

University of Maryland, Baltimore County

STRATEGIC PLAN FOR INFORMATION TECHNOLOGY

**Draft For Campus Review
April, 2000**

PREFACE

This Information Technology Strategic Plan was prepared by the IT Steering Committee during the late fall 1999 and early spring 2000 semesters. Since it was established in 1998, the IT Steering Committee has met monthly to align our IT activities with the goals of the campus and prepare a strategic plan. In doing so, the committee used the following resources for the preparation of this plan:

- The 1994-95 IT Plan developed by the ITT Initiative Task Force.
- Summary of accomplishments from the ITT initiative prepared for the President's retreat August 1997.
- The 1998-2001 Application Development Plan.
- The 1999 departmental planning documents of the Library, University Computing, and Instructional Technology.
- The Provost's 1999 Enrollment Management Report and the Report of the Continuing Education Task Force.
- Prior IT Steering Committee meetings and presentations
- Feedback obtained through individual meetings with the leadership from the various campus Divisions (Vice Presidents, Vice Provosts, Deans).

This plan builds on prior work and represents a living document, which now needs to be discussed by the appropriate campus leadership groups to develop consensus on UMBC's IT activities over the next 2-3 years. The IT Steering Committee developed this document as a draft plan to guide a broader campus discussion on the role of information technology in teaching, learning, research and administrative activities. It is intended that, through such discussion, a sense of prioritization will be developed for UMBC's IT needs, which then will inform the campus budget process.

This draft IT plan will be initially discussed at Provost's Council on April 5, 2000 and at President's Council on April 10, 2000. The feedback obtained through these discussions will then be incorporated into a revised draft to be distributed to the campus for further discussion. This plan will then be forwarded to the campus' three strategic planning task force groups for comment and submitted to the campus steering committee for review by the campus senates in AY 2000/2001. The plan will also be placed on the UMBC web site to gather broader campus input.

The challenge in developing this IT plan is that the role of IT has truly become an integral part of all aspects of university. As a result, this plan touches on a wide range of activities and campus departments. As a living document, the plan represents a mixture of activities, some of which are already funded and in progress, and others in which neither funding or resources have been allocated. Wherever, possible we have tried to note this.

It is important to note that as the IT Steering Committee was developing this document, the University System of Maryland Board of Regents requested that an IT plan for the USM be prepared by the summer of 2000. As a first step, each campus was asked to prepare an IT plan to be submitted by early April of 2000. Under such timing constraints, UMBC will submit this plan as a draft after the discussions at both Provost's and President's Councils. The submission will clearly indicate that this is an evolving plan still under full review and discussion at the campus level.

The IT Steering committee consists of the following members, each of whom represents a key constituent group on campus.

Antonio Moreira, Vice Provost, Chair IT Steering Committee
Victor Aulestia, Director - Office of Instructional Technology
Mark Behm, Vice President for Administration
Zane Berge, Chair -Technology Enhanced Learning Committee
Mike Bradley, Chair - Library Policy Committee
Mike Breton, Assistant Vice Provost, Graduate School
Panos Charlambides, Chair - College of Engineering Compute Committee
Charles Fey, Vice President for Student Affairs
John Fritz, Coordinator - Web Development
John Jeffries, Vice President – Faculty Senate and Chair, APB
Doug Kendzierski, Associate Vice Provost - Continuing Education
Gust Mitchell, Chair Faculty Senate Computer Policy Committee
Mike Morgan, Director - Budget Office
Nancy Ochsner, Director - Office of Institutional Research
George Preisinger, Special Assistant to the VP of Student Affairs
Tom Rabenhorst, Chair - Instructional Technology Committee
Roy Rada, IFSM Professor and Director of the IFSM Flexible Masters
Jack Suess, Director - University Computing Services
Tom Taylor, Chair Applications Advisory Panel, Asst. Vice Provost
Enrollment
George Vitak, Director of Communications
Clolita Williams, Asst. VP Financial Services
Larry Wilt, Director - Albin O.Kuhn Library

1. UMBC INFORMATION TECHNOLOGY VISION STATEMENT

Information technology is a critical enabler for enhancing a wide range of activities, from business services to research to new academic programs. The key to developing UMBC's IT plan is focusing on how information technology can enhance current institutional goals.

1.1. UMBC Planning Context

Program Description

UMBC offers undergraduate, master's and doctoral programs in the arts and sciences and engineering. Within a strong interdisciplinary framework, UMBC programs link the cultures of the sciences, social sciences, visual and performing arts and humanities, and the professions.

Mission

UMBC is a dynamic public research university integrating teaching, research and service to benefit the citizens of Maryland. As an Honors University, the campus offers academically talented students a strong undergraduate liberal arts foundation that prepares them for graduate and professional study, entry into the workforce, and community service and leadership. Known for its outstanding faculty and cutting-edge research, UMBC emphasizes science, engineering, information technology, human services, and public policy at the graduate level. UMBC contributes to the economic development of the State and the region through entrepreneurial initiatives, workforce training, K-16 partnerships, and technology commercialization in collaboration with public agencies and the corporate community. UMBC is dedicated to cultural and ethnic diversity, social responsibility, and lifelong learning.

Vision

An Honors University in Maryland, UMBC aspires to be one of the nation's best public research universities of its size as it combines the traditions of the liberal arts academy, the creative intensity of the research university, and the social responsibility of the public university. UMBC is known for integrating research, teaching and learning, and civic engagement so that each advances the others for the benefit of society.

1.2. Information Technology Vision

UMBC embraces liberal arts values and seeks their realization through use of appropriate technology as an integral part of its teaching, research, and

business practices. Accordingly, the campus intends to be an early adopter of technological innovations that can advance the mission of the campus. As a research university, UMBC faculty will be at the forefront of applying these technology innovations to their respective disciplines. UMBC will also improve administrative functions and customer service through the use of and access to information technology. As a result, UMBC graduates, from their exposure to such innovations on campus, will become leaders in understanding and implementing information technology in their work, home and journey as lifelong learners.

1.2.1. Overarching Goals

- Utilize IT to enhance the quality of teaching and learning, research, and administration.
- Assure all members of the UMBC community have access to IT.
- Provide appropriate training and support so the community can utilize IT.
- Adequately fund new initiatives while maintaining current level of support.
- Develop an IT planning and decision-making process that adapts quickly to rapid change and clearly delineates funding responsibilities of the university, departments and individuals (e.g., shared vs. distributed equipment renewal).
- Utilize UMBC's web site to deliver information, services and products to internal and external customers.

1.2.2. Context for IT Planning

The forces and trends listed below are the primary forces shaping our technology planning. Some of these are internally created, such as our reputation for technology, while others are externally focused, such as the Board of Regents requirements.

- UMBC's reputation for technology creates high expectations that attracts and retains students and corporate partners who hire our graduates.
- UMBC's research aspirations will require a commitment to state-of-the-art IT infrastructure.
- Developing online graduate degree programs will be necessary to increase graduate student enrollments, a key goal identified in the report of the 1999 Enrollment Management Task Force.

- Accountability to internal and external groups must be built directly into our planning as IT increases in importance and resources are allocated.
- UMBC's enrollment and research growth has led to a more complicated budget process requiring more sophisticated administrative information systems. Improved access to data will also improve administrative decision support.
- The Board of Regents has set specific requirements for campus technology and for the technological fluency of students that must be met.
- The UMBC "Assured Access to Computing" initiative will start with the freshman class entering in fall 2001.

1.3. Technology Enhanced Teaching and Learning Goals

The following teaching and learning goals should be explored and implemented as appropriate and feasible to meet the USM mandate to ensure Information Technology fluency and to enable UMBC graduates to possess technology-related skills that have been identified as important to success in employment and that will enhance lifelong learning and communication capabilities. If the campus can fully support students' access to computing, software and the Internet, faculty will be free to incorporate online resources and methods into their teaching and require students to complete assignments that entail use of these resources and methods. Appropriate applications of information technology in teaching and learning will of course vary from discipline to discipline and from course to course.

1.3.1. Teaching

- Core skills: UMBC faculty and students should be able to use computer and Internet technology and skills as appropriate in teaching and learning.

1.3.2. Student Skills

- Online Information Research, Analysis and Writing: UMBC graduates should be able to use information technology to help define research agendas and goals, identify and evaluate information sources, develop, write, and edit reports and papers, and meet other course requirements.
- Publishing/Presentation: UMBC graduates should be able to present their work through a variety of online or technology-assisted means

such as web pages, email, online forums, online portfolios and presentation software to enhance public speaking.

- **Problem Solving:** UMBC graduates should be able to bring appropriate technology to bear on the problems within their disciplines and have knowledge of technological tools relevant to their disciplines.

1.3.3. Enabling Technology

- **Technology Enhanced Learning:** UMBC will further develop its digital aids to learning so that much more of its information resources, study aids, learning media, and services are accessible by students any time, any place, via the Internet.
- **Instructional Software:** UMBC will acquire and/or develop both subject specific and general instructional software as needed and appropriate for technology-enhanced learning and especially for distance education.
- **Faculty Development:** In addition to providing basic access to computing and technical support, UMBC must support faculty in their pedagogical use of technology. Along with providing basic instructional design support, training and consulting, the university should partner with faculty to identify, evaluate and implement best practices for technology-enhanced learning.
- **Classroom Equipment:** University teaching will increasingly rely on appropriate classroom technology necessary to support faculty and students, from basic presentation equipment to fully networked Information Technology labs and classrooms.

1.4. Research Goals

UMBC research and teaching will have the highest quality information technology support so that researchers can concentrate on the content of their work rather than the mechanics of it. This support will include the following elements:

- **Telecommunications:** The UMBC campus will be fully networked and linked to off-campus telecommunications in conformity with the highest standards. UMBC will subscribe to the Internet2 standards for campus network connections; provide robust off-campus network connections; and provide wireless service where appropriate to support instruction and research goals

- **Equipment Renewal:** UMBC will continually renew equipment according to industry standards, presently a three-year cycle. This, and continual software renewal, will enable faculty and staff to take full advantage of continuing improvements in technology for their teaching, research and administrative activities.
- **High-End Applications:** To achieve our campus goal for increasing research, UMBC must also support the specialty-computing needs of key research units through provision of cutting-edge hardware and software appropriate to specific research fields. Specialized labs for such areas as language learning assistance, geography and imaging research, as well as in the sciences and engineering, must be continually developed.
- **Staffing for Technical Support:** Information technology costs include the cost of personnel to maintain equipment and software as well as to instruct faculty, staff and students in its use. UMBC will build personnel support and training for faculty, staff and students into its plans for technological innovation.
- **Publication Support:** UMBC will seek to participate in national and international efforts for publishing research online, to complement disseminating research through established publications¹.
- **Electronic Information Resources:** UMBC will enhance online access to information as a means of increasing the efficiency of research, teaching and learning.

1.5. Administrative Goals

Improving the quality and efficiency of administrative functions requires that they become fully automated and integrated. Through development of user authentication, intelligent workflow and automation of what are currently manual processes, working with UMBC administrative computer systems will become more accessible, efficient and convenient for both employees and “customers.” Some tasks will be redesigned as “user self-service” functions. Some processing and information delivery that now must be performed during business hours and in person will be offered any time, any place, over the Internet. The focus will be to eliminate the vast amount of paper forms and documents presently used on campus and to provide staff and faculty online access to the information needed to perform their work. In-turn, these web-enabled and integrated systems will help faculty and students to focus on teaching, research, and learning.

¹ See <http://www.dlib.org/dlib/december99/12harnad.html>

- Financial and Human Resource System Upgrade: UMBC will implement new software to support financial and human resource transactions, especially in terms of grants management. These systems will eliminate paper-based transactions; improve business processes through automated workflow; provide timely and accurate access to financial data; and support e-commerce.
- Student Information System (SIS): UMBC will participate in the USM partnership with Oracle to develop a new online system that will support student records, financial aid, degree audit, facilities scheduling, account receivables, continuing education, and non-credit programs. This system will be fully online and web-enabled.
- Decision Support and Data Warehousing: UMBC will develop the necessary systems to improve access to information and facilitate higher-level decision-making. These systems will provide decision makers with information across systems and will support the sophistication needed to manage a modern research university.
- Equipment Renewal: UMBC will continually renew equipment according to industry standards, presently a three-year cycle. This, and continual software renewal, will enable faculty and staff to take full advantage of continuing improvements in technology for their teaching, research and administrative activities.
- Campus Communications: UMBC's website, especially myUMBC, the campus web portal, will be further developed as the main communication resource for the campus.
- LIMS 3 (3rd Generation Library Information Management System): Through USM-wide cooperation, a new LIMS will be purchased and implemented. This system will replace the 15-year-old technology of the current system. It will have a client-server architecture that can grow with the increases in online publishing and integrated access to research and learning materials as well as services in all formats.

2. Summary of Recommended IT Actions

In 1995, UMBC made a strategic decision to invest in its network infrastructure. That decision resulted in developing a state-of-the-art network and ultimately being selected to participate in the NSF high-speed network program and Internet2. When UMBC was selected in 1997, it was the first university selected to participate that was not classified as a Carnegie R1/R2 institution. In addition, UMBC's decision to focus on network access provided *all* faculty, staff, and students with high-speed Internet access. By providing all members of the

community with access to the network, utilizing this network for information and administrative services soon took hold. As a result, UMBC has been recognized as a leader in the use of technology in many different ways (e.g. recent CASE awards, participation in Internet2 projects, and State initiatives).

Clearly, much has been achieved, yet the never-ending pace of technology innovation continues to move forward and network access alone will not be sufficient to continue to remain a leader. The unanimous recommendation of the IT Steering committee is that the university should extend its IT vision by investing in the following two overarching actions:

1. UMBC should develop a funding model to provide for a regular cycle of equipment renewal required to support instructional, research, and administrative computing initiatives; and
2. UMBC should develop a staff support model to provide the required help to transform campus use and understanding of information technology.

These priorities are highlighted in the sections below and are the two single most important recommendations of the committee.

2.1. Technology Enhanced Learning

OBJECTIVE	ACTION ITEMS
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Teaching	Core Skills
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1. Expand email communication between instructor and students.
2. Facilitate creation of email discussion lists for courses/sections and real-time chat-rooms.
3. Expand electronic reserves to additional courses and media formats.
4. Enable Web syllabi and other course information on Web, and other items similarly easy to implement.
5. Implement proposed Assured Access program for students. See the "Assured Access to Computing" draft at www.gl.umbc.edu/it/assured.pdf
6. Implement full equipment renewal program for faculty and staff.
7. Provide appropriate staffing support for faculty and students who are increasing their use of technology for teaching and learning.
8. Expand the use presentation software as appropriate.
9. Phase in more classrooms with instructional technology capability, from basic presentation equipment to full networking.

Student Skills	Online Information Research, Analysis and Writing
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10. Provide hardware, software, training and networking to support the teaching and learning of writing in an online environment.
11. Provide instruction in the use and evaluation of online information resources.
12. Develop online reference services and methods for online consultation with faculty and staff.
13. Incorporate instruction in online and computer-assisted methods for research and writing into a wide array of courses throughout the curriculum.
14. Incorporate into each field of study, as appropriate, instruction in computer and online tools relevant to the field.
15. Explore revision of UMBC graduation requirements to include knowledge of online research and writing skills, and perhaps also presentation and specialty-specific

OBJECTIVE**ACTION ITEMS**

computer skills.

16. Explore revision of UMBC graduation requirements to include knowledge of technology appropriate to the student's major.

Publishing/Presentation

17. Provide sufficient hardware, software, network capacity and consulting support to enable students to implement their publication and presentation projects while they attend UMBC.
18. Develop capability to support student graduation portfolios online, to assist students in demonstrating to employers their credentials and their computer skills.
19. Plan a mix of for-credit courses, online self-paced instruction and other stand-alone non-credit learning opportunities for all UMBC students to learn web page development, email, presentation software, computer assisted publishing and other online methods for enhancing publishing, presentation and personal expression.
20. Explore revision of UMBC graduation requirements to include these elements.

Problem Solving

21. Incorporate into each field of study, as appropriate, the teaching of the technological tools appropriate to that field.
22. Support, through specialized labs and other means, the unique hardware, software, networking, and staffing requirements for these specialized tools.
23. Explore revision of UMBC graduation requirements to include knowledge of technology appropriate to the student's specific major.

**Enabling
Technology****Technology Enhanced Learning**

24. Develop plans for remedial, non-credit opportunities for students to learn computer basics if they come to UMBC lacking basic computer skills.

OBJECTIVE	ACTION ITEMS
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	Instructional Software
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| | <ul style="list-style-type: none">25. Establish methodology for campus funding and decision-making on acquisition and support of instructional software.26. Consider, through campus-wide planning, what role Distance Education should play at UMBC and develop technological support, incentives, etc., appropriate to UMBC's eventual distance education goals. Planning to date in this area includes 1999 reports from the Enrollment Management Task Force and the Continuing Education Task Force. |
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	Faculty Development
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| | <ul style="list-style-type: none">27. Provide optional training for faculty and staff in all supported hardware and software, e.g. through the FaCT grant.28. Provide on-call technical expertise in all supported hardware and software.29. Take the lead in Technology Enhanced Learning in the Faculty Development Center.30. Develop methods to provide faculty compensation or incentives for developing technology-enhanced teaching.31. Consider, through campus-wide planning, to what extent UMBC should emphasize faculty development for distance education initiatives. |
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	Classroom Equipment
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| | <ul style="list-style-type: none">32. Develop equipment renewal program to update classroom technology, as needed. |
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2.2. Research Computing

OBJECTIVE	ACTION ITEMS
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Networking	
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| | <ul style="list-style-type: none">33. Bring every desktop up to Internet2 standards for desktop connectivity to insure that UMBC can support MPEG streaming video to every desktop on campus, which is required to support the university's online training initiative for technology enhanced learning and |
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OBJECTIVE**ACTION ITEMS**

administrative applications support.

34. Develop a central network core that can support network speeds of the highest order possible to each building and every research group.
35. Upgrade our external network connectivity to keep pace with rising demand. On average, the external internet usage doubles every 18 months and UMBC must be prepared to double the budget for external networking every 2 years to keep pace.
36. Implement wireless network connectivity in all new buildings and major public places on campus. First priority should be wireless connectivity in the Library, University Center, and ECS building.

**Equipment
Renewal**

37. UMBC should increase funding for the computer replacement initiative to guarantee that all faculty, staff, and instructional classroom computers are replaced every three years. This will require replacing 2500 desktop computers every three years, or 834 per year.
38. UMBC should investigate the feasibility of developing a leasing arrangement with a vendor that could lease computers for three years.
39. Computer replacement should be broadly extended to include at least one desktop system for each researcher. Faculty should not be expected to purchase their office computer out of research funds.
40. Linux is increasingly the desktop operating system of choice for research faculty in engineering and the sciences. UCS should develop support standards for Linux and promote its use on campus as a viable platform for researchers.

**High-end
Applications**

41. UMBC should begin development on a scalable computing cluster utilizing multiprocessor Linux servers. This environment should be extended each year to remain up-to-date.
42. UMBC should investigate creation of a peer-reviewed research panel to provide funding to researchers. In addition, UMBC should investigate working with the campus development office to identify corporate funding partnerships that might provide support to research faculty in equipping their labs. Examples of this include programs such as the Maryland Industrial Partnerships program.

OBJECTIVE**ACTION ITEMS**

43. UMBC should develop policies that allow faculty to request funding for specialized research software through DRIF.
44. UMBC should move to provide better support for Linux in faculty research labs. UCS should train all Unix system administrators in supporting Linux and should develop a "UMBC" standard for Linux.
45. UMBC should extend the Andrew File System (AFS) file services to all research faculty as a means of providing common file services across computing platforms. UCS should provide an AFS gateway to allow PC's running Windows 9x and Macintosh computers to use AFS.

**Staffing &
Technical
Support**

46. Develop automated tools for maintaining an inventory of existing equipment. Use computer replacement to eliminate equipment that falls below minimal campus standards.
47. Work with the IT Steering Committee to define support standards for the most common software and hardware configurations and promulgate them to all faculty and staff. Faculty and staff need to know what products will be supported on campus. Of course people have the right to use whatever they want; they just can't expect support.
48. UCS should work with department IT personnel to extend the Remedy helpdesk system to local department support staff. The UCS helpdesk should be the first line of support for all campus technology questions but have the ability to refer requests for support to local IT support staff.
49. The IT Steering Committee should form a subcommittee consisting of members from the Graduate School, selected research faculty, and UCS to define what the staffing needs are of research faculty. These support staff should have a dual reporting structure that reports to the Director of UCS and a local department representative (e.g. department chair, director, faculty member).
50. UCS should develop a flexible, easy to use knowledge base application modeled after Indiana University

**Electronic
Information
Resources**

51. UMBC should provide students, faculty and staff with convenient and reliable access to a comprehensive and coordinated collection of electronic information

OBJECTIVE	ACTION ITEMS
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- resources, on the campuses and off.
52. UMBC should further develop its electronic reserve or "e-reserve" services so that students can easily access all course reserve materials any time, from any place, in all media and formats: text, image, audio, or video; published or unpublished; digitized representation or original digital artifact; etc.
 53. UMBC should develop a program to assure preservation of electronic institutional records. The campus should establish retention and disposition schedules for the university's institutional databases and electronic records, and evaluate the liabilities involved in electronic record retention. Attention should be accorded to the actual digital media on which information is stored to avoid deterioration over time and obsolescence due to changes in technology.
 54. UMBC should conduct a technology security audit and implement the recommendations of this audit, with actions in areas of Information Technology Policy and Information Technology Security, as well as copyright and intellectual property.

2.3. Administration

OBJECTIVE	ACTION ITEMS
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Financial Systems

55. Develop transparent linkages among disparate systems while migrating from legacy systems still in use.
56. Deploy the procard web, which provides web access via myUMBC to procurement data and allows card holders or business managers to track and reallocate costs to different budget accounts and subcodes.
57. Deploy the finance web applications, which provides access to financial and payroll information.
58. Deploy the FRS Inventory Management component of FRS Plus 2000.
59. Deploy FRS Accounting/Procurement modules of FRS Plus 2000.
60. Purchase and install a new human resources and payroll system.
61. Install COEUS pre-award grants management system.
62. Develop or purchase a post-award grants management system.

OBJECTIVE	ACTION ITEMS
Student Information Systems	<p>63. Develop a budget management system that integrates with the FRS General Accounting System.</p> <p>64. Continue participation in and development of the new Oracle Student Information System initiative. UMBC will develop a project plan that includes all participating functional departments and concludes the implementation in the shortest time possible.</p> <p>65. Complete development of the shadow student information system, which will provide departments with better reporting tools.</p> <p>66. Finish development of the Degree Navigator degree audit system and begin beta testing in fall 2000.</p> <p>67. Begin implementation of the Exeter Admissions and Recruitment system, which will unify recruitment across credit and non-credit programs, as well as the offices of Undergraduate Admissions, Graduate Admissions, and Continuing Education.</p> <p>68. Begin implementation of the Schedule 25 suite software package to support course and facilities scheduling.</p>
Decision Support	<p>69. Purchase and deploy reporting and writing tools from Crystal Reports and Brio that will work with shadow SIS.</p> <p>70. Develop and release RFP for the implementation of a data warehouse on campus.</p> <p>71. Library Information Management Systems</p>
Equipment Renewal	<p>72. Enhance the computer replacement initiative to support a greater number of replacements. Starting FY02, UMBC should begin a program to replace all desktop computers on a three- to four-year cycle.</p>
Library Information Management System (LIMS)	<p>73. UMBC will actively participate in the USM LIMS replacement and be at the forefront of expanding library services to the campus community.</p>
Web Development	<p>74. UMBC will develop the technology infrastructure to support individualized, dynamic database access for web page development.</p> <p>75. The university should continue to develop myUMBC as a platform for learning, administration and communications.</p>

3.0 Technology Enhanced Teaching and Learning Goals

Through students having **ubiquitous access** to the Internet, as well as to computers and a rich array of software, faculty will be free to use online resources and methods in their teaching and to require students to complete assignments that entail use of information technology.

UMBC CONTEXT:

Planning efforts are underway which focus on three areas, with a task force studying each: Research, Student Life, and UMBC as an Honors University. The Honors Task Force's planning includes instructional goals and consequently overlaps with the planning articulated in this section. Coordination of this document with the Honors Task Force's results may have to be addressed after this document is due to be submitted. The "Assured Access to Computing" plan draft has been reviewed by several campus governance bodies; it is also coordinated with the current Information Technology planning. See the "Assured Access to Computing" draft at www.gl.umbc.edu/it/assured.pdf

Apart from the above planning efforts, **infusion of writing and technological proficiency** throughout the curriculum has been identified in several contexts, such as planning retreats, open forums, and feedback from graduates, as crucial to a liberal education and to the success of UMBC. This section of the Information Technology planning document anticipates key instructional goals that are technology-related, as well as the support that will be needed for those faculty and students who work toward those goals.

The **USM Board of Regents** adopted, on February 4, 2000, its "Resolution on Technological Fluency," which establishes the USM context of expectations:

Introduction:

Information technology, which has entered our lives over a relatively brief period of time allowing little educational preparation for many people, is playing an increasingly important role in the work and personal lives of citizens.

There have been impressive claims for the potential benefits of information technology and many would like to realize those benefits.

In order to meet the demands of today's world and to adapt to changes in technology, individuals must learn sufficient foundational material to enable them to acquire new skills independently after the completion of their formal education.

Fluency with informational technology requires contemporary skills, foundational concepts, and intellectual capabilities.

Technological fluency will be among the criteria upon which the world will judge the quality of the product produced by the University System of Maryland, i.e. its graduates.

It is imperative that every graduate of a USM institution be able to demonstrate technological fluency, that is, the ability in both their personal and their professional lives to use the technology available now and to adapt to the rapid and inevitable changes of the future.

Be It Resolved That:

The presidents and faculty leadership of the USM institutions shall develop institutional plans to assure that all graduates of USM institutions are information technology fluent, commensurate with the needs of the marketplace in their chosen majors and/or career choices.

Be It Further Resolved That:

The Chancellor shall report at the May 2000 meeting of the Committee on Education Policy on these institutional plans, including operational goals.

It is the intention of this section of the planning document to provide the framework for meeting this Board of Regents resolution as well as the information technology implications of the UMBC planning efforts.

3.1 UMBC OBJECTIVES FOR TEACHING AND LEARNING:

As Information Technology becomes infused throughout an increasing proportion of the curriculum, all UMBC graduates should be expected to have **technological skills which will enhance their lifelong learning and communication capabilities** and which have been identified as crucial to success in employment.

TEACHING:

- **Core skills:** UMBC faculty, staff and students should be able to use computer and internet technology and skills in teaching and learning.

Competence in basic computer skills, throughout the UMBC campus, is fundamental to achieving the more advanced goals of this

section, and is required by Board of Regents policy. Accordingly, faculty would be inhibited in their use of technology and in requiring its use by their students if they were unable to presume this core competence. For example, one would not convey important messages by email if one could not expect the recipients to be using email, regardless of how much more efficient email communication may be.

The basic hardware and software to support students' core skills should be provided through the Assured Access program. This program allows faculty to presume that students will have the hardware and software they need to apply core skills in carrying out course assignments. Then, faculty are freed to develop their use of technological enhancements within their teaching, as appropriate, without fear of being held back by students' lack of access to hardware and software. The core precepts of the Assured Access program are (1) to require students to acquire their own access to computers, if they have the means to do so; (2) to assist students in acquiring their own access to computers if their means are insufficient; (3) to provide a core set of software to which all students have access; (4) to provide workstations and software for on-campus student use, to supplement what students' provide for themselves; (5) to provide technical support, personal computers, software and classroom technology for faculty who choose to integrate technology into the curriculum; (6) to develop and enhance electronic access to administrative services.

Action Items:

1. Enable email communication between instructor and students.
2. Enable email discussion lists for courses/sections and real-time chatrooms.
3. Expand electronic reserves.
4. Enable Web syllabi and other course information on the Web, and other items similarly easy to implement.
5. Implement proposed Assured Access program for students. See the "Assured Access to Computing" draft at www.gl.umbc.edu/it/assured.pdf
6. Implement full equipment renewal program for faculty and staff.
7. Provide appropriate staffing support for faculty and students who are increasing their use of technology for teaching and learning.

8. Enable the use of presentation software as appropriate.
9. Phase in more classrooms with instructional technology capability, from basic presentation equipment to full networking.

STUDENT SKILLS:

- **Online Information Research, Analysis and Writing:** UMBC graduates should be able to use information technology to help define research agendas and goals, identify and evaluate information sources, develop, write, and edit reports and papers, and meet other course requirements.

Increasingly, online information research, computer assisted analysis and writing with word processing and spreadsheet software are becoming core skills for liberally educated people. Lifelong learning, good citizenship, employment and leadership will all depend on these skills even more over the next decade than they do now. The recent Board of Regents policy (reproduced above) recognizes this, as do students who expect to learn the best information research, analysis and writing skills during their years at UMBC.

Action Items:

10. Provide hardware, software, training and networking to support the teaching and learning of writing in an online environment.
11. Provide instruction in the use and evaluation of online information resources.
12. Develop online reference services and methods for online consultation with faculty and staff.
13. Incorporate instruction in online and computer-assisted methods for research and writing into a wide array of courses throughout the curriculum.
14. Incorporate into each field of study, as appropriate, instruction in computer and online tools relevant to the field.
15. Explore revision of UMBC graduation requirements to include knowledge of online research and writing skills, and perhaps also presentation and specialty-specific computer skills.

16. Explore revision of UMBC graduation requirements to include knowledge of technology appropriate to the student's major.

- **Publishing/Presentation:** UMBC graduates should be able to present their work through a variety of online or technology-assisted means such as web pages, email, online forums, online portfolios and presentation software to enhance public speaking.

Public speaking and writing for publication have long been included in the goals of a liberal education, and skill in these areas are expected of society's leaders. During the last decade, as we have become more accustomed to using information in audio and visual formats, presentations have increasingly depended on the use of overhead projectors and, more recently, on computer-produced graphics and audio material. Increasingly in the 21st century, computer-aided presentations will become the norm and leaders will be expected to incorporate technological aids into their presentations. Similarly, liberally educated people will be expected to be able to publish their ideas through web pages, email, and other online means. UMBC must respond to these emerging standards for communication by preparing its graduates to speak and write with the aid of information technology.

Action Items:

17. Provide sufficient hardware, software, network capacity and consulting support to enable students to implement their publication and presentation projects while they attend UMBC.

18. Develop capability to support student graduation portfolios online, to assist students in demonstrating to employers their credentials and their computer skills.

19. Plan a mix of for-credit courses, online self-paced instruction and other stand-alone non-credit learning opportunities for all UMBC students to learn web page development, email, presentation software, computer assisted publishing and other online methods for enhancing publishing, presentation and personal expression.

20. Explore revision of UMBC graduation requirements to include these elements.

- **Problem Solving:** UMBC graduates will be able to bring appropriate technology to bear on the problems within their disciplines and have knowledge of technological tools relevant to their disciplines.

Various fields and specialties taught at UMBC have embraced specialized software in carrying out their research. Examples include the use of SPSS software to manage data, software to track social work cases, and software to generate and manage bibliographies. When such software becomes important to the cutting edge of a discipline, UMBC faculty have adopted it in their own research and teaching. It is important to pass on knowledge of such specialized technological tools to students as well.

Action Items:

21. Incorporate into each field of study, as appropriate, the teaching of the technological tools appropriate to that field.
22. Support, through specialized labs and other means, the unique hardware, software, networking, and staffing requirements for these specialized tools.
23. Explore revision of UMBC graduation requirements to include knowledge of technology appropriate to the student's specific major.

ENABLING TECHNOLOGY:

These higher-level and discipline specific technological skills entail basic knowledge of computer hardware and software in general.. UMBC should seek to infuse technology broadly throughout courses required as part of our core learning experience. Potential models for the campus are the freshman composition and foreign language courses that now require students to make extensive use of basic computing.

- **Technology Enhanced Learning:** UMBC will further develop its digital aids to learning so that much more of its information resources, study aids, learning media, and services are accessible by students any time, any place.

It had been widely presumed that asynchronous learning facilitated by technology would be primarily of interest to distance education specialists. However, when such systems were actually developed, they often embraced by local students as more efficient ways to learn and to enhance their traditional classroom experiences and study. In addition, automation has greatly improved the convenience for students and faculty alike in dealing with the administrative chores associated with teaching and learning. UMBC should continue to develop technology, which promises to enhance learning.

Action Item:

24. Develop plans for remedial, non-credit opportunities for students to learn computer basics if they come to UMBC lacking basic computer skills.

- **Instructional Software:** UMBC will acquire and/or develop both subject specific and general instructional software as needed and appropriate for technology-enhanced learning and especially for distance education.

While UMBC has acquired several instructional software packages, e.g. WebCT, demand for such tools is expected to increase as faculty discover new software that offers pedagogical advantages.

Action Item:

25. Establish methodology for campus funding and decision-making on acquisition and support of instructional software.

26. Consider, through campus-wide planning, what role distance education should play at UMBC and develop technological support, incentives, etc., appropriate to UMBC's eventual distance education goals. Planning to date in this area includes 1999 reports from the Enrollment Management Task Force and the Continuing Education Task Force.

- **Faculty Development:** In addition to providing basic access to computing and technical support, UMBC must support faculty in their pedagogical use of technology. Along with providing basic instructional design support, training and consulting, the university should partner with faculty to identify, evaluate and implement best practices for technology enhanced learning.

To enable faculty members to take full advantage of the efficiencies and teaching innovations offered by information technology, UMBC will offer professional development opportunities and technical assistance for faculty and staff. Faculty demand for assistance in implementing technology has normally been greater than the campus' capacity. Faculty need for instruction in the use of specialized hardware and software is often quite individual, unique and time-constrained. Consequently, it is difficult and costly to provide.

Action Items:

27. Provide optional training for faculty and staff in all supported hardware and software, e.g. through the FaCT grant.

28. Provide on-call technical expertise in all supported hardware and software.
29. Create faculty development center.
30. Develop methods to provide faculty compensation or incentives for developing technology-enhanced teaching.
31. Consider, through campus-wide planning, to what extent UMBC should emphasize faculty development for distance education initiatives.
- **Classroom Equipment:** University teaching will increasingly rely on appropriate classroom technology necessary to support faculty and students, from basic presentation equipment to fully networked Information Technology labs and classrooms.

A plan has been drafted by Instructional Technology staff for equipping classrooms across the UMBC campus. It indicates that the campus is far from fully equipped for classroom instruction. Demand for such equipment is rising as more faculty adopt technology assisted presentation methods.

Action Item:

32. Develop equipment renewal program to update classroom technology, as needed.

4.0 Research Goals

4.1 Introduction

In 1995 the ITT Research Task Force released the UMBC's first detailed report by research faculty on their respective IT needs. The task force made the following Vision Statements:

- Establish a computer renewal process to ensure that faculty have adequate desktop computers to fully utilize the campus network and IT resources on campus.
- Establish a unified IT support structure to provide support across all aspects of IT. Provide sufficient staff to provide researchers with the support they need.
- Implement the ITT Network plan
- Designate the library as the coordinator of networked information and develop a library of UMBC generated research results for universal access on the web.
- Keep UMBC state-of-the-art in high-end workstation computing. Study the utility of a campus-wide mass storage system.
- Enhance the UMBC external network connectivity to provide robust communications to major research sponsors.
- Provide campus-wide facilities for production of high-end color hardcopy, video, and audio material for presentation of research results.

While much has been accomplished during the last five years, many of the same challenges remain. Though resources have been added to enhance research computing they have done little more than keep pace with increased demand. During this time, UMBC's faculty have continued to expand research and contract funding on campus, increasing external funding by almost 50 percent over the last five years.

4.1.1 IT as an Enabler for Research

In recent years, UMBC has made great strides in the delivery of undergraduate and graduate education and in graduate doctoral funded research consistent with its declared mission. A common thread in its advances in both undergraduate education and research has been the increased use of rapidly changing information technologies in the delivery of instruction and in conducting fundamental research at UMBC. In fact, the overwhelming majority of funded graduate research at UMBC involves the use of computers for data processing, for model implementation and testing, and for large-scale computations in Mathematics. As a result, computing is fundamental to the research function in departments such as Geography, Mathematics, Physics, Chemistry, Biology, Computer Science, Information Systems, and Engineering and as a critical tool in

the development of state-of-the-art computer animation and graphics research conducted by the faculty of the Imaging Research Center.

Much of the effort in research consists of the researcher working alone in the library, laboratory, or office, learning about and evaluating prior accomplishments, gathering and processing new evidence, and collecting and recording new conclusions that help advance knowledge. In the process of discovery, new knowledge is often recorded through peer-reviewed publications and in recent years through Internet postings as needed to establish a common pool of knowledge accessible by other researchers on campus, across the nation, and around the world. Accordingly, an important enhancement IT brings to research productivity of UMBC faculty and students is the ability to share and acquire information through electronic networks with local, national, and international research communities. In addition, through a robust network infrastructure, this gives researchers access to critical, remotely-located resources such as super-computing centers, government laboratories, and remote instrumentation.

UMBC has begun to be recognized as a regional leader in IT. This regional recognition has resulted in larger awards and more advanced requirements for IT infrastructure and support. As was noted in the 1995 ITT Research Report, faculty involved in sponsored research must produce results in an increasingly competitive environment. Information technologies are one of the few ways that UMBC can give their faculty a competitive edge. However, we cannot underestimate the importance of providing adequate technical support in achieving success. The remainder of this section discusses the major goals in detail and identifies tactical actions to achieve these goals.

4.2 Telecommunications

Vision Statement:

Telecommunications: The UMBC campus will be fully networked and linked to off-campus telecommunications in conformity with the highest academic standards. UMBC will subscribe to the Internet2 standards for campus network connections; provide robust off-campus network connections; and provide wireless service where appropriate to support instruction and research goals

The 1995 ITT Research report highlighted the importance of campus networking in the support of research. At that time we hadn't foreseen the impact of the Internet to reshape the economy and become one of the driving forces in world today. From the perspective of the researcher, the Internet is having an equally profound impact on the way that research is conducted and disseminated. Today, tools like email, the web, and Internet video conferencing are used throughout the day to collaborate with peers on research.

UMBC has made impressive improvements in its computing network over the last five years. The campus has been rewired and the network enhanced from 10Megabits and now supports multiple gigabit links to many buildings. UMBC was among the first 55 campuses awarded NSF vBNS connectivity awards and has become an active participant in Internet2. However, maintaining a state-of-the-art network requires consistent upgrades to keep pace with technology.

Pervasive or ubiquitous computing is the next major paradigm for research computing. This type of computing relies on small devices, such as a laptop computer, palm pilot, or web phone, connected to wireless data networks. This type of connectivity will allow new types of collaboration to take place.

Actions:

33. Bring every desktop up to Internet2 standards for desktop connectivity to insure that we can support of MPEG streaming video to every desktop on campus. MPEG streaming video is required to support online training initiative for technology enhanced learning and administrative applications support.
34. Develop a central network core that can support network speeds of the highest order possible to each building and every research group.
35. Upgrade UMBC's external network connectivity to keep pace with rising demand. On average, Internet usage doubles every 18 months and UMBC must be prepared to double the budget for external networking every 2 years to keep pace.
36. Implement wireless network connectivity in all new buildings and major public places on campus. First priority should be wireless connectivity in the Library, University Center, and ECS building.

4.3 Equipment Renewal

Vision Statement

Equipment Renewal: UMBC will continually renew equipment according to industry standards, presently a three-year cycle. This, and continual software renewal, will enable faculty and staff to take full advantage of continuing improvements in technology for their teaching, research and administrative activities.

As was noted in the 1995 ITT Research report, equipment renewal is critical in allowing researchers to stay up-to-date. UMBC faculty are competing against faculty from the very best institutions for sponsored research. Moore's law² has shown that CPU power doubles every 18 months. A researcher using a three-year-old computer has 1/4th the power available to a colleague using a new

² See <http://www.intel.com/intel/museum/25anniv/hof/moore.htm>

computer. If this is a six-year-old computer a researcher has 1/16th the CPU power as compared to a colleague with a new computer.

UMBC has begun to address the issue of equipment renewal through the computer replacement initiative. This initiative has provided replacement funding for almost 500 computers over the last 4 years. While this initiative has made a difference on campus it has not greatly aided researchers. Due to limited funding, priority was given to those without research funding and/or those with the most outdated computers. In that context, researchers with three-year-old computers, often outdated by research standards, are not considered "outdated" enough to warrant replacement.

Equipment renewal has ancillary benefits in addition to aiding research. Equipment renewal enhances the teaching and learning process, facilitates new administrative initiatives, and reduces support costs.

Actions:

37. UMBC should increase funding for the computer replacement initiative to guarantee that all faculty, staff, and instructional classroom computers every three years. This will require that we replace 2500 desktop computers every three years, or 834 per year.
38. UMBC should investigate the feasibility of developing a leasing arrangement with a vendor to lease computers for three years.
39. Computer replacement should be broadly extended to include at least one desktop system for each researcher. Faculty should not be expected to purchase their office computer out of research funds.
40. Linux is increasingly the desktop operating system of choice for research faculty in engineering and the sciences. UCS should develop support standards for Linux and promote it's use on campus as a viable platform for researchers.

4.4 High-End Applications

Vision Statement:

High-End Applications: To achieve the campus' goal for increasing research, UMBC must also support the specialty-computing needs of key research units through provision of cutting-edge hardware and software appropriate to specific research fields. Specialized labs for such areas as language learning assistance, geography and imaging research, as well as in the sciences and engineering, must be continually developed.

The 1995 ITT Research report noted the need to keep UMBC state-of-the-art in workstation computing. To a limited degree UMBC has done this. In 1996, UMBC upgraded its high-end computation server to a 20 processor SGI Power Challenge. This machine is used heavily by researchers, and all twenty CPU's remain busy throughout the day. This is true even though two of the largest computation users have purchased their own eight processor SGI Power Challenge systems. Given Moore's law, UMBC's twenty processor system that was state-of-art in 1996 is now 1/8th as powerful as it was then. For research faculty this represents a major loss vis-à-vis their competition for grants.

In terms of UMBC research labs, the challenge is finding a way to continue to keep these labs state of the art in the presence of declining research support for computing technology. Many research sponsors will no longer provide funding for basic research computing with a grant. It is expected that the institution will cover these costs through the overhead it charges on grants. One possible solution is to utilize Linux workstations more prevalently. Linux provides an excellent way to utilize the low-cost of Intel-based computers in a research environment.

In terms of software, UMBC has a good selection of packages that are broadly licensed for research faculty to use. This forms a very reasonable foundation for supporting faculty. What is lacking is funding for funding support of highly specialized software that may be needed by one or two faculty members for their research.

UMBC has moved to implement a campus-wide mass storage system. In 1998 UMBC brought up the campus Andrew File System (AFS) file services. AFS is the leading distributed file system used in research and now contains over 700 Gigabytes in online storage and will exceed one terabyte in the next year.

Actions:

41. UMBC should begin development of a scalable computing cluster utilizing multiprocessor Linux servers. This environment should be extended each year to remain up-to-date.
42. UMBC should investigate creation of a peer-reviewed research panel to provide funding to researchers. In addition, UMBC should investigate working with the campus development office to identify corporate funding partnerships that might provide support to research faculty in equipping their labs. Examples of this include programs such as the Maryland Industrial Partnerships program.
43. UMBC should develop policies that allow faculty to request funding for specialized research software through DRIF.

44. UMBC should move to provide better support for Linux in faculty research labs. UCS should train all Unix system administrators in supporting Linux and should develop a "UMBC" standard for Linux.
45. UMBC should extend the AFS files services to all research faculty and a means of providing common file services across computing platforms. UCS should provide an AFS gateway to allow PC's running Windows 9x and Macintosh computers to use AFS.

4.5 Staffing for Technical Support

Vision Statement:

Staffing for Technical Support: Information technology costs include the cost of personnel to maintain equipment and software as well as to instruct faculty, staff and students in its use. UMBC will build personnel support and training for faculty, staff and students into its plans for technological innovation.

Providing adequate technical support to faculty and staff is critical to the successful use of technology and achieving the potential productivity gains that are possible through IT. Dr. Polly McClure, CIO of the University of Virginia, has developed an excellent whitepaper on this issue, "*The Crisis in Information Technology Support: Has Our Current Model Reached Its Limit.*"³ Dr. McClure identified the following factors that are causing this problem as the following:

- Demands on central IT organizations are overwhelming support for these reasons:
 - More customers need more services. Now every member of the community must use IT in some fashion whereas in the past we dealt with a sub-population of the campus;
 - Per capita demand for services has increased. Faster computers and new Internet services have caused people to use computers much more than in the past.
 - New users are mainstream. In the past computing support worked closely with the subgroup of faculty that were early adopters and more willing to struggle with technology. Mainstream users just want technology to work, they don't want to invest significant time in learning about technology.
 - Multivendor, distributed technology requires high-level support. Promulgating strict campus technology standards decreases the effectiveness of faculty, especially in performing research; however, the complexity of new technology makes integrating multiple technology platforms very challenging.
 - Funding models are inappropriate. Support operates using the "library model" of providing free support, as requested. This

³ See <http://www.educause.edu/ir/library/pdf/pub3016.pdf>

model does not work well in the face of rapidly rising demand functions. The result is that support staff are stretched and service deteriorates.

- Centrally provided customer support does not scale
 - The breadth of IT services is rapidly increasing. In the early 90s computing provided a small set of well defined services, basic email, statistical and mathematical services, and some basic support of large time sharing systems. Now, new services are being developed each month, from streaming video to distributed supercomputing. Supporting all these new services is very difficult.
 - Assignment of support responsibility is ambiguous. Where departments have hired local IT support staff these staff often set up IT environments at odds with the central campus standards, complicating deployment of new applications to the campus.
 - Distributed systems need special support. A problem with a microcomputer using the network to update web pages stored on a central Unix file server could be a result of a local machine error, a network error, a software error on the Unix server, or a error in the campus file services. Training support staff to understand all these specialized services is very difficult.
 - Every machine in the institution is different. With no defined purchasing standards the campus cannot achieve economies of scale. 2500 microcomputers on UMBC we would probably yield at least 1250 distinct hardware combinations!
 - Central support units are merging. IT support units have undergone dramatic change in structure in "response" to the support crisis. This change has been to squeeze every possible efficiency out of the existing support staff. However, UMBC has implemented the simple fixes and now must address the more systemic issues.

With a definition of the problem, the remaining questions UMBC must answer as a campus are:

1. What are the elements of an ideal support environment?
2. How much support can UMBC afford to provide considering other campus priorities? What funding model should be used?
3. How should the campus fairly ration this support?

Elements of an Ideal Support Environment

To meet the challenge of providing support universities need to develop holistic approaches to support. Faculty, administrators, and IT organizations need to communicate effectively and be prepared to compromise. McClure identified four core components of the ideal support environment.

1. A whole-product approach.
 - a. Deploying robust technology solutions. Mainstream technology services should be made as robust as possible to minimize support problems.
 - b. Develop intuitive and consistent application and technology environments.
 - c. Develop and promulgate standard software solutions wherever possible.
 - d. Identify what services should be supported centrally and what services should be supported by local IT staff or within the department.
2. Develop a funding model for support.
 - a. Presently UMBC has no economic model for support. Using metrics from the Gartner Group, UMBC should have one IT support person per 50 users.⁴ For staff and faculty alone, this would require a support department of approximately 40 staff members. UCS has approximately 10 staff positions broadly defined as IT support.
 - b. Identify the true cost of computer support. The hidden cost of not funding computer support is two-fold: 1) many administrative staff or faculty get burdened with providing this support, thereby lowering their productivity elsewhere; and 2) the campus doesn't achieve the productivity increases it should expect from technology expenditures. UMBC needs to build support costs into technology acquisitions.
 - c. Associate support costs with their sources. Supporting out-dated hardware and software is very costly in terms of support. Utilizing outdated equipment in a department may provide savings for the department that would have to upgrade this equipment but it increases the complexity for UCS and indirectly increases the costs for support. In many cases, it would be more cost effective to upgrade technology (see equipment renewal) than to continue providing support for outdated equipment.
3. Focus on the needs of the customer
 - a. Provide a unified approach to problem reporting across the organization. Don't make the customer need to know whether this problem should be handled by networks, systems, local staff, or central computing staff. Use workflow software to route calls to the appropriate person.
 - b. Locate desktop support staff as close to the customer as possible. Relationship building is critical to building trust for people to try

⁴ See 1999 Campus Computing Project, <http://www.campuscomputing.net/>

- technology. The best way to do this is through departmental support people located as close to staff as possible.
- c. Use carrots not sticks. Promulgate best-practice solutions or software standards through campus-wide site licenses, focused training, and online support.
4. Use technology to automate routine support issues.
 - a. UMBC must develop detailed knowledge bases to frequently asked questions. A good example is the FAQ database at Indiana University⁵. This database provides an easy to use interface for people to get answers to their support questions.
 - b. Develop a common helpdesk solution that integrates all campus IT support personnel.
 - c. Use principles of TQM to review most frequently entered problems and come up with better solutions. In most cases, better documentation or application development can greatly reduce common problems (e.g. how do I change my password).

Actions:

46. Develop automated tools for maintaining an inventory of existing equipment. Use computer replacement to eliminate equipment that falls below minimal campus standards.
47. Work with the IT Steering Committee to define support standards for the most common software and hardware configurations and promulgate them to all faculty and staff. Faculty and staff need to know what products will be supported on campus. Of course people have the right to use whatever they want; they just can't expect support.
48. UCS should work with department IT personnel to extend the Remedy helpdesk system to local department support staff. The UCS helpdesk should be the first line of support for all campus questions but have the ability to refer requests for support to local IT support staff.
49. The IT Steering Committee should form a subcommittee consisting of members from the Graduate School, selected research faculty, and UCS to define what the staffing needs are of research faculty. These support staff should have a dual reporting structure that reports to the Director of UCS and a local department representative (e.g. department chair, director, faculty member).
50. UCS should develop a flexible, easy to use knowledge base application modeled after the Indiana University

⁵ See <http://kb.indiana.edu/>

4.6 Electronic Information Resources:

Vision Statement:

Electronic Information Resources: UMBC will enhance online access to information as a means of increasing the effectiveness and efficiency of research, teaching and learning.

Digital Library Development

Through the USM Library Information Management System (LIMS), other USM and regional cooperative efforts, and the Maryland Digital Library (MDL) the UMBC Library will pursue large-scale digital library development. Issues include:

- Selection locally held materials for digitization
- Organization & implementation of digitization efforts, including participation in larger projects
- Storage and distribution of digital collections among storage sites
- Delivery mechanisms of digital collections to users
- User authentication without disruption of scholarly processes
- Intellectual property rights management
- Design and implementation of appropriate user interfaces and intelligent agents to enable the indexing, mark-up, and maintenance of large personal collections of scholarly material
- Participation in development of a national digital library
- Selection of and funding for commercially available online information resources and balancing the acquisition of such resources with acquisitions in traditional formats
- Repositioning of human and organizational resources to support the use of scholarly material in electronic form (reference services, collection development, cataloging, bibliographic instruction, etc.).

Access to Electronic Resources

UMBC now has online access to over 700 of its paid subscriptions, over 70 indexing and abstracting resources from commercial sources, a growing collection of online reserves, and, of course, free materials over the internet. The management of this access is complex, involving multiple publishers and licensing agents, diverse license terms, and various applications and interpretations of intellectual property and copyright laws.

Actions:

51. **Development of Online Resources.** UMBC should provide students, faculty and staff with convenient and reliable access to a

comprehensive and coordinated collection of electronic information resources, on the campus and off. This should include:

- Making commercial digital resources more widely available to students, faculty and staff
- Digitizing items from existing collections (e.g. slides, audio recordings, video recordings, photographs) and from faculty files
- Promoting the creation of original digital resources (electronic journals, research papers, etc.), including audio and video materials
- Building the technology infrastructure to support the full life-cycle of digital content
- Developing library services to support the scholarly use of digital materials and networked information resources
- Assuring that online resources and services are developed consistent with the needs of distributed education initiatives
- Developing policies and agreements, and implementing technology, that will improve access to digital resources while respecting the legitimate limits dictated by concerns of intellectual property
- Integrating access to all online and traditional resources whether they are subscriptions to individual journals, full text materials contained in indexing and abstracting resources, online and traditional locally held materials, or meritorious free materials accessible through the internet.

52. **Electronic Reserves:** UMBC should further develop its electronic reserve or "e-reserve" services so that students can easily access all course reserve materials any time, from any place, in all media and formats: text, image, audio, or video; published or unpublished; digitized representation or original digital artifact; etc.

53. **Digital Archives and Electronic Records:** UMBC should develop a program to assure preservation of electronic institutional records. The campus should establish retention and disposition schedules for the University's institutional databases and electronic records, and evaluate the liabilities involved in electronic record retention. Attention should be accorded to the actual digital media on which information is stored to avoid deterioration over time and obsolescence due to changes in technology.

54. **Security, Privacy, Intellectual Property:** UMBC should conduct a technology security audit and implement the recommendations of this audit, with actions in areas of Information Technology Policy and Information Technology Security, as well as copyright and intellectual property.

5.0 Administrative Goals

5.1 Introduction

Broadly defined, administrative applications consist of the following major functional areas: enrollment management, registration and grade management, student account receivables, continuing education, financial systems (including general accounting, accounts payable, budget, and procurement), human resources, and institutional reporting and data analysis. These systems are used by every member of the campus community to transact business with the University.

This report follows on the two most recent administrative applications planning documents. The first, the 1995 ITT Administrative Plan, was led by Stan Jakubik and was part of the comprehensive campus IT planning efforts undertaken at that time. The 1995 ITT Administrative plan identified a new vision for administrative business systems, one that can be summarized as web-enabled, customer-centered, and integrated with other business systems across functional units. The second document, developed in June 1998 by the Administrative Applications Panel, was led by Tom Taylor and focused on implementing the vision identified in the 1995 ITT Administrative Plan. The 1998 Application Plan identified a number of new business systems to be purchased and implemented during the 1998 to 2001 time period.

This section of the IT Plan is an update of the 1998 Application Plan with new project timelines and some proposed enhancements identified since the original plan was developed.

5.2 Vision

The broad campus vision for information systems developed in the ITT Administrative Plan and carried forward into the 1998 Applications Panel can be summarized as follows:

- new systems must deal with information as well as data by guiding users and customers to the best solution; this requires applications that anticipate user requirements and are intuitive to use;
- access to information at the point of contact with the client must be a major priority, customers should be able to perform all aspects of their business without having to visit different offices;
- enabling technologies, such as World Wide Web and Internet, must be an integral aspect for all business systems. Through these enabling technologies we should provide customer service 24 hours a day;
- empower users and managers by providing access to easy to use decision making tools and the access to data they need to make decisions;

- decision support should be available from both transactional data sources and from a campus data warehouse that utilizes common data definitions and formats;
- stop the paper chase and eliminate the need for cash-based transactions by moving to electronic authorization and workflow for all new systems;
- application development should whenever possible utilize Oracle databases and development tools in order to realize economies of scale and to maximize the use of common tools.

5.3 Strategy

The 1998 Applications Plan began the task of selecting and implementing new administrative systems. At that time, all of our administrative applications were at least 13 years old and the campus knew that it could not meet our institutional goals with these systems. Within the context of limited funds, the application panel developed plans for implementing a number of new business systems on campus. To date UMBC has purchased the following new systems:

- FRS Plus 2000 -- general accounting, inventory, budget, and procurement;
- Exeter -- credit and non-credit admissions and recruitment for both undergraduate and graduate programs;
- Schedule 25 -- course scheduling and facilities and events management;

The major change in strategy from the 1998 Application Plan is that the campus community has reached a consensus on moving forward with a new student information system (SIS). As part of a USM partnership, UMBC is working with Oracle to develop a new SIS. The six members of the USM group are working with five other institutions across the country in developing the system's specifications. This system will replace UMBC's current student account receivable (SAR), financial aid (SAFERS), records, registration, and enrollment systems.

In addition, the campus has committed funding and is actively pursuing solutions to two other critical business functions, human resources and grants management. The one major area remaining to be addressed for funding is reporting and data warehousing.

Technical Architecture

For a number of reasons, not the least of which was cost, UMBC could not at the time of the 1998 Plan commit to purchasing a single integrated system supporting all the campus business systems. As a result, these systems will have to be linked. The major challenge is to find ways to make these separate application systems appear to be integrated. UMBC should try to accomplish this

through the use of common interface mechanisms (e.g., Netscape, WWW) and through providing improved data access (e.g., through data warehousing and end-user report tools).

From the perspective of the user or customer, the campus' web portal, myUMBC, will provide a common interface to services. The campus community should be consulted for developing specialized reporting tools, examples of which include Office 2000, Crystal Reports, and Brio.

Network access is achieved through a gigabit campus network providing the minimum Internet2 level service to all campus desktops. The campus will authenticate and authorize access through Kerberos authentication and authorization. Wherever possible, this means of authentication will be integrated into existing applications and reduce the number of accounts and passwords that people must manage.

At the server level, the campus is standardizing on Unix servers from Sun and IBM to provide database and application services. LAN services will be handled by Windows 2000 servers.

At the database level, the campus has procured the Oracle campus-wide license providing unlimited access to Oracle databases and development tools. Such access will allow users to manage and utilize data on their desktops through tools such as Microsoft Office, available as part of UMBC's Microsoft site license.

At the user level, the goal should be to integrate these separate applications systems into a coherent interface through myUMBC, giving the end-user the appearance of a fully integrated suite, even though one doesn't exist. To support data access, reporting, and analysis, we will plan a data warehouse strategy that facilitates an integrated view of campus enterprise data across applications.

Action:

- 55. Develop transparent linkages among disparate systems while migrating from legacy systems still in use.

5.4 Financial and Human Resource System Upgrade

Vision Statement:

Financial and Human Resource System Upgrade: UMBC will implement new software to support financial and human resource transactions. These systems will eliminate paper-based transactions; improve business processes through automated workflow; provide timely and accurate access to financial data; and support e-commerce.

The broad goal of upgrading UMBC's financial business systems is to provide better service to the campus while meeting USM and State requirements. Through new initiatives such as the campus Procurement card and the UMBC 1-Card, the majority of our campus business transactions are now handled in a paperless or cashless manner; however, existing business systems often don't provide the flexibility needed to move forward. The goals for new business systems would be to eliminate all paper forms (requisitions, timesheets, payroll journals, expense reimbursements, etc.) to the extent that they are not required by the State or other outside entities; eliminate lines and provide electronic access to services 24 x 7; and provide better management information for maintaining budgets, monitoring expenses, and projecting expenses.

The financial services division recognizes that these new business systems will require updated skills and basic training on these applications and the business processes underlying them. UMBC will implement a comprehensive training and development process to support the deployment of new administrative applications. This training and development process will combine traditional classroom instruction with web-based online training materials. This training will encompass both application specific training and basic technology training. UMBC will also provide web-based access to campus policies and procedures through myUMBC. This will allow faculty and staff to have immediate access to all campus policies and procedures. Associated with each policy will be online training materials describing the procedures for implementation and usage.

Below is a summary of the work being done by different departments to meet these goals.

Accounting/Procurement

UMBC is actively installing the FRS Plus 2000 system and it will be fully installed by July 2001 to support general accounting, online requisitioning, and inventory management. Inventory management will be brought online fall 2000 with the other components slated for spring 2001. Online requisitioning will be web-enabled and eliminate the need for paper requisition forms and the delays associated with processing the forms.

Associated with the FRS PLUS 2000 system but separately developed are two web-enabled applications for providing enhanced access to financial data. Procard Web provides web access through myUMBC to procurement card data and allows card holders or business managers to track and reallocate costs to different budget accounts and subcodes. This system is now in beta release by selected departments and will be made available to the broader campus by summer 2000.

The second application being developed is FinanceWeb. This application provides web-based access to financial accounting information and the ability to

download financial data into an Excel spreadsheet or Quicken for tracking expenditures. This application will begin a beta testing phase in April 2000, and be released to the full campus during summer 2000.

Grants management/accounting is an area under active investigation. As part of the UMBC planning process faculty from the Research Infrastructure Task Force have been meeting with staff from Grants Accounting, Office of Sponsored Programs, Dean of Arts and Sciences, College of Engineering, and University Computing to formulate a plan of action.

Human Resources and Payroll

UMBC has developed a RFP solicitation and is expecting vendor responses by mid-April to implement a new Human Resources and Payroll system to support human resource transactions (e.g., job search, hiring, payroll, benefits, and termination). This system will eliminate paper timesheets and provide information on payroll expenditures. This system is expected to be purchased by September 2000 and begin implementation shortly thereafter. The employee demographic component is expected to come online by summer 2001 with payroll following in the spring of 2002.

Sponsored Programs

UMBC has had tremendous success during the last decade in terms of increasing externally funded grants and contracts. The Office of Sponsored Programs is working closely with grants accounting and the campus business managers to develop specifications for a new grant management system. Plans include the implementation of a pre-award system named COEUS that was developed by M.I.T. It is one of the few systems on the market to support electronic proposal submission.

Budget

Presently the campus uses Microbud, a DOS-based application for preparing budgets that was developed by the USM in the late 1980's. This package has done a reasonable job but is showing its age. Specifically being tied to DOS makes it difficult to print out budgets and communication to and from the budget office is done via floppy disk. As part of the FRS financial systems project the campus will replace Microbud with a new budget preparation system. The budget office is working with UCS on a new system named BDS that will eliminate the need for floppy disk exchanges and give managers more opportunity to integrate budgeting and financial modeling.

Actions:

56. Deploy the ProCard web application. Procard Web provides web access through myUMBC to procurement card data and allows card holders or business managers to track and reallocate costs to different budget accounts and subcodes.
57. Deploy the FinaceWeb applications. This application provides web-based access to financial accounting information and the ability to download financial data into an Excel spreadsheet or Quicken for tracking expenditures.
58. Deploy the FRS Inventory Management component of FRS Plus 2000. Inventory management will be the first test of this new system in production.
59. Deploy the FRS Accounting and Procurement modules of FRS Plus 2000. This will provide the campus with online procurement and a vendor supported general accounting system.
60. Develop online training programs utilizing web technology (streaming video, web pages, online tutorials) so customers and staff will have up-to-date training materials whenever they need to perform some transaction. Integrate this training with myUMBC. This training will be integrated with online campus policies and implementation procedures.
61. Purchase and install a new Human Resource and Payroll system. This system is necessary to implement the new mandated automated payroll system.
62. Install COEUS system for pre-award grants accounting. This system will support electronic proposal submission to federal agencies. Integrate this system with FRS General Accounting and the grants management section.
63. Develop or purchase a post-award grants management system. This system will provide faculty and business managers with up-to-date financial and payroll information appropriate for managing grants.
64. Implement the BDS budget system to replace Microbud and integrate this with the FRS General Accounting system.

5.5 Student Information Systems

Vision Statement:

Student Information System (SIS): UMBC will participate in the USM partnership with Oracle to develop a new online system that will support student records, financial aid, degree audit, facilities scheduling, account receivables, continuing education, and non-credit programs. This system will be fully online and web-enabled.

The broad goal of upgrading our student business systems is to provide better service to the campus while meeting the needs of new degree programs such as the IFSM Flexible Masters. Through myUMBC, UMBC has provided faculty and students with better access to services provided through our SIS; however, the

current business systems don't provide the flexibility needed to improve business processes. Of particular need are new systems for financial aid, student account receivables, and more flexible course registration.

While the campus' primary focus is on the development of a new student information system (SIS) there are a number of ancillary application systems that must be implemented to work cooperatively with the new SIS system. Each of these ancillary systems supports important business functions. Ancillary applications to be implemented include the following:

- Degree audit -- Implement Degree Navigator package to provide web-based degree audit capability for students and faculty;
- Facility scheduling -- Implement Schedule 25 to provide facilities management and room scheduling for both academic courses and events;
- Admissions/recruitment -- Implement Exeter admissions package for credit and non-credit admissions and recruitment; this system will be used by both Undergraduate and Graduate Admissions and Continuing Education.

Below is a detailed description of the SIS initiative and the ancillary systems that are being developed.

The Oracle SIS project is a partnership between Oracle and six participating institutions to develop a new SIS system. The new SIS system is being developed using an Oracle database and Oracle development tools. The SIS was designed from the beginning to support online degree programs and flexible learning environments. This system will also provide greatly improved financial aid and student account receivable modules. This is an exciting project that will provide the campus with a state-of-the art system.

The functions of a student information system are so integrated with the way the campus offices perform their functions that it will take us at least three years to fully implement a new system on campus. In that interim period, UMBC must continue to improve services. Accordingly, the campus must pursue a number of initiatives that will solve problems today, or ultimately integrate into the Oracle SIS system.

One of the first such systems is the *Shadow Student Information System*. This project entails making a copy of the current SIS system mapped to the Oracle relational database system and updated in real-time as the HP production system is updated. The major benefits of this project will be to offload student web requests for read-only data from the HP administrative machines and support better reporting tools against our transactional systems. Presently, much of this work has been completed to support bringing myUMBC into production and the base SIS tables will be completed soon. UMBC should also be analyzing

the feasibility of creating a shadow of the financial aid system and the Student account receivables. Implementing the Shadow SIS will provide experience that will be of value in developing an Operational Data Store, the next step in moving to a true data warehouse.

Degree audit, one of the most pressing needs for students, faculty and staff, is currently not part of the present SIS system. UMBC has purchased the Degree Navigator software to provide degree audit and "what if" modeling capabilities to students. The system will also support key administrative functions such as graduation clearances, as well as providing key enrollment management information to support decision making in the allocation of instructional resources and the development of curriculum. This system has also been selected by Oracle to provide the degree audit capability in their SIS.

Another area of need is to provide a better admissions and recruitment system. UMBC's present SIS system contains a very minimal admissions and recruitment tracking system. This system does not integrate with existing personal computer office products for managing correspondence with prospects and does not provide the type of assistance needed for managing the recruitment of students, especially non-credit students. UMBC has purchased an admissions/recruitment system from Exeter Corporation. This system will utilize an Oracle database system and be integrated with our existing SIS for data tracking and report generation.

UMBC' current SIS does not support the scheduling of courses and maintenance of room assignments well. The campus has purchased a suite of scheduling tools--Schedule25, Resource25, and Model25--from Universal Algorithms. The major benefits of this system will be more efficient and effective scheduling of classes and improved event scheduling and support, both of which will result in better utilization of the campus' limited space. By utilizing a more sophisticated facilities database, Schedule25 can match courses with specific resource requirements to rooms that meet those specifications. The system also provides facilities utilization reporting and modeling capabilities which will support facilities planning and maintenance. Planning for the implementation has begun, with recommendations expected by summer 2000. This system has been chosen by Oracle to fulfill the facilities scheduling component of their new SIS.

Below is a summary of the work being done by different departments to meet these goals.

Enrollment Services

Enrollment services, broadly defined as admissions, advising, financial aid, and the registrar's office, has the lead role in implementing the new SIS and ancillary application systems. Tom Taylor, Vice Provost for Enrollment Services, has

assumed the responsibility of being the UMBC project coordinator for the Oracle SIS development project.

The enrollment services division recognizes that these new business systems will require updated skills and basic training on these applications. UMBC will implement a comprehensive training and development process to support the deployment of new administrative applications. This training and development process will combine traditional classroom instruction with web-based online training materials. This training will encompass both application specific training and basic technology training. By developing online training programs using web technology (streaming video, web pages, online tutorials) customers and staff will have up to date training materials whenever they need to perform some transaction. This training will be available through myUMBC.

Graduate School

One important campus goal is to increase graduate enrollments. To meet this goal in a competitive marketplace the graduate school is focused on providing outstanding customer service and developing new graduate programs that utilize the internet to provide students more flexibility in scheduling.

The graduate school is taking the lead on implementing the new SIS and ancillary systems in a manner consistent with the goals of the campus graduate programs. Of particular interest will be the implementation of the admissions/recruit system that supports the distributed model of graduate admissions and the development of the new Oracle SIS for supporting the flexibility required by online graduate degree programs.

Continuing Education

Continuing education provides credit and non-credit programs on campus, involving both undergraduate and graduate students. In general, the customers of these programs are often non-traditional students and require a great deal of flexibility in payment, admissions, and course scheduling. In addition, the present non-credit admissions system was developed in-house and has little or no integration with the current SIS.

Continuing education will be working closely on development of the admissions/recruitment system, especially in terms of non-credit programs and will take the lead role in the SIS project for non-credit programs and non-traditional students.

Institutional Research

Institutional research provides official campus enrollment information to the USM, State, and Federal agencies. Institutional Research will coordinate efforts to be sure the campus is in compliance with all reporting requirements. This will involve new web-based reporting procedures being implemented by the federal government, along with the conversion of current reporting procedures required by USM and the State.

Actions:

65. Continue participation in and development of the new Oracle SIS initiative. UMBC will develop a project implementation plan that includes all participating functional departments and concludes the implementation is the shortest time possible.
66. Complete development of the shadow student information system. This system will provide departments with better reporting tools.
67. Finish development of the Degree Navigator degree audit program and begin beta testing in fall 2000.
68. Begin implementation of the Schedule-25/Resource-25 software package to support course and facilities scheduling. This package will allow the campus to unify event scheduling and course scheduling.
69. Begin implementation of the Exeter Admissions and Recruitment system. This system will unify recruitment systems across credit and non-credit programs as well as the offices of Undergraduate Admissions, Graduate Admissions, and Continuing Education.

5.6 Decision Support, Data Warehousing, and Reporting

Vision Statement:

Decision Support: UMBC will develop the necessary systems to improve access to information and facilitate higher-level decision making. These systems will provide decision makers with information across systems and will support the sophistication needed to manage a modern research university.

UMBC will develop the necessary systems to improve access to information and facilitate higher-level decision-making. These systems will provide decision makers with information across business systems (e.g. human resources and SIS) and will support the sophistication needed to manage a modern research university. There are two initiatives planned to improve decision-making: one is better reporting against transactional systems; and the second is the development of a data warehouse. These initiatives are complementary; line managers need better tools to manager their day-to-day operations and business functions while senior managers often need to analyze data across business systems to better manage the organization.

The implementation of an Oracle-based shadow of UMBC's existing SIS coupled with better tools (e.g. Brio, Crystal Reports) for reporting will be the basis for

better reporting against our transactional systems. The campus should develop a data warehouse and data administration strategy that would incorporate proven data warehousing concepts along with relevant information from all our transaction systems. The first phase of the data warehouse project will start in the fall 2000 with the development of a RFP for vendor implementation support in building the data warehouse. The goal is to have a system in place by fall 2001.

The Office of Institutional Research will coordinate a campus team to develop an RFP for a data warehouse strategy, including the provision for on-campus training. University Computing will work with major users to develop the Shadow SIS and to choose end-user tools to help line managers access SIS data.

Actions:

70. Select, purchase and deploy report writing tools (such as Crystal Reports and Brio) that will work with the Shadow SIS system to facilitate better transactional report writing capability in end-user departments.
71. Develop and release an RFP for the implementation of a data warehouse on campus.

5.7 Equipment Renewal

Vision Statement:

Equipment Renewal: UMBC will continually renew equipment according to industry standards, presently a three-year cycle. This, and continual software renewal, will enable faculty and staff to take full advantage of continuing improvements in technology for their teaching, research and administrative activities.

By fall 2001, UMBC will have deployed a new financial system providing web-based access to financial data and procurement, shadow SIS requiring new report tools, degree audit system, facility scheduling system, admission web-based policies, data warehouse, and streaming video for online training. The result of this is that *any* faculty or staff member may find herself or himself throughout the day using a web browser for applications, streaming video for training, or specialized report writing tools such as Microsoft Excel 2000 or Crystal Reports to perform their duties. The result of this combination is that *all* faculty staff will require a computer capable of performing these assorted functions. This will require that all computers are capable of running the latest version of Netscape or Internet Explorer, Office 2000, Crystal Reports, and **the selected application** for streaming video. Using today's standard, the minimum machine capable of supporting this combination would be a 233 Mhz Pentium, with 64 megabytes of memory. By 2001 this would likely be at least a 400 Mhz Pentium with 128Mb of memory.

Action:

72. Enhance the computer replacement initiative to support a greater number of replacements. Starting with FY 2002 UMBC should begin a program to replace all desktop computers on a three to four year cycle.

5.8 Library Information Management System (LIMS)

Vision Statement:

LIMS 3 (3rd Generation Library Information Management System):

Through USM-wide cooperation, a new LIMS will be purchased and implemented. This system will replace the 15-year-old technology of the current system. It will have a client-server architecture that can grow with the increases in online publishing and integrated access to research and learning materials as well as services in all formats.

LIMS 3 will replace the current LIMS system, commonly referred to as VICTOR, with a new system that provides more flexibility and will scale with increases in demand. It will do this by replacing the current mainframe architecture of LIMS with a distributed client-server architecture. In addition, Internet and web access will be fundamental aspects of the new system.

Action:

73. UMBC will actively participate in the USM LIMS replacement and be at the forefront of expanding library services to the campus community.

5.9 UMBC Web Development

Vision Statement:

Campus Communications: myUMBC will be further developed as the main communication resource for the campus.

The Internet and especially the web have become the communication medium of choice for student recruitment, dissemination of scholarly information and course materials, performing administrative services, training material, and campus communication. Throughout this section on administrative services the web is the thread that runs through each initiative. To maximize the effectiveness of the UMBC web site the university must develop a web infrastructure that can be individualized, dynamic, and easily extended as new content is added to the site. Current plans call for extending the myUMBC portal to provide customized access to wide range of content at UMBC. To do this and maintain the university's external web presence, additional staff dedicated to web development will need to be hired.

Actions:

74. UMBC will develop the technology infrastructure for supporting dynamic database access for web page development.
75. UMBC will extend the authentication mechanism used in myUMBC to allow other campus sites to use this authentication strategy and to extend access to myUMBC to potential students and alumni.