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ASHEVILLE, NC—With energy costs rising to astronomical levels, homeowners are looking for any way possible to save money. North Carolina-based Deltec Homes, with their unique home design, has the answer.

Deltec specializes in building round homes, which tests have proven to be about twice as energy efficient as the conventional square or rectangular house. Circular structures require less exterior walls to enclose the living area. This allows for less energy to escape from the house. The aerodynamic nature of the circular design also helps reduce drafts throughout the home, which is one of the biggest reasons for increased energy use. "Some of the same qualities that make our homes so wind resistant also contribute to their high degree of energy efficiency," said Joseph Schlenk, Director of Sales and Marketing for Deltec Homes.

"Our design takes the round, energy-efficient design a step further," Schlenk said. "One example of this is the roof venting system, which is unique to Deltec's design."

The roof design contributes to lower energy use by allowing constant airflow throughout the year. The continuous airflow keeps hot air out of the attic in the

summer, reducing the need to cool the house at the level a conventional home requires. The roof system also prevents snow and ice from building up on the roof in the winter, which further reduces heating costs.

The Deltec roof also has an overhang, which keeps out solar energy from the high summer sun and allows solar energy in during the winter when the sun is at a lower angle.

"One of the reasons why we are such believers in the Deltec system is that we used to live in a house that was approximately 1,300 square feet. Our electric bills ranged from \$120 to \$250 a month," Kim, a Deltec homeowner from Magnolia, Texas, said. "Our Deltec home is almost 4,000 square feet (around three times the size of our old house) and our electric bill averages around \$120 to \$130 per month. The Deltec home is the best construction you can find."

In addition to the effective design of the homes, the construction method Deltec uses when building homes also contributes to energy conservation. Homes are constructed panel by panel and then shipped off to the building site. Each panel is constructed so they fit

together so precisely that air drafts are limited.

"We're real good at making sure that happens," Schlenk added. "We ship homes all over the world so we have to be sure the pieces fit together perfectly."

In addition to being a huge energy cost saver, Deltec homes provide numerous other benefits. Among the more important ones is the ability to withstand hurricane-level winds.

As storms battered homes in 2005, Deltec-built houses were able to fight off the winds and survive with no structural damage.

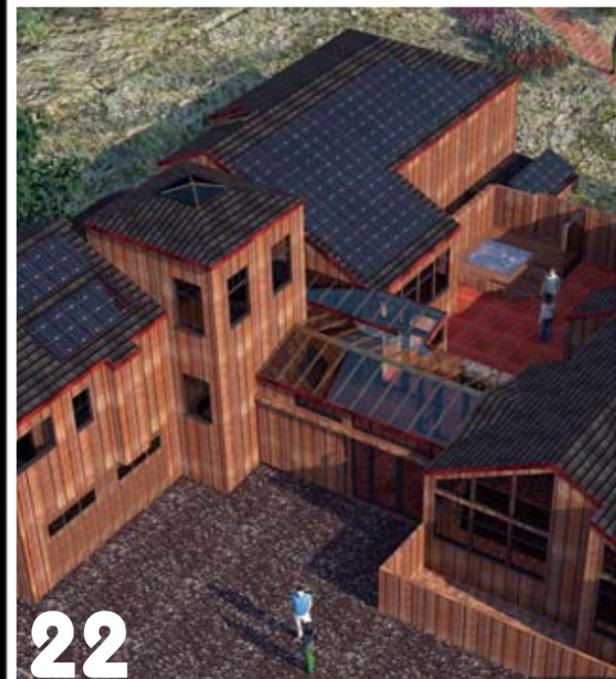
"After Hurricane Katrina we contacted all of our homeowners that were in her path," Schlenk said. "None of the homes suffered any structural damage. Any damage was limited to either minor cosmetic damage or a few missing roof shingles."

Besides the functional features that make these homes so appealing to homeowners, the houses also have an unmatched visual appeal. The unique design and flexible floor plans allow owners to build their dream home. The plentiful windows frame the spectacular views whether the house is in the mountains or on the water.

"Our design allows the homeowner to customize their home, including having windows where they want," Schlenk said. "There are not many designs that can capture a view the way a Deltec home can. When you consider all of the benefits that our design offers—high wind resistance, energy efficiency, design flexibility and overall quality, and high curb appeal—we feel that we can offer our customers the perfect home."

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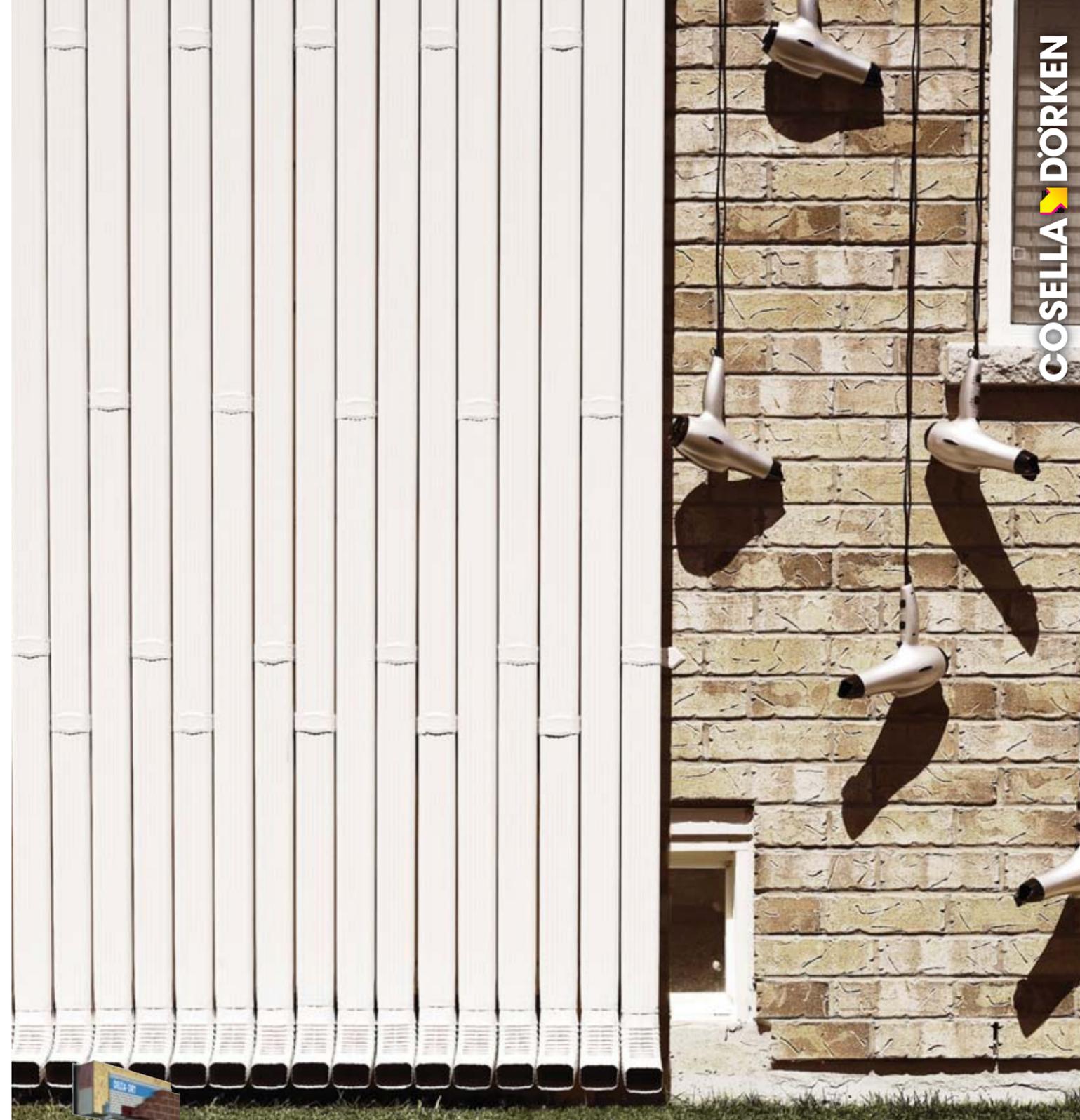
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Editor-In-Chief & Publisher

Gary Reber

Executive Publisher

Marlene Reber

Editorial Directors:

Wolfgang Preiser, Ph.D.

Universal Design

Demian Martin

Electronic Lifestyles

Rob Scheschareg

Electronic Home Healthcare

Bill Wilson

Environmental Design

Ann V. Edminster, M.Arch

LEED Design

Jay Hall, Ph.D.

LEED Design

Julie Stewart-Pollack, ASID, IDEC

Biophilic Design

Contributing Writers:

Eric Ash

Michael Laird

Patricia Rizzo

Rosemarie Rossetti

Charles Schwab, AIA

Sarah Susanka, AIA

Andy Willcox

Pamela Winikoff

Staff:

Sarah Scaglione

Director Of Marketing/Products Editor

James Bertz

Art Director

Nathanael Fowler

Information Systems Manager/Webzine

Designer/Webmaster

Tricia Spears

Editor

Jack Kelley

Editor

Subscription/Production

Stacey Pendry, Subscriptions Manager

Bernice McCarty, Customer Service

27645 Commerce Center Drive

Temecula, CA 92590 / 888 977 7827

Phone 951 676 4914 / Fax 951 693 2960

Subscriptions@UltimateHomeDesign.com

UHD Publications.com STORE

Contact: Stacey Pendry, Customer Service

E-mail: Stacey@UltimateHomeDesign.com

MISSION STATEMENT

The mission of *Ultimate Home Design* is to serve as a catalyst for homeowners to create demand for architects, designers, and builders to adopt the concepts and building practices that define human-centered, optimum-performance home design. *Ultimate Home Design* is aimed at broadening the segment of the American population that is paying closer attention to the products they buy, looking beyond price and branding to focus on other elements of the production and value chain. Increasingly homeowners want to support sustainable building practices that result in a higher living standard. *Ultimate Home Design* is for those homeowners who want to promote a broader shift in patterns of production and consumption by encouraging practices that better reflect their personal values. We are advocates for using products that reduce energy and use renewable, recycled content or otherwise environmentally preferable materials. An important part of our mission is to promote building practices that result in a substantial reduction in energy use for space conditioning, water heating, lighting, and appliance operation. Another important aspect of our mission is to promote construction practices that improve the indoor environment and reduce the risk of building-related illness. This translates to improved occupant health and comfort by improving thermal comfort; natural lighting and electric illumination; and controlling humidity, odor, noise, and vibration.

Ultimate Home Design is for the thinking homeowner, who wants to be educated and learn about intelligent options for home design, whole-house system design, and comprehensive electronic lifestyle features that can enrich the quality of day-to-day life while reducing the cost of operating a home. With the knowledge gained reading *Ultimate Home Design*, you will be empowered to make intelligent choices about the design and make-up of your home, whether considering remodels or additions, planning a new home, or evaluating an already-built home. *Ultimate Home Design* will explore the wide range of possibilities within the context of designing Optimum Performance Homes™ that integrate universal design architecture; sustainable green building materials and techniques; energy-efficient power systems for electricity, lighting, heating, and air conditioning; water conservation techniques; and comprehensive electronic lifestyle features.

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Ultimate Home Design's Publisher Gary Reber, E-mail: Gary@UltimateHomeDesign.com or

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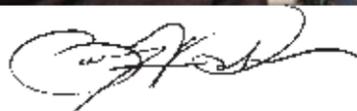


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Is Your Home GreenSpec'd?

The recent Greenbuild Conference and Expo in Denver, Colorado, held last November, was a successful confab offering extensive educational seminars produced by the U.S. Green Building Council, the framers of the LEED® certification programs. LEED stands for Leadership in Energy and Environmental Design.

I was particularly impressed with the extent to which exhibitors showed support for "Going Green," proudly displaying at their booths the "GreenSpec®" product certification emblem. The GreenSpec icon signifies that a product respects the value of our planet's natural resources. An entire book explores this subject with a directory of every product that has to date been certified. Titled, *Green Building Products—The GreenSpec Guide To Residential Building Materials* (Revised 2nd Edition), the book is edited by Alex Wilson and Mark Piepkorn and published by BuildingGreen, Inc. and New Society Publishers (available through *Ultimate Home Design's* Web site: www.ultimatehomedesign.com). This is the book for those concerned about energy costs, old-growth forests, durability, and long-term value; and those looking for ways to be sure that their homes are healthy, safe, beautiful, and efficient. I highly recommend this book as a reliable reference source and a very much needed tool in building a house that is green. I know, because I have spent the past five years doing my own research in designing the first Optimum Performance Home™, and this book could have benefitted me tremendously in that task.

The other rewarding event I attended was the recent AARP® Life@50+ National Event and Expo held in



Anaheim, California. There I found a number of companies displaying products that simply were designed smarter and easy to use. The highlights were Ultratec's CapTel captioned telephone with large, readable dialing buttons. You can use the caption feature or simply turn it off and use it as a traditional telephone that is easy to operate (CapTel@CapTelMail.com). One model of the CapTel phone featured a USB™ port to connect to your computer. Along the same lines were several Digital Clarity Power™ amplified caller ID phones (www.weitbrecht.com). Safety+Mate is an emergency instruction device (EID), which every home should have readily at hand. The portable audible and interactive device provides easy-to-understand life-saving verbal instructions for numerous emergencies (www.safetymate.com). The Samsung Jitterbugs are palm-fitting easy-to-use mobile phones with buttons that are bigger and backlit. The sound is loud and clear and the screen is bright and easy to use. The Jitterbug OneTouch™ is a smart choice if you want the security of having a cell phone in your car, purse, or pocket in case of emergency. All the features are accessed, including voice mail, by answering simple "Yes" or "No" questions, and there are large single buttons for operator, tow, and 911 (800 724 0268 / www.jitterbug.com). EnableMart, the specialty Web cataloger known for "Technology For Everyone," displayed numerous products that will help to simplify and make anyone's life more productive (www.enablemart.com). Finally, SmartHome (part of SmartLabs) exhibited a number of products, including a range of INSTEON™ devices, as featured in their Best Buy's catalog (www.smarthome.com). With a rapidly aging population of "baby boomers," it is gratifying to know that there are so many companies offering products that support people who wish to age-in-place in their own homes.

Inside This Issue

Part VII continues as a case study of the design and building of the first Optimum Performance Home™, a Platinum-level LEED for Homes project. In this part, I spend considerable space describing the design of the dedicated home theatre and rear-projection room. This Optimum Performance Home Theatre will provide an absolute thrilling experience with cutting-edge picture and sound reproduction. The construction will employ eco-friendly materials, which include Amvic insulating concrete

form (ICF) walls, FSC-certified (Forest Stewardship Council) engineered lumber, Latitude wool insulation, Henkel OSI Green Series™ acoustical sealant, Sheetrock™ and Quiet Solution QuietRock® gypsum panels, IAC steel doors, Earth Weave Bio-Floor sustainable wool carpet, and ENERGY STAR-qualified lighting.

Our cover story features one of Sarah Susanka's home designs for everyday living. Sarah does not advocate that we build small spaces, as often people will say. Rather, she urges making better use of the spaces we actually use every day by designing them to feel more spacious, more beautiful, and inspiring to live in. Sarah designs houses for those who want a house that fits the way they really live, and who want a place that friends and

family will love to visit because it embodies the qualities of home. Rooms are sized to retain their more appropriate human-scaled dimensions, while giving them a spacious feel. She has written extensively on such themes in a series of books, the first published being *The Not So Big House*.

We also explore a bit of the control side of an electronic lifestyle home design with articles on INSTEON™, the whole-house command and control technology developed by SmartLabs, "Bright Ideas For Fighting High Energy Bills" by Pamela Winikoff, and Home Heartbeat, a ZigBee wireless network home awareness product that provides homeowners with peace of mind. I believe the highlight of this issue is the wonderful and enlightening article,

"Lighting For Universal Design," authored by Patricia Rizzo of the Lighting Research Center, part of Rensselaer Polytechnic Institute in Troy, New York. Patricia explores the application of light—what we do with lights, where we place them, how much area we light with them, what color "white" light we choose, what shadows we cast, or which artwork we accent.

You might conclude from the contents in this issue that the focus is on "Electronic Lifestyle," and you would be right, though we have only scratched the surface in discussing this fascinating subject. We will return to this subject often in the course of future issues.

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Consumer Demand Brings Healthcare Services Home

Did you know that every day 5,500 baby boomers turn 65? By now, it's no secret that the Baby Boomer generation composes the lion's share of the current population. Influencing everything from politics to marketplace decisions, baby boomers are in fact, our largest group of market drivers. Today's adults who are 50 years and older are more active than their predecessors and most of them want to age gracefully while living in the comfort of their own homes. However, since the golden age of 50 also brings about the onset of chronic conditions, manufacturers are broadening their horizons when it comes to home healthcare solutions.

While older generations are steadily becoming more active, they are also becoming more tech savvy. In a recent study conducted by The Center For Aging Services Technologies, it was found that 90 percent of surveyed baby boomers were willing to pay \$50 or more per month, out of pocket, for technology solutions that effectively meet their families' needs to stay healthy and independent. With the price of healthcare services steadily rising, coupled with the inability of hospitals and doctor's offices to keep up with the increased workload, bringing healthcare services and products into the home has become an industry priority.

Integrating home healthcare products and services is not only a priority for maturing consumers. Now, more than ever, family members are looking for convenient and safe ways to keep an eye on an aging parent or assist in managing elder family member's needs. According to an ADT Security Services Survey (March, 2005), seven

million Americans are responsible for the care of an elder who lives, on average, 300 miles away. With the variety of technology-enabled healthcare products and services available, family members are provided the desired "snapshot" into the daily lives of their elderly parents.

Most of us equate home healthcare monitoring with the "I've fallen and can't get up" Personal Emergency Response Systems (PERS) we've seen on television. With the advent of platforms such as wireless, broadband and standard phone lines, the delivery of home healthcare has been drastically expanded. Products generally fall into one of the categories below:

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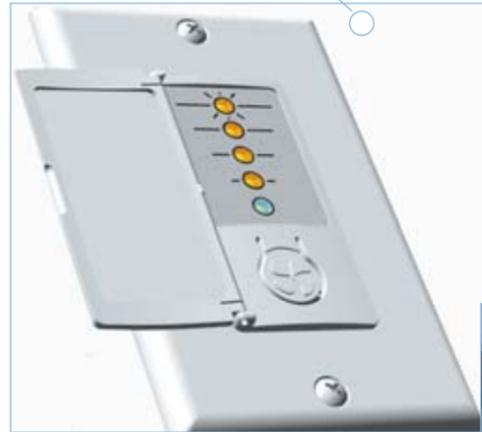


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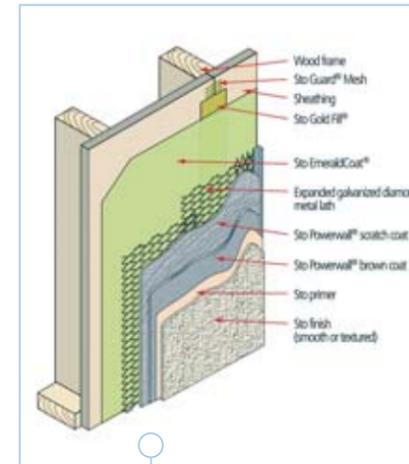


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DESIGN for everyday living

Light at the end of a hallway draws us into a space, directing our view and urging us forward to explore the spaces along the way



A Welcoming Entry

The front entry of the Not So Big Showhouse is set back from the face of the house. The deep porch reaches out to visitors, and gives the impression that you've already been received by the house before you've been invited inside. As

"Comfort has nothing to do with size. Comfort in homes is attained by tailoring our houses to fit the way we really live. I'm not advocating we build small spaces. Rather, I urge making better use of the spaces we actually use every day by designing them to feel more spacious, more beautiful, and inspiring to live in."

you stand inside the entry vestibule, at the threshold of the main house, you are essentially looking along a hallway that runs the entire width of the house, but it is far more interesting than a typical enclosed hallway would be. What makes this view particularly intriguing, and what draws you into the space, is the partially hidden view of the dining room, which makes you want to see more. This is just one of the techniques you can use to make a house more engaging.

Looking down this open hallway (page 16), your eyes are attracted by the window at the far end. This is an example of a principle that architects commonly use to draw you from place to place without your knowing it. It's what I call "Light To Walk Toward." Our attention to light subliminally draws us toward brightness, so placing a window at the end of a long hallway works like light at the end of a tunnel: We move toward the focal point of brightness, and are compelled to explore the other places along the way.

A New 'Great' Room

What makes this living area different from the standard great room is the use of varying ceiling heights to identify one place from the next, without using walls. None of the spaces

In the living area and kitchen, changes in ceiling height help to define these distinct spaces.

Sarah Susanka, AIA

synopsis

-  The house is designed for all of us who want a house that fits the way we really live, and who want a place that friends and family will love to visit because it embodies the qualities of home.
-  The rooms retain their more appropriate human-scaled dimensions, for a spacious feel.
-  One of the key ingredients in the design of the Not So Big Showhouse is the use of our human physiological instincts regarding space and light to vitalize a design, and to make it feel like "home."

As a residential architect, I often hear my clients say that the oversized formal spaces central to so many new homes go largely unused. Huge sections of the average house today sit vacant, waiting for "formal" guests who never arrive. And so much money is spent on these spaces, there's little left in the budget to make the spaces that are used everyday really sing.

In the Not So Big Showhouse, we have taken a different approach—a Not So Big approach. We invested our budget on crafting everyday spaces, and making them sing by eliminating the rooms we rarely use. This house is designed for all of us who want a house that fits the way we really live, and who want a place that friends and family will love to visit because it embodies the qualities of home. In this article, as in the audio and CD/Web tours of the Showhouse, I'll walk you through this Showhouse, describing along the way a few of the key principles to using Space, Light, and Order that are inherent to successful residential design.





In the dining room, a headband—the horizontal trim at the base of the soffits—combined with the use of a darker wall color, tells our senses, that the ceiling is higher than it actually is.



In the mudroom, the coat-hanging and mail-sorting places have been differentiated from the hallway by a dropped ceiling that gives each function a discrete identity.

are particularly tall or grand, yet each is a clearly separate activity place, and all of them work well together.

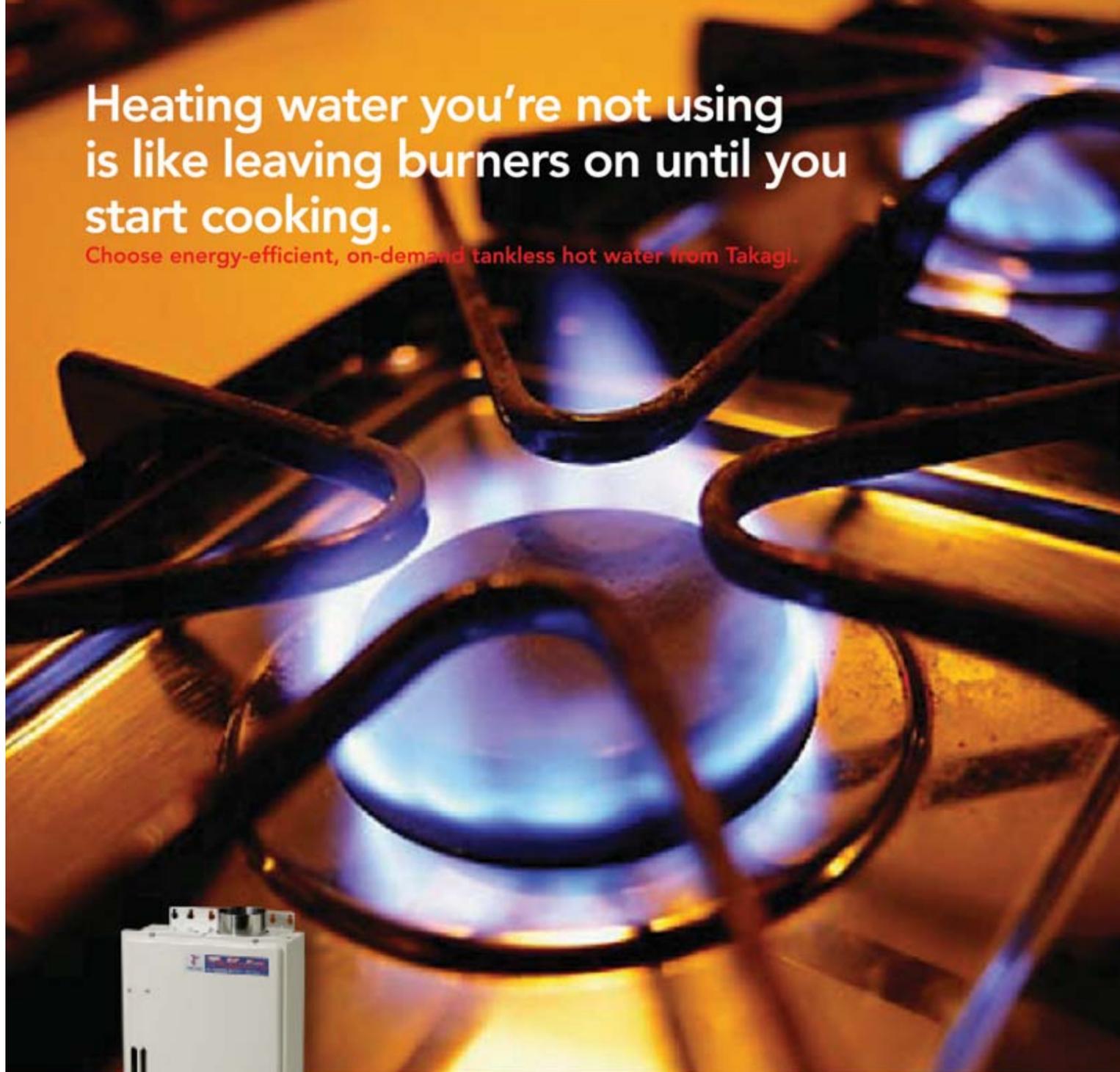
In fact, Ceiling Height Variety is used throughout the house to sculpt the various rooms to better serve their functions. Without the change in ceiling height, rooms would turn into rather nondescript areas, with little or no order to them. The soffits bring the edges of the room down to provide a sense of shelter, as well as make the space more appealing.

Contrast And Illusion

Architects are magicians of space and light, where magic is simply something that isn't readily understood by just looking at it. They use the art of illusion to make less seem like more, and they use contrast—such as the difference between a bright window and a darker surrounding wall—to make our senses take notice.

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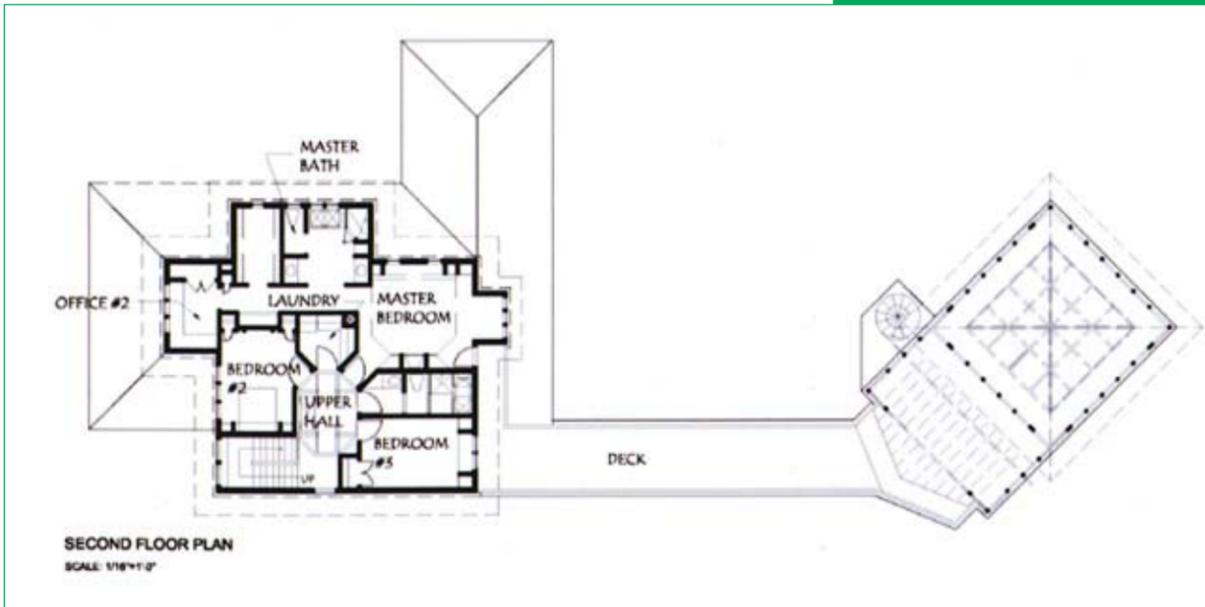
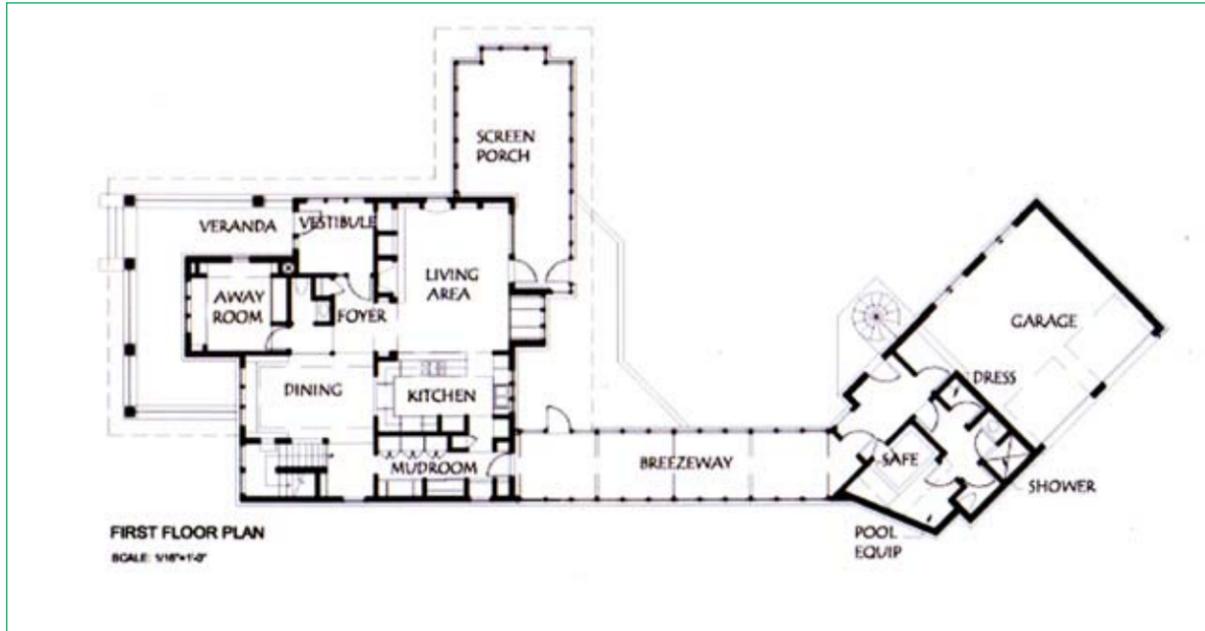
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Take a look at the trim line that surrounds the dining room, just above window height. This line, which I call a headband, is used consistently throughout the Not So Big Showhouse, with a different color of paint applied above and below the line of wood. The contrast between the colors, combined with the separation of the wall surface into two parts, tells our senses that the ceiling is higher than it actually is. This allows the rooms to retain their more appropriate human-scaled dimensions, while giving them a spacious feel.

A Sense Of Order

When I design a new house like the Not So Big Showhouse, I'll work on the designs for both the inside and the outside simultaneously, to give the whole house a sense of order and integrity. On the outside, I try to give the house a shape that fits into the neighborhood, so, in this case, I used a simple square form that resembled the surrounding houses. I think of the composition of roof forms, so that the relative proportions of the windows-to-wall surfaces, overhangs, and roof slope all combine to look pleasing to the eye.

As I designed this space, I slipped between the floor plan and the roof plan, so I was always looking at the interplay between them. That way there's always a continuity of roof from one place to the other. In this case, the eaves' line throughout the house is always at the same height. The same kind of consideration is given to the inside as well. To make the final configuration of spaces flow naturally and gracefully, an architect will typically do a number of iterations of the layout, trying to find a solution in which all the parts fall effortlessly together.

The upper hall of the house presented some interesting challenges on this front. There were five doors, all needing to open onto their respective rooms—three bedrooms, a bathroom,

and a laundry room. After studying several versions of the plan, I arrived at a landing shape that's basically an elongated octagon. This familiar geometrical form lends an order to the space, which might otherwise seem overwhelmed with doors. The octagon is an organizing feature that gives you a way of relating to the multiplicity of entries in a different way.

Combining Elements

You can see all of the primary ingredients—Space, Light, and Order—come together in this home's master bedroom. The ceiling has been crafted to emphasize the center of the room, the tallest area, but in so doing it gives a sense of shelter to the areas beneath the lowered ceilings—the bed, the window seat, and the entrance to the room. Daylight reflects off the side-wall of the window seat, providing a bright spot that draws you into the space, while the painted wall behind the bed lends the room a distinct "Point Of Focus." Like the landing, the entire composition is given an overarching order by the shape of the taller ceiling, which has a much simpler form than that of the perimeter walls. What could have been just an ordinary, and rather amorphous bedroom, with an eight-foot ceiling, has been turned into a place of elegant comfort and quiet remove.

One of the key ingredients in the design of the Not So Big Showhouse is

the use of our human physiological instincts regarding space and light to vitalize a design, and to make it feel like "home." Throughout this design, I use our inclination to move toward light to literally steer people through the house. I use ceiling height variations to give shelter and intimacy to some of the activity places and to give added importance to others. And I use simple geometrical forms and patterns to make the house more intelligible and, therefore, more welcoming.

The ideas embodied in the Not So Big Showhouse, and which I articulate in my books, are intended to give everyone—owner, builder, and architect—a common language for understanding the principles that underlie a well-designed home. It is my intention that you will find sufficient inspiration in these principles to create your own Not So Big homes—whether for yourself, or for others, wherever you live and work. **UHD**



The Author

Sarah Susanka is a best-selling author, architect, and cultural visionary, and has emerged as a leader of a movement that continues to shape the future of the American home. This article was adapted from her latest book, *Home By Design: Transforming Your House Into Home* (Taunton Press, 2004).

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The First Optimum Performance Home™ home theatre structure part VII

Gary Reber



The Sea Ranch, Sonoma County, California

synopsis

The reference home theatre will serve as a review laboratory with a direct high-definition video conferencing system operational from the home office and inside the theatre.

A proprietary automated Room Optimizer Sizer™ computing program modeled the size of the theatre room at 26 feet deep x 21 feet 8.6 inches wide x 13 feet 11.9 inches high, or approximately 8,000 cubic square feet.

The solution to room anomalies is a selection of panels which provide selective high- and mid-frequency and low-frequency sound absorption, reflection, and diffusion characteristics over a wide or narrow bandwidth depending on the acoustical needs of the listening environment.

The design of the home theatre will provide the flexibility to target and treat the specific acoustic needs relative to the room's optimal frequency response, resulting from the combination of the room's acoustical nature and applied treatments and the source, amplification, and loudspeaker performance capabilities.

Introduction

This is the seventh article in the series documenting the design and construction of the first Optimum Performance Home™. The project has been selected by the U.S. Green Building Council (USGBC) for inclusion in the national Leadership In Energy & Environmental Design (LEED®) for Homes pilot program, their new green build certification initiative, and its goal is Platinum certification.

z County, along the Northern California coastline of the Pacific Ocean, approximately 110 miles north of San Francisco.

The showcase project is exemplary of the "Ultimate Home Design™" concept, which integrates age-friendly universal design with the best sustainable building practices while exerting minimal impact on the environment. Universal design is the inclusive, non-discriminatory design of products, buildings, environments, and urban infrastructure, as well as information technologies that are accessible to and useable by (almost) all. With respect to home design, the idea is to design and build homes that have no physical barriers, thus sustaining people of all ages and all capabilities in a functional, comfortable, and aesthetic lifestyle.

A building science systems approach to home building is the cornerstone of the project with emphasis on the relationship between the home's components and the envelope they create. Also paramount is good stewardship—proper regard and respect for the rights of neighboring homeowners and the surrounding natural setting, and resource efficiency. The goal is to optimize occupant health, comfort, and safety; maximize energy efficiency and structural durability; and minimize environmental

impact. In addition, the aim is toward providing a nurturing home environment to support independent living and sustainable lifestyles.

Part I of this case study series appeared in Issue 1, January/February 2006. The introductory article extended to 16 pages and extensively covered the project scope. Thereafter, each issue has contained a part of the continuing series working through site planning and preparation; Low-Impact

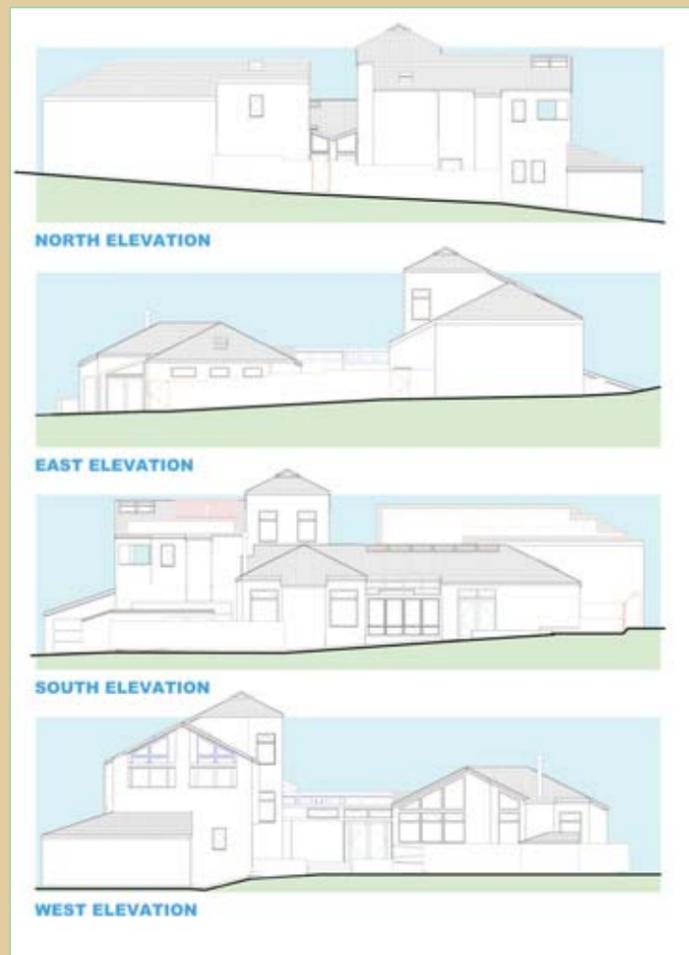
Development (LID); further refinements to the site plan and drainage design; The Sea Ranch Design Committee approval of the architectural/structural and grading/drainage submittals with conditions that translated to clarifications on certain building components and material finishes; particular aspects of the home's mechanical plan; and structural aspects of foundations, structural walls incorporating Insulating Concrete Forms (ICFs) and Structural Insulated Panels (SIPs), and roofing.

A Final Approval letter for The Sea Ranch Association Construction Performance Permit was issued on October 11, 2006, which is required by Sonoma County to obtain a county building permit.

The necessary work to obtain the building permit, including further refinement of the structural and mechanical plans has been completed. Final construction plans are now in the review process with the Sonoma County Building Department and Third Party Plan Check Review. Assuming no further delays, the issuance of permits, the commencement of construction, site grading, foundation, and mechanical infrastructure could start in late January 2007.

In this segment, the focus will be on the design and structural elements of the dedicated Optimum Performance Home Theatre™ and rear-projection room, adjacent to the home office.

"The Optimum Performance Home Theatre will be absolutely state-of-the-art and surpass the performance of the dedicated 'home theatres' that one typically sees in glossy picture-book-dominant magazines and books."



The elevations of the Optimum Performance Home at The Sea Ranch

Design Concept

As previously noted in this series, the home design integrates all of the concepts advocated in *Ultimate Home Design*. The goal is to demonstrate how today's products and building methods can make life safer, more comfortable, and more enjoyable. The science of optimum performance homes is about building structures that use less energy, are quieter and more comfortable, have fewer problems with material degradation, provide clean air and water, and do less damage to the environment. As an integrated holistic design, the house will serve as a home for many people and serve in many phases of one's life.

The Optimum Performance Home's site plan is designed to strongly support the efficient use of the community's water supplies, equitable allocation of water resources provided by the community and harvested on site, elimination of water pollution and contamination from poorly designed or failing septic systems, and general land use patterns that conserve and protect water resources within the overall ecosystem at The Sea Ranch. The water-efficient site plan and drainage design promotes "smart water use." And the overall design of the home will further cut its energy use with efficiency, and then meet the remaining needs with renewable energy sources.

The Digital Home

Whole-house electronics and home automation control are aspects of the "digital home" and the essence of a lifestyle based on convenience, entertainment, and safety. Structured wiring provides the means to have smart automation control and electronics throughout the entire home.

In the Optimum Performance Home at The Sea Ranch, home entertainment components will be extensively deployed and strategically placed throughout the home for optimum performance. Not

only will there be a dedicated Optimum Performance Home Theatre, but studio-quality performance home theatre equipment will be integrated into the design of the living room, home office, master bedroom suite, guest bedrooms, and the study/library/surround music room.

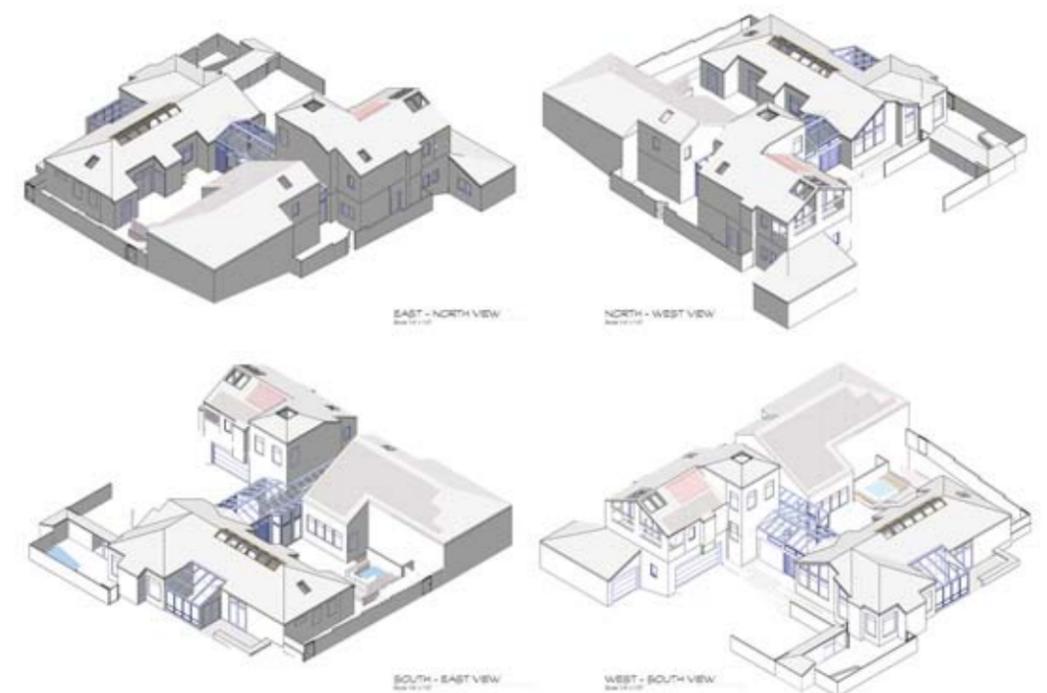
A Passion For Audiophile Sound And Videophile Imagery

As founder and President of WSR Publishing, Inc., for the past 15 years I have been publishing *Widescreen Review*® magazine—The Essential Home Theatre Resource™—and other Internet-based Webzines and e-newsletters dealing with electronic lifestyles, movies, and surround music. There, as with *Ultimate Home Design*, I serve as Editor-In-Chief and Publisher.

Widescreen Review is a serious home theatre and surround music enthusiast publication which enjoys an international audience and is supported by leading-edge consumer electronics manufacturers, as well as a leading-edge trade and end-user readership.

Our mission is to seek out "the best that it can be" in sound and picture performance, plain and simple. We embrace a no-compromise approach, yet recognize that not everyone will be able to afford or implement

Four perspective views of the Optimum Performance Home at The Sea Ranch





Widescreen Review's Reference Holosonic™ Spherical Surround™ Home Theatre Laboratory



their home theatre and surround music systems and environments without some compromise. But by knowing optimum approaches, they will know when they have to compromise, or realize that they have already compromised.

The Optimum Performance Home Theatre in this first Optimum Performance Home is patterned, in large measure, from the Reference Holosonic™ Spherical Surround™ Home Theatre Laboratory we built and completed in March 2001 inside the 7,000-square-foot office building we constructed in Temecula, California (north of San Diego, southeast of Los Angeles).

Thus, as in keeping with this philosophy, this new theatre will be state-of-the-art and surpass the performance of dedicated "home theatres" that one typically sees in glossy picture-book-dominant magazines and books. Usually, such dedicated theatres are interior-design driven rather than optimized for video and audio performance.

Elaborate staging and seating areas complemented by colorful fabric-covered walls decorated with stylish sconces and acoustically treated so as to usually impart a "dead"-room sound are the rule. Audio is regulated to non-full-range

and non-time-coherent "hidden" dissimilar loudspeaker designs all around, often built into the walls, along with bass-managed subwoofers. At best, video displays (usually front-projection types) are calibrated to standards, but always must fight with the light pollution caused by ambient light and the room interior's colors, which to a lesser or greater degree reflect back onto the screen to contaminate the picture causing color distortion or washed-out imaging and less-than-ideal contrast ratio.

Then, too, the audio implementation is typically of the Home THX® type, an approach which attempts to "simulate" the inherent century-old-tied limitations of motion picture "dubbing" stages and thus, movie theatres. The end result is overly electronic-processed audio, which leaves untapped the full potential of the discrete 5.1- and 6.1-channel audio formats and an upcoming 7.1-channel format for delivering outstanding soundstage and holosonic three-dimensional soundfield imaging. This newest discrete multichannel format in a particular loudspeaker

arrangement has been advocated by *Widescreen Review* for years, and that arrangement is now seeing signs of support from Dolby® Laboratories, DTS®, Inc., and Meridian Audio, respected companies involved in setting standards for audio.

I could write enough to publish several books on this subject, which space does not permit in *Ultimate Home Design*. For those interested, I refer you to a series of in-depth articles I wrote on the design and building of the first Optimum Performance Home Theatre, which, as previously noted, is billed as a Reference Holosonic Spherical Surround Home Theatre Laboratory, at the magazine's offices in Temecula. This series was published in *Widescreen Review* Issue 48 (May 2001) through Issue 53 (October 2001). These back issues may be ordered on our Web site at www.widescreenreview.com, or if you are a subscriber, may be downloaded as pdf files. Of course, also available are many, many more reference articles that we have written and published over the years.

This new Optimum Performance Home Theatre and rear-projection room will even surpass the performance widely acclaimed throughout the consumer electronics industry for our first effort. As with the *Widescreen Review* facility, this reference home theatre will serve as a review laboratory with a direct high-definition video conferencing system operational from the home office and inside the theatre to maintain visual communication with my office in Temecula.

Superior Design Performance

The space design of the home theatre and rear-projection room were determined by Dr. Peter D'Antonio, President of RPG Diffusor Systems, Inc. Peter is one of the world's foremost authorities on acoustics. Peter shares with me the view of a balanced, non-dead room, and has developed and patented a number of RPG Diffusor Systems room treatment products (one in particular, the Skyline®, will be used to achieve the desired result). Peter served as the acoustical consultant, and using RPG's proprietary automated Room Optimizer Sizer™ computing program modeled the size of the theatre room at 26 feet deep x 21 feet 8.6 inches wide x 13 feet 11.9 inches high, or approximately 8,000 cubic square feet. These are interior dimensions measured off the interior Amvic Insulating Concrete Form (ICF) walls. RPG's Room Optimizer program, which utilizes modern geometrical image model prediction techniques along with powerful multi-dimensional optimization to achieve the smoothest and flattest bass response in a rectangular room, was then used to properly position the listener and loudspeakers. Thus, as with the reference and review theatre in Temecula, these dimensions should cause the least room modal low-frequency acoustic distortion.

Structural And Acoustical Considerations

As with the mechanical infrastructure and overall structural aspects of the Optimum Performance Home, the design of the dedicated state-of-the-art performance home theatre and rear-projection room will utilize several leading-edge building technologies to create the most energy-efficient and acoustically perfect environment possible to optimize both sound and picture performance in a dedicated room with an all-black interior décor. The end result will be a no-compromise home theatre experience to transport its visitors to the scenes depicted in the on-screen images and on the soundtrack.

To achieve this end result, I brought Norman Varney and Harry Alter, principles in A/V RoomService, Ltd, into the project's design team to consult on the acoustical parameters of the two rooms. Norman and Harry also worked with me on the design solutions implemented in *Widescreen Review's* reference and review theatre.

Their work entailed providing acoustical noise control and sound quality shell design, interior acoustic treatments, and loudspeaker/listener locations. One of the most critical design features associated with good wall, ceiling, and floor noise, and also sound quality control, is to not only dissipate energy leaving and entering the space but to control sound energy as well, which is ultimately held within the room. Therefore, the shell design, while providing excellent noise attenuation, is also designed to help control resonant energy and modes, which typically find their way back into the listening environment. As a result, a number of issues were looked at, including stud and ceiling isolation materials, stud and ceiling support spacings, cavity depths, insulation types, use of air space, and surface treatments, including vibration damping technologies.

The Foundation

The dedicated home theatre and rear-projection room represents 695 square feet of the home's 3,272 square feet of living space (4,899 square feet including garages, covered walkways, courtyard, and decks). The home spaces are arranged in a three-building compound, spread over two foundations. The building science method employed uses a well-sealed, well-insulated, super-tight building envelope that reduces temperature fluctuations and enhances overall energy efficiency.

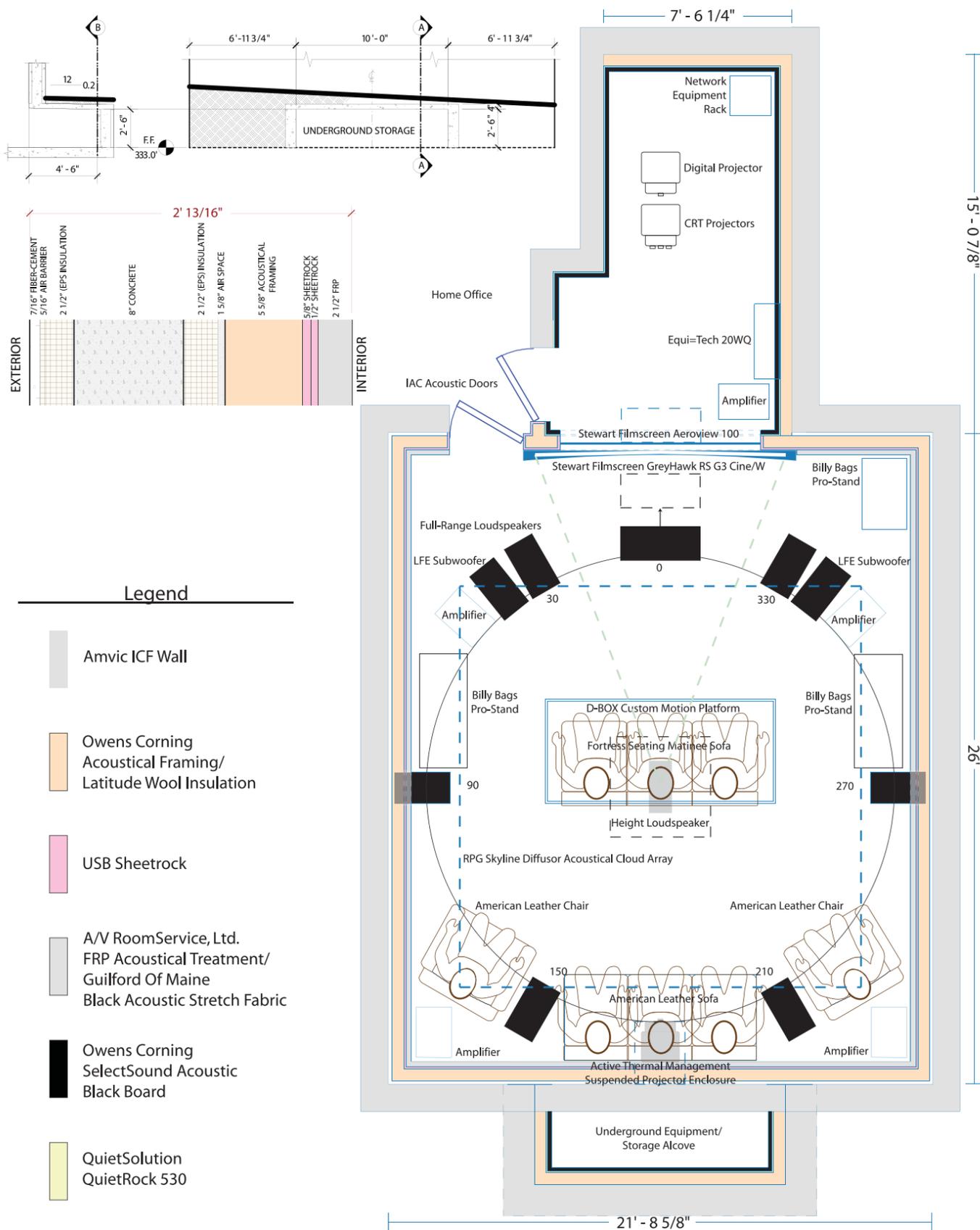
The slab foundations are designed as two structural elements: one foundation is six inches thick and supports the main residence (Building One) and guest quarters and library/home theatre/surround music room (Building Three), including the garages and insulated- and solar-gain-reduced-glass vestibule and covered walkway. The second foundation will support the home office and the dedicated home theatre and integral rear-projection room (Building Two). This foundation, which will be eight inches thick, will be physically separated from the main residence/guest quarters' foundation by an inch. The purpose is to isolate the acoustical vibrational properties of the home theatre complex from the living quarters.

The design of the foundation is such that its flooring surfaces are perfectly level with the other foundation flooring surfaces. This is an important aspect of the home's universal design floor plan that eliminates any challenging physical barriers such as steps, humps, bumps, edges, or uneven surfaces that could pose a potential accidental trip or fall.

As the home's site is subject to wet or moist soil conditions most of the year, the foundations are designed to be water-impenetrable. Working with concrete admixture technology companies and the local concrete mix supplier, Bed Rock of Point Arena/Gualala, a unique mix formula will be utilized for the foundations' pour.

Optimum Performance Home Theatre™

Reference Holosonic™ Spherical Surround™ Home Theatre Laboratory



Kryton's KIM® Admixture System and Headwaters Resources fly ash will be ingredients in the ready-mixed concrete admixture to create a waterproof concrete foundation. As an added protective measure, the foundation will be wrapped with DELTA®-MS, an effective foundation waterproofing and protection system using an air-gap membrane developed by Cosella-Dörken Products, Inc. DELTA-MS Clear will be used on the eastern earth-banked portion of the Amvic ICF wall system of Building Two, which houses the dedicated home theatre and rear-projection room. DELTA-MS Underslab waterproofing and underslab vapor-retarder membrane will be used to improve the floor's performance below the concrete slab foundation.

Air Conditioning And Heating

While most rooms and spaces in the home will be heated with an Uponor® radiant floor-heating system using a WaterFurnace (see Issue 5, September/October 2006) vertical closed-loop geothermal system that circulates water heated by the constant temperature of the earth through a "loop" of small-diameter, underground pipes made of high-density polyethylene, the dedicated home theatre and rear-projection room will not use the radiant floor-heating application. Instead, the geoexchange WaterFurnace system will be used to provide air conditioning to those spaces, and if needed, heat. This will be facilitated with Spunstrand® special underslab high-volume, low-velocity insulated ducts (see Issue 5, September/October 2006) to be installed under the dedicated home theatre/rear-projection room building foundation.

As designed, this heating, ventilation, and air-conditioning system (HVAC) will be specially fabricated with duckboard and ductliner inserted into the Spunstrand ducts to hush background noise due to ventilation hum, self-generated air noise, and on/off ventilator switching. The end result will be an HVAC system that is virtually noise free.

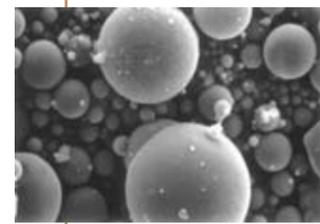
As with the Energy/Heat Recovery Ventilator (E/HRV) units to be installed in Buildings One and Three, the WaterFurnace E Series water-to-air heat pump, in addition to providing air conditioning and heating (if necessary), will exhaust stale air and harmful contaminants and fill the home theatre and rear-projection room with conditioned fresh, clean air.

Kryton's KIM® Admixture System



- KIM Admixture renders hardened concrete impermeable to water penetration, reduces drying shrinkage, protects steel reinforcements from corrosion, and improves concrete durability. The advanced integral crystalline chemicals react with water and unhydrated cement particles to form millions of needle-like crystals to permanently block the pathways for water and water-borne contaminants.

Headwaters Resources



- Fly ash improves the performance of concrete foundations, making them stronger, more durable, and more resistant to chemical attack, while creating significant environmental benefits through stewardship of an abundant industrial resource. Because the tiny fly ash particles fill microscopic spaces in the concrete, and because less water is required, concrete using fly ash is denser and more durable. And concrete containing fly ash becomes even stronger over time compared to concrete made only with cement.

Cosella-Dörken Products, Inc.



- Based on a uniquely formed air-gap membrane, water is kept from ever touching walls on its way through the soil to the footing drainage tile. The DELTA-MS Clear system ensures permanently dry foundations. DELTA-MS underslab waterproofing and underslab vapor-retarder membrane is designed to improve the floor performance below concrete slab foundations.

Amvic Insulated Concrete Forms



- The Amvic ICF 5-in-1 system incorporates structure, insulation, vapor barrier, sound barrier, and studding attachments for drywall and exterior siding in one easy step.

James Hardie Building Products

- James Hardie provides a 50-year limited transferable product warranty on its lap and panel siding. The products are dimensionally stable and resist cracking, rotting, and delamination. As well, they resist damage caused by extended exposure to moisture, humidity, UV rays, and salt air.



Owens Corning QuietZone® Acoustical Wall Framing

- Owens Corning QuietZone Acoustic Wall Framing studs are specially engineered with built-in, acoustically resilient, spring-loaded metal clips designed to significantly reduce the sound vibration path and allow the wallboard on the inside of the room to float and isolate sound wave vibrations.



Wall Systems

Two types of wall-system construction will be utilized in the Optimum Performance Home Theatre.

Amvic ICF Building System

The home theatre and rear-projection room will be constructed with Amvic Insulating Concrete Forms. The Amvic 5-in-1 system incorporates structure, insulation, vapor barrier, sound barrier, and studding attachments for drywall and exterior siding in one easy step.

Amvic ICFs combine closed-celled BASF Styropor® Expanded Polystyrene (EPS) insulation and concrete thermal mass, which evens temperature fluctuations by absorbing and storing heat, and at the same time provides effective soundproofing, exceptional comfort, and energy efficiencies. This is accomplished by preventing air movement in or around the cellular structure, creating an airtight seal around the entire perimeter of the building.

Three wall thicknesses will be used. For walls that serve as below-grade retaining walls in the eastern portion of the home theatre, the total wall thickness will be 15 inches (10 inches of concrete with 2-1/2 inches of BASF Styropor Expanded Polystyrene on each side). For above-grade walls in the home theatre and rear-projection room, the thickness will be 13 inches (eight inches of concrete with 2-1/2 inches of EPS on each side). The interior rear-projection wall adjacent to the home office, will be 11 inches thick (six-inch concrete core).

The BASF Styropor EPS insulation used in Amvic ICF is comprised of closed-cell expanded polystyrene that, together with concrete walls, prevents air movement around the perimeter of a structure, creating an airtight seal and providing performance equivalent to an insulation level of R-40

to R-50. An assembled Amvic ICF wall of a six-inch concrete core or greater has a fire rating of three plus hours. In addition, while conventionally built structures have a Sound Transmission Class (STC) rating of 36 to 38, an Amvic structure has an STC rating of 50 plus—a desirable attribute for a reference home theatre. STC is a single number (laboratory) rating of how well a structure (wall, floor, door, window partition) reduces sound passing through it. As a minimum, an STC-60 (partition) performance will be achieved for the home theatre and rear-projection room.

Furthermore, the reinforced concrete walls provide resistance to high winds and storms. On the exterior, HardiPanel and vertical trim, manufactured by James Hardie Building Products, will be applied to the ICF walls. The non-organic materials in Amvic ICFs prevent insect damage, as well as mold and mildew growth. The latter two benefits are desirable along the Pacific coastline where the Optimum Performance Home is located.

Owens Corning QuietZone® Noise Control Wall System

The Reference Holosonic Spherical Surround Home Theatre Laboratory in Temecula was constructed using the complete Owens Corning QuietZone® Noise Control System. This scientifically developed “noise control” system significantly reduces unwanted sound through vibration control in walls, floors, and ceilings.

In the new reference home theatre and rear-projection room, only the 2 x 6 QuietZone Acoustic Wall Framing will be used, spaced 16 inches on center. The design of the complete wall assembly has an estimated STC performance rating between 69 and 74, a class-leading performance level.

To allow the wall framing assembly to be freely isolated from other walls and ceiling components of the theatre room, Kinetics Noise Control sway braces (Model MWSB) will be secured to the upper section of the QuietZone stud framing system to the outer perimeter walls of the theatre. This will allow the walls to be decoupled from both the ceiling assembly and perimeter wall assemblies, thus optimizing vibration isolation. The MWSB sway brace is a lateral support isolator designed, with the use of a neoprene junction, to isolate wall vibrations between structures.

Because the foundation is an inert slab and isolated from the other foundation serving Buildings One and Three and the connected insulated glass-enclosed

vestibule and walkways, there will be no need to use the Owens Corning's QuietZone Acoustic Floor Mat, which was used in the Temecula office building. The QuietZone Acoustic Floor Mat is a closed-cell, polyethylene foam, specially designed to isolate impact noise in floors and reduce flanking noise around walls via through the floor. Its use is designed to isolate both structure-borne and airborne sound vibrations and is recommended when other living spaces share the same floor/ceiling assembly as the dedicated home theatre portion of the space. “Floating” the finish floor assembly on the acoustic mat not only attenuates noise transmission through the floor, but also improves the acoustical performance of the adjacent walls.

An inner room will be constructed out 1-5/8 inches from the interior surface of the Amvic ICF wall structure to create an air gap. This wall will use the 2 x 6-inch 14-foot specially engineered Owens Corning QuietZone Acoustic Wall Framing studs connected by several acoustically resilient spring-loaded metal clips. These built-in clips significantly reduce the sound-vibration path and allow the wallboard on the inside of the room to float and isolate sound-wave vibrations. As such, this stud system will provide excellent vibration isolation throughout the structure and, due to its resilient spring mechanism, is well suited for improved low-frequency sound quality within the space.

A continuous “barrier” of double-layer, staggered-seam (5/8-inch and 1/2-inch) USG Sheetrock™ Firecode® C Core Gypsum Panels, with acoustical caulking, will be mounted to the resilient stud structure to attenuate a broad spectrum of sound including low frequencies. Type WS gypsum screws will be used. Sheetrock is composed of enhanced fire-resistant gypsum core (Type C) encased in 100 percent recycled natural-finish face paper and 100 percent recycled liner paper on the backside. Sheetrock panels possess superior fire-resistance and heat-transmission properties for added safety, and are exceptionally resistant to cracks caused by structural, thermal, or hygrometric changes.

Room acoustics is all about controlling vibrations and the spectrum of frequencies that can influence our listening experience. All materials vibrate sound energy, including gypsum board, and a broad spectrum of frequencies that can radiate energy back into the listening environment. Our design includes the application of

USG Sheetrock™ Firecode® C Core Gypsum Panels

- USG Sheetrock is composed of enhanced fire-resistant gypsum core (Type C) encased in 100 percent recycled natural-finish face paper and 100 percent recycled liner paper on the backside, possess superior fire-resistance and heat transmission properties for added safety, and are exceptionally resistant to cracks caused by structural, thermal, or hygrometric changes.



OSI™ Sealants, Inc.

- OSI Sealants, Inc. is a leading manufacturer of caulks, sealants, adhesives, and wood-patching products with more than four decades of experience in developing and supplying the highest quality products. The company's Green Series™ features low-VOC construction adhesives, caulks, and sealants.



RoomDamp™ from A/V RoomService, Ltd., a controlled viscoelastic damping (sound absorbing) material designed to better control the spectral imbalances typically re-introduced back into the room from the walls and ceiling. Applied in three-inch strips, RoomDamp will be adhered horizontally at 16-inch and 12-inch centers between drywall layers. The result will be a more balanced and controlled listening environment with faster low-frequency response times and wider dynamic range.

A continuous strip of 3/4-inch diameter foam backer rod will be applied between the finish Sheetrock panels and the floor to further isolate vibrations and seal gaps.

OSI Green Series low-VOC (volatile organic compounds) draft and acoustical caulk, manufactured by Henkel Corporation's North American Consumer Adhesives Business, has been chosen to help meet the LEED for Homes ratings guidelines. There will be a 1/8-inch to 3/16-inch gap where finish corners meet (wall and ceiling) between Sheetrock panels. This will allow the free movement of each independent wall or ceiling assembly. The gaps will be filled with a continuous bead of OSI Green Series draft and acoustical caulk, a permanently flexible and non-flammable sound sealant. As well, all other gaps, electrical boxes, penetrations, and Sheetrock corners will be sealed with OSI Green Series draft and acoustical sealant.

In the rear-projection room, the QuietZone Acoustic Wall Framing resilient studs will be covered with Quiet Solution's QuietRock® 530, a patent-pending CPG (ceramic-polymer-gypsum) composite drywall panel that reduces sound transmission and vibration unlike any other construction material on the market today. QuietRock weighs about the same as standard drywall and provides superior sound isolation. The panel is fire-rated for one hour without No-Burn® (see below) added treatment. The rated 52 to 74 STC value far exceeds 5/8-inch gypsum, cinder block,

Quiet Solution

- QuietRock® 530, a patent-pending CPG (ceramic-polymer-gypsum) composite drywall panel that reduces sound transmission and vibration, weighs about the same as standard drywall, and provides superior sound isolation at a lower total cost than other methods.



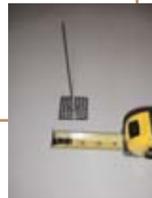
Owens Corning SelectSound® Black Acoustic Board

- Owens Corning SelectSound Black Acoustic Board is composed of inorganic glass fibers and provides excellent acoustic sound absorption properties to control reverberant sound energy produced within the rear-projection room and equipment/storage alcove.



Gemco®

- Gemco manufactures a complete line of insulation hardware accessory products, including Insulation Hangers.



No-Burn

- No-Burn fire retardants and reactants, are a highly advanced line of non-toxic, non-carcinogenic liquids that render a vast array of materials incapable of burning, as well as inhibiting the growth of toxic black mold. No-Burn removes the fuel a fire needs to burn when applied to wood, drywall, fabric, carpet, and furniture.



Latitude

- The natural wool used in Latitude's insulation is from wool processing in New Zealand. Wool, unlike synthetic materials, actually reacts to changes in temperature and atmospheric moisture. Insulation made with natural wool fibers not only achieves impressive R-value thermal performance, but because of wool's thermo-regulation properties, wool insulation has the ability to absorb and release water vapor and has been proven through independent laboratory tests to help keep buildings cool in summer and warm in winter.



and soundboard panels. And it hangs and finishes like standard drywall. It is also available in a mold-resistance form, the version to be used in the Optimum Performance Home.

As an additional measure to control sound energy within this space, Owens Corning SelectSound® Black Acoustic Board will be mounted to the interior face of the QuietRock walls. Gemco® Insulation Hangers will then be used to fasten the acoustic boards onto the interior surfaces.

Owens Corning SelectSound Black Acoustic Board is composed of inorganic glass fibers and provides excellent acoustic sound absorption properties to control reverberant sound energy produced within the rear-projection room. The rear-projection room will house various nine-inch CRT (cathode-ray tube) and digital high-definition front-projectors used in a direct-projection rear-screen application. At two inches thick it will absorb up to 100 percent of the sound striking its surface across a wide band of relevant frequencies.

An underground alcove extending out from the east wall of the home theatre will house equipment racks on wheels and provide storage space for electronic-related items. The alcove's interior dimensions are 10 feet wide x 4 feet deep x 30 inches high, positioned in the center of the wall. This alcove will be constructed as part of the Amvic ICF earth-banked wall system and Owens Corning QuietZone Acoustic Wall Framing, and treated with the Acoustic Solution QuietRock 530 and Owens Corning SelectSound Black Acoustic Board in the same manner as applied in the rear-projection room.

The Owens Corning QuietZone Acoustic Wall Framing studs and Sheetrock and QuietRock panels throughout will be additionally protected against fire with the application of No-Burn fire retardants and reactants, a highly advanced line of non-toxic, non-carcinogenic liquids that render a vast array of materials incapable of burning, as well as inhibiting the growth of toxic black mold.

Interior Wall Insulation

We intend to use Latitude natural wool insulation between the Owens Corning QuietZone Acoustic Wall Framing studs. The natural wool used in Latitude's insulation is from pure virgin wool processing in New Zealand. Wool, unlike synthetic materials, actually reacts to changes in temperature and atmospheric moisture. When wool absorbs

moisture from the air it generates heat. This warmth is not noticeable inside buildings but it acts to prevent condensation in construction cavities by maintaining the temperature above the dew point in damp conditions. Insulation made with natural wool fibers not only achieves impressive R-value thermal performance, but because of wool's thermo-regulation properties, wool insulation has the ability to absorb and release water vapor and has been proven through independent laboratory tests to help keep buildings cool in summer and warm in winter.

Latitude is made with 100 percent post-industrial natural recycled sheep wool fibers joined together using an advanced resin-bonding process to give it excellent strength and structural integrity, allowing it to be self-supporting in building cavities. Latitude is biodegradable and contains no permethrin, pyrethroids, or formaldehyde. At the end of a building's life, Latitude can be recycled for other environmentally friendly applications. To keep away insects and rodents, Latitude is treated with naturally occurring non-toxic elemental boron salts. Advantageously, wool has higher fire resistance than cellulose and cellular plastic insulations; it does not burn, but rather melts away from an ignition source and extinguishes itself. Latitude is treated with a fire-proofing agent to improve its intrinsic fire resistance and complies with the appropriate Class-A industry standard. And wool can remove formaldehyde from the air for a healthier indoor environment.

Acoustically, Latitude properties promote the baffling of unwanted exterior noise and can reduce the level of environmental noise pollution considerably. Except for the rear-projection room and equipment/storage alcove, there will be a 1-5/8 inch air gap between the Amvic ICF walls and the backside of the Owens Corning QuietZone Acoustic Wall Framing with exposed 5-1/2-inch thick Latitude insulation. In the rear-projection room and alcove, Latitude insulation will be applied between the QuietZone Acoustic Wall Framing and flush against the Amvic ICF walls.

Ceiling System

The second level over the rear-projection room and the ceiling crawl space over the home theatre will be constructed with FSC-certified (Forest Stewardship Council) engineered lumber using either Weyerhaeuser iLevel™ TJI® Trus Joist and/or LP Building Products. These high-quality OSB

structural products are engineered for optimum strength, stiffness, uniform straightness, and level surface performance.

To attenuate high levels of sound energy through the ceiling assembly the use of a spring-loaded, suspended-ceiling system was recommended by A/V RoomService, Ltd. The specified spring-loaded, suspended-ceiling system design has the ability to isolate and control a broad range of sound vibrations, especially the low-frequency bandwidths. Known as the ICW Isolation System, the highly resilient and adjustable ceiling system is manufactured by Kinetics Noise Control.

The Model ICW is designed to be incorporated into any isolated ceiling design where one-inch rated spring deflection and minimal reduction in ceiling height are needed for superior performance, coupled with low-profile design.

Secured to wood-frame construction (e.g., joists, trusses), Model ICW incorporates a one-inch rated deflection spring in series with a neoprene cup, to resiliently support one or more layers of gypsum board. The unique design of the Model ICW bracket will allow the isolator to be installed on the joists to optimize ceiling height. A channel clip/leveling rod assembly will carry a single 1-1/2 x 1/2-inch, 16-gauge steel-carrying channel. A drywall furring channel is attached to the carrying channel.

The system provides the installer with a means for leveling the isolated ceiling framing. Gypsum board attaches quickly and easily, thanks to a preload spacer that holds the isolator rigid, until the weight of the gypsum board compresses the spring.

Similar to the walls, the ceiling will incorporate two layers of USG Sheetrock—5/8-inch and 1/2-inch thick Firecode, Type C drywall with A/V RoomService RoomDamp applied between gypsum board layers to damp ceiling vibrations typically radiated back into the listening environment. In addition, A/V RoomService's IsoPad™ will be applied to the perimeter edge of the suspended ceiling to isolate and seal where it meets the walls.

FRP System

In any room used for a home theatre or surround music presentation, when the room, or "enclosure," is left untreated, sound is distorted from its original pristine quality as recorded on the master. Room distortion is prevalent and unique to each listening space. As a result, every room can be its own worst enemy or ally depending on how, what, and where engineered room treatments are placed.

The Frequency Response Panel System (FRP) developed by A/V RoomService, Ltd. is engineered and designed to provide the flexibility to address specific high-quality listening criteria. These can include uneven reverberation decay (dependent on frequency and location), low-frequency modal distortion (also dependent on frequency and room location), and first-order (mid- to high-frequency) reflections (again dependent on room location).

The solution to room anomalies is a selection of panels which provide selective high- and mid-frequency and low-frequency sound absorption, reflection, and diffusion characteristics over a wide or narrow bandwidth depending on the acoustical needs of the listening

LP Building Products & Weyerhaeuser iLevel™

- These high-quality OSB structural products are engineered for optimum strength, stiffness, uniform straightness, and level surface performance.



Kinetics Noise Control

- The Kinetics ICW Isolation System is a spring-loaded, suspended-ceiling system designed to isolate and control a broad range of sound vibrations, especially the low-frequency bandwidths. The Kinetics MWSB sway brace is a lateral support isolator.



A/V RoomService, Ltd.

- A/V RoomService's Frequency Response Panel System (FRP) is engineered and designed to provide the flexibility to address specific high-quality listening criteria, which can include uneven reverberation decay (dependent on frequency and location), low-frequency modal distortion (also dependent on frequency and room location), and first-order (mid-to high-frequency) reflections (again dependent on room location). RoomDamp is a sound absorbing material designed to control spectral imbalances.



RPG Diffusor Systems

- RPG Diffusor Systems' Skyline is the most effective and powerful omnidirectional primitive root number theory two-dimensional diffusor available. The Skyline scatters incident sound uniformly so that the acoustic glare in all directions is minimized.



environment. Optimization of these treatments will be engineered by A/V RoomService, Ltd. using proprietary room modeling programs. FRP provides extraordinary performance within a 2-1/2-inch depth.

There are six types of FRP panels available, all of which are tested in a National Volunteers Laboratory Accreditation Program (NVLAP) Certified Facility. Five are Class A fire rated.

- High-Frequency Equalizer (1.25 inches)
- Bass Equalizer (1.25 inches)
- Broadband Bridge Equalizer (2.25 inches)
- Extended Bass Equalizer (2.25 inches)
- Poly Diffuser (2.25 inches)
- Schroeder Diffuser (1.0 inch)

These panels will then be covered with a stretch fabric system using acoustically tested fabrics making all acoustic treatments invisible to the eye. The end result sought by using the FRP System is not to over-absorb the mid- and high-frequencies, which would sound lifeless, and not to under address the low frequencies, which would sound slow and muddy. The engineered FRP System is ideal for controlling reverberation times, room modes, flutter echo, and first-order reflections in a linear, tunable fashion, which, if not controlled, would result in poor tonality, soundstage, dynamics, and intelligibility. The FRP System is effective down to 63 Hz within 2-1/2 inches of depth.

The FRP System application in the Optimum Performance Home Theatre will provide the flexibility to target and treat the specific acoustic needs relative to the room's optimal frequency response, resulting from the combination of the room's acoustical nature and applied treatments and the source, amplification, and loudspeaker performance capabilities.

Acoustical Cloud

RPG Diffusor Systems' Skyline is the most effective and powerful omnidirectional primitive root number theory two-dimensional diffusor available. The Skyline scatters incident sound uniformly so that the acoustic glare in all directions is minimized. We have designed a 16 x 16-foot T-bar ceiling grid (with 2 x 2-foot slots to hold the individual black Skyline panels in place). This Skyline array will be suspended overhead the sweet spot "chair" position. Just over the "sweet spot" is an opening in the grid that is 4 x 4 feet to allow the coherent wavelength of a height loudspeaker to immerse the listeners seated on the sofa.

Viewed as a whole, the effect is extremely high-tech, suggesting to me an outer space inhabitation.

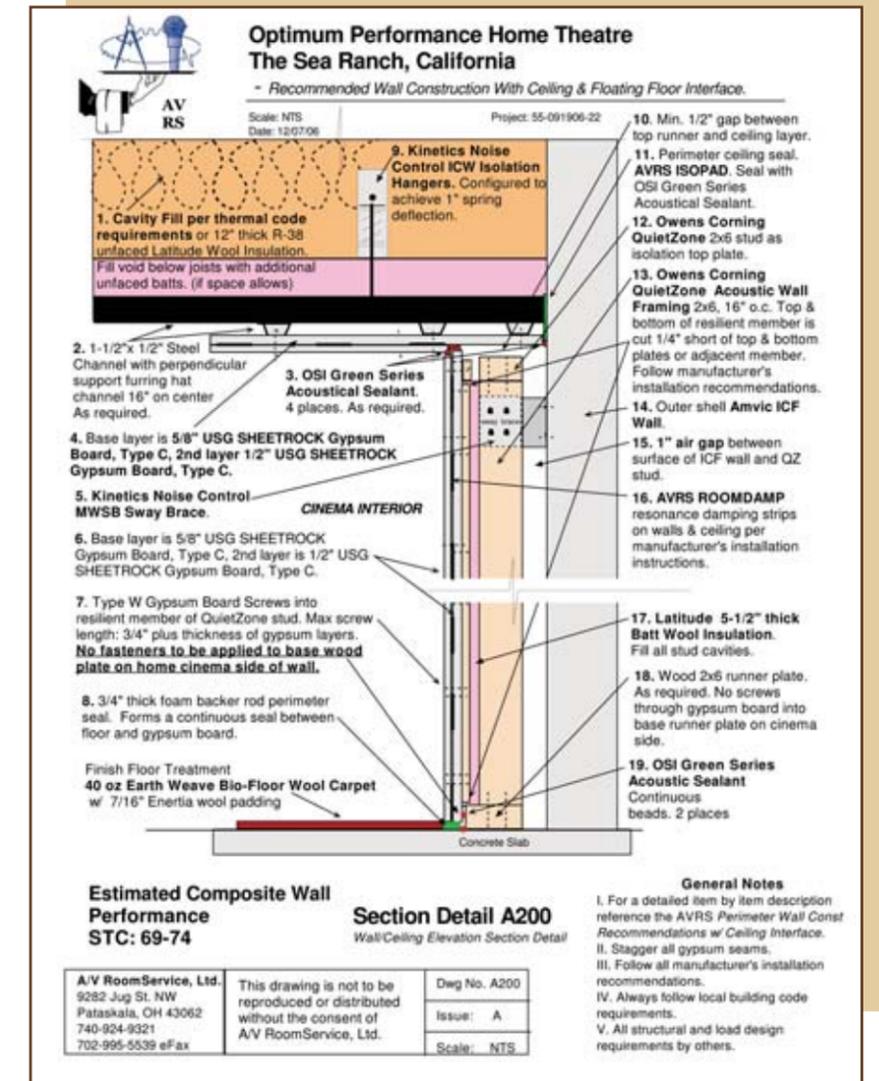
The Preferred Viewing Distance And "Sweet Spot"

The preferred viewing distance from the ScreenWall formula I have used when projecting at 1280 x 720p (progressive) is one-and-one-half times to two times screen width. But because the pixel dimension of 1920 x 1080p is reduced by about one-third with more than twice the pixel resolution of 1280 x 720p, I use one-and-one-third times the screen width for the optimum viewing distance for 1920 x 1080p

anamorphic widescreen presentations. For non-anamorphic widescreen 1920 x 1080p, I use the one-and-one-half distance formula. Therefore, the optimum distance from the 16:9 (1.78:1 aspect ratio in theatrical terms) eight-foot-wide (54-inch high) Stewart Filmscreen Aeroview® 100 screen should be 12 feet. But when the one-and-one-third distance formula is applied to anamorphic 1920 x 1080p projection onto a Stewart 2.40:1 ten-foot-wide (50-inch high) Cine/W™ GrayHawk RS G3 curved screen, the optimum distance should be 13 feet 3 inches from the screen. This distance works well when the loudspeaker positioning relative to the ScreenWall and the entrance to the theatre is taken into account. Thus, I chose a preferred viewing distance and a holosonic listening "sweet spot" at 13 feet 3 inches from the Cine/W screen, which, at 41 degrees (picture-viewing included angle), is well within the minimum 36-degree viewing angle recommended by the THX® Theatre Alignment Program (TAP) when measured from the center of the back row of a commercial theatre for anamorphic CinemaScope and Super 35 images.

This position, which closely corresponds to my preferred sitting location about two-thirds back from the center ScreenWall in a premium movie theatre, will optimize the performance of the Cine/W anamorphic presentation, but slightly compromise the optimum viewing distance for the rear-projection systems when projecting 1920 x 1080p images. Still, the viewing angle for the eight-foot-wide rear-screen Aeroview 100 will be 33 degrees. The reasoning is that it is always better, when having to compromise, to sit further from the screen rather than too close, which will reveal projection artifacts.

My formula for standard-definition non-scaled DVD images has been two times width, which, in this case, should be 16 feet back from the ScreenWall. Using the one-and-one-half formula for non-anamorphic high-definition, the distance from the ScreenWall should



be no closer than 12 feet. But with high-performance projection and good 1080p scaling, one can actually sit closer for standard-definition sources, so the 13-foot 3-inch position is still the best compromise.

Furthermore, this setup allows the full-range loudspeakers to be perfectly positioned in an equidistant "circle of sound" orientation within the room, with flexibility to vary the included angle relative to the listening "sweet spot" 60 to 90 degrees (while maintaining a 41-degree viewing angle) between the front left and right full-range loudspeakers. Likewise the included angle relative to the listening "sweet spot" is variable between 60

and 90 degrees for the back pair of identical full-range loudspeakers. The full-range center channel loudspeaker can also be positioned under or out from the ScreenWall to achieve optimum performance. Such flexibility for the positioning of the loudspeakers is even more critical to optimizing the home theatre experience, since sound contributes up to 80 percent of the perceived experience.

The "circle of sound" or "clock" positioning of the loudspeakers will be along the arc of a 20-foot diameter circle measured from the crosshair center of the "sweet spot" listening position. The additional four-foot extension provided by the eastern wall

Fortress Seating, Inc.

• The Fortress Matinee sectional sofa in black leather is 94 inches wide by 35 inches deep and features two very unique accessories that, when combined with the inherent comfort and ergonomic support, make it a very effective theatre seating arrangement.



American Leather

• The American Leather Comfort Sleeper sofa and Comfort Sleeper chair provide the therapeutic benefits of a pressure-free, temperature-sensitive sleep surface of high-density therapeutic memory foam. The mattress has a soft cover with Bioguard® to provide the added benefit of anti-microbial protection.



equipment/storage alcove and the additional 15-foot "length" extension provided by the rear-projection room will help to optimize extremely deep bass response to below 16 Hz.

Theatre Seating

The "chair" in the "sweet spot" viewing and listening position will be a custom-designed Matinee sectional sofa manufactured by Fortress Seating Inc. This 94-inch-wide by 35-inch-deep black leather unit comes with two very unique accessories that, when combined with the inherent comfort and ergonomic support, make it a very effective theatre seating arrangement. The insertable arms provide for three individual seating positions but can also be removed to form either a single and love-seat arrangement for those more intimate times, or a full sofa for simply stretching out. What is critical is that a center "sweet spot" position is always there, no matter what the arrangement, for serious viewing and listening.

The electronically motorized adjustable low-back height for each seating position allows the user to raise or lower the entire back so as to provide the perfect back support, yet not block any information coming from the rear surround full-range loudspeakers. The capability to lower the backs is important so as not to obstruct viewing while sitting on a black American Leather Comfort Sleeper sofa, which is equipped with a king-size pull-out platform and pressure-free therapeutic memory foam mattress. This 92-inch-wide sleeper sofa will be located along the back theatre wall in perfect center alignment with the ScreenWall. There also will be two black leather 46-inch wide cot-size Comfort Sleeper chairs, one to each side of the rear of the theatre, separated from the sofa by floorstanding full-range surround loudspeakers.

The Matinee also features electronic control for three independent foot and leg positions. The sliding arm caps on each end, which hide both the cup holders and switches, are a very nice aesthetic touch.

Audiophile And Videophile Performance Cables

High-performance audio and video cables will be used exclusively to interface the components in the system. As well, networking Ethernet cables and D-BOX control cables will be employed. While I prefer not to hide cables, especially those of the caliber of performance that will be used, in select areas in the theatre and rear-projection room, conduit will be installed under the floor in the concrete slab during construction. All cables exiting the Billy Bags Pro-Stands™ equipment racks to the rear-projection room will be channeled through this conduit, so as to eliminate cables crossing the entrance to the theatre at the ScreenWall, cable runs to the D-BOX platform, and between equipment racks positioned on opposite walls.

Interior Décor

The entire exposed interior of the FRP System will be concealed with an acoustic all-black stretch fabric system fabricated by Guilford Of Maine. The pattern will be FR701 2100, Color 408 Black.

This same fabric will be applied to the interior Quiet Solution Quiet Rock 530 panels with the Owens Corning SelectSound Black Acoustic Board facing in the rear-projection room and equipment/storage alcove.

As a member of our home theatre project design team, internationally acclaimed designer Theo Kalomirakis of Theo Kalomirakis Theaters advised us on accenting the seams between the panels covered in the black stretch fabric and to use controlled scene color lighting to create an artistic quality that will mesmerize viewers as they enter the theatre and during the pre-show time.

Spencer Kalker, President of ImageCrafters, Inc. and IC Lights, is also a member of the home theatre project team, and serves as our lighting design and installation consultant.

Integrating lighting into the Optimum Performance Home Theatre is elaborate. Numerous scenarios are to be provided: Critical

Viewing, Critical Listening, Critical Equipment (Audio and Video) and Loudspeaker Reviewing, Writing Articles on a Computer, Reading, Presenting Seminars, and Entertaining. Each of these room-usage scenarios have different requirements with regard to how the lighting is placed in the room, what type of lights are used, and how each circuit is controlled and dimmed. A feature of the lighting scheme is a "circle of light," which matches the 20-foot diameter "circle of sound," but positioned 10 feet above floor level. This will be accomplished with IC Lights' LiteRail system in conjunction with Lutron's GRAFIK Eye® and the latest in ENERGY STAR®-qualified lighting technology.

I won't expand on the interior aspects of the home theatre room in this part of the series, but will return to this subject in a future issue along with the full description of the equipment choices for both the video and audio components. At that time, I will also cover our approach to the electronic systems integration and the design work of our CEDIA (Custom Electronic and Design Installation Association) integrator, Engineered Environments, based in Alameda, California.

There is one aspect of the design of the Optimum Performance Theatre that relates to the wall structure that I will address here.

ScreenWall And Projection Systems

I prefer a rear-projection home theatre experience, and, where possible, video projected through an anamorphic lens onto an electronically controlled side-masking screen with a fully open screen aspect ratio of 2.40:1 (the ratio of viewable screen width to height). Most major motion pictures are framed in the 2.40:1 (historically referred to as 2.35:1) aspect ratio, though, in practice, DVDs and high-definition HD DVDs and Blu-ray Disc aspect ratios range from 2.32:1 to 2.40:1. The term CinemaScope® is associated with this super-wide aspect ratio, which, historically is referred to as 2.35:1, which several years past was specified as a 2.40:1 standard by the Society of Motion Picture and Television Engineers (SMPTE).

Rear projection offers much better resistance against ambient light since the screen design allows a significant portion of the ambient light to pass through the screen without being reflected off the viewing surface as in the case with a front-reflective projection screen. Installing the projector



Billy Bags Pro-Stands™ Design

• Billy Bags Pro-Stands improve equipment performance in ways that can be seen and heard. Their racks have in common non-resonant composite wood-laminate shelves, rigid steel frames, optional isolation tipped legs, and leg vibration dampers.

Guilford Of Maine



• Guilford Of Maine specializes in acoustic stretch fabric coverings for walls and acoustical treatments in home theatres.

in an enclosed black room eliminates virtually all ambient light interfering with the path of the image being projected onto the screen. An added and significant benefit is that projector noise is dramatically attenuated because the projector is behind the screen in a separately housed acoustically treated and soundproofed rear-projection room and not in the theatre with the viewers.

In the case of the ScreenWall implementation in the Optimum Performance Home Theatre, the rear-projection screen will be a frame-retardant fixed 1.0 gain Stewart Filmscreen Aeroview 100 flexible screen with an eight-foot-wide 16:9 (1.78:1) aspect ratio (the high-definition HDTV standard) screen. The Aeroview screen material features excellent white-field uniformity and an extremely wide viewing angle, and is the best choice when employing short focal length lenses.

I could have chosen a Stewart CineCurve™ 240:1 screen with electronic side masking for this application but I wanted to maximize the screen size when projecting 1.78:1, 1.85:1, 2.35:1, and 2.40:1 (and any aspect variation) images using non-anamorphic lens-equipped nine-inch CRT projectors. The dedicated rear-projection room is 15-feet 6-inches deep by approximately 7-feet 6-inches wide in the main area, and 9-feet 6-inches wide at the ScreenWall.

As this is a considerably large space to allocate for most homes, Stewart Filmscreen also manufactures an optical mirror system to fold the light path of the projection and reduce the required throw distance by approximately one half. Stewart's OptiKong® Rear Projection Mirror System is equipped with a first-surface 94 percent reflective glass mirror. The home theatre in the living room will use the same Aeroview 100 screen material but in a 2.40:1 aspect ratio six-foot-wide flat screen assembly with electronic side masking.

A specially designed integrated D-BOX® three-axis Custom Motion Platform and Fortress Seating fully motorized brown leather love seat will be the "sweet spot" seating for the living room theatre. A D-BOX Universal Motion Platform (UMP) will also be used for a separate Fortress Seating matching brown leather recliner. The UMP features a two-point Actuator

ImageCrafters/IC Lights

- ImageCrafters, Inc. and IC Lights provide custom interior lighting designs. The IC Lights' LiteRail system will be used in conjunction with Lutron's GRAFIK Eye® lighting-control system.



Lutron Electronics Company, Inc.

- Lutron's Grafik Eye is a lighting control standard widely used for programming lighting scenes in home theatres.



Stewart Filmscreen

- Stewart Filmscreen custom rear-projection ScreenWalls, Cine/W Curved Constant Vertical Height Screen Assemblies, ElectriMask motor systems, and engineered screens deliver leading-edge picture performance.



system in a plug-and-play product that is easy to install on most single seats or can be retrofitted to an existing home theatre setup.

I'll return to this system's description in a future article.

The rear-projection room will house two high-performance nine-inch CRT projectors with separate red, blue, and green tubes, which are capable of exceeding the current HDTV 1920 x 1080p resolution standard: a Runco DTV-1200 and a Sony VPH-G-90. These are two of the finest video projectors ever made and are still considered the performance target for digital-based video projection technologies to emulate, especially with respect to full-field contrast ratio (measured with a full white field and a full black field after first calibrating white and black levels properly) and the absolute black levels and shadow detail these projectors are capable of resolving in a completely black room. A high-end 1920 x 1080p digital-based fixed-pixel projector (all have a constant-on light source that compromises absolute black level and shadow detail) will also occupy this space. One CRT projector will be ceiling-mounted and the other two projectors positioned on specially designed sturdy adjustable platforms.

Black, in video terms, is defined as the absence of light, and CRTs are capable of a virtually infinite contrast ratio when the room is absolutely black while other display technologies are not—at least not yet. Thus, with other projection technologies, when the image should be "black," the screen exhibits "gray" or, at best, "charcoal" to represent "black." This is most apparent in dark movie scenes. Such CRT

display devices are relatively expensive, with "near-professional performance" direct-view high-definition widescreen 34-inch CRT displays currently priced at about \$2,200 (Sony KD-34XBR960) and high-end high-definition front projectors of the recent past upward of \$60,000 plus, though you might be able to find a nine-inch CRT projector for around \$29,500 or less (visit www.fhvideo.com and www.hometheater1.com).

While digital displays can equal or exceed the brightness, sharpness, color accuracy, gray scale tracking (or color temperature) accuracy, overall uniformity, usability, and reliability of even the best reference CRT projectors of the past, the one area in which digital displays still need improvement is to provide fully convincing black levels and shadow detail in the darkest scenes, which are prevalent in most action, science fiction, thriller, mystery, animation, and adventure movies. It is this dynamic range with full-black reproduction that has been the hallmark of CRT performance. Good direct-view CRT displays and CRT projectors are not only capable of exhibiting inky blacks but also impressive image depth. And more impressive is that the screen area disappears into the black frame border around the screen in scenes that are dark. This is an attribute of CRT technology that when fully demonstrated is unforgettable and more impressive than any motion picture presentation you have ever experienced.

As a serious home theatre enthusiasts, I still prefer to experience movies in a darkened, preferably black room, as with the very best cinemas, to fully appreciate the art form. And I love the projected and direct-view CRT experience. But I acknowledge and support the continued improvement with respect to full-field and intra-image contrast ratio performance that fixed-pixel displays are achieving and their other excellent performance parameters, and that is why I have also included both digital fixed-pixel technology projectors and flat-panel displays in the Optimum Performance Home. Plus anamorphic lenses are available on fixed-pixel projectors at a reasonable cost.

The eight-foot-wide Aeroview 100 will be fitted with Stewart Filmscreen's Model LVC Vertical ScreenWall ElectriMask 4-Way electric motorized aspect ratio masking panel system. The ElectriMasks are electronically controlled panels that extend and retract from housings at the top and bottom of the screen frame. A fixed horizontal control system will be used to frame CRT projection at six feet wide. Stewart's



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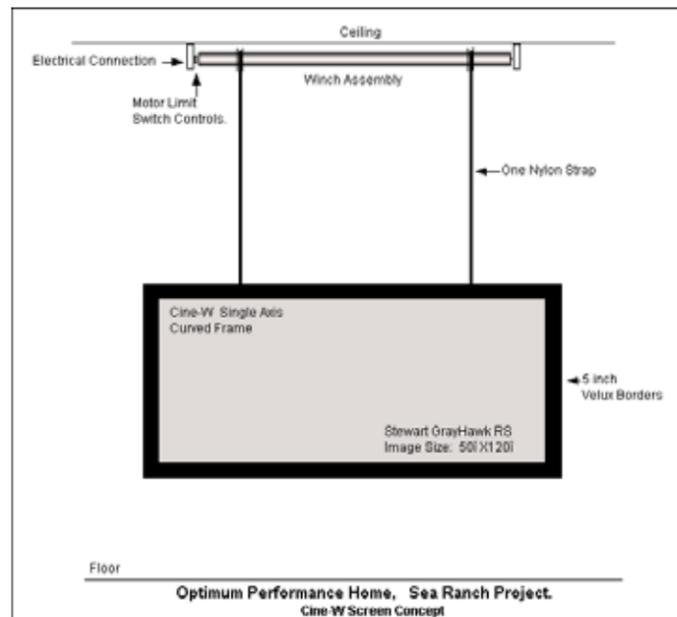


VeLux® appliqué non-reflective light-absorptive black fabric material will be used for the frame treatment. This will ensure that the ScreenWall has a rich look while eliminating image overscan and ensuring a sharp black edge. This system allows for controlled masked widths and heights so that, for example, when projecting with a CRT projector, the viewable screen width can be limited to six feet wide to optimize foot-Lambert light output. When projecting with the greater light output capacity of a fixed-pixel digital projector, the screen width can be fully opened to eight feet wide. In either case, the horizontal mask is fully adjustable to show 16:9 (1.78:1) high-definition (HDTV), theatrical 1.85:1 spherical flat widescreen, and 2.35:1 (2.40:1) theatrical anamorphic CinemaScope or Super 35 widescreen aspect ratios.

Now, the exciting part is the design and configuration of a motorized drop-down 10-foot-wide Stewart Filmscreen Cine/W screen with a fixed super-widescreen 2.40:1 aspect ratio. Don Stewart, one of the Stewart family principles, is designing the remote-controlled motorized drop-down apparatus for the theatre's ScreenWall.

Cine/W's slightly curved shape enhances the super-wide image, creating an increased sense of immersion and improving viewing angles. The entire black VeLux appliqué screen-housing assembly will electronically lower to cover the fixed eight-foot-wide Aeroview 100 rear-projection screen, and disappear overhead when not being used. In its not-in-use raised position, it will be screened from view using frame-retardant acoustical black curtain fabric. The front-projection system will be a Runco (www.runco.com) THX-certified SuperOnyx™ three-chip DLP® 1920 x 1080p projector with CineWide™ lens assembly and the most advanced anamorphic optics manufactured by McKinley Optics of Southampton, Massachusetts. With this projection system presentation, there will be no annoying black bars and every pixel of resolution will be preserved.

The screen material for this application will be Stewart Filmscreen's GrayHawk RS G3, a .92gain front-projection screen material solely designed and engineered to maximize "Image Fidelity" for DLP, D-ILA®,



SXRD®, and LCD projection technologies. The frame-retardant materials' unique translucent optical coatings, combined with its gray-based under-coating, increases image black levels, shadow detailing, and overall color saturation, providing the viewer with a more film-like experience.

Normally, the standard widescreen aspect ratio of most projection systems using a 16:9 (1.78:1) screen leaves "black bars" at the top and bottom of the 2.35:1 (2.40:1) image. There are now projectors sporting anamorphic lens technology that provide a bright, high-contrast image in the CinemaScope format. Rather than downsizing the image and leaving "black bars," today's anamorphic projector lenses allow viewers to enjoy a stunning super-wide image without the "black bars" using a Stewart Filmscreen CineCurve electronic masking screen or Cine/W fixed 2.40:1 aspect ratio curve screen with no electronic masking.

This patent-pending Curved Constant Vertical Height Screen, when configured with its electronic masking system, can accommodate other aspect ratios. The screen maintains a constant vertical height, while the electronically controlled side masking panels create the right screen area for viewing images projected in different aspect ratios.

Suspended Projector Enclosure

Frank Federman and Walt Henry, the two principals behind Active Thermal Management, are working with me on the design of an on-wall suspended projector enclosure to house the front CineWide Runco projector. The enclosure will be positioned on the back wall of the Optimum Performance Home Theatre approximately seven feet off the floor. The throw distance between the Runco projector's anamorphic lens and the Cine/W ScreenWall will be approximately 22 feet (with variable throw distances possible).

Given that a three-chip DLP™ Runco projector is designed to run in a well-ventilated area, particular attention has to be paid to assure that the projector will have adequate airflow, while at the same time the enclosure design has to dramatically attenuate the noise made by the projector, so that there will be no distraction.

Projector noise control should be a paramount concern in home theatres, especially in a theatre that is as quiet as the Optimum Performance Home Theatre will be. Movie soundtracks and surround

music tracks have a potential dynamic range (the difference between the loudest and softest sounds) of 120 dB. Thus, a home theatre must be absolutely quiet to reproduce the entire range of the recordings. While the Optimum Performance Theatre will have a virtually non-audible noise floor, the quietest projectors produce around 30 dB of noise, which is enough to raise the noise floor to an unacceptable level.

The goal is to locate the cooling and exhaust fans in the enclosure so that heated exhaust air is "grabbed" and moved out of the enclosure as soon as it exits the projector, and is prevented from circling back and being drawn into the projector's fresh air intake. The ventilation system chosen must be able to move as much air as the projector's own fan system, so that internal temperatures rise only as much as they would when the projector operates in an open environment. Active Thermal Management has designed an innovative intake-and-exhaust device that quietly and efficiently replaces hot air generated from the projector in the enclosure with room-temperature conditioned air, which is then vented to the outdoors through the Amvic ICF wall on the east exterior of the home theatre.

The Active Thermal Management solution will ensure that the high-wattage projection bulb is properly cooled while at the same time providing significant attenuation of undesirably loud fan noises generated by the projector and the movement of air through cooling passages.

The five-sided box (front completely open or opened around the lens) design will be enough to absorb the annoying frequency components present in fan noise, reducing the overall noise to a level imperceptible in the theatre. The enclosure will be built with FSC-certified MDF (medium-density fiberboard) using simple glue-and-screw construction and lined with two-inch thick fire-retardant Owens Corning SelectSound Black Acoustic Board for effective soundproofing. The all black enclosure will also disguise the projector location for aesthetic reasons.

To deal with the heated air in the enclosure, fresh air from the area around the enclosure will be pulled into the intake port while heated air will be removed through the exhaust port to the outdoors. This design will be implemented with the ATM System 1 EXT, which consists of a very powerful in-line centrifugal blower capable of moving large amounts of air at 60- to 95-CFM up to 30 feet, acoustically insulated tubing enclosed in a six-inch

Active Thermal Management



- Active Thermal Management's ATM System 1 EXT consists of a very powerful in-line centrifugal blower capable of moving large amounts of air at 60 to 95 CFM up to 30 feet, acoustically-insulated tubing enclosed in a six-inch conduit tunnel through the Amvic ICF wall, a hot air collector, and integral spring-loaded backdraft damper.



Industrial Acoustics Corporation (IAC)



- IAC STC-61 Noise-Lock steel door acoustical assemblies feature cam-lift hinges, allowing a barrier-free sill—important for universal design considerations (the door rises as it opens and falls as it closes), magnetic-type triple seals, and magnet sleeve bellows that reach out to provide a continuous seal around the perimeter of the assembly.

conduit tunnel through the Amvic ICF wall, a hot air collector, and integral spring-loaded backdraft damper. The "EXT" version of the System 1 includes a weatherproof enclosure, which is designed for mounting outside the home on the exterior wall.

IAC Noise Rated Doors

Every home theatre must have an entrance door, and the success of the acoustic isolation begins and ends with the door. Both the home theatre and rear-projection room entrances are fitted with 300-pound, 36-inch wide, 3-1/2-inch thick Noise-LockR acoustical doors with an STC-61 rating. These exceptional doors are laboratory-developed and field-proven. Manufactured by IAC, (Industrial Acoustics Company, Inc.) the units are fully assembled and tested before shipment.

There are two basic design considerations for the home theatre. First is Sound Transmission Loss (STL) noise control, or containing the playback within the theatre, so as not to disrupt surrounding living spaces and the outdoor natural environment habitat. Likewise, one must consider surrounding noise entering the theatre and compromising the listening environment. The second design consideration is, of course, the listening environment or room acoustics—absorption (reverberation), diffusion, and reflections (ADR). Since the sound control door (barrier) assembly is part of the "shell," it is a most important part of the whole structural design.

As with the *Widescreen Review* home theatre laboratory, the two doors specified are steel IAC STC-61 Noise-Lock assemblies. They are flat black to complement the black, non-reflective flat interior treatment of the theatre. Hinges are cam-lift, allowing a barrier-free sill—important for universal design considerations. The door rises as it opens and

D-BOX® Technologies, Inc.

• The D-BOX CMP motion simulation technology adds an incomparable dimension to the home theatre experience by completely immersing viewers in on-screen action to bring exhilarating virtual reality to ALL genres of movies.



There are 15 levels of motion intensity adjustment with a flat-frequency response from DC to 100 Hz, to a maximum response of 200 Hz. Each Actuator is capable of a wide range of motion profiles (created by skilled D-BOX motion artists), from very slow/very smooth (imperceptible or subtle movements) to very dynamic ones (vibrations up to 100 Hz). While the actual movement does not exceed more than 5/8 inches (for a total of 1-1/4 inches side-to-side), the impression of movement is much greater, and adds eMotion sensations for a far more realistic experience.

D-BOX motion artists work in special motion-activated editing bays in home theatre-equipped post-synchronization studios to create Motion Codes for individual movies, frame by frame. Using proprietary computer software, they watch and listen to a scene, then, frame by frame, create appropriate Motion Codes for each of the four D-BOX CMP Actuators, to most effectively enhance the overall emotional impact of that scene. This is a new art form, but is very much like motion picture sound and picture editing.

In our implementation of the Custom Motion Platform Integrated Motion System, the D-BOX Actuators will be installed under a platform onto which will be placed the custom-designed Fortress Seating Matinee three-person sectional sofa with motorized back and foot and leg positions. The platform flooring, of course, will be perfectly level with the flooring in the theatre. The four Actuators will be installed directly on the six-inch recessed concrete floor with the custom structural aluminum platform and surface carpeted frame resting on the Actuators' footprint. The recessed chamber will be soundproofed using Owens Corning SelectSound Black Acoustic Board. An air space of three quarters of an inch will be maintained all around the platform to provide ample room for the platform to move in the Left/Right and Front/Rear directions. The nine- by four-foot finish-trimmed wool carpeted platform will be positioned in the center between the theatre sidewalls and in perfect alignment with the sides of the Stewart Filmscreen Aeroview 100 ScreenWall, to provide the optimum motion characteristics to the viewers seated on the Fortress Seating Matinee sectional sofa.

I have implemented this same system in the *Widescreen Review* Reference Holosonic Spherical Surround Home Theatre Laboratory.

falls as it closes. Seals are magnetic-type triple seal. The bellows of the magnet sleeve reach out to provide a continuous seal around the perimeter of the assembly.

The result will be a near vacuum-sealed vault enclosure isolated from the world around it.

D-BOX Custom Motion Platform

An exciting part of the movie experience in the Optimum Performance Home Theatre will be played by the D-BOX Custom Motion Platform (formerly known as Odyssee Motion Simulator), which was developed by Longueuil (Montreal) Québec-based D-BOX Technologies, Inc. The CMP technology adds an incomparable dimension to the home theatre experience by completely immersing viewers in on-screen action to bring exhilarating virtual reality to ALL genres of movies—action, adventure, animation, drama, thriller, and science fiction. This “eMotion” generator makes viewers of movies and video games PART of the action.

There are presently over 650 major motion pictures and television series on DVD whose Motion Codes are recognized by and synchronized to the D-BOX Controller. Presently, selected Blu-ray Disc high-definition releases are available and soon HD DVD releases will also be available in which D-BOX Motion Codes will synchronize to the on-screen picture and soundtrack. The Controller controls the synchronization of CMP and other operational functions, including the communication (KineLink™) with the D-BOX Horizontal Actuators. KineLink is a proprietary bi-directional motion profile transmission communication protocol between the D-BOX Controller and the motor drive (CMP synDrive™) and Actuators. KineLink provides continuous streams of physical position sampling and synchronization to the system's four Actuators.

An Actuator is a small and powerful one-on-one hydraulic DSP-driven brushless AC motor system, which runs a low-friction, ripple-free, high-torque proprietary transmission drive. The D-BOX CMP system uses four Actuators per seating area, which are capable of lifting up to 1,600 pounds (per seating area) at up to 2 Gs (4600p mode). The Actuators are coordinated by the Controller, which synthesizes motion and instructs the Actuators to move seating and occupants on a four-point suspension operating on three axes: Up/Down, Left/Right, Front/Rear. The motion is performed in perfect synchronization with the on-screen action and sound.

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Equi=Tech

• Equi=Tech Wall Cabinet Systems are designed to blanket an entire facility with clean and phase-coherent balanced AC power that remains stable regardless of how the circuits are loaded down.



Flooring

The entire concrete floor of the Optimum Performance Home Theatre and rear-projection room will be wool carpeted. The Bio-Floor™ Collection from Earth Weave Carpet Mills, Inc. is the purest carpet available and is the only truly natural and sustainable carpet produced in North America. Broadloom Bio-Floor is made with 100 percent undyed naturally pigmented wool fibers and yarn with no synthetic glues, no moth proofing, no stain protections or chemicals of any type. The undyed naturally pigmented wool fibers and vegetable-dyed wool yarns are tufted into a cotton/hemp primary backing. The secondary backing is constructed using jute (a hardy earth-friendly fiber-producing plant) and is adhered with a natural rubber adhesive from the rubber tree. The complete absence of chemicals assures that the carpet will not affect indoor air quality through off-gassing of volatile organic compounds (VOC). And the carpet is completely biodegradable so you have peace of mind that after its long useful life, it will return to the Earth from which it came. This is true sustainability and what a “green eco” carpet should be.

Wool is the superior fiber choice for woven and tufted carpets. It is non-toxic, non-allergenic, and will not support bacterial growth. The high-moisture content of wool reduces static electricity and the risk of shocks, which is an important consideration for the home theatre and rear-projection room where there is electronic equipment. The fibers themselves help to regulate moisture in the air and actually take on moisture as well as give off moisture as the environment changes humidity. This is what allows wool to be cool in the summer and warm in the winter.

Wool carpet also purifies indoor air of common contaminants like formaldehyde, nitrogen dioxide, and sulfur dioxide by locking contaminants deep in the core of the fiber. Wool carpets continually purify indoor air for up to 30 years. Another benefit of wool's naturally crimped shape is the formation of millions of air pockets that act as insulation to help regulate room temperature and reduce energy bills, and absorb sound. Wool's high-moisture content and protein constituents make it naturally

flame retardant. And wool carpets have other natural properties such as resilience, resistance to 80 percent of all stains, and natural resistance to soil and dirt.

The Bio-Floor Collection is available in a variety of natural hues. The hue for the home theatre and rear-projection room flooring will be a custom-dyed, Earth Weave irregular-looped, 40-ounce black berber with all-natural 7/16-inch thick Enertia™ wool padding laid over the concrete floor surface. Other undyed, naturally pigmented wool fiber hues manufactured by Earth Weave will be used in other living areas in the Optimum Performance Home.

Theatre Power

As with the *Widescreen Review* installation, the theatre and rear-projection room will be powered with an Equi=Tech Wall Cabinet System. We will be installing the new 497-pound 20WQ, which has a considerable 200-amp output capacity and 20 dedicated 120/60V 20-amp circuits for hard-wiring balanced AC power into the theatre and rear-projection room. The 20WQ's input line is 240v, 60 Hz. The system includes the highest quality components and materials, all of which are factory assembled, such as a large, high-capacity precision torodial isolation transformer, breakers, GFCIs, 240 Joules surge protection filters and EMI/RFI line filters, all prewired throughout with oxygen-free copper wiring (OFC).

Equi=Tech Wall Cabinet Systems are designed to blanket an entire facility with clean and phase-coherent balanced AC power that remains stable regardless of how the circuits are loaded down.

The system's components are housed in a sturdy NEMA 12 steel cabinet and feature a rugged industrial-duty AC distribution panel board with commercial-grade circuit breakers, transient voltage surge protection, and ground fault circuit interrupters. The 20WQ has a two-part black cabinet with a lower section that houses the massive torodial transformer. The top cabinet measures 36 inches wide, 48 inches tall, and 8 inches deep. The lower cabinet measures 24 inches wide, 30 inches tall, and 12 inches deep. Both cabinets will be mounted on the north wall of the rear-projection room.

The transformer is the Equi=Tech proprietary and patented “Q-type,” wound with exceptionally low-line impedance copper and includes two Faraday shields for superior isolation from high-frequency RF and current harmonics. This far more efficient

type of AC power source keeps current and voltage accurately in phase regardless of peak current demands. Importantly, “Q” transformers remain acoustically quiet even in locations where there is considerable line distortion and poor power quality, and run barely warm at near full capacity. The proprietary winding design drastically reduces high inrush current and also provides for distortion-free playback performance under the most demanding load conditions. Their performance is exceptional where power-hungry amplifiers might otherwise choke during high-peak current demands using a conventional power supply. As has been stated in various reviews in *Widescreen Review*, Equi=Tech “Q” transformers provide far greater power efficiency during demanding playback material, which translates into smooth current response in amplifier loads. This adds tightness and amazing definition to low-frequency playback and provides exceptional tightness and definition to bass frequencies. The end result is absolute silence when no audio signal is present, and optimum sound and picture performance delivery when the system is engaged.

Next

As stated in past articles in this series, the design review process itself has no doubt weighed us down over this unexpectedly long period of time—four years. But now that the Design Committee has granted final approval, with the exception of the remaining need to acquire final approval of an on-site landscape plan, the project is moving forward in a hastened manner, so that commencement of construction can hopefully begin in late January 2007, subject to avoiding any serious rainstorms.

The next series of articles will continue to focus on particular design elements and on each stage of construction, the

design approach taken, and the technologies and building systems and materials used to create the first Optimum Performance Home. **UHD**

The Author

Gary Reber is the President of Ultimate Home Design, Inc. and the founding Editor-In-Chief and Publisher of *Ultimate Home Design*®, The Optimum Performance Design & Build Resource For Environmentally Enhanced Lifestyle Living™. He is also President of WSR Publishing, Inc. which publishes *Widescreen Review*®, The Essential Home Theatre Resource™. His diverse background in several fields includes an undergraduate, graduate, and postgraduate university education in architecture, community planning, and economic development planning. For years he was a consultant on community and economic development planning. For the past 15 years he has been an editor and publisher of magazines in the consumer electronics field. Gary can be reached at 951 676 4914 or gary@ultimatehomedesign.com.

Architectural Illustration & Photo Credits

Ronald Devesa is an architectural illustrator, based in Santa Rosa, California. He specializes in architectural rendering and CAD drafting using AutoCAD, Autodesk VIZ-Maxwell, and Photoshop. He is a member of the American Society of Architectural Illustrators. Samples of his work can be viewed at www.geocities.com/rldveesa. Ronald can be reached at 707 849 3500 or rldveesa@sbcglobal.net.

Scott Simpson is a pilot and aerial photographer. His company is West Of One, based in Gualala, California. Scott resides at The Sea Ranch and provided the aerial photos depicted in this article. Samples of his work can be viewed at www.westofone.com. Scott can be reached at 707 785 9445 or scott@westofone.com.

Product Information

- A/V RoomService, Ltd., 9282 Jug Street NW, Pataskala, Ohio 43062, 740 924 9321, www.avroomservice.com
- Active Thermal Management, 90 Mills Road, Kennebunkport, Maine 04046, 661 294 7999, www.activethermal.com
- American Leather, 45 A1 Mountain Creek Parkway, Dallas, Texas 75236, 800 456 9599, www.americanleather.com
- Amvic, Inc., 501 McNicoll Avenue, Toronto, Ontario, Canada 877 470 9991, www.amvicsystem.com
- Amvic, Pacific Inc., 12531 Lowhills Road, Nevada City, Nevada 95959, 530 265 9085, www.amvicsystem.com
- Billy Bags Pro-Stands™ Design, 4147-A Transport Street, Ventura, California 93003, 805 644 2185, www.billybags.com
- Cosella-Dörken Products, Inc., 4655 Delta Way, Ontario, Canada L0R 1B4, 905 563 3255, www.cosella-dorken.com
- D-BOX Technologies, Inc., 2172 Rue de la Province, Longueuil, Québec, Canada 450 442 3003, www.d-box.com
- Earth Weave Carpet Mills, Inc., P.O. Box 6120, Dalton, Georgia 30722, 706 278 8200, www.earthweave.com
- Engineered Environments, 1250 Marina Village Parkway, Alameda, California 94501, 510 521 7500, www.engenv.com
- Equi=Tech Corporation, 18258 Redwood Highway, Selma, Oregon 97538, 415 839 6334,

- 877 378 4832, www.equitech.com
- Fortress Seating, 11969 Arrow Route, Rancho Cucamonga, California 91739, 909 483 6092, 800 873 2828, www.fortresseating.com
- Gemco, 1019 Griggs Street, Danville, Illinois 61834-0846, 217 446 7900, 800 331 1164, www.gemcoinsulation.com
- Guilford Of Maine, 437 Ogle Circle, Costa Mesa, California 92627, 949 548 6001, 800 755 9236,
- Headwaters Resources, 7006 Regents Park Boulevard, Toledo, Ohio 43617, 419 842 8084, www.headwaters.com
- iLevel, Weyerhaeuser Company, 33663 Weyerhaeuser Way, Federal Way, WA 98003, 888 453 8358, www.ilevel.com
- ImageCrafters, Inc./IC Lighting, 7 Jewett Hill, Ipswich, Massachusetts 01938, 978 356 6260, www.imagecraftersinc.com
- Industrial Acoustics Corporation (IAC), 1160 Commerce Avenue, Bronx, New York 10462, 718 931 8000, www.industrialacoustics.com
- James Hardie Building Products, 26300 La Alameda, Suite 250, Mission Viejo, California 92691, 800 348 1811, www.jameshardie.com
- Kinetics Noise Control, 6300 Irelan Place, Dublin, Ohio 43017-0655, 614 889 0480, www.kineticsnoise.com
- Kryton Canada Corporation, 8280 Ross Street, Vancouver, B.C., Canada V5X 4C6, 604 324 8280, www.kryton.com
- Latitude/Live Edge, LLC @ Joinery Structures, 2500 Kirkman Street, Oakland, California 94607, 510 451 6345, www.latitudeinsulation.com
- LP Building Products, 414 Union Street, Suite 2000, Nashville, Tennessee 37219, 615 986 5659, www.lpcorp.com
- Lutron® Electronics Co., Inc., 7200 Suter Road, Coopersburg, Pennsylvania 18036-1299, 610 282 3800, 800 523 9466, www.lutron.com
- No-Burn, 1392 High Street, Suite 211, Wadsworth, Ohio 44281, 330 336 1500, www.noburn.com
- OSI Sealants, Inc./Henkel Corporation, 32150 Just Imagine Drive, Avon, Ohio 44011-1355, 800 321 3578, www.osisealants.com
- Owens Corning, One Owens Corning Parkway, Toledo, Ohio 43659, 419 248 8000 / 2790 Columbus Road, Route 16, Granville, Ohio 43023-1200, 800 GET PINK (800 438 7465), www.owenscorning.com
- Quiet Solution, 1250 Elko Drive, Sunnyvale, California 94089, 408 541 8000, www.quietsolution.com
- RPG Diffusor Systems Inc., 651-C Commerce Drive, Upper Marlboro, Maryland 20772, 301 249 0044, www.rpginc.com
- Runco International, 2900 Faber Street, Union City, California 94587, 510 324 7777, www.runco.com
- Spunstrand Incorporated, 620 North Post Street, Post Falls, Idaho 83854, 208 665 7444, www.spunstrand.com
- Stewart Filmscreen® Corporation, 1161 West Sepulveda, Torrance, California 90502, 310 326 1422, 800 762 4999, www.stewartfilm.com
- United States Gypsum Company/USG Products, 125 South Franklin Street, Chicago, Illinois 60606, 800 874 4968, www.usg.com
- WaterFurnace International, Inc., 9000 Conservation Way, Fort Wayne, Indiana 46809, 800 222 5667, www.waterfurnace.com

INSTEON™ Technology

brings automation
(and control) home

Michelle Laird



(Above) One of the most popular applications for INSTEON lighting is for setting a mood – an important aspect of interior design.
(Below) Alex Chividian's Home Theatre Room: Upon entering the home theatre room, Chividian simply pushes a button and the Stewart movie screen lowers, the Russound music and media center turn on, and the INSTEON-enabled lights dim to 10 percent.



synopsis

-  **SmartLabs deliver a fast, efficient, peer-to-peer redundant dual-mesh network that is optimized for home command and control.**
-  **Every INSTEON device can send, receive, and repeat any message, so network enrollment is reduced to a literal press of a button.**
-  **INSTEON devices are two-way repeaters; they confirm and send every message to every other device on the network, resending the message if any corruption is detected to make sure messages don't get lost.**
-  **Each INSTEON message is transmitted simultaneously through the electrical system and wirelessly throughout the home.**

Home Automation

Home automation began in earnest in the 1970s, with the advent of X10, a technology that used the existing electrical wiring in a home to simultaneously transmit data packets. A few radio-frequency technologies developed later, and from then on, people looking to gain control of their homes have had to choose between establishing either a powerline or a wireless network. When making that choice, the shortcomings of each solution were as much a consideration as their capabilities. Powerline technology was slow and had notorious reliability issues, while wireless networks tended to be pricey and required complex setup, controllers, and routers. Add to that the susceptibility to noise and interference that both single-band options routinely contend with, and it is easy to see why automation has not rocketed to the top of America's home improvement to-do list. There had to be a better way.

SmartLabs

SmartLabs, a leader in home automation since 1992, had been distributing home automation and control products to consumers and installers for nearly a decade when they

began to see a rising tide of increased demand and innovative new products being systematically stymied by the absence of a reliable, easy-to-use infrastructure that consumers could use to link everything together. The aging X10 protocol was hit-and-miss at best, run-the-microwave-and-the-lights-go-out at worst. The available wireless solutions had interference problems, a price point more suited to commercial applications, and it required a degree of technical knowledge that all but guaranteed it would never see the inside of the average American household.

"INSTEON wireless home control networking technology combines wireless RF and powerline."

And so, in 2001, SmartLabs stopped looking for the ideal infrastructure and started building it. The result is INSTEON wireless home control networking technology, the award-winning technology that combines wireless RF and powerline. SmartLabs engineers had several objectives for their project and soon realized there were three features they needed to address: simplicity, simplicity, and simplicity. By resisting the siren song of over-design and focusing on reliability, affordability, and ease of use, SmartLabs delivered a fast, efficient, peer-to-peer redundant dual-mesh network that is optimized for home command and control.

Control

One of the most significant barriers prohibiting home-automation systems from finding a broad consumer market was control. While people were intrigued by the potential, only a handful of home automation enthusiasts and electronics hobbyists had the proficiency and inclination to develop a routing strategy; set up controllers, responders, and repeaters; and manage it all with complex software. INSTEON circumvents control issues because it is a true peer-to-peer network, with no master/slave relationships and no routing strategies. Every INSTEON device can send, receive, and repeat any message, so network enrollment is reduced to a literal press of a button. Messages know where to go because each INSTEON device has a unique, factory-loaded ID embedded in nonvolatile memory. In addition to commands, messages contain their source and destination addresses. In effect, the house becomes the router, and through synchronous simulcasting and path diversity, the network itself directs every command to its target. An additional advantage of giving every device a unique address is security; there is no possibility that your turning off the lights in the den will open your neighbor's garage door. If you have a wireless Internet router at home, you understand the significance of a secure network.

Reliability

Reliability had also been a major concern, particularly in X10, due to the lack of data confirmation; you flip a switch, a message is sent, and if it gets lost or corrupted along the

way, that's the end of it. INSTEON devices are two-way repeaters; they confirm and send every message to every other device on the network, resending the message if any corruption is detected to make sure messages don't get lost. Even if someone turns on the hair dryer when you flip a switch in the kitchen, the intercommunication of the whole INSTEON network ensures that a little noise on the powerline does not result in confused commands. And because every message goes through every device, the more devices you have on a network, the stronger and more dependable that network is.

Radio Frequency Adept

SmartLabs developed the first dual-band home control technology by combining the powerline with radio frequency. Each INSTEON message is transmitted simultaneously through the electrical system and wirelessly throughout the home, overcoming the drawbacks that typically plague single-band solutions. In instances where several powerline devices are installed on different phases of a home's wiring, the wireless layer can act as a phase bridge. Where wireless signals may encounter interference or material obstruction, the powerline can deliver the data. The physical layers of powerline and radio frequency function together, augment each other, and create a dual-mesh topology. Taken together with its redundancy and peer-to-peer architecture, INSTEON delivers a truly unprecedented level of reliability.

Networkable

INSTEON is powerful and flexible enough to act as a stand-alone, but it can also interface with computers or other digital equipment through a dedicated serial link. Hypothetical scenarios of receiving an email if your basement floods or shutting off your sprinklers from your cell phone on a rainy day may be just around the corner or may be years away, but one thing is certain—as products and trends move forward, INSTEON will keep pace supporting them. SmartLabs engineers made a conscious decision to allow the razzle-dazzle of home automation to come from the devices and appliances that utilize it; by keeping INSTEON focused and simple, they ensured its immediate applicability and secured its longevity as the standard for home command and control.

Affordable

SmartLabs began on the retail side of home automation, and they know better than anyone that, while people want the capability to interact effectively with their home, they're not going to mortgage their home to do it. INSTEON is built to be affordable, and its affordability is another derivative of its simplicity.



(Above) With INSTEON, homeowners can open the front door, turn on the heat and light a pathway from the front door to the kitchen with the touch of a button by connecting devices wirelessly.

(Below) The 2493 Keypad Dimmer Starter Kit includes everything you need to begin an INSTEON wireless home control network and requires a simple change of few light switches.



Because it was designed expressly for home control, the logic is simple, the profile is compact, it requires no special controller or software, and it can be designed and integrated into electronic devices easily and at an extremely low cost.

Market Penetration

SmartLabs launched the first INSTEON-enabled products in 2005, offering a suite of light switches, dimmers, plug-in modules, and tabletop controllers. In less than a year, INSTEON has grown to become the best-selling home automation/control technologies on the market. Why? Steve Lee, President of Top Hat Automation

in Northridge, California, explains, "INSTEON will take the place of all the other switches I use. It is backward compatible with X10, more cost effective, and easier to install." In fact, Top Hat recently provided a lighting solution to NBC Theater Productions in Burbank, using INSTEON-enabled products. NBC was looking for a way to control three 3-way switches and one 4-way switch from a console at a podium. Conventional pipe-and-wire was cost prohibitive and virtually impossible, due to acoustical installation in the walls, so Lee turned to INSTEON. The technology allowed him to not only deliver the on-stage solution via a tabletop controller, it also let him provide the projection room with a single switch to control all of the lighting, and transform a switch by the director's chair to a dimmer linked to the three main switches. The director can set the ramp rate to his preference, which now brings all the house lights up or down with the touch of a button. Without pulling a single wire, Lee delighted NBC by solving problems they didn't even know they had, and for a fraction of the cost of more traditional methods.

Lee has been employing INSTEON since its introduction and estimates he has installed 600 to 700 INSTEON devices

for his clients. "It's been flawless for me as far as reliability," he said, citing example after example of customized INSTEON solutions he has supplied to clients all over Southern California. "I'll typically install 15 or 20 [INSTEON] switches in a house," he relates, "and usually, after a few months, they're ready for 20 more, 40 more. One client had me replace every switch in his house."

INSTEON Alliance

Top Hat's clients and other INSTEON users aren't simply controlling their lights, however; they are establishing an INSTEON network in their homes and are poised to take advantage—and control—of all the INSTEON-enabled products on the horizon. There are currently over 500 developer members in the INSTEON Alliance, representing a wide range of industries and applications. As Alliance members produce and market a more diversified range of INSTEON-enabled devices, the possibilities of how it can be used will be limited only by what is on a home's network and what is in the occupant's imagination. **UD**

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LIGHTING FOR UNIVERSAL DESIGN

Patricia Rizzo



(Figure 1) Conceal light source within opaque shade (left) or diffuse glass (below) to protect eyes from glare.



Light And Lighting

Light touches every part of our lives, from the moment we are born until the moment we die, and maybe beyond. It sustains us; allows us to see; allows us to sense the time of day; to sense the season; and it regulates our 24-hour circadian clock, the sleep/wake cycle that we take for granted. We feel joy when the sun shines, and perhaps romance when the moon shines. Shadows intrigue, or frighten us; bright light protects us, makes us feel safe. Light is a constant companion.

In this article, I intend to talk about lighting, specifically lighting for universal design. You've no doubt read about universal design in previous issues of *Ultimate Home Design*™. Universal design is

becoming an increasingly more familiar term in our vernacular. The concept, initiated by Ron Mace in the 1970s, addresses the ability of humans to live comfortably in our built environment. How can we accommodate the needs of a broader segment of our population, in fact, the broadest segment of our population? What types of homes, buildings, and

"Designing lighting that respects energy limits aligns perfectly with lighting that benefits young eyes, aging eyes, and everything in between."

public spaces would allow almost everyone to feel comfortable, to navigate without restriction, despite any physical or sensory impairment? What types of spaces would just make life easier for those of us who are getting older, or even the very young among us?

Aging-in-place is a popular phrase used by the National Association of Homebuilders (NAHB) today. An eponymous CBS News segment recently showcased a family of multiple generations, right up to the great grandmother, all living together in close quarters, under one roof. This is becoming more and more common. Remember when we "baby boomers" were growing up in urban neighborhoods as children? Children, parents, grandparents, aunts, uncles, and cousins often lived within a few blocks of each other, if not in the same apartment building across the hall from one another. There wasn't a day that went by when we didn't see each other, at least once. Everyone's door was open at any time to family and neighbors. We didn't need to make special "plans" to visit, no one had to check their calendar; we just walked right in. The coffee pot was always ready and perking on the stove, and some freshly baked cake or biscotti was just coming out of the oven, or homemade tomato sauce bubbling in the pot, ready for that crust of Italian bread to dunk. Life was simple. We took care of each other. "Nursing home" wasn't in our vocabulary.

That culture was lost to most Americans over the past few decades, but now there is a desire to return to that simple life. People resist being placed in "assisted-living facilities"; no one wants to leave their homes. We yearn to have family around to take care of us once again. So, homes are being built for "sandwich" generations. Master bedrooms, as well as bedroom suites for grandparents, are appearing on the first floor. Doorways and hallways are wider to accommodate any

peripheral walking or wheelchair devices we may need, or just to allow large pieces of furniture to be moved easily. Front entries are step-free, and thresholds throughout the house are smooth. Door handles are levers, not knobs, and microwaves are low enough that even a not-so-tall person can reach them.

So, physical barriers are being mitigated. Now, how do we navigate these spaces? First of all, if we are sighted, we need to see. Lighting is the key element. If we aren't sighted, we need to orient ourselves.

Light—Or Lighting?

Have you ever thought about the difference between light and lighting? Lighting is the application of light. We have endless means of creating light these days—windows, for one; then, we have a variety of lightbulbs, thousands of decorative luminaires, and more popular than ever—the return of the candle. What we do with these tools, where we place them, how much area we light with them, what color "white" light we choose, what shadows we cast, or which artwork we accent—the effects we create—this is lighting. As in the theatre, we evoke emotion through lighting. Although we are generally unaware of it, we design our lighting every day. Lighting has an infinite capacity to improve our living environment, visually, aesthetically, and functionally. With energy in high-crisis mode today, lighting responsibly is our duty. And, fortunately, designing lighting that respects energy limits aligns perfectly with lighting that benefits young eyes, aging eyes, and everything in between.

The Aging Eye

With all the good things that come with aging—wisdom, character, personal and professional accomplishments—so come the not-so-good things. Our vision deteriorates dramatically through the normal aging process. Before age 65, we undergo optical changes, and after age 65, neural changes.

Optical Changes

The retina, which is actually part of our brain, is a network of cells that includes photoreceptors, or light detectors, located at the rear lining of the eye. Increasingly less light reaches the retina (reduced retinal luminance) as we age, because our pupils get smaller, a condition known as senile miosis; and our crystalline lens becomes thicker. More and larger protein molecules accumulate and scatter through the crystalline lens, causing increased stray light and disability glare, or glare that prevents us from performing our task. We also experience reduced retinal contrast and color saturation, so we don't see images as clearly. Add to that presbyopia, or loss of accommodation, which means we cannot adapt as

synopsis

-  Lighting is the application of light. What we do with lights, where we place them, how much area we light with them, what color "white" light we choose, what shadows we cast, or which artwork we accent—the effects we create—this is lighting.
-  As we get older we need more light, but it must be more shielded, balanced, and uniform light.
-  Lighting that is the most effective for an application while using the least amount of energy can be considered energy-efficient.
-  Lighting for universal design is lighting that grows and shrinks as we do; it lives with us, and adapts to our needs.



(Figure 2) Linear fluorescent lights above and below cabinets fill in shadows and increase the impression of brightness while producing a glare-free environment.

glare, and a reduced ability to adapt to large changes in brightness. So what would alleviate these transitions?

Lighting Solutions

As we get older, we need more light, but it must be more shielded, balanced, and uniform light. A few tips include:

- Avoid direct glare caused by exposed lightbulbs. Place some kind of translucent material between you and the light source if you can see the lightbulb while standing or sitting. Select luminaires with some type of shade or diffuser (Figure 1).
- Avoid glossy surfaces, especially on floors or countertops; they become mirrors, reflecting the brightness of the light source and increasing the impression of glare.
- Avoid placing bright luminaires against dark ceilings.
- Use indirect lighting whenever possible; it fills in the shadows and creates a soft, glare-free environment while seeming brighter than a directly lit environment (Figure 2).
- Conceal linear fluorescent luminaires behind a decorative fascia, creating a cove or valance. This works especially well when you have nine-foot ceilings or higher, allowing the light to wash the walls and ceilings so your room surfaces become an extension of your light source (Figure 3).
- Use light color finishes on walls and ceilings to soften the effects of bright light sources and to reduce shadows.
- Avoid making the interior of your home too dark compared to the exterior; use dimmers to balance the brightness of your table lamps, floor lamps, and chandeliers. Balancing light levels within spaces and between adjacent spaces is important, since our accommodation is reduced. We can't negotiate sharp transitions from bright to dark spaces and vice versa as easily.

• Provide good contrast between transition areas. For example, around a doorway, lighting horizontally and vertically around a door jamb is a helpful cue for someone who has a hard time focusing clearly. During the day, contrasting paint colors between wall and door jamb will work well, but illuminated delineation is needed at night. Think about waking up in the middle of the night and trying to orient yourself to the room configuration.

Light that is just bright enough to enable you to see and guide you to where you want to go, without being so bright as to disturb you, is very helpful—a type of large area night-light.

• Maintain uniform illumination where possible. Oftentimes the way recessed or track lighting is located creates scallops of light on our walls or floors. These patterns, or pools, of light can be confusing and disorienting (Figure 4).

• Place more light close to the task. If you are writing at your desk, place your desk lamp opposite your writing hand to avoid working in your own shadow. This is true with overhead lights as well. In your kitchen, make sure the downlight over your sink or stove is in front of you, not over your shoulder.

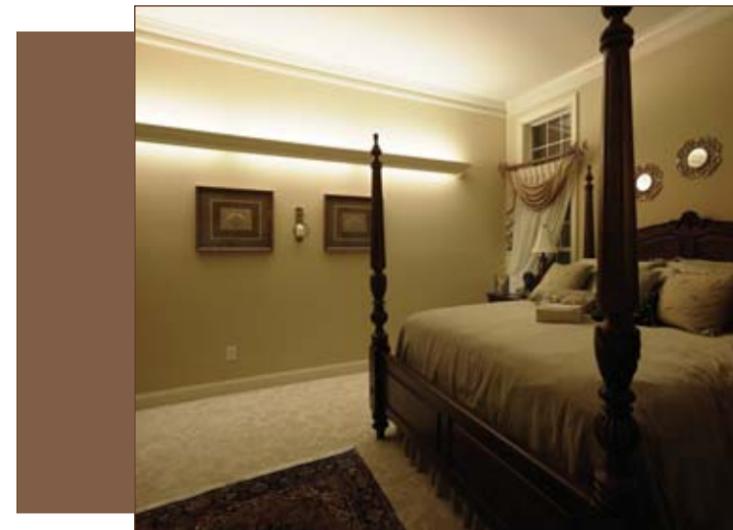
quickly to sharp changes in brightness, and there you have it: the mandatory optical change package that we are forced to live with. And that's the good news!

Neural Changes

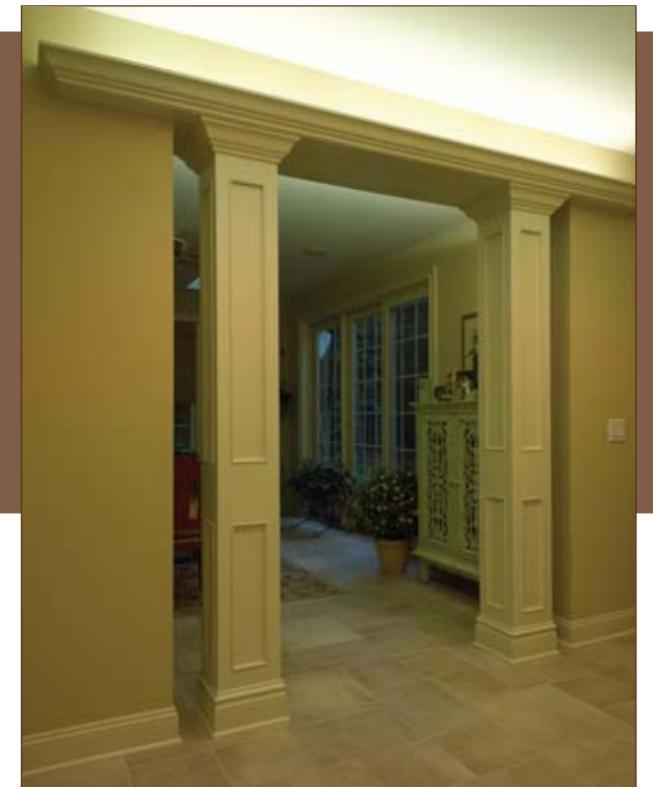
After age 65, our neuron density is reduced. Fewer neurons means limited image enhancement, reduced visual field, and photophobia, or discomfort glare. Diseases such as the following become more common:

- Cataracts—an opacity developing in the lens
- Glaucoma—progressive and visual field loss as the result of a number of diseases that affect the eye
- Macular degeneration—changes to the pigmentation in the macular, a circular yellow-pigmented area of the retina, 2 to 3 millimeters in diameter
- Diabetic retinopathy—results from chronic diabetes mellitus, which effectively destroys parts of the retina through the changes it produces in the vascular system that supplies the retina (Boyce, 2003)

What this all means is that we don't see as well. Less light reaches the retina; there is reduced retinal contrast and color saturation, loss of accommodation, increased sensitivity to



(Figure 3 Above) Valance conceals linear fluorescents providing soft ambient light and eliminating the need for downlights. (Figure 3b Right) Cove is designed to extend from columns, blending into architecture, and provides soft, indirect lighting for passage in hallway.



Energy-Efficient Lighting

A frequent misconception is that energy-efficient lighting equals fluorescent lighting. More accurately, lighting that is the most effective for an application while using the least amount of energy can be considered energy-efficient. In certain instances, that may mean that even your basic incandescent bulb is the most "efficient" for your purposes.

Let's define efficiency in absolute terms. Efficiency is a term typically used to describe the performance of a lighting fixture, or luminaire, and is expressed as a percentage. For example, a linear fluorescent pendant used in an office may have an efficiency of 76 percent. This takes into account the efficacy of the light source itself, in this case the fluorescent bulb and the light loss due to absorption or entrapment by the fixture. Luminaire efficiency is the ratio of the light output emitted by a luminaire to the light output emitted by the lamp-ballast combination (Rea, 2000); it indicates how much of the lamp's light output the luminaire's optical system directs out of the luminaire.

How about efficacy? An awkward word, but that is the metric used to describe the number of lumens emitted by a light source for every watt of energy consumed. Think of it the way you would consider miles per gallon (mpg) in the automotive world. Lumens per watt (lm/W) indicate how efficacious a

lightbulb is in absolute terms. The incandescent bulb, which has been with us since 1879, is still going strong; it averages 14 lm/W. However, only about 10 percent of the energy consumed by an incandescent lamp results in radiation that is within the visible spectrum, or seen as light, while the other 90 percent is radiated as heat.

Fluorescents

Linear fluorescent sources, the long tubes we're used to seeing in industrial fixtures, and often relegated to the garage and basement, average 80 to 100 lm/W. These sources, such as T5 (5/8 of an inch in diameter) and T8 (8/8 of an inch, or 1 inch in diameter) now use a rare earth tri-phosphor coating in their glass envelopes, vastly improving the color they emit and their ability to render color (such as your skin tone, or your drapery fabric). They operate on electronic ballasts instead of the heavier, noisier, flicker-causing magnetic ballasts we're familiar with, making them even more efficient and less obnoxious. The hum and buzz, and greenish color, so long associated with fluorescents has virtually vanished.

Compact fluorescent lamps (CFLs) are the smaller variety designed to replace incandescent bulbs. They come in shapes resembling ice cream twist cones and short bent tubes. They may have a screw base for standard luminaires or a pin base that requires a dedicated socket. CFLs have

efficacies of 55 to 75 lm/W. Unlike incandescent sources, fluorescent sources are a system, made up of a lamp (bulb) and ballast, which is needed to start them and regulate the current running through them.

Fluorescents are touted as energy-efficient because of their longer life as well as their higher efficacies than incandescent. While incandescent bulbs have a life of 800 to 2,000 hours, fluorescents last from 6,000 to 20,000 hours, reducing replacement and maintenance costs.

The higher efficacy of fluorescents translates to 4x as much light as an incandescent for equal amounts of energy consumed—meaning a 15-watt fluorescent is the equivalent of a 60-watt incandescent in light output. The caution here is that the distribution of light is not always the same, so be careful to match expectations. Take a parabolic aluminized reflector (PAR) lamp, for example. A PAR lamp is often used as the recessed floodlight or spotlight in our homes; it not only has a filament providing center beam candlepower, but also has a built-in reflector. This allows all of the lumens to be directed down where they're needed. A recessed CFL will not perform the same way. It doesn't have a filament to provide that center beam punch. Therefore, to place a lot of light directly on a work surface where it's needed, a halogen PAR or MR16 (2-inch diameter low-voltage multi-faceted reflector bulb) may be the better solution (Figure 5).

Dimming is desirable and recommended in residential applications, and it is easily achieved with incandescent technology. In fact, when dimming an incandescent you can extend its life exponentially, so it's a great energy-savings technique. Be aware though, that an incandescent will become more golden in color when dimmed. While some linear and compact versions of fluorescents have dimming options, it is not always easy or cheap to accomplish. A dimming ballast and sometimes special wiring for the dimmer switch is required. It is important to understand how different light sources behave in order to make good decisions on how to use them for maximum benefit.

Fluorescent is not the only technology being considered as energy-efficient these days. In fact, some may say it's so "20th century." So who's the new kid on the block? Light emitting diodes (LEDs), a type of solid-state lighting, hold promise of becoming the great energy saver of the 21st century.

LEDs

LEDs are a solid-state source, so they have no breakable parts, such as a delicate filament or glass envelope. They are robust but small. Their diminutive size allows them to fit in the smallest of spaces. They are easily controllable, so dimming is not an issue as it is with fluorescents. They provide dynamic color changing and so offer endless possibilities to create different moods and atmospheres. Their life is tens of thousands



(Figure 4) Avoid creating pools of light; patterns can be disorienting to the aging eye.



(Figure 5) Different distributions of an A-lamp, a PAR lamp, and an MR 16 lamp

of hours, varying with color and type of LED. Their efficacy (there's that word again!) is eclipsing that of the incandescent and even fluorescent as we speak. U.S. Department of Energy (US DOE) projections are for LEDs to reach at least 150 lm/W by the year 2012. Products are emerging in the market faster than metrics and standards can be developed. Previously confined to the electronics industry for backlighting digital clocks, radios, computers, and cell phones, the LED's merits have propelled it forth into prime time. While the LED is not new by any means—it has been around since the 60s—the invention of the blue LED about a decade ago enabled the creation of the white LED—and this ushered in the feasibility of using LEDs as a source of general illumination.

Like fluorescent sources, LEDs operate as a system, which includes electrical, optical, and thermal components. Unlike fluorescents, they behave well in cold environments such as outdoors or inside refrigerated cases.

As with all light sources, we must use LEDs wisely, or we may be disappointed, and they will never fully reach their potential.

The Color Of Light

There are two metrics associated with the color of light sources. One refers to the appearance of the color the sources emit—correlated color temperature (CCT); and the other refers to the way they render color in objects, including skin tones, their color rendering index (CRI). While incandescent or halogens emit a gold or yellowish color, fluorescents offer degrees of "white" light from yellow, or gold (warm), to bluish white (cool). Each color is associated with a CCT and expressed in degrees Kelvin (K). The yellower the CCT, the lower is the number on a scale of 0 to 10,000. Approximate ranges for each source are as follows:

- Incandescent and halogen sources—2700K to 3000K
- CFLs—2700K to 6500K
- Linear fluorescents—3000K to 7500K

CRI is based on a scale of 0 to 100, with 100 being the best. Incandescents typically are rated with a high CRI, close to 100. CFLs and linear fluorescents can range from the low 50s to the high 80s. It's important to read the package label when looking for the CCT and CRI of fluorescent sources. ENERGY STAR® products guarantee a good CRI, since ENERGY STAR requires CFLs to have a CRI greater than 80 and linear fluorescents to have a CRI greater than 75.

Energy-Efficient Lighting, The Aging Eye, And Universal Design

Revisiting the issues that characterize our visual needs as we get older, we know we must respect glare, accommodation, orientation, and way-finding; and we must minimize equipment replacement in order to avoid climbing ladders, thus inviting accidents. Here are some ways fluorescent and LED sources comply:

Fluorescent Sources

Linear fluorescents make wonderful indirect sources, addressing many of the aging eye issues. They cover a greater area than incandescent sources; linear fluorescents lend themselves to architectural applications such as coves and valances. They can provide soft indirect lighting that fills in shadows, minimizes glare, and utilizes the room surfaces as light sources, while being easily concealed behind decorative moldings. Both linear fluorescents and CFLs have a higher

efficacy than incandescents, emitting approximately 4x as much light for equal wattage consumed, which translates to one-fourth of the operating cost. They live approximately 10x as long as incandescents, so they require less frequent replacement, which saves money while reducing the risk of falls. CFLs are extremely well suited to table and floor lamps, as well as sconces if housed within a diffuse or colored shade.

LED Sources

LEDs have a unique benefit to the aging eye. As we age, our circadian system, which responds to light differently than our visual system, weakens. Our sleep patterns become irregular. Exposure to the right amount and intensity of light at the right time of day can help regulate our circadian rhythm.

The wavelength of the blue LED, peaking at 470 nanometers (nm) happens to be the perfect color and intensity of light to activate our circadian system much more quickly than white light sources. Humans are blue sky detectors; light entrains our 24-hour sleep/wake cycle to the solar day. The amount of light reaching the retina is a key to melatonin suppression, which occurs during the night while we sleep. We can consolidate the amount of our light exposure to help regulate our night-time schedule.

In addition, colored as well as white LEDs can provide sufficient light to help in navigation and orientation from one room to another, and can do so at levels that do not disturb the homeowner.

Rather than be confined in a single lightbulb, LEDs can be distributed, so they can run linearly in the narrowest of places. Under counters and toe kicks—to delineate edges; around door jambs for contrast; behind grab bars for night guidance; for handrails and step lighting, indoors and out, for safety.

Lighting For Universal Design: A "Universal Design Living Laboratory"

All we've touched on brings us back to our main topic, lighting for universal design. Since universal design covers such a broad range of life situations, we can apply the considerable lighting knowledge we've gathered regarding the diverse phases of life: newborns, teenagers, older adults, those with sleep disorders, and those with compromised vision; those with mobility issues, or those that are in general good health with no disabilities to speak of. The following example is a good illustration.

In the spring semester of 2006, the graduate students of the Lighting Research Center, part of Rensselaer Polytechnic Institute in Troy, New York, worked closely with



(Figure 6) Great Room
Color-changing LED system is concealed in cove along each side of great room to uplift vaulted ceiling, and provide mood and circadian benefits; blue light has been found to be effective in activating the circadian system.

(Figure 7) Grandparents' Bedroom
Linear fluorescents provide emanating light from false wall behind bed; and puck lights located along lower wall help in way finding from bed to bathroom.



a client to design the lighting for her universal design home, a home that is to become a "living laboratory" for conceptual and technological advances in universal design. The students spent several hours interviewing the homeowner in person and becoming familiar with her needs (she is 4-feet 2-inches seated in a wheelchair), those of her husband (he is 6-feet 4-inches standing), the lifestyle they wished to sustain, and the objectives of the living laboratory. The homeowner intends to open the home to the public and showcase the spatial and lighting design solutions integrated into the architecture and landscape by holding instructional tours and seminars.

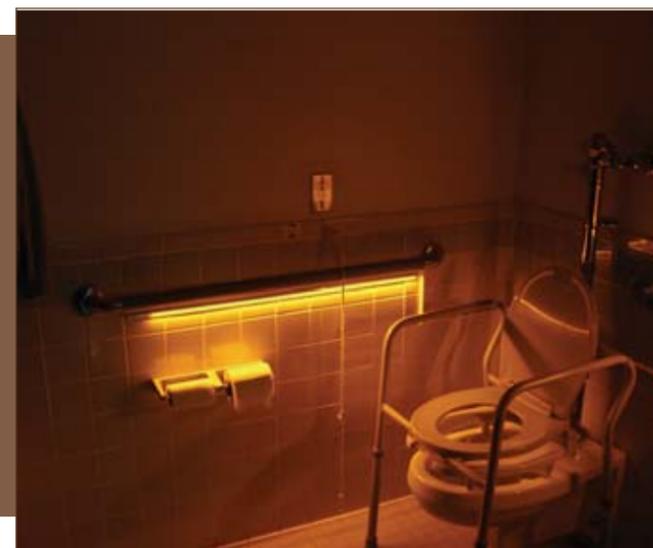
Having already studied light and health issues, and therefore, being well versed in the aging eye, circadian system, sleep phase disorders, and Alzheimer's disease, these students were armed with more than enough knowledge to attempt a "universal" lighting design. Vision science, lighting technology, and artistic sensitivity came together in their solutions.

Their design intent for the project states: "...our design attempts to serve the needs of four broad and disparate segments of the population: the elderly, those suffering from circadian disorder, those who need response with minimal interaction, and the wheelchair-bound."

The students also state that their lighting exemplifies responsiveness to the following needs:

- For the elderly, they focused on the needs of the aging eye by minimizing glare and attempting to create a diffuse and even glow throughout the space.

- For those with circadian disorders, they provided a space, under the color-changing lights in the great room, where those suffering from Seasonal Affective Disorder (SAD), Advance Sleep Phase Syndrome (ASPS), Delayed Sleep Phase Syndrome (DSPS), and various forms of Alzheimer's disease could be suffused with the sky-blue glow known to be particularly effective at affecting the circadian system and dealing with such disorders (Figure 6).



(Figure 8) Amber LEDs light below grab bars to provide sufficient light for navigating at night, but not too much to startle you from sleep.

- For those needing response with minimal interaction, they provided the lighting automation laboratory in the dressing room, where various lighting control schemes, simulating lighting environments from restaurants to offices to daylight, could be implemented and tested, in the true spirit of a lighting laboratory.

- For those who are wheelchair-bound, they located all lighting controls at locations where no inbuilt structure blocks access; and they specified all control mounting heights as 40 inches from the floor.

- For those who are wheelchair-bound or of shorter stature, they provided well-shielded, lensed luminaires to avoid glare when looking up into an under-cabinet light or pendant.

- In addition, for all occupants, they added elements intended to improve the general lighting; they added way-finding elements, such as subtle "puck" night-lights, which bracket the paths to the bathrooms, and amber LEDs lighting the wall below grab bars to provide sufficient light to find your way into the bathroom but not so much that it startles you during the night (Figures 7 and 8).

- Although not part of this design, delineation of transition zones aids in orientation and helps prevent trips and falls [Figueiro, 2006 (Figure 9)].

- Since the garages were the homeowners' principal point of entry, the students wanted to make them interesting and inviting, so they added artistic illumination in the multiple garages.

- They also added dramatic external lighting, intended to bathe the outside walls of the Universal Design Living



(Figure 9a) Delineation of transition zones. Horizontal and vertical lighting provides perceptual cues to help older adults orient themselves when awaking from sleep. These amber LEDs are photosensor and motion controlled. Amber was selected because it gives enough light to see and is closest in color to the familiar incandescent.

Laboratory (UDLL) with a warm, suffuse, inviting glow, thus drawing those of all visual capabilities toward and into the UDLL.

Design, by definition, implies a deliberate, thoughtful solution to a problem/situation. Since each home presents unique situations, when an individual cannot get to an exterior mail box or post office, for example, what's the alternative? A personal, interior drop box—lighted, of course. A door switch activated LED provides a simple solution (Figure 10). This solution sprang from collaboration with a fellow panelist as we

Simple Lighting Tips For Universal Design

- While “baby boomers,” the fastest growing segment of our population today, have additional visual needs, i.e., higher light levels, better shielding—universal design occupants may also need to avoid increased glare from pendants or under-cabinet luminaires, due to the lower vantage point of user
- Since countertop and cooktop heights may be adjustable, task lighting must be flexible
- Provide bright, interesting lighting in the garage since that may be the main point of entry
- Provide contrast by illuminating edges under counters, cabinet toe kicks, and around doorways
- Under-cabinet lighting: linear T5 fluorescent, low-profile so as not to protrude below cabinet trim, well shielded (diffuse lens), good CRI and good distribution; locate luminaire at front of cabinet with lens facing backsplash

Controls:

- Light switches—use lighted, rocker switches; height should be between 36 and 42 inches from floor and be located within easy reach of user (not back wall!)
- Use adjustable controls, i.e. dimmer switches, to enable you to balance brightness levels and create atmosphere
- Consider a preset control system option; this allows you to set varying light levels and scenes according to room or task and eliminates the need to turn lights on or off when you enter or leave your home or individual room; or when you forget to turn that one light off on the other side of the house after you get into bed at night
- Occupancy sensors—automatic or manual on (required in California under Title 24 for sources that are not high efficacy, i.e., incandescent)
- Lighting must be beautiful and seamlessly integrated!



Figure 9b: Change in grade is marked by linear LEDs under step

package. Upgrades are offered for granite countertops and whirlpool bathtubs, and maybe a fancier chandelier. But a chandelier is not lighting—it's furniture.

At the very least, hopefully, this article has revealed that lighting answers specific questions. If we are wobbly when waking up to get to the bathroom at night, we need a switch close to our bed to turn on the light, or an occupancy sensor to do it for us. And we don't need to connect to a bright light, but rather a low-level light so we can adapt to the light, and conversely re-adapt to the dark when returning to bed. That's design. If we can't read the same size font we were able to a couple of years ago, then we need more light. But brighter is not better if it causes glare, and discomfort. So we choose a reading light with a decorative shade to shield the brightness but direct the light onto our book or newspaper, or a simple dimmer. That's design—it's being considerate of how we function as humans; such a simple concept, yet so neglected.

If I were to define lighting for universal design, I would say that it is lighting that grows and shrinks as we do; it lives with us, and adapts to our needs. Furniture manufacturers make cribs now that convert into toddler beds. Why not lighting? Then all the elements we mentioned in this article would be incorpo-

prepared to speak at the National Association of Home Builders (NAHB) Boomers & Beyond Conference in Phoenix, Arizona this past April. And, in the spirit of being truly universal, who wouldn't benefit from such a feature in their home? The only person left to convince would be the mail carrier!

It is safe to say that good lighting is absent from most new construction. Recessed incandescent downlights are rampant and often glaring, and switch locations are often inconvenient. Rare is the case when a building professional calls on the services of a lighting designer to improve their basic construction

Figure 10a: Floor plan showing location of mail drop/pick-up drawer accessible from laundry room.



(Figure 10b) A special universal design application could be a lighted mail drop—a dedicated pull-down drawer located either alongside the front door or in the laundry room that facilitates sending and retrieving packages for someone unable to go out to mailbox or get to a mail center. A door switch-activated LED could light the interior of the box. Also notice the location of the light switch, no higher than 42 inches from the floor. (Floor plan and rendering courtesy of Rob Williams, KTG Architects, Los Angeles, 2006)

rated as naturally as Sheetrock™ and windows. It is not only the responsibility of the builder and the manufacturers—it is the homeowner's as well. We are all educating each other at this point. If homes are truly designed to be “universal,” then comfort and safety and aesthetics will be a priority, not feared for being an “incremental cost.”

When the overlap among our sensory, ambulatory, architectural, and environmental systems is recognized and treated as a unit, not isolated fragments—a lofty goal but achievable—we will be a little closer to longer, happier lives in our own homes, surrounded by our family. **UD**

Acknowledgements

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The Author

Patricia Rizzo, MSC, manages the residential lighting program at the Lighting Research Center at the Rensselaer Polytechnic Institute in Troy, New York. She conducts research, organizes seminars for building professionals on application techniques, and coordinates education and demonstration projects ranging from showcase homes to interactive lighting laboratories in retail showrooms. She is currently exploring the role of lighting in universal design. She has lectured at national and international venues and has been quoted as a lighting design expert in *Better Homes And Gardens* and the *Boston Globe*. She has participated in the curriculum design of a series of seminars organized by state energy and building associations, and is a member of the Illuminating Engineering Society of North America. To contact Patricia, please phone 518 687 7194 or email her at rizzop2@rpi.edu.

Bright Ideas

for fighting
high energy bills

Pamela Winikoff

synopsis

-  **New efficient bulbs and lighting control devices can make a big difference in your monthly utility bills.**
-  **Save a tidy sum by replacing incandescent bulbs in your home with energy-efficient compact fluorescent lamps (CFLs), which use about a quarter of the energy of an incandescent bulb and last about ten times longer.**
-  **By replacing switches with dimmers, you can custom-tailor light levels throughout your home—to match task and mood requirements and save energy.**
-  **Occupancy sensors are ideal for entryways, basements, laundry rooms, hallways, and garages—any place where lights may accidentally be left on long after you've already left the area.**



Unless you've been living in the Dark Ages, you're aware of how much the cost of energy has recently shot up. So far this season, the price of home heating oil has already soared over \$2.50 a gallon, more than twice the price of four years ago, according to the U.S. Energy Information Administration.

The average American household now spends around \$1,900 a year on their utility bills. Is it any wonder people are looking to reduce energy costs any way they can? If you're looking to save on your home's energy costs, the first place to look is directly overhead. One of the simplest and most cost-effective ways to reduce your energy consumption is with energy-efficient light bulbs and lighting controls. New efficient bulbs and lighting control devices can make a big difference in your monthly utility bills. Here are some recommendations:

Money-Saving CFLs

Save a tidy sum by replacing incandescent bulbs in your home with energy-efficient compact fluorescent lamps (CFLs). CFLs use about a quarter of the energy

of an incandescent bulb and last about ten times longer, which means you'll have to replace them far less often. And since they use less energy, that's not only good for your bottom line, it's good for the environment as well. CFLs are ideal for lamps and light fixtures anywhere in your home. And since they don't heat up a room like regular light bulbs, they keep your home cooler in the summer. This means your air conditioners won't have to work as hard.

Dim Some

By replacing switches with dimmers, you can custom-tailor light levels throughout your home—to match

"One of the simplest and most cost-effective ways to reduce your energy consumption is with energy-efficient light bulbs and lighting controls."

task and mood requirements and save energy as well. A dimmer can be installed in as little time as it takes to wire up a light switch. Attractive and stylish, with features that may include soft start, gentle fade operation, LED indicators that show selected brightness levels, and preset levels that "remember" the last selected brightness level, dimmers let you custom-tailor the perfect light level anywhere in your home. Install them in dining rooms, living rooms, entertainment rooms, bedrooms, kitchens, and even the bathroom.

Dimmers use less electricity and save you money. By dimming a bulb 50 percent, you'll use 40 percent less electricity. Dimmers can also extend bulb life up to 20 times. They are available in a wide range of models—including traditional rotary style, touch, slide, push pad, and more—and are available in a wide array of colors to match any décor. Dimmers add a sleek, elegant touch with their modern designer-styled lines wherever you install them.

Timing is Everything

Electronic timer switches offer yet another alternative for replacing existing wall switches. These devices offer the benefits of timed-control light switching, combined with energy savings anywhere in your home. Electronic



timer switches are also ideal for controlling your outdoor lighting, heat lamps, pool and spa pumps, and attic and exhaust fans. These devices provide a choice of time intervals, at the push of a button, and are more accurate and easier to use than mechanical dial-type devices.

Some versions offer programmable ON/OFF schedules that give the home a lived-in look when homeowners are away, adding peace of mind for traveling homeowners.

Hands-Free Lighting Control

Occupancy sensors offer a convenient alternative to traditional on/off switches, with a single-gang wall box installed in their place. These devices use infrared-sensing technology to detect body heat and automatically turn lights on or off, after a specified time interval has passed, once the area has been vacated. Every home is a candidate for these modern devices, especially those with young children who are notorious for forgetting to shut lights off.

Occupancy sensors are ideal for entryways, basements, laundry rooms, hallways, and garages—any place where lights may accidentally be left on long after you've already left the area. These devices offer hands-free convenience and added safety, especially for toddlers and seniors.

Controls For The Great Outdoors

Outdoor motion sensors offer personal safety and security benefits. Homeowners avoid fumbling for their keys in darkened areas, and visitors are greeted by welcoming light when outdoor lighting is instantly

switched on. Motion sensors also help to ward off would-be intruders by removing the cover of darkness from your property. These devices are ideal for front and back entrances to your home, if mounted along the side of your home or entryway to your garage.

Big Savings In A Small Package

Night-lights are a great way to add convenience lighting to your home for just pennies a day. Available in a multitude of different styles, they're inexpensive to purchase and operate, and can be inserted into any outlet, in any room in your home. They radiate a comforting glow in bedrooms, kitchens, bathrooms, and hallways, or any other area of your home where convenience lighting is needed after dark.

Night-lights are ideal for homes with toddlers, small children, or seniors. Statistics show that one out of every three people over the age of 65 falls each year, and according to the Centers for Disease Control and Prevention (CDC), two-thirds of them will unfortunately do so again within six months. Children, too, can wake up disoriented or afraid in a dark room. A night-light can be a reassuring beacon for young and old alike.

Inexpensive to purchase and use, night-lights are available in a wide variety of styles, including LED, incandescent, automatic sensor, sonar- and motion-activated, and other styles.

Keep It Simple

When it comes to saving energy, sometimes conventional wisdom works well—switch off lights when leaving a room. A very effective technique, this requires no installation, other than a string around your finger to remember!

Stop "Phantom" Power Loss

It's a little-known fact that home electronics (like TVs, DVD players, stereos, and computers) actually consume around three-fourths of their total electricity usage when off. Unplug them, or switch off the power strip or surge-protective device they are plugged into, when not using them, and eliminate this needless "phantom" power loss. **UHD**

The Author

Pamela Winikoff is public relations manager of Leviton Manufacturing and editor of the Leviton Institute's *Helpful Hints On Home Electricity* newsletter. Leviton is North America's leading manufacturer of electrical wiring devices and lighting controls.

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"Home Heartbeat provides homeowners with an all-in-one glimpse at the status and condition of their home through a ZigBee wireless network of sensors."

Home Awareness Product

provides homeowners with peace of mind

Eric Ash

Eaton Corporation, a diversified industrial manufacturer, recently introduced a wireless home awareness system, Home Heartbeat. This system enables homeowners the ability to monitor and receive real-time updates on their home.

Home Heartbeat is a "do-it-yourself" system with a simple 10- to 15-minute installation. In three easy steps, the installation is complete: activate the Base Station by plugging it in to an outlet, train the Home Key to provide the homeowners with information that is pertinent to them, and then place the sensors to monitor the home.

The Base Station relays alert messages from the individual sensors to the homeowner, who can then read the messages via the Home Key (in and around the home), text message on a cell phone, or e-mail alerts on a smart phone or e-mail account. Status updates can also be accessed in real-time by way of a secured Web site.

Home Heartbeat provides homeowners with an all-in-one glimpse at the status and condition of their home through a ZigBee wireless network of sensors. The sensors monitor and alert homeowners to a wide range of updates around the home, including water leaks, open/closed doors and windows, appliances that are still drawing power, and even routine maintenance schedules.

A troublesome water leak around the washer, a burst pipe in the basement—every year it's estimated that water losses cause approximately \$4 billion in damage to property in the United States (excluding flood losses). These losses can be reduced with a Home Heartbeat water sensor, which not only relays an alert message to the homeowner but also communicates wirelessly with an installed water shut-off valve to interrupt the main water supply to the home, preventing further water damage.

Additional sensors include a power monitor to track appliances that have been left plugged in, like a curling iron, coffee pot, or space heater. The open/closed sensor can monitor the comings and goings of individuals in the home. The reminder-sensor alerts the homeowner to routine maintenance schedules, like taking a daily vitamin or changing the furnace filter.

Home Heartbeat is also the perfect real-time monitoring device for a vacation home, rental properties, or overseeing the residence of an elderly parent or relative. More information on Home Heartbeat can be found at www.homeheartbeat.com. **UHD**

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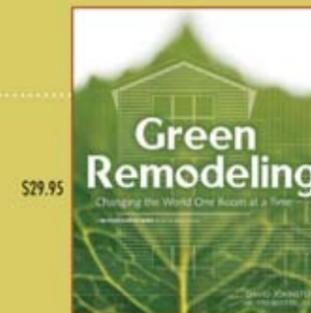
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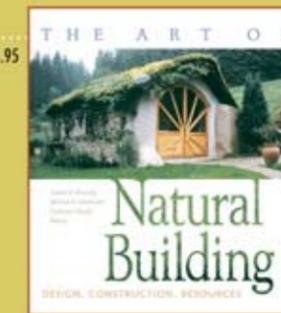
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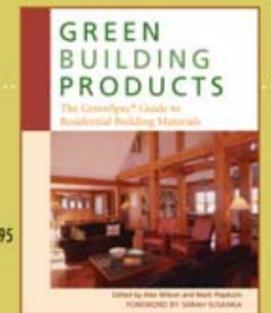
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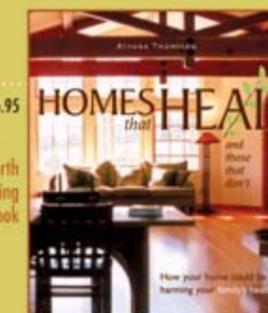
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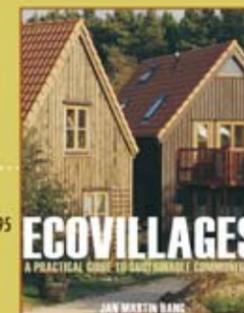
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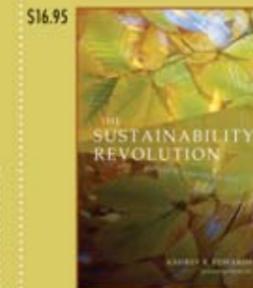
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