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The Life and Times of the Silicon Chip

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From: "Clifford M Dubery" <duberycm@ocean.com.au>
Date: Tue, 15 Sep 1998 09:20:51 -0800
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Below is an article from today's copy of "The Australian" in its computer
section.
It has probably appeared in a number of papers around the world.
I chose to show this to you, to prove that the belief and disinformation
about reverse engineering of UFO's or Alien Spacecraft was the source of our
advanced computer technology.  This short history denies any connection to
this theory and attributes our integrated circuit and miniature CPU's we all
use today to a number of Engineers and Scientists employed b major defence
contractors.  After a lot of hard work to solve a problem they came up with
what has proven to be a revolutionary concept.
So, ACC (American Computer Company), Col. Philip Corso, and many others,
this technology has very terrestrial origins!

----- Begin Forwarded Article -----

Life and times of the silicon chip

In 40 years the silicon chip has transformed the world, and the pace of
development shows no sign of slowing. Roger Harrison reports
THE integrated circuit or silicon chip celebrated its 40th anniversary on
September 12.
Few aspects of our lives escape its influence. We depend on solid-state
chips for so many conveniences.
Our dependence on them will continue to increase.
Electronics technology pervades so many aspects of daily life, from simple
broadcast radios to automotive engine-control units, from microwave-oven
controllers to personal computers and mobile phones.
Without solid-state chips, we wouldn't have electronic pocket calculators or
personal computers, let alone personal digital assistants.
Cars would not meet pollution standards. There would be no Inter-net.
Low-cost, automated medical monitoring and other electronic health-care
equipment would not be possible. Sophisticated ultrasound, X-ray and other
medical imaging machinery would not exist.
Factory automation machinery would be very different. There'd be no OPS
navigation system for planes, ships and consumer automobiles. And the list
goes on.
The integrated circuit has revolutionised 20th century transport and
communications.
Travel has become safer, swifter and less costly in the 40 years since its
invention. Communications have become all pervasive -- and mobile.
The invention and development of the integrated circuit has engendered a
revolution in every industry, from aerospace to zoology, from finance to
xerography -- even the electronics business itself.
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Two men, working separately, were the progenitors of this revolution -- Jack Kilby and the late Robert Noyce.

During 1958, Kilby, a newly hired engineer at Dallas-based Texas Instruments, set about working out how to reliably link the many thousands of components necessary for a solid-state computer.

Dubbed the "tyranny of numbers", it had proved a stumbling block for the electronics industry, then in the early stages of a transition from vacuum tube to solid-state technology.

The invention of the transistor in 1947 made it theoretically possible to build a computer in a much smaller space than the room-sized vacuum-tube monsters of the era.

The first integrated circuit was made from germanium, the solid-state material then widely used to make transistors.

Kilby decided he would fabricate the necessary components for a complete circuit on a piece of germanium and set about making a device to demonstrate it.

He built an oscillator on a sliver of germanium mounted to a glass laboratory slide, with supply and output connections hand-wired to it with small gold wires.

On September 12, 1958, before a few colleagues from Texas Instruments, the 34-year-old Kilby applied power and used an oscilloscope -- a test instrument that displays signals from electronic circuits on a small screen -- to see the result. It worked.

A squiggly waveform appeared on the instrument's screen.

"I perceived that a method for low-cost production of electronic circuits was in hand... that instead of merely being able to build things smaller, we could fabricate entire networks in one sequence, and that we had extended the transistor's capability as a fundamental electronics tool," he later remarked.

In the meantime, in 1957, eight employees at Shockley Semiconductor Laboratory had become disgruntled with William Shockley, the founder and co-inventor of the transistor at Bell Labs 10 years earlier.

Although Shockley Semiconductor was pursuing germanium technology, they believed silicon was the way of the future.

The eight left to set up Fairchild Semiconductor in Mountain View, California, a now-famous address in what later became Silicon Valley.

Later dubbed the traitorous eight by Shockley, they were Julius Blank, Victor Grinich, Jean Hoerni, Eugene Kleiner, Jay last, Gordon Moore, Sheldon Roberts and Noyce.

Noyce, later to co-found Intel, was elected their leader. Collectively and individually, they changed the world irrevocably. With $US3500 ($6100) seed funding from Sherman Fairchild, then head of the eponymous aeronautical, camera and electronics manufacturer, they set about developing a silicon transistor mass-production process.

Jean Hoerni is credited with conceiving and developing the Planar process for mass-producing transistors in 1958, employing photo-lithographic-based etching for laying down planes of semiconductor material to form transistor junctions and other elements.

Hundreds of transistors could be formed side-by-side on a wafer of silicon, each of which could then be sliced off and mounted in a package with connecting wires.

It was one of the most significant developments in semiconductor technology since the invention of the transistor at Bell Labs in 1947.

Fairchild's Planar process technology became the chief method for making transistors and integrated circuits (ICs), by mass-producing large numbers of the same devices side-by-side on a wafer of silicon.

In late 1958, Noyce conceived an Idea for connecting the individual transistors on a wafer by depositing metal between them, to connect the transistors into a circuit, and laying down insulating material where contact was not wanted.

The following year, Noyce and his team perfected a mass-producible method of laying down this metal, using aluminium.

Kilby at Texas Instruments filed for a patent on his integrated circuit at the same time. Noyce followed with a patent on the Fairchild process six months later.

This sparked a patent dispute that ran for more than a decade before being resolved.

Fairchild established a commercial semiconductor production line in 1962. It has continuously manufactured chips longer than any facility in the world, he says.

Thus, Fairchild became the world's first IC manufacturer and an incubator for many chip industry pioneers.

The first ICs found a ready market in defence electronics.

The 1960s military needed small, rugged, low-power-consumption electronics. It needed computers.

This is where Fairchild and Texas Instruments found a market for their first production chips.

Outside the defence sector, bagging integrated circuit technology was something of a sport at technical symposiums in the early 1960s.

In 1965, to counteract negative perceptions, Texas Instrument's chairman Patrick Haggerty went to Kilby -- then deputy director of its semiconductor

research program --and set him a challenge: design and build an electronic calculator small enough for a coat pocket.
The idea was to demonstrate the. practical utility of the silicon.
And he did, with the electronic pocket calculator appearing in 1967. The critics had to eat their words.
The pocket calculator engineered the commercialisation of the integrated circuit.
Cracking the tyranny of numbers in computing was another Holy Grail for the chip industry.
At Fairchild Semiconductor, Noyce and Gordon Moore, tiring of the management approach and, seeing an opportunity to develop and mass-produce memory chips to replace the widely used magnetic-core memories of the day, left and founded a new company, Intel.
They devised a solid-state random access memory (RAM) circuit that could be fabricated on a silicon chip launched by the fledgling company in 1969.
Although the first RAM could only store 64 bits, it was the size of a single ferrite ring -- one bit -- in magnetic-core memories.
The first cost-competitive Intel RAM was the 1103 in 1970. It was the death knell for magnetic core memory.
The 1103 RAM reached a new level of miniaturisatlon, which became the foundation for microcomputer developments.
In the meantime, Intel had been approached by Japanese calculator-manufacturer Busicom to produce its complex logic-chip designs.
In charge of the project was a young engineer, Marcian "Ted" Hoff Jnr, who realised Busicom's designs, involving 11 separate chips, could be improved.
He proposed condensing it to three devices, putting the central processing unit (CPU) on a single chip, and creating at the same time a logic processor capable of more general tasks. Thus, in 1969, Hoff conceived the microprocessor. The first commercial device, the 4004, was released by Intel in 1971. It paid Busicom, in dire financial straits at the time, $US65, 000 for the rights.
The other two chips to accompany the CPU in Hoff's design were a read-write memory, to serve as an electronic notepad for passing calculations and results, and a read-only memory (ROM) for storing a program to drive the CPU.
This led to the explosive development of the personal computer, programmable controllers and a host of other applications.
The number of transistors in the chips produced in the first decade following the IC's invention grew spectacularly, causing Moore to observe in the April 1965 issue of the US magazine Electronics, that complexity in advanced integrated circuits had been doubling every year.
He later modified what became known as Moore's Law in the 1970s, when chip densities ballooned beyond a few thousand elements and the pace slackened to 18 months for doubling in complexity.
That pace shows no signs of slackening, even though Noyce remarked in a 1997 Scientific American article that "a deviation from exponential growth is inevitable". The industry has taken Moore's Law to be a self-fulfilling benchmark.
Inters first microprocessor, the 4004, contained 2300 transistors.
Chips of the 1970s leapt to 10,000, then more than 50,000 transistors, passing 100,000 transistors per chip~ in 1982. By 1995, chips of 10 million transistors were emerging.
This year, the largest ICs will reach 30 million transistors.
During the past 40 years, the microscopic size of features on chips has plummeted, enabling more devices and circuit elements per chip to beat the tyranny of numbers.
By the end of the 1980s, feature sizes had reached one micron -- a. millionth of a metre. By the mid-1990s, it was half a micron on the thumbnail-sized chips of silicon.
Beyond that comes what the industry calls deep sub-micron territory. Today's chip-making factories produce ICs with quarter-micron' feature sizes. Soon, production chips will reach 0.1 micron. Only the laws of physics will challenge the relentless pace of development for the chip industry.

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Created: Sep 15, 1998