Kungliga Musikhögskolan

NIGEL JOPSON experiences a unique immersive audio system in Sweden

The Royal College of Music in Stockholm (Kungliga Musikhögskolan) was founded by the Swedish king Gustav III as a music conservatory of the Royal Swedish Academy of Music in 1771, becoming a separate institution in 1971. After three years of construction, the re-built 'KMH' was officially opened by the present Swedish royal couple in 2017. The new glass building of around 21,000sqm is part of a campus where modern architecture interacts with historical buildings. It houses concert venues, lecture halls, studios for the students, and administration offices. Construction work on the project ran from 2013 to 2016.

Entering the building, the high-ceiling open glass space seems strangely at odds with an aurally calm ambience. One instinctively expects a certain level of sound pollution within a public building of this type, yet the peaceful vibe showcases just what can be achieved when audio becomes an architectural imperative. The building contains numerous practice rooms, recording studios and performance spaces, all rooms can now be used simultaneously due to excellent isolation. Previously, the school was limited in which rooms were available (depending on the program of concerts and rehearsals). The large performance areas are now individual floating-

floor rooms within the building, completely isolated from the adjacent spaces. The concrete foundations are cut to avoid vibration transfer — it's quite unusual to experience recording studio-style separation in a building of this size — closing the door on a loud jazz band and immediately experiencing 40-something dB of attenuation seems surreal in such a public space.

We were guests of William Brunson, professor of electroacoustic music and studio director. Brunson, a composer who has lived and worked in Sweden since 1980, teaches the studio program and practical implementation of spatial audio. On a tour of six new control rooms, three recording studios and five performance venues, we were eager to see the spatial audio system installed in the Lilla Salen. The immersive design comprises 29 Genelec 8040s in 3 rings which form a hemisphere, 'the dome', suspended from motorised trussing. These rings of speakers — which Brunson describes as "16:8:4:1" — can be complemented with 16 speakers on the ground mounted on ISO Acoustic stands to augment the hemisphere and provide additional vertical cues.

Enter the dome

"The idea with this setup is to be able to do concerts rather spontaneously, the room is actually designed for amplified music, the slats [to wall traps] are very far apart and the added reflectors give a little more comfort for speech in the room," says Brunson. The Genelec speakers have been a really great choice for us because, combined with the acoustic design,
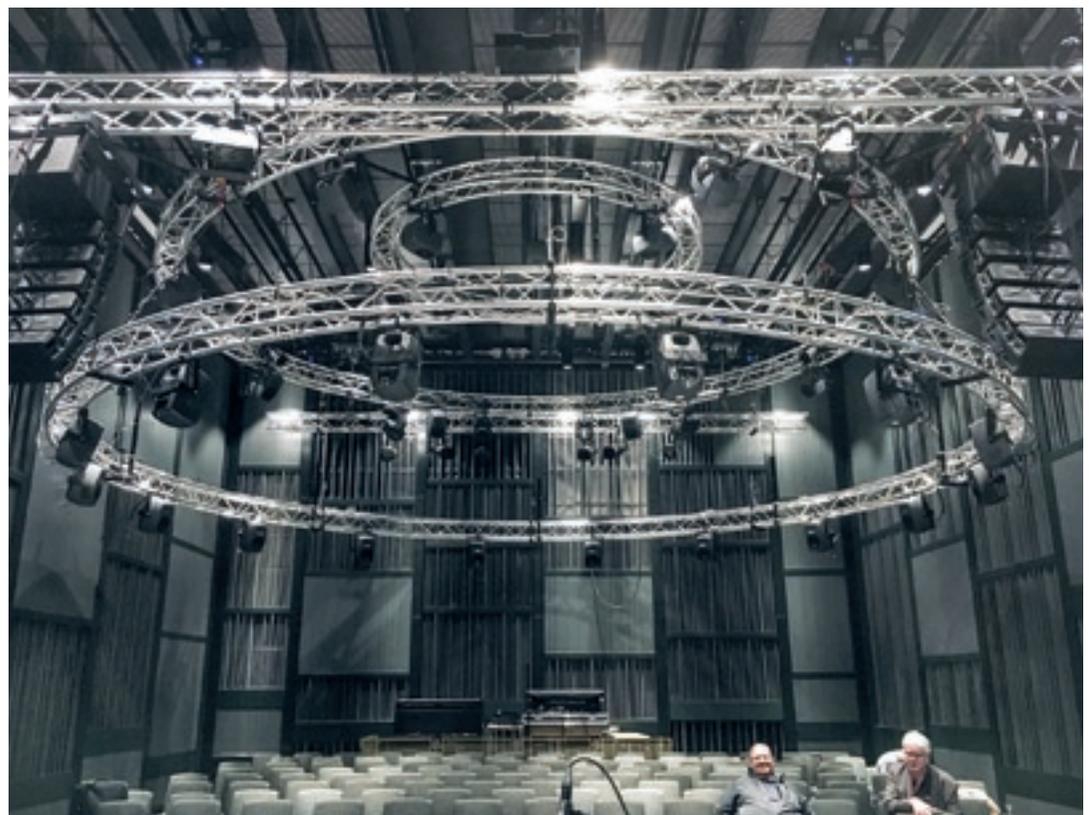
/ **'The dome' 29 Genelec 8040s in 3 rings**

/ **KMH entrance leading to performance space**

/ **Professor William Brunson**

we obtain really high definition and sound localisation in this room. The two rings of Genelecs are normally lowered a little [compared to *Resolution's* photograph] to form a sphere."

Brunson explains that surround sound is part of a long tradition in electro-acoustic music. There was a sound diffusion system called the 'Acousmonium', designed in 1974 by Frenchman Francois Bayle, consisting of 80 loudspeakers of differing size and shape to be performed with like an orchestra. Someone would sit in the middle and live mix performance art music. A concept that was ahead of its time, but possible to realise today with studio production and automation.

"Although there are only a few, other listening spaces like this do exist in the world, and using Ambisonics allows us to adapt a production between different configurations," Brunson says. "We have very good resolution on the lower ring of speakers, as we go up, the rings become smaller, and we may add two speakers to the top and bottom ring to satisfy the Ambisonics equation... We're between 4th and 5th order, and we additionally have four subwoofers."

As part of the electro-acoustic music program, students compose with the idea of spatial positioning as part of music. "As well as pitch, rhythm , dynamics and timbre... you also have space. The German composer Karlheinz Stockhausen was instrumental in defining space

as a musical parameter. This performance venue is very well liked, and attracts a lot of audiences," says Brunson. "Just as my generation of music students enjoyed listening to Jimi Hendrix, many of our current students have parallel lives as techno-DJs or similar — this performance space has acted as a good recruitment feature for several talented young musicians," Brunson reveals, "the moment they walk in here they're convinced about KMH!"

Apart from its use for live performance, playback and as a teaching venue, the unique loudspeaker system has plenty of potential for research projects. "For example, we have a medical professor who will work here, she's interested in researching stress and
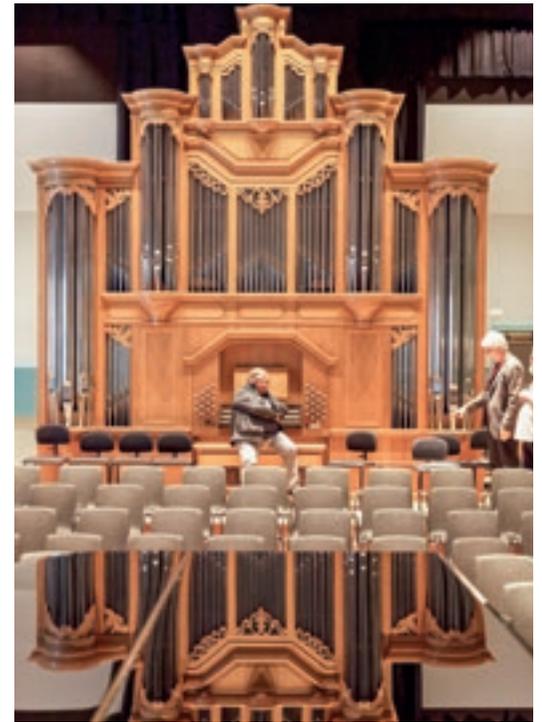
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/ **SSL Duality mixer in one of the control rooms**

/ **Magnificent organ in the concert hall**

environment," Brunson explains. "She can use the dome to replay very realistic recordings of stressful ambience, but in a controlled situation with no visual stimulus. The professor plans to bring her 'subjects' here to do the research."

Despite the presence of SSL Duality consoles in the college, the control of such ambitious immersive systems clearly presented routing and setup challenges. While watching a BBC newsroom TV documentary, Brunson came to the conclusion the solution lay with broadcast-style matrix routing for the dome. "The fundamental infrastructure is dual layer, it's distributed on fibre optic using equipment from Stage Tec. The NEXUS Base Device is an audio network, a router, and an I/O matrix that also

offers A-D/D-A and format conversion. There's another layer of Dante which is independent but can also be connected. We have something like 400 analogue lines, which sounds a lot, but then we have around 32,000 digital channels! We have a Stage Tec AURUS console which takes care of our large hall, we also have the CRESCENDO Platinum in two versions: a 32 fader version in the Lilla Salen (so we can run the dome off one layer), and a smaller 8-channel version for the chamber music hall." Brunson reveals the Stage Tec system has dramatically reduced set-up time. "Some years ago, when we did a conference, we set up a 24.2 system — it took about a week! Now we just lower the dome, roll in the mixer and

connect a single fibre optic and network cable. Fifteen minutes and ready to go!"

The equipment list includes three NEXUS Monitor Controllers. The software for the controllers had to be specially adapted because of the unusually large number of loudspeakers. "The way we solved the routing with the CRESCENDO was to have the first layer assigned to the 29 speakers, with sub-bass on another layer. The NEXUS Monitor Controllers' GUIs have been customised individually for us by Stage Tec. For safety reasons, I wanted to have a single overall volume control!"

Multiple studios and control rooms

As we continued our tour of the facility, it

became apparent this professor was unusual in having the technical knowledge and operational experience one might normally expect from a system integrator. Foldback systems, power supplies, the pros and cons of various MADI boxes and Bill's early experience with MCI consoles were all discussed on a whirlwind tour of air-lock protected machine rooms and studios.

"We originally had two SSL 4000 G+ mixers in our main control rooms, which we replaced with the Duality consoles when SSL servicing was discontinued. I liked the hybrid approach adopted by SSL with the Duality… I only wish it were possible to write the data down to the automation lanes of Pro Tools, then we could move projects to our other studios with Pro Tools rigs, which don't have Duality consoles. The Duality has proved flexible, we're using the busses to address ambisonic routing: we can do analogue, digital, or even bypass the entire mixer to go directly from a DAW to the speakers — a mix of different formats. We wanted it to be possible for students to come in with their laptops and to use whichever software or plug-ins they liked. I try to encourage them to use the power of our Pro Tools rig, which has 768 voices, and to go back and forth so the computer becomes more of an 'instrument' than a workstation."

Monitoring in the control rooms has been designed to allow immersive audio production. "Originally we only had the main Genelec 8250 monitors, the surround Genelec 1038s were installed when we decided we needed a critical listening environment — a 'little dome' — where we could mix projects and then move to the large concert venue dome. We tried to keep with industry standard placements for the surround monitoring — if you're panning audio there are lots of triangle-style options — you can find different panning paths."

As we moved through the facility, we passed rooms containing a cornucopia of traditional

/ **The 1970-vintage Buchla 200 synthesizer**

instrumentation, and discovered a treasure trove of electronic musical instruments — all of which are in working order and regularly serviced. An early Yamaha Disklavier — a Synclavier — an EMS VCS3 and, quite amazingly, a 1970s Buchla 200 series, a modular analogue synthesizer, whose lights and 'mind expanding' control features are redolent of a time of free-form experimentation — Multiple Arbitrary Function Generator (MARF), anyone? Don Buchla didn't like the term synthesizer, as he felt the name gave the impression of imitating existing sounds or instruments, when his intent was to manufacture instruments which created new sounds. Somehow the glowing vintage music machine seemed to embody something of the modern intent from Brunson's program at KMH.

"There's different ways to use the performance opportunities offered by our immersive playback systems — some people just code it — we teach programming here. Composers might use SuperCollider or Max/MSP; we also use IRCAM's [Institut de Recherche et Coordination Acoustique/Musique] SPAT as an interface [a room

/ **Stage Tec customised NEXUS Monitor Controller**

acoustics simulation and localisation plug-in, made by Flux]. We use decoders from IEM, and also some which we have developed here. The students find a way through this: workflow and experience are concepts we feel are important. Students have to make decisions about how to record their sound sources — should it be stereo — or maybe use a Soundfield microphone? We're trying to get funding at the moment to purchase an em32 Eigenmike [a microphone array of pro-quality capsules positioned on the surface of a sphere]."

I asked if some of these composition processes were somewhat removed from popular music production, but Brunson observed: "Some of the ideas may have started out as a bit 'left field', but now it moves over into sound design, sound for film, and soundscape-style documentary work. All of those can come to bear". KMH students are actually being schooled in an incubator for the appointment-to-listen audio projects of the future — an essential field currently emerging as a future value-add for sound. It's all in the dome! "We've had the space for three years," says Brunson, "and everyone is still coming up with innovative ideas for performing — the adventure hasn't worn off yet!" ●