Report on the Technology Roadmap Work Group
December 9 - 10, 2002
BWI Hilton Garden Inn

General Session

These sessions of the PATH Roadmapping group were focused on the IT and Advanced Panel Roadmaps. During the general session of the Roadmap meeting, David Dacquisto of Newport Partners, LLC presented an overview of the contents and status of the PATH IT Roadmap. Some progress has been made in implementing all areas of the roadmap, with significant progress on several fronts. The four implementation strategies being pursued include (1) development of a "common language," (2) using IT to streamline the regulatory process, (3) creation of a non-commercial information portal, and (4) creation of an "Interactive Supply Chain." Ongoing work by Builders FirstSource and Virginia Tech has led to progress under the first and fourth strategies, and the Toolbase portal operated by NAHB Research Center represents a partial implementation of the third strategy. The need to establish or review suggested priorities in the roadmap was emphasized, and the desirability of addressing needs of small and larger builders alike as part of this work was discussed. Ron Wakefield of Virginia Tech followed with a presentation on his work documenting information flows in production building operations, then Tom Leete, Builders First Source, summarized work he has led to develop attribute-based product descriptions for lumber and panel products in an XML schema designed to facilitate e-commerce.

Mark Nowak of Newport Partners, LLC presented an overview of the Advanced Panelized Roadmap as a refresher for past participants and to introduce the roadmap to new participants. The presentation included planned activities by HUD, in particular an upcoming project to establish the performance attributes of panels. Mr. Nowak also discussed current PATH/Newport Partners LLC activities to obtain end-user input on panel functions from builders and trade contractors. Finally, Mr. Nowak discussed the need to better-define the cost analysis tool during a separate breakout session. There is a specific need to address the scope of the tool, its audience, and other issues important to the persons or group who ultimately develop the tool.

The groups then convened to breakout sessions for the remainder of the first day and the morning of day two.

Breakout Session - IT

The goals of the breakout session were to solicit participant views on the four strategies presented in the roadmap, to gather input on how to revise the document in order to reflect current priorities, thinking and progress to date, and to identify opportunities for field demonstrations and other work that would advance progress towards the vision in the roadmap.

Common Language: High Priority Items from this section focused on section 1.2 and building on the information developed by Virginia Tech and working it through with small to medium size builders to ensure relevance. (This theme was picked up again in section 4.) There was much discussion on the need to continue activities on developing common language and a

thesaurus but no real agreement. The work done to support product descriptions for the wood industry was recognized as helpful and a good example of how PATH can play a constructive role in standards development (by lending its name and federal presence), to activities carried out with financial support from industry.

There was agreement that following and participating in the ongoing activities to develop both AECXML and the Industry Foundation Classes framework would provide the basis for progress on a broader scale.

Production Management Systems: The sense of the group was that at this point it would be appropriate to survey builders and determine what types of systems are currently being used or considered by builders of various size. The results might vary by region as well as size of company. It was recommended to follow-up with Hanley-Wood to see if they are interested in either doing the survey or joint venturing on it.   Of particular interest to the builders are systems used for estimating, buying/ordering, and getting feedback from suppliers regarding the fulfillment and tracking of pending orders.

In discussing change orders, a distinction was drawn between tracking change orders for internal purposes and propagating updated information reflecting changes to third parties. The greatest interest focused on the internal tracking. While it was pointed out that software does exist allowing change order processing within larger production management systems, it wasn't clear how good the software was, or how it was used.

Production management systems could be adapted for use in land planning and land development. There was interest in survey of cities and local jurisdictions to assess the state of the art for land planning.

Non-commercial Information Portal: It was reported that the information portal described in the roadmap had been implemented (www.toolbase.org) and was getting good traffic, however, the group felt it was important to understand what types of users are visiting the site (builders, consumers, trade contractors, etc) and suggested that an acceptable way be developed to collect and track user self-classifications.

The term "non-commercial" was questioned and discussed at length. There was general agreement that what was sought was objectivity and lack of bias, and that the absence of advertising was important in communicating that message. It was recognized that it would be difficult to ever support something that was totally non-commercial unless it was government sponsored (such as NIH) or government funded. HUD pointed out that the Toolbase site currently hosted predominantly Research Center information and that the information needed to be expanded, or linkages established with other portals such as Builder OnLine and HousingZone.

The roadmap calls for the portal to present users with decision support tools. While PATH may ultimately develop such tools, the group thought it was important to catalog the analytical tools that now exist and evaluating their relevance and potential value. Government sponsored tools that should be looked at exist within EPA, DOE, and NIST. Appropriate tools could be made

available directly or indirectly through toolbase. Similarly, it was recommended that existing tools for web-based training of various parties within the building industry be inventoried and possibly offered via toolbase rather than focusing on developing new tools.

Streamlining the Regulatory Process: This is an area where the pace of implementation is controlled by local code authorities, not by builders or manufacturers. Progress has not been systematically assessed, but is believed to have been variable. Even steps as easy as accepting electronic applications for building permits over the Internet have proven elusive. Development of expert systems for plan review is impeded by local amendments to model codes as well as the inherent complexity of dealing with a variety of electronic plan formats that are not object-oriented. The use of GIS and remote sensing for inspections is still just a vision. From a practical standpoint, the highest priorities under this topic may be documenting best practices and cost saving potential for code authorities to use in making their case for greater automation, and developing a simple toolkit for jurisdictions to use in getting electronic operations underway.

Short-Term Follow-Up Items
The following short-term issues were identified for follow-up during the meeting. Some results are attached.
1. Investigate what is being done on "smart tags": low-cost chips containing embedded product codes, a possible successor to current barcoding technology.
2. Investigate work being performed at MIT relating to PATH and IT in home building
3. Investigate the "Voluntary Interindustry Commerce Standards" work being performed in conjunction with the Uniform Code Council. Lowes and Home Depot are reportedly active in this effort to develop or approve a variety of e-commerce standards. The approach differs in some respects from the attribute-based product description approach used by Builders FirstSource.

Breakout Session Participants

Bill Asdal, Asdal & Co. Builders
Liza Bowles, Newport Partners LLC
Patrick Bridges, Bridges and Associates
Wayne Ciccolo, Newport Partners LLC
Mike Crosbie, Steven Winter Associates
David Dacquisto, Newport Partners LLC
Michael Dickens, Build IQ
Tom Leete, Builders FirstSource
Carlos Martin, U.S. Department of Housing and Urban Development
Brad Oberg, IBACOS
Wayne Pignolet, EBuild
Michael Strong, Brothers Strong
Steve Thorsell, BOCA International
Michael Turner, The Home Service Store
Ron Wakefield, Virginia Polytechnic and State University

Follow-up Items from IT Roadmap Session

1. Smart Tags

The idea for Radio Frequency Identification (RFID) technologies have been around for decades, but their application has been held back in part by the expense of the tags, which ranges from just under $1 to $20. Now the potential cost has dropped to about a nickel, as sponsors of the commercially funded Auto-ID Center at Massachusetts Institute of Technology have figured out ways to produce cheap chips in quantity based on developing standards. "You need volume," says Kevin Ashton, executive director of the Auto-ID Center. "If you produce them in the billions, it'll cost as little as 5 cents." Ashton unveiled one of the first of the low-cost tags, just manufactured by Alien Technology Corp., at InformationWeek's Fall Conference in Tucson, Ariz.

- With businesses lining up behind the effort, large-scale production may not be far off. Since the Auto-ID Center was founded three years ago, membership has grown to 67. In addition to the four companies mentioned above, sponsors include Coca-Cola, the Department of Defense, Kraft, Johnson & Johnson, and Pfizer. If Procter & Gamble fully embraced the concept, it alone could account for about 2 billion chips a year
- Large retailers such as Wal-Mart will create a cascade of demand for RFID tags and the hardware and software needed to use them if those companies push business partners to adopt the technology for improved supply-chain coordination. "
- Depending on the outcome of an upcoming test, Home Depot Inc. says it could eventually put RFID tags on all of the 50,000 products it sells. If that happens, the home-improvement chain envisions asking manufacturers and distributors to join the initiative
- Unilever is conducting a three-phase trial of RFID technology, based on the Auto-ID Center's developing standard, that involves testing the tags on pallets, cases of goods, and eventually individual items.
- The Auto-ID Center is slated to publish a complete standard in the second half of next year
- Unilever is working with pallet rental company CHEP International to develop reusable shipping pallets with built-in RFID tags and with RedPrairie Corp. on applications for warehouse management that work with RFID tags
- Old Dominion Freight Line Inc. is using RFID tags on 12,000 pieces of trucking equipment to control inventory in its freight yard, track shipments, and monitor employee productivity

Reference - InformationWeek.com, David M. Ewalt, September 30, 2002

2. Relevant Work at MIT

- http://web.mit.edu/supplychain/index.html - The Integrated Supply Chain Management Program (ISCM) is a consortium of non-competing companies that was started in January 1995 by a group of faculty and staff from the Sloan School of Management and the Center for Transportation & Logistics, where the Program is currently managed. The purpose of the program is to accelerate the implementation of supply chain management principles within the sponsor companies, and to advance the state of the art of supply chain management.

- http://architecture.mit.edu/house_n/ - explores how new technologies, materials, and strategies for design can make possible dynamic, evolving places that respond to the complexities of life. An expansion of House_n: the MIT Home of the Future Consortium, this joint Media Laboratory and Department of Architecture Consortium emphasizes links between the home and places of healing, work, learning, and community.
- http://web.mit.edu/bt/www/index.html - Research projects range from experiments in specialized laboratories within the three departments to analysis, computer applications and design.
- http://ebusiness.mit.edu/ - a large-scale research program, involving over 50 faculty, participating in 42 projects, and funded by generous industry support,
- http://web.mit.edu/cipd/ - Research projects include; Virtual Customer, Distributed Object-based Modeling Environment, Information Flow Modeling and others.
- http://web.mit.edu/ctpid/www/ - Center for Technology, Policy and Industrial Development.
- http://destech.mit.edu/ - Center for Design Technology and Computation
- http://web.mit.edu/telac/ - Technology lab for advanced composites.

3. Home Depot and Supply Chain Initiatives

Home Depot Inc. is introducing customer self-checkout in its stores following a major investment in technologies from NCR Corp. and Microsoft. It's the third big IT initiative this quarter for the retailer, which also is overhauling its decision-support systems and purchasing 40,000 desktop PCs.

The world's largest home-improvement company last week said that it has signed an enterprise license agreement to use CommerceQuest Inc.'s EnableNet Data Integrator and IBM MQ Series middleware to replace its homegrown supply-chain systems. It's also buying Avaya Inc.'s Interaction Management for multichannel CRM. The company will be able to move data contained in MQSeries messages in as close to real time as possible, instead of in batches, which tend to clog its frame-relay network. It will also let Home Depot share data with partners and with its individual stores

Home Depot is using Red Hat Linux 6.1 as a key building block for a huge in-store system that its employees will use for tasks such as receiving, ordering, and inventory management. Thin clients will download Linux from the company's Hewlett-Packard and IBM servers in each store. Applications, written in Java, will also be downloaded to the thin-client terminals from the servers.

Front-end Accuracy and Service Transformation (FAST) are new partnerships with NCR Corporation (NYSE:NCR) and Microsoft (Nasdaq:MSFT). These partnerships combine leading-edge hardware and software solutions to reduce the time customers spend in check-out lines, improve the accuracy of price scanning, and enhance Home Depot cashiers' performance.

Home Depot has been active in standards development through the Voluntary Interindustry Commerce Standards Association ("VICS", http://www.vics.org). - Established in 1986, the mission of the VICS Association is to take a global leadership role in the ongoing improvement

of the flow of product and information about the product throughout the entire supply chain in the retail industry. VICS Committees include:

- ✍ Floor Ready Merchandise
- ✍ Direct to Consumer - The committee addresses business process requirements and message standards between retailers, suppliers, and transportation carriers to enable direct to consumer commerce.
- ✍ The VICS Direct to Consumer Business Requirements document has been submitted to the EAN-UCC Global Standards Management Process to request enhancements to current Business Message Standards for Item, Party and Order Processes.
- ✍ Logistics - The Committee evaluates current logistics processes throughout the product pipeline and develops guidelines for improving efficiency and accuracy in delivering products to the customer
- ✍ Product Classification - This committee, which began as a joint initiative with the Uniform Code Council (UCC) now operates as the Global Commerce Initiative (GCI) Product Classification project. Its mandate is to develop a globally acceptable, flexible product classification system that serves the general merchandise and grocery business-to-business needs for item setup, maintenance, authorization and query.
- ✍ Internet Commerce - see "Internet Commerce Model - Recommended Technologies for Internet Commerce", Version 2.0, September 26, 2001, downloadable as http://www.vics.org/documents/pdf/VICSInternetCommerceModel_Final_2002.pdf
- ✍ Collaboration, Planning, Forecasting and Replenishment - The mission of this committee is to create collaborative relationships between buyers and sellers through co-managed processes and shared information. By integrating demand and supply side processes CPFR® will improve efficiencies, increase sales, reduce fixed assets and working capital, and reduce inventory for the entire supply chain while satisfying consumer needs.

Breakout Session - Advanced Panels

The goal of the breakout session was to better define what we should and can do with the cost analysis tool. The following questions were presented and reviewed by the group:

1. What specifically is the appropriate baseline? Is it site-built, wood-frame construction? Or open-wall, wood panels? Or more-advanced existing panel technology (SIPS, Pre-cast concrete, etc)?
2. What can the tool reasonable expect to offer? Material costs, labor costs, design costs, or a complete in-place cost analysis?
3. Should the tool address all applications including roofs, walls, floors? If so, should it go further to address the whole house? Is this feasible?
4. Should national averages be used or should there be local, state, and regional comparisons? Or all of these?
5. Is a tool of this type the only way to get the information into the target user's hands?

The group decided the following regarding the questions above:

?? The baseline against which we should measure panel technology should be conventional, site-built construction. Primarily, this should be stick-built, wood-frame conventional construction but with allowances to address differences in conventional practices such as the use of masonry in Florida and other regional practices. The group suggested that a project was necessary to identify the most prevalent practices that should be the focus of the cost analysis tool development. For example, the practices used by 80% or some other number of builders may be adequate to cover a broad range of practices but would eliminate the need to address all practices.
?? The tool should address in-place costs if geared toward builders. Manufacturer input suggests a detailed breakdown is necessary for them to see how the costs are distributed. Issues that should be addressed include material costs, labor hours and costs, and design costs.
?? The tool should address the entire home as a whole but it should be set up to examine the various components separately. This will allow a manufacturer to compare panels that offer various benefits to be directly compared to the equivalent stick-built features.
?? There was no particular preference for addressing national as well as regional and local costs. One builder suggested the tool could be applied to various levels of homes (e.g., entry-level, middle of road, and move-up homes) and allow it to be moved to different areas of the country.

The group indicated that the most important use for the tool was to help manufacturers compare their technology to the baseline. The builders in the group said they want to know if the cost is within the normal range of their construction. Exact numbers are not as important to them because of the variations they see in costs. They also indicated they would be willing to pay a premium for a panel if it also offered other benefits.

The working group also stressed the need to address performance requirements as a priority activity. They strongly recommended that the cost analysis tool should be closely tied to the

performance and functional attributes. Results of these tasks are all important to manufacturers and PATH should attempt as much as is possible to deliver these items as a package.

The last question above (Is a tool of this type the only way to get the information into the target user's hands?) was addressed by reviewing a paper prepared by Newport Partners, LLC on the various option for delivering cost information to the intended audience. The Options and their advantages and disadvantages are as follows:

Cost Analysis Tool Options:

1. Comprehensive "intelligent" tool that conducts searches of the web and updates variable inputs for the user. Users will respond to a series of prompts on local market conditions, climate, etc. Outputs will be a comparison of the cost of specified alternatives to local, regional, or national practice.

2. Comprehensive tool limited to the most promising alternatives. This option is a less-advanced version of Option 1. The program will not search for updated information but will periodically be updated by an administrator. Users respond to a series of prompts on local market conditions, climate, etc. Output will be a comparison of the cost of the most promising alternatives.

3. Simplified spreadsheet or web-based tool that determines the cost of conventional construction and provides a framework for the user to enter inputs for any alternative panel product for which they have material and labor costs. The effort would focus on development of costs for conventional construction and a model to instruct users on how to develop the comparison for alternatives.

4. Expanded version of Option 3. This option could include a detailed analysis of the most widely used, commercially-available, panel products.

5. Development of a report based on an analysis of a conventional "baseline system" versus available alternatives in different regions. This is basically a one-time research study.

6. Literature review and report on studies completed to date on conventional construction versus panel systems. This task would likely be the first step required in any of the other options.

Advantages and Disadvantages of Cost Analysis Tool Options:

Option	Advantages	Disadvantages
6. Literature review and report	Short time frame	Limited to review of existing studies
5. Cost analysis of alternatives	Short time frame	Limited to existing technologies
		May require extensive studies to obtain in-place cost data and regional/local data.
4, 3. Simplified spreadsheet or model	Allows user to examine effects of different variables	May require extensive studies to obtain in-place cost data and regional/local data.
	Can be set up to allow for expansion	Would not directly address developing technologies, except by setting up a model or framework
2. Comprehensive analysis tool	Can cover large number of alternatives	Extensive resources required.
	Allows user to examine different variables	Long time frame to complete
	Easy to use, menu driven.	May require extensive studies to obtain in-place cost data and regional/local data.
		Requires administrator to update
1. Comprehensive smart tool	Blue-sky option	Blue-sky option
	Automatic updates	May require extensive studies to obtain in-place cost data and regional/local data.
	Can cover large number of alternatives	Long time frame to complete
	Allows user to examine effects of different variables	Extensive resources required.
	Easy to use, menu driven.	

The group reached general consensus that Option 3 would best serve the manufacturers. It would not be as useful for builders but the builders in the group did not necessarily view this as a

negative. They repeated comments made earlier that the cost tool is not as critical for them as having "ball-park" numbers. The group also prefers that the tool be web-based so that updates could be easily provided to users.

The group also identified a set of performance attributes that are must-do items as part of the on-going effort to develop advanced panels. These include:
- Sound
- Thermal/energy
- Fire
- Compatibility with other parts of the home (e.g., windows and wall thicknesses)
- Utilities (mainly wiring)
- Moisture
- Exposure to the elements
- User-driven functions (e.g., maintenance or hanging of pictures)
- Transport and design

The group also stressed that PATH should identify additional features that, although not mandatory, should be provided to manufacturers to encourage further improvements and innovation. Examples include durability or low maintenance, waste reduction, reduced call backs, energy/HVAC benefits, and more advanced features such as integration of PV into panels.

The group agreed that it was necessary to interview builders and trade contractors to get feedback on functions of panels. They suggested this activity be expanded to include obtaining feedback from additional manufacturers and from the academic community to seek more information on radical advances that could result in a next generation of panels.

A brief discussion was held on the scanning activities. Gary Marcus of Euro-composites agreed to help in making sure we were contacting the appropriate groups or individuals in the composites industry. Mark Nowak will send the Scanning target list to Gary for review.

Finally, the group stressed the importance of addressing disentangling of utilities. We noted that this was part of the Whole-house Roadmap. The group recommended that PATH consider elevating the importance of projects designed to remove utilities from the wall cavity, particularly wiring.

Participants in the Advanced Panelization Roadmap Breakout Session included:
Hank Adler, Hickey Custom Homes
Mike Baker, Trus Joist
Michael Blanford, US Department of HUD
Roy Diez, moderator
Dana Bres, US Department of HUD
David Cohen, Cohen Brothers
Terry Logee, US Department of Energy
Gary Marcus, Euro-Composites
Mark Nowak, Newport Partners, LLC
Larry Zarker, Newport Partners, LLC