



*Tony Hooley who started a high-tech company 7 years ago explains to Nina Hall how his astronomy training inspired his technological creativity*



# Ideas man

Nina Hall

Imagine watching football on TV and feeling the thrill of a goal as excited cheers from the stadium crowd echo around your sofa. That experience may soon be possible with a new technology that produces surround-sound from just one speaker without the need for annoying cables and further speakers.

The technology is just one of several created by ex-radioastronomer Tony Hooley in Cambridge. His company, 1Limited, is working on several kinds of loudspeaker technology that have a wide range of applications – from slim sound projectors to minuscule actuators that automatically focus small cameras in the next generation of mobile phones. Tony and his team are now negotiating licences with the major electronics companies; they hope to see at least one of the products on sale in high-street stores in the next year.

This will be a rewarding achievement for Tony after many years of working and developing novel ideas in electronics and computing – and some disappointments. He started out with a first degree in electronics from London University, but then decided “it would be fun” to do a PhD in radioastronomy at Cambridge. Working at the Mullard Radio Astronomy

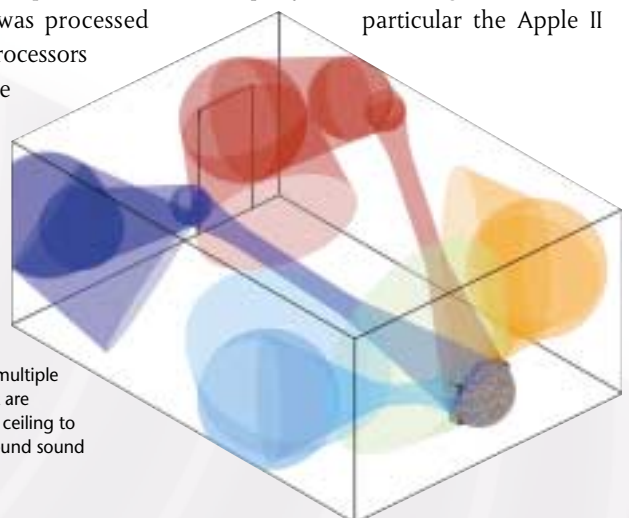
Observatory at the Cavendish Laboratory on radio technology, Tony says he learnt to solve difficult problems and make exciting machinery on a very low budget.

## Computers on a budget

Tony then moved across the road to the Institute of Astronomy to join the team building the Automatic Plate Measuring (APM) machine for scanning photographic plates from telescopes such as the Anglo Australian telescope (this was in the mid-1970s, before the use of CCD arrays and optical-fibre devices). In those days, the data were stored on magnetic tape. Since the raw information from one plate would have filled 300 tapes, it was processed online in real time. Microprocessors and PCs weren't available then, minicomputers were hopelessly underpowered, and mainframes were far too expensive, so Tony and his colleagues had to build a computer out of logic chips – and write the

software. “It was a riveting learning experience of how to do really hard stuff with low cost by designing something that was appropriately balanced between hardware and software. It was extremely useful training,” says Tony.

Building on this crucial experience, Tony and a colleague went on to found a company, Eicon Research, offering consultancies in both hardware and software. These were the heady days when no one was quite sure where the microchip revolution was leading and fortunes were waiting to be made. They designed all kinds of electronic control systems, and noting the inadequacy of data storage devices – in particular the Apple II



The single panel produces multiple steerable sound beams that are ‘bounced’ off the walls and ceiling to produce an enhanced surround sound

which had a disk drive holding only 140k of memory – they developed 1 and 2 megabyte floppy drives which they sold in the UK and the US. By 1980 the company was designing and building a whole range of products including a device that used the forerunner of the universal SCSI interface ('SASI') as a high-speed network interconnect. Unfortunately, the business ran out of cash and it folded.

Tony left the UK to start again in Australia. There, he got the chance to learn about the rudiments of business, first running a university technology company in Sydney and then creating a computer business school for the University which made a million dollars in the first year. He returned to the UK in 1993, and after a short spell as R&D director of a company, started up again on his own with new ideas. Tony decided to look at the technology behind sound reproduction and realised that what needed improving were loudspeakers which had not changed in 75 years. "It seemed to me that with high-speed, cheap processing power you could design a digital loudspeaker based on an array of small transducers," explains Tony. "I patented the idea and on that basis got a DTI SMART award, and started the company."

## And now, the Helimorph

Converting the kitchen, bathroom and laundry room at the back of his house into a lab, Tony also started thinking about new types of transducers not based on electromagnets (as in traditional speakers). Piezoelectricity (an effect in which certain crystals deform when a voltage is applied) seemed the way to go, and Tony designed a piezoelectric device that produced a large movement compared to its size. It was a ceramic two-layer tape wound round a rod into a straight helix. When driven electrically, the helix contracted radially and was used to squeeze an internal air-bearing carrying a piston which then moved a significant distance.

This first actuator was the forerunner to what is now called the Helimorph, which is a doubly-coiled helical actuator. In the

Helimorph, the deformation produces torque in the primary helix resulting in the secondary helix moving up and down a distance up to three times its height. Tony realised that this actuator could be used in a wide range of applications – given the Helimorph's long list of assets. These are: it can be made in almost any size; it has no moving parts other than the deformation so there are no bearings to be lubricated or to wear out; it's light, silent and compact; it uses little power and doesn't produce an interfering magnetic field. In fact, the

on was driven separately with its own processing channel, it would be possible to project and steer individual beams of sound to create a stereo effect, and in fact, to be able to reproduce full 5.1 channel surround sound for 'home theatre'. A single-speaker sound projector was decidedly commercial, and the company has now signed with Pioneer (one of the biggest Japanese manufacturers of plasma screens). Tony is looking forward to seeing the first products soon.

The company has now grown to 36 people and includes highly qualified as well as experienced technical, marketing and financial people. The business is on a sound managerial footing. Tony has relinquished his position as CEO to a colleague with more commercial experience, to allow him to refocus on the technology. "Growing this business has been great fun but what I really like is developing the good technology ideas we have," he says. ♦

Tony learnt to solve difficult problems and make exciting machinery on a very low budget



Helimorph turns out to be ideal for auto-focusing miniature camera lenses, and it seems likely that the first use of this clever invention will be in camera phones (fixed-lens ones are already hitting the high-street!).

Tony has also come up with another technology to improve sound reproduction – flat speakers backed with a sound absorber made from silica aerogel (a highly porous, lighter-than-air form of silica with bizarre acoustic properties). It's still being developed but looks promising.

In 1998 the company, now three people, moved into business premises. Tony and the team realised that since each transducer of the speaker they were working



1 Limited's digital surround sound projector