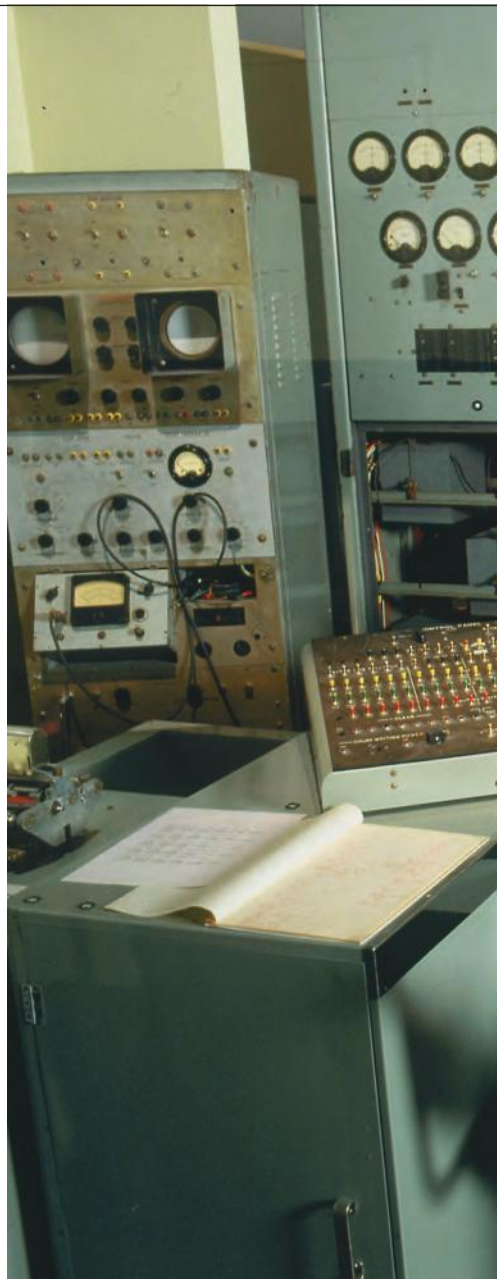
WORDS BY **WILSON da SILVA**

FORGOTTEN HERO

IT WAS A MARVEL OF ITS TIME — ONE OF THE WORLD'S VERY FIRST COMPUTERS — BUT FOR DECADES REMAINED A FORGOTTEN RELIC. TODAY, CSIRAC IS RECOGNISED AS ONE OF THE GRANDFATHERS OF MODERN COMPUTERS.



IN NOVEMBER 1949, CSIRO scientists in Sydney independently created what is now recognised as only the fourth digital stored-program computer in the world: CSIRAC.

It came hot on the heels of other "first generation" computers created in the UK and the US only a year earlier.

Using vacuum tubes instead of microchips, the noisy behemoth filled a room and consumed enough electricity to power a suburban street. While paltry by today's standards, CSIRAC was a stunning achievement at the very dawn of the computer age.

"It had a presence like Stonehenge, a scale that was impressive – big grey cabinets filling a room, humming like a power station," recalls Peter Thorne who, in the 1950s, at the age of 19, began working on CSIRAC; he went on to head up computer engineering at the University of Melbourne.

Before CSIRAC, a "computer" was a job: someone who wrangled equations on a mechanical calculator. Complex calculations would be split into many parts and distributed to individual "computers": row after row of mathematics graduates – mostly women – who would labour over arithmetic for hours, sometimes days, to complete a single task.

"CSIRAC was 1000 times faster than that – so it was like a supercomputer in its day," Thorne says.

MODEST BEGINNINGS

Compared with today's computers, CSIRAC was Lilliputian. Its main memory, what we would now call its RAM (random access memory), was just 2 KB – or four million times smaller than a typical laptop with 8 GB of RAM.

Its long-term data storage was 5 KB – or 25 million times smaller than the simplest thumb drive you can buy. And its top clock speed, or the speed at which it processed calculations, was 1 kHz, or 1000 cycles per second. Today's laptops are measured in gigahertz, or billions of cycles per second.

"It was an extraordinary piece of engineering, new and exciting. We knew we were at the beginning of something wonderful, we just didn't know how big it would be. We certainly didn't think that one day we'd have millions of times more computing power on our wrists," Thorne says, pointing to his Apple Watch.

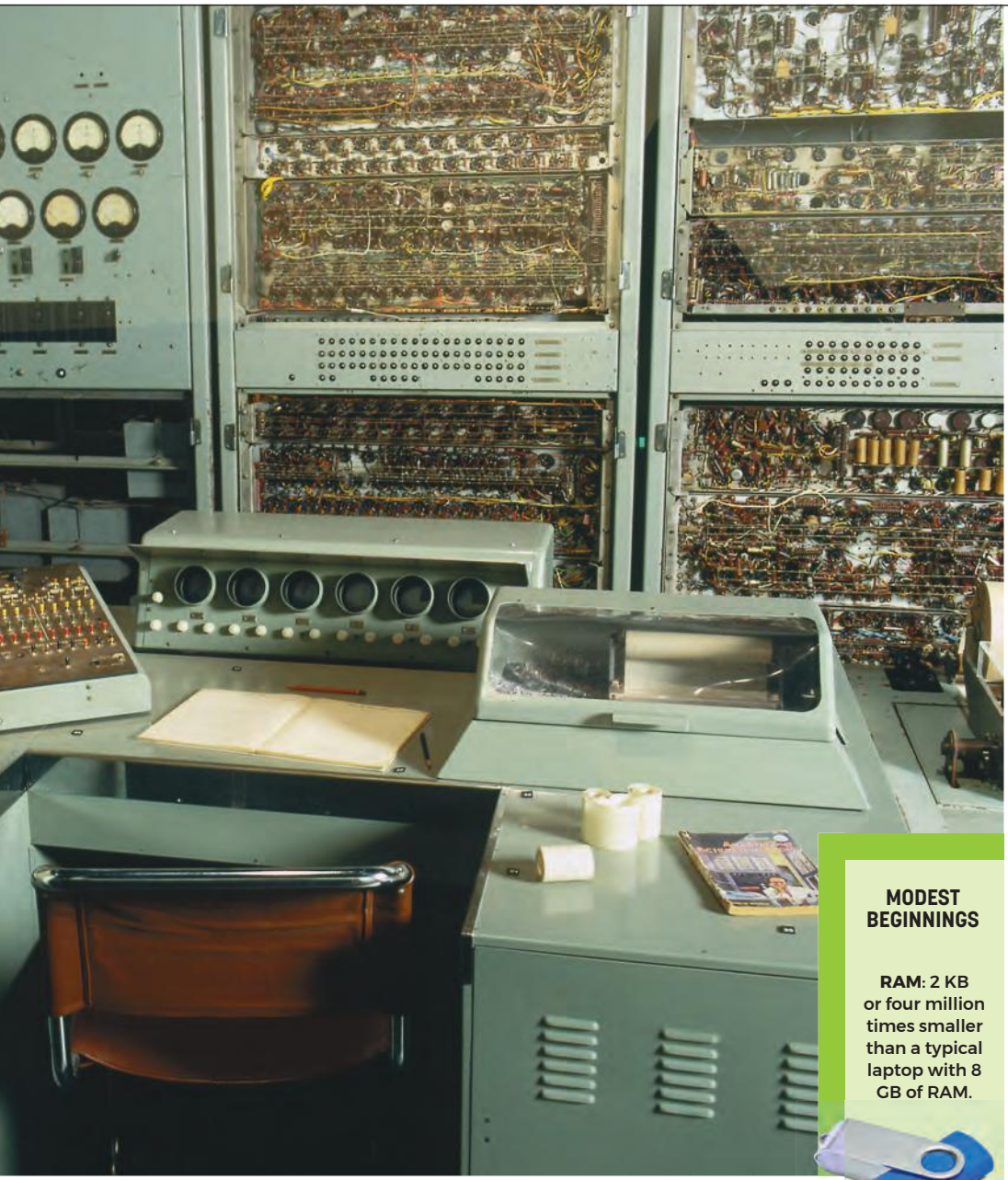
"It's an iconic machine globally, and something Australia should be immensely proud of," says Wayne Fitzsimmons FIEAust, a former vice-president of Data General who went on to found technology companies in Australia. "It's miraculous what they were able to achieve. All the parts – valves, relays, wiring, switches, the software, everything – were made locally. It's the most Australian computer ever built."

ABOVE: CSIRAC designer Trevor Pearcey (top) and engineer Maston Beard. RIGHT: CSIRAC on display at the Melbourne Museum.

CSIRAC's remarkable story began in Sydney in 1947, at the Radiophysics Laboratory of CSIR – the Council for Scientific and Industrial Research, the forerunner of CSIRO.

Calculations for a range of new applications, from radar to radio astronomy, had become laborious

IMAGES: MUSEUMS VICTORIA; CSIRO ARCHIVES



"CSIRAC WAS LIKE A SUPERCOMPUTER IN ITS DAY."

and slow. The physicists and engineers – like others elsewhere in the world at the time – reasoned it was now practical to build a large-scale electronic calculator that could be pre-programmed to handle such hefty tasks.

So began the grand endeavour to build a massive electronic calculator. Maston Beard, a research engineer at the laboratory, teamed with Trevor Pearcey, a physicist and mathematician who had worked in the UK for many years developing shortwave and microwave radar.

In 1946, Pearcey began to design a large electronic computation device with a stored memory, which he called an "automatic computor". Finally, in early 1948, construction began with Beard in charge of engineering and Pearcey the design.

The moment of truth came in November 1949, when the first test program was run: a long multiplication routine.

And it worked.

To its creators it was a marvel, able to operate more than 1000 times faster than the best mechanical calculators of the time.

MODEST BEGINNINGS

RAM: 2 KB or four million times smaller than a typical laptop with 8 GB of RAM.

LONG TERM DATA STORAGE: 5 KB or 25 million times smaller than the simplest thumb drive.

TOP CLOCK SPEED: 1 kHz or 1000 cycles per second. Today's laptops are measured in gigahertz, or billions of cycles per second.

GIANT-SIZE

The jubilant team called its metal colossus the CSIR Mark 1, later renamed CSIRAC, for "CSIR Automatic Computer".

When fired up, it covered 40 m^2 of floor space, weighed 2.5 t and consumed 30 kW of power. Twenty years before computer monitors were invented, CSIRAC was using cathode-ray tubes – or small televisions – to display its internal workings.

It had no mouse or floppy disks: instructions were written on punched paper tape, and then "uploaded" via a feeder wheel.

A photo-electric detector would read each line of 12 holes on the spool of paper, row by row. An operator would sit on a ponderous grey metal console covered with toggles, switches and meters.

Once the hour-long testing procedure had been completed, and the paper "software" loaded, CSIRAC would fire up. Its row after row of metal cabinets covered in dials and gauges would come alive. Coloured lights, dotted in rows along its panels, would blink on and off as it processed its task.

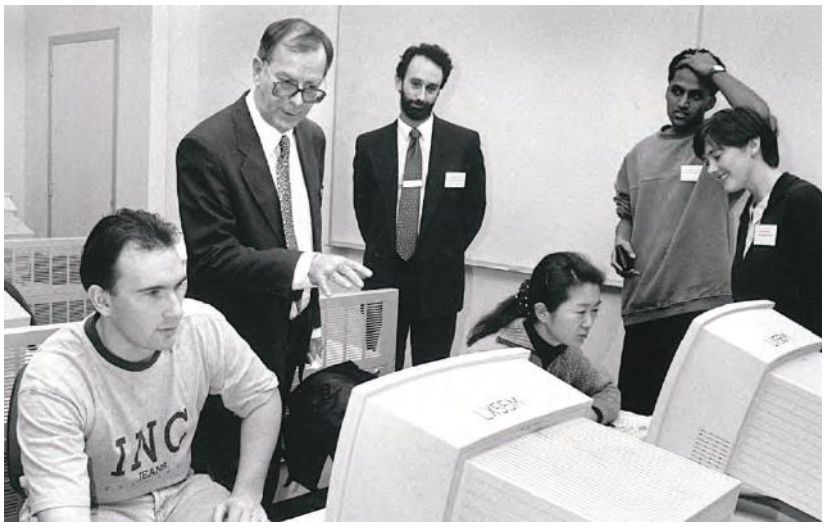
Inside the cabinets, jumbles of thick wiring, mercury switches and vacuum tubes would do their job. When it was fully operational, CSIRAC had 2000 vacuum tubes in its innards – the glass-enclosed valves found in old radios.

Despite this early lead, the CSIRO decided that computers were "outside its purview" – a decision which left designer Trevor Pearcey deeply disappointed. In his view, Australia had thrown away a chance to lead the world in digital computing.

"We were living off the sheep's back in those days, so the potential wasn't recognised," says Fitzsimmons.

CSIRAC was moved to the University of Melbourne, where it was used for a decade before being decommissioned and going into storage.

To be fair, vacuum tube computers like CSIRAC were quickly overtaken by the arrival of transistors in the 1950s, which ➤



LEFT: Peter Thorne (centre) former head of computer science at the University of Melbourne.

made digital electronic computers easier and faster to build.

These led to microchips, which triggered the dizzying climb up the scale of Moore's law, where computer processors double in speed every two years.

Hence, while CSIRAC had a long operational life, it did the same amount of processing in 14 years that a smartphone can do in about a minute.

QUANTUM OF SOLACE

Today, a new chapter in computer technology is being written thanks to an explosion of investment by governments and venture capital in quantum computing.

While Australia may have missed an opportunity at the birth of the computer age with CSIRAC, the same cannot be said of quantum computing.

There's globally renowned research coming from Australian universities, and notable local start-ups, like Q-CTRL, which makes devices and software to improve the performance of quantum hardware; Silicon Quantum Computing, focusing on single-atom qubits for information processing; and Diraq, which relies on spin qubits and existing microchip technology used by today's classical computers.

"If these Australian companies make it, it'll be fantastic," says Fitzsimmons. "And we're right there at the beginning – there's strong backing and lots of money flowing in. So, it's very positive."

"I SEE PEARCEY AND THE CSIRAC STORY AS AN INSPIRATION OF WHAT AUSTRALIANS CAN DO."

Thorne agrees.

"We're giving it a much better shot this time," he says.

"Government and industry have a more sophisticated view of the significance of high technology and its potential. But it's still a hard road to hoe because this is an area that's exceptionally competitive."

Fitzsimmons is now chair of the Pearcey Foundation, created in 1998 in memory of CSIRAC's designer and which annually recognises innovation excellence in Australian information technology with a series of awards, debates and orations. He recalls meeting Pearcey in the 1960s, when Fitzsimmons was starting out in computer sales.

"He was an oddball guy, but a completely original thinker," recalls Fitzsimmons. "In 1946 he was already envisioning what he called an 'automatic encyclopaedic service delivered via a national teleprinter or telephone system'. That's basically electronic libraries and the internet.

"I see Pearcey and the CSIRAC story as an inspiration of what Australians can do." ●

IMAGES: UNIVERSITY OF MELBOURNE ARCHIVES; CSIRO ARCHIVES; UNIVERSITY OF MANCHESTER

The first computers

The difficulty with establishing a definitive history of computers is agreeing on just what a computer is.

Some early electro-mechanical calculators were able to do large-scale calculations as far back as 1941.

It's also difficult to assign a ranking to the operational dates for many first-generation computers, since much depends on the definition of "operational". Does it mean when the first test program was run, or when the computer started routine operation? Early electronic computers were room-sized, custom-built research projects. Once the basic operations were sound, the machines were continuously improved.

This list applies today's definition of a digital computer — an all-electronic machine capable of calculating operations, where the data and instructions are held in rewritable memory:

JUNE 1948

The Manchester Baby (or Small-Scale Experimental Machine), built at the University of Manchester, is generally accepted as the first electronic stored-program computer. It is upgraded in April 1949 into a fully operational machine and renamed the Mark I.

BELOW: The Manchester Mark-1.

MAY 1949

EDSAC, built at Cambridge University in Britain, goes live and runs its first stored program.

AUGUST 1949

BINAC, or Binary Automatic Computer, was designed for Northrop Aircraft Company and runs its first stored program. It is generally considered the first stored-program computer in the United States, although was limited in scope and never fully functional.

RIGHT: Pearcey with his creation.

NOVEMBER 1949

CSIRAC goes live, running its first program — a long multiplication routine.