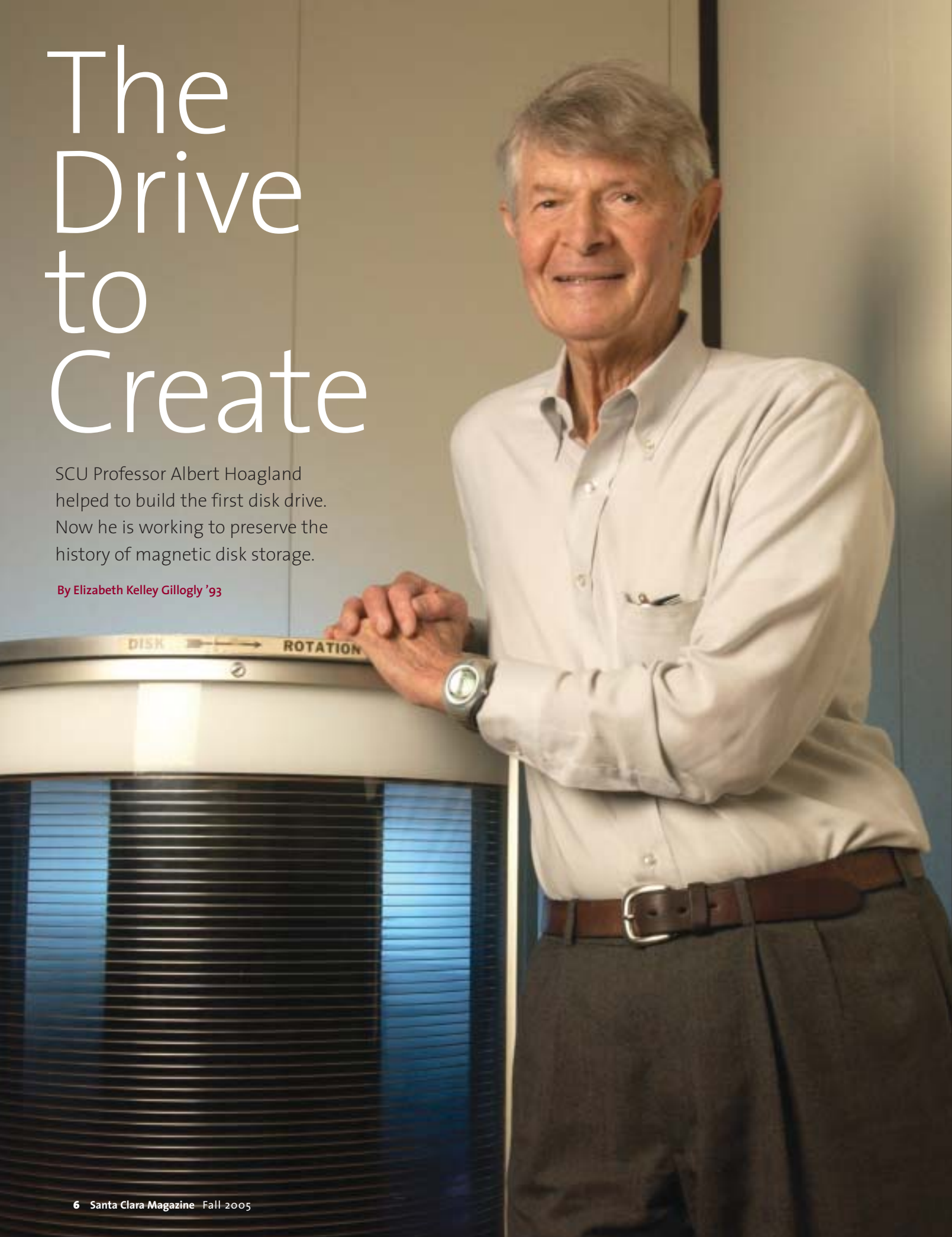
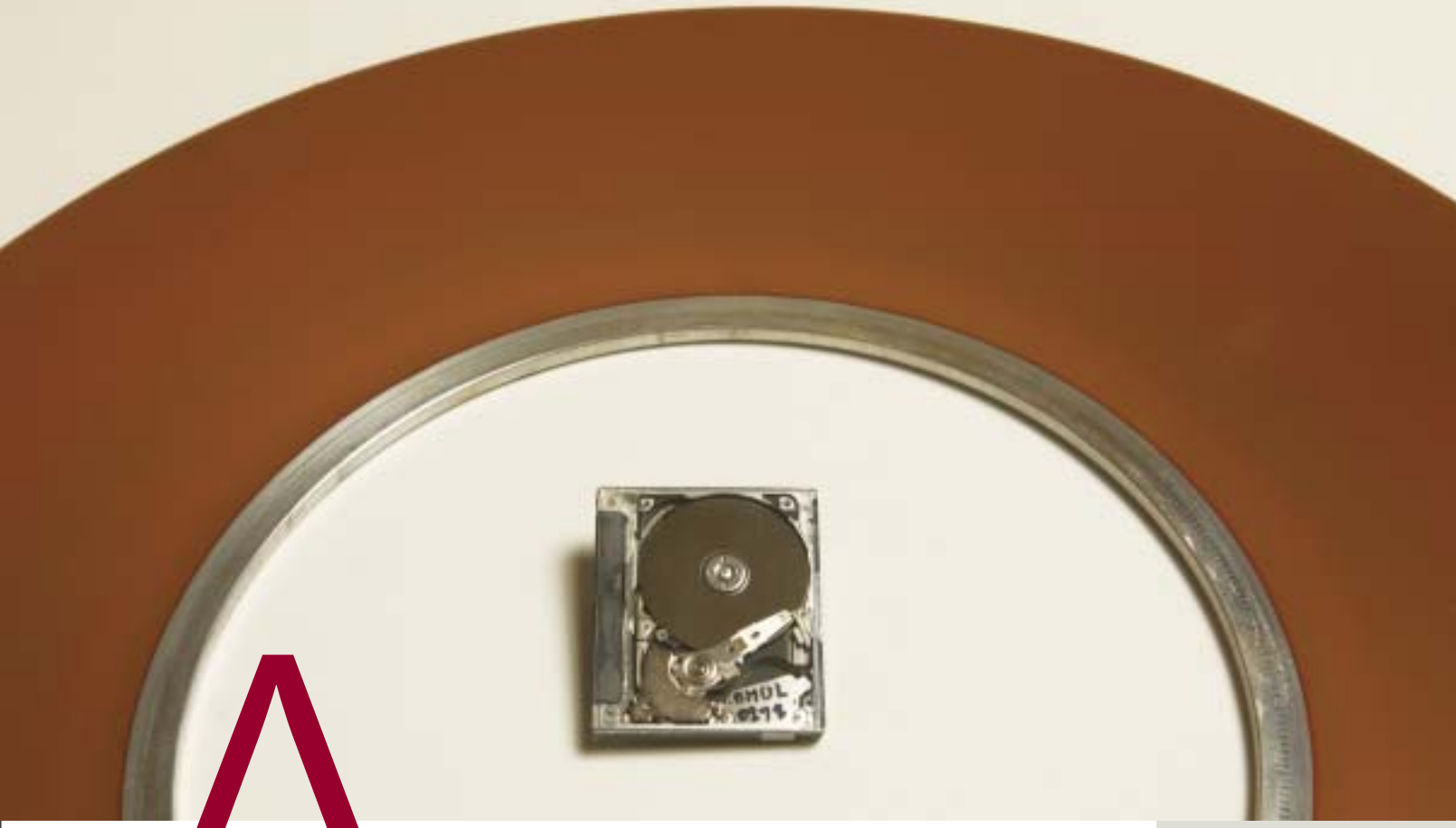
The Drive to Create

SCU Professor Albert Hoagland helped to build the first disk drive. Now he is working to preserve the history of magnetic disk storage.

By Elizabeth Kelley Gillogly '93





Albert S. Hoagland, an adjunct professor at SCU since 1984, has witnessed first-hand the incredible shrinking disk drive.

Back in the 1950s, Hoagland was one of a small group of IBM engineers who developed the first magnetic disk drive for data storage. Larger than a refrigerator, it held a mere 5 megabytes (an amount that would be used up by three or four typical-sized digital pictures these days). Today, domino-sized drives can hold 10 gigabytes (or 10,000 megabytes). "Storage density has increased by a factor of 50 million in 50 years," explains Hoagland. The field has changed at a breathtaking pace, and Hoagland wants to ensure that history is not lost in the process.

"People take magnetic disk storage for granted," says Hoagland, who will retire from SCU this year. "But if you look at technological history, you may not find anything more important." With older methods of storage, including magnetic tape or punched cards, direct access to a record was not possible and it could take hours or days to retrieve data. With the invention of magnetic disk storage with random access, this data retrieval took less than a second. (Remember how long it took to find your favorite song on a cassette, and how quickly you can do it now on an iPod?)

This capability is essential to so much in our lives today, including desktop computers, the World Wide Web, TiVo, ATM's, and soon PDA's and cell phones.

"A historic change in the storage and retrieval of information is rapidly occurring with magnetic data storage taking over," Hoagland says. "Punched cards were first obsoleted; photographic film is now suffering the same fate; music, movies, and images are moving to disk. The Internet would not be possible without magnetic disk storage and it has become the way information is now stored and shared worldwide."

Hoagland earned his bachelor of science, master of science, and doctorate degrees—all in electrical engineering—from the University of California at Berkeley. He is the author of *Digital Magnetic Recording*, considered by many to be the most important book on the topic, as well as numerous publications in the fields of magnetic recording and data storage, and he has received multiple awards and wide recognition for his work in the field.

On Facing Page: Al Hoagland stands with the RAMAC he helped create five decades ago. This page: A 2.5-inch laptop drive with the cover removed, a standard size in most laptops today, shown in the center of a 14-inch magnetic oxide coated disk, which was the standard size in the 1960's and 1970's.

Above: The original RAMAC leadership team photographed at 99 Notre Dame in 1952. Left to right: R. Manning Hermes, William A. Goddard, lab manager Reynold B. Johnson, Louis D. Stevens, Arthur J. Critchlow, and John W. Haanstra. Below: A standard desktop 3.5-inch computer disk drive with cover removed.

Over the course of his more than two decades at SCU, he has also inspired numerous students, says Daniel Pitt, dean of the SCU School of Engineering. "Al Hoagland's pioneering work in computer storage, so crucial to the widespread utility of computing in the final four decades of the 20th century, inspired countless hundreds if not thousands of our students," explains Pitt. "Al understands the science, the technology, and the constraints of commercial viability that define the engineering profession, and he can personalize it with stories of real people who faced and overcame the many obstacles to bringing mass storage to the masses. After all, he was there as it happened. We will all miss his daily inspiration and sage advice."

Making History

While a graduate student at Berkeley, Hoagland worked as a consultant to IBM and he was responsible for key magnetic head design and recording for the Random Access Method of Accounting and Control (RAMAC) disk drive. He later joined IBM, first working under Rey Johnson, the creator and leader of the RAMAC effort. "This period was characterized by the pursuit of all sorts of novel ideas since disk storage was then virgin territory and for a long time IBM San Jose had no competition," says Hoagland. He went on to make major contributions to magnetic disk storage technology and the design of magnetic disk drives, and he served in many leadership roles, including director for technical planning for the research division.

In 1982, IBM asked Hoagland to establish data storage centers in academia, and he helped create one at U.C. San Diego and one at Carnegie Mellon University. However, explains Hoagland, people in the industry were disappointed that there was no "center" in the Santa Clara Valley, where most of the disk drive technical professionals were located.

Since IBM, the largest disk drive company, was in south San Jose, Hoagland decided that SCU would be the ideal location, and he came up with a proposal. In 1984, Hoagland left IBM to found the Institute for Information Storage Technology (IIST) at SCU. "The IIST mission was essentially to provide the professionals in the field a set of graduate courses, short courses, symposia, workshops, et cetera, so they could keep abreast of the leading-edge technical advances as well as educate new graduates for positions in this field," explains Hoagland, who has served as its director since the founding.

Andy Hospodor Ph.D. '94, M.S. '86, met Hoagland in 1986 and worked for the Institute. "I really respect Al's ability to not only listen, but really hear people, even if he disagrees with them," explains Hospodor, a storage industry veteran who most recently founded Corosoft, a provider of data center automation software. "Everyone in the industry recognizes him as a kingpin—the designer of the first magnetic recording head for disks, who then wrote the seminal book on magnetic recording. But Al sees himself as a regular guy, and this allows him to relate to practically anyone."

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In 1984, Art Geffon was vice president of engineering at Quantum, an $800 million per year data storage company, which was an early sponsor of the Institute. "Al has made, and continues to make, a significant contribution to our industry," says Geffon, a longtime engineering executive. "Beyond his many technical contributions…is Al's contribution to the education of the practitioners in our field as well as the education of a new generation of practitioners," explains Geffon.

Restoring History

At Santa Clara University, Hoagland obtained an original RAMAC disk drive to try to restore it to an operational status. "This effort, if successful, I perceive as a great means to make a much broader number of people aware of magnetic disk storage and the importance of preserving its story and

historical legacy," says Hoagland. "The plan was to proceed using two successive senior design projects to attempt to demonstrate the feasibility of the project. Last year we were able to successfully demonstrate the ability to access any disk, track and record—or sector—on the disk stack. This year, we succeeded in demonstrating we could read and write recorded magnetic patters on the disks," he explains.

Hoagland says Santa Clara students have been central to the project. "I believe using students has proven itself a fortunate choice. Volunteer pioneers tend to have their minds filled with all the problems and challenges seen in the development and use of the RAMAC, and are skeptical and hesitant to proceed. Students—who are unencumbered this way—have no reason to believe the challenges cannot be overcome," he says.

"The final phase will draw on experienced engineers to repackage and refine the work done here to meet the requirements of public display," adds Hoagland.

David Nguyen '05, who was part of a student group that worked with Hoagland on the restoration project, says he respects Hoagland for his knowledge, sense of humor, and his leadership. "He has a great talent with communicating with any person he meets," says Nguyen. "His extensive knowledge and his connections with industry engineers helped me to see the importance of networking and keeping connections with fellow engineers," he adds. "It also helped me to decide to go back to graduate school this coming fall."

Patrick Connolly, a teaching assistant and master's candidate at SCU, has also been working with Hoagland on the project. "Al taught me how to work independently," Connolly says. "This project was very open-ended, and as a result he gave me free reign to accomplish the required goals in any way I wished. This refined my independent thinking skills, and forced me to evaluate different courses of action and choose the best one," he explains.

Connolly also says he admires Hoagland's dedication. "Once he sets a goal for himself, there is no stopping him," he says.

Preserving History

Hoagland's early work in this field revolutionized how the world preserves data. Now he is working to preserve history. In 2001, he established the Magnetic Disk Heritage Center (MDHC) whose mission is "to preserve the story and historical legacy of magnetic disk storage at 99 Notre Dame, San Jose, California, where it all began."

"Magnetic disk storage is the most important technical achievement ever in San Jose," Hoagland says. "What specifically triggered me…was my visit to the building where it all started, at 99 Notre Dame Avenue in San Jose, to see how things looked, having been told a new garage was to be built on that city block. I discovered the original building still there, and suddenly I saw that an incredible opportunity existed for the City of San Jose: to establish a technical museum featuring magnetic disk storage in the original building where the RAMAC was created," he explains, adding that the downtown location would make such a museum very accessible to the public.

Hoagland has succeeded in getting the site designated as a city landmark, and achieved an agreement by the city to preserve the original building. In May, the San Jose City Council passed a resolution that commits the City of San Jose to enter into discussions with the MDHC and pursue setting up a magnetic disk storage museum at the site. "This is a major step forward," says Hoagland, "but in the political world you can take nothing for granted."

The Progress to Come

"I have a great belief and dedication to this method of data storage," says Hoagland, whose entire career has been in the field of digital magnetic recording data storage. "The advances since the 1950s have continued and are expected to do so for many more years to come."

After his retirement from Santa Clara, Hoagland says he will continue the RAMAC restoration project (he hopes that it will be on exhibit in late 2006), and his work on establishing a technical museum in San Jose. Hoagland also plans to write some of the history himself in the form of a book covering the story of the first 50 years of magnetic disk storage.

As he reflects on his career, Hoagland realizes he has come full circle: "I started my industrial career on the RAMAC, and 50 years later I am back where I started." SCU

Elizabeth Kelley Gillogly '93 is the associate editor of *Santa Clara Magazine*.

Above: The RAMAC 305A System at the SCU Electrical Engineering Department circa 1962-1963. Below: An original IBM one-inch microdrive, which debuted in 1999 with a capacity of 340 megabytes (MB). Today this same drive is available in capacities up to 6 Gigabyte (GB). The microdrive made the 4 GB iPod possible.