Calvin F. Quate
Bio

Calvin Quate was born in the small desert town of Baker, Nevada, on December 7, 1923. The region is dominated by sagebrush, quaking aspen, and ancient bristlecone pines. As a boy, Cal and his friends rode horses for hours over the desert terrain, when they weren't tending their families' flocks of sheep.

Baker is located in what is now Great Basin National Park, home to Wheeler Peak and Lehman Caves. If you take a tour through the Lehman Caves today, you can see where Cal and his brothers wrote their names on the cave ceiling in 1927, using the smoke from their oil lamps. (This was before the caves became part of a national park, of course.)

Cal was educated in a one-room schoolhouse until the age of 11. In 1934, the family moved to Salt Lake City, where Cal earned a BS in electrical engineering from the University of Utah in 1944.

Meanwhile, the Manhattan Project had begun in 1939 because American scientists feared that Germany was developing an atomic bomb. Oak Ridge National Laboratory was established in 1943 as part of the Manhattan Project. The goal of activities in Oak Ridge was to separate and produce uranium and plutonium for use in developing a nuclear weapon.

The Army Corps of Engineers ran the Manhattan Project. Electrical engineering grads from all over the country were summoned to work at Oak Ridge.

Cal remembers:

> I graduated from the University of Utah in 1944 and had landed a job with General Electric on the East Coast. I was down at the Salt Lake City bus station, buying my ticket. (My parents were out of the country and I had no money, so I was going to ride the bus across the country to get to my new job.)
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> I was intercepted by an official. He told me, "Your orders have changed. You're to report to Colonel Nichols in Oak Ridge, Tennessee."
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> I had never heard of Oak Ridge. After I found out where it was, I changed my tickets, and rode the bus to Knoxville, Tennessee. There I was met by Col. Nichols. He said, "I'm here to meet you for one reason, and that is to tell you that you are not to talk about anything here."
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> I said, "Not anything?"
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> He said, "Well, you can talk about mud, if you want. But nothing else."

At Oak Ridge, our job was to monitor the production of the isotype of uranium. The isotope was separated by machines we called "D's". These were large D-shaped machines that propelled the particles in a semi-circle and separated the heavier particles. The D's were driven by magnetic fields, produced by huge conductors made of silver and gold. The gold came from Fort Knox.

We made enough material for the two bombs that were actually used. (After that they used a new, more efficient technology called diffusion.)

Once we had generated enough material, I was given a commission in the Navy and was sent to Bowdoin College in Maine for training.

I remember I was walking down the Bowdoin campus steps when the news came out that an atomic bomb had been dropped on Hiroshima. I knew it was the result of our work at Oak Ridge, and I knew that at that moment that probably 20,000 people were dead.

I told my fellow students that 20,000 people had just died in Japan. They were surprised and didn't quite believe me. No one knew we had nuclear power, and they couldn't fathom that so many people had been killed.

When details emerged, the number was in fact close to 20,000. Many, many people. But it had to be used. To end the war.

After basic Navy training in Maine, Cal was assigned to a ship in Seattle.

Cal remembers:

Once we had boarded the ship, we set sail for Norfolk, Virginia. When we arrived on the Pacific side of the Panama Canal, the Captain, who had gone ashore, was nowhere to be found.

We waited for two days for the Captain to return. When we finally spied him coming toward the ship, he was so drunk he had to be carried up the gangplank. They deposited him into his bunk, and I told the pilot that we couldn't leave because the Captain hadn't given orders to sail.

The pilot said, "As second-in-command, you are the Captain now."

So I was the Captain of the ship while we sailed through the Panama Canal.

We sailed up to Norfolk, Virginia, where we stayed for a few days. Then we received orders to deploy to Puerto Rico, to protect the port.

> On our way to Puerto Rico, I notified the Captain that I'd seen another ship headed in our general direction. The Captain didn't seem to notice or understand. As I watched, we collided with the other ship.
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> At that point, the Captain was relieved of his duties and another Captain was assigned to the ship.

After his stint in the Navy, Cal obtained a PhD in electrical engineering from Stanford in 1950 and went to work at Bell Laboratories in New Jersey. At the time, Bell Laboratories was where the action was. Radio technology was still a very new thing. Not radio as in broadcast radio -- radio as in the study of larger signals at higher frequencies. We now call them microwaves.

At the time, radio was a mysterious, unexplored field. What could you do with those frequencies up there? They must be useful for something. How do you generate them, how do you detect them?

To answer these questions, Cal set up an experiment with a colleague, Chape Cutler. Cutler worked on the measurements and Cal worked mostly on the calculations. Together they were able to verify a theory concerning an electron beam projected through traveling wave tubes. Measuring the noise level excited in the cavity, they found the resulting waves predicted by the theory. This became known as the Cutler-Quate experiment.

In 1959, Cal went to work for Sandia National Laboratories in Albuquerque, and then joined Stanford's departments of Applied Physics and Electrical Engineering in 1961.

At Stanford, Cal and his students, in association with Gerd Binnig and Christoph Gerber, developed the Atomic Force Microscope. The AFM traces surface contours using a needle to maintain constant pressure against the surface to reveal atomic detail, and proved to be the foundation of the $100 million nanotechnology industry.

Cal often took students skiing, kayaking and camping in Nevada, Colorado and California. At the age of 50, he learned to windsurf. And, until just a few years ago, he and three of his boyhood friends gathered every year for an annual weeklong wilderness backpacking trip.

In 1982, Cal was awarded the Rank Prize for Opto-Electronics, and in 1992 he won the National Medal of Science. In 1995 he was named Scientist of the Year by R&D Magazine, and was given membership in Britain's Royal Society. In 2011 he was named a Stanford Engineering Hero.

Cal Quate has four daughters, three stepchildren, and one granddaughter, who also attended Stanford and also majored in Engineering.