

# “Go off and do something wonderful”

FOUR STORIES FROM THE LIFE OF ROBERT NOYCE // BY LESLIE BERLIN

Bob Noyce (left) and his older brother Gaylord proudly display the glider they built in the summer of 1945.



*Image courtesy of Stanford University Libraries, Department of Special Collections.*

**R**obert Noyce was called the Thomas Edison and the Henry Ford of Silicon Valley: Edison for his coinvention of the integrated circuit, a device that lies at the heart of modern electronics; Ford for his work as a cofounder of two companies—Fairchild Semiconductor, the first successful silicon firm in Silicon Valley, and Intel, today the largest semiconductor company in the world. Noyce also mentored dozens of entrepreneurs, an effort he loved and called “restocking the stream I fished from.”

Right up until his death in 1990 at the age of sixty-two, Noyce was a daredevil. His jacket bore a patch that read, “No guts, no glory.” It was a fitting motto for a man who flew his own jets and took time off every year to go helicopter skiing. It is no wonder, then, that for many his life encapsulated the high-flying, high-risk, high-reward world of high technology.

It is impossible to do justice to Noyce in a brief article. Instead, I offer four stories that provide glimpses into what made him one of the twentieth century’s most important inventors and entrepreneurs. And in the spirit of Noyce’s belief that the best knowledge is knowledge that can be used, each story includes a “take-away” for readers.

### **BOYHOOD ADVENTURER**

When Noyce was twelve, he and his fourteen-year-old brother Gaylord decided to build a boy-sized glider. They used no blueprints, only the knowledge they had gained from years of constructing model airplanes.

Building the glider was the highlight of the summer of 1940 for many of the seventeen children Bobby Noyce convinced to help in the effort. A boy whose father’s furniture store received rugs on long bamboo spindles donated the rods for the glider’s frame. A girl sewed the cheesecloth that stretched over the wings. And the boy with the newly minted driver’s license was charged with hitching the glider to the back of his father’s car to see if the plane could be flown like a kite.

But for Bobby Noyce, the real test of success would be if he could, as he put it, “jump off the roof of a barn and live.”

That’s what he resolved to do. He climbed up on top of the barn near his house, had someone hand him the glider, took a deep breath, and then ran right off the edge of that roof into the unknown.

He was only aloft for a few seconds, but he landed without crushing the machine and declared the experiment a success.

**TAKE-AWAY.** Noyce, at age twelve, already possessed three attributes that would define his future success as a technical entrepreneur. First, his technical ability with his hands is evident. Throughout his life, Noyce was respected by engineers as well as scientists because he was not simply a thinker; he was also a builder. Second, the adolescent Noyce pulled together a diverse team, each member of which he tapped for his or her ability to contribute something unique to the project. Finally, in the boy who reached the edge of the roof and kept on running, we see the soul of the man who lived without limits, a man who believed that every idea could be taken further. These three attributes—technical credibility, the ability to assemble and motivate a diverse team, and a “no limits” mindset when it came to goal-setting—underpinned Noyce’s technical and business success.

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### **SCIENTIST TO MANAGER**

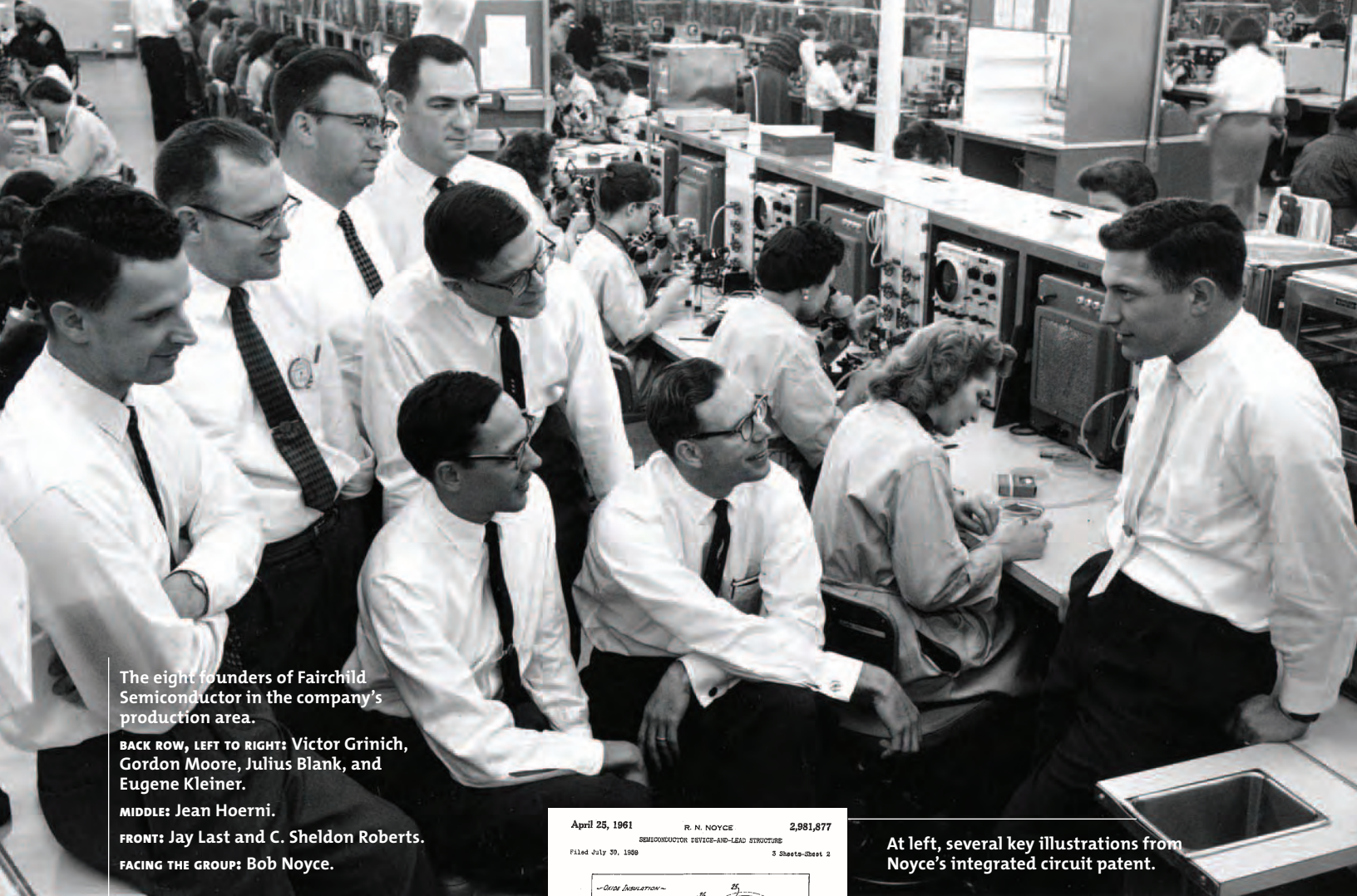
In September 1957, Noyce, then thirty years old, joined a rebellion led by seven of his coworkers. Julius Blank, Vic Grinich, Jean Hoerni, Eugene Kleiner, Jay Last, Gordon Moore, and Sheldon Roberts had met more than a year earlier when they were hired by William Shockley, coinventor of the transistor, to work at his new company in Mountain View.

In short order, Shockley proved an unpredictable micromanager. Even worse, he wrenched the company’s focus away from silicon transistors, the broad market for which was apparent even at that time, to four-layer diodes that were difficult to build and served a limited market. The group of seven, soon joined by Noyce, decided to leave.

It was not easy to find someone willing to fund a start-up company managed by young technologists in 1957, but with the help of two New York bankers (one of whom was Arthur Rock), the group did so. Fairchild Camera and Instrument agreed to back the fledgling operation, Fairchild Semiconductor, and soon acquired it outright.

Noyce headed research and development at Fairchild Semiconductor. He adopted a hands-off management style that encouraged outside-the-box thinking, creative freedom, and collaboration. He was an excellent supervisor of technical work.

In January 1959, Noyce became general manager of Fairchild Semiconductor. A PhD physicist with no formal business training, Noyce taught himself business skills over the next eight years. Within a decade of the company’s founding, Fairchild Semiconductor had 11,000 employees and \$12 million in profits. For a while, its parent company (essentially all of whose profit came from the semiconductor division) was the best-performing stock on Wall Street.



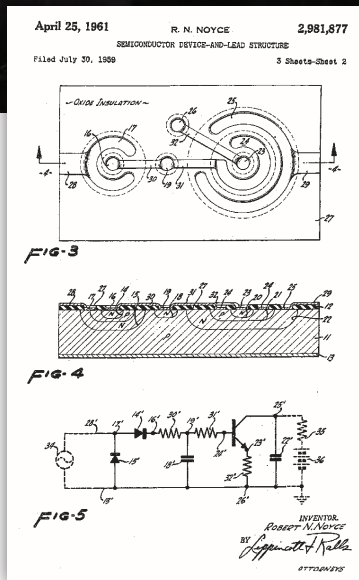
The eight founders of Fairchild Semiconductor in the company's production area.

BACK ROW, LEFT TO RIGHT: Victor Grinich, Gordon Moore, Julius Blank, and Eugene Kleiner.

MIDDLE: Jean Hoerni.

FRONT: Jay Last and C. Sheldon Roberts.

FACING THE GROUP: Bob Noyce.



At left, several key illustrations from Noyce's integrated circuit patent.

Then everything fell apart. Fairchild began missing scheduled deliveries. Products in the development stage could not be successfully transferred to manufacturing. The trickle of employees leaving Fairchild in recent years became a flood. In the third quarter of 1967, profits were 95.5 percent lower than a year before.

Fairchild Semiconductor declined for many reasons, but Noyce himself must bear some responsibility. His laissez-faire management approach—offering general directives rather than following up on specific process details—was ideal for inspiring and supervising highly creative technical work, but this management style did not translate well to large, multifaceted organizations.

**TAKE-AWAY.** Inspirational leadership alone is not effective management. At times, the same person can be both an excellent big-picture, rally-the-troops leader and an outstanding detail-oriented manager, but this was not the case with Noyce, who was the former but not the latter.

Noyce's experiences at Fairchild forced him to recognize his own shortcomings. "One thing I learned at Fairchild," he later admitted, "is that I don't run large organizations well. I don't have the discipline to do that, have the follow through."

When Noyce and his Fairchild cofounder Gordon Moore left the company in July of 1968 to start a small memory operation that today is called Intel, they deliberately split power evenly between them. This decision, which came directly from Noyce's having confronted his own managerial limitations at Fairchild, offers yet another take-away:

Noyce was willing to act on the knowledge of his own professional limits.

### INVENTOR

Of the seven patents Noyce filed in his first eighteen months at Fairchild, the best known is #2,981,877 for "Semiconductor Device-and-Lead Structure." Fairchild called the product developed on the basis of this patent—a complete electronic circuit built on a chip of silicon small enough to be carried off by an ant—a "monolithic integrated circuit." Nearly every electronic device today contains descendants of the integrated circuit in Noyce's patent application.

By the time Noyce's patent application was submitted, however, Noyce himself had left the lab—and research science—for good. As general manager of Fairchild Semiconductor, his primary contribution to integrated circuit development came through his funding relevant research and encouraging gifted researchers. It was not Noyce but a team led by his cofounder Jay Last and anchored by men such as Isy Haas, Bob Norman, Lionel Kattner, and Jim Nall that transitioned Noyce's notebook entry from good idea to real product. And in truth, Noyce's patent did not provide much guidance. It said that it ought to be possible to build integrated circuits using isolation techniques as well as the breakthrough planar process invented by Noyce's Fairchild cofounder Jean Hoerni. The patent did not, however, say how to make this possibility a reality. That was what Last's group figured out through their own remarkably innovative work, some of which earned team members patents on their own key ideas and processes.

**TAKE-AWAY.** Innovation is rarely the product of a single mind. Invention is best understood as a team effort, with the person ultimately called “inventor” occupying much the same space as the pitcher who has just had a perfect game. The outfielders might have caught a dozen fly balls, the first baseman might have nearly broken his neck to step on the bag an instant before the runner, the catcher might have called for pitches perfectly calibrated to each batter's weakness, but the record books note only that the pitcher threw a perfect game.

Noyce never hesitated to admit that his ideas about integrated circuits relied heavily on ideas that were “in the air” in 1958 and 1959. Without Hoerni, without Moore, without the work of Kurt Lehovec at Sprague, Noyce never would have imagined the integrated circuit in the way he did. Without Last, the microcircuits group at Fairchild, and other people around the world working in the field, Noyce's ideas would never have become marketable products.

## MENTOR

After Noyce retired as Intel board chair in 1979—he remained a board member until his death—he enjoyed mentoring young entrepreneurs. Noyce worked with dozens of youthful technologists and funded many small companies. The best known of the entrepreneurs he encouraged was Steve Jobs, cofounder and CEO of Apple and cofounder of Pixar, Inc.

The two met in 1977, when Apple was a year old. Noyce's wife, Ann Bowers, headed human resources at Apple, and through her, Jobs deliberately sought out Noyce as a mentor. “Steve would regularly appear at our house on his motorcycle,” Bowers recalls. “Soon he and Bob were disappearing into the basement, talking about projects.”

Noyce answered Jobs's phone calls—which invariably began with, “I've been thinking about what you said” or “I have an idea”—even when they came at midnight. At some point he confided to Bowers, “If he calls late again, I'm going to kill him” ... but still he answered the phone.

“He was very interested in—fascinated by—the personal computer, and we talked a lot about that,” Jobs recalls of Noyce.

BELOW | Bob Noyce and Steve Jobs in the mid-1980s. Jobs is one of many entrepreneurs who count Noyce among their major influences.



For his part, Jobs believed that “you cannot understand what is happening today without understanding what came before,” and Noyce gave him a way to experience what Jobs called “that second wonderful era of the valley, the semiconductor companies leading into the computer.”

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**TAKE-AWAY.** There is an informal sort of generational succession in Silicon Valley that places Noyce near the top of the family tree. A few years ago, for example, the founders of Google asked Steve Jobs for advice and mentorship in the same way Jobs had come to Noyce when Apple was young.

Noyce believed that would-be entrepreneurs needed successful role models (though he never would have put it that way). His financial success directly benefited the entrepreneurs whose companies he funded as an informal angel investor, but the stories about his success indirectly inspired many more who thought, “If he can do it, I can, too.” This belief is an essential aspect of any innovative culture because it encourages new ideas and risk-taking—and with it engenders a self-perpetuating cycle of entrepreneurship. “Optimism is an essential ingredient for innovation,” Noyce—who often advised people to “go off and do something wonderful”—once said. “How else can the individual welcome change over security, adventure over staying in a safe place?”

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