



Xerox PARC

—Heroes of the micro revolution

A look at the think tank where many feel it all began

BY MARTIN PORTER

WHEN Apple introduced its Macintosh last winter, memories were stirred in scientists who have seen the personal computer grow up over the past ten years.

While the press extolled Mac's innovations—its mouse, high-resolution graphics, icons—the unit is actually reminiscent of a machine that predates personal computing altogether, the Alto. Although the Alto was not as personal as today's products in size or cost, it was a prototype for distributed processing. It also set the stage for such subsequent innovations as the local area network (LAN), laser printing, Smalltalk (a combination of a programming language and a graphics package), bitmap display and overlapping windows.

Alto and these corollary features originated where many other of today's leading-edge technologies have their roots: Xerox PARC. It is no surprise that the Xerox Palo Alto Research Center has an

aura of almost Olympian proportions in the microcomputer industry.

The numerous features that originated there are now widely exploited in the marketplace by firms like Apple and Microsoft, where outstanding Xerox alumni migrated as they scattered throughout the industry. Other PARC scientists are making their marks elsewhere as well: Convergent Technologies, 3Com, GRiD and DEC. Even though VisiCalc co-author Dan Bricklin never worked there, he commented that PARC is a national human resource. His statement is often repeated these days, even by Xerox executives who make sure you know they are only joking.

Today, however, Xerox isn't eager to talk about its premiere R&D facility

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whose past is so much more celebrated than its present. Talking about the past isn't popular at any facility in an industry where last year already seems like the Bronze Age.

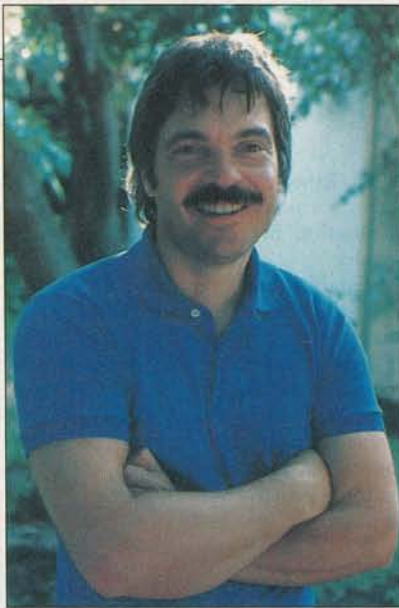
The Golden Age of PARC

The personal computer business of 1984 was very much in gear at PARC ten years ago. The golden age of PARC occurred from 1971 to 1976. Then Xerox, fat from a decade of enormous growth and profits, gave the youngest and most talented computer scientists in the world a blank check and an opportunity to define the paperless office of the future. The Mansfield amendment in 1969 had dried up all nonmilitary Department of Defense money, pinching tight research programs at universities. An independent lab like PARC could only benefit. It became known as the best computer science department in the United States.

Bob Taylor is given credit for assem-

bling the staff at the computer science lab. He had been the administrator of the Pentagon's Advanced Research Projects Agency (ARPA), the U.S. space agency that preceded NASA. He is remembered as the man with the money at ARPA in the 1960s, when some argue the true golden age of computing occurred. At PARC he collected people the way a connoisseur might collect Tiffany glass. While he couldn't print money, he was able to offer creative freedom without pressure: no rush to get a product to market, no need to teach classes of undergraduates, no push to politic for tenure.

Taylor hand-picked the entire team. Smalltalk author Alan Kay recalls that the hiring period for any new employee took days and involved extensive evaluation of what that person could add. "Every new person was a celebration," he remembers. In fact, it was a commonplace in the industry that out of the top 100 PhDs in computer science in the country each year, General Motors got the most, followed by Bell Labs, but Xerox PARC



Alan Kay conceived of Dynabook, the forerunner of Alto.

gramming inspiration in the middle of the night from the video game precursor, Space War. "There was simply nothing we couldn't do," he recalls.

According to Larry Tesler, a PARC alumnus who went to work at Apple in 1980, "The main thing driving PARC was the realization that in 10 or 25 years you would be able to get a lot of power into a low-cost product." Taylor and his staff also realized that personal computing, not time-sharing or data processing, was the wave of the future.

According to Charles Simonyi, now at Microsoft but at PARC the author of the Bravo editor, the dream that was realized at PARC was that humans would be able to communicate with computers through graphics rather than through text, simply by pointing.

Communicating with computers in the most "human" way was what led many of the researchers to consider their Alto stations more as personal secretaries than as personal computers. As an in-joke some signed their memos "B. A. Ear," a name formed from the initials for Bravo and Alto and the code name Ear of the PARC laser printer. In fact, the elusive B.A. Ear has been credited in university dissertations on the work of PARC.

Enter Alto

At a summer ARPA symposium Kay first conceived of Dynabook, the long-term project that bore as a first fruit, Alto. Kay had seen one of the first plasma panels at a lab at the University of Illinois. When he joined PARC that image became a prototype for a lap-size computer, very much like the popular TRS-80 Model 100, but even more like a Convergent Technology Workslate with a bigger screen. The dream machine could go on line, could store several million

characters, and had a touch-sensitive screen. It would come bundled with word processing, Smalltalk and even a video game or two.

Alto appeared then as an interim Dynabook. There had been previous attempts at building personal computers as early as the the 1960s at MIT's Lincoln Labs. What set Alto apart from early attempts was the emphasis its designers put on communication with the silicon beast and on developing its software.

The story of how the Alto was finally put together varies, depending on whom you talk to. The two most common stories, though, incorporate a bit of anti-establishment defiance: Either it was built—in three months in the spring of 1973—to disprove a research manager's statement that it couldn't be done or it was bootlegged against his wishes while he was out of town. Either way, the Alto was never designed as a marketable item, but as a prototype upon which the scientists could test out their software and hardware ideas. Even after several thousand machines were built and installed throughout PARC, at other Xerox facilities, and then in offices of the Federal Government, the machine remained out of production.

The basic system of the original Alto included a video display and a three-button mouse in addition to a standard keyboard and finger keyset, 2.5M byte disk, Ethernet interface, and 64K 16-bit semiconductor memory expandable to 256K. It looked like a sleek and contemporary workstation with a dishwasher-sized CPU built under its counter. It wasn't quite Alan Kay's Dynabook, but it was a start.

The PARC Legacy

For Xerox the most important out-



Larry Tesler left PARC to go to Apple and direct the Lisa Project.



Charles Simonyi wrote the Bravo editor while at PARC.

got the 10 best.

PARC was guided by Taylor's idea that a think tank needed to be more a fertile medium and less an institution. It was mainly a matter of getting good people in and leaving them alone, according to PARC alumnus Alan Kay. "You just had to mix together the right combination of minds, and the result would be scientific dynamite."

Kay remembers Xerox PARC in the early 1970s as a place populated by wild-eyed scientists in their twenties. They were left to "follow their noses" without a marketing executive looking over their shoulders. They spent hours ruminating about the future in a lounge scattered with bean bag chairs and sought pro-

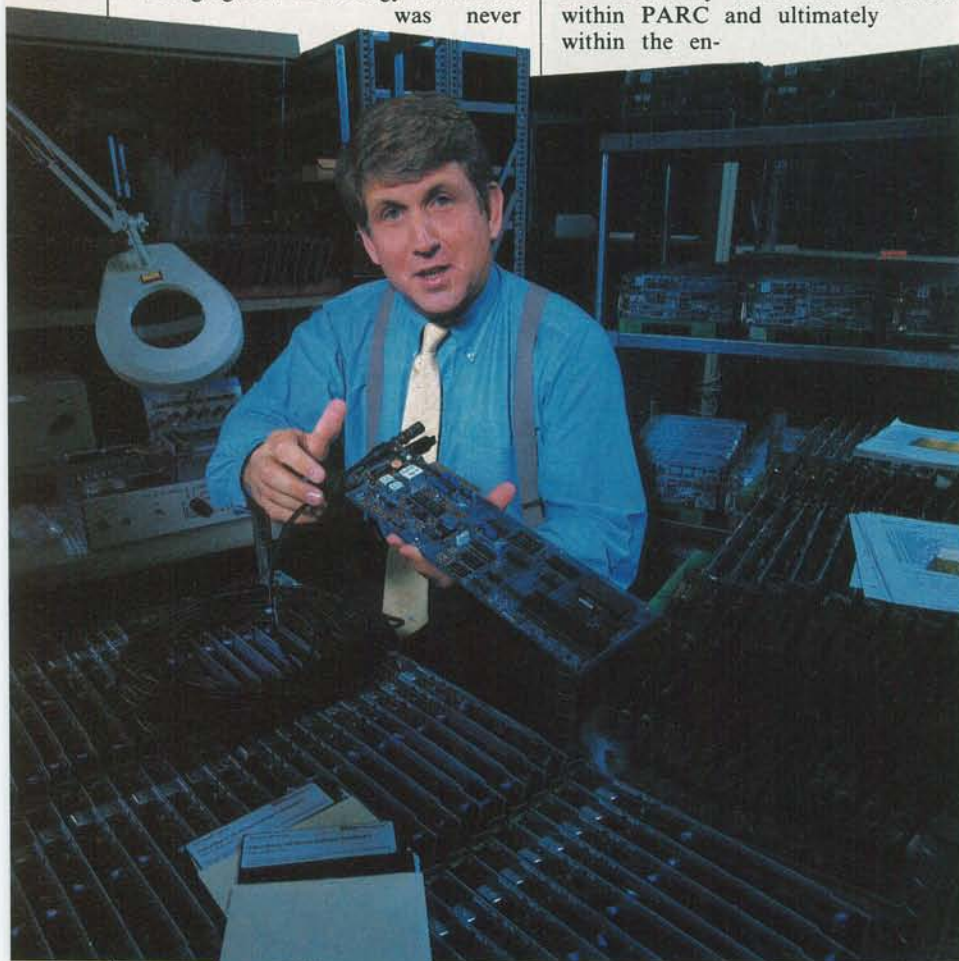
Xerox PARC

come of PARC was laser printing: It has already become a business bringing in \$250 million a year for the company. It is expected to grow further with a new generation of low-cost laser printers next year. For the computer industry, however, PARC was a source of new products, ideas and inspiration. Dan Bricklin recalls, "a lot of people were turned on by that place even if they never worked there."

Bringing new technology to real life
was never

1980. Ethernet, which is one of 250 systems licensed from Xerox, transports information in "packets" along coaxial cable.

Establishing some sort of network with the Alto had been one of the earliest design aims of the PARC research team. Communication among computers for resource sharing was advanced by ARPA, in fact. The Ethernet was designed in consort with the Alto in 1973 and eventually interlinked the Altos within PARC and ultimately within the en-



Bob Metcalfe invented Ethernet and founded 3Com Corp.

the aim of the researchers at PARC. In fact, in the pursuit of marketplace realities several of the more prominent PARC alumni left to start businesses of their own or join more product-oriented companies. In their new settings they realized, in products and markets, potentials of ideas that had germinated at PARC.

Bob Metcalfe, the inventor of Ethernet, for instance, founded 3Com Corporation, which supplies Ethernet local area networks for IBM PCs and compatible computers, after he left PARC in

tire Xerox Corporation.

Today Ethernet is generally agreed to be the industry standard for local area networks. The use of LAN is becoming an established business strategy, with companies as diverse as DEC and Apple using the Ethernet standard. Ethernet has brought modest revenues to Xerox and serves as the basis of the company's newest Xerox team office systems approach.

Metcalfe's company, 3Com, though, is catching more fish in its Ethernet. 3Com went public in early April with an

issue of over 2 million shares of stock. It is now shipping about 400 new Ethernets per month. In all it has shipped 15,000 of the connections since it began manufacturing them in March 1981. Most recently 3Com announced it will be the supplier of hardware to go into a Xerox Ethernet for the IBM PC and its compatibles.

One of Metcalfe's classmates, John Ellenby, also went from PARC to a more commercially oriented company. Now he is in charge of GRiD's Compass, an \$8000 high performance lap computer; at PARC he had been in charge of taking Alto II to the buyer. A test market of the plan was nixed by Xerox corporate in favor of the Xerox Star in 1980. The Star utilized Alto ideas, particularly icons, but has so far been a marketplace dud. Although Ellenby, like many, maintains that Xerox probably missed the boat in several product areas, he feels that the public underestimates the contribution that laser printing has had on the company. "Xerox was pioneering a whole new business. The fact that they didn't know it themselves is rather sad."

Larry Tesler left PARC to work for Apple in 1980. There he directed the Lisa project, which brought to fruition much of his work at PARC. At PARC he had devoted his main efforts to making Smalltalk a productive programming environment, as well as to improving such user interfaces as the mouse (which was not developed at PARC but by Doug Engelbart at Stanford Research Institute), and to making the use of graphics, icons and menus more convenient. The bitmap display, which Tesler has developed at Apple, coordinates every screen dot from a single chip and offers increased control and definitions. "It was something whose value Xerox PARC demonstrated on a relatively inexpensive computer (Alto costs about \$20,000) and Apple just bought it to a much lower-priced computer (Macintosh costs about \$2500). The style of user interface that was developed first as Smalltalk, we imitated. That includes using a mouse, overlapping windows and a command language relatively free of modes. Later the Star systems came out and we borrowed the use of icons... However, a

PHOTO OF CHARLES SIMONYI
BY CLYDE KELLER
PHOTO OF ALAN KAY BY
NEIL REICHLINE
PHOTOS OF LARRY TESLER
AND BOB METCALFE
BY MIKE CARR

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lot of people adopted ideas from PARC. Apple just put enough money behind it and invested in driving its cost down to something everybody could afford."

Charles Simonyi also admits that companies like Microsoft, where he works, and even the entire industry owes a lot to PARC. He credits PARC's contribution not to how unique the scientists were but to the special circumstances they were given. "Other people have held the same dream but didn't have the freedom to develop it in a laboratory." Now he prefers to speak about the present: "What's going on now is a lot more exciting. The innovations that were once introduced by academics and at facilities like PARC now come from the industry."

New PARCs

PARC not only inspired new products and new ideas; it also has spawned similar environments at other companies. Steve Jobs, Apple chairman and cofounder, visited PARC in 1979 and was inspired enough to invest in the Lisa and Mac technology. In the publicity that accompanied the debuts of these

products, he acknowledged his debt to PARC and its impact on Apple products. He has also collected former PARC employees, including Larry Tesler, who went to work at Apple in 1980 and Alan Kay, who arrived by an indirect route. After his years at PARC, Kay went first to Atari, where his job meant "politicking, keeping my finger in the dike and following my nose." Even as a chief scientist at Atari, Kay had a hard time trying to rationalize the need for basic computer research. The "bean counters," as he likes to call accountants, had the final word. At Apple he can expect a difference, especially because Jobs seems eager to resurrect the magic of Xerox PARC in developing its newest line of 32-bit machines.

New Gardeners at PARC

The golden age at PARC officially ended when a new research management entered and Bob Taylor left last. Others had taken their leaves in the late 1970s when corporate headquarters in Stamford, Connecticut, took a more active interest in PARC operations. Scientists at PARC started to feel pressed to make

their work more relevant to the Xerox bottom line. In the spring of 1983 Xerox appointed a new PARC director, William Spencer, a Bell Labs veteran who is particularly oriented in turning the lab toward the marketplace.

Taylor hasn't retired. He, with members of the original PARC team, is in the process of establishing a new computer research facility in Palo Alto, with another corporate parent, DEC (Digital Equipment Corporation).

Though details are few, it appears that DEC, a company that has a solid standing in personal computers and is well-trenched as the minicomputer leader, needs the ideas that only a think tank expert and talent collector like Taylor can offer.

While Taylor is reluctant to talk about a center that isn't even completely built, he did put the new DEC center and PARC in a long perspective: "If you're going to try and connect the present with the past, I would suggest going back to the ARPA days. The whole thing has been a continuum. PARC is not anything special in that continuum. It was just a midway point." ◇