The Solomons Parliament

It's amazing what a well-designed sound system can do for the democratic process.

Text:/ Brad Watts

The Solomons are a scattered group of around 1000 islands to the east of Papua New Guinea. Known for pristine coral atolls and exemplary dive sites, it's also a destination for travellers investigating the many military battle sites across this archipelago. The Solomons became a British protectorate in 1893 and consequently the backdrop for war against a Japanese invasion during WWII. Independence was established in 1978 but during the following 20 years tribal rivalries erupted into armed hostility and the nation spiralled into lawlessness. Australia was prompted to launch RAMSI, the Regional Assistance Mission to Solomon Islands, in July 2003 at the request of the Solomon's government. Since that time hostilities have ended, and the nation is back on track with an elected government in power.

Of course, a parliament needs a venue to convene in, and the Solomon's government already enjoyed a parliament house completed with international involvement in 1995. Unfortunately the sound reinforcement system left a lot to be desired. In fact, the system would regularly elapse into feedback should the parliamentary members begin to raise voices (the members had a workaround – cease any debate and remain silent until the feedback dissipated... hardly a solution for a forum espousing free speech).

In 2007 ICE Design was asked by the Australian Government to undertake an assessment of the sound system for the Solomon Islands Parliament as part of Australia's Governance Strengthening aid project. ICE Design is a specialist in the field of courtroom audio integration, with over 300 courtrooms and lecture theatres under their belt. ICE also designed and installed the sound reinforcement and recording systems for both the Australian and the New Zealand parliaments, so it seemed well qualified to tackle this job.

AV recently spoke with Glenn Leembruggen, one of the principals of ICE Design and Acoustic Directions. Glenn lent his extensive knowledge to the task of modernising the audio systems within the Solomons Parliament House, with the results far exceeding the fledgling parliament's expectations.

ROUNDLY PANNED

AV: Glenn can you outline the initial brief?

Glenn Leembruggen: Our work was three-fold. It was to make substantial improvements in the quality and clarity of the speech presented to the Hansard recording people [Hansard services being recording the minutes in Parliament – dubbed 'Hansard' after Thomas Curson Hansard who originally published a condensed, printed version of the minutes of British parliament in 1811]. To make a gross improvement in the quality of the sound presented or fed to the broadcast organisation, Solomon TV and radio. And finally, to make a gross improvement in the quality and clarity of the speech in the House itself, in the actual debating chambers.

AV: And the older system was definitely on its last legs?

GL: The old system was effectively irrelevant. There were loudspeakers very high up in the debating chamber, microphones which fed back very quickly, and when people coughed there was no auto-mixing. Extraneous noises such as coughing are quite regular as tuberculosis is common throughout the islands. So when members coughed, the system would produce enormous amounts of racket and offer no clarity. I think it's safe to say although the parliament was opened in 1992, the technology used and the design of the system was from the '60s. Underpowered, loudspeakers in the wrong location, poor microphones, and incorrect equipment trying to be automatic, but not working effectively. It was the most antiquated system I've ever come across, and as readers can see from the photos, it's a challenging space.

AV: It's round.

GL: Yes, round with a conical ceiling – 'round and flat' is way better than round with a conical roof. So the combination of the equipment plus the acoustics meant meaningless sound... just useless.

AV: The surfaces are very hard and unforgiving.

GL: The internal cladding is primarily plasterboard, however the floor was tile. The walls were plasterboard, and the conical ceiling is a mineral fibre tile that's had applique designs imposed on it. So the only absorption in place was the mineral fibre ceiling tiles, which were then stuck to a palsterboard substrate – 10-12mm of mineral fibre tile – a minimal degree of acoustic absorption. However, beneath that, the architecture of the building was quite substantial. It was actually built by the Japanese with American funds as a joint friendship gesture and was given to the Solomon people in 1992. The architecture's beautiful, I just loved the interior – very gracious, culturally appropriate and quite relaxing to be in.

So ICE Design was initially engaged to do a concept design and costing, which was then presented to the Parliament in three tiers: a broadcast system, Hansard system and house sound. The parliament adopted the proposal and funding was found through the RAMSI Program. Then Integrated Media did the actual installation and employed ICE Design as sub-consultants to finalise the design and the commissioning, which was where I came in.

HEAR HEAR: THE ARRAY

AV: Can you explain the column speaker design?

GL: They're all steered line arrays – what we call a 'hybrid line array', something we've used in a number of installations, including St Paul's Cathedral [see Issue 1], New Zealand Parliament, and others. It's 'hybrid' because it's a combination of a fixed high frequency tilted array, and a beam-steered low-mid line array. It's a combination that gives us a wider radiation pattern than you can achieve with conventional, high-tech, fully-steered line arrays, which can often give too narrow a high frequency range. So the combination of the steered low-mid array, plus the physically tilted high-frequency array means we can achieve a pattern match at all frequencies.

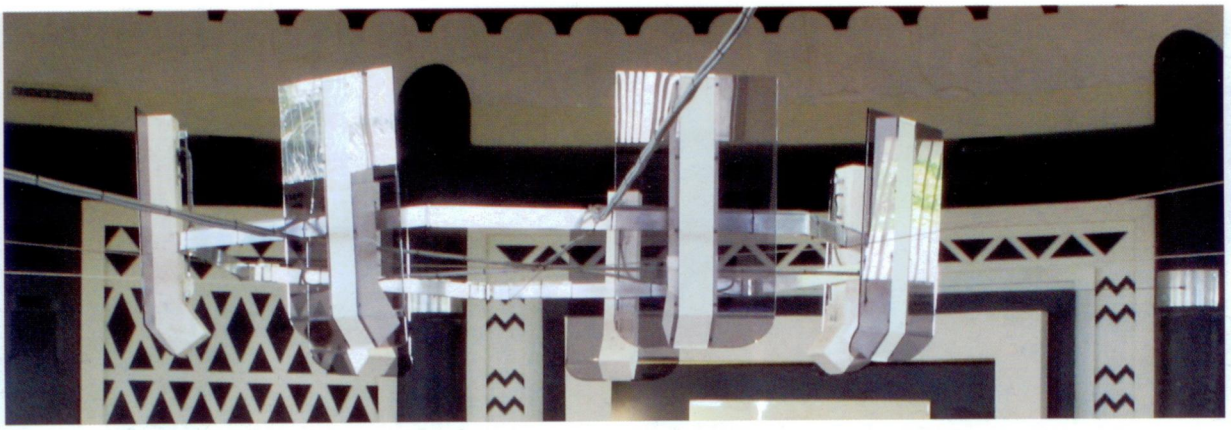
AV: What are the acrylic wings in aid of?

GL: The acrylic wings were designed to attenuate rear radiation. Any small radiator radiates sound in an omni-directional pattern and we didn't want low and lower-mid frequencies bleeding backwards, so the acrylic baffle reduces that. Plus it gives us more control over the zoning of the sound – we're dealing with seven speakers in a ring, and they cover the entire chamber floor. Speaker 1, for example, covers the Government area. We didn't want it covering the Opposition area, for example. Because those speakers have a suitably narrow pattern, that acrylic panel also attenuates the sound going up into the conical ceiling above, to stop sound hitting the floor directly below. Without it, sound would bounce back up into the roof more easily, resulting in a more uncontrollable echo path.

AV: Are these line arrays powered units?

GL: No, they're an externally powered device. You just take an eight-channel amplifier, an eight-channel DSP and go. Acoustic Technologies has

Before & After: Prior to the new installation (left) sound reinforcement was 'irrelevant'. The new system ensures clarity and intelligibility despite the hostile acoustics.



Point of Order: Each Acoustic Technologies 'hybrid' array combines a beam steered mid/low section and a fixed HF tilted array at the bottom. The acrylic wings are used to attenuate unwanted rear radiation, providing further pattern control.

a dedicated DSP and amplifier that are perfect for most applications, but for this project we wanted networked reporting functions to remotely access amplifier data. So in this case we used LabGruppen's C series amplifiers that have the ability to report status via a network – ideal for remote troubleshooting.

So there's a bunch of eight-channel C Series amps that drive each of the boxes, and Biamp Nexias DSP devices to steer the arrays and act as crossovers. Then another three Biamp Nexias provide signal routing for broadcast and Hansard outputs, and some of the auto-mixing functions for the Hansard system. We also instigated a touchscreen controller for the clerk to control proceedings in the house. So whoever has the floor is manually activated on a touchscreen – it's no longer an automatic system. However, we do use automatic mixers to clean up the feed to the broadcast and Hansard sends.

AV: Have you attempted to acoustically treat the interior at all?

GL: Well, the system fires directly at the seats, and in so doing some sound will hit the curved walls behind the seats. And, because the building is circular it would then start to set up patterns of late arrivals across the chamber, creating some focussing effects. For that dilemma we put some acoustical treatment on the walls – Tontine Acoustisorb 3. It's not noticeable visually, but acoustically it's an important part of the solution.

In the public gallery, the only form of acoustic absorption is carpet on the floor. The public gallery surrounds the chamber on what would probably amount to 270 degrees. So we needed to put sound up there that bled back as little as possible into the chamber. Again, this had to be done cost-effectively, so we mounted what we call cardioid loudspeakers – a CS6 loudspeaker from Acoustic Technologies with some signal processing we've designed. In this particular install we've increased the directionality, into a hyper-cardioid, which gave a measurable reduction in the amount of radiation back into the chamber floor.

AV: How much do you take into account sound absorption by actual human bodies?

GL: To be honest, not a great deal. There's two effects of human bodies. If the loudspeaker system exhibits a poor frequency response due to its design, or bad phase interference effects, then when the space is empty reflections can fill in the frequency response gaps. Once people are in there and those reflections aren't as strong, the frequency response then becomes very poor. You can get over that simply by making sure you have a very good direct field frequency response at all locations. So in that sense, if you initially have an even frequency response, you don't need to consider people.

The other effect of people is a decrease in reverberation time. If the design provides appropriate clarity in an empty room – if you've achieved an effective early-to-late ratio – then as the room fills up the sound just gets better.

The last thing is occupational noise that people make – coughing, sneezing, and so forth – so the system needs to produce enough level to get over that. Maximum SPL is set according to how much of the dynamic you wish to deal with. If someone starts shouting, do you want to reproduce that, or do you want to be able to compress it? Generally, we go for reproduction. Occupational noise is usually the big issue; it's not so much the bodies, but the extraneous noise that affects the amount of gain you've got. After that it's down to the loudspeaker design and the type of microphone.

MICROPHONES – TESTING TIMES

AV: What mics did you settle on?

GL: We've done plenty of testing with different microphones, and not just listening. We've put the major players in the 'gooseneck lectern marketplace' into our lab and found significant differences between products that are ostensibly the same, and there are indeed profound differences between them. We use the Audio-Technica U857Qs – the hyper-cardioid version has become our standard benchmark. It's been selected due to its consistent off-axis frequency response, and the smoothness of its on-axis response, and its low self noise. In those domains, it comes out the winner every time.

AV: So what degree of gain are you dealing with? What amount of headroom are you dealing with?

GL: The Solomon Islands is a reasonably well behaved parliament, unlike Australia or New Zealand, so we don't need to go particularly loud. It will probably do about 85dB, long term RMS with 15dB headroom, but they don't engage in prolonged shouting like in Australia and we didn't need to crunch the SPL calculations so much. Whereas in the New Zealand system we recently finished, we had to look at those calculations very closely. This kind of job is very much about the early-to-late ratio, direct frequency response and acoustic gain. We're getting an equivalent acoustic distance of about 1.7 metres, which means that at a normal operational gain everyone hears the audio as if they're 1.7 metres apart, which is a relatively low figure. Normally systems are set for around a 2.5 metre threshold.

AV: How have the Solomon people found it?

GL: We've had some very good feedback. I think the best was from a member who was hard of hearing. Remember, these people are very poor, they don't have hearing aids. He sits behind the leader of the Opposition, and according to the clerk he couldn't understand what was going on. On the day parliament opened we were walking around tweaking the system, performing level adjustments, and he mentioned that for for the first time he could hear *everything*. That was the first accolade.

Then I had the architect say, because he listens to parliament regularly, he usually struggles to hear a lot of it over the radio, and he's also hearing impaired. He said: "For the first time ever, I understood parliament over the radio".

And what's so lovely is the Solomons are just so hungry for political process. Everyone listens to parliament, everyone watches parliamentary TV – they love it. They're very politically savvy, even out in the little villages. So it's amazing how many people knew about what was happening and knew about the new sound system.

AV: Isn't that refreshing!

GL: It is; it's lovely. It's just a delight to do something for people who appreciate it.