Designing an academic library as a place and a space: How a robotic storage system will create a twenty-first century library design

Sharon L. Bostick, Ph.D., Dean of Libraries
University of Missouri Kansas City

Bryan Irwin, AIA, Principal
Sasaki Associates

Renovating, expanding or building new libraries today is a challenge on several levels. Libraries in general are faced with image issues, such as the assumption that a library building exists only to house print material followed by the equally erroneous assumption that everything is now available online, thus rendering a physical building obsolete. Libraries are also faced with serious funding issues, and with the basic reality that space is at a premium. In academic libraries, the way students use libraries is changing as are their expectations of a library. University faculty also have different expectations for using libraries, both for themselves and their students. The nature of learning is changing, becoming more collaborative and less structured in many situations. Finally– and omnipresent throughout– is the increasing awareness of the need for fiscal restraint. In the United States, costs for a university education are soaring, far outpacing the consumer price index, placing higher education beyond the reach of a larger and larger sector of society. All these factors have serious implications for university libraries.

Many academic library buildings are older and were designed to protect printed material and other physical items, such as artifacts or recordings. Spaces for people, while important, were by necessity secondary to this protection. This has led to many buildings functioning as more of a warehouse than a center for scholarly and academic activity. Services, reader spaces, and classrooms tended to be secondary and available only as stack space allowed. The consistent incorporation of new technologies is drastically altering this environment. Among these new technologies are of course the many library resources that are now available electronically. The need for growth space for printed books and journals is reduced, although not eliminated completely. At the same time the need for a variety of different library and learning spaces has increased.

New technologies also include advances in building materials and design options that allow light to become a major feature in library design, creating a bright, open, welcoming space. This creates opportunities to develop flexible, innovative learning spaces. And new storage technologies are being used to create and expand vital learning spaces while keeping valuable texts and other items close by and easily retrievable.

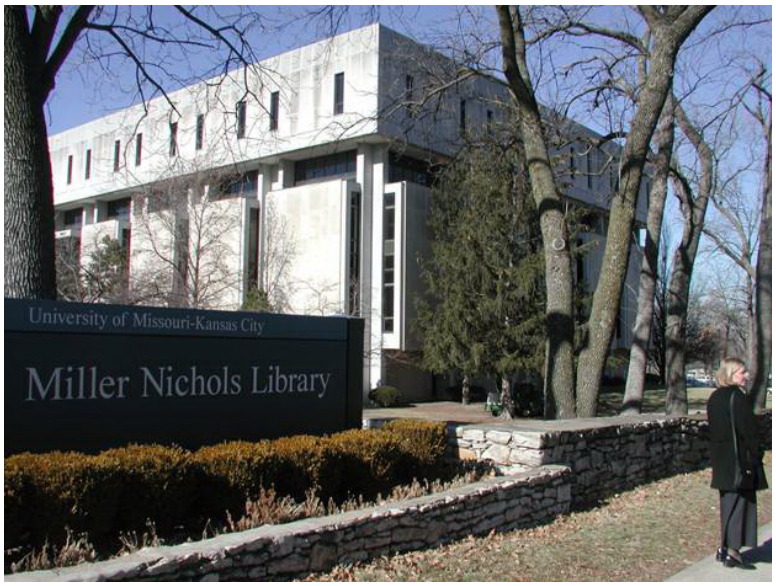
While new space opportunities are both required and desired, the need to support the print collection remains, and space is often limited. A common solution is to move less used items to an offsite storage facility. In general, these facilities are not close to the library, or even the campus. Many are at a considerable distance. Remote storage facilities are varied in size, scope and type. Many are shared by a number of similar institutions,

with shared management and costs. While this is a secure, often cost effective way to store parts of the collection, it also requires that the user wait, often several days, for the needed item. Also, retrieving the book involves a delivery system, which can be expensive, labor intensive, and energy consuming. This discourages libraries from putting all but their least used items in a remote storage facility. The more popular items remain on the shelves in the library building. An offsite storage option is often considered not because it is what the librarians and customers want, but because it can be a financially responsible alternative to building a larger library with traditional stacks. It is considered an acceptable compromise. Lizanne Payne gives an excellent overview of this type of storage in her report: "Library Storage Facilities and the Future of Print Collections in North America". (Payne, Lizanne. 2007. Library Storage Facilities and the Future of Print Collections in North America. Report commissioned by OCLC Programs and Research. Published online at: www.oclc.org/programs/publications/reports/2007-01.pdf).

The University of Missouri-Kansas City project

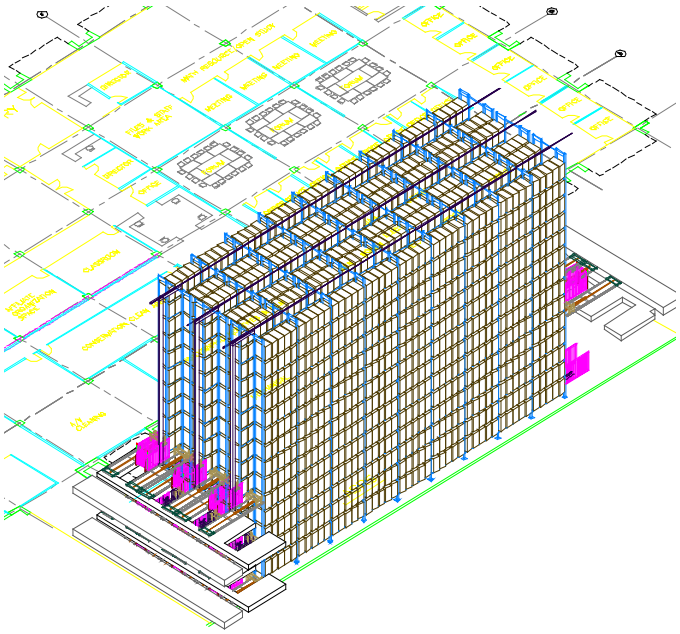
Because remote storage options tend to be a compromise, librarians tend to hope that library buildings can be expanded to house the growing print collections. This was the thinking at the University of Missouri-Kansas City (UMKC) when planning began for the expansion and renovation of its largest facility, the Miller Nichols Library.

UMKC is part of the University of Missouri system. It is an urban institution with an enrollment of about 14,000. It consists of twelve schools on two campuses, the Volker campus and the Hospital Hill campus, where the health sciences schools are located. The University Libraries consists of three separate buildings: the Health Sciences Library, on Hospital Hill, which serves the schools of Medicine, Nursing and Pharmacy, the Dental Library, also on Hospital Hill, and the largest, the Miller Nichols Library, which is located on the Volker campus. The Miller Nichols Library serves the College of Arts and Sciences, Business and Public Administration, Biological Sciences, Computing and Engineering, Education, Graduate Studies and the Conservatory of Music. There is also a School of Law, which houses its own library. All libraries on the two campuses are available for onsite use by the Kansas City community.



The Miller Nichols Library was built in 1969. It was the first purpose-built library at UMKC. It fill up rapidly and an additional floor was added in 1990, but the building was full by 1999 and had very little space for services. An information commons was created in 2000 thanks to a gift from the Miller Nichols family. This was very innovative for its time and set the tone for the type of library public spaces needed for the future. However, the space issues remained and were getting worse. Cost of maintenance and expansion of the collec-

tions were continuing to rise dramatically. At the same time, funding bodies were reluctant to support expansion of library buildings. Nevertheless, planning began for an expansion and renovation, involving the entire university community. A design architect was selected, Sasaki and Associates, and PGAV in Kansas City was selected as the managing architects. A design was developed, emphasizing innovation and collaboration, and including traditional stack space. Given funding realities and campus priorities, the growth potential for even the new stack space was approximately five years. Shortly after this design, funding was reduced, creating a smaller building plan. At that time the new Dean of Libraries began to work with the library staff to seek alternative solutions to storing library materials. They became intrigued by the possibilities of a newer type of alternative storage, a robotic automated, high density storage and retrieval system (ASRS). These systems were very common in the manufacturing sector, but relatively rare in a library setting. When funding for the expansion and renovation project was reduced, the revised design could not accommodate all of the existing collection, and certainly did not have room for collection growth. A remote storage option was possible, joining in with the other libraries in the University of Missouri System. However, this option utilized facilities two hours from the UMKC campus and, via a delivery van, would take one to two days to arrive at the library.



A key component of the new library was the creation of an interactive learning center, with a variety of learning spaces and many new services and collaborative learning opportunities. The goal was to discover new ways to attract students, faculty and the community to the library building, and to become more relevant to the university's academic mission. A serious investigation was launched, including librarians, campus facilities and the architects, into an automated storage and retrieval system. The group made extensive site visits to libraries already using this technology, and consulted with vendors of these systems. It was determined that the Automated Storage and Retrieval System to be not only a cost effective solution to our collection space concerns, but most importantly it became a catalyst for the evolution of our philosophy of library services and access.

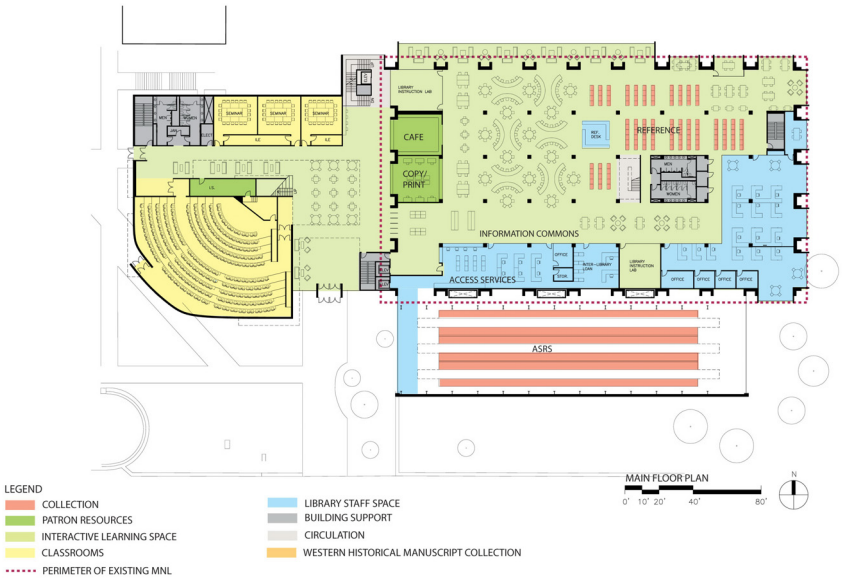
When looking at the details of designing a library with high density storage right on site, it became apparent that there were many opportunities for having very flexible space for emerging library needs, both current and those yet to come. Instead of thinking that a bigger library was needed to hold the books the team became excited about the idea that a large part of the collection, but not all, would be in the Automated Storage and Retrieval System, which was called robot by the library staff. The robot became a dynamic design and service feature of the re-imagined facility. Not only would the valuable collections be environmentally secure and protected from theft and damage, it would also align the library for the future and the innovative growth of the university.

The building project had a campus-wide advisory committee established by the Provost, and they became a valuable voice in the planning. The robot was also incorporated into the project's fundraising materials. The donors are very excited about it, and very pleased that the books will be staying on site. The excitement level throughout the campus and community is very high.

The selection of the ASRS vendor was dependant on a number of factors based on the library's unique needs. It was determined that the majority of the collections will be in the robot, including some from the Health Sciences and Dental Libraries. Approximately 200,000 of the most current or heavily used titles will be on traditional open shelves. The Building Planning Committee decided that most of the libraries' special collections would also be in the robot, including rare recordings from the sound archives. Further investigations revealed that there were two basic types of storage devices: bins and shelves, and a combination of the two. It was determined that bins were the most efficient for books in the general collection, but a shelving solution was best for the sound recordings and some special collections. Other considerations included cost, service and maintenance, and the reputation of the vendor. A Request for Proposal (RFP) was issued and a competitive bid process was utilized. HK Systems, who have worked with other academic libraries, was the selected vendor. The library staff began the planning stages with them to finalize the requirements, and the architects began working with them to design the structure to house it.

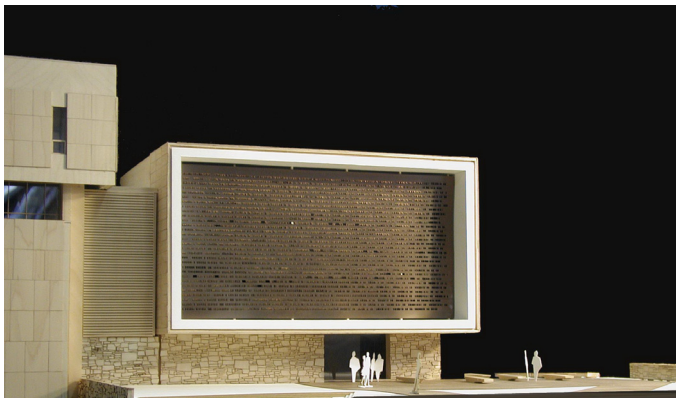
The Head of Collections and the individual selectors are working with faculty and other library staff to determine which items will remain on the open shelves, and a system will be developed to monitor it and integrate new purchases. Once it is established it will be easy to move items in and out of the robot as need dictate.

The robot will be available to users from computers in the University Libraries, elsewhere on campus, or from the user's home or any remote site. This will be accomplished via the ILS, which in this case is the MERLIN catalog from Innovative Interfaces, Inc. Once a request is made, an automatic crane—a robot—will retrieve the bin or shelf and deliver it to a "pick station", where the item is retrieved. There will be a pick station by the circulation desk and another in the special collections

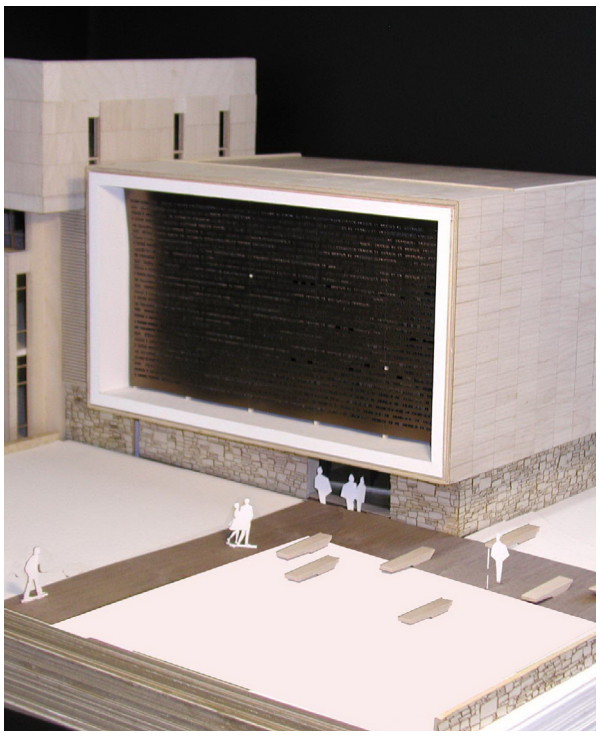


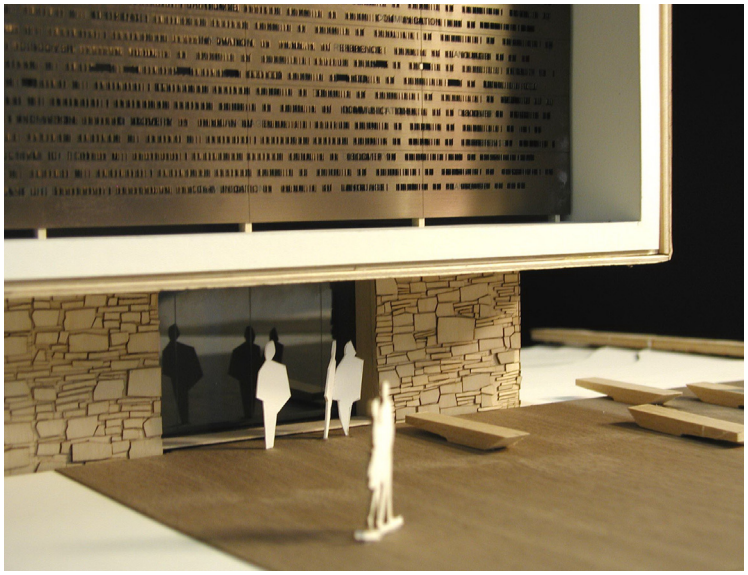
department. It will take about four minutes for the robot to retrieve the item and have it available for user pick up. The design will incorporate windows so that the robot at work can be viewed. A UMKC Miller Nichols Library Expansion Project website was created to keep everyone up-to-date on the project, including details of the robot and links to videos of it at other institutions. The website can be found at: http://library.umkc.edu/newmnl

Once the determination was made to utilize the ASRS as a core element of the revitalization of the Miller Nichols Library, the design team turned its attention to the spatial consequences of this decision. At first pass, the early indicators were not promising. With its roots as a warehousing and inventory apparatus, the typical ASRS is long on efficiency and reliability and short on looks. Eschewing natural light, and devoid of a human element—it is, after all, a triumph of computer automation—the programmatic needs of UMKC's ASRS was that of a windowless box 125 feet long, 60 feet wide, and 60 feet high, with no requirement for human interaction except for the pick stations at the two short ends. Within this rubric the design team set about its task.



Fundamentally, there appeared to be an inherent contradiction: on one hand, one of the underlying goals of the Miller Nichols Library Revitalization Initiative was to take an existing fortress-like monolith and turn it into a beacon, yet the very nature of the ASRS—a key element in this strategy—was the antithesis of this transparency and accessibility. This dilemma was only made worse when our schematic planning studies showed the optimal location for the ASRS from a staffing and operational point of view was on the south side of the existing building with an east-west orientation—in essence we were proposing a 60 foot high by 125 foot long solid wall running alongside one of the main campus pedestrian paths. In response, the design team developed a strategy for developing the scheme that revolved around three important moves: 1. utilize a massing strategy that reduces the overall scale of the ASRS, 2. offer passers-by an opportunity to see and appreciate the workings of the robot, and 3. use the need to introduce filtered natural light into the staff pick areas as an opportunity to create a unique and iconic design expression on the exterior.

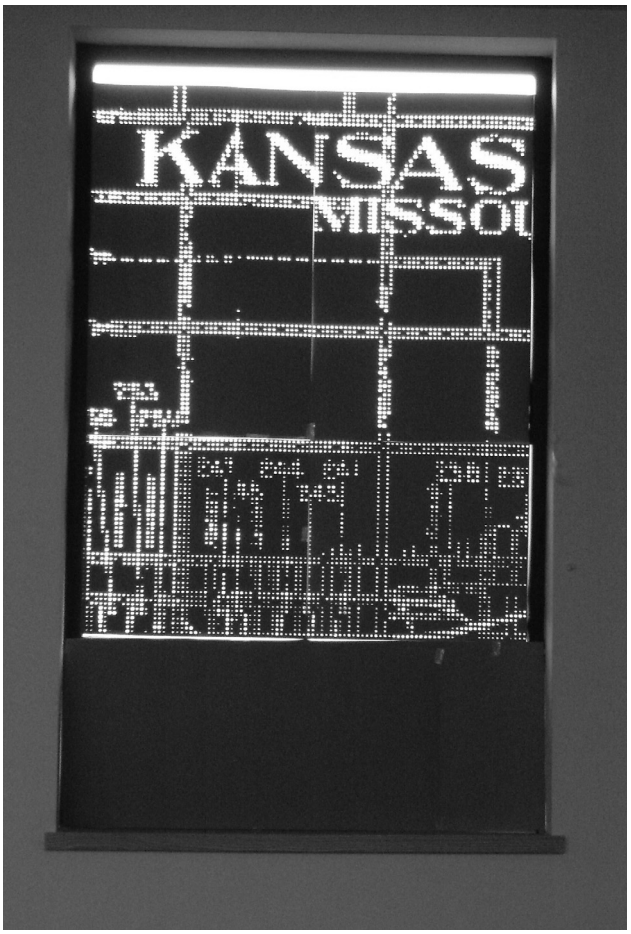


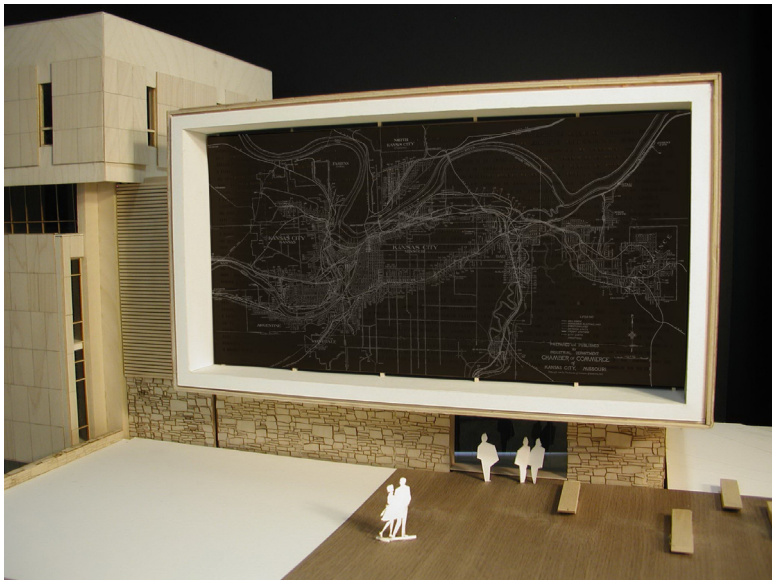


In reducing the scale of the ASRS, the design team sought clues from the surrounding context. A dominant element on campus and the surrounding city parks, are landscape walls comprised of local native stone. By using this rusticated stone as a base condition to the ASRS, the addition is knit into the campus landscape. The rest of the ASRS is cantilevered out over the base stone, creating a shadow line that visually "floats" the box.

Our visits to other ASRS facilities showed us that the most kinetic, visually interesting portions of the ASRS are the end components where the material is delivered to the pick stations in a carefully choreographed and elegant sequence of robotic moves. One large window is placed alongside the plaza at the west end of the ASRS allowing users to view the main access pick stations. This window is detailed to be frameless glass extending all the way to the paving, thus accentuating the sensation of the viewer being a part of the activity.

With the staff pick stations situated at the east and west ends, there were strong desires to have these areas receive natural light but without the accompanying problems: extreme temperature fluctuations, visual glare, or direct sunlight on sensitive archival material. This led to the development of an exterior shade screen that offered perhaps our strongest opportunity to create a dynamic and iconic visual element. Examining archival material with the library staff, the design team translated one of the early maps of Kansas City into a perforated sunscreen that protects the east and west ends of the building. Offering dappled light to the staff areas during the day, at night the screen will be lit from behind producing a shimmering image and casting light on the new entry plaza to the library.





The utilization of the ASRS system—now becoming affectionately known as “the robot”—will play a key role in the revitalization and expansion of UMKC’s Miller Nichols Library. It offers a strategy for keeping the university’s collection on campus and easily accessible while allowing former stack areas to be re-purposed into study spaces more relevant to the needs of today’s students and faculty. With construction of the ASRS well underway, the design team can now turn its attention to phase two of the initiative: working with the university to prototype innovative study and collaboration spaces that will be tested, improved, and ultimately implemented in this new-found space.