who uses a wheelchair demonstrates how his home is custom-modified with characteristics such as pull-down shelves.

Multi-use buildings such as OPEN_1 and Unity House, the home for the President of Unity College, serve both as public residences and public buildings, meaning the function of the building changes—sometimes very quickly. The ability to make larger scale modifications relatively easily is more important.

- Interior walls can be moved/removed

www.openprototype.com



Removable wall in OPEN_1.



OPEN Prototype Initiative

Transforming the Way America Builds Homes



An Initiative of **MIT House_n** and **Bensonwood Homes**

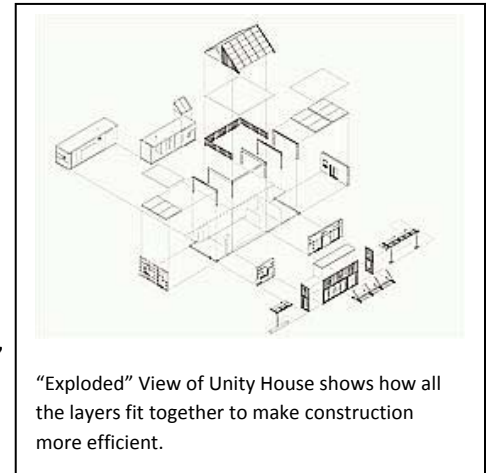
- Wiring/data accessible without cutting holes
- Plumbing, heating, HVAC easily accessible
- Renovations take less time and create less waste

Disentanglement of Systems

Open building views the home as a collection of layered systems. The layers include:

- The Site
- Structure
- Skin
- Space Plan
- Services (wiring, plumbing, HVAC, etc.)
- “Stuff” within the home (furniture, occupants, etc.)

Keeping these layers separate and disentangled allows for the creation of systems that are appropriate for their expected life spans. For example, the structural frame of a building can last 100-300 years, the skin may last 40-100 years, and the interior partition walls may need updating every 1-10 years. Access to systems, commensurate with the need for future modification, is designed into the initial plan.



Delivering Prebuilt Systems to the Site

Prebuilding components such as the floors, walls and roof allow for assembly on-site to be much more efficient than traditional homebuilding. Advantages include:

- Controlled working conditions in the shop – no rain, snow or excessive heat to encounter
- Assurance of quality of materials and workmanship
- Computerized numerically-controlled (CNC) machinery can be incorporated
- Jigs and fixtures can be installed in the shop
- Brief construction time on-site, minimizing disturbances, such as noise and dust, to people in the area



OPEN Prototype Initiative

Transforming the Way America Builds Homes



An Initiative of **MIT House_n** and **Bensonwood Homes**

Planning Inclusively and Building Virtually

One of the fundamentals of Open Building is to involve the major stakeholders and key subcontractors in the planning process for each project. When everyone is involved in the design and construction of the building beforehand, the potential for conflicts about time, space, and quality, conflicts that are common on a typical construction site, are minimized.

Bensonwood's project steward team provides expertise in project management. They coordinate meetings with the electrician, the plumber, the HVAC subcontractor and others to discuss when and how the systems will be installed, and use sophisticated 3-D modeling software for much of the work. The software can incorporate:

- Architectural drawings from designers that include site details and seasonal variables
- Information from engineers such as snow loads, wind variables, and weights that determine structural materials and sizing
- Wall panel and roof panel systems
- Exterior and interior finishes

Once the total design is complete, a high-quality, virtual 3-D model is visible.



3-D Image of OPEN_2