



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

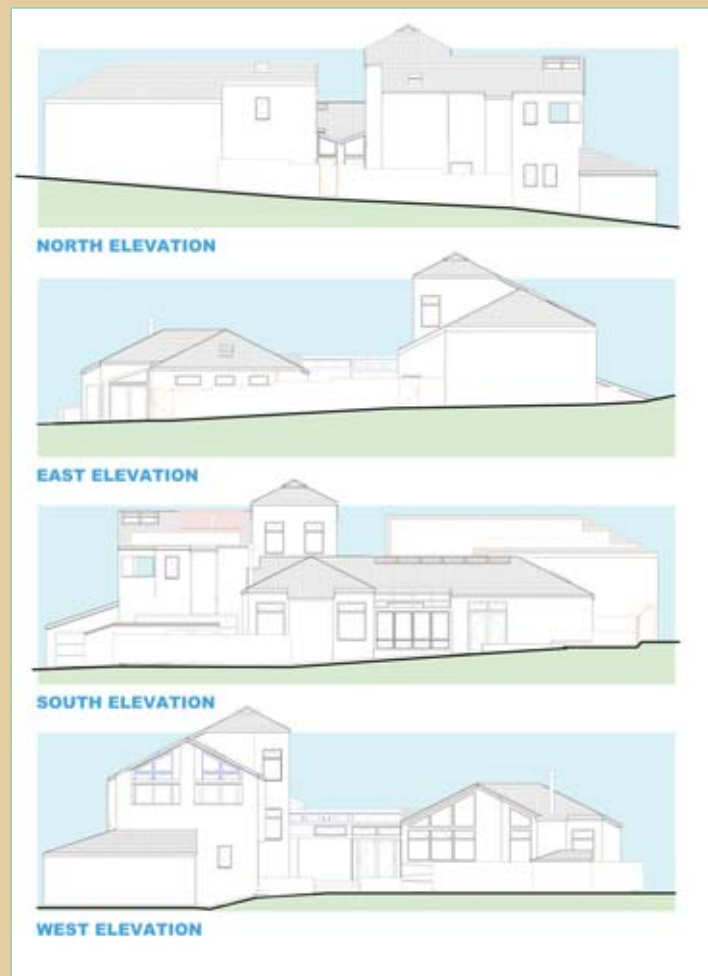
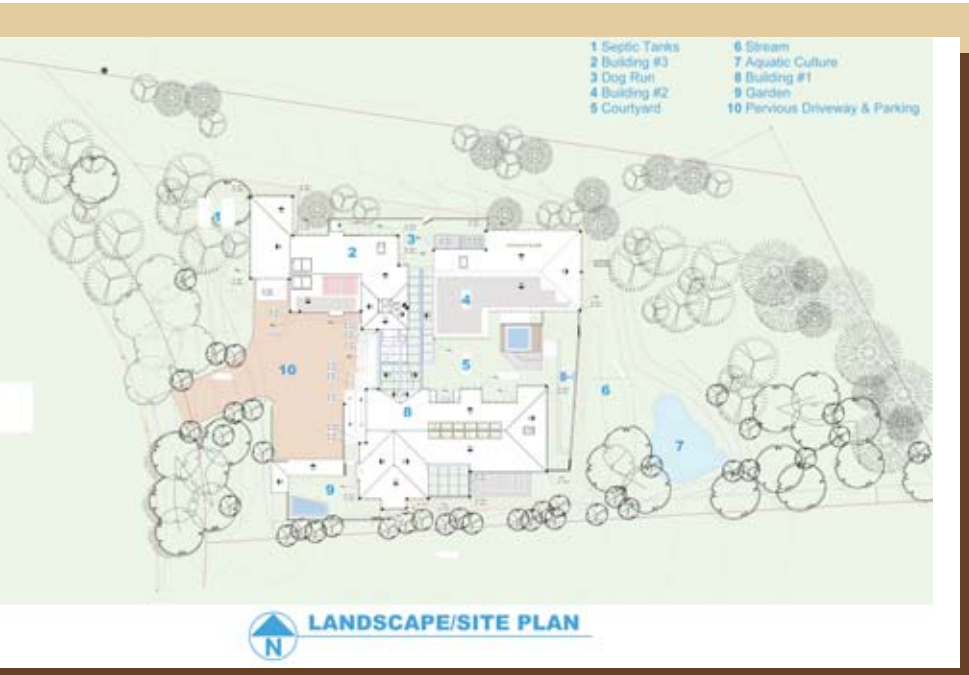
Development (LID); further refinements to the site plan and drainage design; The Sea Ranch Design Committee approval of the architectural/structural and grading/drainage submittals with conditions that translated to clarifications on certain building components and material finishes; particular aspects 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

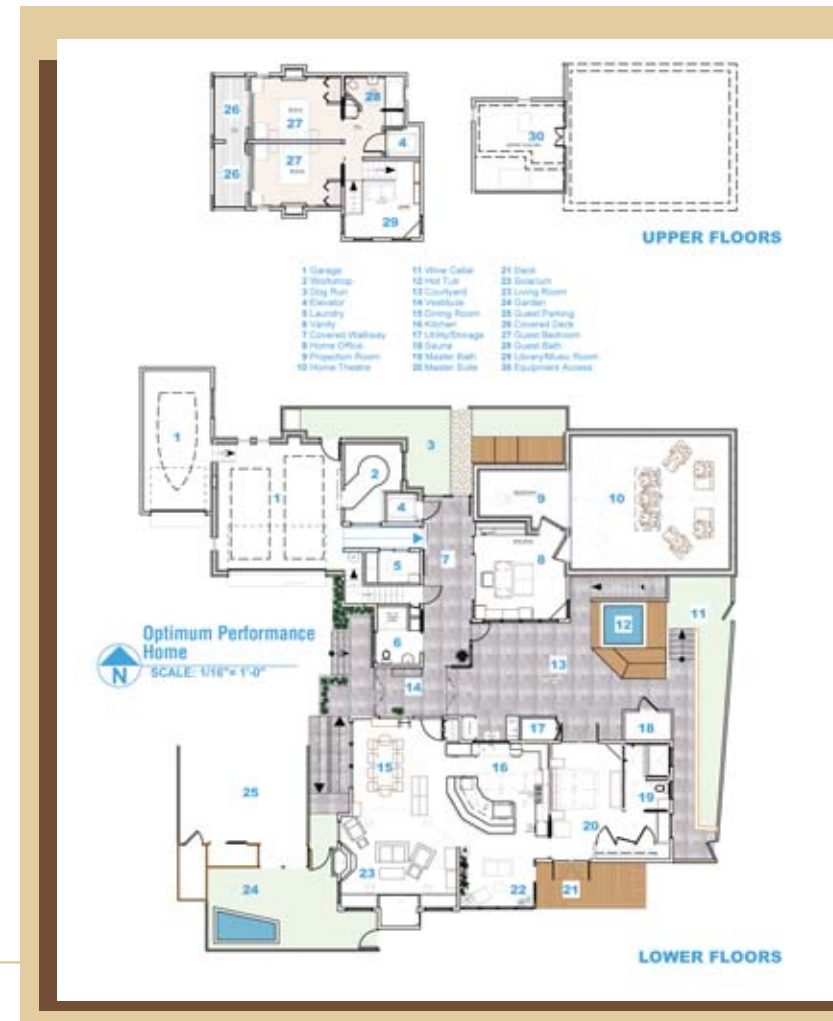
only will there be a dedicated Optimum Performance Home Theatre, but studio-quality performance home theatre equipment will be integrated into the design of the living room, home office, master bedroom suite, guest bedrooms, and the study/library/surround music room.

A Passion For Audiophile Sound And Videophile Imagery

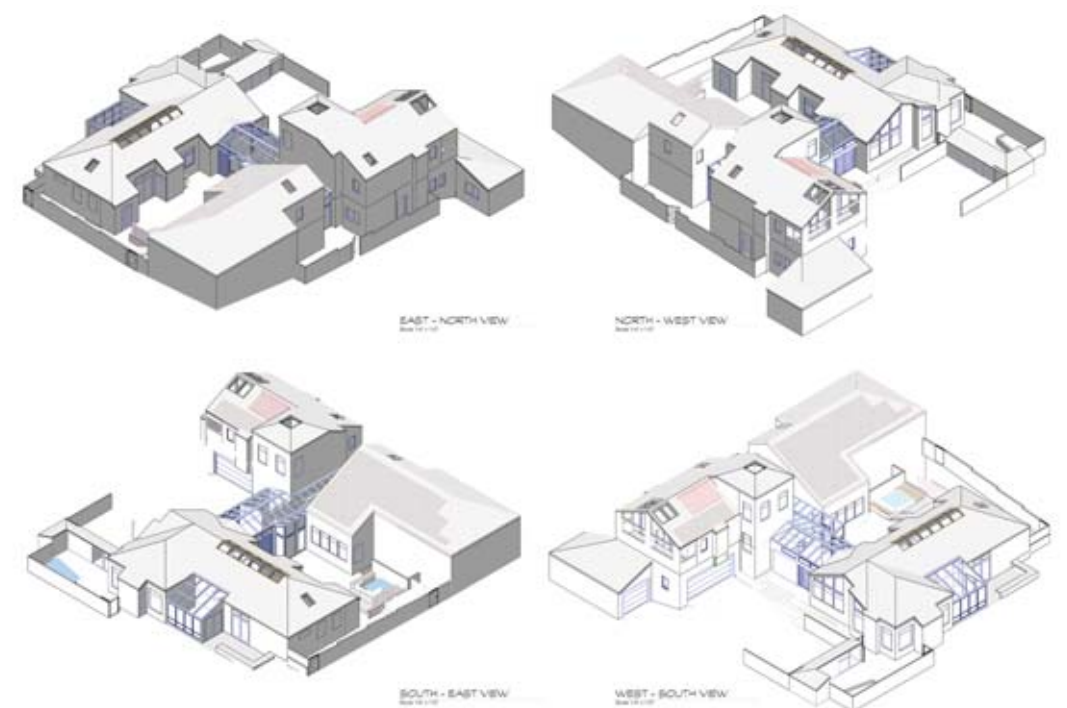
As founder and President of WSR Publishing, Inc., for the past 15 years I have been publishing *Widescreen Review*® magazine—The Essential Home Theatre Resource™—and other Internet-based Webzines and e-newsletters dealing with electronic lifestyles, movies, and surround music. There, as with *Ultimate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

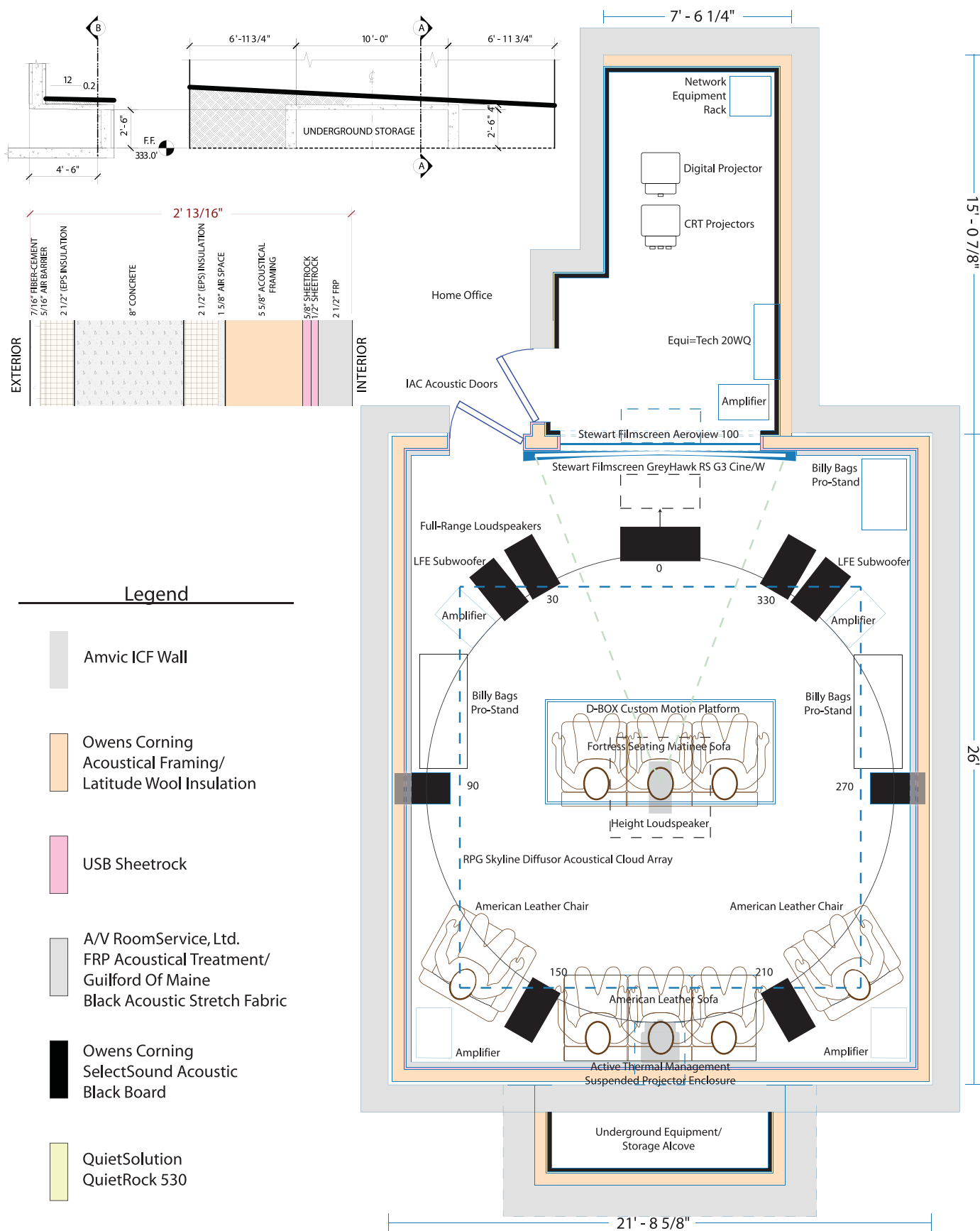
The slab foundations are designed as two structural elements: one foundation is six inches thick and supports the main residence (Building One) and guest quarters and library/home theatre/surround music room (Building Three), including the garages and insulated- and solar-gain-reduced-glass vestibule 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.

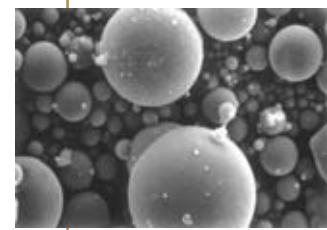
As with the Energy/Heat Recovery Ventilator (E/HRV) units to be installed in Buildings One and Three, the WaterFurnace E Series water-to-air heat pump, in addition to providing air conditioning and heating (if necessary), will exhaust stale air and harmful contaminants and fill the home theatre and rear-projection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

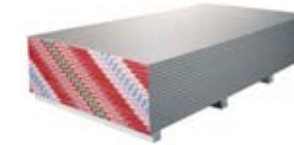
An inner room will be constructed out 1-5/8 inches from the interior surface of the Amvic ICF wall structure to create an air gap. This wall will use the 2 x 6-inch 14-foot specially engineered Owens Corning QuietZone Acoustic Wall Framing studs connected by several acoustically resilient spring-loaded 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.



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

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.



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.

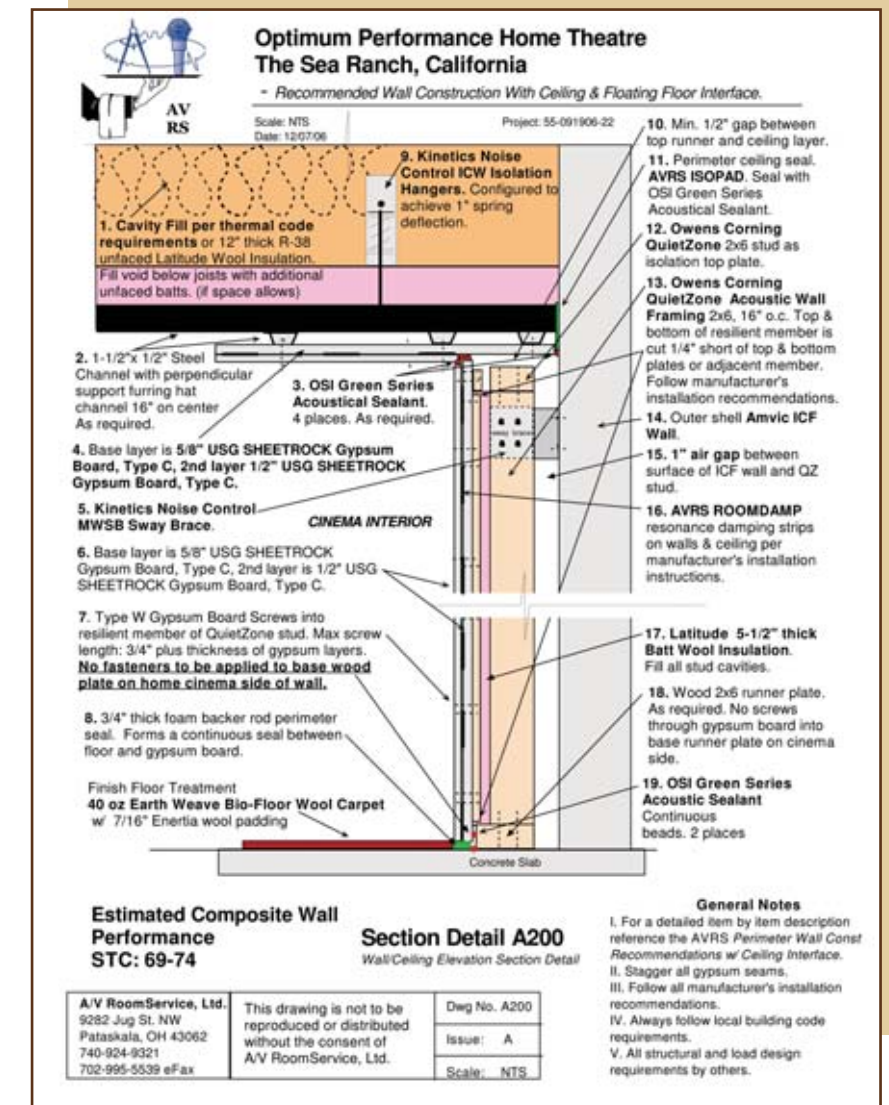
The Preferred Viewing Distance And "Sweet Spot"

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).

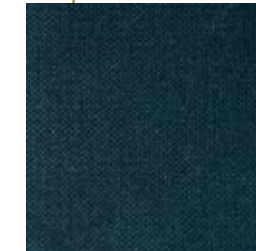
Rear projection offers much better resistance against ambient light since the screen design allows a significant portion of the ambient light to pass through the screen without being reflected off the viewing surface as in the case with a front-reflective projection screen. Installing the projector



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.



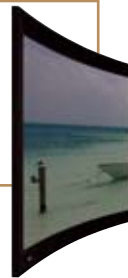
Lutron Electronics Company, Inc.

- 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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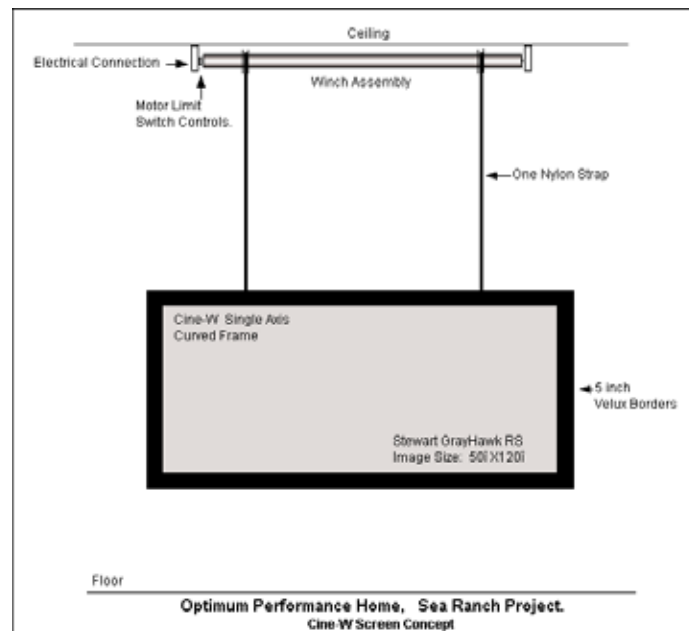


VeLux® appliqué non-reflective light-absorptive black fabric material will be used for the frame treatment. This will ensure that the ScreenWall has a rich look while eliminating image overscan and ensuring a sharp black edge. This system allows for controlled masked widths and heights so that, for example, 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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Earth Weave Carpet Mills, Inc.

- Broadloom Bio-Floor sustainable carpet is made with 100 percent undyed naturally pigmented wool fibers and yarn with no synthetic glues, no moth proofing, and no stain protections or chemicals of any type, which assures that the carpet will not affect indoor air quality through off-gassing of volatile organic compounds (VOC).



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

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- 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
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- Fortress Seating, 11969 Arrow Route, Rancho Cucamonga, California 91739, 909 483 6092, 800 873 2828, www.fortresseating.com
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- 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
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- 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