

A DSP Odyssey



Rane's HAL aims to demystify and simplify DSP installation and management with the 'most comprehensive set of tools for every application'. **Richard Lawn** takes a deeper look

WHEN DIGITAL SIGNAL PROCESSING (DSP) was initially introduced amongst the professional audio community, the technology was likened to science fiction. With the widespread acceptance of computers and IT over the course of the past two decades, DSP has been fully embraced and developed in order to measure, filter and compress continuous real-world analogue signals.



Rane headquarters in Mukilteo near Seattle

Seattle-based manufacturer Rane initially embarked on its own DSP programme in 1997 with the launch of RPM26. It progressed along the digital path with Mongoose and its own proprietary DragNet software programme. Now, Rane is urging systems integrators and contractors to meet HAL, its newly developed room combining, paging and distributed audio system.

With the launch of HAL (Heuristic Audio Laboratory) the christening of Rane's technology has been adopted from the fictional antagonistic computer character (Heuristically programmed ALgorithmic computer) from Arthur C Clarke's 2001: A Space Odyssey. Rather than coming full circle, however, HAL has seriously

demystified and simplified DSP installation and management.

The road to HAL

Director of R&D engineering Kevin Frank explains that the HAL project began as soon as the Mongoose platform was made available in 2008. 'Mongoose provides remote A/D and D/A conversion, compatible with any CobraNet DSP. By eliminating a great quantity of copper and microphone cables from systems using this platform, integrators can benefit from increased cost savings and improved sonic performance. However, following the launch we knew we could take DSP to the next level from Mongoose.'

Rather than tweak Mongoose or take a closer examination of the technologies promoted by its competitors, Mr Frank and his team went back to the drawing board. 'For a product to evolve one has to critically assess what works and what doesn't, which meant fully evaluating the RPM series and Mongoose platform. We therefore wanted to pick the brains of our customers and flew in a variety of consultants, systems integrators and programmers to get their feedback. From this we drew up fictitious characters in various jobs to see who would suffer or benefit from a design choice.' Rane's sanity checking was applied throughout the product development programme in order to constantly monitor feedback. Resultant mantras included 'you don't have to be smart to use it, but using it makes you smarter'. And 'greater flexibility and power, yet simpler to manage and configure.'

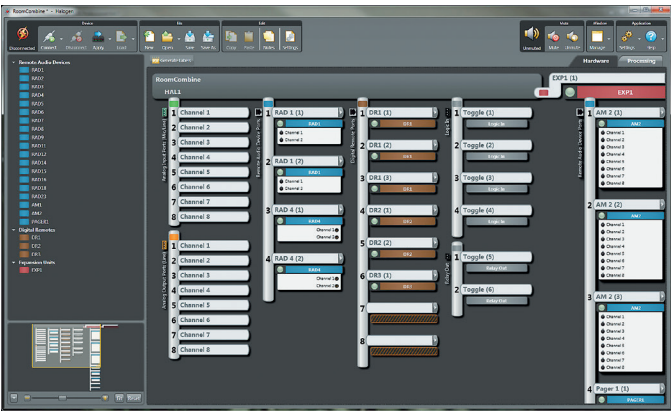
Mongoose is now viewed as the stepping stone that bridged RPM to HAL as Rane's software engineers laboured past deadlines to take digital audio all the way to the wall plates. The manner in which inputs and outputs are configured

essentially sets HAL apart. Similar products largely employ fixed and modular I/O and core based designs. In contrast, and like Mongoose, HAL is built on a de-centralised I/O approach which remotes the A/D and D/A functionality.

However, HAL's centralised processor does integrate local I/O, combining eight mic/line inputs, eight line outputs, four proprietary remote audio devices (RADs) and eight digital remotes, together with two relays and four logic ports. An expansion bus based on FireWire protocol can be added to provide a further 64 inputs and 32 outputs of audio. Unlike CobraNet or Ethernet transfers, FireWire protocol offers a consistent latency to each device, and as such, the maximum delay offered by EXP1 is limited to 830µs. No virtual wiring is required to distribute pages and background music to multiple zones. The I/O approach operates at distances up to 160m (60m more than Ethernet) over a Cat-5 cabling infrastructure, and is reportedly less susceptible to interference.

The HAL multi-processor and Halogen software continually checks the status, location, Cat-5 wiring integrity and audio flowing in all peripheral devices, depicted by LED indicators. Three HAL multi-processors provide various audio I/O and control options for a variety of installation sizes.

HAL1 supports 16-in x 16-out audio, but this may be increased up to 80-in x 48-out by adding EXP1 expanders. The DSP horsepower of HAL1 is five times greater than that of the RPM 88. Furthermore, microphone inputs



The Halogen hardware screen

may also be added with AM1 and AM2 Automixers. HAL2 supports 18-in x 18-out audio, for which the additional 2 x 2 comes from AES3 on XLR connections, whilst HAL3 supports 4-in x 8-out audio, of which two 'line-plus' inputs accept balanced line, or sum stereo unbalanced lines.

Using HAL

The manufacturer's claim that HAL 'easily guides novice users through what used to be complex tasks in minutes' is justified with no intricate matrix mixing or pre-sets required for room combining and paging. The essentially plug-and-play devices can be serviced by a non-technical facility manager, whereby systems such as those in financial institutions, for example, can be managed without having to access the rack room. No separate line or mic-input is required when using Cat-5 cabling and the software together with the RADs automatically confirms that all wiring is correct and functional.

Programming is conducted via the Halogen software. The Room Combiner Processor module allows for groupings of up to 12 rooms with 11 walls, whereby the programmer can define rooms and operable partitions, whilst the software calculates all the possible configurations. When six rooms alone are combined, the software produces some 70 to 80 possible configurations with associated routing matrices.

HAL shows the signal flow from the input to the output without



HAL 1, 2 and 3

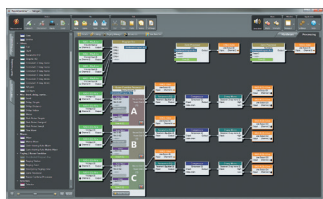


HAL 1's rear panel

adding the wiring. A dedicated bus is provided for program material and is discretely sent to each output zone. The varying DSP and volume controls for each combination are calculated, into which paper clip attachments can be added on screen. If the RADs outnumber the amount of ports available, HAL automatically adds an EXP1 expander unit.

The system interfaces with a broad variety of peripheral devices including smart digital remotes, RADs, portable and in-rack auto-mixers, audio I/O and control logic expansion devices, ambient sensing microphones, small remote amplifiers and an advanced paging station. The entire family of RAD models are all hot swappable and interface with either HAL or Mongoose for 24-bit, 48kHz digital to analogue conversion at the wall. Shielded Cat-5e cabling transports two digital audio channels in each direction, together with power, ground and a communications channel.

It offers status indicators at each RAD, HAL, EXP or Mongoose unit, and Halogen or Tracker software. A green light denotes a working connection, a flashing red light indicates that HAL was programmed to receive a different device at that specific input, whereas a solid red light denotes a cabling error. A solid yellow indicates that HAL is connected to the programmed RAD at that input,



The Halogen processing screen

the cabling is wired correctly and the audio is working correctly. HAL is therefore continually communicating with the RADs, for which automatic firmware upgrades and downgrades ensure that the individual RAD matches HAL.

There are currently 22 RADs, ranging from one-mic and one-line to two-line in and two-line out, but the R&D team are continually making new additions. Recent examples include the RAD24 plenum-rated 1W, 8-ohm amplifier, which can power a small speaker in a bathroom, and the RAD17 omnidirectional boundary layer microphone.

Software tools

With its rotary selector and backlit screen, Pager1 is a device that defines all possible paging zones when used in conjunction with the 'paging manager'. The GUI displaying this information allows users to define stations, scenarios (pre-set



Sales director Dean Standing with the Pager1 and HAL software

routing configurations) and zones accordingly. The linking module is where hardware/software control associations are defined, whereby the control devices and parameters are selected to form associations.

Halogen software includes Ethernet control support for third-party control systems. Since the same software code runs on both Windows and within HAL hardware, third-party control developers can test all their code using only the Halogen Windows software. The software can be used on its own to test the control systems code and the hardware can then be added when the installation is actually in progress. Control protocols exist for AMX, Crestron and Stardraw Control.

HAL may still be in its infancy as it is gently rolled out by Rane, but it is fast penetrating boardroom, government, educational and sports facilities in addition to houses of worship as Cat-5 cable infrastructures generally don't require conduits. 'HAL didn't go down the CobraNet route and so its users can be assured of future proofing benefits,' furthers Mr Frank. 'In the future, we may choose to create a translation box that will allow HAL to talk to Dante and AVB, but it's within our capabilities.'

'With HAL, we'll really be pushing scalability but for now we're just showing the first building blocks,'

he continues. 'The lack of latency has also grabbed the attention of performance venues where delays to monitoring systems cannot be tolerated. Our in-house designers are offering installers support and advice on site via WebEx. We're also receiving a lot of attention from museums which use Guideport systems as we can provide noise masking solutions.'

The centralised topology is currently more suited to small and medium sized applications. However, as HAL is rolled out, this will no doubt change – the DSP power can already accommodate up to 2,065 mic inputs via EXP1 modules and AM2 cascading auto mixers together with 1,296 parametric filters over 48 channels.

In 2001: *A Space Odyssey*, HAL the computer has no distinct physical form and resorts to killing the astronauts it is meant to serve. Having not taken on artificial intelligence, Rane's HAL in contrast is making the lives of programmers, installers and end users a lot simpler. 'The amount of tools you can place in a customers' toolbox will ensure your DSP solution is selected,' Mr Frank concludes. 'We're aiming to deliver the most comprehensive set of tools for every application.'

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