



OSLO OPERA HOUSE

A PROJECT THAT HAS NOT ONLY MADE RIPPLES IN OSLO'S EXPANSE OF FJORDS, BUT ACROSS EUROPE AND BEYOND, OSLO OPERA HOUSE OFFERS EVERYTHING YOU WOULD HOPE FOR FROM A NEW VENUE. AND ITS STORY JUST TOOK ANOTHER TWIST...



OSLO, NORWAY
EUROPE/MIDDLE EAST/AFRICA

When Oslo Opera House (OOH) officially opened on 12 April 2008, the project was almost a decade old. Now, two years after its unveiling to the world, and with a healthy volume of reflective water under the proverbial bridge, the full extent of the venue's introduction to the Bjørnvika-located bank of Oslofjord can begin to be quantified.

The Norwegian Government-funded project, which at the time of opening was approximated at 4.4 billion NOK (£430 million), naturally enmeshed a significant technology story. That story has recently been refreshed with the upgrading of the venue's lighting dimming system, excusing **mondo*dr** the opportunity to discuss a venue, which will continue to grow in significance with the passing years.

On 26 June 2009, Norwegian installer and distributor, AVAB CAC AS began work on replacing the sine wave dimming system, as the initial installation ended unsuccessfully. The company had been invited to bid for the new dimmer contract, and subsequently won. Karsten Lyngstad, AVAB CAC's Technical Director revealed that, though confident that they could deliver a successful solution, had a certain degree of trepidation: "We were anxious about whether our equipment would work, because we'd heard about, amongst other things, that there were issues with the power supply. But we didn't have any problems at all."

Entailing the extraction of 25 full-size cabinets and installation of 25 new State Automation cabinets, the work was spread across eight

different dimming rooms and resulted in more than 2,000 channels of sine wave dimmers. The task's significant challenge was swollen by a timeframe of only six weeks, completed by 7 August for the venue's re-opening.

Sine wave dimming was particularly attractive to the OOH, for a number of reasons, including; minimised harmonic noise, efficient power transfer and improved power quality. State Automation's Variable Sinewave Technology (VST) boasts advantages above and beyond those expected from such a system.

AVAB CAC, which also distributes Martin Professional, MA Lighting, Robert Juliat, James Thomas, ALUR, Meyer Sound, Midas, Turbosound, Lab.gruppen and Tannoy, chose State Automation's Solution 96 Optical Fibre Dimmer Rack. It is the first fixed installation rack with an integrated optical fibre Ethernet connection for the reporting system, and is capable of receiving multiple network DMX signals from up to four individual sources. It also reports the real-time status of three-phase current and voltage, fan operating status and other operating parameters of individual channels. Remote monitoring and control is also possible from multiple locations.

Whilst that new dimming system dominates the latest chapter in the OOH story, you have to go much further back to find its beginning. In 1999, Theatre Projects Consultants (TPC) was approached by Den Norske Opera and Ballet to make the initial steps towards the realisation of a long-standing dream, as David Staples, Managing ►

Director of TPC explained: "We were the theatre consultants for the project, from the very inception of the project to the very end. When I say inception, I mean we were engaged by the clients - the Norwegian Opera Company - to write the brief for the building. This is two or three years before the architects were selected, we wrote the brief, which was then used in the architectural selection competition.

"We worked with the opera company and ballet company for about five months on that exercise. Then there was the architectural competition, and it was a huge competition; 238 architectural firms entered, we were with about 20 of those teams. We were with three of the 10 teams shortlisted, and fortunately teams we were with placed first and second.

"In architectural competitions, there's no difference between being second and 238th. You lost. There's only one place you want to be, and that's first. Fortunately, we were with Snøhetta, who got first place in the competition. We then acted in two ways; we were the theatre planning and design consultants on the building, and we were also the theatre equipment consultants responsible for the design and specification of lighting systems, most of the stage machinery etc. And we took that all the way through the design stages, the site work, the commissioning, right through to the opening."



AVAB CAC's Karsten Lyngstad with Cooper Controls' Franck Tiesing

Snøhetta's winning proposal is now a living, breathing structure, which appears to emerge from the waters of the Oslofjord. Eight individual projects, commissioned by the specifically-formed Art Committee for the New Opera House, have been worked into the building's design; some fully-integrated, others partially, and others as standalone pieces. One of these commissions saw the extremities of the structure clad with over 33,000 marble stones, covering 19,000 square metres. When the glistening reflections of the quartz crystals catch the Scandinavian sun, and people swarm the sloping structure, fulfilling many architects' ideal of their creation being lived in, the Opera House resembles an iceberg, whose cap has been infested by inquisitive creatures. The resemblance doesn't end there, for much of the building resides below sea level. The acoustical challenge was met by Arup Acoustics and

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Brekke Strand Akustikk, who collaborated together to form BrekkeStrandArup. Arup's Senior Auditorium Acoustics Designer, Jeremy Newton, explained the working relationship: "It was basically a joint venture, where Brekke Strand dealt with the majority of the sound insulation, building services noise, and noise control within the building. And they also looked after the room acoustic for practice spaces and the 400-seat studio theatre. It basically fronted up the thing from a local point of view, looking at local 'regs' and all of that side of things. We were responsible for the room acoustics in the main auditorium there, and also provided them (Brekke Strand) with specialist input, as and when necessary, for the rest of the project."

The main acoustic challenge of the Main Hall was, as Jeremy revealed, related to the reverberation time: "The reverberation time for Oslo was set to be right at the upper end of the range that is regarded as the suitable range for opera, and the client basically wanted a very reverberant sound, almost verging on the sound for symphonic music; a very rich, orchestral sound, but not at the expense of vocal clarity, as well. That was one of the major points within the client's brief.

"The design there actually was limited. Basically the architects had won a competition based on the external elevations of the building, which didn't actually allow sufficient height to go upwards and provide the adequate room volume, vertically, which is how it's normally done in opera houses. So we widened the room quite significantly, above the top tier of audience."

One of Arup's main thrusts as an acoustic consultant, wherever



possible, is integration of acoustic techniques within the architecture, as opposed to bolt-on panels prescribed in apparent afterthought. This was particularly prevalent at OOH. "Integration of the acoustics into the room form, and into the architectural finishes, is something that we hold very strongly," revealed Jeremy. "Within this room, you've got the sculpting of the surfaces and all the shapes there are there for acoustic reasons. You've also got very carefully worked out 'scattering' details, so that as the sound strikes surfaces, rather than all coming off in the same direction, it's scattered. It's a little bit like looking at light through a broken mirror, rather than looking at it through a normal mirror. It doesn't come off as a harsh reflection; it's dampened down a little bit by the scattering that we include. And somebody actually in the room wouldn't necessarily know that that's what it was there for."

Naturally, Arup's concern was with the room's pedigree for hosting opera, but the 1,364-seat Main Hall and, indeed, other spaces in the OOH, including the adjacent Little Hall, accommodate a range of performance genres. To answer the performance demands of the Main Hall, an extensive sound system was specified.

With TPC handling the majority of the stage machinery and lighting fixtures, the final piece of the technical jigsaw was completed with the appointment of Benum. In conjunction with YIT of Norway, Benum met a design spec from consultants Artifon AB of Sweden and COWI AS of Norway, which included Renkus-Heinz loudspeakers, Yamaha digital processors and QSC amplification, with Stagetec's Nexus network and Aurus mixing consoles comprising one of the biggest control systems ever built for an opera house. A Clear-Com communication system was also installed, as well as a state-of-the-art Stagetracker stage manager system built on a TCP/IP network, with the ability to control all the elements of a show on a timeline or cue-based user interface.

A TiMax IM16 matrix is integrated with each hall's Salzbrenner StageteC Nexus DSP and routing core via AES3 and optical networking, allowing either TiMax matrix to be used in any room without physical re-patching. Salzbrenner StageteC previously approached TiMax manufacturers Out Board to help implement the delay-matrix element of the source-oriented reinforcement specification, resulting in a hybrid integration of TiMax with the StageteC Aurus consoles. A networked KVM link allows operators to program and control two TiMax Cue One Showcontrol PC's from multiple locations. Out Board Director, Dave Haydon, was on-site to commission and program both systems with consultant Alf Berntson and Egil Eide from project contractors Benum.

As well as the multiple surround images for Stage One, Alf Berntson requested special ambient height effects and distant far left, right and back localisations. Images were also created for front-fill and on-stage effects, which can also double as vocal localisations for occasional reinforced shows. These TiMax Image Definitions comprised different delay-matrixed combinations of the main Renkus-Heinz L-C-R and front-fill systems, plus the distributed surround cabinets hidden in the sumptuous hardwood finishes

TECHNICAL INFORMATION

MAIN HALL

SOUND: 5 x Renkus-Heinz; ST4/4-2T active speaker; 4 x Renkus-Heinz DR18-2 active sub; 4 x Renkus-Heinz PN61 active speaker; 54 x Renkus Heinz PNX61 speaker; 5 x Renkus-Heinz PN121M monitor speaker; 2 x Yamaha DME64 digital processor; StageteC Nexus Star 180 channels and 64 busses (6 x DSP card); StageteC Aurus Direct-Access console 40 fader; StageteC Aurus Direct-Access Console 24 fader; Genelec 8030A stereo monitoring; TiMax IM16 Audio Imaging system; TTA Stagetracker 16FXR stage manager system; Shure, AKG, DPA, Neumann and Crown mics; Clear-Com Eclipse digital matrix system

LIGHTING: 22 x Martin Professional MAC 2000E; 20 x ADB WARP; 26 x Martin Professional TW1; 4 x Philips Selecon Toru; 4 x Philips Selecon Tah; 42 x Robert Juliat 611SX; 66 x Robert Juliat 614SX; 8 x Robert Juliat 613SX; 59 x Robert Juliat 711SX2; 20 x Robert Juliat 710SX2; 2 x Robert Juliat 714SX2; 60 x LDR Xpress 2500W profile; 72 Philips Selecon Rama HP; 48 x LDR Xpress 1200W PC; 48 x Philips Selecon Arena HP; 48 x LDR Xpress 2500W fresnel; 3 x Strand Quartzcolor Bambino F; 12 x Strand Quartzcolor F 2500W; 12 x LDR Xpress 2500W HMI fresnel; 2 x Strand Quartzcolor F 4000W HMI fresnel; 72 x Prolite Par 64 wide; 68 x Prolite Par 64 medium; 108 LDR Xpress Par 64; 30 x Philips Selecon Aurora Flood; 10 x Philips Selecon Groundrow; 26 x James Thomas Par 16; 10 x ETC Source 4 PAR; 20 x LDR Rima; ETC Congo 6000; ETC Junior; 3 x E.GO Prego

DIMMING: 25 x State Automation Solution 96 with RCM dimmer cabinets; 750 x Module 2-channel VST 3kW 16A (sine wave) 1500-channels; 123 x Module 2-channel VST 5kW 25A (sine wave) 246-channels; 2 x Module 1-channel VST 10kW 50A (sine wave) 2-channels; 82 x Module 2-channel Relay 3kW 16A (non-dim) 164-channels; 23 x Module 2-channel Relay 5kW 25A (non-dim) 132-channels; 38 x Module 2-channel PC 3kW 16A (leading edge) 76-channels; 9 x Module 2-channel PC 5kW 25A (leading edge) 18-channels

EFFECTS: 2 x Look Solutions Viper; 2 x American DJ Scotty II; 2 x Look Solutions Tiny Fogger; 4 x Look Solutions Unique 2; 1 x Jem Glaciator X-Stream; 4 x Martin Professional Atomic; Lighting Innovation SUPERBEAM 1200; 1 x Le Maitre Surefire control console; 16 x Le Maitre Surefire receiver; 12 x Le Maitre PyroFlash pod;

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around and above the three-tiered audience seating. A Stagetracker 16FXR, which has two RadioEye infrared detectors installed in the truss, and has capacity to handle 16-tagged performers simultaneously on the large stage, features in the installation. The sophisticated hardware and software enables the positions of performers on stage to be tracked in real time, applying an actor's position to his microphone signal so that his voice appears to follow him as he moves around the stage. The result is a more realistic and natural sound, making it easier for the audience to become immersed in the action and the story. The Renkus-Heinz installation comprises both active and passive speakers, with QSC amplification powering the latter. Two ST4/4-2T self-powered PowerNet Reference Point Arrays, positioned in moveable towers at either side of the stage are disguised by acoustically transparent cloth. The L-C-R system is achieved with the centrally-flown ST4/4-21's, with bass frequencies handled by

four active DR18-2 dual 18-inch subwoofers. Under-balcony fill comes from 54 passive PNX61 loudspeakers, which are powered by QSC CX501 and CX1102 2-channel amplifiers, housed in temperature controlled machine rooms. Two more PNX81/9's and two PNX61's are flown from the circular lighting bridge, 30 metres above the stalls. Control comes from Renkus-Heinz's proprietary R-control network, interfaced with a Yamaha DME64 Digital Mix Engine, and connected to the networked Stage Tec NEXUS STAR audio router system. The Renkus-Heinz and Yamaha relationship continues in the adjacent Little Hall where the system comprises nine PN81/9s, 10 PN121Ms, eight PN16s, plus DR18-2 subs and a Yamaha DME64. AVAB CAC's State Automation dimming installation is working an extensive lighting equipment list, specified by TPC and supplied by Norwegian company Elpag AS, which includes ADB and Martin ►



Professional motorised luminaries, Philips Selecon follow spots, Robert Juliat profile luminaries, and Prolite and James Thomas wash and beam luminaries. Den Norske Opera opted for the ETC Congo control console, along with ETC Juniors, which are used as a designer's remote and in the stage manager's station, and are controlled by three E.GO Prego systems. Le Maitre pyrotechnics, including PyroFlash pods, are joined by other effects units from Look Solutions, Jem and Martin Professional.

It would be difficult to overstate the significance of Oslo Opera House. As a feat of architecture, a piercing cultural statement and a technological conglomerate, there are few recent venue projects to rival it. The level of workmanship is high, and professional input extensive, and with the AVAB CAC dimming installation, the operation and impact of the performance spaces can truly match its exorbitant potential.

It is, perhaps, TPC's David Staples' feelings about a venue that means so many things to so many people, which goes some way to quantifying its impact: "I think the venue itself is quite an

extraordinary venue. They made it a truly national project in Norway. Although it sits in Oslo, and Oslo actually is not a very big city - it's only half-a-million people - the opera company and the ballet company from the very beginning said; 'this is a project for all the people of Norway'. So when they came to the opening night, they had this performance with arias, operas, and dance, and at the end of the first act they had a most wonderful chorus from Verdi's 'Nabucco' - the 'Slave's Chorus' - and they invited someone from every commune or village, or city in Norway to send one singer. So they had 485 singers onstage for the Slave's Chorus, which was pretty spectacular.

"I think there are 650 people that work in the building; there's a full opera company, full ballet company, their orchestra, all the workshops, and all the technologies that go into being a major opera-producing house. It's lifted the Norwegian National Opera from being an okay, regional European opera to the international circuit, doing co-productions with the Royal Opera House in London and The Metropolitan Opera in New York." 