Waves

The biggest and original plug-in company is based in Israel. ZENON SCHOEPE visits Tel Aviv to find out how it all works.

Perched high in a monolithic triangular building in the centre of Tel Aviv with views to the sea and over the busy high-tech centre of Israel, Waves also occupies a very special position within audio. Plug-ins changed the audio universe and no company has been more influential in this field than Waves. It was there at the onset and it helped to fashion the very fibre of digital yet a little more than 20 years later it is poised again to help revolutionise working methods and take us to what is seen within the company as where the industry ought to be technologically and practically. You get a sense that things are happening within the down to earth and relaxed environment of the high rise that are going to make a difference. The first and biggest plug-in manufacturer is neither brash or flash, nobody has a secretary or a PA, the teams sit close together, discourse is frequent and there is a familiarity among the staff that feels natural. There is also an unmistakable feeling that you are in the presence of a lot of very smart people.

The biggest plug-in manufacturer in the world employs more than 150 staff with offices in US, Israel, and China. What you won't know is that it has a consumer division that has been busy for years applying Waves technology into consumer devices of all kinds. I enjoyed a Dell laptop in which some spectacular algorithms and preset tuning had compensated for the small and insignificant speakers and transformed their apparent frequency response, spatial breadth, roundness and reach into a massive sound at the press of a button. It's an example of how the company doesn't waste much and most importantly creates systems that allow its products to be modular in concept and to be reapplied. There is a clear belief in the right to a diversity of choice for the end user almost as company value. When you spend time with the founders Gilad Keren (chief executive officer) and Meir Shaashua (chief technological officer) you see where it comes from. There is no plan for world domination but there is an appreciation of the value of collaboration — something that Waves has done with it Artist Signature Series, its hardware modelling, Abbey Road tie up and its partnership with Digico in DigiGrid.

Meir and Gilad.

'We believe that's the way to go,' says Meir. 'We started as a third party plug-in company so collaboration is in the roots of this company. This industry, the audio industry, was never a one manufacturer thing. If you look at gear nobody has all their gear from one manufacturer. The same goes for plug-ins — a Waves user will have Softube, McDSP and Izotope and they live together because that is the essence of this industry — a variety of tools, colours and workflows. I think that the success of Digidesign, now Avid, in the beginning was that they were open to third parties. As a company it's fundamental to us and we believe that's how it should be.'

But then the company started as a collaboration between Gilad and Meir. Gilad majored in Applied Mathematics and was a sound engineer and Meir majored in Physics and Mathematics and was a musician. Both had been in national service and the two met when a cousin introduced them and they found they shared an interest in music, sound and fledgling digital in particular. Meir had continued his studies in the army and was active in developing DSP algorithms and control software for Radar. They got a development board for the Motorola DSP56 and Gilad, who was very taken by the vocoder at the time, said they should attempt to create a digital vocoder. This was deemed too difficult so he said they should do a filter first instead. Waves began in 1992 with the introduction of the Q10 paragraphic equaliser plug-in for Sound Designer II. From that point on they were a bit busy.

Gilad was the visionary, the entrepreneur, the business development, the marketing but with a lot of involvement in the technical side and the technical directions and Meir was the technical creator. Meir is described as being in permanent 'start-up mode' because he is always working on the next start-up technology project at Waves. 'When we issued Q10 people were jumping all over it because they had been waiting for something like that in the digital domain and if anyone was to see the type of EQ Sound Designer II had at the time they would understand why; it was unusable! Ours worked well, was intuitive, sounded good it was a success right away,' he says.

Then came the L1. Meir had visited a Sound Designer II user and was shown how the engineer spent an eternity with a pencil tool flattening off the tops of the peaks so the average level of the mix could be increased. The L1 was designed to achieve the same results more elegantly and automatically and was followed by the hardware L2. So started the loudness wars.

'I learnt how to make a very small operating system on the DSP56 that allowed us from the very first day to share different plug-in on the same DSP. If you go back you'll see that at the very beginning a DSP from any company could only run several instances of the same plug-in but only Waves could run a Q10 and L1 on the same DSP. The word infrastructure is like a thread that runs through the technical history of this company because it is infrastructure, if it is well thought out, flexible and forward-looking, that has enabled us to be as creative and productive as we are,' says Meir. 'Then there's the infrastructure of our GUI in which the fundamentals go back to the 90s where we had the correct vision of how to separate GUI from logic from real-time processing and that separation allows us then to support the concepts of shells — we can run the same plug-in on DSP or native. We did it right and we could write a plug-in once and it would run DSP or native and today it also runs SoundGrid. It's the same infrastructure. It was a way to educate the programmers that this is the way to design the system and that it pays off in the long run.'

Waves now not only has a massive and continually updated portfolio of products it also has a large staff of programmers. Managing that is again down to infrastructure according to Meir. 'First of all, every group has a great manager and apart from being great managers and assets they are also great technologists. That's a key, having good people. You have to have an infrastructure that allows you to split the work to modules or entities that are highly independent and the way you get to that independence is by defining APIs — the protocol in which they talk.

'Managing a group of developers is about having an infrastructure that allows you to separate the work into well defined, self-contained modules. Once you have this and well defined communication between them you can split the work.'

So how is a plug-in created? 'A plug-in takes from six months to about a year depending on how elaborate they are,' explains Meir. 'We have a department of product managers who represent the user — they have sound engineering backgrounds and good ears. They will suggest features and say if the sound is good so they do the product definition although the idea for a product could come from anywhere. Once we decide a plug-in is a good idea we assign a product manager and he studies the material so he knows what people are looking for and the competition.

'In Waves traditionally the product manager is also the driver; the evangelist for that plug-in. It's matrix management -- we have algorithms guys, software guys, QA guys and product managers. A plug-in has a GUI and the actual signal processing and they are different disciplines. The guy who is doing the real-time processing would have learnt electrical engineering and signal processing and


Amir Vinci.


Software department.

communications, while the guy who does the GUI does the graphics and how it talks to the system and has a software background.

'A team is created from these people and when the product nears completion then marketing is involved.'

Modelling plug-ins follow the same process but are slightly differently weighted according to Meir. 'Most of the work in modelling is in the algorithms,' he says. 'We frequently need analogue skills that we don't have in house so we have external experts for that. They get the schematics of the old gear, analyse it and turn it into mathematic equations. Then come the DSP guys who take those equations and turn them into something that can work in real-time in DSP. It's a process that we have expertise in; some of our DSP guys are expert in modelling and new modelling projects go to them.'

Some readers may remember that Waves introduced the APA Audio Processing Accelerator external processor boxes in 2005 (*Resolution* V4.5) as an interesting combination of CPU power and ethernet that was seen as a means of stepping off the DSP train in favour of a faster route. It never really happened as a product due to technical issues and also for being a little ahead of the times. While the project was halted Waves didn't stop pursuing the idea. Meir says that SoundGrid was the result and they amassed enormous experience along the way.

'It is about looking to the future, about being visionary. Going back, there was native processing and then people needed more and we thought how do you give them more — by making an acceleration card with DSPs? DSP? At that time the Intel CPU was more powerful than the DSPs and we were thinking about accelerating this with this, are you kidding me? Let's accelerate the CPU with another CPU and that was the notion. It was becoming clear that cost effectively it was better to get DSP from an Intel processor than from a DSP and you can see this today — an HDX card will cost you seven grand at Sweetwater while a server that has twice the power is $1500. We realised that ten years ago like we realised networking technology and how it was also always growing. We saw these mainstream technologies and we knew that these were the core technologies we should build on because they are the most powerful and the most cost-effective.'

SoundGrid has been well received and adopted in live sound across brands but its route to the studio market through DigiGrid interfaces inevitably means it has to deal with the dominance of Pro Tools. 'Pro Tools is here to stay and it will evolve — I don't know how but I do know that you will be able to connect it to DigiGrid,' says Meir. 'If you ask me where I think users will be investing

SoundGrid studio.

then it's in networking. Look at the advantages — it does the audio and the clock synchronisation, it's modular so you can always add to it. There's also the modularity of the server.

'SoundGrid is a vision and we need to get that across to the users because it's not a one solution thing; a year from now I'm sure there will be people using it in ways we didn't imagine; it has a variety of I-O, connections to DigiLink, it will have breakouts to other networks, CPU offloading, a mixer, low latency monitoring, so you can do many different things with it and many third parties will be on it too,' says Meir.

Senior product manager Amir Vinci was Waves' first product manager and joined 17 years ago and beta tested for the company before. As such he has enormous experience in the creation of plug-ins and is pleased with the Waves rate of making hits. 'We have a lot of good people here and a lot of us are also users and we have pretty high standards,' he says adding that there are occasional 'lemons' that don't make it through to release, yet their technology is rarely wasted and can materialise in something else.

Amir says they are mindful of changing user expectations. 'In the 17 years I've been here we've already seen some returns to previous attitudes,' says Amir. 'We started with the Q10 and it was good product but many, many buttons and knobs while the C1 compressor had a usability problem and many were intimidated by it. Nowadays people who are using plug-ins are probably less knowledgeable about the properties of each tweak so a lot of the stuff we find ourselves working on is trying to make things easier. It's something worth doing for us as well because instead of putting out a plug-in like the C1 that does everything we put out different ones that do different things. The Renaissance Compressor in terms of control was already more like an old classic box with a few knobs on and a couple of switches. I call the Renaissance Vox the first one-knob, even though it has three! It was magic.'

Which brings us to the Vocal Rider-type plug-ins that are almost completely stripped back. 'I was very happy to see the Vocal Rider get so much success and it was at a time when we realised that selling in bundles to businesses was something we needed to grow out of,' says Amir. 'It also has a technological breakthrough in thinking for us; we think it's about peaks but we hear more of an average. Vocal Rider is like a compressor but it works on a longer range of time and it works on the loudness of the vocal and it is also capable of being sensitive to the loudness of the other stuff. It's part of research we've done into making a good mix easier.

'But it's a natural human tendency to try to find an easier way to do things. For us as a manufacturer we need to be connected to the users and they are very varied,' he says.

Amir showed me an early iteration of a plug-in in the raw development Sound Quality Assurance stage. This passes audio and looks like a massive matrix of variable parameters but the purpose of the exercise is to play with 'the engine' and distil down its parameter and control value count to suit the intended use. Amir pointed out that the engine I was looking at was already a consolidation of an even more complicated previous version. What's interesting is that they can take it in any direction from a one-knob to a very many knob.

'Then there are modelling plug-ins where the product definition is the thing that you start with,' he says. 'As much as you know what the end product should look like the process is still about creating engines that allow you to remake this type of harmonic distortion that happens naturally in an amplifier and to create a modulator that sounds more like an analogue wow and flutter kind of thing rather than being too clean.

'The initial process involves analysing the circuits and deriving all kinds of building blocks that do things to the incoming signal and there are also measurement procedures and equipment that verify that what you found in the circuit is indeed happening and if there is a departure from that then you go back to see what went wrong.' They have got very good at it.

'It goes like this: EQs and filters — much more efficient. Non linear systems and processes tend to get astronomically complex,' says Amir. 'Sometimes with the development of technology and computer power you find a way to do something better than you did. That's what happened with the release of the Scheps 73, for example. We made an improvement in our technology and especially in being able to mimic the amplifier's harmonic distortion.'

You're aware that the process of modelling at Waves involves more than a little respect for the cherished equipment being reproduced. There's also an element of preservation behind it and the opening up of rare and exclusive equipment to more users.

The testing process involves a group of testers who effectively try to trip the plug-in up and break it across platforms and plug-in variants albeit in a methodological way that can be back-tracked and repeated. Bug spotting is about context but it is also about prioritisation and when major changes are made the retracing of the bug tests saves time. They also have auto test routines. I met senior product manager Mike Fradis who was dealing with the imminent release of a modelling plug-in that had come back from Beta testers and now required the renaming of a parameter. The change had widespread implications and changes had to be made. Waves has some 200 Beta testers who are looking at the overall user experience. As Mike says, the product is passed to the Beta testers at the point where Waves believes the product is very close to completion. It's a vital stage of the process and while they are aware that true consensus is unlikely general trends can still be spotted.

After the laid back tour of the office departments with Amir, including some candid insights into precisely what is coming down the pipe, time spent with Gilad is lively and immediately challenging. 'Ten years from now a good sound engineer is going to know networking very well,' he says. 'It will follow other models — in the 90s when DAWs were becoming popular the desktop

Waves tech support.

Mike Fradis.

publishing market was already starting to go towards networking. We have a phase delay of 15 years or so but it's finally happening. But, by the way, there was no reason why this could not have happened ten years ago because Intel processors were strong enough to do it. The reason it didn't was that nobody made it. Our APA [2005] was a great product and our initial orders were very strong but after we released it we found out that we had to redo it. It wasn't one of the best pieces of work we've done.

'I went with the ideas of SoundGrid to Avid, multiple meetings trying to persuade them that networking was the way to go forward. They didn't want to hear about it. The truth is that the DAW market is a little backwards right now, it hasn't been following up with what could be done.

'At Gigabit ethernet you can run 400 audio channels or 200 at 96kHz,' he says. 'That's quite a lot of power. Now 10Gigabit is coming down in price and in five years it's going to be commonplace — Thunderbolt is already 10Gigabit output; but it's not a network. People say it's great for audio but it's just got a lot of bandwidth.

'We're talking about creating bridges between SoundGrid and AVB, Dante, and other systems if and when it's appropriate,' he continues. 'I think we're going to see merging of the technologies of DAWs and live; the same sort of stuff that happens in the DAW will happen live.'

'For those who want to mix in the box it's our job to make a really good mixer but on the network. The way I see it you're going to have people working on different DAWs, network them and then mix outside them in the network with a big mixer and whatever controls they want.'

Gilad sees growth potential in plug-ins, consumer, SoundGrid and the Live Division which has accumulated a wealth of experience from a comparatively short period of involvement. Like Meir he's a complete believer in the power of CPUs and believes that DSP-based systems will not be able to compete. 'The DSP chip is going to be obsolete finally,' he says. 'There will still be niches for DSP but not in a DAW or a recorder application. Have you seen the new Intel Edison chip? It includes ethernet, it's a system on a chip — two cores at 400MHz and all the other stuff — and it's tiny and it kills DSP. The hardware companies that partner with us are going to be happy because they get a bunch of technology with no development cost, hardly any expenses, short time to market, all the software drivers from us, and access to a big user base. Our biggest challenge is signing up a bunch of companies that want to work with us.'

Like with so many pivotal companies, Gilad acknowledges that it would be hard to imagine Waves having similar levels of success if it was starting today. 'We were at the right time and in the right place with the right knowledge and vision,' he says. 'And a bit of luck and we know that, we aren't arrogant about that. We try to be very down to earth because we're just engineers working for other engineers. Our customers work for their customers and we work for them; we're tool makers.'