

INSIDE INTEL

How Andy Grove Built the World's
Most Successful Chip Company

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1.

When most people think of the start-up phase of a high technology company like Intel, they have a mental picture of a lone scientist working feverishly away in a garage late at night to develop a device everyone else thinks is impossible. The establishment of Intel in 1968, however, was nothing like this cliché.

Intel's co-founders were Robert Noyce and Gordon Moore.

Robert Noyce was 40 years old in 1968. He had been hired by Bell Laboratories in 1956 and had assisted in the development of the transistor -- for which he and two other engineers had been awarded a Nobel prize. Robert Noyce was widely regarded as one of the pre-eminent engineers in his field.

When Noyce had left Bell Laboratories in 1957 to set up Fairchild Semiconductors, he came into contact with Gordon Moore who was hired to head up Fairchild's research and development program. Moore, like Noyce, had a PhD in chemical engineering.

By 1968, both men had become disillusioned with how Fairchild was going, and decided to start their own company. To fund it, Noyce called Arthur Rock, an investment banker based in San Francisco. They put together a two page document outlining their business plan, and made 15 phone calls to people they thought might be interested in investing in the as yet unnamed company. All 15 people agreed to provide funding -- they literally lined up \$2.3 million of start-up funding in one afternoon of phone calls.

It helped, of course, that both Noyce and Moore were quite wealthy themselves, and were each contributing around \$300,000 themselves to the new company. Nevertheless, most of the start-up funding was provided solely on the strength of the professional reputation of the two founders.

Within a couple of weeks, they had decided on a name for their new venture, deciding that "NM Electronics" didn't sound right but "Integrated Electronics" sounded much better. This was eventually shortened to Intel, and the new company was formally incorporated on July 16, 1968. (Once the company was formed, they then found another company called Intelco was already in existence, but they were able to buy the right to use the Intel name from Intelco for \$15,000).

While the new company's initial "Business Plan" could have been described as sketchy and vague at best, in reality the company founders knew exactly what they wanted to develop and build -- memory devices for computers using the new semiconductor devices, built from silicon chips.

"Fabricating silicon chips was the modern world's answer to medieval alchemy, the turning of base metals into gold. Except here, the raw material was sand, which was turned into a crystalline silicon which arrived at the fab molded into a long sausage, two inches in diameter. The silicon would then be sliced into thin "wafers" a fraction of an inch thick. By a series of secret, almost magical processes, each wafer would be coated with scores of identical miniature circuits, neatly stepped in rows and columns. Then the wafers would be scored with a diamond cutter, and the individual chips would then be sawn away from their neighbors and wired individually into black ceramic packages, often with a line of metal pins down each side."

– Tim Jackson

Noyce and Moore found an old Union Carbide plant in Mountain View, California, which was set up for manufacturing. They leased the building, which was about 17,000 sq. feet in size, and

started ordering manufacturing equipment that would have the capacity to manufacture around 10 million integrated circuits a year -- an ambitious goal for a new company without even a circuit design of its own yet.

Noyce and Moore also hired a director of operations to assume responsibility for the manufacturing side of the company. They chose Andrew Grove, a PhD physicist who had no manufacturing experience whatsoever.

"In 1968, people who met Grove for the first time usually noticed three things. One was that he was very bright, very good at explaining things -- particularly semiconductor devices, whose physical behavior he had written a book about. Another was that he was very organized, and seemed to know exactly what he wanted and how he was going to achieve it. A third was that he was very keen to make an impression, to justify his position. Grove knew that Noyce and Moore had taken a risk by giving him the job of director of operations, and he was determined to prove they had made no mistake."

– Tim Jackson

At around this same time, Noyce and Moore also hired Bob Graham, one of Fairchild's star salesmen, to become Intel's marketing director.

2.

The first focus for Intel was to develop a new manufacturing process for integrated circuits that would be more cost effective. To achieve this, they used an approach Noyce and Moore had first examined while at Fairchild -- a process using metal oxide on silicon which was called "silicon gate". Since they weren't certain the process could be scaled up to commercial volume production, they also worked on two other approaches -- multichip memory modules and the "Schottky bipolar" -- with the objective that all three approaches would be tried simultaneously until the best was successfully into production.

While this simultaneous development program may have been commercially prudent, it also had the effect of generating some highly charged internal discussions within the company. Most of these "discussion" sessions would be conducted with both parties screaming at each other at the top of their lungs -- and usually in front of other people. The first year of Intel's history was full of such stand-up screaming matchups.

By the spring of 1969, the bipolar team had developed a 64-bit memory chip which Honeywell agreed to use in a new computer the company was developing.

"The chip for Honeywell became the new company's first commercial product. It was a symptom of Intel's target market that the new chip wasn't even given a name. Instead, it was referred to only by a part number, 3101. Intel's potential customers were engineers inside computer companies, who though of themselves as rational decision makers choosing between one part and another strictly on technical merit, quality and price. A catchy name wouldn't have increased sales; on the contrary, it might have excited suspicion that there was a shortage of engineering talent to cover up for. A simple part number, preferably a number that meant something, was the way to go."

– Tim Jackson

The early success of the bipolar team spurred the silicon gate team onwards with steely determination. They were having

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