Successful Proposal to the Mellon Foundation for First Phase (ended 2002)

Executive Summary

The Milton S. Eisenhower Library is collaborating with The Johns Hopkins Whiting School of Engineering, IBM, Ameritech, and Minolta to develop CAPM, a method for providing real-time browsability of library collections stored at off-campus storage facilities. Through this partnership between a premier research institution and international corporations we propose to create and utilize robots, automated systems, planetary scanners and software for revolutionizing the potential use of library off-site shelving facilities. This project will result in a national model for library service and access to resources, providing patrons with new electronic capabilities to access, browse, and electronically capture information through a cost-saving process that will enhance library service while helping universities control the rising cost of higher education. CAPM addresses library patrons' primary criticism of book storage facilities--being separated from library materials. It will create an automated, electronic link using cost-effective and high quality processes achieved by industry. Our efforts will result in a technological and economic model with demonstrated potential for mass production by industry for widespread use (as illustrated by the level of commitment from IBM,
Ameritech, and Minolta, and interest from an expansive range of libraries)

Once CAPM is implemented on a broad scale, it will offer significant cost-efficient benefits by: 1) facilitating the shifting of larger percentages of a library's collection to off-site; 2) providing a far less costly alternative to new construction--purchasing/leasing an existing storage facility; 3) virtually eliminating the loss of items due to misshelving; 4) electronically storing any scanned material that is in the public domain; 5) providing additional, more efficient search tools such as indexes of scanned full-text (a feature that remains available for items protected by copyright); 6) creating opportunities for libraries to pool scanned material; 7) bringing 24 hours/day, mechanized scanning capabilities to library collections; 8) and advancing preservation efforts by reducing wear on items (many will be scanned only once), providing nearly ideal environmental conditions, and housing each item in a carbon infused, mass-produced paper case.

Colleges and universities are increasingly dependent on libraries to provide the latest in information technology as well as traditional services to help enhance their teaching and research capabilities. These services are expensive and contribute to a severe overcrowding of facilities. As a result, many libraries are seeking annual budget increases over 5 percent; some are indicating 7-12 percent increases are needed, far out pacing the 1.6 percent rise in the consumer price index.

This challenge, and the appropriateness of Hopkins to respond, is perhaps best stated by Hopkins president Dr. William Brody: "In the past, libraries have assembled collections of scholarly material and made them available on a "just-in-case" basis. Materials filling our library are duplicated in thousands of other libraries. Today, few libraries can afford to maintain
such collections. So librarians are looking at "just-in-time" libraries. These are facilities that will provide access to materials when you need them. They will not necessarily be required to maintain that information in their own physical collection. Such "virtual" libraries are technically possible to introduce today...One of my goals is to see this university take up the challenge of designing and implementing the library of the future. Financial pressures alone may make this effort a matter of necessity in the near future."

CAPM promises not only to improve the efficiency with which libraries provide materials "just in time", but also to move libraries toward a "just-for-you" approach for scholars by integrating web-based access to library holdings, real-time browsing and enhanced features such as full-text search and indexes. Such methods will further improve and economize libraries' service to education.

Overview

The Milton S. Eisenhower Library is seeking Mellon funding to support Comprehensive Access to Off-Site Print Materials (CAPM), a project that will improve access to library and information resources and ease severe budgetary and space constraints in libraries by maximizing the potential use of off-site shelving facilities. The Eisenhower Library is collaborating with The Johns Hopkins Whiting School of Engineering, IBM, Ameritech, and Minolta to create and utilize robots, automated systems, planetary scanners and software for providing real-time browsability of library collections stored at off-campus shelving facilities. This revolutionary system will not only restore browsability of these materials, but also enhance their research value by providing additional, more efficient search tools such as indexes of scanned full-text (a feature that remains available for items protected by copyright). It will also bring 24 hours/day, mechanized scanning capabilities to library collections. To complete this project we have created a two-
year plan during which we will undertake four concurrent activities: Economic Analysis, Automated Item Retrieval, Automated Page Turning, and Digital Control Programming. WE ARE SEEKING A GRANT FROM THE MELLON FOUNDATION TO FUND THE ECONOMIC ANALYSIS AND HELP SUPPORT THE AUTOMATIC ITEM RETRIEVAL ACTIVITIES OF THIS PROJECT.

These critical activities will provide a sound economic framework for analyzing the costs and benefits of the CAPM system that relies upon standard welfare economics in combination with multi-criteria decision-making (MCDM) methodologies. Through an interview process and group discussions in two workshops, we will delineate methods for monetizing preferences and tradeoffs that are inherent in evaluating library services. This type of analysis will be conducive for economic evaluation of library services in general. As part of any cost-benefit analysis, it is necessary to estimate costs. Consequently, this project will include prototype development of robotic system components to provide essential cost data. To this end, we are seeking Mellon funding to help support the item retrieval system as well as the economic analysis. We are securing additional sources of funding--Federal, corporate, foundation and private--to develop the other automated systems which comprise CAPM.

Why Libraries Must Maintain Their Print Collections
Recent advances in digital and information technology have provided further impetus for the concept of a digital library. The potential of digital libraries is great and, justifiably, much effort is dedicated to clarifying and developing this concept within a new era of scholarship. However, with the advent of digital libraries, there is a danger that patrons will place less emphasis on the wealth of scholarship and knowledge stored in traditional print formats. Some worst-case scenarios, as reviewed by Geoffrey Nunberg, even predict the obsolescence of the paper book ("The Place of Books in the Age of

Digital libraries offer the potential of the encyclopedic ideal with universal access to knowledge without disciplinary boundaries. However, it is essential to integrate older sources of knowledge, contained in books and other print materials, with newer forms of digital knowledge. One possible response to this situation is to digitize the contents of print materials. This method is inadequate for the following reasons. First, copyright restrictions prohibit the wholesale digitization of many print materials. Second, the cost and scope of digitizing such large collections is enormous, especially if the books remain bound. Even though much information is created in digital formats today, libraries will continue to receive information in print formats for the foreseeable future.

Why Library Costs Are Rising
Library use is on the rise; 24 percent more graduate students are using libraries than a decade ago, 8 percent more undergraduates, and 17 percent more faculty members. In the past 10 years, requests for reference help have risen by 14 percent, while the demand on librarians for instruction has climbed by 33 percent (numbers that are sure to rise with the introduction of more-sophisticated technologies). [James Shapiro, "University Libraries: the 7-Per-Cent Solution," The Chronicle of Higher Education, December 12, 1997.] Indeed, the Eisenhower Library has witnessed an increase in patronage of more than 40 percent since completing its renovation in 1997.

Costs of providing quality library services to students and faculty are increasing sharply, well beyond the rate of inflation. For example, the percent change in serial prices from '92-'96 was 54.06 percent for North American periodicals and 55.80 percent for European periodicals. [Lee Ketcham and Kathleen Born, "Projecting the Electronic Revolution while Budgeting for the Status Quo," Library Journal, April 15, 1996, pp. 45-51.]
The largest increases in library costs, however, are to accommodate advances in information technology. Over the past twenty years, academic libraries have changed considerably as bibliographic utilities, online catalogs, automated circulation systems, and other new technologies have been implemented in a majority of library operations and services. The increased access to electronic information systems not held locally and to other new technologies such as CD-ROM, interactive multimedia packages, OCR (optical character storage recognition) and imaging systems, laptop computers, digital asset management and hierarchal management systems, and servers are also impacting library costs, along with local area networks and wide area networks for interconnected local computing resources. [Maureen Pastine and Carolyn Kacena, "Library Automation, Networking, and Other Online and New Technology Costs in Academic Libraries," Library Trends, v. 42 (Winter 1994), pp 524-36.]

During the past 5 years, for example, the Eisenhower Library's average budget increase was 5 percent per year. Reallocation of operating funds has been necessary to cover major budget increases for technology (e.g. during FY94-FY96, electronic infrastructure costs increased by an average of 13 percent per year). Many libraries are seeking annual budget increases over 5 percent; some are indicating 7-12 percent annual increases are needed to maintain the level of quality service expected of academic libraries. These percentage increases far outpace the 1.6 percent rise in the consumer price index. What can libraries do in this era of academic fiscal constraint to provide traditional as well as new and enhanced library services essential to the success of higher education in this country?

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Why Libraries Are Facing Severe Space Constraints
Libraries must accommodate a constantly expanding collection as well as provide an increasing number of services such as access to online resources, audio/visual materials, CD ROMS, and electronic resource laboratories. The tension of these competing responsibilities creates an "urgency of space needs that affects virtually all libraries." [Peter E. Wagner, "The
One solution to library overcrowding—new facilities—requires substantial institutional investment not only for the construction costs, but also of another scarce resource, campus land. Construction projects at two- and four-year colleges have skyrocketed in an attempt to catch up with a growing lack of space—for teaching, laboratories, services, and housing. Indeed, colleges project at least $18.75 billion in construction projects over the next three years. The vast majority of these projects will be new construction, escalating the demand, and the land value, of college campuses and surrounding neighborhoods. [Joe Agron, "Rising to New Heights," American School & University, v. 69, no.9, May 1997.]

New library construction is expensive. It costs colleges and universities, and ultimately their students, more than 2 times more to build a new library than to renovate an existing one. In 1996, new buildings cost on average $142.55/sq. ft, and renovations $63.71 sq. ft. The cost difference would be even more dramatic if we included the cost of (or loss of) the valuable campus property on which the libraries were being built. [Bette-Lee Fox, "The Renovation Role Model," Library Journal, December 1997, pp.49-51.]

Why Current Off-Campus Book Storage Facilities Are Inadequate
Teaching institutions are searching for alternatives to the high cost of new construction for addressing the shortage of space in their libraries. One solution being adopted—off-campus book storage facilities—is providing partial relief. The main benefit of off-campus storage is financial. The cost of building and operating the no-frills warehouses is as little as one-fifteenth that of a traditional library, even considering the expense of delivering the materials to the campus. The climate-controlled storage sites also do a better job of preserving books, micro-films, and other items—books last eight times longer in storage. [Jeffrey R. Young, "In the New Model of the Research Library, Unused Books Are Out,

Many academic administrators are concluding that bringing books to readers is better than devoting scarce real estate to storing journals. For example, the Eisenhower Library at The Johns Hopkins University has recently implemented an off-campus shelving facility that will hold almost two million volumes. The facility offers high-density storage with materials stored in boxes by size instead of call number. Materials are stored in closed stacks within environmentally controlled space and retrieved by library staff using a forklift. Requested items are delivered twice daily during weekdays.

Off-campus book "warehouses" are not new; they are being used by an increasing number of libraries to store their least-used materials. Libraries and faculty, however, are ambivalent about this trend. "Like a distant and unpopular cousin, discussions of storage often seem relegated to behind the scenes conversations of worst case scenarios and compromised virtue." [Wendy P. Lougee, "Remote Shelving Comes of Age: Storage Collection Management at the University of Michigan," Collection Management, v. 16 no. 2, 1992, p. 93-107.] Patrons passionately respond against being separated from library collections, arguing that browsing a library's collection is an essential, albeit serendipitous, research exercise. Nonetheless, 100 percent of the provosts who responded to a 1995 Academic Libraries survey stated that it was "necessary to resort to remote storage" for part of the collection. This necessity is exhibited by libraries that have implemented similar off-site facilities and often provide rented storage space for institutions without off-site storage options. [Peter E. Wagner, "The Library and the Provost," Academic Libraries (Greenwood Press: -19953.) [For a list of institutional participation in ALA's library storage serve, 'LibStorage,' see TOPIC INTEREST appendix.]

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Benefits Offered by CAPM
Once implemented the CAPM model will offer improved access to information and cost efficiency in the following
ways: 1) by providing browsability to items stored at off-site facilities, it facilitates the shifting of larger percentages of a library's collection to off-site, freeing up expensive on-campus space; 2) it provides those institutions contemplating a new facility or addition with the far less costly option of purchasing/leasing an existing storage facility; 3) it virtually eliminates the loss of items due to misshelving because the item retrieval and delivery system is automated; 4) it eliminates the need to retrieve (and scan) more than once any item in storage that is in the public domain; 5) it provides additional, more efficient search tools such as indexes of scanned full-text (a feature that remains available for items protected by copyright); 6) it provides an opportunity for libraries to pool scanned items in the public domain, thus eliminating much redundancy; 7) it brings 24 hours/day, mechanized scanning capabilities to library collections, enabling libraries to scan select items whenever equipment is not serving a library patron; 8) it contributes to the preservation of a library's collection by reducing wear on an item (in many cases it will only be scanned once), by being stored in a facility with nearly ideal atmospheric conditions, and by having each item stored in a carbon-infused, mass-produced paper case. [For additional information on preservation see PRESERVATION appendix.]

The CAPM concept deals with the copyright restriction by relying upon "fair use" guidelines. It is not permissible to digitize materials protected under copyright anticipating demand for a particular item. However, if the demand exists (that is, a patron requests the item), then fair use provisions allow reproduction within limits, similar to when patrons photocopy materials. Since the CAPM system will digitize materials protected by copyright only when a patron issues a request, the scanning process falls under the auspices of fair use.

Over time, continuous scanning of volumes that are in the public domain will free space within the storage unit for other volumes, thus eliminating the need for further storage space. Remote storage would thus be able to provide better access to scanned materials stored in off-site facilities than materials
stored within the library where titles would not be available digitally. With this system, "remote" will take on an ironic and misleading meaning in terms of access of materials.

Project Goals
The goal of the CAPM project is to develop efficient (i.e., cost-effective), real-time, enhanced browsing and search capabilities, through a Web browser interface, to off-site materials by using a combination of robotics, automated systems, software and high-speed telecommunications. Essentially, CAPM will incorporate and modify existing technologies to lower library operating costs while enhancing the quality of service. Claire Bellanti Head, Access Services and Director, UC Southern Regional Library Facility states, "The proposal from Johns Hopkins is especially exciting because it takes the concept of the storage facility to a new level." [Refer to Bellanti letter in SUPPORT appendix.] The incorporation of robots and automated systems into manufacturing industries resulted in cost-effective and higher quality operating systems. CAPM will introduce similar techniques into off-site facilities to achieve lower cost, higher quality operating systems.

A description of how the CAPM system would be used is provided below:

1. A patron will search for an item using the library management system via a Web browser.
2. An item is identified as being located in Moravia Park (or some off-site facility).
3. Patron will choose the CAPM option.
4. CAPM software will transmit a request for the item to be retrieved and delivered to a scanning station.
5. Requested item is retrieved and delivered to scanning stations by robot systems.
6. Requested pages are scanned, converted to full-text by OCR software, and indexed with software.
7. Digital images of the pages are sent across the network and displayed on the patron's browser.
8. The patron can then view additional pages, print pages, ask the system to return the item to shelving or request the item for physical delivery.

The entire process will take seconds or minutes, depending on the location of the item within the off-site shelving facility. Ultimately, the CAPM system will result in the ability for patrons, even outside of The Johns Hopkins University, to browse materials stored at the off-site facility at Moravia Park, independent of space and time. Expanding this concept to other library collections, eventually, patrons will be able to browse any print materials stored in off-site facilities with enhanced search and retrieval features. With this capability, libraries will be more willing to move collections into off-site facilities, thereby reducing operating costs.

While this vision represents the ultimate goal, for this phase of the project we propose a more fundamental and immediate goal: state the economic viability of the system with an economic model for evaluating library services and the proof of concept. Consequently, this initial project phase will not result in a robotic system throughout the Moravia Park facility, but rather the development of the economic framework and prototype robotic and automated components of the overall CAPM system. This process is reminiscent of integration of robotics into manufacturing industries which relied upon a research and development phase.

Hopkins and its corporate partners have made substantial long-term commitments to this project. The Johns Hopkins University has applied for a U.S. patent and the rights to apply for worldwide patent protection. Russ Taylor, Professor of Computer Science and co-investigator, has proposed an ongoing design project for students to focus on continued development of the CAPM system, and IBM has expressed strong interest in developing a student coop program. CAPM will provide opportunities for Minolta, IBM and Ameritech to further develop their hardware and software as evidenced by their contributions. Consequently, these companies have a vested interest in long-term development. Having secured the
necessary corporate commitment, Hopkins now seeks Mellon support to provide "seed" funds for the development process of what promises to be a project with international implications. [Please refer to budget documents for additional information on corporate support.]

The activity for which the library is seeking Mellon support will result in an economic framework that will ensure the viability of the system. This economic analysis will incorporate cost-benefit analysis along with other decision-making tools, an approach that will make the analysis an important tool for assessing other library services. This project will apply cost efficient, technological methods used in industry to address the primary criticism that currently limits the use of book warehouses--they separate patrons from information in library collections. By incorporating and modifying technology in book storage facilities, libraries and their patrons can benefit from the cost-effective and enhanced processes used by industry. Our efforts will result in a model with demonstrated potential for mass-production by industry (as illustrated in the level of commitment shown by IBM, Ameritech, and Minolta) and broad implementation in the field. [Refer to SUPPORT appendix for letters of support.]

Technical and Economic Feasibility Studies
The scope of work for developing the CAPM system was delineated by the results of a technical and preliminary economic feasibility study. Both studies also guided the development of appropriate partnerships within the university and with corporate partners.

The technical feasibility study team consisted of G. Sayeed Choudhury, Head of the Digital Knowledge Center at the Milton S. Eisenhower Library, Louis L. Whitcomb, Assistant Professor, Department of Mechanical Engineering, and Todd D. Kelley, Associate Provost and Librarian of the College, St. Mary's College of Maryland. [Refer to T. FEASIBILITY appendix for the complete technical feasibility study report, which represents an assessment of the state of the art 2 years ago. The technical feasibility team, however, continually
assesses available technology.]

The question that guided the technical feasibility study was: does a system similar to CAPM exist for purchase "off-the-shelf?" After a thorough investigation, it became evident that, while some of the components are available, an integrated version of CAPM is currently unavailable. Consequently, the focus shifted towards-classifying which components are available and ready for purchase, and which components will require modification. The following types of hardware and software were reviewed: item retrieval (from shelves); item delivery (to scanning stations); scanning and imaging; page turning devices; image display and manipulation; and image transmission.

Based on this study, the PS 3000 planetary scanner from Minolta Corporation was identified as the best scanning/imaging platform for the CAPM system. Consequently, the technical feasibility team approached Minolta to discuss potential collaboration. Minolta has endorsed CAPM with the delivery of four PS 3000 scanners. [Refer to Minolta letter in SUPPORT appendix.]

The technical feasibility team identified existing item retrieval/delivery systems and page turning devices. However, both types of systems require modification for integration within the CAPM system. For example, the item retrieval/delivery systems must be customized to deal with (often-fragile) books; the page turning system must work with the PS 3000 scanner. Given the types of modification that are necessary, appropriate faculty at The Johns Hopkins University were contacted. Details of the project team are provided in the following section. After the completion of a successful technical feasibility study, a preliminary economic analysis was conducted with support from the Council on Library and Information Resources.

The economic feasibility study team consisted of G. Sayeed Choudhury, Ben F. Hobbs, Professor of Geography and Environmental Engineering, and Todd D. Kelley. [Refer to E. FEASIBILITY for the complete economic feasibility study,
final and interim reports.] This team identified the benefits from implementing the CAPM system and methodologies for analyzing costs and benefits. The conclusion of this preliminary study indicated that implementing CAPM is beneficial from an economic perspective.

Further economic work will build upon the preliminary economic feasibility study. Traditional cost-benefit analyses will be utilized and incorporated with multicriteria decision making methodologies through two workshops focusing on monetizing preferences and tradeoffs associated with evaluating library services. While this economic analysis methodology will be applied ating the CAPM system, it is envisioned to result in a general evaluation tool for library services.

Project Personnel and Corporate Partners
As stated previously, the composition of the project personnel and corporate partners reflects the needs identified during the feasibility studies. [Refer to BIOS appendix for additional information on participants.] Sayeed Choudhury has played a vital role in CAPM since its inception. His background in engineering and experience with libraries has facilitated communication and collaboration between the Whiting School of Engineering and the Milton S. Eisenhower Library. He will act as Project Director and administrative head of CAPM.

Professors Russell Taylor, Louis Whitcomb and Greg Chirikjian are experts in robot systems from both a theoretical and practical perspective. Both Russ Taylor and Louis Whitcomb have extensive experience with the private sector. Greg Chirikjian will oversee the development of the item retrieval/delivery system. Russ Taylor will supervise the software development (computer code) to control the item retrieval/delivery system. Louis Whitcomb will coordinate the development of the page turning device. Each professor has been involved with CAPM from early stages and has a full understanding of the project's dimensions.

Professor Ben Hobbs participated in the economic feasibility
analysis and is an expert in dealing with "goods" without clearly defined markets (such as library services). He has extensive experience with both standard welfare economic methods and multiple criteria decision-making methodologies. He will supervise the economic analysis that will include two workshops at The Johns Hopkins University.

Jeanne Drewes, Head of Preservations at the Milton S. Eisenhower Library, will provide oversight to ensure that the CAPM system maximizes preservation benefits. For example, books will be encapsulated in boxes for ease of retrieval and delivery; Jeanne Drewes will coordinate the creation of these boxes that will include lining to protect the books. She will also ensure that any cases that are used can be mass-produced cheaply. [Refer to additional preservation information in PRESERVATION appendix.]

John Opgaard, Horizon Systems Administrator at the Milton S. Eisenhower Library, will work closely with Ameritech Library Services to ensure seamless integration of the Horizon library management system with the CAPM software. John has overseen the implementation of the Horizon system at The Johns Hopkins University and worked previously for Ameritech Library Services.

Ameritech Library Services was contacted for partnership because the Milton S. Eisenhower Library is implementing the Horizon library management system. It should be noted that Horizon is accessed through a Web-based interface, offered through the WebPAC module. The Horizon system is also Z39.50 compliant (a well-accepted information retrieval protocol). This combination of features means that CAPM will work with any Z39.50 compliant database and be accessible via standard Web browsers. Ameritech Library Services has agreed to modify their Horizon software to ensure seamless integration with the CAPM system.

Sayeed Choudhury has spoken to individuals at IBM's T.J. Watson Research Laboratories regarding the CAPM project. Watson Labs has software, currently in development, which could be useful in the CAPM system. This software will parse
through full text to create indexes and identify keywords that facilitate searching. For example, one potential output from this software is recognition of proper names. Consequently, a patron could use CAPM to not only search bibliographic information and browse items, but also to identify specific content and use full-text indexes.

IBM will further develop their document retrieval and text indexing software by using the CAPM system as a testing platform. This partnership will result in enhanced searching and browsing capabilities for users of the CAPM system. IBM has indicated an interest in integrating automated-scanning and enhanced search features into their Digital Library software suite. With this interest, the long-term commitment and viability of CAPM are strengthened. Please see attached correspondence from IBM for further details and note that this collaboration is still being discussed. Individuals from IBM's Watson Research Laboratories and Santa Teresa Laboratories will visit the Milton S. Eisenhower Library this summer to confirm specific contributions for the CAPM project.

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Work Plan

Months 1 to 3
Materials and supplies will be purchased. Engineering faculty will identify appropriate students and staff who will work on the project. Jeanne Drewes will identify different "test" books to ensure that the CAPM system can accommodate multiple varieties of books. These books will be used for the small-scale versions of the robot systems. John Opgaard will outline a specification sheet that will be submitted to Ameritech Library Services. Participants for the first workshop focusing on economic analysis will be identified.

Months 4 to 15
Small-scale prototype models of the item retrieval/delivery and page turning device will be developed. These scale versions will be demonstrated in the laboratory setting with the test books encapsulated in boxes. Software modification of the Horizon system will be implemented. The first workshop for
the economic analysis is convened. This workshop will focus on identifying appropriate benefits, costs and objectives. In addition to traditional cost-benefit analysis, other appropriate modeling procedures will be identified and implemented following the workshop.

Months 16 to 24

Books at Moravia Park will be selected for encapsulation (with due consideration to preservation issues). Based on progress, small-scale prototypes will be expanded to full-scale versions and implemented at Moravia Park. Final modifications to the WebPAC Web browser interface are created and the CAPM system is tested. The final workshop for the economic analysis is held. Preferences that were identified during the first workshop and costs extrapolated from prototype development are monetized, analyzed and presented. After a final discussion, the results will be produced in a final report.

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A Long Range Vision for Libraries

Academic libraries face increasing pressure to embrace technology, both to help colleges and universities improve their teaching capabilities and to help curb the cost of providing their services. This challenge, and the appropriateness of Hopkins to respond, is perhaps best stated by Dr. William Brody, President, The Johns Hopkins University, in his inaugural address (February 23, 1997):

"In the past, libraries have assembled collections of scholarly material—journals, books, and manuscripts—and made them available on a "just-in-case" basis. Materials filling our library at Hopkins are duplicated in thousands of other libraries, just in case a student or faculty member needs immediate access to the material.

Today, few libraries can afford to maintain such collections. So librarians on the cusp of change are looking at "just-in-time" libraries. These are facilities that will provide access to materials when you need them, using electronic access or express delivery. They will not necessarily be required to maintain that information in their own physical collection.
Such "virtual" libraries are technically possible to introduce today...One of my goals is to see this university take up the challenge of designing and implementing the library of the future. Financial pressures alone may make this effort a matter of necessity in the near future. This is just one aspect of the profound changes brought about by the information revolution."

The Johns Hopkins University is a world leader in innovative and successful research and development projects. It has a range of research and professional expertise, facilities, and information resources that is not duplicated anywhere in the world. As a result, Hopkins is in a unique position to undertake CAPM, being able to attract the corporate participation necessary for its long-range implementation and to absorb much of the high overhead costs associated with such a project.

Calling on all its resources, Hopkins promises not only to improve the efficiency with which libraries provide materials "just in time", but also to move libraries toward a "just-for-you" approach for scholars by integrating Web-based access to library holdings, real-time browsing and enhanced features such as full-text search and indexes. Such methods can improve and further economize libraries in the not-too-distant future. By undertaking CAPM, The Johns Hopkins University can make a significant and timely contribution to this vision.