



WALL-E Hits the Stacks: Implementing a Robotic System for Collection Storage and Retrieval

Bonnie Postlethwaite, Associate Dean of Libraries
Stuart Hinds, Head of Special Collections
University of Missouri Kansas City



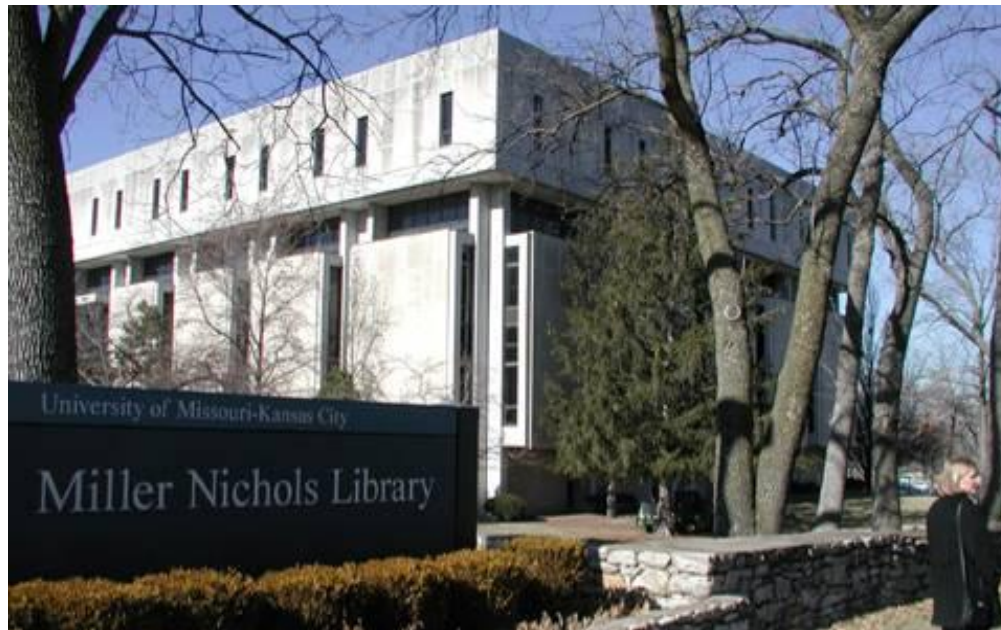
(BENNETT ROBOT WORKS)



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MILLER NICHOLS LIBRARY

- built in 1969 and had a floor added in 1991
 - Building full by 1999
 - Added information commons in 2000
- set the tone for the type
of public spaces
needed for the future



TRENDS INFLUENCING THE DECISION TO USE A ROBOTIC SYSTEM TO RE-INVENT THE MILLER NICHOLS LIBRARY



- The changing nature of learning in higher education
 - Fiscal constraints

THE CHANGING NATURE OF LEARNING



Previous Learning Styles

Learning is an individual activity

Only happens in classrooms at fixed times

Classrooms always have a front

- Chalkboards or white boards
- Tablet chairs—one-size fits all
- No sound system except in largest of rooms

Rote Learning

No food or drink

New Learning Styles

Learning is a group and an individual activity

Learning takes place everywhere

Learning spaces are open and flexible

- Moveable furniture
- Shared screens
- No front to the room
- Lots of screen projection and white boards
- Technology rich

Learning that fosters critical thinking and development of communication skills

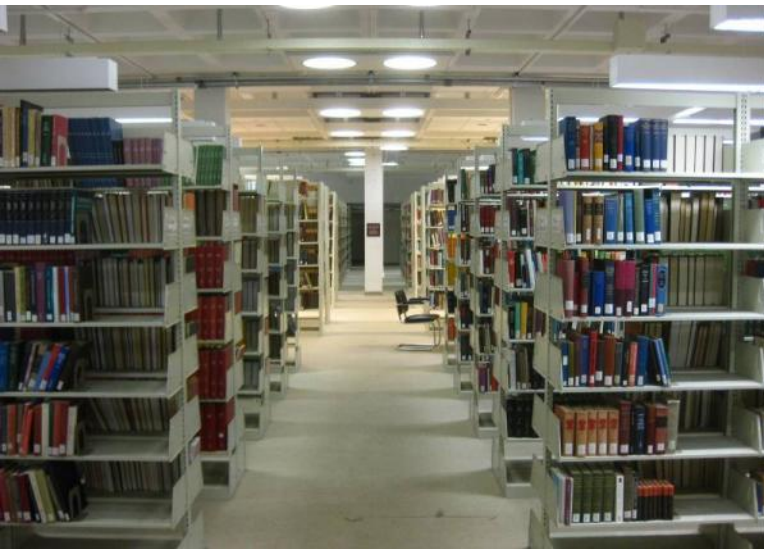
- Team projects
- Open discussions

Café with full food service



ISSUES FOR EXPANDING MILLER NICHOLS LIBRARY

- Services, reader spaces, and classrooms were secondary and tended to be available only as stack space allowed
- Costs of maintenance and expansion rising dramatically
- Electronic and print collections continue to grow
- Funding bodies reluctant to support larger buildings

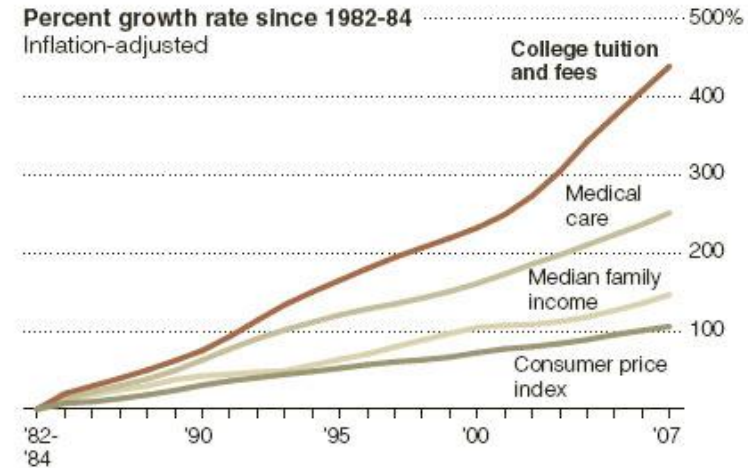


THE FISCAL REALITIES OF HIGHER EDUCATION

	1973	2004	Growth
Average Space per Student (gsf) (SCUP – 2004 figure is estimate)	300	880	295%
Average size of American home (gsf) (NPR)	1,500	2,349	157%

Soaring College Tuitions

College tuition continues to outpace median family income and the cost of medical care, food and housing.



Net college costs as a percentage of median family income*

INCOME CATEGORY	FOUR-YEAR PUBLIC		TWO-YEAR PUBLIC	
	1999-2000	2007-8	1999-2000	2007-8
Lowest	39%	55%	40%	49%
Lower-middle	23	33	22	29
Middle	18	25	15	20
Upper-middle	12	16	10	13
Highest	7	9	6	7

Note: Net college costs are tuition and room and board minus financial aid.

Source: "Measuring Up 2008," the National Center for Public Policy and Higher Education

THE NEW YORK TIMES

INITIAL DESIGN CONCEPT

- First design emphasized innovation and collaboration and included traditional stack space
- Growth potential of collection was five to ten years



BUDGET CONSTRAINTS FORCE A NEW CONCEPT

Reduced funding created smaller building plan-- unable to accommodate all of the existing collection or growth



REMOTE STORAGE OF COLLECTIONS AS AN OPTION

Benefits

- Financially responsible alternative to building a larger library
- Most facilities are secure from physical damage and theft with environmental controls
- Least used items can be put in storage, while leaving the more heavily used items on shelves onsite
 - Retrieval is systematic

Concerns

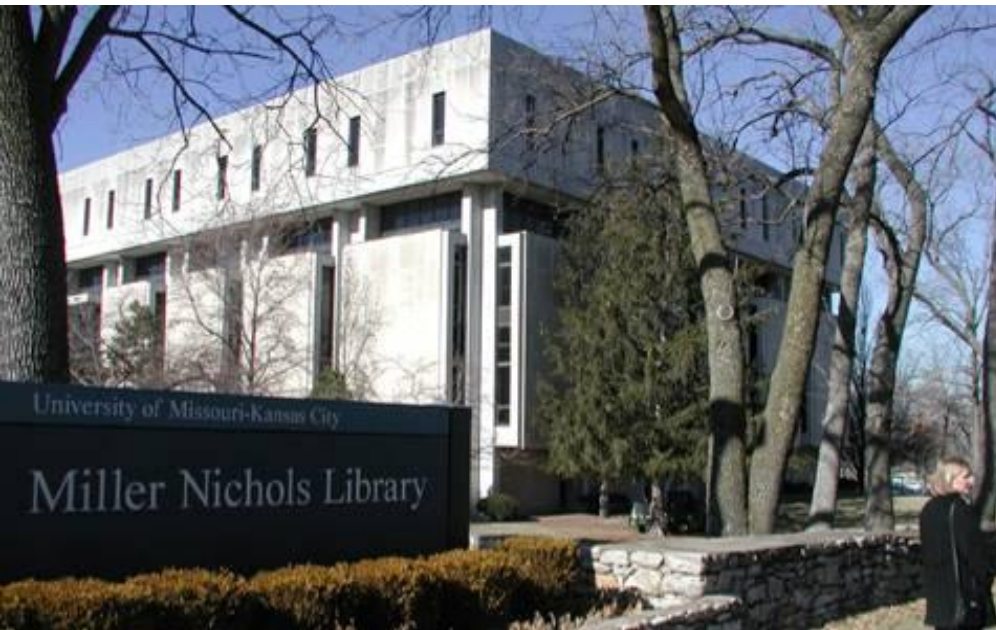
- Usually not part of a library building
- Often at a considerable distance from the library
 - Sometimes shared storage facilities
 - Requires delivery system
 - Users must wait for items



THE UMKC PROJECT

Campus perspective:

- Remote storage options are a compromise
 - on site storage the preferred option



ALTERNATIVE SOLUTION

- The library staff began to seek alternative solutions to increase growth potential
- An existing remote storage option with the University of Missouri System would mean a one to two day delivery time



OUR STORAGE OPTION

- We became intrigued by the possibilities of a newer type of alternative storage, a robotic automated, high density storage and retrieval system (ASRS)



THE "ROOBOT"

- We found the robotic system to be:
 - A cost effective solution to our collection space concerns
 - A source of opportunities for having very flexible space for emerging library needs
 - An environmentally friendly system, with low energy needs and a green roof
 - An opportunity to create a stunning design as a campus feature
 - A catalyst for the evolution of our philosophy of library services and access



THE ROBOT AND THE LIBRARY

- **The robot facility is a dynamic design and service feature of our re-imagined facility**
- **It enables us to align ourselves for the future and the innovative growth of the university**
- **Our books are safe and secure, retrieved in a few minutes**

THE ROBOT CHANGES OUR THINKING

- We stopped thinking that we needed a bigger library to hold our collections
- We became excited about the idea that a large part of our collection, but not all, would be in the robot
- Multiple delivery points enable creative use of space
- Item can be called up from anywhere, anytime and retrieved at a library pickup point
- New faculty book delivery service makes this transparent

THE ROBOT AS A CATALYST FOR CHANGE

- **Space reclaimed will allow for flexibility in our services**
- **We can expand the information commons concept**
- **We can test new ideas**
 - Performance Space
 - Presentation Practice Room
- **We can create support and encourage a collaborative learning environment**
- **We will have space have flexible space to adapt to changing needs**



SELECTING A VENDOR

- **Several factors came into play:**
 - the majority of our collections will be in the robot
 - approximately 150,000 of our most current or heavily used titles will be on traditional open shelves
 - most of our special collections will go into the robot, including rare recordings from our sound archives
 - Bins were the most efficient for general books but a shelving solution was best for the sound recordings and some special collections—a hybrid solution.

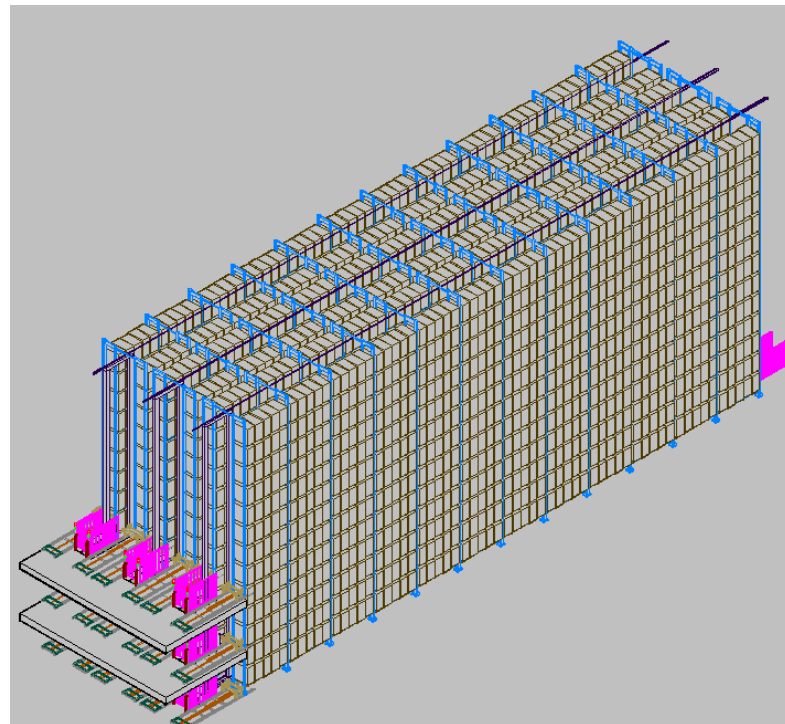
THE SELECTION PROCESS

- We issued a RFP
- Competitive bid process
- HK Systems was the successful bidder
- Architects worked with them to design the structure to house it.

DESIGNING THE "ROBOT"

Basic Premise behind the ASRS:

Super high density shelving bins accessed only by automated forklift and delivered to staff stations at the end of the rows



DESIGN PARAMETERS

Long Rows are most efficient

Location of "pick stations"
determines staff layout

Most efficient at approximately 50 feet high

Daylight is a liability





- location II:
- disadvantage: doesn't orient rows towards access
 - advantage: minimal impact on University Way view corridor
 - advantage: access services near entry
 - advantage: efficient shape (long)

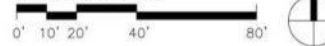
IMPLEMENTING THE "ROBOT": DESIGN PARAMETERS



LEGEND

- COLLECTION
- PATRON RESOURCES
- INTERACTIVE LEARNING SPACE
- CLASSROOMS
- PERIMETER OF EXISTING MNL
- LIBRARY STAFF SPACE
- BUILDING SUPPORT
- CIRCULATION
- WESTERN HISTORICAL MANUSCRIPT COLLECTION

MAIN FLOOR PLAN



IMPLEMENTING THE "ROBOT": DESIGN PARAMETERS





SUSTAINABILITY COMPONENTS

- ASRS minimizes site disturbance, preserves green space, reduces square footage required by traditional book stacks (1/7 the space) , and allows for future adaptive reuse of existing grounds
- high performance building envelope and mechanical system for energy efficient
- Temperature and humidity controls can be set for optimal conditions for the collections which will save on energy consumption
- Lighting requirements inside the Robot are limited to the work areas only.
- Daylight in all occupied areas of the addition



SUSTAINABILITY COMPONENTS (cont.)

- **Building exterior to feature durable, low maintenance materials such as:**
 - **Kansas Limestone: quarried less than 100 miles from the project site, reducing carbon footprint in transport**
 - **Metal Screens: high in recycled content, and manufactured locally reducing carbon footprint in transport**
- **Green Roof over the addition**

DESIGN ELEMENT: PUBLIC ART

- Minimizing the big box look
- Highlighting the rich library content



Portions of this presentation were originally made by UMKC Dean of Libraries, Sharon Bostick, and Bryan Irwin, Design Architect for the UMKC project, Sasaki Associates, at the 2009 Computers in Libraries conference with their permission.

