Working late in the lab...

PROFESSOR ANDY HOPPER IS A BIT OF A HIGH FLYER AS FAR AS COMPUTER RESEARCH IS CONCERNED – AND IT'S NOT JUST DOWN TO HIS CESSNA 210. JOHN MURPHY FINDS OUT MORE...

FLYING TO THE ARCTIC CIRCLE in a light plane just to test your satellite phone is the sort of thing that gets you known as a nutty professor. It is also the sort of thing that makes Cambridge University Professor Andy Hopper popular with his undergraduate students.

But what keeps him in favour with the university authorities is his extraordinary knack of pulling in huge amounts of industrial sponsorship for research. If venture capital for spin-off companies is included in the overall figure, he has brought in over £120m to Cambridge. For that he can be as nutty as he likes. Hopper has also transformed the private lab he founded over 15 years ago from the Olivetti Research Laboratory to the AT&T Research Laboratory, bringing the resources of a £31bn corporation with over 100,000 employees to bear on a very grateful engineering department.

The lab is currently working on a number of cutting-edge technologies. Many of these projects sound far-fetched, but the idea is not to create products, but to set research goals with spin-offs coming from what the team learns on the way to achieving those goals.

For example, Hopper has been interested for some time now in the idea of a computer network which is constantly aware of the positions of users and facilities. From this interest sprung the Active Badge system which monitors where everyone in a building is at any time so that phone calls can be diverted to the nearest telephone extension.

Hopper's lab has further developed this idea into what it calls Sentient Computing. Researchers walk around with badges that sense where they are and which way they are facing. As they approach a computer terminal their computer desktop appears on the screen without them having to touch the computer. The lab has even taken this idea a step further by having the computer plot staff movements in real time. The laboratory wall has a massive screen on which the computer recreates the room as a 3D image. As people move around the room their ghostly computer image moves on the screen.

But more intriguing is the way the computer can be made to create virtual buttons and devices anywhere in the room. For example, the computer can be programmed so that if someone touches a piece of paper on the wall, it will turn the lights on and off. A different part of the wall can be designated as a whiteboard and monitored by a video camera so that anything written on it is recorded in digital form.

Another area of research is thin-client computing. In fact researchers have already developed one of the thinnest clients available. Weighing in at just 200KB, the client acts as a display for software running on a server. The server only sends the pixels that make up the screen image to the client device. Hopper's office is particularly quiet because there are no disks spinning anywhere on the floor. Terminals on his desk can bring up his desktop from a server elsewhere on the network. The bandwidth required is so low that it can easily be sent over the Internet or over a normal telephone line. A researcher wanting to work from home can simply log in to the lab's server over a phone line and have the same access to that server as someone sitting next to the machine.

As a development of this idea, the lab's researchers have stuffed this thin client into a phone. Using the telephone's special built-in display, the user can read faxes or emails, surf the web or even control domestic appliances.

In fact, when AT&T chairman and CEO Mike Armstrong flew in from the US to attend the official re-opening of the lab in July last year, this was the device that most impressed him.

Armstrong liked it so much he wanted to demonstrate it to Bill Gates at the annual Sun Valley, Idaho conference of the top 300 business leaders in the US, and now about 100 of these special phones are being built to be tested at the Cambridge facility and AT&T's labs in the US.

PHOTOGRAPHY MARC BURDEN

The fact that Armstrong was so impressed with the research being carried out at the lab has given Hopper a certain amount of untouchability within the company for the time being. In fact, much of Hopper's success over the years can be put down to the way he manages the divide between the academic and commercial worlds. His early work on advanced networking technologies such as the Cambridge Ring and ATM gives him a lot of credibility within the academic world, while his ability to sell the benefits of research to large companies has impressed the commercial world.

'The monolithic model of research does not work any more,' said Hopper, referring to the way many companies are doing more research in-house, but at the same time sub-contracting parts of that work to university facilities. Universities are also being more fluid about their approach to research, with many starting to nurture spin-off companies when a development in their labs turns out have commercial potential.

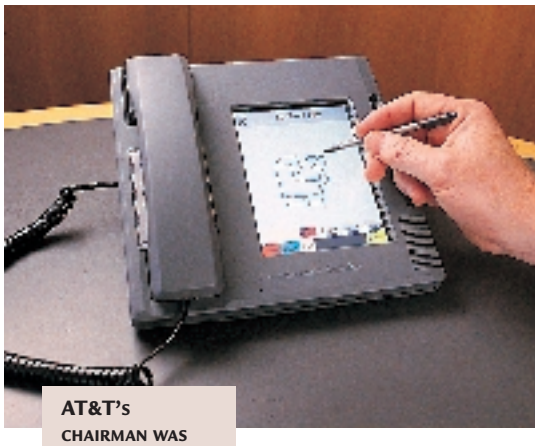
'Things go in and out of companies and universities several times before they emerge as products. What we need is a way to manage this process and keep things under control,' he said.

When the lab was owned by Olivetti, the Italian office equipment giant never brought any of its inventions to market itself. Instead it covered its investment and made a healthy profit from taking shares in spin-off companies. But because much of the research work is concerned with advanced networking there is more of a chance of products emerging directly from AT&T this time around. This is also likely to better suit Hopper's approach to technology development.

According to Steve Furber, a one-time colleague of Hopper at Acorn and now ICL Professor of Computer Engineering at Manchester University, Hopper has a natural ability to work between the academic and corporate worlds. Hopper and Furber worked together in the early days of Acorn. Furber did the hardware design of the BBC Micro while Hopper turned it into VLSI chip designs.

SENTIENT ALLOWS STAFF MOVEMENTS TO BE PLOTTED IN REAL TIME

'Managing academics has often been described as being like herding cats. They are always wanting to head off in their own directions and it's difficult to get them working towards a common objective. Andy is a very good cat herder. He knows how to create a comfortable environment for academics while keeping a commercial focus,' he said.



AT&T'S CHAIRMAN WAS IMPRESSED BY THE LAB'S THIN-CLIENT PHONE

While working in Hopper's lab may look like a comfortable billet, it does have its own pressures. Salaries are generally higher than the academic world and the equipment budgets are more generous, but the peer pressure associated with working in such a group can be considerably greater than any commercial pressure that is imposed in the industrial sector.

'When you are working in that kind of environment the pressure is enormous,' Furber said. 'You are surrounded by very good people and if for any reason you were not performing you would stick out like a sore thumb.'

Despite his obvious academic abilities, Hopper says he was only an average student at school, getting mostly Cs in his A Levels. It was only when he reached university and discovered his 'sweet spot' in computer engineering that his academic career really took off. There he worked on the Cambridge Ring project for his PhD thesis and almost immediately got commercial sponsorship to continue his work.

A significant amount of the technology behind the Cambridge Ring became part of the Asynchronous Transfer Mode (ATM) networking technology which is now used by most of the major telecoms companies.

Ever since this initial funding, Hopper has kept a keen eye on the commercial side to his work. The result is that he is significantly better off than the majority of other academics. Hence the aeroplane.

This summer he headed off in his single-engine Cessna 210 to the far north of Canada. He landed at a military base at the northern tip of Grant Island, which is so far north he was able to fly over the Magnetic North Pole. The purpose of the expedition was to test his Iridium mobile phone, which worked fine despite being on the extreme edge of the system's coverage.

With Iridium having filed for bankruptcy protection, he might be the first and last person to use his phone at the Magnetic North Pole. But his research work will guarantee that is not all he will be remembered for.

AT&T Labs tune in to radio and microwaves

Imagine a tiny radio receiver that uses hardly any power and can be put in any device ranging from a household appliance to a door sign. Although largely overtaken by the new Bluetooth wireless standard, the PicoNet device is designed to use so little power that it can run independently for many years. All the rooms at the AT&T Labs have electronic door signs, which means when someone moves office the name on the door is changed by radio.

Broadband trial

Hopper's lab also developed a combined microwave 'dish' and associated electronics for broadband networking in a package the size of a book. As part of a trial, these are being positioned on the roofs of buildings around Cambridge to give 25Mbits/sec network access to staff and other people involved in the trial. The experiment is trying to discover what people would use bandwidth for if they had broadband access in their home.

BROADBAND TRIAL: STAFF HAVE 25MBITS/SEC NETWORK ACCESS