Automated Storage & Retrieval Systems (ASRS)

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December 4, 2011

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A Paper Completed in Partial Fulfillment of the Requirements for LIBR 202
Abstract

Automated Storage and Retrieval Systems (ASRS) are unique structures that provide many benefits to academic libraries and their users. Even so, the presence of ASRS in academic libraries is sparse within the United States. The essay provides the history of ASRS and discusses their implementation and development in academic libraries. A literature review gives insight into the available literature about ASRS in academic libraries as well as the lack of information and written literature available. Furthermore, the essay provides an overview of the structure and content of ASRS as well as how they are used to retrieve and return materials.
Introduction

A large part of the library experience is walking through numerous stacks and browsing even a greater number of books. These books are cataloged with careful precision down to a specific order. But what if the stacks were taken away and the books were miscellaneously barcoded and stored in huge metal bins that required a crane to retrieve and replace them in a single space? This describes the concept of an automated storage and retrieval system (ASRS). Even though the concept of ASRS is fairly new in planning and developing libraries within the past decade, this system has been around since the 1950s in the industrial environment, but was not implemented in the library until the 1970s, and has very slowly developed over the decades.

Many materials are now available via the internet in electronic databases, but there are still materials being printed that require space. As collections within academic libraries continually grow, more space is needed to accommodate the new materials. Automated Storage and Retrieval Systems is one solution to the problem. In many instances, especially at academic libraries, this automated system has not only proved beneficial in managing space, but it has also proved effective in reducing cost, time, and labor. Despite their overall reduction, money, time, and labor are required in order to successfully implement an ASRS. The changes caused by implementing an ASRS might take getting used to and might even be resisted, but these changes will prove successful and beneficial to university students, faculty, and academic librarians over the long-term.

History of ASRS

The automated storage and retrieval system was first introduced in the automotive industry in the 1950s for “warehousing raw materials, parts, and end product” (Quinn & Haslam,
1998). The general layout of the warehouse ASRS can be described as having aisles with metal frames that housed bins, which contained parts and materials. A retrieval mechanism would remove a bin from its place and take it to a delivery station for further action (Quinn & Haslam, 1998).

Libraries, on the other hand did not begin implementing the ASRS until the 1970s. In an initial experiment, only one out of five libraries was successful (Quinn & Haslam, 1988). Out of the Library at Erasmus University in Rotterdam, Netherlands, Medical Sciences Library at Ohio State University, one U.S. community college, and two U.S. public libraries, the Library at Erasmus had the only successful implementation. The reason was that Erasmus (as at most European universities) already contained closed stacks (rather than open stacks like at U.S. libraries), and so the early ASRS version, the Randtriever, appeared faster than a manual retrieval system (Shirato, Cogan, & Yee, 2001). Even with their success, Erasmus continually maintained their facility over several years by “installing safety devices, replacing communications systems, converting to computer control, and linking to the library’s circulation system” (Quinn & Haslam, 1998).

Unfortunately, there were too many failures and too many technical complications of the ASRS in the United States to persuade libraries to continue to use or implement the system. As a result, “all U.S. libraries stopped using the system” (Bullard & Wrosch, 2009) for 19 years between 1970 and 1989. However, storing growing collections within libraries is an ongoing problem, in which an automated storage and retrieval system seems to be an appropriate solution as it significantly reduces the space allotted for documents” (Quinn & Haslam, 1998).
Literature Review

As previously mentioned, the idea of automated storage and retrieval systems is not new. A considerable amount of literature that involves automated storage and retrieval systems are based around the automotive industry as well as warehouse structure and capacity. Unfortunately, the concept of implementing ASRS in academic libraries does not seem very popular, even though there have been quite a few success stories in the past twenty years.

Much of the literature about ASRS in academic libraries is over five years old, and any current literature is about already existing ASRS in academic libraries only to provide insight to any changes and developments after many years of using the system. For instance, Bullard & Wrosch (2009) provides a review of Eastern Michigan University’s ARC after ten years of operation. But long before this article appeared, Shirato, Cogan, & Yee (2001) wrote an article about the benefits and challenges of the ARC. Another ASRS that is commonly written about is MARS at the University of Nevada, Reno. Sundstrand (2008) and Beisler & Ragains (2010) respectively wrote about how library staff members use MARS to secure and preserve materials from Special Collections and the Federal Depository Collection.

Although some authors, like Shirato, Cogan, & Yee (2001), mention beneficial impacts on their libraries, they do not provide results or statistics from any studies or surveys to show exactly how much the ASRS have benefited libraries, staff, and students. With a limited amount of literature that discusses student and library staff perceptions, it is difficult to truly know how they feel about the new technology and system. Some students might not care that the changed occurred while others might be concerned or confused about finding material. But there is no literature that explains these challenges. The challenges that are discussed are how to choose
which materials should be placed into an ASRS, how they should be cataloged, and how to
decide the most effective transportation method to move materials from a holding area to the
finished library (Skinner, 2010; Sundstrand, 2008; Bravender & Long, 2011).

**Developments of ASRS in Academic Libraries**

According to Sundstrand (2008), “ASRS facilities are being built as a more cost-effective
long-term model to serve as additional off-campus library storage, or are becoming those
facilities on-campus.” A concise definition of the purpose of ASRS can be described by
Amrhein & Resetar (2004): An automated storage and retrieval system is a means by which a
large quantity of books (or other materials) can be stored in a single room and can be easily
accessed within seconds.

The Leviathan II ASRS at the Oviatt Library CSU Northridge began a new era of
implementing ASRS when it “came online in 1991 with the promise of quick retrievals and
delivery to the circulation desk” (Bullard & Wrosch, 2009). Much of the innovation changes
that Erasmus made, were implemented at CSU Northridge.

Eastern Michigan University (EMU) first “installed an ASRS as part of the new Halle
Library” (Bullard & Wrosch, 2009) in May 1998, and becoming the second university library
with a successful in-house quick retrieval storage system – CSU Northridge being the first.
EMU’s automated retrieval collection (ARC) cost $1.6 million. The ARC in Halle Library takes
“one-seventh of the space needed for regular shelving” (Bullard & Wrosch, 2009) even though
the structure is five stories high.

The Special Collections Departments at both the University of Nevada, Las Vegas
(UNLV) and the University of Nevada, Reno (UNR) particularly use the ASRS to securely store
materials and limit access to only special collections staff. In 2001, the Lied Library along with its ASRS – Lied Automated Storage Retrieval (LASR) – officially opened at the University of Nevada, Las Vegas. Like many other facilities, the Lied Library was planned to accommodate collection growth and space needs (Haslam, 2005). Seven years later, in 2008, the University of Nevada, Reno Library moved to the Mathewson-IGT Knowledge Center, where “half of the library’s print collections were moved into the building’s automated storage and retrieval system” (Beisler & Ragains, 2010), which was named the Mathewson Automated Retrieval System (MARS). Like other ASRS systems, MARS houses many of the “older, low-use books, journals, and other materials” (What is MARS?), including government documents as “UNR is one of 50 regional federal depository libraries in the United States” (Beisler & Ragains, 2010).

Other academic libraries that have recently implemented an ASRS within the last decade include: Grand Valley State University (GVSU), who installed an ASRS in their Steelcase Library in 2000 (Bravender & Long, 2011); Southern Georgia University who installed their ASRS in the Zach L. Henderson Library in 2004 (Skinner, 2010); Sonoma State University in California (Sundstrand, 2008); and Valparaiso University in Indiana obtained their ASRS is 2004 ((Amrhein & Resetar, 2004).

The primary manufacturer of constructing and providing an ASRS is HK Systems Inc., who supplies “the main robotic system server, a backup server, and a dial-in diagnostic modem” (Amrhein & Resetar, 2004) in addition to computers for “each operator workstation at the front of the bin aisles with attached receipt printers and a networked report printer” (Amrhein & Resetar, 2004). As more libraries consider implementing ASRS, “HK systems has been
marketing to libraries by attending ALA and featuring library application prominently in their promotional materials” (Haslam, 2005).

In addition to the technology that HK Systems Inc. provides, the software for linking the content in the ASRS database to the library’s OPAC is prominently provided by Innovative Interfaces, Inc., who “continues to develop the software that allows LASR to work with the library catalog” (Haslam, 2005).

**Structure, Content, & Usage of ASRS**

Despite immense construction costs, an ASRS is very cost-effective in providing more open spaces for university students and faculty to study, work, and collaborate within the library environment without maneuvering around many enormous immobile book stacks. Furthermore, “preservation conditions are much better than they were in the open stacks since [ASRS] bins are in a climate-controlled environment and items are handled only when needed” (Beisler & Ragains, 2010). However, both librarians and students must adapt to the many changes ASRS requires as the collections “can only be browsed virtually” (Skinner, 2010).

**Structure**

The ARC at Eastern Michigan University consists of 3 aisles, 35 columns, and 36 rows. The bins are 24 inches wide, 48 inches long, and 10, 12, and 15 inches high (Bullard & Wrosch, 2009). Haslam (2005) describes the LASR at the Lied Library at UNLV as “a gigantic card catalog with metal bins instead of drawers.” Similarly to the ARC, the LASR consists of 3 aisles of bins mounted on racks, but differs by having two additional columns and only 26 rows (Haslam, 2005). Some ASRS library facilities contain conveyor belts, but UNLV does not (Quinn & Haslam, 1998). The number of aisles and bin sizes appear to remain the same.
throughout all ASRS systems, while the amount of columns and rows might vary according to available space of a library. Visualizing the structure of an ASRS might be difficult if simply based upon the description. The Appendix contains three images of what an ASRS looks like, how it is set up in a closed stacks facility, and how books are arranged in the bins.

**Content**

The purpose of the ASRS at UNR, UNLV, and EMU is to store items that are “older, less used, fragile, or prone to theft or mutilation” (Bullard & Wrosch, 2009). For instance, MARS at UNR contains books published before 1995 (but only if checked out seven or fewer times), journals that are older than one year, the Permanent Reserve Collection, most of Special Collections, and most of government documents (What is in MARS?). The material stored in LASR at UNLV primarily consisted of “bound periodicals published before 1992, Government documents, bound indexes, old references, Special Collections, and microforms” (Haslam, 2005). Similarly, the ARC at EMU holds books and periodicals over ten years old, computer books older than five years, videotapes, DVDs, and other items that require a more secure environment (Bullard & Wrosch, 2009).

While these specialized items will be safer and better preserved in the long-term, they can greatly challenge librarians. For, despite the success of randomness with the ASRS, it is not always the best method when considering unbound documents or extremely large materials. Sundstrand (2008) explains that “not all items fit into standard manuscript boxes or cartons. Scrapbooks and ledgers through the ages come in too many shapes, sizes, and weights.” So, librarians need to figure out ways to effectively store non-standard-sized items if they want these items to be housed in ASRS.
Although library ASRS are most effective at storing materials from Special Collections and equipped to store government documents, they are not only used for older and less used materials. The ASRS at GVSU in the Steelcase Library was the only ASRS “used to hold a circulating collection” (Bravender & Long, 2011). Accordingly, “complete and accurate bibliographic records are essential so that the materials in the [ASRS] system become a collection as opposed to storage” (Skinner, 2010). The term ‘storage’ can have a negative connotation and can be viewed as being off-campus rather than being part of the on-campus facility and easily accessible. So in order for ASRS to be successful, students need to feel that they are able to access materials that are necessary for research and class projects.

Usage – Material Retrieval and Return

Quite conveniently, the technology required to operate the ASRS is able to “interact effectively with library catalogs” (Beisler & Ragains, 2010). With this connection, students are able to submit requests for materials located in an ASRS from home or at school through their library’s online catalog. Unfortunately, “the only way to retrieve an individual item from within the bins is via the crane after it has been requested through the library’s online catalog” (Bravender & Long, 2011). This system is the same for the ASRS at Grand Valley, UNR, UNLV, EMU, and CSU Northridge. Although the system might appear completely automatic, “staff members still need to be involved for the physical retrieval and return of items in the bins” (Amrhein & Resetar, 2004). When a request is submitted, a signal is sent to the ASRS crane to remove a bin from its place and notifies the “operator to retrieve the item from the storage bin… and send it to the circulation desk, where it will be held for the user” (How does it work?) to pick
up at a later time or date. At UNR, the entire process of retrieval takes between five to ten minutes (How does it work?).

Differing from an open stacks system, materials in the closed stacks of an ASRS are arranged by barcode rather than call number. In fact, “titles and call numbers are not visible. Each book would have to be pulled out and examined to determine its subject matter” (Bravender & Long, 2011). In order to make book retrieval even easier, “the last three digits of the bar code label were written on the top of the book pages” (Skinner, 2010). Furthermore, books do not need to be returned to their original bin from which they were retrieved. In most cases, “materials are stored by size (mostly height)” (Skinner, 2010). Luckily, the ASRS technology allows the system to be programed to ‘know’ that “if a book came out of an eight-inch deep bin, it must go back to an eight-inch deep bin” (Sundstrand, 2008).

**Conclusion**

An automated storage and retrieval system is certainly a good way for academic libraries to store library materials and create space for other library services like computer labs and study areas. The structure of ASRS takes up little space, better preserves materials, and allows libraries to quickly retrieve materials. But, although ASRS have proven efficient and successful, it is still unknown how students feel about the new approach of obtaining materials from closed stacks. In the future, more libraries might seek to implement ASRS (if libraries and universities can afford the immediate high cost, time, and effort of installation and transferring materials), and evolve into a more technologically based environment. However, the aspect and characteristics of a traditional library, such as wandering through a maze of open stacks among thousands of books, should not be forgotten.
References


Appendix

Image 1:

Two staff members or the Mathewson-IGT Knowledge Center operating MARS, the ASRS at the University of Nevada, Reno (http://knowledgecenter.unr.edu).
Image 2:

Photo of Steelcase Library ARS by Amanda Pitts (Bravender & Long, 2011). This photo shows columns and rows of bins that make up ASRS.
Image 3:

Photo of Steelcase Library ARS bin by Karen Martin (Bravender & Long, 2011). The photo shows how operators can easily identify which book to retrieve based upon the number written on the top of the pages near the binding.