College of Engineering

Vision Plan for Information Technology

2000-2001

College of Engineering Computer Committee

ASE/EM: Schutz, Robert (Chair)
CE: Wood, Sharon
ChE: Qin, Joe
ECE: Ghosh, Joydeep
ME: Crawford, Richard H.
PGE: Sepehrnoori, Kamy

Dir. I/T: Gloyd, Bob

Edgar, Thomas F. (ex-officio)
Armstrong, Neal E. (ex-officio)

Members of the Engineering Technical Advisory Group (ETAG) also attend the committee meetings.

Table of Contents

Executive Summary 4
College vision, goals and objectives, recent progress towards realizing goals 5
Facilities, staffing and other infrastructure 6
Academic Thrust Projects for College of Engineering I/T Vision Plan 2000-2001 7
Academic Thrust Projects for College of Engineering I/T Vision Plan 2000-2001 (cont.) 8
Academic Thrust Projects for College of Engineering I/T Vision Plan 2000-2001 (cont.) 9
Administrative Project Listing for College of Engineering I/T Vision Plan 2000-2001 10
Research Project Listing for College of Engineering I/T Vision Plan 2000-2001 10
Academic Project Listing for College of Engineering I/T Vision Plan 2000-2001 11

College I/T funding overview and life cycle methodology 16
Appendices 18
1. Total I/T expenditures report for 1998-99 18
2a. Networking Status 19
2b. Technology Classroom Inventory 21

Executive Summary

A matured vision and experience with distributed learning initiatives are the focal point and impetus for this year's College of Engineering Vision Plan for Information Technology. The insight generated by acknowledging the roles of Information Technology (I/T) to enable Life Long Learning through conventional academic curriculum, continuing education, and K-14 outreach have been invaluable in working toward developing an infrastructure that also aptly supports research and administrative operations and facilitates corporate relationships.

Empirical understanding of the role of I/T in each of these venues is helping us to determine an optimal future and to align progress toward these goals purposefully with a Total Cost of Ownership (TCO) mindset. The Laptops for Learning Initiative, a voluntary laptop computer purchase program promoted through the College of Engineering, is but one of the tactics used to implement the spectrum of I/T computing solutions which range from enabling distance education to providing a robust set of application, instructional, web and file services.

Recent I/T efforts such as the campus license for National Instruments LabVIEW, multi-college AutoCAD license, UT System Microsoft licensing agreement, the Multimedia Enhancement Task Force (METF), Y2K readiness and the Network Master Plan committee are greatly appreciated as they tangibly contribute to and align with College priorities. University service organizations such as the Center for Instructional Technologies (CIT) contribute needed guidance, collaboration, and training in support of faculty teaching in partnership with the College of Engineering's Instructional Media Lab (IML). Documents such as the "Information Technology and the Future of the University" prepared for the SACS accreditation provide far-reaching and insightful perspective for internal strategic planning. Groundbreaking forums, such as the Technology Dean's Working Group, have acted as a catalyst to identify key issues and forge I/T futures. These collective efforts provide an invaluable virtual infrastructure that sustains the front-line I/T efforts pursued from within the Engineering College.

The College of Engineering Vision Plan for Information Technology reflects, in the attached table, the priority projects desired for funding as a result of internal strategic planning and alignment with the University vision. The individual entries relate total budget requests and relevance to the overall mission along with numerous fundamental campus issues that should be addressed through collective efforts to fully implement the UT vision recommendations. As available, College funding will be committed to fulfilling the depicted projects. Alternate funding sources will be aggressively pursued to supplement the fee-based revenue and further progress toward achieving the identified goals. Any funding which ITAC could provide toward this objective will be greatly appreciated, and it is hoped that at least the top priorities will be adequately funded.

College vision, goals and objectives, recent progress towards realizing goals

The College of Engineering Strategic Plan for 1998 is published on the web at the URL: http://www.engr.utexas.edu/research/strategic_plan/ and should be considered the definitive document defining the overarching mission of the Engineering College in relation to the University's mission. The Strategic Plan relates our core purpose, values, and our Vision, as well as specific goals, strategies, and actions for implementing objectives.

The underlying objective of information technology is to support this Strategic Plan and, by the nature of the implementation, increase the value of the information to the enterprise and it's constituency. This year's Vision Plan strives to take a fresh, hard look at the contribution of I/T toward our fundamental objectives and to discern the processes and projects that need to be implemented to fulfill the Vision. Although this document serves only as a summary of these efforts**,** as nominally applicable to the academic mission, painstaking efforts have gone into assessing the I/T status quo and envisioning a future system whereby academic, research and business processes will be optimized through the effective use of information technology. The proposed discrete projects depict a transition process to leverage existing resources toward the envisioned future.

Forthright acknowledgment should be made that this is a dynamic process, constantly attempting to correlate an ever-changing reality with a living, fluid Strategic Plan. This admonition is not made to remove accountability, but rather to convey the purposeful design that the implementation details of the vision plan must be nimble and able to rapidly respond to the evolving requirements of the Vision. Thus, this vision plan has a built-in flexibility that allows for the investigation and, if appropriate, implementation of emerging technologies.

The experiential assumption is that we are not making optimum use of information technology within the College. The ad hoc and reactive heritage of I/T acquisitions has reflected a best-efforts mentality by the individual units and has inadvertently created a managed chaos environment whereby even seemingly trivial tasks may be complex and inordinately expensive from a labor requirement perspective. The goal is to evolve the use of I/T as an enterprise resource by assimilating industry best-practices and aligning these resources with enterprise objectives. A Total Cost of Ownership (TCO) model acknowledging the life-cycle cost for I/T will be applied to optimize the return of investment (ROI) for I/T expenditures. Cost-recovery models based upon service requirements and alternative-funding efforts can be provided as necessary.

Enterprise System Management (ESM) mechanisms comprise the main hope we have of affordably and effectively managing our information technology resources. Sustaining the capability for every person within the organization to access properly installed, configured, patched, secured, and maintained applications throughout the enterprise is essential. This necessitates mechanisms and an environment whereby this objective can be reasonably accomplished. Although this objective will not be overtly represented in the proposed projects, it is important to acknowledge the foundation upon which these projects are architected to ensure consistency and success.

Progress toward the envisioned future has historically been undesirably erratic due to the distributed and autonomous heritage of I/T support and funding structures, but progress within the past year has been remarkable due to common visions and commitment of our corporate relations group to help us leverage industry philanthropy. This is a direct result of the efforts being made to acknowledge the strengths of the existing diversity, develop new partnerships, and nurture cooperation through a best-practices focus to improve services and alleviate redundancies. These efforts are further illustrated in the Life Cycle Methodology section. Priority projects have focused on enhancing the ability to integrate multimedia capabilities and web-based materials into the curriculum, establish TEAM centers and forge ahead with Enterprise Systems Management plans.

Facilities, staffing and other infrastructure

Academic computing support within the College is in large part supported directly from within the six departmental Learning Resource Centers (LRCs). Each department caters to its engineering niche and discipline-

specific curriculum needs. Each LRC is independently managed within the department and determines the level and availability of services it will offer to students and faculty through departmental advisory committees and the support staff capabilities. LRCs attempt to offer an approximately 11-to-1, student-to-computer ratio with a mix of Windows, Mac, and UNIX operating systems within their facilities. The specifics of each LRC are published on their respective Web pages. Physical space for the individual LRC operations typically have been carved directly out of classroom or departmental lab space in direct competition with these missions. Remodeling challenges are often inadequate, costly, and interminably slow.

I/T support of research is highly variable. Research centers that can afford their own I/T personnel generally hire their own staff, spread them too thin, and seek to outsource for expanding or unanticipated service needs. Too often they may hobble together networks, operating systems, and applications for which there is little or no campus knowledge-base, then their overworked staff get better offers from industry and leave. Smaller research projects typically rely upon graduate students who become amateur system administrators developing useable and employable skills yet detracting from their prime objectives, then graduate, as students do, leaving behind a system that others seldom understand. The other students typically use it until something fails, and then they will pursue LRC staff to help them get it fixed. The LRC staff will typically attempt to help, over-investing time, and detracting from other duties to update multiple versions of the operating system and patch numerous applications, then they may operate satisfactorily for awhile. Unsponsored research generally occurs directly in the LRCs or on PCs tucked away in labs, student offices, or increasingly on student-owned laptops.

Administrative support consists of administrative and LRC staff, many of who are assigned part-time to support I/T and hence cannot fully provide the support desired of them. Things still get done, due to hard working and dedicated people. Efforts this past year have attempted to identify key administrative concerns and goals are identified in the projects section.

The networking infrastructure could best be described as "precarious". Although the departmental and campus staff have done a remarkable job of implementing and maintaining the network infrastructure thus far, the predicted demands upon the system to carry data, video, and voice will bring the system, along with our enterprise productivity, to its knees unless purposeful steps are taken and funding is provided to address these future bandwidth requirements. Some departments have even been able to implement gigabit infrastructures for their buildings, but the current emphasis on distributed learning may overload ailing network infrastructures. The current feast/famine/scrounge network sustenance process must be replaced by a funding model and implementation plan encompassing the spectrum from the desktops of distributed learners and distributed campus constituents, to building infrastructures, campus backbones, and hearty pipes to the World. Specifics of the network progress and challenges are related in Appendix 2a, report on the network status.

Finally, ACITS, ACS and OTS offer services and skills that are generally not available within the Colleges. In recent years, measurable progress has been made toward aligning the services of these units in support of College missions, but further work is needed at the institutional level to architect a comprehensive, inclusive institutional vision for I/T. College tactics for addressing facility, staffing and infrastructure issues are presented in the Life Cycle Methodology section. Particular challenges for the forthcoming year include the deployment of robust distributed learning infrastructures, application servers, Office 2000, Windows 2000, Active Directory Services (ADS), and collaborative services based upon Microsoft Outlook/Exchange.

The College of Engineering academic thrust projects, for which funding is being aggressively pursued, are listed below in priority order.

The theme of the thrust projects is to implement distributed learning as a catalyst to change the pedagogical experience and paradigm.

Separate tables list the administrative, research and more comprehensive academic endeavors.

SPECIAL NOTE: Regarding the $126,000 currently allocated to this vision plan from ITAC for this fiscal year, it has been determined that the best use would be to continue implementing the Multimedia Teaching Podiums as their impact is immediate and pervasive.

Academic Thrust Projects for College of Engineering I/T Vision Plan 2000-2001

P#	Project Title	Brief Description	Audience	Resource Requirements (staffing, equipment and materials)	Proposed Budget/ Funding Source	Space	Special Considerations/ Partnerships
1	Distributed Learning Classroom (new facilities)	Establishment of one to three new facilities, likely retrofitting an existing classroom to accommodate distributed learning.	Direct impact upon engineering students in auditorium (~100) sized classroom.	Specifications determined by the Distributed Learning report as appropriate for auditoria. (3 facilities are needed immediately and at least one new facility per year in the forthcoming years)	$250,000 per classroom (3 needed ASAP for a total of $750K) ITAC	The extent of remodeling necessitated will differ greatly from building to building.	Renovation costs and aggressive timeline for implementation must be made a priority by the institution.
2	Distributed Learning Classroom (upgrade to existing facility)	Quality enhancements are needed to enable high fidelity transmission of instructional materials to the distant classroom, promoting interaction within the virtual classroom.	Engineering and non-engineering faculty/staff and distance education students.	Room accommodations, broadcast quality monitors, higher quality cameras. (This would be an upgrade to an existing distant learning classroom within the IML.)	$75,000 ITAC and other sources	Existing IML space	
3	Multimedia Teaching Podiums (continuing)	Consistent with the suggestions of the Multimedia Enhancement Task Force (METF), campus teaching centers should be appropriately equipped to facilitate the integration of multimedia into the classroom either through permanent installations or through a responsive service organization.	Direct impact upon engineering students in the classroom as instructors integrate multimedia presentations into the curriculum.	Specifications determined by the METF report as appropriate for auditoria, large, medium, and small classrooms. This objective needs to be tightly coupled with a service organization which can properly operate and maintain these facilities, see Instructional Design, Implementation and Deployment Team.	$285,000 per year ITAC and other sources Incremental deployment throughout the college as funding allows.	The extent of remodeling necessitated will differ greatly from building to building.	Innovative instruction must be deliverable in trivial fashion else much of the effort and emphasis placed upon these innovative tools will go unrealized. Current capabilities largely require inordinate pre-coordination and labor-intensive support to insure a professional presentation.

Academic Thrust Projects for College of Engineering I/T Vision Plan 2000-2001 (cont.)

				Resource Requirements	Proposed Budget/		Special

P#	Project Title	Brief Description	Audience	(staffing, equipment and materials)	Funding Source	Space	Considerations/ Partnerships
4	Courseware Server Infrastructure	Server infrastructure for hosting the results of the innovative, interactive, web-based learning materials that are developed.	Increasing number of faculty using student-centered innovative, collaborative, and action oriented approaches to teaching and learning.	Courseware server environment to support rapidly evolving production and development demands in a fault-tolerant environment.	$350,000 (in initial capital to setup the servers, portions will need to be renewed ~ every 3 years)	Integrated into existing server room.	Bandwidth demand upon the networking infrastructure and ability to reach Internet based customers is critical.
5	Faculty Innovation in Instruction Center (FIIC)	The FIIC will provide a center where faculty can find experts in instruction design and the use of instructional technology. For faculty to explore technology-enabled learning, they must first look at their current instructional practices, learn about new approaches, and then they must be given institutional support that promotes their efforts to change. By applying instructional design, faculty will be able to appropriately use instructional technology and achieve the greatest teaching and learning impact possible.	Increasing number of faculty using student-centered innovative, collaborative, and action oriented approaches to teaching and learning.	Instructional technology resources in multimedia, online course production, and distance learning. We want to encourage faculty to become innovative instructors who move away from faculty-centered approaches to student-centered, collaborative, and action oriented approaches to teaching and learning. The College of Engineering wants to be a leader in this change by creating a Faculty Innovation in Instruction Center ("FIIC").	$180,000 (in initial capital to setup the center)	Space allocation and assistance with renovation will be important contributions from the campus.	In partnership with the Instructional Media Lab (IML), instructors will have the resources available to take a concept and implement the content for delivery in the classroom.
6	Engineering Building Bandwidth	Higher network bandwidth connections for Engineering buildings, PRC connections and key internet sites are needed in order to keep pace with increasing service demands.	All six Engineering buildings on main campus are the central focus of this request but other sites, especially PRC and links to key customers need to be maintained.	Primary building network switches, fiber pulls to NOC and client hub/switch capacity. Portions of the cost estimate will provide equipment to the NOC to enable them to provide adequate service to the Engineering	$240,000 per year ITAC (a permanent funding model needs to be established)	Existing network control room space within each building will be utilized.	Engineering has consulted with William Green of ACITS/OTS to insure Engineering network upgrades are necessary and in alignment with the total campus networking infrastructure.

complex.

Academic Thrust Projects for College of Engineering I/T Vision Plan 2000-2001 (cont.)

P#	Project Title	Brief Description	Audience	Resource Requirements (staffing, equipment and materials)	Proposed Budget/ Funding Source	Space	Special Considerations/ Partnerships
7	Studio Classroom	At least one additional studio classroom per year within the College will be needed for the foreseeable future. The capacity of the two classrooms with this capability is saturated, and it is necessary to extend this capability rather than restrict its availability once it becomes a motivating force behind the innovative use of I/T in the classroom.	Direct impact upon engineering students in the classroom in a participatory environment.	20-25 client CPUs, server, networking, multimedia teaching podiums integration, room remodeling.	$230,000 ITAC Per classroom.	Space will be allocated from within the College.	Once the students have experienced the presentation of various technology based tools and been made aware of their capabilities, a portion of these capabilities need to be followed up by hands-on studio classroom activities. The campus needs to be a contributing remodeling partner.
8	TEAM Focus Center	Extrapolating the success of the studio classrooms, focus TEAM centers need to be established that provide an environment for small, technologically equipped brainstorming and project work.	Direct impact upon engineering students in a team project/participatory environment.	1-3 client CPUs, server, networking, multimedia teaching podiums integration, whiteboards, distributed collaboration capabilities, room remodeling.	$80,000 for the pilot facility	Space will be allocated from within the College.	General Library Space may be the most accommodating environment for these centers. Remodeling assistance may be needed.

The Laptops for Learning Initiative, a voluntary laptop computer purchase program for students, faculty and staff promoted through the College of Engineering, will remain a centerpiece of the technology strategy within Engineering and is one of the tactics used to implement the spectrum of I/T computing solutions which range from enabling distance education to providing a robust set of application, instructional, web and file services.

Administrative Project Listing for College of Engineering I/T Vision Plan 2000-2001

Project Title	Brief Description	Proposed Budget / Funding Source
Service Desk	An accessible and responsive service desk promoting guaranteed service levels in being pursued as a productivity imperative.	
Calendaring, email and Collaboration	Evolving calendaring capabilities beyond the limitations of Meeting Maker MUST be communicated and accomplished carefully. Bulk email facilities need to be matured to permit enhanced communication with colleagues. Collaborative sharing of documents and access to resources such as projectors and scheduling of rooms is an optimization necessity. Calendaring and collaboration have many intertwined capabilities, and the envisioned solution is tightly integrated and based upon Microsoft Outlook/Exchange.	Existing funds, although a "technology fringe" is highly desired as a suitable means for providing adequate funding.
Training	Training is needed for the entire spectrum of I/T activities to include novice, intermediate, and advanced offerings.	
WinTel migration	Although the Engineering Dean's office has made a formal commitment to migrate to PCs through attrition in order to lower cost and increase level of service, other departments seem to be pursuing this same objective by less formal means.	

Research Project Listing for College of Engineering I/T Vision Plan 2000-2001

Project Title	Brief Description	Proposed Budget / Funding Source
Collaboration	Collaborative tools are needed in order to facilitate proposal writing and accomplish research activities to include communicating with sponsors.	
Industry Interface	The existing database of research interests needs to be matured and integrated with industry interface portals.	Existing funds, on a per project basis.
Presentation Services	Presentation services are needed in order to help deliver engaging proposal presentations at off-campus sites.	
TEAM Centers	Honing the academic TEAM center concept to focus on small, technologically equipped brainstorming and project centers.	

All areas, including corporate relations, lifelong learning and outreach projects will highly leverage the technologies put into place for accomplishing the academic mission to take advantage of the expertise available within the College. Major thrusts will be the implementation of managed systems, through the use of enterprise system management tools and application servers, to deliver services to customers. Emphasis will be placed on the maturation of digital dashboards, data warehouses, and collaborative tools that will enhance workflow. Existing funds and grants will attempt to fund these projects.

Academic Project Listing for College of Engineering I/T Vision Plan 2000-2001

This opportunity also has been taken to list numerous projects, some of which are already in progress by various groups and fundamental campus issues that should be addressed through collective campus efforts to

fully implement the UT vision recommendations.

#	Project Title	Brief Description	Audience	Resource Requirements (staffing, equipment and materials)	Proposed Budget/ Funding Source	Space	Special Considerations/ Partnerships
	Application Servers (continuing)	Extending application services to all computing platform clients from a unified client/server model leverages many factors and is anticipated to have a significant cost savings on both hardware and software licensing costs in the future. This funding would determine the scalability of these types of applications and gauge the impact upon the networking infrastructure to provide this new service capability.	Initially for Engineering students, but the benefits of this technology could rapidly unfold to the entire campus as Windows-based computing is made available to mobile, remote, UNIX, and MacOS users across the network.	LRC effectiveness could substantially increase as they evolve to support more computationally intensive tasks. The potential contribution to distance education programs is promising.	$90,000 ITAC	Minimal server room space, which is already available.	Liberal Arts, Business, ACS and ACITS would be valuable partners in this groundbreaking endeavor. Network bandwidth requirements could be impacted as the demand and maturity of these services evolves.
	Enterprise Infrastructure Services (continuing)	Providing asset management of networking and computing resources with such tools as Tivoli Enterprise will help to evolve the use of information technology as an enterprise resource by assimilating industry best-practices and aligning these resources with enterprise objectives. A Total Cost of Ownership (TCO) model acknowledging the life-cycle cost for I/T will be applied to optimize the return of investment (ROI) for I/T expenditures permitting proactive adjustment to service	Initially Engineering and scaling with participating campus partners.	Initially 1 FTE and 1 student, control consoles and ESM software working in concert with existing departmental resources. Enterprise System Management (ESM) mechanisms are the best hope we have of affordably and effectively managing our information technology resources. Sustaining the capability for every person within the organization to access properly installed, configured, patched, secured and maintained applications throughout the enterprise is essential. This necessitates a	$465,000 ITAC/ITF Implementation tools could appear costly, but the ROI cannot be truly assessed in our ad hoc environment. Recurring costs are also substantial. Cost recovery models based upon service requirements and alternative-funding efforts can be provided as necessary.	Office space to house two staff members, initially.	Corporate partnerships will be pursued to substantially reduce implementation costs.

		requirements.		mechanism and environment whereby these objectives can be reasonably accomplished.			
#	Project Title	Brief Description	Audience	Resource Requirements (staffing, equipment and materials)	Proposed Budget/ Funding Source	Space	Special Considerations/ Partnerships
	Universal File & Web Services	100 MB per student accessible from both Windows and UNIX across the enterprise offering both file and web services.	Initially Engineering and scaling with participating campus partners.	Terabyte sized disk farm, supporting network infrastructure and support staff. (Current game of disk space leapfrog could be alleviated.)	$500,000 per yr. ITAC/ITF (~ $5 per month per user)	Existing space, with power and HVAC adjustments.	Ubiquitous and ample access to this resource are now affordable and the geographical installation could address networking demands. A student portfolio project in underway.
	Multimedia Implementation and Deployment Team	Service organization catering to the engineering community, facilitating the use of technology in the classroom per METF suggestions and providing adequate instructional support for implementation, and integration of multimedia instruction into the curriculum.	Entire Engineering community.	Professional design staff establishes mechanism and students individually cater to faculty needs. Scaling to 3 FTEs, 2/3 students on-call (from pool of 10-15). Perpetuation of the courseware servers would also be accomplished under this funding model.	$650,000 per yr. ITAC/ITF (this organization and funding could perpetuate the Multimedia Teaching Podium project)	Space will be needed for support staff and associated servers.	Supporting partners will be the College of Engineering Instructional Media Lab and Continuing Education groups and ACITS-CIT.
	Instructional Media Lab Resource Center	The Instructional Media Lab (IML), housed in ETC, strives “to create the technological framework to help present your ideas and thoughts” and is currently providing unique talents and tools to instructors wanting to develop	Engineering and non-engineering faculty, directly impacting the innovative nature of instruction to the students.	Expanding the capabilities of the existing facility are the primary goals, please visit their web-site at: http://uts.cc.utexas.edu/~iml/ and see if you could make use of their services.	ITF Student fee increases have been proposed to assist in funding this operation.	The existing IML facility is in ETC.	The CIT, ACITS and the General Libraries are complementary partners in providing these services.

		Multimedia based instruction. It serves both Engineering and non-engineering faculty. Funding for this facility needs to be significantly increased as demand outstretches existing resources. Primary thrust areas have been identified for this year and have been separated for consideration as separate funding items.					
#	Project Title	Brief Description	Audience	Resource Requirements (staffing, equipment and materials)	Proposed Budget/ Funding Source	Space	Special Considerations/ Partnerships
	IML-Studio	Improved studio equipment with enhanced capabilities to address the increasingly sophisticated demands of the faculty, such as blue-screening, narration, and custom music scores, which greatly reduces the cost of licensing music for inclusion in instructional media.	Engineering and non-engineering faculty/staff.	Blue-screen improvements, music sequencer, keyboard, and software.	$16,250 ITF	Existing studio space.	
	IML-Field	Procurement of equipment specifically designed to be taken into the field has become increasingly necessary since acquiring footage on-site is essential in many situations (currently studio equipment must be used for both	Engineering and non-engineering faculty/staff.	Digital camera, tripod, field audio package, field Digital Audio Tape (DAT) recorder, portable field monitor.	$27,000 ITF	The great outdoors and client sites.	Preserves equipment intended for exclusive use in studio environment.

		purposes).					
	IML-deployment	Deployment of selected, mature IML services into the departments is indicated since the demand for these scanning, image processing and OCR services has become widespread.	Extends capability directly to students and faculty within their buildings.	Audio/Visual capable PC, Adobe Premier software, ample disk space, scanner, OCR software, Adobe PhotoShop.	$36,000 ITF ($6,000 for each of the 6 departments.)	Space allocated by departments to integrate desired functionality into their operations.	
	Learning Resource Centers (LRCs)	Learning Resource Centers (LRCs) are the staples of our I/T capabilities, housing our front-line talent and the computing resources that the students use daily. Funding for these centers needs to be maintained and standards for services they provide need to be established and evolved while developing campus partnerships and eliminating redundant efforts.	Direct support of students on a daily basis, department by department or college.	Centralized computing resources need to be well maintained and have well documented standards of operation to serve academic endeavors effectively.	ITF Existing student fees are the primary source of funding.	Space adjustments will be made at the college and departmental levels. A building designed with this purpose in mind is envisioned.	

#	Project Title	Brief Description	Audience	Resource Requirements (staffing, equipment and materials)	Proposed Budget/ Funding Source	Space	Special Considerations/ Partnerships
	Printing	Trivial, reliable access to a spectrum of output devices across campus needs to be made a practical reality. (Inadequate and unreliable IP-based printing has historically caused great frustration on campus and a reliable enterprise solution has still not been identified or developed.	Entire UT community.	Focused intellects to investigate industry solutions and then customize to our unique campus needs. A long-range plan should be developed in our evolving NT-centric world with an emphasis on reliable printing and identification of media types and physical locations to be supported.	Unknown, but once capability is established and findings are published, it is anticipated that the cost could be largely distributed throughout campus, existing budgets and a cost-recovery basis.	Integration with existing capabilities is anticipated..	A strong partnership between LRCs, ACITS and ACS is needed to study the breadth of this issue and propose a comprehensive and standardized solution. Departments should not be left to fend for themselves on this pervasive issue. The Technology Deans' working group is adopting this as a key issue.

	Although a small band of ACITS people are committed to helping resolve this issue, this project needs to be significantly escalated in importance to provide widespread utility across campus.)					
Wireless Pilot	Wireless networking is becoming affordable and reliable, and therefore is a practical consideration. A well-documented pilot project, in partnership with a corporate vendor, should be established and tightly coupled with laptop computing capabilities. Effective utilization of wireless technology could fundamentally impact other I/T costs and innovative instruction efforts.	Initial investigation would involve a small control group, but implementation/utilization implications would involve the entire campus.	Total pilot project parameters would need to be matured by participating parities, but would largely use existing staff and infrastructure.	$25,000 ITAC	Loaned and mobile equipment would be used for the pilot project. Space implications would be determined.	ACITS and the Business School would be good partners to implement this pilot by extending existing services. Corporate partner(s) willing to greatly defer cost of investigation should be identified.
Smart Cards	Smart cards distributed to the entire UT community immediately with authorization for use of such cards handled securely over the web. Desired access to existing LRCs by undergraduate students is of particular concern.	Entire UT community.	Extensive installation/upgrade of card reader across campus is anticipated.	Total cost is unknown, but is anticipated to be relatively small on a per card basis especially when weighed against the existing losses of utilization of expensive I/T equipment.	Minimal space is anticipated at card access sites, but the central authority may need a center of operations.	UT System efforts and pilot programs, such as in the College of Business are important to an effective and farsighted implementation. Communication of progress should be conveyed to college liaisons on an ongoing basis.

#	Project Title	Brief Description	Audience	Resource Requirements (staffing, equipment and materials)	Proposed Budget/ Funding Source	Space	Special Considerations/ Partnerships
	Process Infrastructure	Campus policies and service standards need to be established as the infrastructure within which we work. These parameters will transcend the ever-changing technology. Mission-critical functionality, such as our networking infrastructure needs to be identified and adequately funded. Pervasive impact and synergy will occur once training and help desk support are aligned and evolved with the service standards established. Engineering will pursue coordinating these structures with campus partners to collaborate and establish this framework where a void remains.	The entire campus computing community and setting standards for other institutions (leading the way).	Cooperation and a focus on identifying core business processes are the keys here. It may require distinguishing when autonomy is desirable to promote innovation and when standards may provide more time for innovation.	Reallocation and more effective use of existing resources are most likely.	No known impact	Losses in productivity and energies toward innovation are immeasurable within our functional chaos. Factions currently succeed in spite of all odds, but effective I/T tools need to provide services for our entire campus community.
	Campus classroom connectivity	Full deployment of network connections throughout the College is desired in order to made Internet resources available in the classroom as desired by the instructors. Lack of pervasive classroom connectivity hinders innovative instruction initiatives all across campus. Existing deployment, within the College, has been prioritized and	Funding request focuses on only the six Engineering buildings on main campus, but there are also significant needs in other Engineering buildings and many other campus classrooms do not have essential service for the instructor.	Extensive category 5 cabling and associated hub service. Bandwidth upgrades of the primary network switches has been addressed as a separate item on this list.	$750,000 ITAC/ITF This funding request specifically focuses on main campus Engineering needs, general campus requirements need to be address separately.	Existing network control room space within each building will be utilized.	The hurdles to coordinate network connections beyond the realm of Engineering's network control are stifling. This further inhibits adequate deployment of innovative instructional materials developed for the Engineering curriculum. A central campus authority, such as OTS, needs to help establish and

implemented aligned with available funding to address the most highly utilized areas. Although several hundred access points have been added within the past year, a significant number of classrooms and labs still lack adequate desktop connectivity due to insufficient funding.	coordinate the connectivity of campus classrooms.

College I/T funding overview and life cycle methodology

Funding models for I/T, although still inadequate, have been earnestly addressed only within the academic realm, and are founded upon assessing student fees. The academic fee structure has evolved over the past dozen years to three primary fees that largely contribute to the operation of the departmental Learning Resource Centers (LRCs).

Information Technology Fee - $6/SCH	University-wide fee. Approximately 57% is returned to the College initially. Additional funding may be received through ITAC allocations for specific projects. ($6 97-00)
Instructional Technology Fee - $17/SCH	College of Engineering fee in 98-99 ($9 97/98; $12 98/99; $17 99/00)
Learning Resource Center Fee: ~$150/semester (six distinct fees aligned with their respective departments)	

Administrative funding of I/T has been a perpetual concern. Operational budgets have not been adjusted for the inclusion of technology as an essential tool to accomplish administrative functions. Research funding for I/T is, of course, project based. One particularly, sensitive issue is the percentage of a project allocated to overhead for infrastructure costs, yet I/T still not being considered part of the infrastructure. In addition to this, research, in many situations, has found it necessary to subsidize the purchase of adequate technology to perform both academic and administrative functions for themselves and to support staff.

This improvisational system is a response to the lack of a purposeful funding mechanism provided by the institution acknowledging the role of technology in accomplishing job-duties. It also has an unfortunate side-effect of units attempting to purchase the most powerful computer they can afford with available funding, which is many times not the most appropriate solution, because they are not sure when the next opportunity to replace the equipment will arrive. An innovative solution for providing appropriate technology and training for an individual to accomplish their job may be something along the lines of a "technology fringe" corresponding to fringe benefits associated with a person's salary and aligning with their role within the institution. The technology fringe could be allocated to ensure the infrastructure, services and training needed to perform a specific job function are adequate. Enterprise system management efforts and strategic purchasing opportunities are attempting to improve this situation.

The first step in implementing an effective Total Cost of Ownership (TCO) model to improve the Return On Investment (ROI) for I/T expenditures is architecting an infrastructure that leverages existing investments and assesses life cycle costs for all future acquisitions. Specifically, strategic procurement, proactive deployment and monitoring coupled with training and a responsive service desk are projects currently underway. Where these practices will have the most noticeable impact is upon the migration toward managed desktop computing environments where a user's application suite can be audited and updated across the network as deemed appropriate to accomplish their job-related duties, transcending the current inability to keep all systems across the enterprise properly maintained. This capability will be implemented by the deployment of enterprise system management (ESM) tools that facilitate the installation and maintenance of applications through a central console and will have an especially significant impact upon administrative and academic installations that deploy numerous instances of the same configuration. Initially, parallel ESM systems will need to be maintained to accommodate the arbitrary diversity of computing platforms, but through attrition over the next few years, managed clients will be able to replace conventional desktops, reducing the overhead and providing better service to the desktop. In the meantime, the establishment of application servers and multi-platform software clients will extend the life of existing hardware until it's utility is diminished. Similar services will be offered to mobile computing users and system adjustments will be accomplished when the units are connected to the network. Through these mechanisms, software licensing will be afforded several benefits and yield significant savings. Audit capabilities will enable effective license management and application servers will provide network access to high cost or apparent high volume needs through concurrent licensing.

Life cycle optimization standards for multiprocessor workstations, servers, printers and peripherals also will be established and acknowledge the capital expenditure, configuration, training, support, supplies, and maintenance needed to effectively utilize the resources. Coincident with this assessment should be the declaration that multiple CPUs are rarely needed by a single individual to accomplish their job-duties and every effort should be made to ensure this is a cost-effective situation when it arises. Paramount in the establishment of these standards will be the effectiveness in meeting customer needs and developing supportable standards to ensure that there will be no second-class citizens in the organization. When we give an individual a charge to perform a task that requires the use of information technology, adequate resources should be supplied to that individual to accomplish the task at hand. Both the individual and the technical support staff should feel adequately prepared and trained to perform the task and able to quickly recover from unpreventable circumstances such as hardware or software failures.

Research should adopt these established standards wherever possible to ensure the availability of a campus knowledge-base should service outsourcing become desirable.

I/T staffing adjustments will be needed as various projects are funded and specific roles will be adjusted to accommodate the changing skill set requirements as TCO models are deployed. Staff and student positions capable of ensuring the effective deployment of technology in the classroom and supporting distributed-learning, diagnosing network problems and implementing enterprise system management tools will be of special interest.

The network infrastructure needs to be adequately funded from all participants, academic, research and administrative, and a funding model which implements this needs to be established. Specific challenges to the College of Engineering network are identified in Appendix 2a, but it is believed that an institutional model is needed which does not leave the internal building infrastructure unspecified and without robust diagnostic and bandwidth utilization assessment tools. It is anticipated that adequate networking capability could be provided to an individual for a cost less than that of a telephone handset per month. Capacity offerings could mimic television cable service such and BASIC (~10 MBPS), STANDARD (~ 100 MBPS) and PREMIUM (^{3}GB) and offer innovative new services such as voice-over-IP (VoIP) and wireless services. An internal, College of Engineering model will be established in lieu of a campus model once

feedback is received from the Networking Master Plan study.

Adequate physical facilities to support complementary academic and research endeavors have historically been lacking and it is suggested that efforts be pursued to construct a building that is specifically designed to accommodate academic and research computing requirements.

Appendices

1. Total I/T expenditures report for 1998-99

		ITAC Fee	Inst. Tech Fee	TOTAL
BALANCE FORWARD		$185,750	$244,408	$430,158
AMOUNTS RECEIVED:				
	Actual Income		$1,204,944	$1,204,944
	Continuing Annual Amount	$353,650		353,650
	One-time Allocation	163,000		163,000
TOTAL AMOUNT AVAILABLE		**$702,400**	**$1,449,352**	**$2,151,752**
SALARIES AND FRINGE:				
	Salaries	$0	($342,880)	($342,880)
	Fringe Benefits	0	(59,683)	(59,683)
		$0	($402,563)	($402,563)
HARDWARE:				
	Computer Purchases (Capitalized)	($71,214)	($371,050)	($442,264)
	Computer Purchases (Not Capitalized)	(17,102)	(42,290)	(59,392)
		($88,316)	($413,340)	($501,656)
SOFTWARE:	Computer Software	($25,742)	($40,347)	($66,089)
SUPPORT:	Telecommunication	(3,842)	(3,966)	(7,808)
MAINTENANCE:				
	Computer Maintenance	(5,644)	(4,825)	(10,469)
	Maintenance & Repair	(17,884)	(29,314)	(47,198)
		($23,528)	($34,139)	($57,667)
OTHER:	Books and Subscriptions	$0	($582)	($582)
	Consumable Supplies	(24,434)	(10,556)	(34,990)
	Equipment & Furniture	(57,939)	(68,801)	(126,740)
	Freight & Postage	(142)	(3,652)	(3,794)

Insurance	(742)	(296)	(1,038)
Other Operating Expenses	(12,462)	(10,911)	(23,373)
Other Services	(22,792)	(6,535)	(29,327)
Printing and Reproduction	(1,090)	(4,444)	(5,534)
Travel	0	(5,526)	(5,526)
	($119,601)	($111,303)	($230,904)
ENCUMBRANCES	($62,179)	($139,794)	($201,973)
TOTAL EXPENDITURES & ENCUMBRANCES	**($323,208)**	**($1,145,452)**	**($1,468,660)**
ENDING BALANCE	**$379,192**	**$303,900**	**$683,092**

2a. Networking Status

The College of Engineering networking infrastructure spans six main campus buildings with a seventh shared facility under construction (the ACES building is due online in May of 2000). Engineering facilities located at the Pickle Research Center and other locations are not included in this inventory perspective. Efforts are underway, as resources allow, to integrate the entire spectrum of networking needs for the college into a master networking plan for engineering.

The most recent collective efforts to upgrade networking capabilities throughout the six main campus buildings were made in the Fall of 1994. Each building implemented a network infrastructure in coordination with the Office of Telecommunication Services (OTS). The three main goals accomplished during this implementation were:

1. Bandwidth connectivity to UTnet: Each building installed a Cisco 7000 router and all six buildings used a single-shared 10 MBPS Ethernet link to the UTnet Network Operations Center (NOC).
2. Wiring within the Buildings: Category 5 Unshielded Twisted Pair cable (Cat5 UTP) was installed to as many endpoints as could be afforded, to include classrooms (for the instructor) and faculty offices. (As a side note this simple concept took over two years to accomplish as a battle raged with telephone services to transcend the historical telephone patch panel convention and move toward installing “home-runs” (which permit a single cable to run from a centralized network control room (NCR) directly to the users CPU), but this insistence has proven to be worth its weight in gold and today, it is still the standard installation procedure. These home-runs are also a critical link that will allow us to ability to deliver multimedia and Voice over IP (VoIP) throughout the college without modifying this portion of the infrastructure.)
3. Bandwidth within the Buildings: This was the installation of 10 MBPS shared Ethernet hubs to interconnect computers, printers, and servers within the building.

Incremental changes have occurred since this coordinated effort to include accomplishing independent fiber pulls directly to the NOC and three departments have pursued Gigabit core installations. Also, as funding has allowed, the 10 MBPS shared Ethernet hubs have been replaced with 10/100 MBPS Ethernet Switches in 50% of the buildings. This alone has improved network performance ~10x.

The bandwidth demands upon the nominally 5-year old network infrastructure continue to escalate as new services are brought on-line such as Distributed Learning, TEAM Centers, Application Servers and

Enterprise Systems Management capabilities. Of particular concern are emerging applications for distance education that can place inordinate demands upon general-purpose infrastructures when attempting to deliver instructional materials with either synchronous or asynchronous video and audio signals. In a specific project, distance-learning capabilities were enhanced between main campus and the Applied Research Lab (ARL) to demonstrate the ease with which distance education may be accomplished when significant scheduling overhead, due to limited bandwidth, is not a deterring factor. This production system has also made clear several enhancements needed to ensure quality instruction at the distant site to accomplish the virtual classroom experience. Voice over IP (VoIP) also has numerous applications, from distributed learning to service desk and the potential for incredible impact.

Network accessibility in also becoming an increasing concern. The increasing prevalence of laptop computers with the college, due to the continued success of the Laptops for Learning Initiative demands pervasive campus DHCP and DNS standards in order to provide these services in a consistent and reliable manner. The increasing demand for multimedia in the classrooms also stresses the need for consistent networking standards across campus. Since hardwiring student desktops will always be cost prohibitive a wireless pilot project, in coordination with OTS, could potentially provide network services to classrooms, libraries, and other previously inaccessible zones.

Although crucial components of the networking infrastructure are requested for funding through the proposed projects within this vision plan, a comprehensive plan and associated funding model must be established in order to address our increasing reliance upon network services to accomplish our academic, research, outreach missions and administrative operations. Particular attention should be paid to the challenges and capital expenditure associated with adequately networking buildings not located on main campus and the unfortunate circumstance where a unit must be moved from one location to another.

Projects of special importance to the six engineering buildings on main campus:

- Replace remaining Cisco 7000 Routers. Funding of this project will be used to replace the aging single-shared 10 MBPS hardware infrastructure installed in the 1994 Fall semester with current technology standards which consist of 1 GB single-mode fiber links to UTnet. (Fair compensation should also be considered for those departments who have already accommodated this need.)
- Replace remaining 10 MBPS Hubs. Funding of this project will be used to install 10/100 MBPS Ethernet Switches capable of current VLan technology and high-speed data throughput.
- Wireless pilot project. This project will be coordinated in conjunction with OTS to serve as the test bench for the campus.
- Voice over IP pilot project. This project too will be coordinated in conjunctions with OTS to serve as the test bench for the campus.

2b. Technology Classroom Inventory

The College's Strategic Plan and the report written by the University's Multimedia Enhancement Task Force have enabled the College to move forward on implementing multimedia in the classrooms in a timely and coordinated manner. To date, of the 24 general-purpose classrooms and 23 College and Departmental classrooms within the Engineering complex, 25 percent have some level of multimedia equipment installed thanks to these measures.

Historically, multimedia in College of Engineering classrooms have been accomplished by independent, almost disjoint, grassroots efforts to provide projection systems and Internet connectivity to the classroom with no overarching vision or concept of quality or level of service. Independent initiatives (e.g., roving projectors via the College and departments plus the IML Distance Learning Classroom and ENS 302)

evolved into collective purchasing attempts. Some of these independent efforts provided a good service foundation for the College to build upon.

In 1997, the College purchased three 3M LCD projectors for use throughout the College. The following year, the College allocated $15,000 to each department to use for independent installations and facilitated the purchase of nine Sharp 3000XGU projectors. At the same time, the College developed a Strategic Plan that included pursuing technology in the classrooms as a high priority and the University coordinated the Multimedia Enhancement Task Force (METF). As a result, the next round of multimedia installations was pursued in a more systematic manner.

In spring 1999, 14 classrooms (six departmental, eight general purpose) were targeted for multimedia installations because data showed that these rooms had a strong correlation between high engineering usage and a high number of requests for multimedia equipment. This analysis also anticipated high multimedia usage in four classrooms under construction in ENS. Of the 14, four classrooms are complete while the remainder await funding and construction.

Progress is being made towards developing a service organization that would take care of faculty needs in the classroom. Other institutions with a service organization in place, such as the College of Business, were benchmarked, and a focus group was formed to develop policies on the usage of these rooms. In addition, a funding model for a service organization is being pursued and we are working to ensure the installations are compatible with Distance Learning needs.

As we continue to move ahead in our corner of campus, we need to coordinate efforts with other Colleges so our faculty can take advantage of the latest technologies no matter where they teach.

Within the College of Engineering main campus buildings we have:

- 1 fully equipped distance education classroom in ETC
- 2 studio classrooms (via two grants from HP)
- 9 classrooms with permanently affixed multimedia teaching podium equipment (planning for the next round of classrooms is underway). Presentation needs for the remaining rooms are met with by individual users with roving platforms equipped with an LCD projector, a computer and a VCR that can be checked out from any of the six Engineering departments or the centralized Service Desk organization residing in Dean's office.
- 6 LRCs with varying levels of support to accommodate classes within their facilities

The tables and associated legend below depict an audit of all classrooms located with the engineering buildings, both general purpose and departmental, and the equipment with which they are equipped. A web-based mechanism is available to facilitate requests for mobile equipment within the classroom and a web-published table will be updated as we progress in our project to better equip the classrooms per the Multimedia Enhancement Task Force (METF) suggestions.

Comprehensive Engineering Classroom Inventory

						Capabilities		Cost
Building	No.	Configuration	Authority	Capacity	ADA	Instructor	Student	
CPE	**2.202**	**Classroom**	**PGE**	**26**	**1**	**CWS, SCR, TBL**		
CPE	**2.204**	**Classroom**	**GP**	**90**		**CWS, SCR**		
CPE	**2.206**	**Classroom**	**GP**	**73**		**CWS, SCR**		
CPE	**2.208**	**Classroom**	**GP**	**144**		**SCR**		
CPE	**2.210**	**Classroom**	**GP**	**73**		**CWS, SCR**		

CPE	2.212	Classroom	GP	73		CWS, SCR		
CPE	2.214	Classroom	GP	144		SCR		
CPE	2.216	Classroom	GP	73		CWS, SCR		
CPE	2.218	Classroom	GP	90		CWS, SCR, LCD (Sharp XG3000U)		$11,000
CPE	2.220	Classroom	GP	73		CWS, SCR, LCD (Sharp XG3000U)		$11,000
CPE	2.222	Classroom	ChE	50		CWS, SCR		
ECJ	B.102	Classroom	CE	22	1			
ECJ	B.111	Classroom	CE	18	1			
ECJ	B.226	Classroom	CE	28	1			
ECJ	1.202	Classroom	GP	176		CWS, SCR		
ECJ	1.204	Classroom	GP	75		CWS, SCR		
ECJ	1.214	Seminar room	GP	36		MC, TBL, SCR		
ECJ	3.301	Computer lab	CE	15		1 PC	14 PCs	
ECJ	3.302	Computer lab	CE	20		1 PC	19 PCs	
ECJ	3.402	Computer lab (HPSC2)	CE	22		1 PC, LCD (Sharp XG3000U)	22 PCs	
ECJ	5.406	Classroom	CE				drafting tables	
ECJ	5.410	Classroom	CE	50	1	CWS, SCR, LCD (Proxima 9250+)		$11,000
ECJ	5.416	Classroom	CE	22	1			
ECJ	7.202	Classroom	CE	22	1	SCR, LCD (Proxima 9250+)		$11,000
ECJ	7.208	Classroom	CE	28	1	SCR, LCD (Proxima 9250+)		$11,000
ECJ	9.236	Classroom	CE	30	1			
ENS	109	Classroom	GP	42		SCR		
ENS*	115	Classroom	GP	81				
ENS*	116	Classroom	GP	49				
ENS*	126	Classroom	GP	49				
ENS*	127	Classroom	ECE	87				
ENS	145	Classroom	GP	42		SCR		
ENS	302	Classroom	ECE	100		SCR, PC, VCR, LCD (Proxima), Elmo		$35,000
ENS	317	Computer lab	ECE	80	1	CWS, SCR, 1 PC	79 PCs	
ENS	334	Computer lab	ECE	36	1	CWS, SCR, 1 PC	35 PCs	
ENS	340	Computer lab	ECE	36	1	CWS, SCR, 1 PC	35 PCs	
ENS**	402	Classroom	GP	302				
ENS**	431	Classroom	GP	42		CWS, SCR		
ENS	507	Computer lab	ECE	80	1	CWS, SCR, 1 PC	79 PCs	

Comprehensive Engineering Classroom Inventory, continued

						Capabilities		Cost
ENS**	532	Classroom	GP	36		CWS, SCR		
ENS**	637	Classroom	ECE	71		CWS, SCR		
ETC	2.102	Classroom	GP	32		CWS, MC, SCR		
ETC	2.108	Classroom	GP	150		SCR, LCD (Sharp XG3000U)		$16,000

ETC	**2.114**	**Classroom**	**GP**	**38**		**CWS, SCR**		
ETC	**2.132**	**Classroom**	**GP**	**38**		**CWS, SCR**		
ETC	**2.136**	**Classroom**	**GP**	**94**		**CWS, SCR, LCD (Sharp XG3000U)**		**$16,000**
ETC	**2.144**	**Computer lab (HPSC1)**	**ME**	**38**		**1 PC, LCD (3M 8740)**	**18 PCs**	
ETC	**3.134**	**Computer lab**	**ME**	**11**			**11 PCs**	
ETC	**3.136**	**Computer lab**	**ME**	**12**				
ETC	**3.142**	**Computer lab**	**ME**	**26**		**LCD**	**26 PCs**	
ETC	**4.160**	**Computer lab**	**ME**	**18**			**5 PCs**	
ETC	**4.150**	**Classroom**	**ME**	**37**		**TBL, LCD (Proxima 9250+)**		**$11,000**
ETC	**5.212**	**Conference room**	**ME**	**10**		**1 PC, LCD (Proxima LS1)**		
ETC	**5.132**	**Classroom**	**ME**	**38**				
ETC	**5.148**	**Distance Ed**	**ME**	**30**	**1**	**PC, LCDs, CWS**		
ETC	**7.111**	**Classroom**	**ME**	**24**				
ETC	**7.146**	**Classroom**	**ME**	**38**				
WRW	**101**	**Conference**	**AE**	**12**		**CWS**		
WRW	**102**	**Classroom**	**GP**	**139**		**SCR**		
WRW	**113**	**Classroom**	**GP**	**56**		**CWS, SCR**		
WRW	**219A**	**Conference**	**AE**	**6**		**CWS**		
WRW	**310**	**Conference**	**AE**	**18**		**TV/VCR SCR CWS**		
WRW	**312**	**Classroom**	**AE**	**24**		**CWS**		
WRW	**410**	**Classroom**	**AE**	**40**		**TV/VCR SCR CWS**		
WRW	**413**	**Classroom**	**AE**	**20**		**CWS**		
							Tally	

*To be completed Spring 2000
**To be discontinued Spring 2000

Legend

CNF = Conference Room
CWS = Continuous Writing Surface
LCD = Computer Projector
MC = Moveable Chairs
MF = Media Facility
PC = Computer
SCR = Screen
TBL = Movable Tables.