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BUSINESS EDITOR DOUG IVERSON DIVERSON@PIONEERPRESS.COM 651-228-5431
Sunday 1-3-2010 D

REMEMBERING: HOW THE NEXT BIG THING TOOK SHAPE IN ST. PAUL

COURTESY: LOCKHEED MARTIN TACTICAL SYSTEMS

The original site of Engineering Research Associates was at 1902 Minnehaha Ave. in St. Paul. The ERA name was quickly absorbed by other companies.

Engineering Research Associates

After World War II, St. Paul was one of two incubator sites for the computer industry — but missed out on later explosive growth.

COURTESY: LOCKHEED MARTIN TACTICAL SYSTEMS

This 1985 aerial photograph shows what had become the sprawling UNIVAC plant in St. Paul. At one point, UNIVAC had 13,000 employees in the Twin Cities.

The almost Silicon Valley

By Tom Webb
twebb@pioneerpress.com

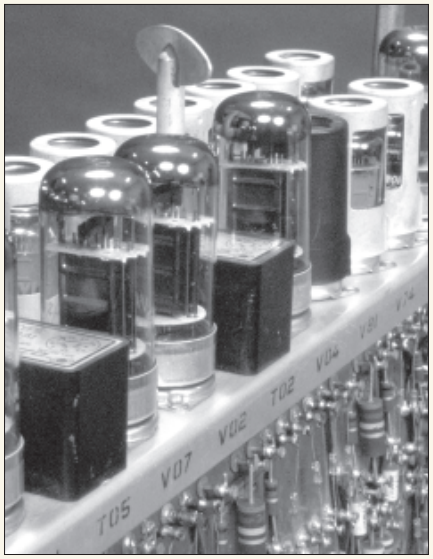
At the end of World War II, an elite group of Navy code breakers created a company whose top-secret work helped to launch the world's computer industry.

It wasn't based in Silicon Valley. It was based in St. Paul.

The company was called Engineering Research Associates, and few people knew its secrets. Most still don't. Yet in the 1940s and early 1950s, its group of brainy engineers was quietly making history — and forging a path that turned the Twin Cities into a high-tech power for decades.

"You can say quite confidently that the computer industry has its roots in two places in the world, Philadelphia and here," said Thomas Misa, director of the Charles Babbage Institute, dedicated to the history of computing and housed at the University of Minnesota.

The ERA name lasted only a decade before it was absorbed by other companies. But its pioneering work would put Minnesota at the lead of the postwar era's most far-reaching technology. Most of Minnesota's famed computer names — UNIVAC, Control Data, Cray Research and scores more — can trace their roots to that original ERA site at the corner of Prior and Minnehaha avenues.



COURTESY: LOCKHEED MARTIN TACTICAL SYSTEMS

The early computers contained thousands of vacuum tubes, precursors to the transistor. Keeping the machines cool proved a challenge for ERA engineers.

"It's the seed from which an industry grows," Misa said. "It's not only the ERA company but spinoffs of the ERA company that were founded by ERA veterans, including Control Data. And Control Data led to 45 more spinoffs, the most famous of which was Cray Research."

The fruits of that revolution amaze the ERA pioneers.

"None of us had any idea that computers would eventually evolve into an everyday item," said Don Weidenbach, who joined ERA in 1946. "To us, a computer was a huge machine that cost a million dollars or more, and the only people who could afford them were universities or the government."

There's a secondary story, as well, in what did not hap-

ALMOST SILICON VALLEY, 4D ›

PIONEER PRESS FILE PHOTO

In 1955, ERA founder and eventual Control Data CEO Bill Norris broke ground for the Remington Rand UNIVAC plant on Shepard Road in St. Paul.

COURTESY: LOCKHEED MARTIN TACTICAL SYSTEMS

Engineer Earl Joseph programs the breakthrough ERA 1101 computer, the Navy-sanctioned version of the Atlas. None were sold; businesses didn't see the point.

COURTESY: CHARLES BABBAGE INSTITUTE, UNIVERSITY OF MINNESOTA

In 1947, ERA engineers developed the magnetic storage drum, the forerunner of today's computer hard drives. They were top-secret in 1947, but ERA later sold them commercially.

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› Almost Silicon Valley

pen: The Twin Cities did not become Silicon Valley. William Norris, famed for leading Control Data, was a founder of ERA. Before his death in 2006, he lamented the paths not taken in the late 1940s and early 1950s.

"We had enormous technology, and we were much more advanced than any other company," Norris told an interviewer in 1980. "IBM at that time was still a small outfit and didn't have the advanced knowledge that we had at ERA. It was the chance of a lifetime, and we missed it."

Today, it's Silicon Valley, not St. Paul, that's heralded for digital innovation. Yet, ERA's legacy is still visible here. Minnesota remains an industry leader in the sector ERA pioneered six decades ago: engineering powerful computer machinery that is rugged and durable and doing vital — often secret — work for government and the military. Thousands of Minnesotans still do that work daily.

And it all started here, thanks to one incredible stroke of good fortune.

THE CODE BREAKERS

As World War II was nearing an end in 1945, the U.S. Navy had a new worry.

During the war, the Navy had assembled in Washington, D.C., an elite group of engineers, mathematicians, physicists and cryptologists. Their job: to crack the enemy's secret codes, which required creating the world's most sophisticated analytical machines. That elite group succeeded in spectacular fashion. But once the war ended, the Navy feared all that brainpower would scatter, and the Navy would lose its technological edge.

One of those key code breakers was Bill Norris, a Navy lieutenant.

"The Navy could never have broken the codes without this group of people," Norris told the Babbage Institute decades later. "And it represented an enormous reservoir of knowledge that had been built up during the war."

Norris and a colleague proposed an unusual solution: After the war ended, why not preserve the group in a private company, where they could continue top-secret work, but on a contract basis? The Navy brass liked the idea.

But corporate America did not. The concept was pitched to major corporations, one after another, and each one rejected it, eager to resume civilian work instead. Finally, the code breakers pitched the plan to John Parker, a Washington investment banker who had run a factory in St. Paul that made wooden gliders during the war and was searching for a postwar enterprise.

Parker met with Adm. Chester Nimitz, former commander of the Pacific Fleet. Decades later, in an interview with the Babbage Institute, Parker told what happened.

"All Admiral Nimitz said to me, as he tapped me on the chest, was, 'I've looked into your background, and there's a job that I would like to have you do.' And he said, 'It may be more important in peacetime than it is in wartime.' And I said, 'Aye-aye, sir.' I had no idea what I was going to do."

With Parker's financial support, the core group of code breakers and engineers was kept intact. The new private company was launched in January 1946. Then, one by one, 40 world-class scientists moved from Washington to St. Paul.

1902 MINNEHAHA AVE.

Even in 1946, the old glider factory was no showplace. Cavernous and poorly insulated, the government-owned factory was freezing in wintertime, sweltering in summer and a haven for birds.

"We had to come in and sweep off our desks in the morning, because the birds left their calling cards," Weidenbach recalled.

From those Spartan beginnings, the world's computer industry began to sprout.

The engineers and mathematicians arriving in St. Paul were a young group, most of them in their 20s and early 30s. They got an unusual incentive: shares of ERA's closely held stock. They joined a core of Minnesota workers who'd built 1,500 wooden gliders during the war, as well as Navy personnel, who provided oversight and security. Quickly, the Navy began to issue top-secret contracts.

"It was a felony to disclose at the time, back there, that you were in this business of codebreaking … and the development of the computer business for doing this code work," Parker said decades later.

It wasn't until 1977 that the government's National Security Agency publicly revealed ERA's pioneering work in the computer age and its "excellent record of delivering equipment that 'worked.' "

THE PIONEERS

"It was the most unique place I'd ever worked in my life in that there were innovative people all around you," said Jack Ross, a mechanical engineer. "There wasn't any problem you could come up with that someone in that group couldn't solve."

In interviews, ERA veterans always mention that constellation of brilliant people. Paul Nikolai was a graduate student in mathematics in the 1950s, working with an astronomer, a plant pathologist and electrical engineers.

"You just learned all kinds of stuff from these people," Nikolai said. "They had different experiences, and they shared them with you. It was very uplifting."

The secret work was compartmentalized. People assigned to classified projects worked in tight-knit teams; those outside that circle knew nothing about them.

Natural tensions between the collaboration-minded scientists and the secrecy-minded Navy seem to have been largely kept in check. But occasionally, the camps needled each other.

One Navy officer liked to rig up a long pole "to see if he could snatch a drawing off the desks and pull it through the window," Navy Captain Edward Svendsen told the Babbage Institute. "And he succeeded a couple of times."

On the other hand, Ross recalled, "We used to have badges that were round, about the size of a milk-bottle cap. One of the guys took a milk-bottle cap and drew on it, and showed it at the security gate. He got in a few times."

FERTILE GROUND

Although ERA came to St. Paul almost by accident, it was a seed that fell on fertile ground.

Local institutions aided its success, including 3M and the First National Bank of St. Paul. And the U provided a pipeline of talent — including Seymour Cray, later heralded as the father of the supercomputer.

Said Misa, "The story is that the whole electrical engineering class in 1950 and 1951 went to work for ERA, and that includes Cray … who would be on everybody's list of the five most important computer designers, ever."

Although it functioned as a high-level job shop for Naval intelligence, ERA also hoped to develop profitable businesses on the outside.

So its engineers teamed with Great Northern Railway on weighing iron-ore cars; with airlines on early reservations systems; even with Pearson's Candy Co. on how to make its complicated Seven-Up candy bar.

"Nobody knew at that time which of these things would turn into some solid line of products and services," said engineer Arnold Cohen in a Babbage Institute interview.

ERA's fame, however, would not come from candy bars.

THE BREAKTHROUGH

Back when punch cards and paper tape were the cutting edge of data storage, ERA introduced a digital storage system that was revolutionary in every sense.

In 1948, ERA invented a magnetic storage system using a high-speed rotating drum, which allowed digital data to be entered, saved, searched and altered. The top-secret device was code-named Goldberg.

"It's no different than the standard hard drive that's in your computer, a hard drive that spins," Misa said. "There are a zillion neat engineering tricks between the Goldberg

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scheme and today, but it's the same principle — to store data in the binary, the zeroes and ones."

Weidenbach, a hardware engineer now retired in Eagan, designed circuits for both Goldberg and a related top-secret machine, Demon.

"It used all vacuum tubes, like the old radio sets," he remembers. "These machines got huge. We probably used between 5,000 and 10,000 vacuum tubes in one machine, and it generated a lot of heat. There were a lot of problems in cooling the machines down."

In top-secret circles, ERA's drum storage was a sensation. But Demon soon revealed a chink in its armor. It was engineered for a single job: to break a particular Soviet code. When the Soviets changed the code, Demon became useless.

Said Misa, "It was just out of that moment … that the ERA people clearly got the picture that what they wanted to build, and would be more useful, would be a programmable machine."

A TRUE COMPUTER FIRST?

The question of who built the first computer is controversial. Huge patent wars have been fought over the claim, and even today, clear answers are hard to come by.

The ENIAC, completed in Philadelphia in 1946 by J. Presper Eckert and John Mauchly, often is recognized as the first. It's now in the Smithsonian Institution. But some ERA veterans believe St. Paul was the birthplace of the first general-purpose computer, code-named Atlas.

Misa won't go that far.

"It goes back to the really difficult question of who invented the first computer," he said. "There are about a dozen claimants of that, and Atlas is really one of those claimants."

ERA delivered the Atlas computer in 1950, when ENIAC and other early computing machines were already on the scene. At the time, Atlas wasn't even called a computer, and it absolutely wasn't public. What Atlas did have was instructions stored on the machine with the ability to change them.

"That was really the first true, general-purpose machine," Weidenbach said. "You could change the machine to do many problems — just write new software for it."

The earlier computational machines were marvels, but to Misa, they did the work of elaborate adding machines.

What stored-program technology did, Misa said, was transform the computer from a calculator into a machine with countless applications. That opened a future where computers would, eventually, operate everything from cell phones to dishwashers.

Atlas "transforms a computational machine into a machine that can do conditional tests," Misa said. "And if you can do any kind of *if/then* statements, you have a machine in principle that can do any kind of calculation and solve a huge range of problems."

As in playing chess: *If* your opponent moves a pawn, *then* you move a bishop.

A STUMBLE, A SALE, A REVIVAL

If Atlas showcased ERA's talents, its shortcomings soon became clear.

The Navy eventually gave ERA clearance to sell a less-powerful version of Atlas — renamed the ERA 1101 — in the commercial market. But the company failed to sell a single machine, in part because business customers couldn't see the point. If ERA's technology was world-class, its marketing, sales and customer service were not.

Within a year, ERA President John Parker sold the company for $1.7 million (about $14 million today) to Remington-Rand, based in Connecticut. By then, ERA had grown to 850 employees, most in St. Paul.

On paper, the deal held promise. ERA would become part of a better-heeled enterprise. Plus, Remington-Rand owned the world's other leading computer company, formed by ENIAC's creators, Eckert and Mauchly.

It might have produced a golden age. Instead, the two camps became bitter rivals.

Despite the friction, the ERA Division developed success after success, including in non-classified work: a breakthrough commercial computer (the 1103), an air-traffic control system, a profitable antenna coupler device and more. Gradually, the ERA name was phased out in favor of UNIVAC, which stood for Universal Automatic Computer.

In 1955, Remington Rand merged with Sperry to form Sperry-Rand. Impressed by the profits and products coming from St. Paul, Sperry-Rand pulled together its UNIVAC computer operations under Norris' leadership.

A COLOSSUS, THEN A COLLAPSE

The first of the sprawling computer plants arose in St. Paul, then Roseville, Eagan, Bloomington and elsewhere. By 1957, Norris left UNIVAC to lead the upstart Control Data Corp., fueling even more computer industry growth in the Twin Cities.

Like Control Data's, ERA's pattern of spinoffs is among its greatest legacies, and it was aided by that now-lucrative stock granted to early ERA engineers.

"It created a network of people that had the technical savvy — but also the financial means — to become business people, entrepreneurs, themselves," Misa said. "So it's not the one company; it's the network of companies."

Jerry Williams illustrates how innovation multiplied. An electrical engineer, he joined ERA in 1951 and stayed until 1958.

"That was when Control Data was just getting started, and I was one of the early stockholders there and invited to buy stock by Bill Norris," Williams said. "Then I left and started a different company, called Transistor Electronics."

He later returned to Control Data before founding another company called Williams Sound. Today, the Eden Prairie firm is the largest supplier of wireless systems for the hard-of-hearing and has 75 employees.

For three decades, the Minnesota economy was lifted to impressive heights by the sprawling network of computer-related companies and their spinoffs. UNIVAC once had 13,000 employees here; Control Data once employed 15,000.

"One of the two world-leading centers of computers in the 1950s, '60s and '70s was here," Misa notes.

Then, beginning in the mid-1980s, everything turned. Giant mainframes were out; personal computers and then the Internet were in. Manufacturing moved overseas. Integrated circuits and cheap storage ended the heyday of engineering teams and mainframe companies. Even the Cold War ended.

One by one, Minnesota's computer giants imploded, helped along by disastrous management decisions.

A LEGACY CONTINUES

Today, Minnesota's computer industry is much smaller and harder to see. But it's still around.

Though Control Data has vanished, Seagate Technology has assumed its hard-drive business. Said Misa, "The technology of magnetic storage is something you can draw a line from the ERA company to Control Data to Seagate."

UNIVAC became Unisys and sold its defense unit. Today, the defense work continues as Lockheed Martin Tactical Systems, with 1,400 employees in Eagan.

"Engineers in this facility are designing the world's smallest (ruggedized) supercomputer. That's going into the Joint Strike Fighter," said John Nikolai, director of electronic products and logistics. "It has more processing than several Cray computers, and it's the size of a breadbox."

Lockheed Martin and Unisys engineers and retirees have been active in telling the ERA story, now that its secrets can be revealed.

For Minnesota's 150th birthday in 2008, a panel compiled a list of 150 "people, places and things that shaped our state." ERA didn't make the list, prompting retiree Harvey Taipale to call the commission.

"We said, 'Hey, you forgot Engineering Research Associates.' And they said, 'Who are they?' "

That led to a fruitful exchange, leading to an ERA exhibit at the state Capitol, another at the State Fair. Now at the Minnesota History Center, ERA's prototype drum memory — history's first magnetic memory drive — is on display in the Minnesota's Greatest Generation exhibit.

In the end, it didn't lead to Minnesota becoming Silicon Valley. But from that first drafty factory in St. Paul, ERA spawned a rich legacy of innovation and jobs and wealth. And to a degree, it still does.

Tom Webb can be reached at 651-228-5428.

An industry's roots

Engineering Research Associates was first located in a glider factory at the corner of Prior and Minnehaha avenues in St. Paul's Midway area.

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COURTESY: LOCKHEED MARTIN

Employees assemble antenna couplers, one of ERA's most profitable products, at the plant in St. Paul in the 1950s.

PIONEER PRESS FILE PHOTO

Workers at UNIVAC'S Roseville plant hand-wire computer components in 1967.