Report of the Information Systems/Technology Task Force

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The Information Systems/Technology Task Force will create a broad based information technology development strategy for UAB that addresses as part of its response the correlative economic and management issues. The work of the Information Systems/Technology Task Force will be coordinated with the ongoing work of the Campus-wide Information Services Committee (CISC) and its sub-committees and the hospital/foundation Information Technology Advisory Group (ITAG). In this manner, duplication of effort will be minimized and the work of a regular part of the University's planning/consultative apparatus will be utilized.

UAB has evolved over its short history in intense spurts of growth which have seen different components independently develop a variety of methodologies and operational procedures for information systems in response to immediate and anticipated needs. In this period of university-wide strategic planning, it is appropriate to assume a broad perspective and consider how the university's needs and services in the area of information systems/technology can be met in the most efficient and user-friendly fashion.

Information, its management and supporting network are central to every aspect of the university, driving all of its activities. Everything we do involves the dissemination and communication of information, the development of new information, the retrievable storage of selected bits of information, and the means to call up these bits, manipulate them, draw conclusions from them and use them as a basis for continued operation. The system in place for managing this information, and how it interacts with any user group, will greatly influence how effectively this group will function and how, or whether, it will be able to carry out its objectives.

The task force has focused on visualizing an information system and uses of technology to serve a wide range of constituencies within a complex interactive environment. The implementation of such a system must involve affordable technology which is available today if it is to be of realizable value to the university. Characteristics of the system are best delineated from the point of view of various user groups.

Teaching and Learning Services and Academic Support

A high quality academic program will require an information system as an integral part of its infrastructure, making use of flexibility and expandability of data, video and voice technology to meet changing needs conveniently and in ways available to the user without regard to geographical location or method of access.

Information systems and technology will have a major impact on:

- the classroom of the near future;
- student access to computing;
- student information and student life;
- remote interactions between students, faculty and administration;
- use of the library.
The classroom of the near future will support the use of voice, data, video and multi-media presentations. It will enable the instructor to tap into the information system regardless of format or location. Classrooms will be equipped with video/data projection systems or LCD panels.

Mere will also be facilities providing individual workstations and support for laboratory and interactive activities, as well as access to the system from portable (notebook) computers, both in scheduled class periods and at random times available to students. This is particularly important in view of the core curriculum academic computing requirement.

The system will supplement printed materials by providing ready single-point access to information about the university, available services, student records and student life, calendars of events, class schedules, registration and a variety of other items. In the long term, these components of the system will migrate toward a common user interface. For example, a student will be able to review his or her transcript, e-mail an advisor for suggestions about courses, call up a schedule, register for courses, identify study and support groups, and pay tuition and fees.

The libraries will continue as a major information resource for the academic programs. This resource will be available through a common user interface, built on national standards for database maintenance and data transfer and readily available to the user community independent of platform, software or location. The library must be able to interface with national networks to avoid isolation from information resources.

**Academic/Administrative Information Management**

Academic/administrative information systems (including management of financial, human resources, and other kinds of information) support the management needs of departments, schools, centers, and other organizational units within UAB, as well as overall institutional needs. The system will have the following characteristics and objectives:

- single point of storage and single time entry and quality control for any given item of information;
- One common user interface for all transactions;
- minimal dependence on paper;
- digital storage of document images;
- elimination of redundancy.

Single point of storage will apply regardless of where or how a point of information enters the system. The user will have ready access to data that is clearly defined, appropriately timed, consistent, and integrated across functional boundaries. This will reduce storage costs and redundancy of data entry, and will improve information quality control. It will also require the development and documentation of an information warehouse/repository of current and historical administrative/management information, crossing functional boundaries of administrative units. Retrieval and analysis will use commercially available access and analysis tools and require
minimal training. Security will restrict access to end-users on a "need to know" basis.

One common user interface for all transactions (such as purchasing, accounting, budgeting, expense/travel reimbursement, maintenance requests, hiring, and student registration) will provide users with entry and access to various elements of the system.

Minimal dependence on paper, both in originating transactions and in the flow of documents for communication and signature approvals, will effect a savings in time, cost and efficiency. Currently paper is purchased, stored, distributed, used for transactions, copied, transmitted, copies stored, recopied and sent further along the chain, eventually to be shredded and removed, an inefficient and costly process with questionable value added at each step. Transactions will originate through on-line forms filled out by the end-user (for example, a registering student, a job applicant, or a secretary ordering supplies). Documents not affecting data items in the information warehouse will be scanned into the system one time. Forms or documents will be routed electronically between individuals for communications and signature. General mailings (for example, meeting and policy announcements and the UAB Reporter) will be electronic, using whatever communication technology (such as e-mail, news server, or Web server) is suitable.

Digital storage of document images will reduce the number of paper files and multiple paper copies made throughout by multiple recipients. Digital images of documents will be stored one place and indexed sufficiently that any authorized person can retrieve the document on a need to know basis. Documents not affecting data items in the information warehouse should be scanned into the information system one time. Systems must be designed to automatically store and index every document needed for historical or legal records.

Finally, a primary objective of an information system should be the elimination of redundancy, which is created by the need of autonomous units for information. The redundancies currently seen in duplications in data entry, quality controls, information storage by multiple recipients of documents, and management and training of multiple information technology support services, will be eliminated by a well designed and centrally managed information system.

Research

The demands placed upon information systems for use in research are often quite different from those originating from administrative and teaching applications. Frequently the computing needs of a research laboratory can be met only at the individual level by specialized computing tools and datasets pertaining only to that unit’s work.

Beyond these individualized systems, many UAB research personnel utilize related information systems used by other laboratories, either on campus or elsewhere. Such use generally involves three components:

- access to large and expanding datasets providing a base of information;
- software and support to extract data into various formats for specialized kinds of analysis;
• technical expertise to carry out this analysis.

An example is provided by the human genome project, which began with a dataset of genomic sequence information accumulated over many years from many different research groups. The dataset is now growing exponentially. A researcher who has isolated a new gene may want to know if there are related genes in the genomic sequence database. There are software tools that will search the complete database looking for similar, but not necessarily identical sequence patterns that may be present. This task requires definition of what constitutes similarity, how much similarity must be present to allow inferences of common function, and what types of statistical measures can be applied to aid in these decisions. Finally, once the appropriate dataset has been extracted, analytical tools must be available to derive from it the information of interest to the research team. A research team will usually need support in selecting and applying such tools.

This use of information systems frequently transcends department and school boundaries, and meeting these needs in a cost efficient manner will require higher level coordination to provide centralized access to shared resources along with the technical expertise to support these resources. A central mechanism is needed to fund and support such information sources.

Clinical/Patient Care, Member Records

The hospital and Health Services Foundation have completed an eight month planning process to address the future needs of clinicians. The plan defines an architecture for the future as well as a project plan for the next three years.

It is the view of this task force that an information system suited to meeting clinical/patient care needs will serve different needs and be developed independently from an information system used for administration, teaching and research at the university. However, clinical information or important research databases generated within the patient/patient care system may be of use and interest to other research groups on campus. There should therefore be provision for legitimate research interests to access portions of data warehouses in both systems.

In addition to examining the needs of user groups, the task force considered the issues of networking/communications infrastructure and user support services.

Networking/Communications Infrastructure

Improvements in the handling of information require a reliable and capable networking infrastructure, including wires, switches, computers and other hardware, communication protocols and software, network applications (e-mail, World Wide Web servers), management and end user support.

Currently, information systems at UAB are decentralized. This encourages freedom in intellectual development, but results in a proliferation of different technical solutions to common
problems. There are, for example, several e-mail systems on campus, with no standard for assigning or accessing e-mail addresses.

Generally, the current network meets the access and bandwidth needs of most information systems, except for video. Even now, however, improvements are needed to reduce the growing contention for limited network capacity. The networking infrastructure has to provide adequate bandwidth, reliability and availability to meet the demands of the administrative, educational and research environment, while operating with standard wiring, communications protocols and software and maintenance procedures.

UAB faculty, staff and students will have increased need to duplicate their high speed data and voice messaging capabilities away from campus, for example, at home. Telecommuting requires integrated messaging and high speed digital telecommunications to shared files quickly between campus computers and computers at other sites. In like manner, there should be access to information sites around the world from campus or home. Students should have an easy means to electronically access the library, instructors and advisors, registration processes and other on-campus resources from home or while on campus. Document sharing should be straightforward whether on the campus network or elsewhere.

**User Support Services**

The use of information systems and technology is contingent upon the availability of support services, several aspects of which should be emphasized.

- All computer purchases must include planning for software installation and setup, Internet hardware and software connection, user training, on-going problem solving, reliable security, backup and disaster recovery, and budgeting for upgrades and replacements.

For an organization to receive full value from investments in computing hardware and set-ups, adequate support must be provided. Studies estimate that support services may run six times the cost of computer hardware. Campus organizations, such as Data Information Systems, provide central Communications/Network Support and Health the support for the overall network users and their staffs, but are not adequate to serving needs of individual users of the system.

- A tiered model providing technical support to each desktop is needed, but is currently unavailable.

A tiered model would feature several levels of technical support distributed around campus to meet software and hardware support needs. Some of the larger units have hired their own network managers to provide second tier support, and in academic departments faculty and graduate students often serve this need. However, significant numbers of users have no such second-tier support. Support for such network managers should include training regarding current standards and other technical issues. Guidelines should be made available to units
regarding what kinds of personnel to recruit for network management.

- A tiered model of training in computer literacy is required.

  Faculty and managers are increasingly preparing their own reports and papers, but they need assistance in formatting information for presentation, grant applications and publications. One layer of specific computer skills must be identified as prerequisites for employment in designated staff positions, and another layer identified to be included in personnel training.

- A standard level of support for students should be designated and appropriate support made available.

  Student access to information in the system will require that that students have access to computers and the support needed to use them, including the ability to dial into the system from without, and to plug in portable computers.

- A new group of information professionals is needed at the institutional level.

  Use of large datasets, such as clinical information from patient care activities, or important research databases, often transcend the bounds of any department or unit. The analysis and use of information will require a new group of staff professionals who are expert in data sets and definitions, survey techniques, data manipulation tools, conceptual formulation, statistical inference and presentation media. Investigators provide the expertise in their disciplines for the interpretation of research information, as well as the protocols for acquiring the data, but are not expected to become experts in the tools for building and analyzing subsets of information from the repositories.

**Recommendations**

Recommendations are offered in the areas of standards, access, support and training, instruction/teaching, and dissemination of information. End user groups should be an integral part of policy development in those areas in which the need for policies has been identified.

### Standards

- **Write and distribute a development and maintenance plan, including provision for a networking infrastructure to provide higher performance capability where needed.** The plan should include the definition of the information system and its component parts; determine the costs associated with the utility and a proposed methodology for funding; establish campus standards for network wiring and communication protocols, as well as standards for product support from the core facility; establish a clearing house for network expertise; and allow for growth of devices and in the amount of information traversing the network, as well as bandwidth capacity.

- **Develop standards for information storage and exchange,** including the Following core technologies: central database/repository (nomenclature and characteristics of data elements), research databases, communications technologies (wiring, protocols, electronic mail, directory services), front-end tools (graphical interface, data access and analysis, word processing, e-mail (including mailing of formatted documents), FAX and printing),
workstation platforms (primarily determining which operating systems will be supported), financial management packages, and document transmission and storage. Needs of both

- front end user departments and central administration should be recognized, and a balance drawn between standardization and the freedom of units to purchase their own preferred equipment and software. Adopted standards should take cognizance of accepted national and international standards.

- **Develop a policy for use of the World Wide Web**, recognizing that publication quality, appearance and legality are at stake. An institutional web home page should be developed with the realization that this will be an official publication accessed by potentially millions of readers.

- **Develop and evaluate a common user interface for UAB transaction processing systems.** All transactions (such as purchasing, accounting, budgeting, payroll, ordering supplies, maintenance requests, and student registration) should use a common, intuitive and friendly interface. This interface should be windows-based, graphical with color, and employ a pointing device. It should support encryption for security, provide contextual help and support legal electronic signature. The interface should be the same regardless of whether one is processing on or off campus, or in a PC, Macintosh or Unix platform.

- **Implement a common user interface through the libraries to as many information sources as possible,** utilizing approaches that encourage wide use of the library resource. Partnerships with other institutions should be pursued to share costs for information resources and their development over the largest population base possible.

- **Increase the priority of the current administrative document imaging study in Purchasing, Human Resources and Financial Aid.** The study should produce document storage and indexing standards and a model imaging system whose use can be expanded university-wide.

- **Develop a policy for connecting devices to the voice, data and video network,** in order to ensure the system’s reliability as well as growth. The policy should specify a minimum level of the components necessary for network monitoring and management, and include the enforcement of wiring standards, a means of review, the use of wiring closets and the security of the equipment contained within.

**Access**

- **Make available to authorized persons the means to access all information sources on local computers.** Users should be able to log into a common server that will obtain a menu of information sources and analysis tools from which to choose.

- **Develop an administrative/management information warehouse.** There is a need for a centrally maintained warehouse of data consisting of current and historical information that crosses departmental and central administrative boundaries and meets the needs of all end users. The process of defining the information warehouse should include identification of all sources of useable information, determination of the uses of the data, definition of the data structures and determining the storage location of the data. Before implementation begins, a reasonably complete data model should be developed and documented, considering campus-
wide
needs for the information. The data model should be self-explanatory, and intelligent query tools should be provided. Security standards need to be established to provide access to end users on a "need to know" basis.

- **Provide coordinated, centralized access to shared resources and the technical expertise to support these resources.**

- **Undertake a pilot project to address the operational, managerial, and strategic needs of various units.** Identify a standard data model and user views for units throughout the university, determine common interfaces to existing administrative systems, and identify platforms for development. Using a unit-centered development approach, produce a prototype from the data model that includes department functionality, makes electronic administrative processes more intuitive and friendly, eliminates much of the current double-keying and reconciliation effort, and provides an accessible warehouse of current and historical administrative and management information. Field test the prototype, assess its impact on university resources, and develop policies and procedures for its use.

- **Incorporate the characteristics of the academic/administrative management vision into rewriting the student information system.** Redesign the department and institutional processing and flow of student information and develop an information system which is consistent with combined needs. The new system should have a single point of storage and single time entry and quality control for given items of information. A common user interface should be used for all transactions (such as application for admission and course scheduling). Documents should be transferred and stored electronically.

- **For the short term, increase the number of modems available to dial-in users.** Both for short and long term, student needs include general access to network connected PC labs and learning centers with dial-in capabilities. For the longer term, UAB must determine whether the responsibility for remote access lies within the university, through partnerships with vendors, or through commercial Internet providers.

- **Connect the clinical/patient care system to the overall university system to allow for cooperation in research activities.** This assumes that UAB will maintain its clinical/patient care system separately from the university administration, academic and research system due to business arrangements that must be entered into. A review should be undertaken to define the nature of the separation and connection of these components.

- **Provide for** UAB faculty, students and staff to duplicate high speed data and voice messaging capabilities at off campus sites. Users should have an easy means to electronically access the library, instructors, registration, and other on-campus resources. Document sharing should be straightforward independent of geographic location.
**Support and Training**

- **Provide support staff** with the necessary expertise to assist in using information systems. Interaction should be possible via electronic mail or scheduling electronic or personal meetings with appropriate staff. The university must design a solution for providing computer services support to every desktop. Some possibilities include: sharing personnel across units, an independent internal "consulting" office, or hiring additional staff and recovering costs through billing for services.

- **Make leading edge technology available on an as needed basis.** There will be tiered levels of need and there should be tiered levels of technology support. Technology should cascade down from areas that continually require leading edge equipment and services to units where needs are not as demanding.

- **Determine how to provide support to network users and have the infrastructure in place for higher performance capability where needed.** Currently the needs of certain image intensive applications must be met through construction of special pathways for information transmission. As technology matures to support new ways to do research and manage information, the electronics for higher bandwidth should extend to the individual workstation.

- **Identify and evaluate information needs for multi-user applicability, as a first step toward providing a shared research-related information support structure.** Most of these information sources are already available in some form on campus, but may not be supported, or may not be available except to a small group. One means of identifying such needs would be to survey each unit. Another method would be through establishing a peer-reviewed funding mechanism where funding proposals related to research information sources would be received and evaluated using appropriate criteria. In addition to identifying important research-related information resources for funding purposes, such a process will also provide a listing of all such information resources on campus. This listing can be compiled into an electronic catalog that should be available on a campus World Wide Web server and provide all information needed to access the data.

- **Recognize a minimum level of computer literacy throughout the institution as a short-term goal.** This will involve identification of computer skills required in all office positions and establishment of corresponding job descriptions and training programs.

- **Organize and identify a new group of staff professionals** who are expert in UAB data sets and definitions, survey techniques, data manipulation tools, conceptual formulation, statistical inference, and presentation media.

**Instruction/Teaching**

- **Construct electronic classrooms.** Initiate pilot projects to determine optimum configurations and locations and then put the classrooms in place.

- **Provide support in the use of electronic classrooms,** including the development of innovative modes of instruction of utilizing technology.

- **Evaluate and review the definition of academic computing.** A plan must be established to
provide multipurpose use of technology to support curriculum requirements, computer literacy and advanced course work and student research.

**Dissemination of Information**

- **Develop a catalog of information systems on campus** (research, administrative, or other), enabling UAB students, faculty and staff to obtain a listing of all such sources of information on a campus World Wide Web page that indexes these resources and gives appropriate contact information.
- **Develop a directory, available through the system, of telephone, e-mail and FAX number**

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**Expected Outcomes – A Vision for the Future**

In keeping with the belief that the end user is the object of primary interest in utilizing technology and designing an information system and the requisite network and support infrastructure, expected outcomes are best seen in terms of increased user capability. The following are typical scenarios.

- A student is about to begin a term. With help from support staff, she uses the system to contact her advisor and have questions answered, then calls up the latest schedule of courses, registers, and pays tuition and fees. Next she accesses a bulletin board of student activities and events and sends messages to some friends. Two weeks into the term she would like to meet with other students to discuss electromagnetic fields, and posts a notice on an electronic student bulletin board. She finds others who share this need and a study/support group forms. She uses e-mail to keep in touch with her brother in another state. Toward the end of the term she is engaged in a joint project with four other students, culminating in a paper. She and her collaborators are able to exchange versions in the form of formatted documents with bold, underlined and italicized text, titles, page numbers, and other format elements.

- An engineering professor is lecturing on stress on girders in bridge construction. Students find correlations between curvature of the girder and support capability a little dry. Finally a student wonders how parabolic arches with different foci might function as supports in a suspension bridge. The professor uses the terminal in the front of the room to key in a computational CAD-CAM program and try different shapes of support, estimating the stress of each proposed design. With a little trial and error the class finds an optimal supporting shape among parabolic supports. Students leave feeling that they discovered something interesting.

- In the adjoining classroom, a professor of art history is asked whether Leonardo himself was the model for the Mona Lisa, as recent computer simulations have suggested. The instructor calls up a display of the Mona Lisa and superimposes an image of Leonardo on file in the library database. The students experiment with rearrangements of some features (shape and trim of the eyebrows, expression of the lips, and so on). Students remain after the class period to continue debating the question.
A research scientist needs some specialized data for her work. She e-mails colleagues on campus and in several other institutions and learns of a relevant database. After some further communication she obtains permission to import parts of it. With help from support services in accessing the information, she soon has the data merged into her own database. As the analysis of the data reveals directions for further work and collaborations, she returns to her office and calls up information on funding agencies and forms, preparing a proposal which is transmitted electronically through the approval chain.

The chemistry department is making its annual order for chemicals. The stockroom manager calls up an inventory of chemicals on hand, compares it with use from the previous year, fills out an electronic order and transmits it through the system.

A department wants to hire an assistant professor. A position description is transmitted electronically to the appropriate journals, and soon applications are accumulated in the designated file repository in the department. The hiring committee conducts a first screening, communicates with ten candidates by e-mail and eventually invites five to the campus for interviews. After an offer is made and accepted by telephone, the necessary forms are transmitted through the system and a letter of offer generated and sent to the prospective faculty member. Upon receipt of an acceptance, the chairman's assistant keys the requisite forms into the system.

An administrative assistant is asked to provide an update on the department’s finances. He scans the university financial management system for expenditures from the department budget and various grant accounts, determines income from indirect cost recoveries and gifts, and transmits a report to the chairman.

A recent college graduate in Colorado is interested in finding a graduate program to study how the brain works. He uses the World Wide Web to search for candidate schools and discovers that UAB has an interdisciplinary neuroscience program, as well as a bioengineering program in brain imaging. He reads the UAB web page describing the programs, sees pictures of some faculty and learns of their research interests. Additional web pages give selected research papers and show pictures of laboratory facilities. The prospective student is also provided with information about the city of Birmingham and shown pictures of the campus and the Southside area. Impressed, he fills in an electronic form requisition application forms, and uses e-mail to arrange a visit to the departments.

A faculty member has been awarded a research grant. As soon as the funds are available, he is able to track expenditures for equipment, supplies and personnel and compare actual spending against the grant budget. All of the transactions, including standard requisitions, local purchase orders, bookstore purchases, library xerox charges, salary encumbrances, Photography and Graphics orders, and travel reimbursements, are typed once and show up automatically in the grant summary and bottom line reports.

Strategic Questions

1. Who is responsible for a university-wide information system? Who sets its objectives, decides whether those objectives are being met, writes policies, and pays for support services and infrastructure?
2. Is UAB ready for, and does it wish to have, a reduced paper environment?
3. Is collaboration important for the future of UAB? This raises issues such as access, standards, support, teleconferencing and imaging.
4. Is it important to overcome the barriers of physical distance? This impacts such issues as access, distance learning and medical care enhanced at a distance.