

“It’s the audio that truly blows you away — so much power, so clean. My wife almost cried hearing this for the first time.”

Audio configuration

There are, in all, 17 speakers in this home cinema, although David Moseley accurately describes the system as operating in 7.1.4. So that’s four ceiling speakers plus seven channels on the floor, though these seven are delivered from nine speaker positions, with L, C, R at the front, plus six surround speakers, with two speakers on each side to handle the side surround signal.

“Since we were using the 13.1-channel Anthem audio processor, we split the audio signal on the side channels to create a wider soundfield to the seating rows,” explains David. “One speaker can be too easy to localise, and can create a large gap between the front and rear speakers.”

Similarly the ‘.1’ in the 7.1.4 doesn’t indicate only a single subwoofer — this system uses four in total, with two 15-inch Theory Audio subwoofers at the front and two 12-inch digital active subwoofers from new brand Elementi (see overleaf) bringing up the rear.

“Four subwoofers were used to ensure a smooth frequency response across all seats,” notes David. “So some people might mistakenly call this a 7.4.4 cinema, or even 9.4.4 given the split side surround speakers. But the subwoofers in the system are used as a single channel for low frequency extension. They are time-aligned and levelled to produce

the best response before room tuning. Only once this is done correctly can the final system be calibrated. It is possible to use multiple subs to provide bass steering [differentiating the bass signals to match their position in the room] when the cinema has been engineered to eliminate standing waves — and that is something we do in our higher-end projects. But the goal here was to deliver tight, even bass. So the true description of the system here is 7.1.4, despite the fact we are utilising 17 speakers and subs in all.”

Wavetrain was able to meet the budget of the client by using, along with the Anthem processor, a combination of Theory, Triad and Elementi speakers and amplification (see the equipment list).

Video system

The video system, meanwhile, includes a 165-inch Severtson CinemaScope projection screen, illuminated by BenQ’s LK990, which uses Texas Instrument’s pixel-flipping DLP XPR technology to deliver UHD (4K) resolution with 6000 ANSI lumens light output.

“The video system was designed to achieve 100 nits of screen brightness, which we consider essential to achieve a true High Dynamic Range image in a cinema environment,” says David. “This is approximately double the screen brightness of a commercial



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Entertainment extension by Wavetrain Cinemas

Considering a home extension? Why not make a Statement? We asked Wavetrain Cinemas’ David Moseley to explain some of the secrets behind this stunning home cinema with 165-inch screen.

If you’re going to build an extension to your home, what better use for it than a reference-level home cinema! Wavetrain Cinemas was engaged to design this home’s new cinema space from the ground up, as an extension to the existing house.

“The client was after a cinema that could match commercial cinema performance,” says Wavetrain’s David Moseley. “And from the very start we knew we would exceed that goal by correctly designing all elements of the cinema.” And according to the lucky owner of this eight-seat theatre, David Moseley’s confidence was not misplaced.

“Wavetrain far exceeded what I thought would be possible in a home cinema environment,” the owner tells *Sound+Image*. “Initially I thought it was about ‘coming as close as possible’ to the commercial cinema experience. How wrong we were! This project flipped the tables — now the commercial cinema experience falls far short.”

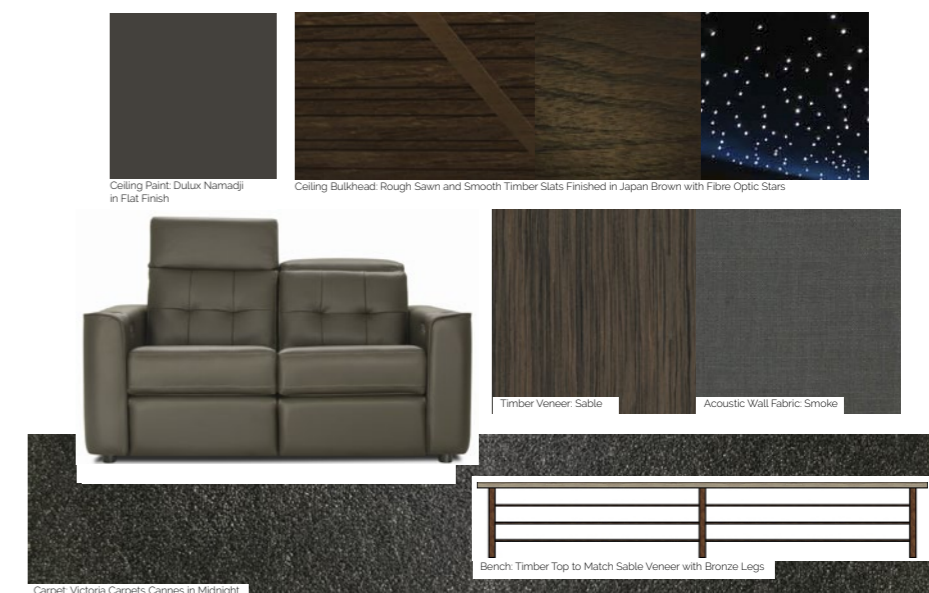
Making a Statement

While Wavetrain describes itself as “a complete turnkey cinema company”, able to follow any preference for any space, it can also help ease the potentially overwhelming task of going from empty space to working home cinema by having a number of pre-designed home cinema options which can be tailored to the owner’s particular requirements. Step one,

it says, is simply to make an appointment. Step two is to discuss your goals and experience Wavetrain’s demonstration rooms in Taren Point, Sydney, to experience what’s possible and get inspired. And step three sees Wavetrain then “handcraft a cinema that brings your vision to life”, producing architectural drawings, the mechanical and acoustic engineering, supplying the entire cinema fit-out, and then undertaking final audio/video calibration.

Wavetrain is also notably proud of its role in interior design. In this case, the clients had selected a cinema design from one of Wavetrain’s ‘Statement Cinemas’.

“These pre-designed cinemas mean we can concentrate on engineering the room, leaving the only real choices as carpet, fabric, timber and chair colours, which can be handled by our Interior Design team. In this case the clients wanted a clean-lined contemporary cinema design, and the twist in the design was the fibre-optic star ceiling.”



▲ MOOD BOARD: Wavetrain’s interior design brief, produced in consultation with the client, specifies the key colour palette and finishes for the project, including paint, timbers and fabrics.

Enter Elementi...

This home cinema is the first we've seen in Sound+Image to feature a new range of speakers called Elementi. Designed specifically for home cinema use (though the largest of them could potentially service commercial applications), the Elementi brand includes 'Fire' and 'Air' speaker ranges, plus an 'Earth' range of subwoofers, and an upcoming 'Water' range of Atmos speakers. The 'Fire' range (pictured opposite) uses compression drivers for high frequency delivery, while the 'Air' models share the cabinet and mid-bass drivers from the Fire range but switch to a pleated diaphragm 'tweeter' along the lines of Oskar Hail's air motion transformer.

MOVING THE AMPLIFIERS

Aside from the merits of each individual speaker design, Elementi brings a significant shift in equipment layout in a home cinema, by removing the power amplification from the main equipment rack. This delivers the usual active speaker advantage in removing the need to run long speaker cables, where electrical properties can significantly change over the longer runs required around a cinema and potentially through walls. Elementi notes that ideally speakers should be located within three metres of the amplifier.

Although the Elementi speakers are described as digital active, the amplifiers are not internal; the amplifier components are kept separate but adjacent to the speakers they individually power. The amps are relatively shallow and modular units designed to mount vertically against the cinema walls, hidden behind fabric or in joinery. Audio signals can then be run over balanced analogue audio cables, or kept digital (via Dante audio-over-IP) right through the Elementi amplifiers' floating 32-point DSP processing, digital crossovers, FIR filters (with correction in both the frequency and time domains), and high quality digital-to-analogue converters.

The actual power modules within these Elementi amplifiers are full bandwidth PWM modulation Class-D modules from Danish company Pascal, whose modules have gained a reputation for both reliability and high-level sonic performance. Elementi's 500W and 1000W amplifier models feature passive cooling which ensures they are silent in the cinema. The 2200W active models feature ultra-silent fans and suit front wall placement to run Elementi Audio's most powerful speakers and subwoofers.

"One big issue doing custom installation work is the amount of heat that's in a rack" notes Wavetrain's David Moseley. "You need to deal with it properly for longevity of equipment, but a lot of dealers put the power amplifiers at the bottom, the preamp above, and source components at the top. It sounds a little bit logical that you might do it that way, but something like a Trinnov processor — which is a computer — actually generates a huge amount of heat right at the bottom of the unit. So if you put a Trinnov above power amplifiers then convection cooling simply doesn't work, because the hottest thing is actually the Trinnov above them. Your power amplifiers run too hot and they'll be in danger of falling over. So by removing the amplifiers from the rack, which is often a fair portion of what a rack might be, you get down to a situation where the equipment is only about 600mm to 1200mm in height, and there's not a lot of heat in there."

Having the amplifiers spread around the room has other benefits, including ease of servicing.

"If you're using a digital active speaker design where the amplifier is in the back of the speaker, and if you custom-install that speaker behind a screen, typically you would have to install it from the front," explains David. "Then if the speaker fails, you've got to take the screen out, and take the speaker out to get to the amplifier to work out the problem. It becomes a labour-intensive process to maintain a custom installation. Whereas if you have the amplifier mounted near the speakers, say under a screen where you can just pull off a panel and get to it, then you can work out if there's an issue with that amplifier — is it working, is it on? You can get to it and unscrew it easily. The Elementi amplifiers take up only about 150mm in depth including cables, they're quite shallow. So we may have a frame at the front of the room behind which the amplifiers for the front speakers can fit, and we often

have an acoustically-transparent curtain in front of the rear speakers which has enough space to fit the amplifiers as well.

"So they can be put into the position where they can best serve up the end result, whether that be thermally, or delivering a clean electrical signal to the speaker, or whatever facet you look at. And being modular they can deliver the power required for the speakers based on the SPL requirements."

It means changes in some of the usual ways of wiring a cinema, and thinking in quite a different way.

"Yes, and especially with audio-over-IP," says David. "Dante is probably the most robust of the audio-over-IP systems, and by using Dante the installers are then just wiring up standard data cabling, not having to terminate balanced lines. Everything becomes far less expensive, the terminations become quick and easy — and in the process you're eliminating D-A and A-D conversions and just doing conversion at the amplifier itself."

SPEAKERS WITH A PURPOSE

Elementi explains that the speakers themselves are also different partly because of how they have been designed for precise purposes within a home cinema. The Firefly, for example (pictured second from the right below) has an unusual waveguide with 120° horizontal dispersion and 40° degree vertical, and comes as standard with a bracket that can angle the speaker at 20° to the wall.

"So the speaker audio tracks the wall and then outward to 120 degrees," notes Wavetrain's David Moseley, who has already been involved in the design of a number of new home cinemas using the Elementi range. "That makes the Firefly perfect for front wides or surround channels, because the coverage is so wide, and means you can get much closer to the speaker because it's not going to be such a point source in your ear. Yet it's still high output — it can be used as a front LCR, where a very wide horizontal dispersion means the integration between the three front speakers is going to be seamless even for a big screen. With a narrow dispersion speaker behind a large screen you might have to add a couple more and do five across the front for a uniform sound field."

Topping the Fire range is the FireDragon, which Elementi tells us will hit reference levels at 25 metres, making it suited to rooms of any size, where other manufacturers would struggle, and even in commercial cinemas. Another full-on design is the Kola subwoofer (named after the deepest hole in the Earth), featuring single or dual 24-inch drivers delivering from 10 to 100Hz under 2200W of power.

And while compression drivers, as used in the Elementi Fire range, are not unusual in home cinema use, here the processing in the dedicated amplifiers makes a difference.

"These speakers employ FIR filters, which allow the speakers to be tuned accurately in the laboratory," explains David Moseley. "Most compression driver systems are known to sound dynamic and detailed, but also harsh — vocals can sound like someone is speaking with a cone held to their mouth. Elementi has taken the best of what compression drivers have to offer and then tamed the sound by tuning not just frequency but phase. The result is a speaker that sounds powerful, clean, warm and effortless."

Using digital crossovers prior to the amplification also ensures that if the bass drivers are being pushed hard, that strain does not show up in the tweeters to affect the quality of detail in the sound.

For more information on Elementi's ranges visit: www.elementiaudio.com

cinema and of what is required for SDR content. It provides a clear distinction between SDR and HDR content."

The screen is 2.35-to-1 ratio, but no anamorphic lens is used here. Instead anamorphic changes are made using the go-to secret weapon we are seeing now in so many high-end home cinema designs — a Lumagen Radiance Pro 4K video scaler and processor.

"The Lumagen can remap the video to any configuration," explains David Moseley. "In this instance we are not using an anamorphic lens, but rather we project within the 2.35:1 frame and then display 16:9 as either an image within the frame, or the client has the option to use Lumagen's Non-Linear Stretch option to project a 16:9 image in a 2.35:1 frame. All the colour mapping and HDR conversion is also handled by the Lumagen."

To make the most of the UHD/4K capabilities, sources include Panasonic's DMP-UB820 UHD Blu-ray player and a Nvidia Shield media player, along with connections for both PC gaming and a gaming console.

Keeping it on the inside

Sound isolation was a key criterion for this client, as it's something of which they currently enjoy too little, with a young family in an open-plan house. It was critical the cinema could be used without affecting the rest of the home.

"The entire system was designed to achieve 80dB of attenuation to match the noise floor of the Living Room adjacent," says David, noting the use of a Kinetic RIM floating floor system, high-density plasterboard, Green Glue and plenty more to achieve the required result. Wavetrain also manufactured the custom sound isolation doors.

The result? "At full blast the cinema can barely be heard directly in the Living Room," he confirms.

Careful design of the air-conditioning system is another signature of Wavetrain-designed projects, essential in this case not only to deliver a low noise floor for the audio, but to achieve that desired sound isolation.

"A single power point not sealed correctly will halve the sound isolation performance of a cinema room," notes David. "So the large duct penetrations in a cinema for air-conditioning need to be attenuated to the same level of the whole cinema sound isolation system, otherwise the system falls over and the client has wasted their money."

"The other aspect of air-conditioning design is that many parts are manufactured in galvanised steel. That's a quick way to end up with rattles in the system, which are near impossible to correct once hidden behind the walls and ceiling. Wavetrain Cinemas manufactures a range of AC products specifically for cinemas that are built into the structure to attenuate sound escaping the room, and to slow the air velocity to eliminate air turbulence and ensure that the system can never rattle."

Getting the sound right

Wavetrain had the advantage of being involved from the get-go with this extension design, so had a headstart in getting the original room proportions ideal for purpose.

"Then you place seats into positions where they share common issues, and you place the speakers and subwoofers to eliminate the worst problems in the room," says David. "Acoustic treatment improves the imaging, to tighten voices that are then easy to understand, and takes the edge off the harshness of the room."

David Moseley is a fount of knowledge on cinema acoustics, having presented training courses for other

ELEMENTI PHOENIX front LCR or surround

- Digital active 2-way with 2-channel 500W or 1000W external amplifier
- 25mm compression driver, 90°/40° dispersion waveguide
- Dual 6-inch drivers, neodymium magnets
- 730 x 270 x 150mm (hwd)



ELEMENTI FIREBIRD front LCR or surround

- Digital active 2-way with 2-channel 500W or 1000W external amplifier
- 25mm compression driver, 90°/40° dispersion waveguide
- Dual 6-inch drivers, neodymium magnets
- 662 x 270 x 120mm (hwd)



ELEMENTI FIREFLY front LCR or surround

- Digital active 2-way with 2-channel 500W external amplifier
- 25mm compression driver, 120°/40° waveguide
- Dual 6-inch drivers, ferrite magnets
- 585 x 260 x 130mm (hwd)



ELEMENTI FIRE-DRAGON front LCR

- Digital active 3-way with 3-channel 2200W external amplifier
- 44mm + 3.5-inch compression drivers, 90°/40° dispersion waveguide
- Dual 12-inch drivers, neodymium magnets
- 1009 x 450 x 280mm (hwd)

cinema designers and installers. We asked him to explain in a nutshell why room acoustics are so important.

“The speakers will take on the sound of whatever acoustical space they are put into,” he explains. “And if you don’t understand what I mean by that, try walking around your home from room to room with either you or someone else talking, and listen closely to how the sound of the voice changes. You become a different version of yourself depending on the size of the room and the acoustic treatment in the room — carpets, rugs, curtains, furniture and so on. In a cinema room, once you have the acoustic signature of a space correct, you will be able to play the system at incredibly high levels, with no ear fatigue.

“We always use a combination of MSR and custom Wavetrain treatments. In this room the ceiling, seating platform and the front corners of the cinema are all custom bass traps. The ceiling also contains a custom absorption system for the first reflection from the front speakers.”

David notes that if the room has been correctly designed and treated, final tuning becomes a relatively straightforward process.

“The speakers and subwoofers are positioned to eliminate standing waves,” he notes, “and then we time, level and phase align everything to ensure the best result, and finally tune the cinema. Tuning a cinema is the last step and should be a fine tuning of the system, not a fix for all the unresolved problems in a room. Good rooms and correctly-engineered systems produce great results, and tuning the room is just the icing on the cake.”

And where tweaks are required, he recommends downward adjustments, not upward.

“If the room has been done correctly, the final tuning of the system mainly comprises cutting some bass power in the room, rather than boosting the amplified signal,” he explains. “It’s an easy thing to forget that a 3dB boost requires twice the amplifier power, and that the increased driver excursion will introduce distortions.”

Motion pictures

There’s an extra dimension hidden in this cinema, and that’s D-BOX, the system that moves your seat in time with the movie, using carefully-designed cues created by the Canadian-based D-BOX team. You can experience this for yourself at public cinemas in Sydney or Melbourne, and Wavetrain’s demonstration rooms convinced the client that it’s an experience worth having, telling us that D-BOX was the “icing on the cake, stepping up the home cinema experience to the next level of immersion.”

Not surprisingly, as Wavetrain is the Australian distributor for D-BOX motion seating, David Moseley agrees.



“D-BOX is, in my opinion and that of our clients, an essential part of the cinema experience; it adds something tangible that cannot be experienced any other way,” he says. “Around 80% of all Wavetrain Cinema projects implement it.”

In this case D-BOX-ready seating was used on the whole rear row, as something which could be easily upgraded later once funds allowed.

“But at the end of the project,” notes David, “the client asked us to secretly add one actuator set in the centre loveseat, without telling his wife — a surprise! They are now looking to add more, to stop the fighting over who sits in the loveseat...”

Since completing the cinema, Wavetrain has been further engaged to design a drinks bar outside the cinema, which will also act as a butler pantry for the home’s new kitchen and living room areas, in which Wavetrain will also be involved. Part of the new expanded brief is to address the sound issues in the whole home, to enhance the way that the clients live. It’s something well worth remembering — that acoustic treatment is not just for music and movie rooms. The owners here notably describe their home cinema as being “a perfect space to relax, unwind and celebrate the hard work put into its inception.”

“Watching everything in 4K resolution and vibrant colour is tremendously rewarding,” they tell us. “But it’s the audio that truly blows you away — so much power, so clean. My wife almost cried, hearing this for the first time.” —

EQUIPMENT & CONTACTS

EQUIPMENT

Panasonic DMP-UB820 UHD Blu-ray player
Nvidia Shield TV Pro streaming media player
 Gaming PC prewired for addition
 Gaming console prewired for addition
BenQ LK990 4K HDR projector
Severtson 165-inch CinemaScope projection screen
Lumagen Radiance Pro 4242 4K video processor
Anthem AVM-60 11.2 Channel AV processor
Elementi Phoenix speakers x 3 (LCR)
Elementi Tungsten amplifiers (2 x 1000W) x 3
Elementi Basalt 12-inch subwoofers x 2 (rear)
Elementi Tungsten amplifiers (2 x 1000W) x 3
Theory Audio SUB15 subwoofers x 2 (front)
Theory Audio SB-25 loudspeaker x 6 (surround)
Theory Audio ALC-1809 9-channel power amplifier (for front subs & surrounds)
Triad Bronze 8 LCR in-ceiling speakers x 4 (height)
Triad PAMP1-200 power amplifier x 2 (height)
Sanus 36RU AV rack
Isotek EVO3 Corvus 9-outlet filter power board
IsoTek EVO3 Mini Mira 2-way AV power conditioner
MSR Acoustics diffusers & other treatment (see article)
RTI XP-6s control processor
RTI XP RTIPanel iPad software
Lutron lighting control
Wavetrain seating (2 x Loveseats, 4 x armchairs)
D-BOX haptic technology on 1 Loveseat;
 back row all pre-wired for D-BOX
PHOTOGRAPHY: Holly Muldrock

DESIGN & INSTALLATION

Wavetrain Cinemas
Telephone: 02 9526 5497
Email: projects@wavetrain.com.au
Web: www.wavetrain.com.au