

# Automated Storage and Retrieval —The Next Generation: How Northridge’s Success is Spurring a Revolution in Library Storage and Circulation

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## *Abstract*

The first automated storage and retrieval system combined with an online catalog was heralded as a “pilot project” when it was introduced in 1990 at California State University at Northridge (CSUN). Librarians across the country were watching to see whether the system would succeed or fail. The automated storage and retrieval system’s integration of industrial technology and an online catalog appeared to be an excellent solution to many libraries’ storage problems. Since the CSUN installation, there has been little discussion in the library literature either about the exciting possibilities of automated storage and retrieval systems or the possible drawbacks of such systems. Despite the possible drawbacks, many libraries are installing automated storage and retrieval systems to meet their storage needs.

The presentation of this paper will begin with a short survey to demonstrate the audience’s knowledge of automated storage and retrieval. The discussion of the audience’s answers will lead into the beginning of the paper.

The paper will examine the current state of automated storage and retrieval. Beginning with the promising system installation at California State University at Northridge, the paper will consider both the expected advantages and actual advantages of the CSUN system.

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(One unexpected advantage is the system's resistance to earthquakes).

The paper will also discuss the forthcoming system installations at Simon Fraser University, Eastern Michigan University, and University of Nevada, Las Vegas. This discussion will explore the effect the CSUN system has had upon automated storage and retrieval systems' popularity. The paper will conclude by anticipating the future of automated storage and retrieval systems in academic libraries.

The lack of library space at California State University at Northridge (CSUN) could no longer be ignored. By 1990 the University's Oviatt Library would have a space deficit of 72,985 square feet. It is a well-known fact that "Large research libraries do not, by and large, ever dispose of any of their materials and the result is that their collections increase each year." The library administration knew they had to expand the library, but communication with the university chancellor's office led them to expect that there would not be money to provide for a facility to house the library's growing collection in open stack shelving.

They had a limited number of options remaining. Because the need for space was immediate, digitizing their collection was not an option. Compact shelving, remote storage, and regional depositories were all carefully considered, but the most attractive option they discussed was installing an automated storage and retrieval system in the proposed addition to the library.

Automated storage and retrieval technology had been used in the industrial world since the 1950s. The technology's original function was to do away with "the walking that accounted for 70% of manual retrieval time." An automated storage and retrieval system consists of aisles between rows of frames containing bins or pallets. Up and down the aisles, between the rows of frames, the robotic crane mechanism journeys at the whim of its operator. In accordance with its operator's instructions, the robot selects a bin or pallet and transports it to the appropriate station. When the bin or pallet is no longer needed, it is returned to storage by the robot. Automated storage and retrieval technology may be adapted for library use by bar-coding each book and bin. The computer links each book to a bin. When a book leaves the system, the link is deleted. Upon the book's return to the system, the linking process is repeated. The edge of a book may be coded with a part of the id number so that the staff member who receives

the bin will have an easier job of finding one book among the hundred in the bin.

CSUN's library administrators were not the first to consider the possibilities of such a system for use in a library. Four automated storage and retrieval systems had been installed in American libraries in the 1970s. This first generation of library installations had met with disaster. Problems with suppliers, unanticipated maintenance costs, crude equipment, primitive computer control, and ignorance of user requirements had the combined effect of making these library installations a nightmare to the staff and a laughing stock to American libraries.

In contrast to the failure in America, the contemporaneous installation at Erasmus University, Rotterdam, the Netherlands survived. Their initial system installation did not work properly either. Much money and time was invested to make the Erasmus installation work. The changes made over the years included adding microprocessor computer controls, adding an error detection system and funding periodic maintenance, as well as developing an interface between the automated storage and retrieval system and their public catalog.

The Erasmus success story left little doubt that an automated storage and retrieval system could be operated effectively in a library. The question was whether improvements in technology since the late 1960s and lessons learned from both the success and failure of automated storage and retrieval systems in libraries made it desirable to try another American installation in the 1990s. CSUN thought that the experiment was worth trying. According to their research, an automated storage and retrieval system was the most economical choice available to them. They could store books in 1/12 of the space of open stack shelving at 1/4 of the cost.

Not only would such a facility be less expensive, but also the environment could be regulated for the comfort of books rather than humans. Usually the darkness, humidity settings, and temperatures ideal for book preservation must be adjusted in a library for the comfort of its users. Because the library users and staff would not be inside the enclosed automated storage and retrieval system, the atmosphere could be set and maintained at ideal preservation levels. Books printed on acid paper that are stored in an automated storage and retrieval system will last 40 years longer than if they were on open shelves. Not having to install lighting, wall coverings, floor coverings, and false ceilings in the storage area also saves on expense.

Another benefit of such a system is that tracking the actual location of an item would be much simpler. Far fewer would be the moments of frustration for both library users and library staff as the staff attempt to explain to the users that a book may not be “available” even though it is listed as such on the computerized online catalog.

Perhaps an advantage more apparent to the user would be the shortness of retrieval time, which was estimated to be around 5 minutes. The ability to request items electronically and pick them up within minutes eliminates the user’s frustration at searching the aisles and floors of an unfamiliar library.

The real usage of an item could be more accurately estimated, because the items checked out of the automated storage facility would be checked out twice, once for use in the building and again if the user desired to take them out of the library. Over time, this would enable the staff to adjust what was stored in the facility to conform to real usage. Any items in storage receiving a lot of use could be relocated to the open shelves. An added bonus of this record keeping would be greater security. There would be far fewer instances of mutilation and fewer missing items.

If CSUN’s experiment worked, libraries would no longer have to store their rarely used items in buildings on the remote edges of campuses. Library users would no longer have to wait hours or days to receive items from storage. Therefore not only the CSUN community was intrigued by the idea of this experiment, but the entire academic library community.

The disadvantages of such a system were also considered. One obvious disadvantage of an automated storage and retrieval system is that it is enclosed. The library user may only stand outside and watch through windows as the robotic mechanism follows its instructions. Here there is no serendipitous browsing of shelves. The books are in bins, and may be stored randomly. For materials in the storage facility, the users have to rely on the computerized online catalog. Another disadvantage is the possibility of equipment failure. Such failure would effectively cut the size of the library’s collection in half, causing distress to its users.

CSUN did not ignore these potential problem areas. They hired a full-time technician for the system to minimize mechanical problems. Because of the lack of browsing, they took great care in selecting items for storage. CSUN decided to store periodicals published be-

fore 1990 and books that were not used very often. It has turned out that of the library’s annual book loans, only 15% are books in the automated storage and retrieval system.

CSUN has been delighted with the success of their automated storage and retrieval system, which began operating in June of 1991. In a 1994 earthquake no books in the storage facility were damaged, although nearly all of the books on the open shelves ended up on the floor. They had a few software problems in the beginning, which have since been solved. Overall, they report “very little downtime and no long-term maintenance headaches.”

Now, fifteen years after CSUN’s facility was first conceived, other libraries are installing automated storage and retrieval facilities. Eastern Michigan University has installed such a system in its new Bruce T. Halle Library. The Dean of Learning Resources and Technologies wanted the expensive floor space to be used for people rather than books. Having an automated storage and retrieval system allows for more study spaces and computer workstations. The 30-foot high system is in a vault which houses 6500 storage bins each capable of holding 100 to 140 books. At full capacity it will hold 800,000 books, though it is less than half full now. The automated storage and retrieval system cost \$1.6 million and an additional \$100,000 for software totaling \$1.7 million. It has saved 50,000 square feet of floor space.

Although the Dean is proud and excited about this technology, he acknowledges that “just like any computerized technology, when its down, it’s down.” To avoid system problems, EMU bought a 20-year supply of major spare parts and employs the equivalent of 1 1/2 full-time workers to care for its automated storage and retrieval system.

An upcoming installation will begin operation with the January 2000 opening of the new Lied Library at the University of Nevada-Las Vegas. Inspired by the success at Northridge, the Dean of the Library sold the idea to the legislators. They chose to economize by building a 300,000 square foot library with a \$2.2 million automated storage and retrieval system instead of constructing a 425,00 square foot library.

This system’s specifications indicate that it will closely resemble CSUN’s system. To begin with, the 40-foot high system will have three aisles, with three additional aisles to be added at a later date. Its height will measure three stories and it will take up about 1,300 square feet of floor

space This application differs from CSUN's in that a sizable portion of UNLV's collection designated for storage are depository government documents.

Yet another library poised to follow CSUN's example is Canada's Simon Fraser University (SFU). SFU's library administration chose automated storage and retrieval only after careful consideration of all of their storage options and consultation with many university committees. The proposed robotic storage system had duly been added to the university's capital plan. A report of the Library External Review Committee in May of 1998 indicated that the university community was not convinced of the value of such a system. They opposed their loss of access and ability to browse. They suggested that SFU may be guilty of trendiness. The Library External Review Committee proposed further studies and reports. It is to be hoped that as more automated storage and retrieval system installations are successful, the need for this kind of justification will diminish.

Users are concerned that they will lose the open stacks that have been around since the 1940s, which were revolutionary for their day. They see in the enclosed nature of an automated storage and retrieval system the steel prisons of multitier structural stack shelving (closed stacks) that were used in the hundred years before their beloved open stacks gave users the freedom to browse.

Therefore, users must be convinced that the choice is not between an automated storage and retrieval system or open shelves, but rather between an automated storage and retrieval system or remote storage, an automated storage and retrieval system or boxes of books stacked up to the ceiling with nowhere to put them.

Having found neither closed stack shelving nor open stack shelving to be entirely satisfactory, CSUN and its followers have found that by using automated storage and retrieval technology they can economically combine the two shelving models to their best advantage. CSUN has developed a new paradigm for the academic research library.